Vehicle Emissions Control Program in Connecticut

Connecticut General Assembly

LEGISLATIVE PROGRAM REVIEW AND INVESTIGATIONS COMMITTEE

December 1986

CONNECTICUT GENERAL ASSEMBLY

LEGISLATIVE PROGRAM REVIEW AND INVESTIGATIONS COMMITTEE

The Legislative Program Review and Investigations Committee is a joint, bipartisan, statutory committee of the Connecticut General Assembly. It was established in 1972 as the Legislative Program Review Committee to evaluate the efficiency and effectiveness of selected state programs and to recommend improvements where indicated. In 1975 the General Assembly expanded the committee's function to include investigations and changed its name to the Legislative Program Review and Investigations Committee. During the 1977 session, the committee's mandate was again expanded by the Executive Reorganization Act to include "Sunset" performance reviews of nearly 100 agencies, boards, and commissions, commencing on January 1, 1979. Review of the original schedule of sunset entities was completed in 1984. Review of the list will begin again in 1988.

The committee is composed of 12 members. The president pro tempore of the senate, the senate minority leader, the speaker of the house, and the house minority leader each appoint three of those members.

Staff on this Report

L. Spencer Cain, Chief Analyst
Warren Wood Pierce, II, Program Analyst

Legislative Office Building, 18 Trinity St., Hartford, CT 06106 (203)566-8480

THE VEHICLE EMISSIONS CONTROL PROGRAM

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SUMMARY

The Legislative Program Review and Investigations Committee was directed by the General Assembly to conduct a review of the state's vehicle emissions inspection and maintenance program. The committee conducted a ten-month study of Connecticut's program to provide the General Assembly with information necessary to determine the program's future. Specifically, the committee studied the operational aspects of the program and the policy issues which form the program's foundation. The committee was assisted by a panel of experts from the Connecticut Academy of Science and Engineering.

This report contains descriptive information, analysis, findings, and recommendations concerning: 1) the legislative and regulatory background of emissions inspections; 2) the interaction of the Department of Motor Vehicles and Connecticut Vehicle Inspection Program, Inc., the independent contractor that operates the inspection network; and 3) the effectiveness of the program in meeting its objectives. The report contains seven sections:

I. Introduction; II. Legislative Background; III. Inspection and Maintenance Programs in Other States; IV. Program Overview; V. Program Management; VI. Program Analysis and Effectiveness; and VII. Program Recommendations.

The Connecticut vehicle emissions inspection and maintenance program is intended to reduce the output of pollutants into the state's air. The program's purpose is to limit the amount of hydrocarbons and carbon monoxide that vehicles produce. Vehicles are tested and required to meet certain standards for these two emissions. The program requires owners to maintain vehicles in a condition that will result in their passing the emissions test. Vehicles not passing the test are subject to specific requirements before they are considered to be in compliance with the law.

The vehicle emissions testing program is required by the federal law with implementing regulations established by the U. S. Environmental Protection Agency. The Connecticut program is part of the Department of Environmental Protection's plan for lessening air pollution. The Department of Motor Vehicles administers the program, which is run by contract with the Connecticut Vehicle Inspection Program, Inc., a subsidiary of United Technologies. The contractor operates 18 vehicle inspection stations around the state.

During its study of the vehicle emissions inspection program, the Legislative Program Review and Investigations Committee found that although the program, as designed, is well-run, serious questions exist regarding the effectiveness of the program on a conceptual basis. While there has been an overall improvement in Connecticut's air quality, the Department of Environmental Protection and the U.S. Environmental Protection

Agency can only establish the relationship between emissions inspections and the improvement in the state's air quality by a predictive computer model. The program review committee found that insufficient utilization is made of data from actual tests to ascertain the accuracy of computer modeling, or to study program effectiveness.

The committee also determined that the Department of Motor Vehicles needs to improve its oversight of station operations. The committee recommended that this situation be rectified through the development of more efficient methods of data analysis.

Recommendations

The following recommendations are intended to meet federal requirements for air quality while at the same time making the program cost effective by testing those vehicles that will have the greatest impact on improving the air. The recommendations will also improve the operation of the program, although the Legislative Program Review and Investigations Committee did find the program operating satisfactorily.

The Legislative Program Review and Investigations Committee recommends that the emissions testing program be continued as a result of the federal requirements and that vehicles be tested after they are five years old. It is further recommended that the state subsidize the program to maintain a low or nominal testing fee, if necessary.

The Legislative and Program Review and Investigations Committee recommends the current system of a centralized emission inspection program run by a single contractor be retained.

The Legislative Program Review and Investigations Committee recommends that the seminars with the private garage mechanics be continued and the emissions newsletter be published, both on a regular basis.

The Legislative Program Review and Investigations Committee recommends the following:

1) **The Department of Environmental Protection shall conduct research and report to the Legislature on Connecticut's air quality, the impact of air pollution produced in other states on Connecticut, and the impact the emissions inspection program is actually having on the state's air based upon the inspection tests that are currently collected.**

2) **The Department of Motor Vehicles shall retain waiver data and compile the information for the purposes of analysis. Additionally, the station audit reports on analyzer calibrations should be computerized and reported to the contractor on an ongoing basis.**

The Legislative Program Review Committee recommends that the Department of Environmental Protection study the information that is being developed by the U.S. Environmental Protection Agency concerning diesel vehicles. Based upon this study, DEP should consider the appropriateness of testing diesel vehicles as one of the strategies for reducing pollutants when the state implementation plan is revised.

I. INTRODUCTION

The Connecticut vehicle emissions inspection and maintenance program is intended to reduce the output of pollutants into the state's air. The program's purpose is to limit the amount of hydrocarbons and carbon monoxide that vehicles produce. Vehicles are tested and required to meet certain standards for these two emissions. The program requires owners to maintain vehicles in a condition that will result in their passing the emissions test. Vehicles not passing the test are subject to specific requirements before they are considered to be in compliance with the law.

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Rationale and Scope of Study

The Legislative Program Review and Investigations Committee was directed by the General Assembly to conduct a review of the state's inspection and maintenance program for vehicle emissions. The committee conducted a ten-month review of Connecticut's vehicle emissions inspection program to provide the General Assembly with information necessary to determine the program's future. Specifically, the committee studied the operational aspects of the program and the policy issues which form the program's foundation. The committee was assisted by a panel of experts from the Connecticut Academy of Science and Engineering.

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The statutory authority implementing the program, Connecticut General Statutes Chapter 246a, established a minimum contract period of five years for the operation of testing facilities by a private company. The current contract with Hamilton Test Systems, the independent contractor, ends on December 31, 1987. This review is intended to provide the legislature with information to determine the future of the emissions testing program.

Methodology

Several research methods were used to study vehicle emissions inspections. The initial focus was upon the legislative and regulatory history of emissions inspections to achieve an understanding of the issues behind the emissions testing program. Documentation for this stage of the report came from: the United States Code Annotated and the relevant congressional hearings; the Connecticut General Statutes and the appropriate legislative hearings; notices in the Federal Register; judicial opinions; interviews with federal and state officials associated with the program; and articles by social commentators.

Once an understanding of the legislative and Congressional objectives had been obtained, the committee reviewed the inspection process. Extensive discussions were conducted with officials at the Auto Emissions Division of the Department of Motor Vehicles, and Connecticut Vehicle Inspections Program, Inc. to identify those reports and studies that would provide the greatest amount of information regarding program operations.

Committee staff, as well as members from the Connecticut Academy of Science and Engineering, visited the repair facilities of the contractor and emissions stations to learn how the emissions analyzers operated and the maintenance procedures for the equipment.

To gain a perspective on the Connecticut program, all states currently operating an emissions inspection network were asked to provide a copy of their rules and regulations.

Officials at the Department of Environmental Protection provided the committee with actual emissions testing data for the latter half of 1985. A random sample of 196,000 tests was used from this data for extensive analysis of the program.

Analysts at the U.S. Environmental Protection Agency provided their input regarding: the effectiveness of the Connecticut program; typical operational problems in programs nationwide; their statistical modeling database to predict program benefits (Mobile3); and their view of the program's future direction.

II. LEGISLATIVE AND REGULATORY BACKGROUND

Connecticut's vehicle emissions inspection program, like that of 28 other states, is the result of congressional action to reduce air pollution throughout the nation. However, the Clean Air Act of 1963 and its subsequent amendments do not require the states to administer a specific uniform federal program. The control and prevention of air pollution, at its source, is a responsibility that has been delegated to state and local governments. The federal role, as formulated by the federal Environmental Protection Agency (EPA), has been to provide technical leadership and financial assistance as well as to impose federal funding sanctions where necessary to force compliance federal air quality standards.

Federal Role

The Clean Air Act authorizes the EPA administrator to classify any atmospheric emission as an air pollutant if:

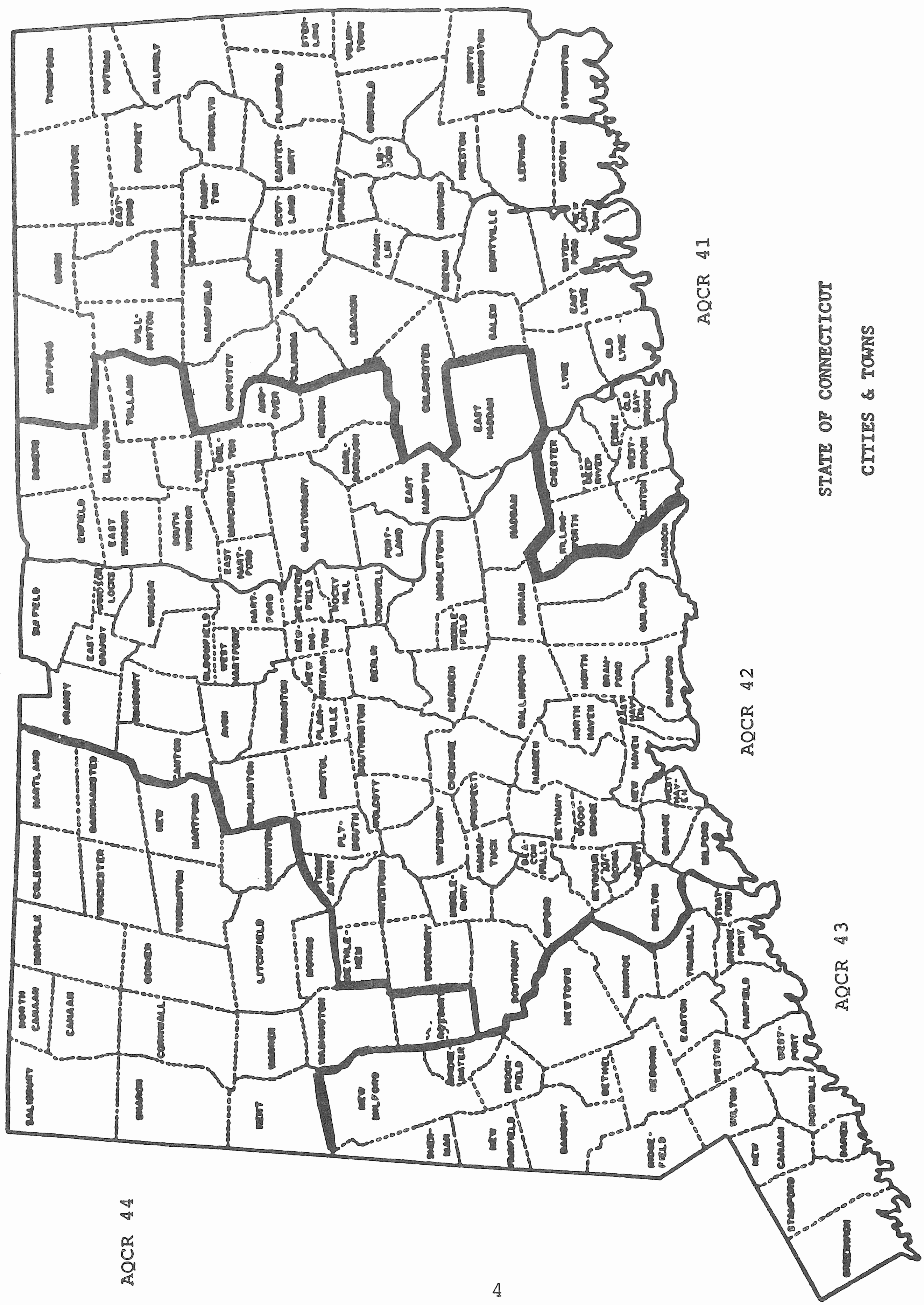
- o the pollutant constituted a danger to public health or welfare;
- o the pollutant comes from numerous sources; and
- o the air quality criteria, for that pollutant, had not been published.

Air quality criteria describe an emission's identifiable effects on public health or welfare. Once the criteria have been published, the administrator is mandated to publish regulations concerning the emissions primary and secondary ambient air quality standards.

National primary ambient air quality standards refer to the level of air purity necessary to protect public health. National secondary ambient air quality standards are those levels that will protect human welfare. In the context of the Clean Air Act, human welfare may be defined as those aspects of man's environment which have a direct bearing on the quality of life. The two standards are referred to as "national ambient air quality standards" (NAAQS) and are the major components of the Clean Air Act.

For the purpose of implementing an air pollution control strategy, air quality control regions (AQCR) were drawn up within each state's boundaries. Chart II-1 shows the boundaries of the air quality control regions in Connecticut. All air quality control regions are designated as: 1) in attainment, 2) in non-attainment, or 3) unclassified. These labels denote the regions' status in achieving the NAAQS for any pollutant. An air quality control region may be listed as attainment for one pollutant, but

Chart II-1. Map of Connecticut's Air Quality Control Regions.



non-attainment for another. As shown by Table II-1, in Connecticut, all air quality control regions are classified as being in attainment for sulfur dioxide but have been categorized as non-attainment for ozone.

Table II-1 Designation of Connecticut's Air Quality Control Regions.

A - Attainment
X - Non-Attainment
U - Unclassifiable

Pollutant	Primary or Secondary	NAAQS	AQCR41	AQCR42	AQCR43	AQCR44
Sulfur Dioxide	Primary	Annual	A	A	A	A
		24-Hour	A	A	A	A
		3-Hour	A	A	A	A
Ozone*	Primary	1-Hour	X	X	X	X
Carbon Monoxide	Primary	1-Hour	U	A	X	U
		8-Hour	U	X	X	U
	Secondary	1-Hour	U	A	X	U
		8-Hour	U	X	X	U

* Ozone is created by the oxidation of hydrocarbons.

Source: "To Breathe Clean Air", A Citizens' Guide To Connecticut's Air Pollution Control Program. Published by the Department of Environmental Protection 1985.

Regulatory Requirements

Every state is responsible for the air quality in the control regions within its borders. The present federal policy is to give the individual state governments a wide degree of latitude in determining how to achieve the NAAQS.

Each state was required by the federal Clean Air Act to develop a State Implementation Plan (SIP) that outlined the steps to be taken to reach the national air quality standards. A SIP contains the following:

- pollution control goals;
- an explanation of how those goals were established (usually by computer modeling);
- a listing of the methodologies to be employed in meeting these goals; and
- the legal authority that guarantees the state will be able to proceed with its program.

Due to the problems many states experienced in reaching the NAAQS for regions within their borders, the 1977 amendments to the Clean Air Act mandated that each state, by July 1, 1979, submit its SIP to the EPA administrator for approval. Under the Clean Air Act, the EPA administrator is required to approve any plan that contained a reasonable possibility of success in attaining the NAAQS.

The amendments required each state to meet the NAAQS goals for all appropriate air emissions by December 1982. However, the 1977 amendments to the Clean Air Act provided statutory authority for the EPA administrator to grant an extension of time upon the application of a state. Most importantly, in cases of extensions for the carbon monoxide and ozone standards, the approval would not be granted if the SIP did not include a vehicle emissions inspection program.

Federal Enforcement

In the event that a plan was not submitted or did not meet statutory requirements, the act empowered the administrator to promulgate the plan for the state. This is the least severe of the coercive options open to EPA. EPA may also impose federal funding sanctions upon any state government that has not complied with the Clean Air Act's requirements.

In general terms, the options available to EPA amount to: the impounding of federal highway funds and clean air planning grants; a moratorium on the construction of stationary sources of air pollution; and the withholding of sewage treatment grants. A specific discussion of EPA's options is discussed in greater detail in section VII.

Connecticut Legislative and Regulatory History

The Connecticut General Assembly passed the first emission testing program in 1978, Public Act 78-335, entitled "An Act Concerning the Control of Motor Vehicle Emissions." Prior law merely prohibited the registration of motor vehicles with inoperative or malfunctioning pollution control equipment. The emphasis of the earlier legislation was on passively preventing tampering with the equipment as opposed to actively testing exhaust emissions. The enactment of Public Act 78-335 reversed this policy. Public Act 78-335 was passed in order to bring Connecticut into compliance with the inspection/maintenance requirements of the Clean Air Act and to avoid the imposition of federal funding sanctions upon a failure to submit a legally valid SIP.

The Connecticut act featured three major sections. The first section directed the commissioner of motor vehicles to develop an emissions program that would best serve the state and public while meeting the objectives of the act.

The second section contained the initial rules and regulations under which the system would operate. These included a mandatory commencement date, a policy for exemptions and waivers, penalties for non-compliance, and a maximum vehicle inspection fee of $5.00.

Finally, the act established a Motor Vehicle Emissions Inspection Fund to cover the costs of administering any agreement with an independent contractor. The fund was to be financed by: state appropriations; inspection fees from owners; administrative fees from fleet inspection stations; private grants/donations specified for the fund; and federal funds.

In the 1979 session of the General Assembly several modifications were made to the emissions law. Several of the revisions are especially noteworthy. Most significantly, the law directed the commissioner of motor vehicles to select an appropriate independent contractor to actually conduct the state's program. Other major changes included:

- an increase in the maximum inspection fee to $10.00;
- the addition of new classes of exempt vehicles and the deletion of others; and
- the elimination of the Motor Vehicles Emissions Inspection Fund.

Public Act 80-458, passed in 1980, finalized the legislature's decision to adopt a centralized, contractor-run program. The law authorized the commissioner of motor vehicles to enter into an agreement with an appropriate private firm.

Current Legislation

The state's vehicle emissions inspection law is embodied in Chapter 246a of the Connecticut General Statutes. The law has retained its earlier policy requiring that a vehicle's pollution control equipment be maintained in proper working order. Failure to do so can result in a loss of the automobile's registration.

This chapter vests the commissioner of environmental protection with the responsibility to set the emission standards and to monitor program results to determine compliance with the air quality goals of the state implementation plan. As part of this duty, the statute requires that the department submit quarterly reports to the legislature's Transportation Committee describing the amount of emissions reductions throughout the state.

The statute charges the commissioner of motor vehicles with the responsibility of supervising the day-to-day policies and practices of the program. Their principle responsibility is to administer a quality control program. An additional duty of the Department of Motor Vehicles (DMV) is to present monthly reports to the legislative Transportation Committee detailing operational aspects of the program.

There are nine statutorily established categories of exempt vehicles: 1) automobiles weighing over 10,000 pounds; 2) vehicles powered by a fuel other than gasoline; 3) bicycles with motors; 4) motorcycles; 5) vehicles with temporary registrations; 6) vehicles built before the 1968 model year; 7) new vehicles at the time of the initial sale; 8) registered vehicles not designed primarily for highway usage and 9) farm vehicles. All other vehicles must be inspected on an annual basis. Companies that own or lease 25 or more vehicles are permitted to conduct emissions inspections on their vehicles pursuant to regulations set by the commissioner of motor vehicles.

If a vehicle fails the initial inspection, the owner is entitled to one free reinspection, if performed within 30 days of the first examination. If the second test is failed, and the vehicle owner has spent $40.00 on a low-level emissions tune-up, then an application for a waiver will be considered. The $40.00 limit only applies to emissions related repairs, it does not include cost of repairing air pollution control equipment that is inoperative or missing.

III. INSPECTION AND MAINTENANCE PROGRAMS IN OTHER STATES

Exhaust emission inspection programs are commonly referred to as inspection and maintenance (I/M). "Inspection" refers to the examination element of a vehicle inspection program. "Maintenance" is derived from the need to adjust any vehicle that has failed the inspection. Inspection and maintenance programs may be categorized as either centralized or decentralized.

A centralized program, as in Connecticut, is characterized by a relatively small number of inspection stations. The role of these stations is only to conduct a test of the vehicle's emissions. If the vehicle fails to meet the emissions standards set by the state, then the vehicle must be taken to a private garage for repair. In centralized programs, the inspection component is separated from that of repair, thereby reducing the potential for repair fraud. An additional safeguard to the consumer is that centralized programs use automated computer systems, which prevent the testing personnel inspector from interfering with the pass/fail decision.

Centralized inspection stations are run by either an independent contractor or by the state, county, or local government. At this time, the majority of centralized programs are operated by independent contractors.

Decentralized programs utilize the services of private repair facilities, which results in a large number of test stations. These programs are convenient to the public because: 1) they afford a greater choice of where the test may be conducted; and 2) the inspection and maintenance components may be combined under one roof, which reduces the travel burden to the consumer.

Inspection and maintenance programs may have additional characteristics such as whether they are computerized or manual operations, or whether they have an anti-tampering component in place. Manual programs, which are utilized in decentralized networks, use electronic emissions testing equipment with the readings recorded by the garage mechanic. The analyzer readings are written on a form and then submitted to the governmental regulatory agency responsible for administering the program.

Computerized systems use an emissions analyzer to test the exhaust, and the results are generated and printed by the equipment. These results are then brought to the appropriate regulatory agency. Computerized programs may be used in both centralized and decentralized programs. The only difference between manual and computerized systems is the manner in which vehicle test results are recorded and submitted for review.

A third program option is an anti-tampering test, where the inspector examines the engine to determine whether the air pollution control equipment has been by-passed, removed, or is simply out of adjustment. Anti-tampering inspections have been the target of considerable study and are now being considered by several states as a deterrent to the deliberate removal of air pollution control equipment.

During this study, program review staff contacted I/M officials in other states and requested copies of any pertinent rules, regulations, and official reports. In the case of centralized programs, the request was broadened to include a copy of the state's agreement with its independent contractor for purposes of comparing contractor services.

Table III-1 lists all the emissions inspection programs in operation in the United States as of January 1986. This listing was compiled through data supplied by EPA and individual states.

The first column of the table lists the state in which the program is operated. Several states may be listed more than once. For example, there are two listings for Kentucky because there are two separate programs being conducted in that state, each covering a different air quality control region. In one program, all inspections are conducted by an independent contractor. In the other program, anti-tampering inspections are performed by private repair facilities.

As shown in the column titled "Region Affected", the number of emissions inspection programs covering all vehicles in a state is small. The majority of programs are confined to specific geographic areas, usually cities, that do not meet the national air quality standards. As an example, inspections are only required in New York State for vehicles registered in the five boroughs of New York City plus Westchester, Rockland, Nassau, Suffolk, and Putnam counties. New Hampshire, which has just commenced implementing an I/M program, will only require inspections for vehicles registered in Nashua. In Connecticut, the program covers all vehicles garaged anywhere in the state.

"Program Type" refers to the primary characteristics of the program. With the exception of Kentucky, whenever more than one I/M program is being operated in a state identical programs are established, as was done in Alaska with the Fairbanks and Anchorage testing programs.

"Enforcement Method" refers to how compliance is enforced. The majority of states mandate emission inspections as a prerequisite for vehicle registration. Other states, as in Connecticut, rely upon windshield stickers to ascertain whether or not the vehicle is complying with the law. In Kentucky and some other states, the supervising government agency utilizes an on-line computer system to match those vehicles requiring inspection with those that have been inspected. Any vehicle owner whose car does not match on both lists may be issued a summons by mail.

Table III-1. Summary of Programs in Other States.

State	Region Affected	Start Date	Annual/ Biennial	Program Type	Enforcement Method	Tampering Inspection
Alaska (I)	Selective	7/85	Annual	Decentral-computer	Regis.	Always 75+
Alaska (II)	Selective	7/85	Annual	Decentral-computer	Regis.	Always
Arizona	Selective	1/77	Annual	Central-contractor	Regis.	Failed
California	Selective	3/84	Biennial	Decentral-computer	Regis.	Always
Colorado	Selective	1/82	Annual	Decentral-manual	Sticker	Always 82+
Connecticut	Statewide	1/83	Annual	Central-contractor	Sticker	Waivers
Deleware	Selective	1/83	Annual	Central-state	Regis.	None
Georgia	Selective	4/82	Annual	Decentral-manual	Reg/Stk.	Always
Idaho	Selective	8/84	Annual	Decentral-manual	Com/Stk.	Always 84+
Illinois	Selective	5/86	Annual	Central-contractor	Com/Stk.	Waiver
Indiana	Selective	6/84	Biennial	Central-contractor	N/A	Waiver
Kentucky (I)	Selective	1/84	Annual	Central-contractor	Computer	None
Kentucky (II)	Selective	11/86	Annual	Decentral-tampering	Computer	Always
Louisiana	Selective	9/85	Annual	Decentral-tampering	Sticker	Always
Maryland	Selective	2/84	Annual	Central-contractor	Regis.	Owner Chg.
Massachusetts	Statewide	4/83	Annual	Decentral-computer	Sticker	Always 80+
Michigan	Selective	12/8	Annual	Decentral-computer	Regis.	Waiver
Missouri	Selective	1/84	Annual	Decentral-manual	Regis.	Always
Nevada	Selective	10/8	Annual	Decentral-manual	Regis.	Waiver 75+
New Hampshire	Selective	9/87	Annual	Decentral-computer	Regis.	Always 85+
New Jersey	Statewide	2/74	Annual	Central-decentral	Sticker	Always 85+
New Mexico	PROGRAM CANCELLED - SANCTIONS IMPOSED					
New York	Selective	1/82	Annual	Decentral-computer	Sticker	Always 84+
N. Carolina	Selective	12/82	Annual	Decentral-manual	Sticker	Always
Ohio	SIP DISAPPROVED					
Oklahoma	Selective	1/86	Annual	Decentral-tampering	Sticker	Always
Oregon (I)	Selective	7/75	Biennial	Central-state	Regis.	Always 75+
Oregon (II)	Selective	1/86	Biennial	Central-state	Regis.	Always 75+
Pennsylvania	Selective	6/84	Annual	Decentral-computer	Sticker	Waiver
Rhode Island	Statewide	1/79	Annual	Decentral-manual	Sticker	None
Tennessee (I)	Selective	8/83	Annual	Central-local	Regis.	Waiver
Tennessee (II)	Selective	1/85	Annual	Central-contractor	Regis.	None
Texas	Selective	7/84	Annual	Decentral-tampering	Sticker	Always
Utah (I)	Selective	4/84	Annual	Decentral-manual	Regis.	Always
Utah (II)	Selective	4/84	Annual	Decentral-manual	Regis.	Always
Utah (III)	Selective	7/86	Annual	Decentral-manual	Regis.	Always
Virginia	Selective	12/81	Annual	Decentral-manual	Reg/Stk	Always
Washington (I)	Selective	1/82	Annual	Central-contractor	Regis.	None
Washington (II)	Selective	7/85	Annual	Central-contractor	Regis.	None
Washington D.C.	Selective	1/83	Annual	Central-local	Sticker	None
Wisconsin	Selective	4/84	Annual	Central-contractor	Regis.	Waiver

Source: E.P.A. Inspection/Maintenance Implementation Summary - January 1986.

The tampering column lists whether or not vehicles are being inspected for properly maintained air pollution control equipment. Most states will, at some point, check for inoperative equipment. The different reasons for requiring an anti-tampering inspection include: inspections for all vehicles is a part of the examination; inspection depends upon the vehicle's model year; the owner is applying for a waiver; the vehicle has failed the inspection; or, in the case of Maryland, the vehicle is being sold by the owner.

IV. PROGRAM OVERVIEW

Approval of a State Implementation Plan by the U. S. Environmental Protection Agency for a state not meeting air quality standards for carbon monoxide and ozone is conditional upon the existence, in the plan, of a viable vehicle inspection and maintenance program. It is, therefore, important to know what EPA deems to be a valid program and how this is met in Connecticut. The following elements form the basis for Connecticut's emissions testing program.

Program Elements

Inspection test procedures. Connecticut has a contract with Connecticut Vehicle Inspection Program, Inc. (CTVIP) that details specifically how each inspection shall be conducted and is discussed in greater detail below. The presence of these procedures, coupled with the centralized nature of the program is a guarantee that procedures, and thereby test results, are uniform throughout the state. Program consistency is vital to the public image of the operation.

Emission standards. Emission standards do not, by themselves, indicate that a vehicle is a gross polluter. The standards do show that, relative to all other vehicles inspected statewide, the automobile is polluting excessively. Emission standards are set to fail a pre-determined percentage of cars within the state each year. The assumption is that each failed vehicle will be repaired in an attempt to meet the emission standards. This increased efficiency of the automobile's engine will result in a reduction in atmospheric pollutants. Over a 5-year period, if 20 percent of the inspection fleet fails annually, the program can reduce the amount of pollutants being emitted substantially. Failure rates are computed for each year and put into a mathematical model created by EPA to determine the reduction in the amount of pollutants resulting from the program. The mathematical model takes into consideration such factors as total vehicle miles driven in the state, the age of the vehicle fleet, and each model year's actual failure rate.

Emission analyzer equipment, maintenance and calibration requirements. The capabilities of the inspection equipment used in the Connecticut vehicle inspection program are set by the contract with CTVIP, Inc. Identical equipment is used throughout the system, which reinforces consistency in test procedures and results.

Maintenance and calibration requirements are also included in the contract. Calibration is performed upon the equipment twice each week. Maintenance is conducted on an as-needed basis. As discussed below, maintenance and calibration are supervised by the Department of Motor Vehicles.

Quality control, audit and surveillance procedures. Quality control is performed for the Department of Motor Vehicles by two of its field representatives through unannounced inspection visits. Each lane in every station in the state, is checked by DMV field representatives at least once every two weeks. The field representatives examine the analyzer equipment for calibration and leaks that could affect a test outcome. If the equipment is not operating properly, the field representative has the authority to order the equipment taken out of operation until it has been adjusted to state specifications.

Record keeping and record submittal requirements. The results of each inspection are recorded on computerized equipment within the station and are transmitted to the Department of Motor Vehicles and the Department of Environmental Protection. The contract specifies the data to be retained by CTVIP as follows:

- test date and station identification code;
- test identification number;
- vehicle identification number;
- registration number;
- whether or not the motorist has a valid insurance card;
- odometer reading;
- vehicle manufacturer and model year;
- first test results for hydrocarbons and carbon monoxide; and
- second test results for hydrocarbons and carbon monoxide.

Enforcement procedures for non-complying vehicles. Connecticut uses a system of windshield stickers to determine compliance with the inspection law. There are four types of stickers: pass; fail; waiver; and exempt. All vehicles that are required to undergo the annual inspection must have one of the first three stickers upon the windshield. The pass sticker indicates that the vehicle has met its emission standards and is in compliance until the day of the month and year shown on the sticker.

Fail stickers are for vehicles that have failed the inspection; the sticker date is valid for 30 days from the date of the inspection, during which time it is expected that the vehicle will be repaired.

Waiver stickers are granted, upon application, to vehicle owners whose automobiles failed both the initial and second inspection and have spent at least $40.00 to bring the car into adjustment. If the waiver request is approved, the owner is granted one year in which compliance with the emissions standards is not necessary.

Exempt stickers are distributed to vehicle owners whose automobiles are not required, by statute, to be inspected for exhaust emissions and are valid for the life of the vehicle.

Public awareness program. The state's contract with CTVIP specifies that a set amount of money is to be spent on a public awareness program to acquaint the public with the rules and objectives of the vehicle inspection program. In 1985, the contractor spent $199,400 on a variety of public relations projects.

Mechanics training program. A mechanics training program is a crucial component of any vehicle inspection program. In Connecticut, courses on emissions and emissions equipment and repairs have been offered by the vocational colleges under the auspices of the Department of Education.

The general trend in the state has been to not offer the course unless 15 students expressed an interest in the course. Officials at DMV report that attendance at the courses has slipped steadily since the vehicle inspection program first commenced. The decrease has been attributed to the fact that there is no real incentive for the mechanics to take the course as they will receive repair business in any event. To counteract this, the Department of Motor Vehicles, in conjunction with Connecticut Vehicle Inspection Program, Inc. has prepared a newsletter to be sent to garages throughout the state with articles on emissions repairs.

The Inspection and Testing Process

The inspection and testing process requires a vehicle's emissions to be analyzed at one of the 44 testing lanes in the state. Each lane has three locations where CTVIP employees conduct: 1) data entry; 2) the emissions inspection; and 3) provide the driver with the test results. See Chart IV-1.

At the first location, the vehicle driver is requested to present the car's insurance card and registration. The insurance card is for Department of Motor Vehicle statistics only and is not a prerequisite to taking the test. The registration is a necessity as the inspection will not be performed without it.

After it has been determined that the driver has a valid registration, the lane inspector enters the following vehicle information into the computer terminal: make; model year; vehicle identification number; license plate number; odometer reading; and weight class. Each of these entries has varying degrees of importance to the test itself.

As shown by Table IV-1, different model years must meet different standards. A vehicle built in 1968 is tested at a standard for hydrocarbon and carbon monoxide emissions that is much more generous than that for a car built after 1979. Vehicles built between 1975 and 1979 were equipped with first generation pollution control technology. Given the disparity in engine technology, coupled with the age of the vehicles, it would be inappropriate to judge a 1968 car against that built in 1983 using the same emissions standards.

Table IV-1 also points out the differences in emission standards for vehicles of two different weight classes. The heavier vehicles are tested at lower emission standards than the average passenger vehicle. In those instances where some doubt could exist, the lane inspectors check the inside drivers door panel where the manufacturer has stamped the weight code. The entry of vehicle model year and weight instructs the lane computer as to the emission standards to be used during the inspection.

Table IV-1. 1986-1987 Emission Standards by Vehicle Year and Weight.

	Less Than 6000 Pounds		6,000 to 8,500 Pounds		8,501 to 10,000 Pounds	
Model Year	HC (PPM)	CO (Vol %)	HC (PPM)	CO (Vol %)	HC (PPM)	CO (Vol %)
1968-1969	750	7.5	850	7.0	850	7.0
1970	650	7.0	700	5.5	700	5.5
1971	650	6.0	700	5.5	700	5.5
1972	575	6.0	700	5.5	700	5.5
1973	425	6.0	700	5.5	700	5.5
1974	425	6.0	500	4.0	500	4.0
1975-1978	300	3.0	500	4.0	500	4.0
1979	300	3.0	300	3.0	300	3.0
1980	275	2.5	275	2.5	300	3.0
1981+	220	1.2	220	1.2	300	3.0

Source: 1986-1987 Reinspection Brochure.

All vehicle test data are stored on a computer in the facility and transmitted to the contractor's headquarters each day where they are processed. A tape is later sent to the Departments of Motor Vehicles and Environmental Protection. These test data are used for billings and for analyzing program effects on overall air pollution, problem trends by vehicle model and make, and repair industry effectiveness.

The actual test of the vehicle's exhaust emissions takes place at station two.

The first step is a visual inspection of the automobile as it moves from station one to station two. The inspection is to check for such conditions as a leaking gas tank or overheating radiator; conditions that could prove hazardous to the inspector or the driver. Assuming that the vehicle is safe to inspect, the inspector at station two will begin the inspection.

The test is conducted by the use of a long probe that is inserted into a vehicle's tailpipe. If part of the tailpipe is missing, or its construction is such that the probe cannot be inserted the required depth, the inspector may attach a "boot" to the tailpipe to act as an extension.

Before the computer begins the inspection, it samples the exhaust emissions for the presence of carbon dioxide. If the carbon dioxide concentration is less than four percent, the computer will not test the vehicle. This "sample dilution" check ensures that excessive amounts of air are not being emitted through the tailpipe, thereby diluting the concentrations of hydrocarbons and carbon monoxide and resulting in inaccurate readings.

If the vehicle passes the sample dilution test, the inspection continues. After the probe has been in the exhaust pipe for approximately 20 seconds, the computer will decide if the vehicle has passed, or whether further testing is necessary. If the vehicle's hydrocarbons and carbon monoxide readings do not exceed the emissions standard for that year and weight, then the vehicle passes, and the results are forwarded by the computer to station three. On the other hand, if the reading for either pollutant exceeds the standards, then the vehicle fails the first examination.

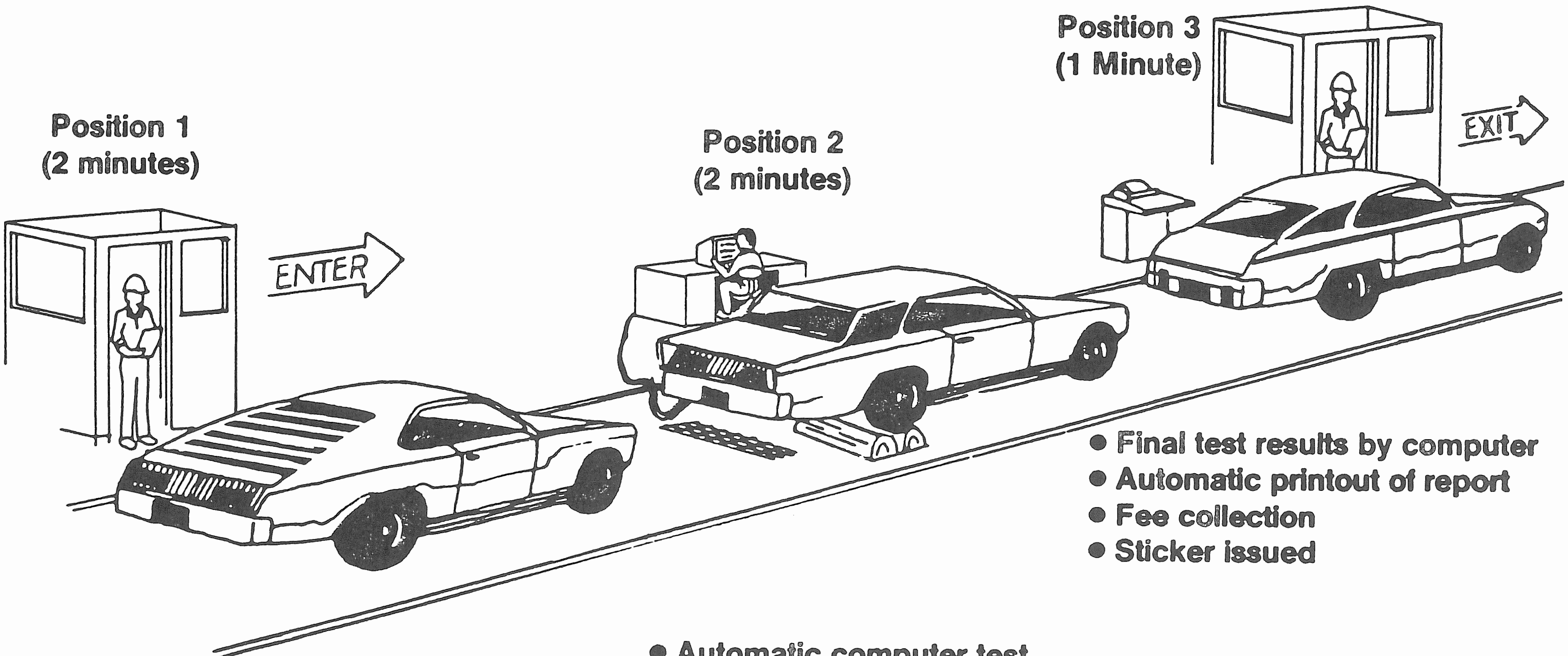
A failing vehicle is then conditioned by running it on a dynamometer for 20 seconds. During the time the vehicle is in the conditioning mode, the computer continues to sample the exhaust emissions. After the car returns to idle, the computer again examines the tailpipe emissions. Only the second idle results are used for the final decision. Regardless of the computer's decision, the testing process is now complete, and the vehicle proceeds to station three.

The final pass/fail results are completely automated. It is impossible for the inspector to influence the test results. If the probe is not properly inserted or not inserted at all, the computer will record a sample dilution and refuse to continue with the examination. Similarly, if the inspector attempts to withdraw the probe before the test is completed, thereby reducing the concentration of pollutants, a sample dilution will most likely result.

At station three, the driver pays the inspection fee and receives the results of the emissions inspection. If the vehicle has passed the inspection, the driver receives a copy of the vehicle inspection report (VIR). A new sticker good for one year is attached to the windshield by the inspector.

Chart IV-1. The Inspection Process.

INSPECTION LANE OPERATION



If the vehicle failed the inspection, the driver is given a copy of the VIR and an explanatory brochure explaining why the car failed and the procedure for reinspection.

The vehicle inspection report, as shown in Appendix B, contains a set of diagnostic codes. These codes are derived from the computer's sampling of the vehicle's emissions during the conditioning mode. Each of the codes explains a different engine problem that may have contributed to the failure, and thus assists the motorist or the garage mechanic in fixing the vehicle.

In addition to receiving the brochure and vehicle inspection report, the station three inspector will affix a fail sticker to the car windshield, in the lower left-hand corner. All car owners that fail have 30 days in which to have the car repaired, if it is to be reinspected without charge. Owners who return after the 30 day period must pay the regular $10.00 fee.

In the event the vehicle fails the second inspection, the owner may be eligible for a waiver from compliance. Waivers may only be granted by the station's DMV representative. To qualify, the vehicle owner must have: 1) had a low level emissions tune-up; and 2) produce a written estimate from a mechanic showing that further repairs will exceed $40. If the owner has met all requirements for repairs and money spent, the station representative will conduct a physical inspection of the automobile's air pollution control equipment. If any of the equipment has been tampered with the inspector must disapprove the waiver application. As shown in Table IV-2, out of a total of 52,000 requests,

Table IV-2. Total Waivers Approved and Denied Statewide - 1985.

Month	Total Waivers Granted	Total Waivers Denied
January	3,408	1,070
February	3,047	1,025
March	3,657	1,224
April	3,361	1,093
May	4,050	1,170
June	3,879	1,097
July	4,139	1,116
August	3,847	1,046
September	2,640	760
October	3,169	1,017
November	2,403	847
December	2,277	755
Total	39,877	12,220

Source: Department of Motor Vehicles, Emissions Division.

almost 40,000 waivers or 77 percent were granted statewide in 1985. When a vehicle is not granted a waiver, it is generally due to the absence of the air pollution control equipment. In this case, the owner must have the equipment repaired before the waiver will be approved.

V. PROGRAM MANAGEMENT

The Legislative Program Review and Investigations Committee reviewed the Department of Motor Vehicles' management of the emissions program. This section outlines the department's role, resources, staff, and quality assurance program in relation to the the contractor-run testing program.

The Role of the Department of Motor Vehicles

The Department of Motor Vehicles has responsibility for supervising the daily operational aspects of Connecticut's vehicle emissions inspection program. Program oversight is conducted by the department's Emissions Division.

Budget

The emissions inspection program began full operation on January 1, 1983. However, funds for the program were appropriated beginning in fiscal year 1980 and were used for study and development of the emissions program. The legislature also established a special fund in 1978, the Enterprise Fund, which contains all the inspections fees, state funds, and federal funds that are used to administer the program.

Table V-1 presents the emissions division's budget over a seven-year period. The first full year of the program is represented by FY 84. In the prior fiscal year, FY 83, the program was operating for only six months. The personnel figures for that year represent funding for the half-year program. For FY 84, the department employed 71 staff to oversee the emissions program, and staff costs were $1,071,742. A large portion of the other expense category is used to pay the contractor, Hamilton Test Systems, for administration of the testing program.

After FY84, no money from the general fund was used for the program. All expenditures were made from the Enterprise Fund. In addition, all DMV staff are paid from the fund, as noted in Table V-2. The fund receives money primarily from the inspection fees collected at the emission testing stations and investments made from the retained earnings. As Table V-2 indicates there was over a six million dollar surplus in the fund as of June 30, 1985.

There has been a 32 percent increase in total expenses from FY83 to estimated FY87. The increase is primarily due to more cars being tested, thus resulting in larger payments to the contractor, and increases in wages and fringe benefits for DMV employees.

Table V-2. Auto Emissions Inspection Fund (Enterprise Fund) Revenues, Expenditures, and Changes in Retained Earnings.

REVENUES:	FY83	FY84	FY85
Vehicle Inspection Fees	$8,008,436	$15,837,144	$17,184,560
Sale of Fleet Inspection Stickers	58,275	124,038	152,604
Sale of Dealer Temporary Stickers	58,075	130,065	136,430
Investment Income	0	445,609	540,229
Other Income	0	0	140
TOTAL REVENUES	$8,124,786	$16,536,856	$18,013,963
EXPENDITURES:			
DMV Salaries	0	1,144,223	1,293,255
DMV Fringe Benefits	0	348,983	592,071
Payments To Contractor	6,362,791	12,391,056	13,480,658
Payments For Outside Prof. Serv.	0	6,295	20,976
Payments To DEP	97,500	195,000	195,000
Equipment	0	13,907	14,099
Other Expenses	0	181,274	198,142
TOTAL EXPENDITURES	$6,460,291	$14,280,738	$15,794,201
EXCESS OF REVENUES OVER EXPENDITURES:			
RETAINED EARNINGS FOR THE FISCAL YEAR	$1,664,495	$2,256,118	$2,219,762
TOTAL RETAINED EARNINGS IN FUND	$1,664,495	$3,934,520	$6,168,381

Current Staff

Table V-3 and Figure V-1 outline the current staffing patterns and organization for the Department of Motor Vehicles' Emissions Control Division. The largest portion of the staff is found in the contractor's program. Specifically, there are 28 field representatives working at the 18 emissions station whose primary duties are to issue waivers for eligible vehicles failing the emissions test.

Table V-1. Emissions Division's Seven-Year Budget - FY 79 to FY 87.

	FY79-80	FY80-81	PERCENT CHANGE FY80-FY81	FY81-82	PERCENT CHANGE FY81-FY82	FY82-83	PERCENT CHANGE FY82-FY83	FY83-84	PERCENT CHANGE FY83-FY84	FY84-85	PERCENT CHANGE FY84-FY85	ESTIMATED FY85-86	PERCENT CHANGE FY85-FY86	REQUESTED FY86-FY87	PERCENT CHANGE FY83-FY87
DIVISION OF EMISSIONS															
Personnel #'s	4	5	20.0%	5	0.0%	80	93.8%	71	-12.7%	71	0.0%	71	0.0%	71	0%
Personnel $'s	0	79,489	100.0%	86,269	7.9%	504,373	82.9%	1,071,742	52.9%	1,279,266	16.2%	1,486,363	13.9%	1,544,824	44%
Other Expenses	87,371	4,530	-1828.7%	6,001	24.5%	490,849	98.8%	13,257,167	96.3%	14,663,515	9.6%	15,987,400	8.3%	17,303,362	31%
Total Expenses	87,371	84,019	-4.0%	92,270	8.9%	995,222	90.7%	14,328,909	93.1%	15,942,781	10.1%	17,473,763	8.8%	18,848,186	32%
General Fund	87,371	84,019	-4.0%	92,270	8.9%	995,222	90.7%	0		0		0		0	
Emissions Fund	0	0		0		0		14,328,909	100.0%	15,942,781	10.1%	17,473,763	8.8%	18,832,386	31%
Total All Funds	$87,371	$84,019	-4.0%	$92,270	8.9%	$995,222	90.7%	$14,328,909	93.1%	$15,942,781	10.1%	$17,473,763	8.8%	$18,832,386	31%

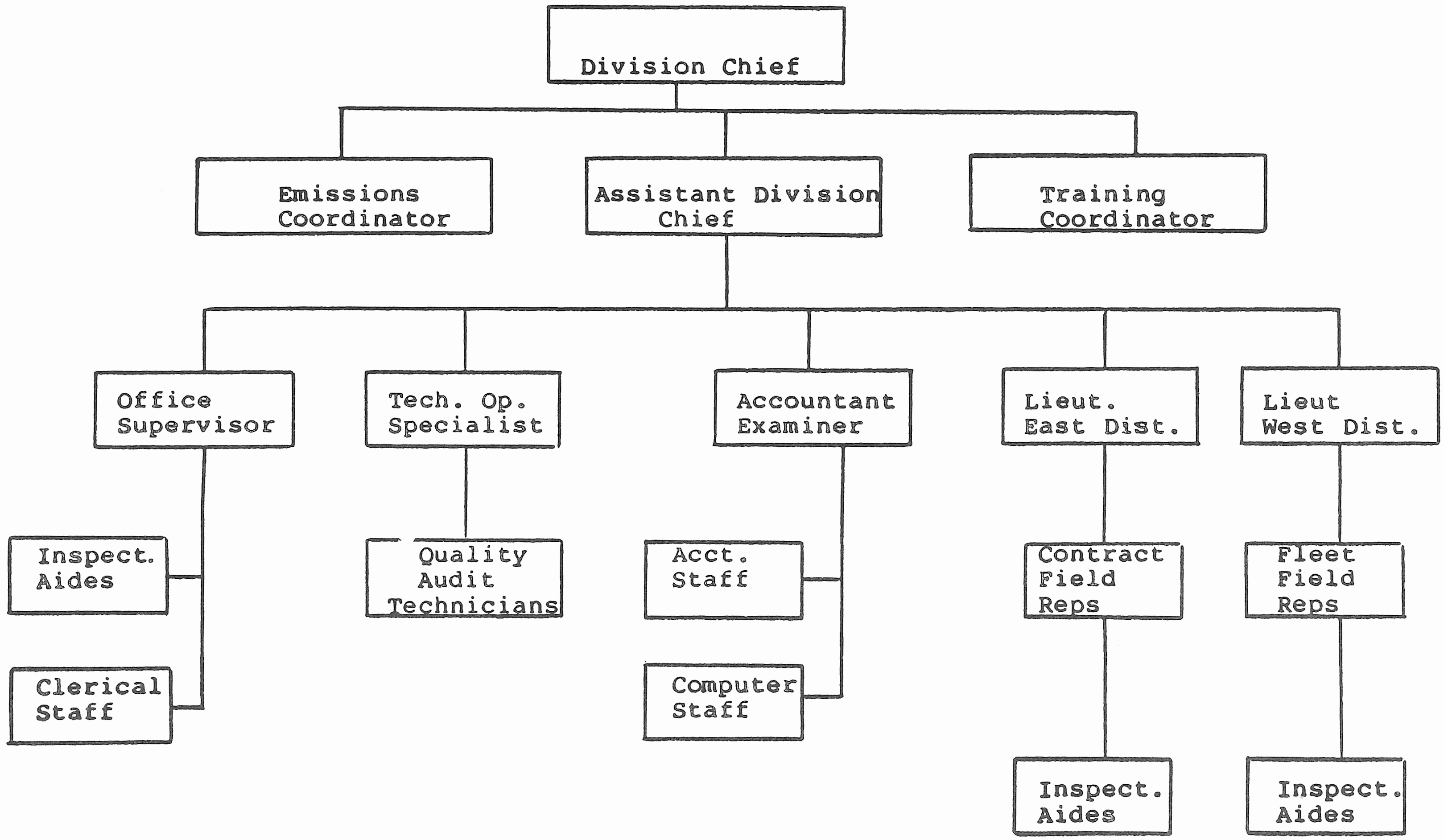
Table V-3. Emission Control Division's Staffing Pattern

Administrative & Director's Office:	
Division Chief I	1
Assistant Division Chief	1
Emissions Tech. Operations Spec.	1
Staff Development Coordinator	1
Office Supervisor III	1
Accountant I	1
Accountant III	1
Accounts Examiner I	1
Accounts Examiner II	1
Senior Clerk	2
Clerk Typist	2
Financial Clerk	1
Junior Accountant	1
Contractor's Program:	
Lieutenant	1
Emissions Field Representatives	28
Emissions Coordinator	1
Clerk Typist	1
Computer Programmer II	2
Computer Operator I	1
Data Entry Operator I	3
Inspection Aide	8
Head Clerk	1
Storekeeper I	1
Clerk	2
Part-time	2
Fleet Program:	
Lieutenant	1
Emissions Field Representatives	4
Senior Clerk	1
Total Staff:	71

Source: DMV Monthly Personnel Status Report -- June 19, 1986.

The division is organized as outlined in Figure V-1. The major units are the east and west units containing the field representatives, the office supervisor in charge of administrative staff, the accounting unit, and technical operations.

Figure V-1. Emission Division Organization.



Source: Department of Motor Vehicles

With its staff of 71 employees, the Auto Emissions Division:

- reimburses Connecticut Vehicle Inspection Program, Inc. (CTVIP), the independent contractor that runs the program;
- sponsors, in conjunction with CTVIP, a variety of seminars to keep private repair mechanics aware of changes in automotive emissions maintenance technology;
- monitors operators of fleet self-inspection stations;
- issues waivers and exemption stickers; and
- monitors the emissions stations' analyzer calibration.

Three groups of employees are especially important to the division's ability to carry out its mission: the field inspectors; the department's station representatives; and field representatives.

The eighteen field inspectors are based at the division's headquarters in Wethersfield. These inspectors perform equipment inspections at the fleet emissions garages, handle problems between private garages and consumers, and enforce compliance through the issuance of warning or violation tickets.

Twenty division employees represent the department at each of the 18 emissions stations. The station representative's primary duties are to monitor daily station operations and process waiver applications. In addition, vehicle owners may request replacement pass stickers to replace those lost on broken windshields. The station representative has contact with the local repair industry and also attends to: consumer complaints or inquiries on the inspection procedure; questions regarding automotive repairs; and requests for information on air pollution control equipment warranties.

Two field representatives are headquartered in Wethersfield. The field representatives primary responsibility is to carry out the quality assurance program by visiting each emissions station once every two weeks to examine the station's emissions analyzers for accuracy. If the analyzers exceed accuracy limits set by CTVIP and DMV, the field representative can order that the analyzer be removed from service until it is calibrated.

<u>Quality Assurance</u>

The program review committee identified the accuracy of the emissions testing equipment as a major issue to be examined in this study. Complementing the committee's review of this area, members of the Connecticut Academy of Science and Engineering visited the North Haven emissions station to study the equipment and the efforts of the contractor to maintain the analyzers within contract specifications.

At the outset, it should be noted that as of July 1986, the Department of Motor Vehicles, in consultation with the federal EPA and CTVIP, revised the required tolerance limits within which the emissions analyzers had to perform. According to CTVIP, the manufacturer could not warrant the equipment's performance within the specifications set by DMV. Consequently, the contractor, and ultimately EPA, proposed that the standards be relaxed to reasonably reflect the capabilities of the machinery. Our review of the quality assurance program is based upon these new standards.

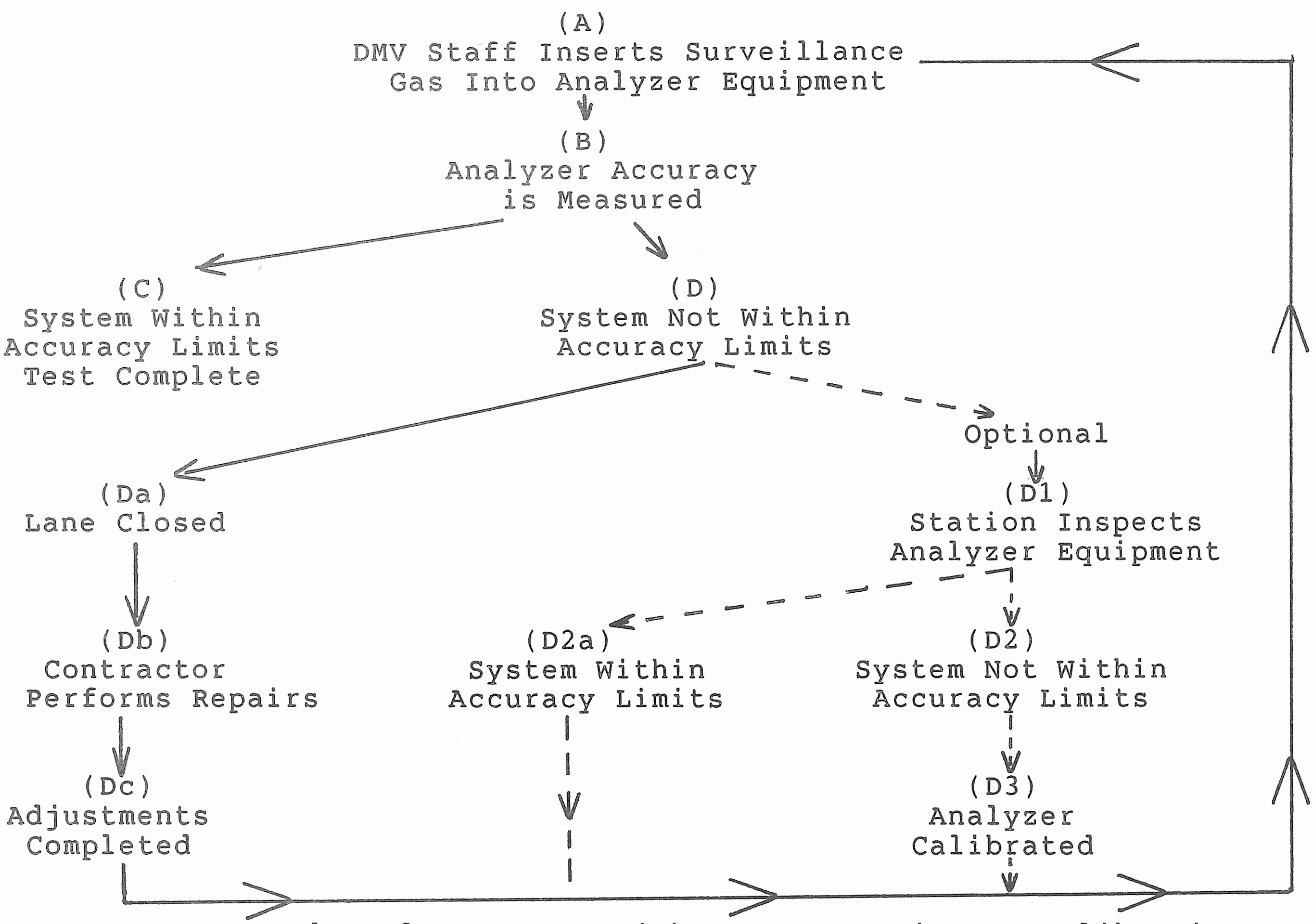
An emissions analyzer is the lane equipment that actually measures the pollutants produced by a motor vehicle at idle. The analyzers used in Connecticut's emissions station are completely automated and the role of the lane inspector is limited to entering data and inserting a probe into the car's tailpipe to begin the test.

The auto emissions division of DMV conducts quality assurance tests to ensure that the analyzers are measuring an automobile's tailpipe emissions accurately. The test is initiated by the DMV field representative who inserts a test gas into the analyzer equipment. The test gas is contained in a pressurized bottle, and each bottle is labeled with the composition of the gas it contains. The test consists of having the analyzer equipment measure the content of the bottled gas. Equipment that is in perfect calibration would identify the make-up of the test gas to be the same as its labeled composition.

Figure V-2 is a flow chart diagraming how the analyzer inspection is conducted. The test is initiated by the DMV field representative with the insertion of a pre-determined sample gas (A). The analyzer equipment is then inspected to determine if its accuracy is within contract specifications (B). If so, the examination is terminated (C). However, if the equipment does not pass the inspection (D), there are two options available to the contractor.

It is possible that the station management may wish to test the equipment (D1). If this option is exercised using a sample gas stored at the station, and the analyzer is determined to be accurate (D2a), the field representative will repeat the inspection (A). On the other hand, if the station finds the analyzer to be inaccurate (D2), it will then calibrate the equipment (D3) using its own sample gas. Once this calibration is completed, the field inspector test the equipment again (A).

Figure V-2. Emissions Analyzer Quality Assurance Process.



Source: Memorandum of Agreement with CTVIP: Equipment Calibration Surveillance. September, 1982.

The second option, which is generally followed, is for the contractor to close the lane (Da) and adjust the equipment (Db). When the adjustments have been finished, (Dc), the field representative repeats the test procedure (A).

In practice, the equipment's measurement of the gas composition usually is within a percentage, plus or minus, of the actual value. It is then up to the field representatives to decide, based on test results and their relation to the accuracy standards, whether the equipment's performance has met contract specifications.

Two distinct gases are used to measure analyzer accuracy - carbon monoxide and hexane (hexane is a substitute for hydrocarbons). Each gas is used in varying concentrations. Table V-4 presents the accuracy limits within which each analyzer must measure the test gas.

Table V-4. Analyzer Accuracy Limits.

Hydrocarbon (PPM Hexane)	Tolerance Limits	Carbon Monoxide (Volume %)	Tolerance Limits
110-220 (low)	-21 to +15	0.60-1.40 (low)	-.14 to +.10
221-2000 (high)	-10% to +7%	1.41-10.00 (high)	-10% to + 7%

Source: Department of Motor Vehicles, Auto Emissions Division, Quality Assurance Unit.

When low-range gases are used to inspect the equipment, accuracy is determined by subtracting the concentration of the test gas from the actual test reading. For example, in an inspection where the test gas equals 216 parts per million hexane, and the analyzer measures the gas as 210 ppm, the machine's accuracy is measured as an absolute value of -6 which is within tolerance limits.

If the test gas is a high-range gas, the formula to determine analyzer accuracy is somewhat different. Assuming the test gas consists of 700 ppm hexane, and the analyzer measures the gas as containing 689 ppm hexane, the equation to determine accuracy would appear as: ((689-700)/700)X100 = -1.57% and the analyzer would again pass inspection.

The form used by the field representatives to record their findings is reproduced as Figure V-3. Each form details:

- the ultimate result of the audit (A);
- the station audited (B);
- the lane audited (C);
- the time of the audit (D);
- the date of the audit (E);
- the test gas concentration (F1-F2);
- the analyzer response (G1-G4);

Figure V-3. Audit Result Form.

DEPARTMENT OF MOTOR VEHICLES
AUTO EMISSIONS DIVISION
QUALITY ASSURANCE UNIT

(A)

☐ ANALYZER O.K.
☐ ANALYZER OUT
☐ LEAK > 3%

STATION DATA	STATION LOCATION (B)	LANE (C)	TIME (D)	DATE (E)
	ATMOSPHERIC PRESSURE	HUMIDITY ATTENDANT WET BULB ____°F DRY BULB ____°F		CTVIP ATTENDANT
ANALYZER DATA	SERIAL NO.	P.E.F.		ANALYZER PRESSURE
	ZERO DATA	CO_2 DATA		
	SAMPLE FLOW	CONDITION OF HOSE PROBE ☐ O.K. ☐ NOT ACCEPTABLE		SAMPLE DILUTION CHECK ☐ O.K. ☐ NOT O.K.
AUDIT GAS DATA	BOTTLE I.D.	BOTTLE PRESSURE		
	STATE GAS CONCENTRATION (F1) % CO Actual	______ PPM LABELED PROPANE x P.E.F. = (F2) PPM ACTUAL HEXANE		

ANALYZER ACCURACY REQUIREMENTS (Cal Port)				EMS ACCURACY REQUIREMENTS (Through the Probe)			
HC		CO		HC		CO	
RANGE (PPMH)	ACCURACY	RANGE (Percent CO)	ACCURACY	RANGE (PPMH)	TOLERANCE	RANGE (Percent CO)	TOLERANCE
110 - 220 (Low Range)	± 15 PPM	0.6 - 1.4 (Low Range)	± .10%	110 - 220 (Low Range)	-21 to +15	0.6 - 1.40 (Low Range)	-.14 to +.10%
221 - 2000 (High Range)	± 7% of Point	1.41 - 10.0 (High Range)	± 7% of Point	221 - 2000 (High Range)	-10% to +7% of Point	1.41 - 10.0 (High Range)	-10% to +7% of Point

AUDIT RESULTS

ANALYZER RESPONSE				LEAK CHECK	ACCURACY *Negative sign means analyzer reads low		PASS	F
PROBE		CAL PORT						
HC	CO	HC	CO	(% LEAK)	HC	CO	(✓)	
(G1)	(G2)	(G3)	(G4)	(H)	(I1)	(I2)	(J)	

LEAK CHECK FORMULA

$$\% \text{Leak} = \frac{\text{CO Cal Port} - \text{CO Probe}}{\text{CO Cal Port}}$$

HC ACCURACY FORMULA (High Range)

$$\% \text{Difference(HC)} = \frac{\text{HC Probe} - \text{HC Actual Hexane}}{\text{HC Actual Hexane}} \times 100$$

HC ACCURACY FORMULA (Low Range)

HC Difference = HC Probe − HC Actual Hexane

CO ACCURACY FORMULA (High Range)

$$\% \text{Difference (CO)} = \frac{\text{CO Probe} - \text{CO Actual}}{\text{CO Actual}} \times 100$$

CO ACCURACY FORMULA (Low Range)

CO Difference = CO Probe − CO Actual

COMMENTS

☐ INITIAL AUDIT	☐ REINSPECTION	REINSPECTION DATE	SIGNATURE X

(MARGINALS)

- the results of a leak check to see if the test gas flow is being diluted (H);
- the accuracy of the analyzer reading (I1-I2); and
- the pass/fail results based upon the accuracy reading (J).

In terms of contract adherence, the contractor's performance is measured by the number of audit results (A) that result in a pass or fail. Although the field representative may find an analyzer to be out of calibration during one test, two subsequent tests may produce a contrary finding and the representative may judge the analyzer's performance as acceptable.

For the purpose of this report, two important distinctions should be explained. The contractor and DMV refer to the inspection of an analyzers as an "audit." An audit of a lane's analyzer may amount to one test for each gas or a series of tests using different compositions of each gas. An "audit" result means that the decision has been made on the equipment as a whole. Contractually, only audit results are important. However, for the purposes of analyzing audit data, the term "inspection" is used. An inspection in this context is a single test of an analyzer's accuracy. An inspection is a small component of an audit but is relevant only in analyzing the accuracy of emissions testing equipment. Explained differently, an inspection is the method by which an audit decision is reached.

The committee attempted to analyze the pass/fail audit results as they might have been under the new standard but found that variables that could have influenced the field representative's final decision were not available. Table V-5 presents the audit results for 1985 by month under the old standard.

Table V-5 does not include audit results for tests performed on the back-up analyzers utilized by single lane inspection stations. Under the terms of the present contract, while these analyzers are examined, the results are not considered in terms of contractual liability. However, the program review committee has included that data in its analysis of the quality assurance results. The back-up analyzers must be kept in a constant state of readiness in the event the station's only analyzer malfunctions. Therefore, it is just as important that the back-ups be in proper calibration.

The audit report form records more than the representative's ultimate decision regarding the machine's calibration. The representatives findings are almost always predicated upon a series of accuracy tests, often involving test gases of different concentrations. This is especially true if there is a possibility that the equipment may not pass the inspection.

Table V-5. Monthly Analyzer Audit Failures - 1985.

Month	Total Audits	Audit Failures	Audit Failures As A Percentage
January	185	0	0.0%
February	213	6	2.8%
March	219	23	10.5%
April	209	14	6.7%
May	228	2	0.9%
June	87	4	4.6%
July	181	21	11.6%
August	183	14	7.7%
September	168	4	2.4%
October	242	3	1.2%
November	229	2	0.9%
December	203	3	1.5%
TOTAL	2,347	96	4.1%

Source: Department of Motor Vehicles, Auto Emissions Division, Quality Assurance Unit records.

To analyze the network's equipment reliability, the committee looked beyond the audit results and reviewed data from the individual inspections, regardless of the ultimate disposition of the audit. Specifically, committee staff reviewed: accuracy readings for each test involving hydrocarbons and carbon monoxide; the instances where contract limits were exceeded; occasions where the contract limits were not passed, but the readings were near the outer boundaries; whether the equipment readings were under or over test gas concentrations; and any other trends that could affect the reliability of the test procedures.

Although an analyzer is often examined more than once during a station audit, the DMV field representative is not confined to conducting multiple inspections using the same test gas during the same audit. Table V-6 presents the number of inspections performed within several test ranges for both hydrocarbons and carbon monoxide.

Table V-7 is the analyzer pass/fail rate for each of the above test ranges. For hydrocarbons, 63 percent of the tests were performed using test gases with a concentration between 200 ppm and 500 ppm. In 1985, under the new test standard, only 1.3 percent of the total inspections showed analyzer readings outside of tolerance limits; all of these failures occurred in the 200-500 ppm range.

Table V-6. Number of Inspections by Test Gas Range - 1985.

Hydrocarbon Test Range	Number of Inspections	Percent	Carbon Monoxide Test Range	Number of Inspections	Percent
200-299	606	22.5%	0.01-1.25	579	21.5%
300-399	720	26.7%	1.41-1.99	388	14.4%
400-499	389	14.4%	2.00-2.99	388	14.4%
500-599	000	00.0%	3.00-3.99	370	13.7%
600-699	22	00.8%	4.00-5.99	000	00.0%
700-799	718	26.6%	6.00-6.99	884	32.8%
800-999	152	5.6%	7.00-7.99	89	3.3%
1000-2000	92	3.4%	8.00-10.00	000	00.0%

Source: Legislative Program Review & Investigations Committee Analysis.

Table V-7. Pass/Fail Results For Single Inspections By Test Gas Range - 1985.

Hydrocarbons (PPM)	Total Inspections	Total Pass	Total Fail	Percentage of Range Failures
200-299	606	589	17	2.81%
300-399	720	704	16	2.22%
400-499	389	386	3	0.77%
600-699	22	22	0	0.00%
700-799	718	718	0	0.00%
800-999	152	152	0	0.00%
1000-2000	92	92	0	0.00%
Total	2,699	2,663	36	1.33%

Carbon Monoxide (Volume %)	Total Inspections	Total Pass	Total Fail	Percentage of Range Failures
0.01-1.25	578	576	2	0.35%
1.41-1.99	388	372	16	4.12%
2.00-2.99	388	383	5	1.29%
3.00-3.99	370	367	3	0.81%
6.00-6.99	884	883	1	0.11%
7.00-7.99	89	89	0	0.00%
Total	2,697	2,670	27	1.01%

Source: Legislative Program Review & Investigations Committee Analysis.

When the test was for accuracy in measuring carbon monoxide, individual inspection failures occurred in all but one of the above test ranges, with the greatest number of failures happening when the test gas range was between 1.41 and 1.99 percent volume of carbon monoxide. However, carbon monoxide showed a better overall result - only a 1 percent analyzer failure rate during the individual inspections.

In terms of how the network's analyzers performed in measuring the gases, the program review committee reviewed the analyzer responses for both tolerance ranges of each gas. Although it is not expected that the analyzer will perform perfectly 100 percent of the time, the degree of inaccuracy can be important. These data are presented in Figure V-4.

Regardless of the composition of the test gas, and the applicable tolerance limit, the analyzers did not exceed the tolerance limits in more than 2 percent of all tests. The only exception to this was low-range hexane gas where the measuring equipment exceeded tolerance limits by reading low in 3 percent of the individual inspections.

The analyzers showed a tendency to under-measure the hexane test gas irrespective of test gas composition. In all instances involving hexane, over 91 percent of all measurements were low. This is a significant contrast to the results for carbon monoxide where the percentage was approximately 58 percent. In fact, while the data showed that the analyzers were more likely to perfectly measure the composition of the carbon monoxide test gas, in about 10 percent of the examinations overall, it was also discovered that the analyzers over-stated the contents of the carbon monoxide test gas during 30 percent of all individual inspections.

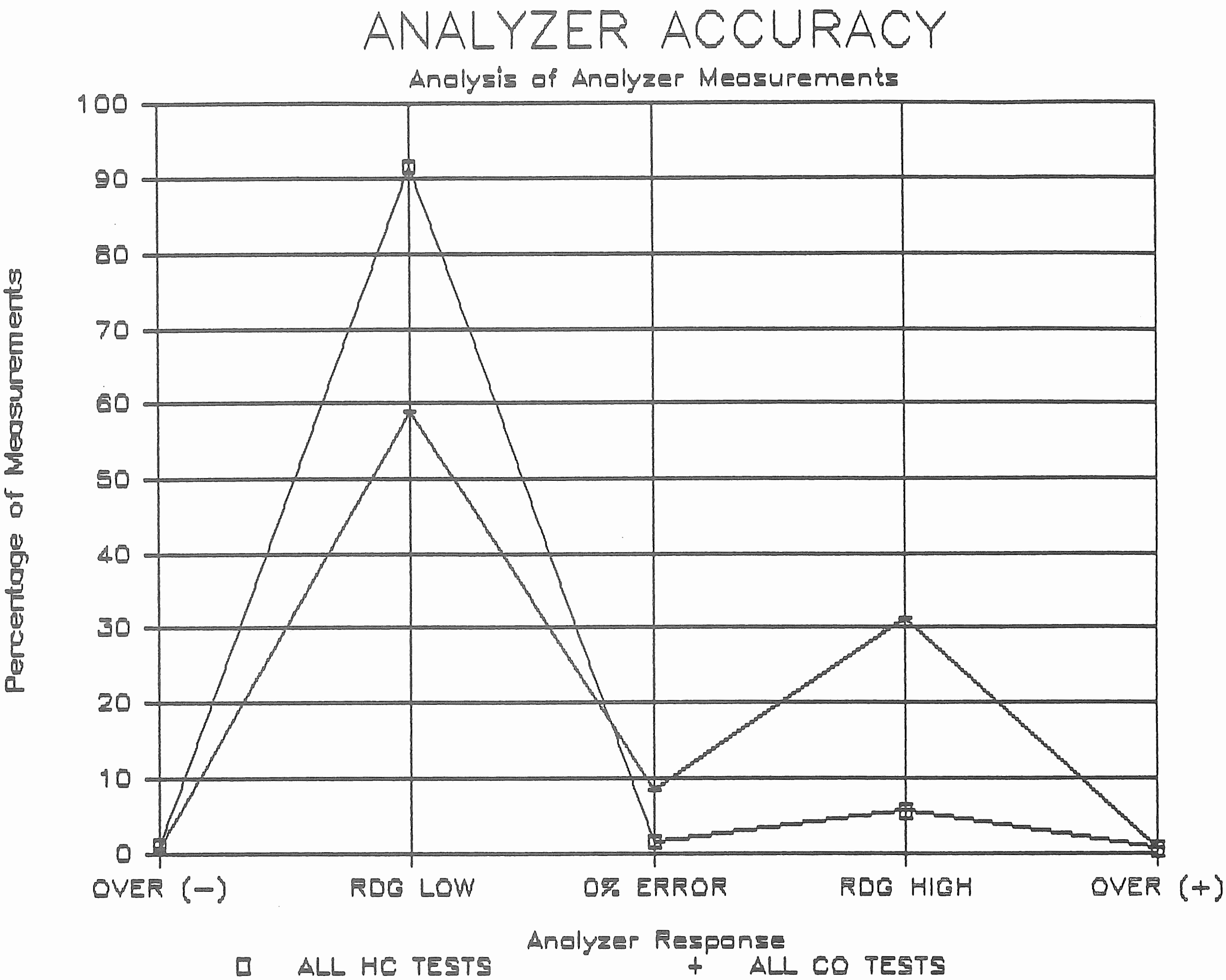
An analyzer that is measuring test gas concentration low will pass motor vehicles when they might have failed their inspection. Conversely, if the analyzer is reading the test gas as high, cars that should pass may fail.

There is no readily available reason why the analyzers measure the hexane test gas low more consistently than they do carbon monoxide. However, in terms of actual numbers, the total number of inspections producing a high reading is insignificant when viewed in light of the total 2,699 observations. Additionally, in order for these inaccuracies to have an impact upon program results the analyzer would have to be out of calibration at the moment that a borderline vehicle was being inspected.

Contractor's Role

The emissions inspection facilities in Connecticut, as mentioned previously, are not run by a state agency. All stations are owned and operated by Connecticut Vehicle Inspection Program Inc., an independent contractor.

igure V-4. Analyzer Accuracy Limits.



CTVIP is one of several independent contractors operating emissions inspection stations throughout the country. Table V-8 lists all centralized programs as well as their program commencement date and contractor as of January, 1986.

Table V-8. States with Independent Contractors.

State	Start Date	Contractor
Arizona	Jan. 1977	Hamilton Test Systems
Connecticut	Jan. 1983	Connecticut Vehicle Inspection Program, Inc.
Illinois	May 1986	Systems Control, Inc.
Indiana	Jun. 1984	Indiana Vocational Technical College
Louisville, KY.	Jan. 1984	Gordon-Darby, Inc.
Maryland	Feb. 1984	Systems Control, Inc.
Nashville, TN.	Jan. 1985	MARTA, Inc.
Washington	Jan. 1982	Vehicle Test Technologies, Inc.
Wisconsin	Apr. 1984	Hamilton Test Systems

The contractor manages 18 inspection stations in Connecticut (see Chart V-1). The 18 stations operate a total of 44 inspection lanes, and in 1985, 1,892,785 vehicles were tested. This figure includes both initial inspections and reinspections. The number of lanes per station ranges from a low of 1 to a maximum of 5. Table V-9 presents the number of inspections performed in 1985 by month.

Each inspection station has at least one full-time manager and one assistant manager as well as a maintenance inspector whose duty it is to maintain and calibrate the stations equipment. The other station employees are the lane inspectors. Approximately 250 persons are employed, in all categories, to operate the program.

The contract between CTVIP and state of Connecticut covers all aspects of program operations from office equipment to the computer system to be used. Policies and practices that are not governed by the contract are left open for arbitration in the event of a dispute between the two parties. The contract also contains technical provisions on station design, inspection procedures, operations, data gathering and retrieval, and computer equipment. The contract stresses uniformity throughout the program.

Chart V-1. Emission Station Locations.

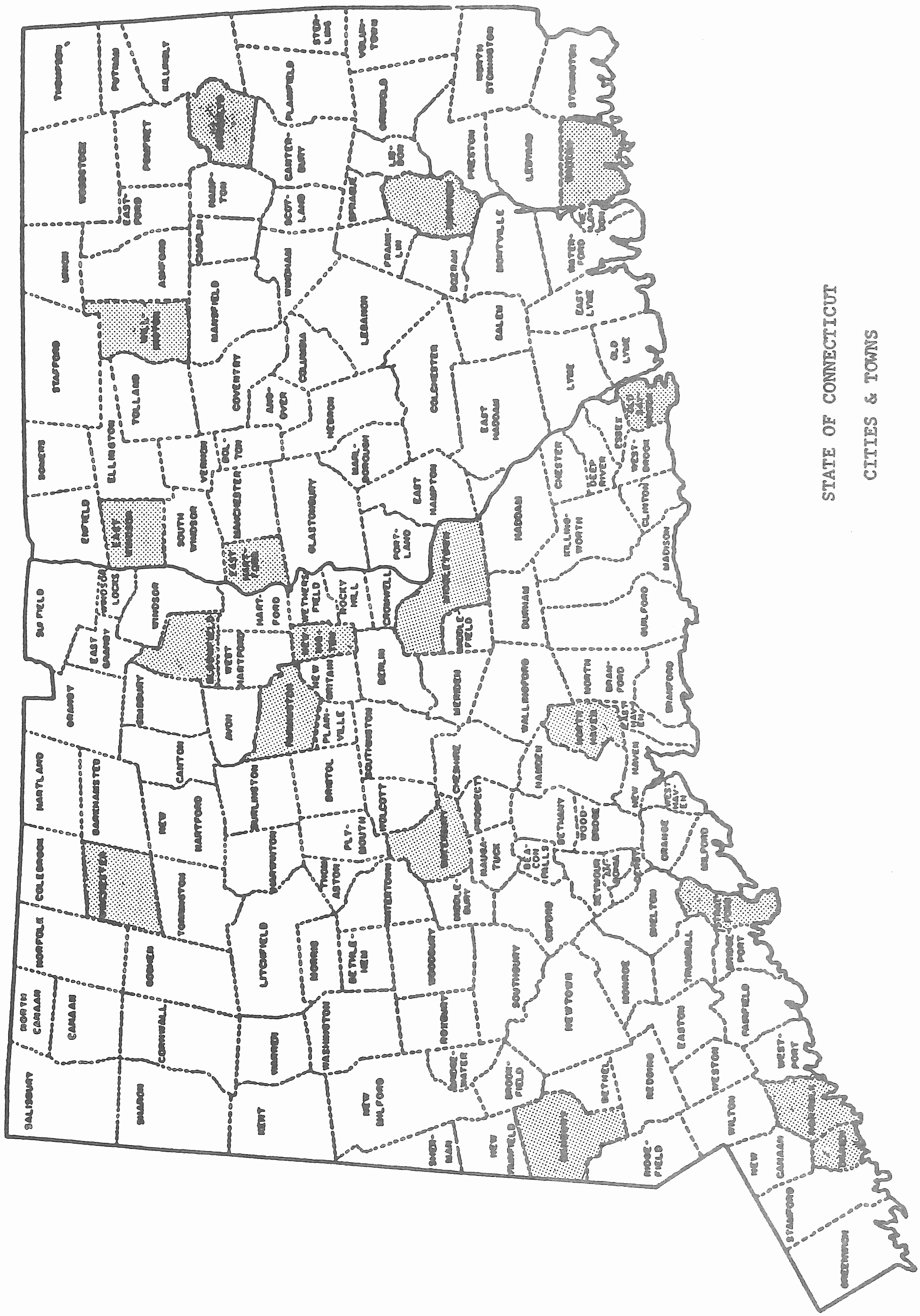


Table V-9. Monthly Statewide Pass/Fail Results - 1985

Month	First Pass	First Fail	Second Pass	Second Fail	Total Inspections
January	120,606	22,142	15,325	4,651	162,724
February	109,719	18,846	13,908	4,242	146,715
March	126,469	22,474	15,483	5,362	169,788
April	116,637	21,320	14,103	5,312	157,372
May	127,457	23,330	15,524	6,086	172,397
June	119,954	21,098	15,017	5,629	161,698
July	123,797	23,715	14,298	6,391	168,201
August	126,180	22,731	13,844	5,436	168,191
September	99,241	16,621	10,288	3,602	129,752
October	134,410	21,077	11,840	4,191	171,518
November	109,088	17,012	10,056	3,313	139,469
December	115,448	17,316	9,263	2,933	144,960
Totals	1,429,006	247,682	158,949	57,148	1,892,785

Source: Department of Motor Vehicles, Auto Emissions Division. 1985 Operational Reports.

All inspection stations were built to the same specifications; from landscaping to the structural composition of the building. Except for the number of lanes, all the stations are identical in appearance.

The agreement provides a step-by-step narration on how each inspection must be performed. In addition, educational and training requirements for the contractor's personnel are detailed. Specifications in the contract also include interaction with the repair industry, consumer complaints, and safety and inspection personnel attire, and a precise public education schedule to be followed by the contractor.

Most consumer inquiries and/or complaints are handled by CTVIP station management. Typical issues include: replacement of lost vehicle inspection reports; replacement of compliance stickers due to broken windshields; questions regarding 6-month stickers issued to motorists who are more than 3 months late in having their vehicles inspected; vehicular accidents in the test lanes; and emissions inspection procedures.

Vehicle owners who telephone the station after business hours receive a pre-recorded message giving the station's hours and the procedure for having a vehicle tested. In addition, CTVIP maintains a toll-free "800" number at its headquarters, which the public may use.

If a motorist so desires, the DMV station representative is also present to answer any questions. Primarily, the issues with which the station representative must deal include:

- the procedure for applying for a waiver;
- replacement of compliance stickers lost on broken windshields;
- questions regarding the probable repairs that will enable a vehicle to pass the reinspection; and
- questions regarding why a vehicle did not pass its reinspection despite having had an emissions tune-up.

In addition, there are toll-free numbers available to vehicle owners who telephone the Auto Emissions Division headquarters seeking a resolution to their question/problem.

Waiting Times. Table V-10 details the average waiting times for all stations, by month, in 1985. While the statewide average waiting time, calculated from the moment the vehicle enters the waiting line to the time of station exit, is seven minutes, other factors may influence the wait at individual stations at particular times of the month. A problem that may increase waiting time is the amount of time spent by vehicles in the conditioning mode. Another factor is the tendency for motorists to wait until weekends or the end of their test cycle before going for an inspection. This behavior results in a larger number of drivers attempting to have their vehicles inspected at the same time.

Table V-10. Average Statewide Waiting Times By Month - 1985.

Month	Average Waiting Time
January	8 minutes
February	8 minutes
March	6 minutes
April	6 minutes
May	7 minutes
June	8 minutes
July	8 minutes
August	6 minutes
September	4 minutes
October	7 minutes
November	5 minutes
December	6 minutes
Statewide Average	7 minutes

Source: Department of Motor Vehicles, Emissions Division.

Payment. The contractor and the state have agreed to a system of payment whereby the contractor collects and deposits all fees and then in turn bills the state for inspections conducted. The contractor is only paid for each vehicle's initial inspection. No payments are made for the free reinspection given vehicles that fail and return in 30 days.

The amount paid to the contractor, per test, is not a constant figure and is predicated upon a base fee and a base volume. For 1985, the base fee was $8.30 on an anticipated volume of 1,661,213 inspections. Table V-11 shows the base fee and volume for each year of the contract.

Table V-11. Base Fee and Base Volume Per Contract Year.

Calendar Year	Base Fee	Base Volume
1983	$7.53	1,612,476
1984	7.95	1,636,663
1985	8.30	1,661,213
1986	8.64	1,686,131
1987	9.04	1,711,423

Source: Contract between State of Connecticut and Connecticut Vehicle Inspection Program, Inc.

VI. PROGRAM ANALYSIS AND EFFECTIVENESS

A central question that this study attempts to answer is how effective the Connecticut vehicle inspection program is in cleaning the air. This section examines the program's effectiveness in terms of air quality. It outlines the Department of Environmental Protection's role in the program and presents a picture of the quality of Connecticut's air. Also included is an examination of emissions test characteristics, an analysis of the differences in lane to lane tests and the effect temperature has on emission test results.

Department of Environmental Protection's Role

The Department of Environmental Protection (DEP) is responsible for solving air pollution problems and protecting air resources in the state. The department has been given specific authority to carry out the EPA required State Implementation Plan, which outlines programs the state intends to undertake to reduce pollutants that exceed the National Ambient Air Quality Standard established by the federal government.

The major components of the SIP include: 1) a demonstration that reasonably available technology is being applied to existing stationary (smokestack) sources of pollution; 2) an emissions inventory; 3) a permit program for major new stationary sources of pollutants; 4) use of public participation in the air quality decision-making process; and 5) for areas of the state where ozone and carbon monoxide levels exceed the standards, a schedule for implementation of a motor vehicle emissions and maintenance program.

In terms of pollutants, the major chemicals in need of control are:

- particulates - solids and liquids emitted by many types of industrial sources;
- sulfur oxides - gases caused primarily by fuel burning for heat, and generation of electricity;
- nitrogen oxides - gases that are emitted by motor vehicles, industrial furnaces, and power plants;
- carbon monoxide - a gas emitted by motor vehicles;
- hydrocarbons - a class of compounds found in petroleum, natural gas, and coal and primarily emitted by motor vehicles;
- ozone (smog) - a compound formed in the atmosphere when nitrogen oxides and hydrocarbons react on hot, sunny days; and

o lead - as an air pollutant, it is primarily emitted by motor vehicles.

Pollutants in Connecticut are monitored by a network of air monitoring stations scattered around the state. The stations continually record the various pollutants considered to be detrimental to the environment.

As noted in the earlier section on legislative background, the two major pollutants for which the state does not meet federal standards are ozone and carbon monoxide. The four pie charts contained in Figure VI-1 indicated the contributions of various sources of these two pollutants. Both 1980 actual and 1987 projected source contributions are given. For carbon monoxide, gasoline and diesel vehicles represent the largest source. For ozone, of which hydrocarbons are a major component, vehicles represent the largest share in 1980, decreasing significantly by 1987. This decreasing contribution of motor vehicles is attributable in large part to federal standards for air pollution control equipment on automobiles. The state's vehicle inspections and maintenance program is also aimed at reducing these two pollutants.

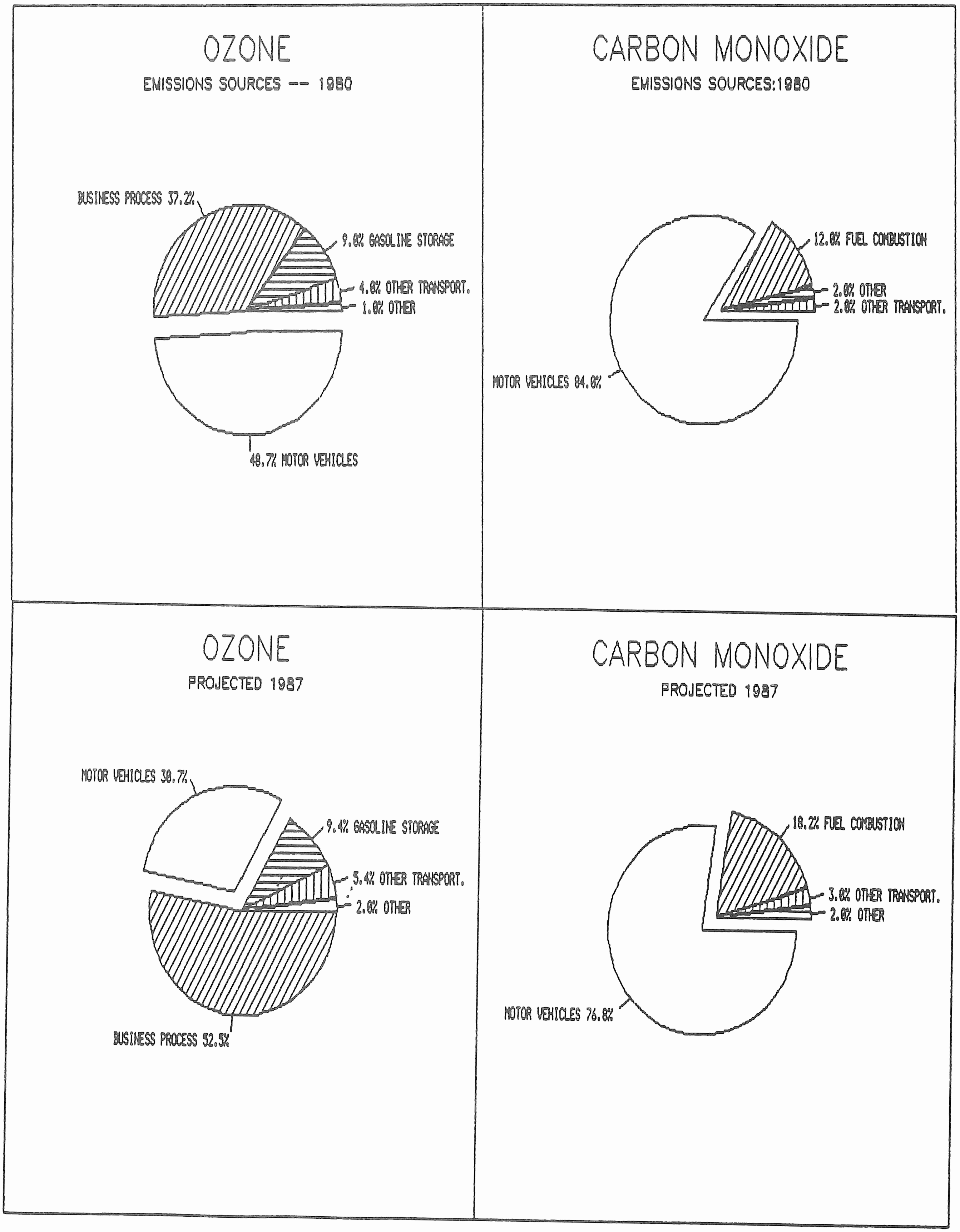
In addition to the emission program, DEP has 19 other program strategies intended primarily to reduce ozone. Some of those other strategies include gasoline vapor recovery requirements for tank storage, right turn on red lights, reductions in the use of various chemicals in industrial processes, and the development of a transportation plan that encourages alternatives to automobile use. However, almost half of the DEP projected reductions in pollutants come from the auto emissions control program.

Air Quality

The Department of Environmental Protection has provided the program review committee with graphs illustrating ozone and carbon monoxide trends over several years. The trends are taken from data compiled from the air monitoring stations. Ozone and carbon monoxide are formed in very different ways. Carbon monoxide is an colorless gas emitted directly by automobiles and dissipates quickly in warm temperatures. It presents a localized problem generally in the winter months when when the gas is not able to dissipate quickly in high volume traffic corridors. Ozone, on the other hand, involves a complex chemical reaction of hydrocarbons and nitrogen oxide, both of which are emitted directly by the automobile, on warm, sunny days. Ozone, or smog, therefore becomes a problem primarily in the summer months and usually occurs downwind from the source of the two pollutants. The distance from the source depends downwind velocity.

Figures VI-2 through VI-6 show ozone trends for Bridgeport, East Hartford, Danbury, Middletown, Hartford, New Haven, and the average for the seven air monitoring sites. Figures VI-2 and VI-3

Figure VI-1. Carbon Monoxide and Ozone Sources.



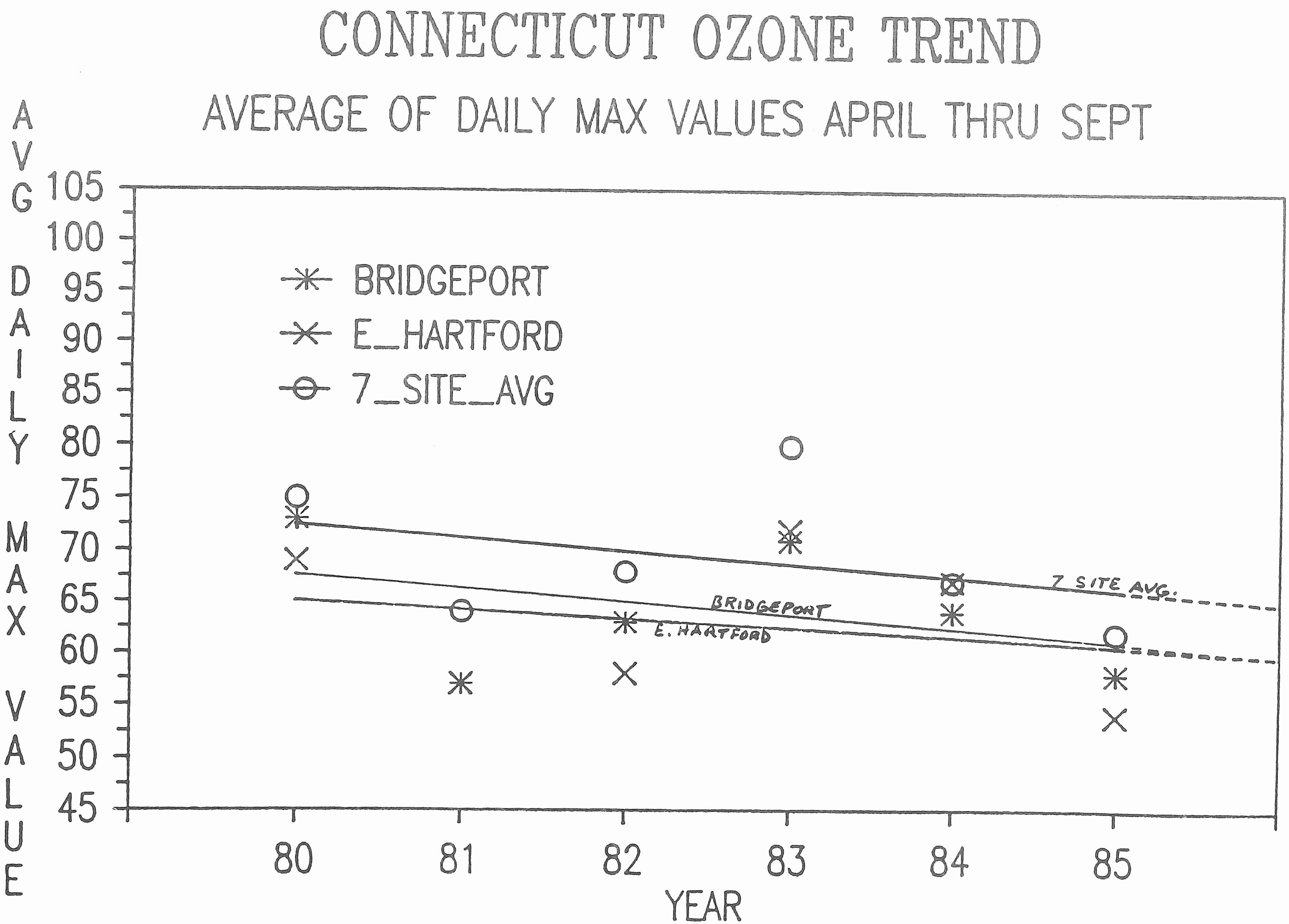


Figure VI-2. Connecticut Ozone Trend (Bridgeport, East Hartford, and Seven Site Average) 1980-1985.

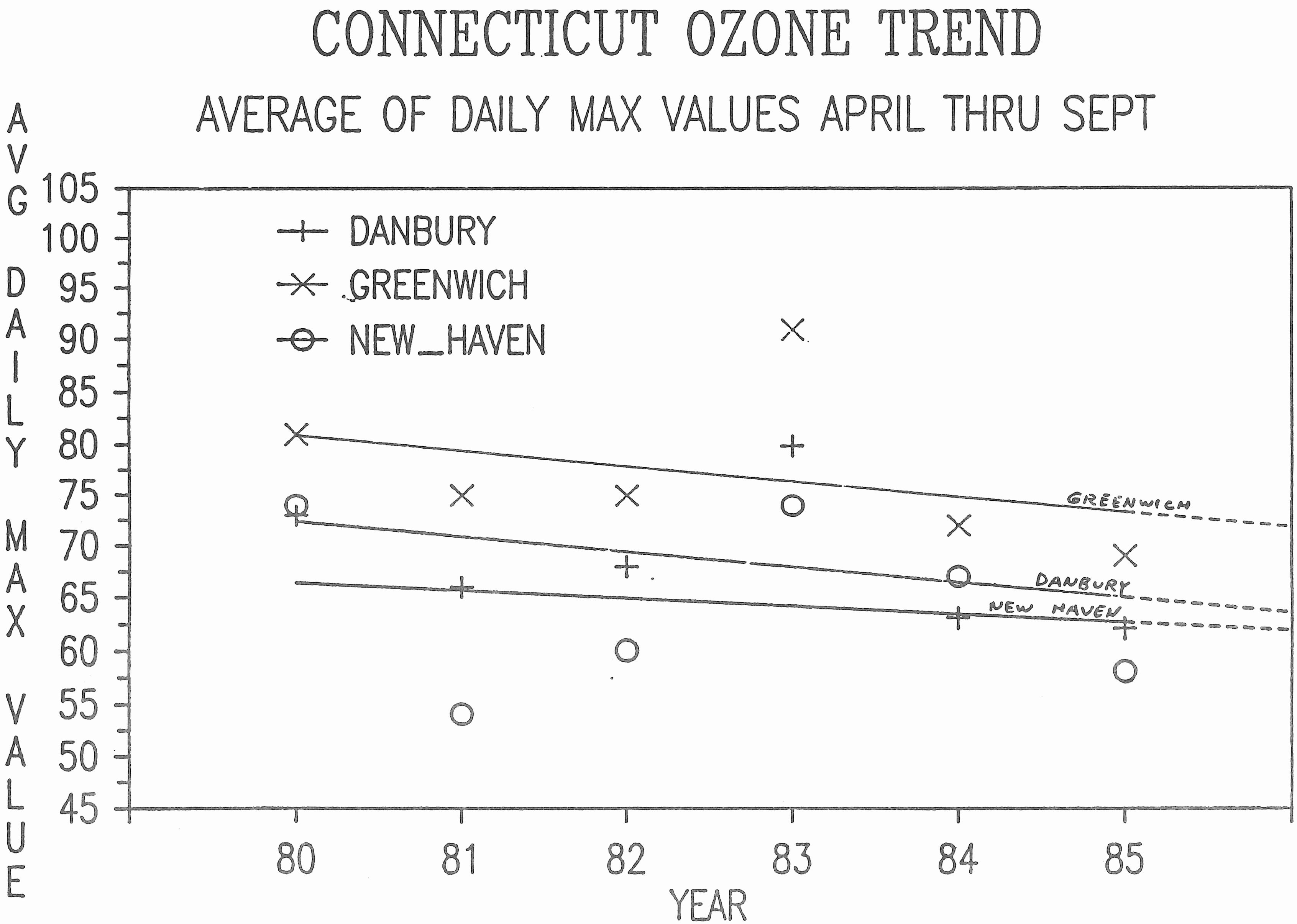


Figure VI-3. Connecticut Ozone Trend (Danbury, Greenwich, New Haven) 1980-1985.

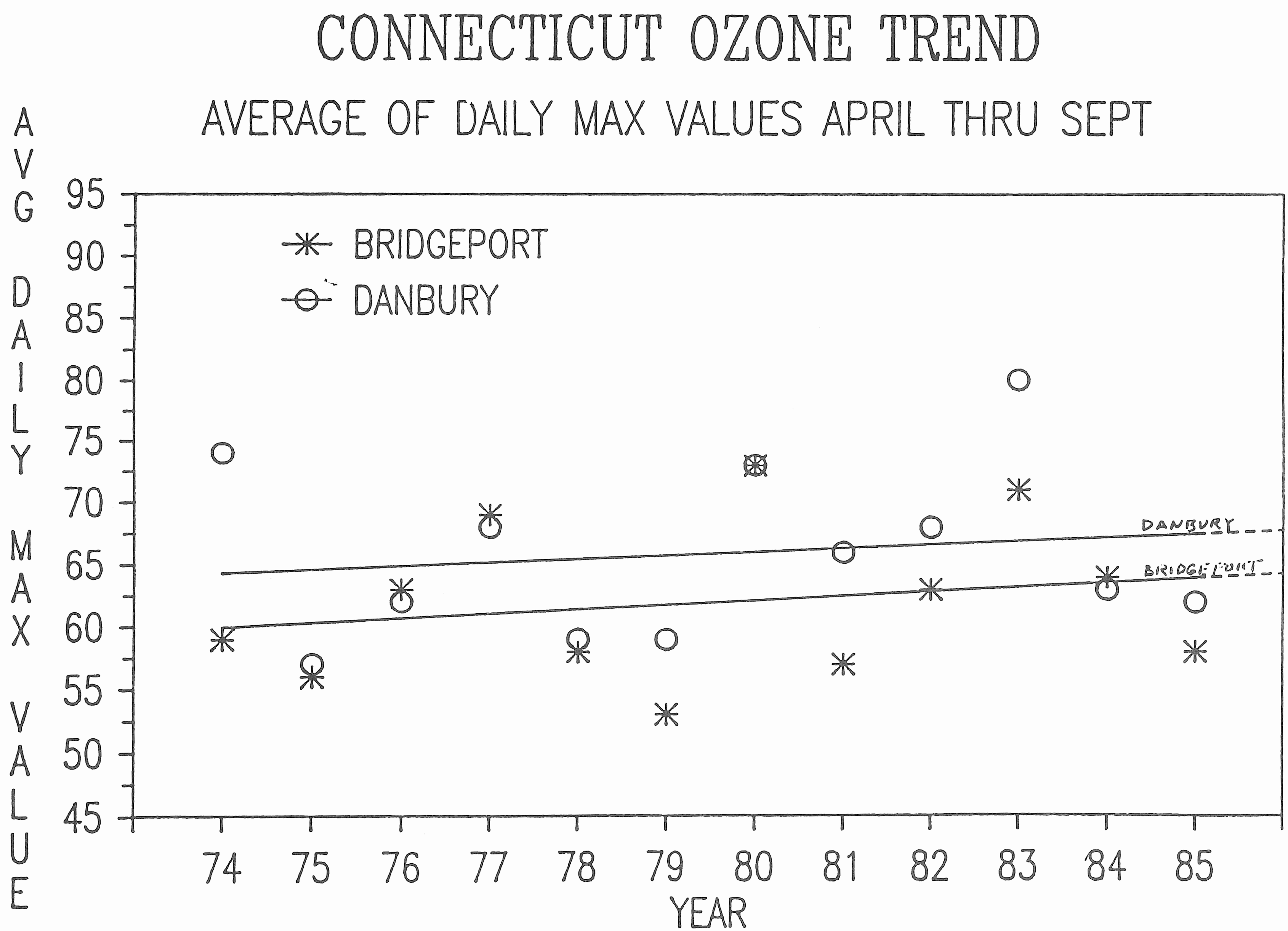


Figure VI-4. Connecticut Ozone Trend (Bridgeport, Danbury) 1974-1985.

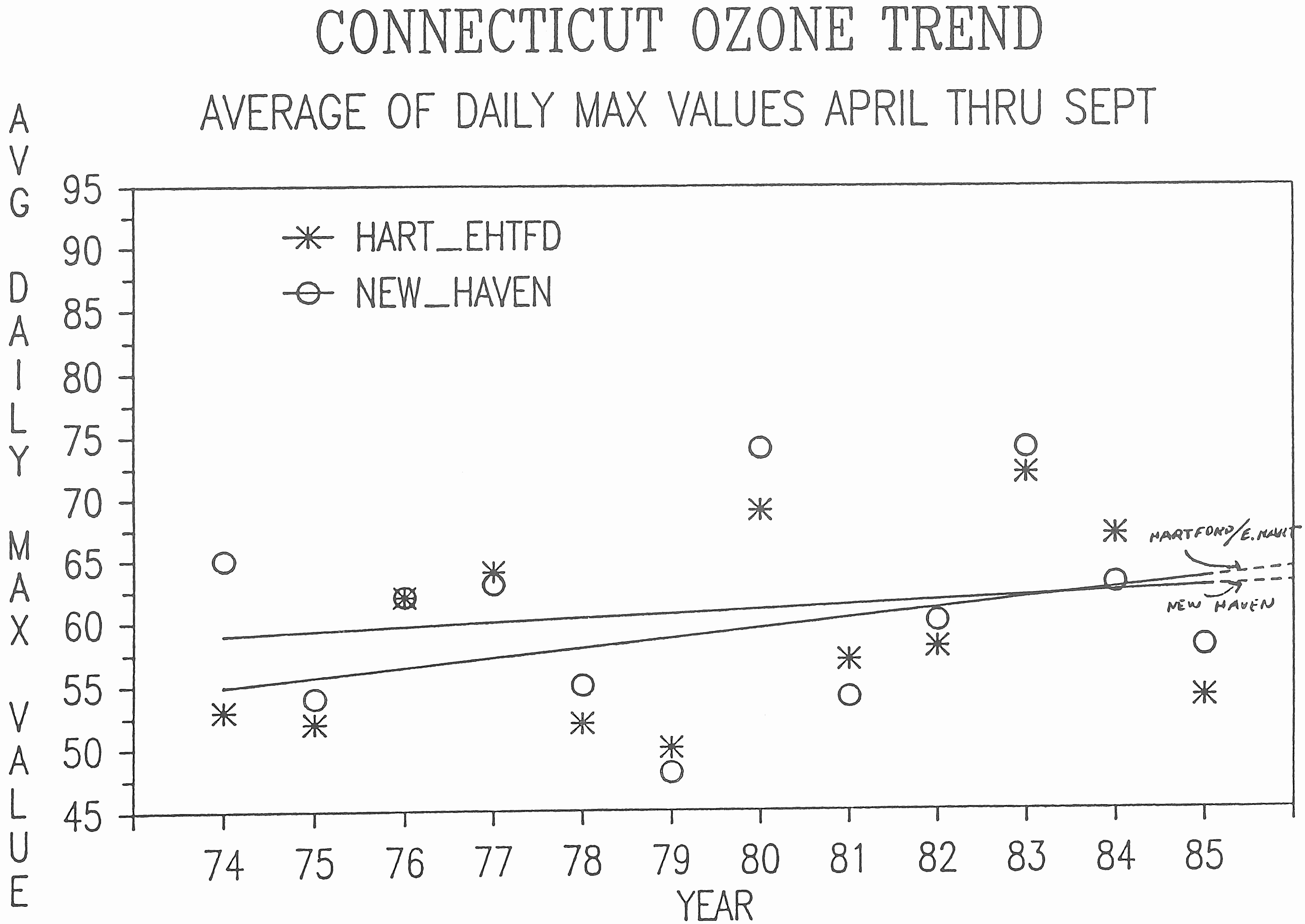


Figure VI-5. Connecticut Ozone Trend (Hartford, East Hartford, New Haven) 1974-1985.

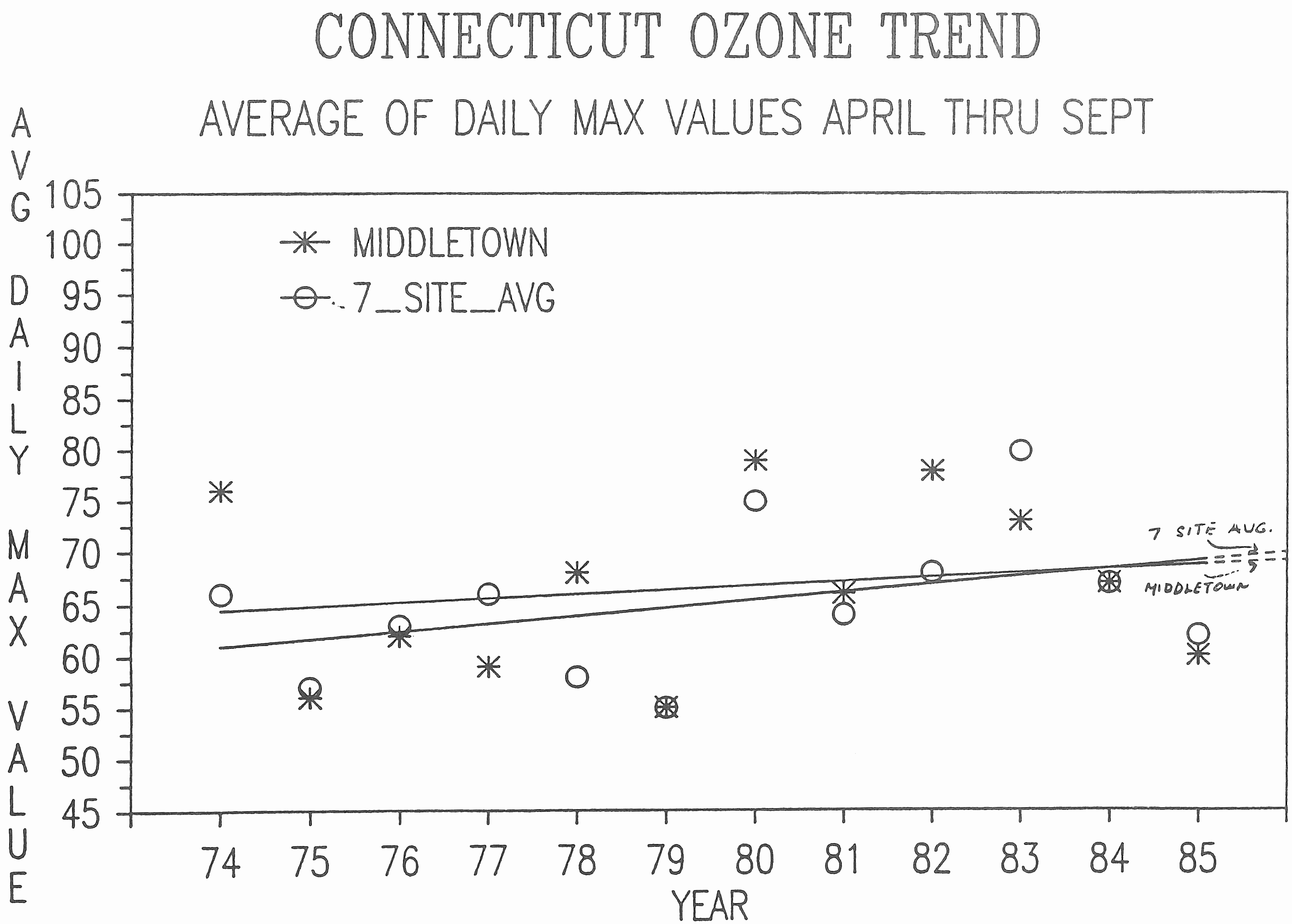


Figure VI-6. Connecticut Ozone Trend (Middletown, Seven-Site Average) 1974-1985.

CONNECTICUT CARBON MONOXIDE

AVERAGE OF DAILY MAX. VALUES EACH MONTH

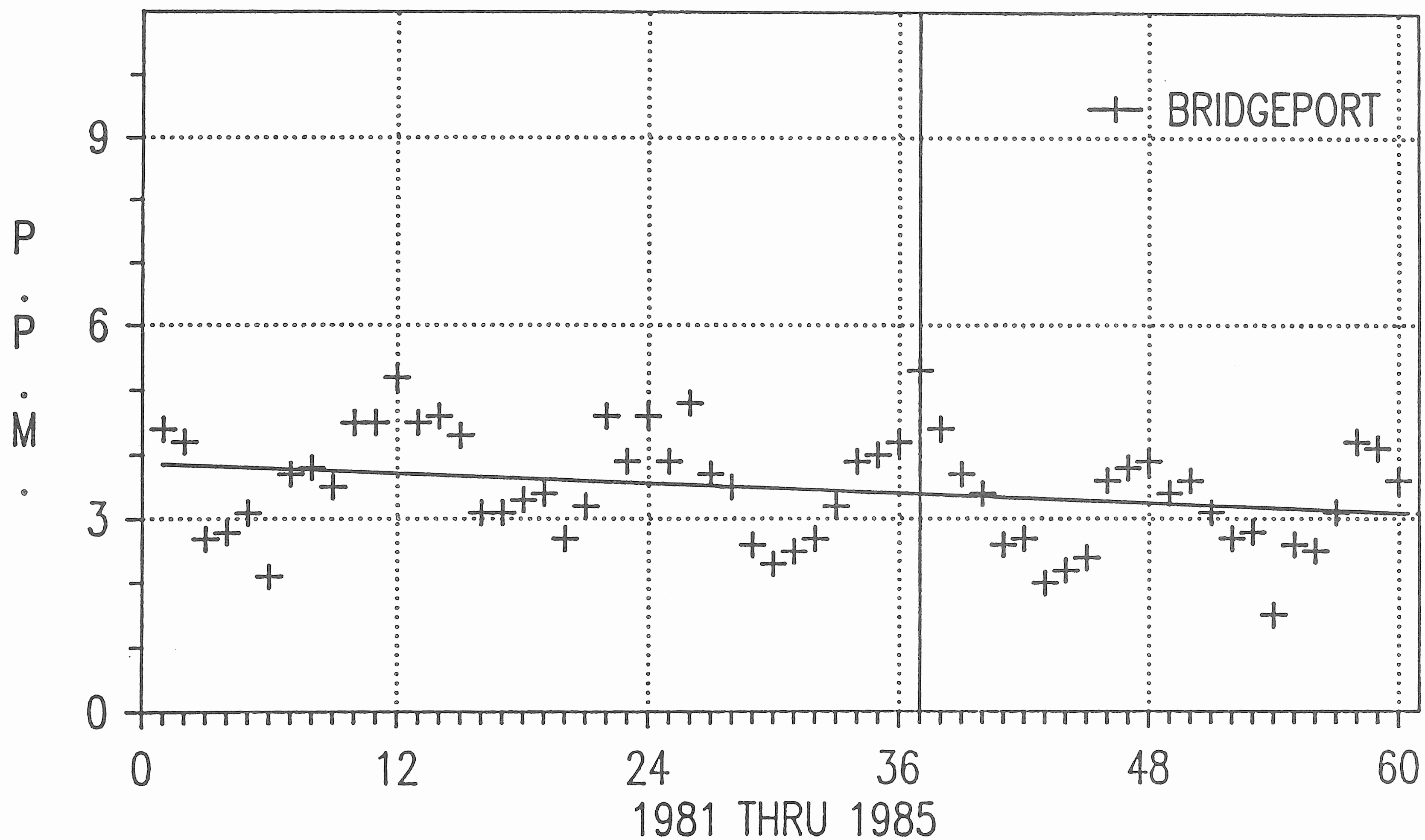


Figure VI-7. Connecticut Carbon Monoxide (Bridgeport) 1981-1985.

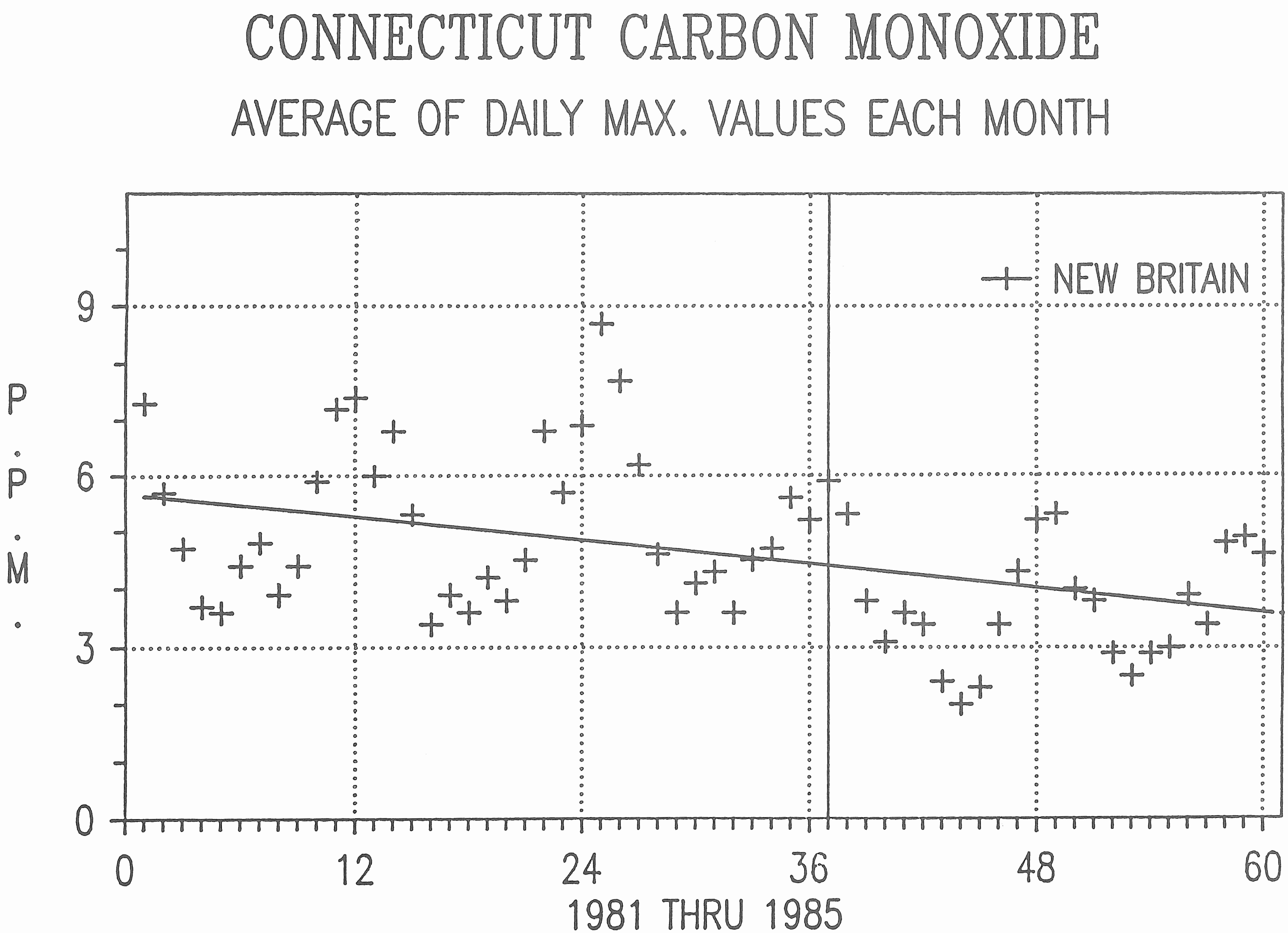


Figure VI-8. Connecticut Carbon Monoxide (New Britain) 1981-1985.

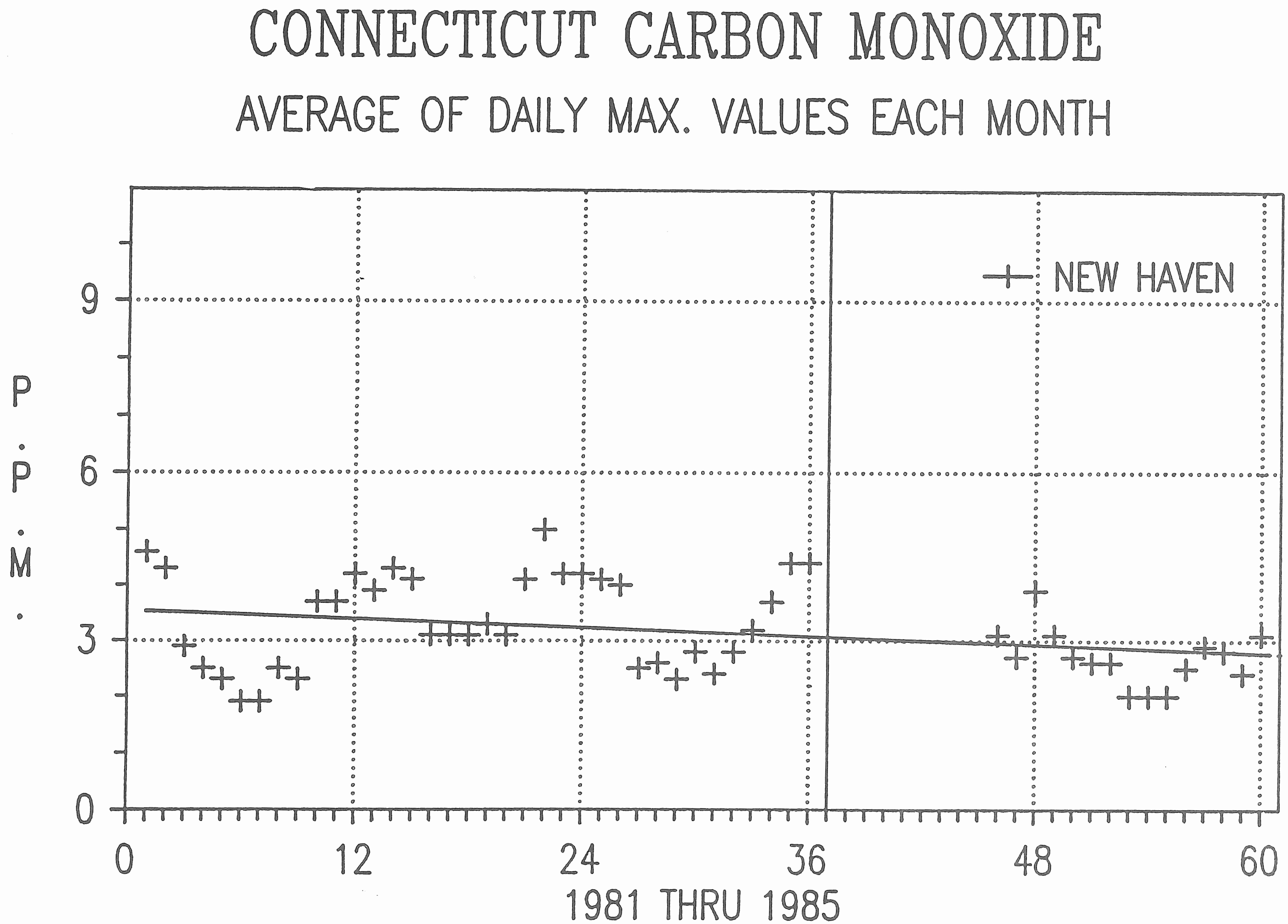


Figure VI-9. Connecticut Carbon Monoxide (New Haven) 1981-1985.

show trends from 1980 to 1985, while Figures VI-4, VI-5, and VI-6 cover a longer period from 1974 to 1985. The data does not present any clear trends; while the shorter period indicates a downward trend, the longer period seems to portray the opposite. It is interesting to note the effect temperatures have on the creation of ozone. The summer of 1983 was particularly hot with ozone readings at some of the highest levels.

The trends for carbon monoxide, which is a more localized problem, are found in Figures VI-7 through VI-9 for Bridgeport, New Britain and New Haven. While carbon monoxide levels are cyclical, higher in cold weather and lower in warm, the general trend for these three sites over a five-year period is down.

<u>Assessing the Federal Standards</u>

A key indicator for determining whether or not the state is meeting the federal air quality standards is the number of days a given pollutant exceeds the prescribed standard. The federal standard for ozone is .120 parts per million (ppm) for a 1-hour period at any of the air monitoring stations. The Environmental Protection Agency considers an area in attainment with the national air quality standards for ozone if for three years there is an average of only one exceedance per year of the .120 parts per million standard. The standard for carbon monoxide is 35 ppm averaged for a one-hour period and 9 ppm averaged over an 8-hour period.

Table VI-1 gives the number of ozone exceedances for 6 continuous air monitoring stations for an 11 year period. The totals of all exceedances for each year are graphed in Figure VI-10. It shows a cyclical trend to 1983 with decreasing exceedances since that year. Exceedances do seem to be declining since 1980, if the unusually hot summer of 1983 were not included. In 1986 it is estimated that there are few exceedances of the ozone standard, but it was also a very cool year with only 4 days over 95 degrees. Temperature has such a great impact on ozone levels that it will probably take several more years of data before any trend can be established.

It is very difficult to determine, even through computer modeling, if ozone levels are coming down as a result of cleaner running vehicles because it is almost impossible to hold weather conditions constant. An indication of the effects of temperature can be found in Table VI-2 which shows the percentage of ozone exceedances for 5 years and the total number of days the temperature was greater than 85 degrees in descending order. At this temperature and above, creation of ozone is most likely to occur.

Table VI-1. Ozone Exceedances for Six Continuous Air Monitoring Stations: 1975 to 1985.

Sites / Years	Bridgept.	Danbury	Greenwch.	Middltn.	New Haven	Htfd.	TOTAL
1975	20	17	18	18	15	12	100
1976	23	28	26	28	25	27	157
1977	27	31	27	22	27	25	159
1978	9	8	18	12	12	15	74
1979	15	14	18	MISSING	11	15	73
1980	22	24	30	28	18	21	143
1981	10	14	19	18	8	7	76
1982	11	11	17	21	10	7	77
1983	24	24	32	21	27	16	144
1984	13	13	17	14	13	7	77
1985	4	4	13	10	6	3	40

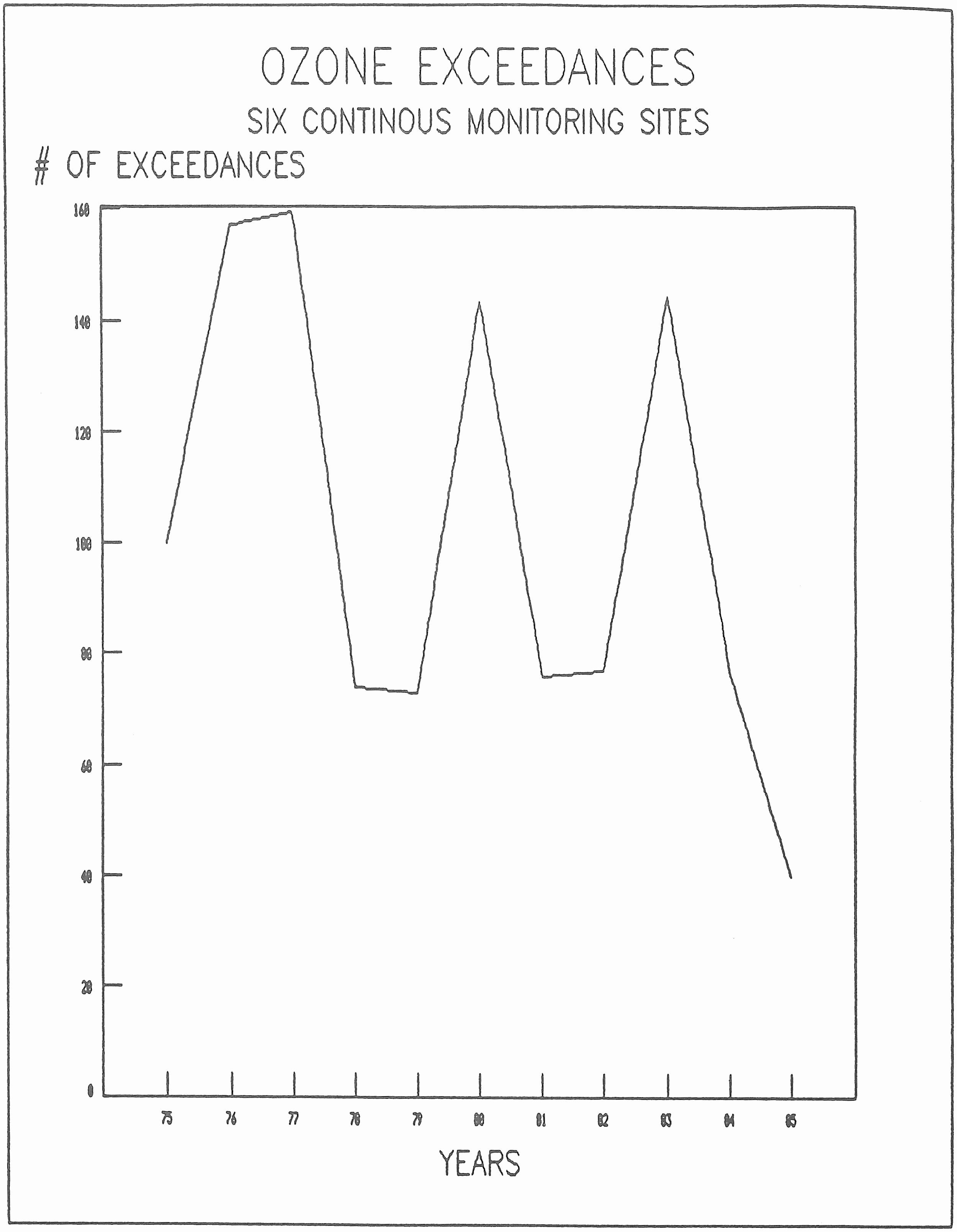
Source: Department of Environmental Protection.

Table VI-2. Percentage of Ozone Levels Exceeding .120 PPM (One-Hour Average) and Days over 85 Degrees.

Days Greater Than 85 Degrees	Ozone Over .120	Year
84	38%	83
54	28%	81
47	19%	84
46	15%	85
34	29%	82

Source: DEP And LPR&IC.

Figure VI-10. Ozone Exceedances - Total for Six Continuous Air Monitoring Stations: 1975 to 1985.



With the exception of 1982, the more days over 85 degrees the greater the percentage of times the federal standard is violated. Due to the fact that ozone is created downwind, prevailing winds, as well as temperature and sun, can significantly affect the creation of ozone and may have influenced the ozone levels in 1982.

The Legislative Program Review and Investigations Committee, in conjunction with the Connecticut Academy of Science and Engineering Committee members, analyzed ozone levels for 1981 to 1985 on days when the temperature reached between 86 and 90 degrees in an attempt to partially control for weather conditions. A factor not controlled for on these days is the wind direction, which could have a large impact ozone formation. A south or southwest wind can bring large amounts of hydrocarbons, nitrogen oxides, and ozone from the population centers of New Jersey and New York City.

The analysis of ozone readings for 1981 to 1985 for the 86 to 95 degree temperature range is presented in Table VI-3. The information is also graphed in Figures VI-11. The data show average ozone readings for each year in parts per million as well as the number of days between 86 and 95 degrees. The results found in Table VI-3 show a downward trend similar to that which was found when all ozone readings were compared, not just those in this temperature range. While the trends are similar to those presented in the earlier figures (Figures VI-2 to VI-6), there is less year-to-year variation of the 86 to 90 degree ozone exceedance readings when compared to all the ozone readings. There is

Table VI-3. Average Yearly Ozone Readings for Days Between 86 and 90 Degrees.

Number of Days	Average Ozone Reading (PPM)	Standard Deviation	Year
55	.106	.043	1983
47	.098	.036	1981
38	.086	.033	1985
36	.093	.039	1984
23	.101	.049	1982

Source: Department of Environmental Protection and Legislative Program Review and Investigations Committee analysis.

still a slight rise in the average ozone reading from 1981 to 1983 and then a decline to 1985. The decline is expected to continue into 1986. The year-to-year differences of the sample are statistically significant based upon an analysis of variance test of the data.

As will be noted in the next section, automobile manufacturers have had to meet increasingly stringent standards for the amount of pollutants allowed to be emitted. Since 1970, there has been approximately a 93 percent reduction in hydrocarbons and a 90 percent reduction in carbon monoxide emissions allowed by the federal government for new vehicles. As newer, cleaner cars replace older cars, the entire fleet will pollute less as a result of the more stringent standards imposed upon manufacturers by EPA. The substantial reduction in allowed pollutants will bring ozone levels down even if the fleet gets larger. This will certainly be more probable for carbon monoxide, which is produced directly by automobiles, than for ozone, a product of chemical reaction of which auto-emitted hydrocarbons are only a part.

Analysis of the Emission Testing Data

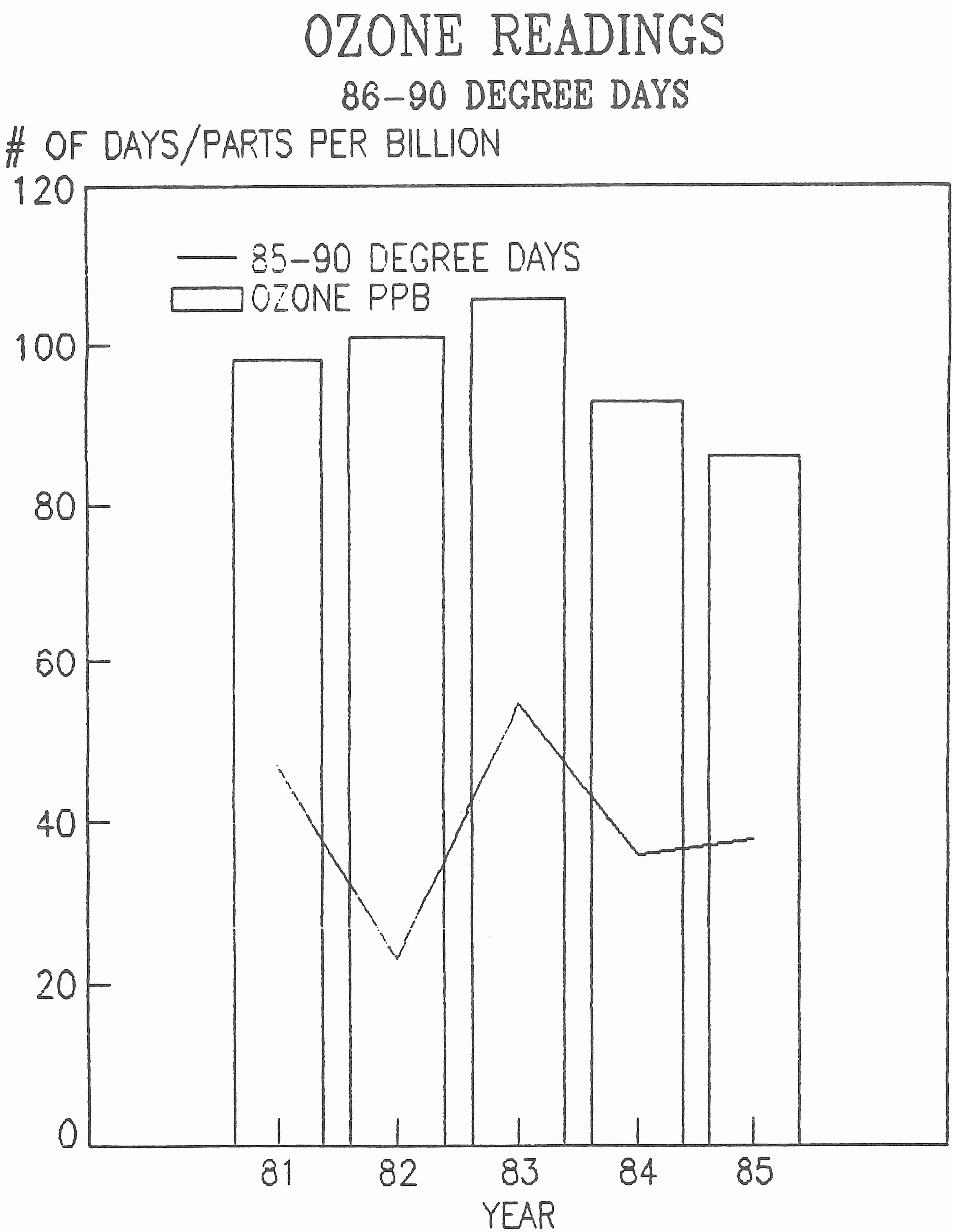
There are several factors that account for different readings of idle emissions: the model year of the vehicle, vehicle make and engine size, and the vehicle's mileage. Since 1968, as was just noted, vehicles have been required to meet various standards for the emission of pollutants by the federal government. These standards have been met by manufacturers adding pollution control equipment such as catalytic converters and air pumps. Therefore, the year a vehicle was produced will have an effect on its output of emissions. Also, a larger engine tends to emit a greater amount of pollutants because it burns more fuel. As a vehicle is driven, its engine and emissions system deteriorates resulting in more pollutants being emitted. Therefore, a vehicle with greater mileage, holding other things constant, will pollute more.

Other factors that affect idle emissions readings are vehicle maintenance, fuel used, weather conditions under which the vehicle is tested, and the equipment used to test the vehicle. Accounting for the effects each of these factors has upon the vehicle's emissions is not easy because isolating and testing for each factor is a complex and expensive task.

Of all these factors, the vehicle emissions inspection program is intended to change the way vehicles are maintained by their owners. By requiring owners to have their vehicles inspected, and thus maintaining them in good working order, the program attempts to reduce the number of vehicles that are high polluters.

One of the difficulties in analyzing the emissions control program is the great variability in idle emission readings for both hydrocarbons and carbon monoxide. This variability makes it

Figure VI-11. Ozone Readings: 86-90 Degree Days.



difficult to determine the causes for differences in emission readings, and, thus, makes finding an answer to the question of why one car pollutes more than another elusive.

To adequately assess the efficacy of the emissions program, the program review committee, along with members of the Connecticut Academy of Science and Engineering Committee, analyzed a large sample of actual emission tests. The emissions test sample included 196,345 randomly selected vehicles that were tested at the emissions stations between July 1 to December 31, 1985. This sample is used throughout the study as the basis for analysis of the program.

Analysis of the data was done to examine: 1) the variability of emission readings, 2) failure rates by vehicle year, 3) differences in average hydrocarbon and carbon monoxide readings among emission testing lanes, and 4) pass/fail rates at various outside temperature readings. Additional sources of data included actual emission tests representing approximately half the vehicles tested in 1983 and 1984. This data were used to estimate the effectiveness of the emission control program.

Variability in Emissions Tests

As noted previously, there are numerous factors that cause variation in emission. The average emission readings for all vehicles in the sample is 138 parts per million for hydrocarbons and 1.33 percent of air volume for carbon monoxide. The range of readings extends from 0 to 2,000 ppm for hydrocarbons (HC) and from 0 to 10 percent volume for carbon monoxide (CO), which represents the limits of the testing equipment. More interesting is the variance around the mean, a measure of variability. For HC the standard deviation is 247 ppm, almost twice the mean. This indicates that there is a wide spread of readings. Even when the cars are narrowed to those between the 1981 and 1986 model years, there is still great variation. For this segment of the vehicle population, the average hydrocarbon reading was 47 ppm with a standard deviation of 99 ppm, more than twice the mean.

Further analysis of the emissions testing data was conducted to identify such fleet characteristics as model year distribution, failure rates for each model year and frequency distribution of vehicles by intervals of hydrocarbons and carbon monoxide. Several of these analyses are presented in graphs depicting various trends. The first graph in Figure VI-12 shows the total number of vehicles tested in the sample by vehicle year. Nearly 48 percent of the vehicles tested, as represented by this sample, are 1980 or newer model years.

The second graph in Figure VI-12 illustrates the failure rates by vehicle year in two ways. The solid-line represents the failure rate for each vehicle year, while the dashed-line is the percentage of vehicles that failed in relation to the total vehicle population. For instance, the failure rate for 1975 vehicles is over 30 percent, but 1975 vehicles represents only 8 percent of the total population of vehicles that failed. The graph indicates a dramatic drop-off in both the failure rate for vehicles after 1979 and the percentage of the total number of vehicles that failed.

Frequency distribution of vehicles by intervals of hydrocarbons are presented in Tables VI-4 and VI-5. The vehicles in the sample were broken down into two model year groups: 1) 1975-1979 (Table VI-4); and 2) 1980-86 (Table VI-5). These two groups of vehicles represent approximately 85 percent of all vehicles tested. Table VI-4 covers 1975 to 1979 vehicles and presents intervals of hydrocarbon readings for the vehicles tested. The first column, HC1/PPM, is the hydrocarbon readings for the first emissions test in parts per million. The first test is the only test for a vehicle that passes. If it fails, the vehicle is run on a dynamometer and tested a second time.

The second column shows the number of vehicles falling into the ranges presented in the first column. The next column breaks down the percent of vehicles falling into the ranges. The last two columns give the cumulative frequency and the cumulative percent. The same information is presented for 1980-86 vehicles in Table VI-5.

In Table VI-4, 83.8 percent of the 1975-79 vehicles passed the standard set for hydrocarbon emissions. That compares to 95 percent passing the standard set for 1980-86 vehicles in Table VI-5. Of those 1975-79 vehicles failing the first test, 60 percent passed after the car was run on the dynamometer and a second test was done. For 1980-86 vehicles, 65 percent of the vehicles passed the second test.

Table VI-4. Frequencies For Hydrocarbons (1st Test): 1975-79 Vehicles.

HC1/PPM	Frequency	Percent	Cumulative Frequency	Cumulative Percent
0	757	1.1	757	1.1
0-24	8,773	12.2	9,530	13.2
25-49	8,736	12.1	18,266	25.4
50-99	15,969	22.2	34,235	47.5
100-199	18,407	25.6	52,642	73.1
200-299	7,686	10.7	60,328	83.8
300-599	7,336	10.2	67,664	94.0
600-1200	3,192	4.4	70,856	98.4
OVER 1200	1,157	1.6	72,013	100.0

Source: Legislative Program Review and Investigations Committee

Figure VI-12. Emissions Data: Number of Vehicles Tested and Fail Rates by Model Year/As Percent of Total Vehicles.

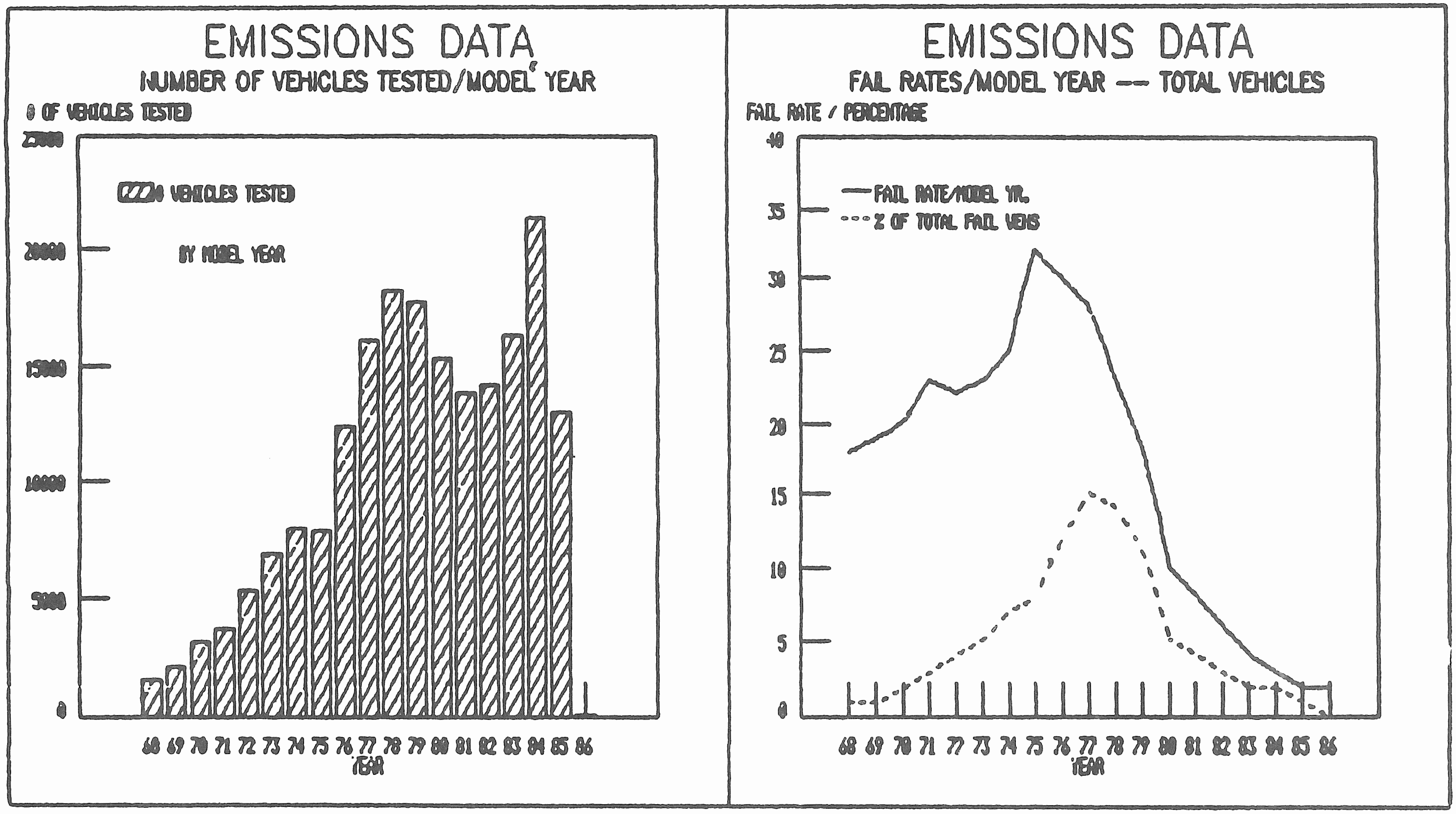


Table VI-5. Frequencies For Hydrocarbons (1st Test):1980-86 Vehicles

HC1/PPM	Frequency	Percent	Cumulative Frequency	Cumulative Percent
0	9,852	10.5	9,852	10.5
0-24	46,432	49.4	56,284	59.9
25-49	14,508	15.4	70,792	75.4
50-99	10,399	11.1	81,191	86.4
100-199	7,434	7.9	88,625	94.4
200-299	2,609	2.8	91,234	97.1
300-599	1,989	2.1	93,223	99.3
600-1200	530	0.6	93,753	99.8
OVER 1200	173	0.2	93,926	100.0

Source: Legislative Program Review and Investigations Committee

It appears from the information provided in the tables that the major portion of hydrocarbon emissions comes from vehicles manufactured prior to 1980. This is due in part to the age of the vehicles and the emissions technology in place on these post-1979 vehicles. Similar results were found when making comparisons between the same two groups for carbon monoxide readings.

The overall pass/fail rate also reflects these findings. A breakdown of the overall pass/fail rate by model year is given in Table VI-6. The highest percentage failure rate occurs for the 1975 vehicle year at 32 percent, while the lowest is 1.64 percent for 1985 vehicles. These failure rates will influence the potential savings from the program that will be estimated in a subsequent section on program effectiveness.

Table VI-6. Overall Pass/Fail Rates by Model Year.

Model Year	Percentage Fail	Percentage Pass	Total Sample Vehicles	Cumulative Percent of Fleet
68	17.54	82.46	1,545	.79
69	18.79	81.21	2,044	1.83
70	20.85	79.15	3,113	3.42
71	23.86	76.14	3,625	5.26
72	22.23	77.77	5,249	7.93
73	23.41	76.59	6,902	11.44

Model Year	Percentage Fail	Percentage Pass	Total Sample Vehicles	Cumulative Percent of Fleet
74	25.54	74.46	7,928	15.48
75	31.57	68.43	7,868	19.49
76	30.16	69.84	12,344	25.78
77	28.18	71.82	16,027	33.95
78	23.28	76.72	18,150	43.20
79	17.87	82.13	17,624	52.18
80	9.75	90.25	15,248	59.95
81	8.31	91.69	13,735	66.95
82	5.81	94.19	14,185	74.18
83	3.55	96.45	16,262	82.47
84	2.75	97.25	21,454	93.40
85	1.64	98.36	12,957	100.00

Source: Legislative Program Review and Investigations Committee

Analysis of Emissions Among Testing Lanes

The Legislative Program Review and Investigations Committee, with the assistance of CASE committee members, reviewed the sample data on average hydrocarbon and carbon monoxide readings for all 44 lanes at the 18 vehicle testing stations to determine if there was any significant difference among lanes. This analysis was conducted in a number of ways that attempted to isolate the differences in average emissions readings to lanes only. This was done by choosing vehicles with with similar characteristics and conducting an analysis of variance test on only that vehicle population.

When all vehicles in the sample are grouped by testing lanes, the average hydrocarbon reading ranges from 175 ppm for a lane in Norwich to a low of 109 ppm for a lane in Darien. These statistics include all types of cars and, as was noted earlier, cars of different makes and model years have significantly different emissions readings. If the cars going through the lanes in Darien are much newer than the cars being tested in Norwich, a distinct possibility, then we would expect the average readings for those lanes to be lower.

To isolate the differences in vehicles tested in the lanes, vehicle makes with similar engine types and newer model years were chosen for analysis. A sample of 1981 through 1986 model year Hondas was selected from larger sample of vehicles. Including only these vehicles yielded a sample size of 3,817 cars. To test for significant differences in emissions readings among lanes, an analysis of variance was done on this homogeneous group.

The range in hydrocarbon readings for the 1981 to 1986 Hondas ranged from 7.30 ppm to 45.04 ppm for the 44 lanes. However, the analysis of variance test concluded that there was no statistically significant difference among the lane means for these vehicles. In other words, while variation does occur little of it can be accounted for by testing the vehicles in different lanes. The contractor also indicated that the testing equipment is not able to accurately measure readings when emissions fall below 50 ppm. Similar results were found when the analysis of variance test was run for carbon monoxide.

<u>Effects of Temperature on Idle Emission Tests</u>

As a result of information compiled on failure rates by month, the Legislative Program Review and Investigations Committee conducted a more extensive examination into the effect outside air temperature had on pass/fail rates. This analysis was designed to determine whether pass/fail rates differed based upon the outside temperature at the time the test was given. The program review committee used temperature data collected at the state's air monitoring stations, which are received on a daily and hourly basis. The data was then matched with the emissions test sample of 196,000 cars so that every test has a temperature reading that was recorded at the nearest air monitoring on the same day and hour the test was given.

The analysis compares pass/fail rates for various phases of the test with temperature intervals. There are five possible pass/fail points for a vehicle taking the emission's test. A vehicle could pass or fail the first test for hydrocarbons and pass or fail the second test for hydrocarbons, which is taken after the vehicle fails the first test and is run on a dynamometer. The first and second tests can also be done for carbon monoxide. The fifth point is the overall pass/fail designation for the vehicle. The vehicle must pass the first or second test for both pollutants to receive an overall pass rating.

Five tables have been developed to illustrate the pass/fail rates for each possible test at eight temperature intervals ranging from -20 degrees to 95 degrees and above. Table VI-7 shows the overall pass/fail rates for vehicles in the sample. Next to each interval is the number of vehicles passing or failing and the percentage of the total each represents.

Table VI-7 does indicate that more vehicles fail when the outside temperature at which they are tested is greater than 74 degrees. In the -20 and 74 degrees temperature range, the failure rate holds steady at between 13.5 and 15 percent. At the next interval the failure rate jumps about three percent. When the outside temperature reaches over 95 degrees the failure rate continues to increase, but there are considerably fewer cars being tested at this interval.

Table VI-7. Overall Pass/Fail Rates at Temperature Intervals.

Temperature	Fail	Pass	Total
-20 to 32	2,175 13.65%	13,864 86.44%	16,039
33 to 44	3,441 13.26%	22,518 86.74%	25,959
45 to 54	2,720 13.58%	17,305 86.42%	20,025
55 to 64	4,136 13.82%	25,788 86.18%	29,924
65 to 74	6,934 15.08%	39,054 84.92%	45,988
75 to 84	7,128 17.57%	33,443 82.43%	40,571
85 to 94	2,016 20.57%	7,786 79.43%	9,802
95 +	33 24.26%	103 75.74%	136
Total	28,583	159,861	188,444

Source: Legislative Program Review & Investigations Committee Analysis.

Tables VI-8 and VI-9 give the failure rates for the first and second test for HC. Both have remarkably steady failure rates, at around 9.5 to 10.5 percent, especially given the wide variations that occur in emission readings. Above 85 degrees, the failure rate jumps 2 percent for the first test. Again, only when the temperature exceeds 95 is there a substantial increase in failure rates. A similar pattern of steady percentages is found when failure rates are examined for the second hydrocarbon test.

Table VI-8. Pass/Fail Rates for Hydrocarbons: First Test.

Temperature	Fail	Pass	Total
-20 to 32	1,488 9.28%	14,551 90.72%	16,039
33 to 44	2,348 9.05%	23,611 90.95%	25,959
45 to 54	1,858 9.28%	18,167 90.72%	20,025
55 to 64	2,852 9.53%	27,072 90.47%	29,924
65 to 74	4,550 9.89%	41,438 90.11%	45,988
75 to 84	4,283 10.56%	36,288 89.44%	40,571
85 to 94	1,249 12.74%	8,553 87.26%	9,802
95 +	23 16.91%	113 83.09%	136
TOTAL	18,651	169,793	188,444

Source: Legislative Program Review & Investigations Committee Analysis.

Increases in outside temperatures seem to affect the test for carbon monoxide more than the test for hydrocarbons. The failure rates increase steadily once the temperature reaches 65 degrees as shown in Table VI-10. From an average failure rate of 12 percent for temperatures under 65 degrees, the rate increases to almost 14 percent for the 65 to 74 degree interval, to 16.6 percent for the next interval, and then to 22.5 percent for the 85 to 94 degree interval. The difference between the low and high failure rate is 8.5 percent, excluding the 95+ temperature range. This increase in failure rates is of greater magnitude than that for hydrocarbons and is driving the overall failure rates up as shown in Table VI-7.

Table VI-9. Pass/Fail Rates for Hydrocarbons: Second Test.

Temperature	Fail	Pass	Total
-20 to 32	1,087 36.99%	1,852 63.01%	2,939
33 to 40	1,720 37.21%	2,903 62.79%	4,623
45 to 54	1,383 38.61%	2,199 61.39%	3,582
55 to 64	2,094 38.72%	3,314 61.28%	5,408
65 to 74	3,428 37.54%	5,704 62.46%	9,132
75 to 84	3,405 36.97%	5,805 63.03%	9,210
85 to 94	990 37.71%	1,635 62.29%	2,625
95 +	18 46.15%	21 53.85%	39
Total	14,125	23,433	37,558

Source: Legislative Program Review & Investigations Committee Analysis.

Table VI-11 shows a slightly smaller difference in the failure rate on the second carbon monoxide test across the temperature ranges than those only failing the first test, from a low of 53 percent to a high of 59.6 percent for the 85 to 94 degree interval, a 6.6 percent difference. This seems to indicate that once a car is run on the dynamometer at higher speed the CO emissions are affected less by high outside temperatures.

At the 95+ interval there are too few cars to consider the pass/fail rate to be valid because there are not enough to capture a representative sample of the vehicle population. With so few cars the range could be skewed, for instance, by older cars that tend to have a higher failure rate. However, because the failure rate is so dramatically high further study should be done to determine if this temperature effect is accurate.

Failure rates do seem to be affected by outside temperature, but only when the temperature is in the 80's and 90's, and then it is the first carbon monoxide test that seems to be influenced the most. Excluding the 95+ interval, the failure rate increases from the lowest to the highest rate by 8.59 percent for CO and 3.69 percent for HC on the first test.

Table VI-10. Pass/Fail Rates for Carbon Monoxide: First Test.

Temperature	Fail	Pass	Total
-20 to 32	2,047 12.76%	13,992 87.24%	16,039
33 to 40	3,136 12.08%	22,823 87.92%	25,959
45 to 54	2,390 11.94%	17,635 88.06%	20,025
55 to 64	3,598 12.02%	26,326 87.98%	29,924
65 to 74	6,314 13.73%	39,674 86.27%	45,988
75 to 84	6,735 16.60%	33,836 83.40%	40,571
85 to 94	2,012 20.53%	7,790 79.47%	9,802
95 +	30 22.06%	106 77.94%	136
Total	26,262	162,182	188,444

Source: Legislative Program Review and Investigations Committee

Table VI-11. Pass/Fail Rates for Carbon Monoxide: Second Test.

Temperature	Fail	Pass	Total
-20 to 32	1,587 54.00%	1,352 46.00%	2,939
33 to 44	2,457 53.15%	2,166 46.85%	4,623
45 to 54	1,903 53.13%	1,679 46.87%	3,582
55 to 64	2,859 52.87%	2,549 47.13%	5,408
65 to 74	4,962 54.34%	4,170 45.66%	9,132
75 to 84	5,316 57.72%	3,894 42.28%	9,210
85 to 94	1,565 59.62%	1,060 40.38%	2,625
95 +	29 74.36%	10 25.64%	39
Total	20,678	16,880	37,558

Source: Legislative Program Review & Investigations Committee Analysis.

Effectiveness of the Emissions Testing Program

The effectiveness of the emission control program depends upon determining the amount of hydrocarbon and carbon monoxide emissions that are reduced as a result of the program. The United States Environmental Protection Agency has developed a mathematical model to project the total emissions being produced by motor vehicles. The model also predicts reductions in emissions from having an emissions control program.

The model can be used with information from a specific geographic area, such as Connecticut, and give emissions results for the vehicles that are used by the population. The model was originally used to determine what emissions reductions would be required of Connecticut to meet the federal National Ambient Air Quality Standards. The model has been updated several times by EPA to reflect changing motor vehicle technology and the gathering of additional information intended to improve the model's forecasting capabilities. The current EPA computer model is called Mobile3.

Because the emissions testing program only gives results in idle emissions, it is impossible to use these results to determine the amount of savings that the program is producing. The EPA has not developed a formula for converting idle emissions into the amount of pollutants that are produced by a traveling vehicle. To obtain the amount of pollutants a vehicle is producing per mile, the EPA conducts a controlled test that collects all the emission of a vehicle running on a dynamometer traveling a typical 20-minute trip. It is from this test that emission rates are derived and used to estimate the savings for vehicles that are tested at idle only.

Mobile3 Computer Model Design

The Mobile3 model attempts to predict hydrocarbons and carbon monoxide based upon an emissions rate in a grams-per-mile formula that uses data obtained by the EPA from the testing of over 5,000 vehicles. Basically, the model multiplies the vehicle miles traveled for a given area by the emissions rate for those vehicles to determine total emissions output. The model refines the vehicles miles traveled and the emissions rate by taking into consideration such factors as speed, air conditioning usage, fuel evaporation, and towing, all of which would effect emissions.

The model estimates the miles traveled by different types of vehicles, such as passenger vehicles and light-weight trucks, and the number of vehicles in each model year. In Connecticut, the Department of Transportation generates information on vehicle miles traveled (VMTs) for the entire motor vehicle fleet. The Mobile3 model then determines which fraction of the fleet contributes how many miles to the overall total.

This fraction is based upon national registration data for each type of vehicle. For instance, national registration figures indicate that 65 percent of the fleet is composed of light-duty gasoline vehicles (passenger cars). That percentage is used to apportion the miles driven by those vehicles. Other percentages are used to weight the distribution of light-duty gasoline trucks, heavy duty gasoline trucks, light duty diesel vehicles, light-duty diesel trucks, heavy-duty diesel trucks, and motorcycles.

The model estimates the miles driven by each model year based upon EPA's estimate of model year registration distribution. Ultimately the model predicts the vehicle miles driven by 1) vehicle type; and 2) model year for a given point in time, such as January 1, 1987. This allows the Mobile3 model to be used to predict emissions produced for any given year.

The next major factor in the model is the basic emissions rate for each type of vehicle and model year. The emissions rate is based upon two estimated variables: 1) the emissions rate of a vehicle (by type and model year) with zero mileage; and 2) emissions rates after a vehicle has deteriorated based upon accumulated mileage. The EPA has estimated both variables based upon samples of vehicles that have been driven by the public and then tested by EPA staff. Based upon the data, EPA has developed a regression equation that predicts the increase in a vehicle's emission rate based upon increasing mileage. The rates are further adjusted for the effects of tampering with pollution control equipment.

The model can be run for any given year to determine emissions output because the model will age the fleet depending upon the period for which it is run. For instance, if the model is run for vehicles ranging from 1968 to 1984 and then run for vehicles for 1968 to 1987, the 1984 vehicles will be aged according to the emission deterioration rates predicted by EPA.

Predicting the Effectiveness of the Program

The Mobile3 model predicts the effectiveness of an inspection and maintenance program by determining the amount of emissions that are saved as a result of vehicles being inspected and repaired. The model uses sample data to estimate the emission rates of normal cars, high-emitting cars, and super-emitting cars. From the sample data, emission rates are projected for each category and then applied to the distribution of vehicle miles travelled discussed earlier. The model assumes that those vehicles failing the emission test emit at a certain rate and those that pass emit at a lower rate. Once the failing vehicles are detected by the program and repaired, they will then emit at the lower passing rate. The amount of savings produced by the program is estimated by the number of vehicles that fail and then pass multiplied by the number of vehicle miles travelled by those vehicles.

The failure rates used in the model are determined in two ways. For vehicles built prior to 1981, the rate is set by using failure rates for each vehicle year that actually resulted from the state's emission testing program. Connecticut's failure rates from the program for each model are used in the model. For 1981 and newer vehicles, the computer model estimates the failure rates based upon EPA's sample of vehicles tested for those years.

To determine the emissions savings from the program, the Legislative Program Review and Investigations Committee asked the Department of Environmental Protection to run the Mobile3 computer modeling program in several ways. The program was run first to determine what the total hydrocarbon and carbon monoxide emissions would be in the absence of a inspection and maintenance program. Then a run was made to determine the pollutants that would be emitted if only vehicles from 1968 to 1979 model years were tested. Successive runs were then made adding each model year to estimate the impact testing each year has on emissions output. Table VI-12 displays the findings for hydrocarbons based upon this computer analysis. The smallest amount of HC emissions, 69,854 tons, occurs if all years were tested, compared to 78,519 tons that the model predicts would be emitted without an inspection program. Thus, the model projects that the inspection program eliminates 8,665 tons of HC a year, an 11 percent reduction.

Table VI-12. Hydrocarbon Emissions Produced: Adding Each Year Tested after 1979.

Model Year Inspected	Tons Per Year Emitted by Vehicles (68-87)	Year Added	Year Added Impact/ Tons Per Year
68-79	73,241	None	
68-80	72,715	'80	526
68-81	72,098	'81	617
68-82	71,460	'82	638
68-83	70,803	'83	657
68-84	70,288	'84	515
68-85	70,029	'85	259
68-86	69,854	'86	175
68-87	69,854	'87	0

Source: Department of Environmental Protection Mobile3 Computer Modeling Program.

Similarly, Table VI-13 shows that the model predicts that 365,394 tons of carbon monoxide will be emitted if all model years are tested. The model projected that 530,947 tons would be emitted in the absence of an inspection program. Thus the program is estimated to reduce carbon monoxide emissions by 165,533 tons or 31 percent of the total vehicle emissions.

The model's estimates need to be compared to the total air burden produced by all sources of pollution in Connecticut to gain a perspective on contributions the I/M program is having on Connecticut's air. According to the Department of Environmental Protection, in 1987 all sources of pollution in Connecticut will contribute 130,740 tons of hydrocarbons and 807,745 tons of carbon monoxides to air. Based upon these estimates, the inspection-/maintenance program will reduce hydrocarbon emissions by 6.63 percent and carbon monoxide by 20.5 per cent in 1987. However, this estimate of air burden takes into consideration only emissions that are produced in Connecticut, not emissions that are produced in other states, particularly hydrocarbons which are the precursors to ozone, and are brought into Connecticut by prevailing winds.

Table VI-13. Carbon Monoxide Emissions Produced: Adding Each Year Tested after 1979.

Model Year Inspected	Tons Per Year Emitted by Vehicles (68-87)	Year Added	Year Added Impact/ Tons Per Year
68-79	411,359	None	
68-80	403,657	'80	7,702
68-81	394,861	'81	8,797
68-82	386,185	'82	8,676
68-83	377,917	'83	8,267
68-84	371,315	'84	6,603
68-85	367,270	'85	4,044
68-86	365,621	'86	1,650
68-87	365,394	'87	226

Source: Department of Environmental Protection Mobile3 Computer Modeling Program.

Table VI-14. Percentage Contribution To Air Burden: By Vehicle Year.

Vehicle Year	Percent Contribution/ Hydrocarbons	Percent Contribution/ Carbon Monoxide
1987	00.00%	00.03%
1986	00.13%	00.20%
1985	00.20%	00.50%
1984	00.39%	00.82%
1983	00.50%	01.02%
1982	00.49%	01.07%
1981	00.47%	01.09%
1980	00.40%	00.95%
Total	02.59%	05.69%

Source: Legislative Program Review & Investigations Committee Analysis.

Based upon the figures derived from the previous two tables, the emission reduction achieved by testing 1980 and newer cars will amount to 2.59 percent of the total hydrocarbon and 5.69 percent of the total carbon monoxide emissions, compared to a 97.41 percent reduction in HC and a 94.31 percent CO reduction gained by testing pre-1980 vehicles. Table VI-14 illustrates the percentage each vehicle year contributes to the total reduction in pollutants gained by the program.

With the exception of the years 1981 to 1983, the reduction in emission these vehicles will contribute is less than one percent for any vehicle year. As noted in the earlier analysis on failure rates, these model years fail at a rate much less than older vehicles. One reason for this is that the standards the manufacturers of these vehicles are required to meet have been tightened drastically. For example, the federal exhaust emission standards for hydrocarbons for 1970 vehicles was 5.9 grams per mile, for 1975 vehicles it was 1.5 grams per mile, and for 1980 and newer vehicles it was .41 grams per mile. This represents a 93 per cent reduction in emissions since 1970. There has been a similar reduction for carbon monoxide. The CO standard went from 33.3 grams per mile for 1970 vehicles to 3.4 grams per mile for 1980 vehicles, a 90 percent reduction.

Staff Model

The Legislative Program Review and Investigations Committee staff, in conjunction with members of the Connecticut Academy of Science and Engineering, developed a similar model to estimate the hydrocarbon and carbon monoxide savings due to the program. The program review committee staff model covers only 1980 to 1987 vehicle model years. The model uses data from the actual test results for vehicles passing, failing, and waived in 1983, 1984, and 1985. Data for actual miles driven were compiled by matching vehicles in one year with the same vehicles in the next test year and taking the difference in odometer readings. Because only approximately 45 percent of the vehicles are matched from one period to the next, the vehicles and mileage were extrapolated to estimate the entire fleet.

The staff model uses similar emission rates for passing and failing vehicles and deteriorates the vehicles to provide projections for 1987, the same year used in running the Mobile3 computer model. It also projects failure rates based upon the actual failure rates for the vehicles tested in Connecticut in 1983, 1984, and 1985. The model also gives credit to vehicles that are waived, but show an improvement in the idle emissions from their first test to the final test before being issued a waiver.

The model gives information specific to Connecticut by using actual mileage and vehicle data, and basing estimated failures rates on the most recent historical data, rather than relying on estimates. The staff model indicates that for 1980 to 1984 model years, with the exception of 1980, the savings are somewhat less than those projected by the Mobile3. The following table, Table VI-15, compares the the findings for hydrocarbons for the Mobile3 model and the program review committee staff model.

Table VI-15. Emission Estimates Comparisons Between Legislative Program Review & Investigation Committee Staff Model and Mobile3 -- Hydrocarbons.

Model Year	Tons Per Year Mobile3	Tons Per Year Staff Model	Model Differences
1980	526	631	-105
1981	617	437	180
1982	639	325	313
1983	657	301	356
1984	515	156	359

Source: Legislative Program Review & Investigations Committee Analysis.

Further work needs to be done to develop a model that will better estimate reductions in pollutants based upon the vehicles that are being tested in the state and the actual miles driven. These data are available from the emissions testing program and the beginnings of a model to more accurately predict reductions is presented here. The Department of Environmental Protection, along with the U. S. Environmental Protection Agency, need to commit resources to develop a formula to better estimate actual savings in emissions based upon idle tests rather then relying upon a predictive model that makes assumptions about data and information that is readily available.

VII. PROGRAM OPTIONS AND RECOMMENDATIONS

Introduction

The following recommendations are intended to meet federal requirements for the air quality plan while at the same time making the program cost effective by testing those vehicles that will have the greatest impact on improving the air. The recommendations will also improve the operation of the program, although the Legislative Program Review and Investigations Committee did find the program operating satisfactorily.

The program review committee believes that an ongoing effort has to be made to analyze the program's benefits in a rigorous fashion. Better models need to be developed that incorporate actual emissions information to assess program results rather than relying upon a predictive model that uses assumptions.

EPA's Current Policy

The EPA's authority to require the implementation of inspection/maintenance programs is backed by its power to impose federal funding restrictions when a state fails to observe the provisions of the Clean Air Act.

Under title 42, section 7506(a) of the United States Code Annotated (USCA), the EPA may impose its most severe funding restrictions on states that are unwilling or have not made a good faith effort to submit a viable SIP. This sanction amounts to impounding federal grants and transportation funds for all projects except those involving air quality improvement, mass transit, or transit safety.

Under 42 USCA 7506(b), sanctions may be placed against a state that is refusing to implement the provisions of a previously approved plan. In this event, sanctions are limited to any grants the EPA may have provided the state.

Regardless of which of the above two sanctions apply, the EPA must by statute take additional action. Section 7505 requires the impounding of federal funds donated by the EPA to assist in the development of SIP revisions. Finally, federal statutes require the EPA to establish a moratorium on the construction of major stationary sources of carbon monoxide.

When the EPA began to notify the states that needed to implement emissions inspections to comply with the Clean Air Act, the agency met with considerable opposition to the concept. Eventually, 11 states were threatened with cutoffs in federal highway funds. Despite this, the EPA's preferred policy has been to abstain from economic coercion unless absolutely necessary.

The city of Albuquerque, New Mexico was forced to repeal its inspection/maintenance program after a state court found the program's statute unconstitutional under state law. Shortly thereafter, the EPA notified the state and city that it would impose sanctions unless good faith efforts were made by local officials to re-establish the program. After a year of negotiations, the state and city governments lost a total of $6 million in federal highway funds for not making a good faith effort to submit a viable SIP. The state appealed the decision to the federal appellate court maintaining that a good faith effort had been made, even though the SIP was not being implemented.

The court upheld the EPA's application of the sanctions for lack of a good faith effort to submit a viable plan. According to the court, the latent unconstitutionality of the SIP, when submitted, meant that the state had not submitted a legally enforceable plan in accordance with the Clean Air Act even though the provisions of the plan had been previously approved by the EPA.

Suspension of emissions inspections in Connecticut would constitute the first time a legitimate program had been repealed without the prior approval of the EPA, unlike New Mexico where the program was legally deficient from the outset. While sanctions have been levied for failure to begin an inspection program, only in New Mexico were they imposed due to the repeal of an existing inspection/maintenance program. While it can be expected that the EPA would seek to impose federal funding restrictions upon this state, it is impossible to predict how well the federal action would stand up in a court case. It is anticipated that the EPA would, in the event of program repeal, request a revision to the state's SIP. A submission of a plan, without provision for an emissions inspection program, would amount to a violation of the Clean Air Act and thereby vest the EPA with the legal authority necessary to impose highway funding restrictions.

Before federal funding restrictions can be imposed, the EPA must publish notices in the Federal Register of its intent to do so. This usually follows negotiations between the EPA and the appropriate state emissions officials. The EPA determines the amount of highway funding restrictions in consultation with Federal Highway Administration officials.

The Legislative Program Review and Investigations Committee have attempted to calculate the cost to Connecticut if the emissions program is repealed. An exact figure for highway funds is impossible to predict. The date when sanctions are formally levied will have an effect on the amount of funds that have not been released to the state. Additionally, despite the absolute wording of the statutes, the EPA has not established a definitive standard by which the total dollar amount of the funding restrictions would be calculated.

The program review committee estimate that the imposition of sanctions would cost Connecticut approximately $58 million in highway funds. This estimate is based on financial grants for federal fiscal year 1985-86 projections.

EPA Policy Beyond 1987

The Environmental Protection Agency is currently considering what its future policy will be on air quality improvement programs beyond 1987. States that originally requested an extension of time to meet federally mandated air quality standards, including Connecticut, were given until December 1987 to comply with the Clean Air Act. However, the statute does not specifically address what is to happen to those states that have failed to meet the national ambient air quality standards, despite good faith efforts by the state and the requirements imposed upon them by the federal government.

At this point in time, the policy of the EPA is that authority exists in the spirit of the Clean Air Act that will support any attempt by the agency to ensure that the states do not abandon their emissions inspection program. In conversations with the Legislative Program Review and Investigations Committee, EPA has conceded that explicit statutory language does not exist to support its position. The agency does believe that a legal review of the act would show that the spirit of the act would require that inspection/maintenance programs be maintained. Environmental Protection Agency officials have stated that Connecticut will not attain the federal air quality standards for ozone by 1987. If the emissions inspection requirements have validity beyond 1987, violation of the ozone standards would necessitate the continuation of the I/M program.

The Legislative Program Review and Investigations Committee does question the amount of impact the program is having on Connecticut's air quality. The figures presented in section VI on program effectiveness indicate that at the very most there is a 6.63 percent reduction in hydrocarbons and 20.5 percent savings in carbon monoxide emitted in Connecticut based upon the predictions of EPA's computer model. These estimates do not take into consideration pollution that enters Connecticut from other states. The reductions will continue to decrease as the fleet becomes newer and comprised of much cleaner, post-1980 vehicles.

The Legislative Program Review and Investigations Committee does not believe it is cost-effective to test all vehicles, particularly newer model years. In 1988, the testing of 1983 to 1987 vehicles will result in a reduction in the percentage of the total air burden for hydrocarbons of 1.22 percent and 2.07 percent for carbon monoxide. To get this reduction, approximately 575,570 cars will be tested at a cost of $5,775,700, plus an estimated $1,732,710 for the cost of traveling to and from the testing stations, for a total cost of $7,508,410.

The Legislative Program Review and Investigations Committee, therefore, recommends that the emissions testing program be continued as a result of the federal requirements and that vehicles be tested after they are five years old. It is further recommended that the state subsidize the program to maintain a low or nominal testing fee, if necessary.

The five-year exemption was chosen based upon the failure rates the program is currently experiencing and EPA's estimates of the deterioration that occurs in emission rates. The emission factors contained in EPA's model indicate significant deterioration begins after 60,000 miles for post-1980 vehicles.

Due to the fact that all citizens of the state share in the benefits of clean air, it is also recommended that the state subsidize the program. By subsidizing the program and maintaining a low or nominal fee for testing, the burden of maintaining clean air will not fall only upon those citizens who own older vehicles.

Program Operation

As discussed above, Connecticut Vehicle Inspection Program, Inc., an independent contractor, actually operates the state's 18 emissions inspection stations in accordance with a contract between Hamilton Test Systems and the state of Connecticut.

Each state that is required to establish an inspection/maintenance program has a wide degree of latitude in determining how it will set up its network. There are two primary types of programs, centralized and decentralized.

The Connecticut operation is an example of a centralized emissions program. Centralized programs are characterized by a small number of inspection stations. In centralized systems, the inspections are performed at the emissions stations, whereas any needed repairs are made at independent repair facilities.

Decentralized systems couple the inspection process with repairs in order that a vehicle owner may have any necessary repairs conducted at the same facility that performed the inspection test. A decentralized program utilizes the services of a large number of independent repair facilities to do the inspections.

Each type of operation has its pros and cons. Based upon telephone conversations with the EPA and officials in other states, as well as a review of all available documents, the committee isolated the primary arguments for and against each program.

There are two predominant reasons favoring the implementation of a decentralized emissions inspection program. The first is that a decentralized network provides for more inspection stations, which allows the vehicle owner more flexibility in choosing where and when to have the inspection done. The motorist would also be able to have any necessary repairs performed at the same facility where the vehicle is being inspected.

The second position is that private mechanics tend to have a better understanding of both emissions inspection theory and emissions technology when they are both conducting the test and performing repairs. The committee found that states that rely upon private garages to conduct emissions inspections invariably require that those mechanics attend courses or emissions repairs. In addition, it is not uncommon for those states to require the mechanics pass a written and/or oral examination on emission repair technology.

The primary rationale favoring centralized programs is that they protect the vehicle owner against potential fraud. The separation of inspections and repairs removes any incentive an inspector may have to falsify the examination's outcome, in an attempt to generate income from the repair process. This type of abuse is a major problem in some programs.

There are other arguments favoring centralized programs. Linked to the problems of false inspection reports is the need, in decentralized systems, for an extensive surveillance and audit program. A large degree of surveillance is a necessity, not only to protect vehicle owners against unnecessary repairs, but also to ensure that motorists do not receive compliance stickers for vehicles that have not passed the emissions inspection. Increased audit demands are the result of decentralized emission inspection networks as there is a larger number of machines whose calibration must be checked to ensure maximum accuracy of readings throughout the system. Such an audit system will add to the cost of the program.

Finally, centralized systems are believed to be fairer in that they provide uniform emission test readings throughout the entire network and allow for easier data retrieval. Centralized programs usually are computerized, removing the test decision from the control of the operator. This system promotes uniformity of test procedures and allows for less variation in factors that can affect the results, such as the use of different testing equipment.

The Legislative and Program Review and Investigations Committee recommends the current system of a centralized emission inspection program run by a single contractor be retained.

The program review committee believes the centralized network offers the greatest overall advantages without adding any appreciable burden to the state motorists in terms of having vehicles tested and repaired. In light of the finding that the current equipment's calibration record is very good and considering the uniformity of test procedure, the Legislative and

Program Review and Investigations Committee is of the opinion that the centralized network best meets the objectives of the program.

Mechanic Training

A vital component of any vehicle emissions inspection program is the presence of quality automotive repair mechanics. From a practical viewpoint, a major objective of inspection/maintenance programs is the adjustment of motor vehicles that have been identified as excessive polluters. Obviously, this goal cannot be realized if the private mechanics lack a proper understanding of the programs aims and emissions repair technology.

As discussed above, the task of educating mechanics in decentralized programs is addressed by the requirement that mechanics pass a course in emissions technology. In those systems, passing the course is a prerequisite to licensing or certification, and these are preconditions to being allowed to conduct emissions inspections. Certification of mechanics is not required in Connecticut.

In the early stages of the vehicle emissions inspection program, courses in emissions repair were offered to any interested party at the state vocational/technical schools. Attendance at the courses was voluntary. Because of a lack of interest, the courses are now offered only when sufficient interest is shown.

During this study, the committee distributed a survey to 700 randomly selected repair facilities throughout the state. A copy of the survey with the responses by category is reproduced as Appendix C.

Three questions were of major interest: 1) the location at which mechanics received training in emissions repairs, if any; 2) how mechanics keep abreast of changing automotive emissions technology; and 3) if applicable, the reasons why the mechanic did not take advantage of emission repair courses.

Of the respondents who answered the question on their initial emissions training, 37 percent indicated that their knowledge had been gained at a course offered by a vehicle manufacturer. The next two largest groups, comprising almost 50 percent of the remaining respondents, received their training either by the company that sold the garage their emissions analyzers or at the state vocational/technical schools.

The next issue was how mechanics stayed current on repairing automotive air pollution control equipment. More than 75 percent of all answers fell into one of three categories: vehicle manufacturers' bulletins; trade journals or newsletters; or commercially available repair manuals.

The final area dealt with the reasons why garage mechanics had not taken any formal training courses in emissions repairs. Answers varied when the numbers were broken down by the type of repair facility. Overall, the major rationale of 28 percent of the respondents was a lack of awareness that the courses were even offered. Other significant answers included the statement that a course was not offered at a convenient time or place, and that the course would not increase the expertise of the workforce.

One question queried the mechanics as to whether there would be interest in a newsletter that would convey the same information as an academic course, an idea approved of by 96 percent of all respondents. In September 1986, the emissions division and CTVIP jointly produced an issue of an emissions technology newsletter that was mailed to all garages in the state.

In the fall of 1986, the Auto Emissions Division, in conjunction with CTVIP, instituted a series of seminars meant to bring together private mechanics and representatives from DMV and CTVIP. The seminars are being held at local emissions inspection stations, and personnel from the contractor and the emissions division have attended these sessions to meet with local mechanics.

The Legislative Program Review and Investigations Committee recommends that the seminars with the private garage mechanics be continued and the emissions newsletter be published, both on a regular basis.

Data Analysis and Research

The Legislative Program Review and Investigations Committee believes that the emissions testing program needs to be continually monitored to determine the program's benefits. To do this adequately, certain information should be systematically collected and analyzed. The information needs to be compiled in three major areas: 1) air quality; 2) program effectiveness; and 3) program operation and compliance.

In terms of air quality, the Department of Environmental Protection should produce information concerning the state's air quality, which includes the impact emissions from other areas (e.g., New York City and northern New Jersey) have on Connecticut's air. This information is needed to determine what influence the various pollution control strategies developed by Connecticut have on the state's air burden. The department also needs to conduct the appropriate research to develop a methodology for dealing with the effects of weather on ozone creation in order to accurately assess the year-to-year changes in ozone readings.

Program effectiveness is a key question being asked of the emissions inspection program. To determine effectiveness, data must be extracted from the computerized test information and fed into a formula that will estimate the amount of hydrocarbons and carbon monoxide that are being saved by the program. The program committee found that too much reliance has been placed in the belief that a reduction in idle emissions will reduce the total amount of pollutants produced. The committee found no research that established a relationship between the amount of pollutants produced at idle and the amount of pollutants produced by an automobile on a typical trip. If idle emissions do not accurately predict what will happen on a typical trip, then the idle test is meaningless. If it is a good predictor, then a model could be developed that will better estimate the amount of savings the program is producing than the current EPA predictive model (Mobile3). The Department of Environmental Protection has actual emission tests that could produce more accurate results. The department, in conjunction with EPA, should seek to use this information and develop an appropriate analytical method.

Information on program operation and compliance can also be improved by computerizing the waiver information that is currently being collected by the Department of Motor Vehicles. When a motor vehicle has failed two emissions inspections, the owner may be eligible for a waiver from compliance if certain conditions are met. These conditions are: if the vehicle has received the required emissions tune-up; if up to $40 has been spent on emissions-related repairs or a written estimate is produced which states repairs will exceed that amount; and if all air pollution control devices are connected to the vehicle. If any of these conditions are not met, the waiver is denied, and a "deficiency checklist" is filled out.

Waiver approval forms are now forwarded to the division's offices in Wethersfield on a weekly basis. However, when the program review committee attempted to review why waivers were denied in 1985, the hardcopy files were not available for inspection. The committee believes that waiver information is important because it presents a clear picture as to why vehicles are not able to comply with the vehicle inspection law. Retaining the waiver information would further allow DMV staff to monitor station waiver statistics to determine if any one station is approving abnormally large numbers of waivers.

The program review committee also believes that lane calibration information should be entered upon a master computer by the DMV field representatives. Presently, all information on lane audits is kept in hardcopy files. During the examination of these files, staff discovered that some of the audit results may have been missing from the file cabinets. The lane calibration reports are of significant importance and should be retained, not only as contractual program compliance information, but also for data analysis.

The Legislative Program Review and Investigations Committee recommends the following:

1) The Department of Environmental Protection shall conduct research and report to the Legislature on Connecticut's air quality, the impact of air pollution produced in other states on Connecticut, and the impact the emissions inspection program is actually having on the state's air based upon the inspection tests that are currently collected.

2) The Department of Motor Vehicles shall retain waiver data and compile the information for the purposes of analysis. Additionally, the station audit reports on analyzer calibrations should be computerized and reported to the contractor on an ongoing basis.

Testing of Diesel Vehicles

The program review committee raised questions about the testing of diesel vehicles. Diesel engines emit low levels of carbon monoxides and hydrocarbons which the emissions control program is designed to control. According to EPA, the testing of diesels for CO or HC would not provide any emissions reductions for these pollutants and may create maintenance problems for the emissions analyzers due to the particulate material in the diesel exhaust. The Environmental Protection Agency further states that the environmental benefit from testing diesels for density of smoke and nitrogen oxides. EPA says that a program designed to reduce visible diesel smoke may not have a significant effect on the fine particulate fraction of the exhaust. It is this fraction which is likely to contain the most carcinogens, according to EPA. The agency is beginning to review standards for diesel engines that manufacturers will be required to meet.

Table VII-1 estimates the percentage of vehicle miles traveled based upon national registration data. These figures would approximate the proportion of total miles travelled by all diesel vehicles in Connecticut. Actual data based upon state registration information is not available.

The testing of diesel vehicles presents several problems. As noted by EPA, special analyzers are needed to do the testing. Heavy diesel trucks account for 5 percent of the total 10.7 percent of total vehicle miles traveled, a substantial proportion of which maybe coming from out-of-state and therefore not subject to a testing program based upon in-state registration. Lastly, there are still serious questions as to the effectiveness of diesel testing program. EPA and DEP need to study these issues before a testing program is begun.

Table VII-1. Percentage of Vehicles Miles Traveled by Diesels.

Vehicle Type	Proportion of Miles Travelled
Passenger Cars	3.6%
Light Diesel Trucks	2.1%
Heavy Diesel Trucks	5.0%
Total Diesel Vehicles	10.7%

The Legislative Program Review Committee, therefore, recommends that the Department of Environmental Protection study the information that is being developed by the U.S. Environmental Protection Agency concerning diesel vehicles. Based upon this study, DEP should consider the appropriateness of testing diesel vehicles as one of the strategies for reducing pollutants when the state implementation plan is revised.

APPENDICES

CONNECTICUT ACADEMY OF SCIENCE AND ENGINEERING
410 Asylum Street, Hartford, Connecticut 06103 • (203) 527-2161

ABBREVIATED
RESPONSE TO INQUIRY

TITLE OF INQUIRY: Automobile Emissions Testing

ORIGIN: Legislative Program Review and Investigations Committee, Connecticut General Assembly

DATE INQUIRY ACCEPTED: February 5, 1986

DATE RESPONSE SUBMITTED: Final Draft: November 10, 1986;
Final Report: November 14, 1986
Abbreviated Report: December 19, 1986

RESPONDENT: Norman E. Bowne, B.S., Vice President and Chief Scientist, TRC Environmental Consultants, Inc.; Member of the Academy Technical Committee on the Atmosphere

SOURCES CONSULTED:

ad hoc Committee on Automobile Emissions Testing

*Marshall A. Atwater, Ph.D., Thor Analytics and Adjunct Professor of Physics, Eastern Connecticut State University.

*John G. Atwood, M.S., Vice President of Laboratory Medicine, The Perkin-Elmer Corporation.

*Richard D. Berlin, M.D., Professor and Chairman, Department of Physiology, University of Connecticut Health Center.

*Robert W. Berliner, M.D., Professor of Physiology and Medicine, Yale University School of Medicine.

Brian Clarke, B.S.M.E., M.B.A., President, Sensor Engineering, Echlin, Inc.

*Gary L. Haller, Ph.D., Becton Professor of Engineering and Applied Science, Yale University.

*William E. Reifsnyder, Ph.D., Professor of Forest Meteorology and Public Health (Biometeorology), Yale University School of Forestry and Environmental Studies.

*Charles A. Walker, D. Eng., Raymond J. Wean Professor of Engineering and Applied Science, Yale University.

*Members of the Academy

LPR & I Committee Staff

L. Spencer Cain, M.A., Senior Program Analyst

Michael L. Nauer, Ph.D., Director

Warren Wood Pierce, II, J.D., Research Analyst

REFERENCES: At end of report.

NOTE: The full report, issued November 14, 1986, was edited by the Council of the Academy and was released with its approval.

This abbreviated report was prepared by the Respondant, Norman E. Bowne, at the request of the Legislative Program Review and Investigations Committee. In the interest of brevity, much detailed background information was omitted. Readers are therefore cautioned to be aware that much of the data and argument needed to support the conclusions are not reproduced herein.

STATEMENT OF INQUIRY:

It is requested that the Academy examine certain technical aspects of the Connecticut automobile emissions control program. In particular, the Academy is to perform the following tasks:

a. Determine the extent to which the program complies with the requirements of the State Implementation Plan (SIP) as submitted to the U.S. Environmental Protection Agency (EPA);

b. Determine whether the vendor measuring equipment performance, as evidenced by audit, meets EPA standards;

c. Evaluate the probable effects on testing reliability of the following variables:

   1. comparison between lanes for any vehicle, whether or not in adjustment;

   2. state of adjustment or gross alteration of a vehicle;

   3. variations between manufacturers and models, all properly adjusted; and

   4. variations in atmospheric conditions;

d. Evaluate the success of the program in effecting a reduction of atmospheric pollutants;

e. To the extent that time permits, consider also the effects that differing fuels have on the levels of automobile emissions, in particular:

   --the effects of varying chemical compositions of gasolines; and

   --the effects of the use of diesel fuel;

f. Evaluate the probable benefits to public health;

g. Assess the future of the program.

Task a.: Connecticut Compliance with the SIP

The State Implementation Plan specifies that Connecticut must comply with Sections 171 and 172(b) of the Clean Air Act by meeting the National Ambient Air Quality Standards (NAAQS). In an effort to determine whether the state is in compliance with these Standards two recent reports (see References 1 and 2) have been reviewed, prepared by the Air Compliance Unit of the Connecticut Department of Environmental Protection. One of these reports is concerned with standards for ozone and hydrocarbons and the other with standards for carbon monoxide. The purpose of Task a. is to determine whether automotive emissions have been sufficiently controlled in Connecticut so as to permit it to be in compliance with these standards.

Carbon monoxide is monitored continuously at five sites (Bridgeport, Hartford, New Britain, New Haven, Stamford). The analytical results of this monitoring indicate that all of these sites are in compliance with regulation on monthly 1-hour highs. Highest monthly 8-hour averages have declined from 8.0 to 5.0 ppm in the period 1980-85, and all sites are expected to be in compliance by 1987.

In addition to developing and analyzing data on the concentration of carbon monoxide in ambient air in Connecticut, DEP scientists have developed models for estimating the rates of emission of carbon monoxide by mobile, area, and point sources. The data in Table 1 indicate that carbon monoxide emissions from mobile sources declined about 33% in the period 1980-84, constituting about 80% of total emissions in 1980, but 71% in 1984. Relatively smaller declines through 1987 are estimated to be sufficient to bring the state into total compliance with regulations concerning carbon monoxide.

Non-methane Hydrocarbons (NMHC). Data on projected NMHC emissions are given in Table 2. These data indicate that a 31.4% reduction in emissions from motor vehicles was achieved between 1980 and 1984. The projected emission rate for 1987 from all sources is 325 metric tons per day. A target of 368 metric tons per day is estimated to be sufficient to attain the NAAQS for ozone of 0.12 ppm.

Ozone. Ozone concentrations in the air in Connecticut are dependent on precursor (NMHC) concentrations, the quality of air entering Connecticut from the New York/New Jersey area, and temperature. Concentrations of this pollutant are measured from May through October by a network of monitoring sites.

Monitoring data are presented in Reference 1 in the form of the number of exceedances of ozone NAAQS at each site in the years 1974-84. Data on the number of exceedances at each of these sites are summarized in Table 3. It is noted in the references that "the high number of occurrences in 1983 is thought to be the result of unusually hot weather, and an unusual frequency of days on which the wind was from the southwest."

It is difficult to find a way of aggregating these data, and thus there seems to be little choice other than to look for trends with time at each site. Ignoring data for 1983, some sites seem to indicate decreases with time while others indicate little change. In general, however, conclusions based on this table would be questionable in the absence of more detailed information on summer conditions. Therefore, the status of compliance with the ozone standard is undetermined.

Table 1
Carbon Monoxide

Emissions, tons per day

	1980	1982	1983	1984	1985*	1986*	1987*
Mobile Sources	2936	2676	2543	1972	1695	1542	1452
Area Sources	716	723	726	730	733	739	740
Point Sources	73	21	20	20	20	20	21
Total	3676	3420	3294	2772	2448	2299	2213

*estimated

Table 2
Projected Non-methane Hydrocarbon Emissions, metric tons/day

	1980	1983	1984	1985	1986	1987
Motor Vehicles	297	233	203	185	168	153
Area Sources	129	122	117	118	118	119
Point Sources	71	60	57	53	49	46
Planned Growth	--	--	--	1	5	7
Total	497	415	377	357	340	325
Unplanned Growth				12	28	43
Cumulative % Reduction (from 1980)		16.7	24.2	28.4	31.6	34.7

Source: Table 12 in Reference 1.

Table 3
Number of Exceedances of the Ozone NAAQS

Site	1980	1981	1982	1983	1984
Bridgeport	22	9	9	24	13
Danbury	20	11	9	24	13
Hartford/E. Hartford	21	6	6	15	7
Greenwich	28	13	15	32	17
Middletown	26	17	19	20	14
New Haven	16	6	10	27	13
Stafford/Enfield	10	8	10	20	8
Stratford	36	24	21	45	28

Task b.: Performance of Vendor Measuring Equipment

A direct audit was performed by a member of the Academy who is skilled in instrumentation, at the North Haven Inspection Station. Observations indicate that the performance of the NDIR instruments exceeds specifications nearly all the time.

Quality control of the measurement system appeared well planned. The equipment used was well suited to the task. Large supplies of accurate test gas mixtures were available. The computerized data reduction in the test made it very easy for the operators to calibrate the NDIR instruments. The operators appeared to be well trained.

The overall impression of the North Haven facility is that it is a well planned, well run facility with adequate equipment and well trained staff. The rates of error in the inspection reports should be low enough so that the public can have reasonable confidence that reported measurements are accurate and repeatable, and that major variations from test to test reflect varying performance of the vehicles.

Finally, the above conclusions are supported by the results of the EPA's unannounced audit of the Connecticut Motor Vehicle Inspection Program on September 17-18, 1985, where all analyzers checked were within the audit limit specified by the EPA. The EPA termed this "quite an accomplishment" since normally a small percentage of the analyzers are expected to be outside of those limits.

Task c.: Effects of Variables on Testing Reliability

Lane Variation: On the question of the reliability of the test for any vehicle, whether or not in adjustment, compared between testing lanes, the State provided statistical data for the second half of 1985 indicating that while variations did occur in the test results, there appeared to be no statistically significant difference between test lanes for any vehicle.

State of Adjustment: The question is the effect on testing reliability for vehicles in different states of adjustment and vehicles which have been altered (tampering). While the State's data does not address either of those items, a significant amount of literature is available from the EPA and the Society of Automotive Engineers (SAE) concerning them. In summary, it is generally considered that vehicles produced prior to model year 1981 may be subject to significant variations in engine emissions based on the state of adjustment of the engine operating system. Those items include idle mixture, idle speed, ignition timing and choke adjustment. In October 1985 the EPA published a motor vehicle tampering survey for 1984 indicating that 22% of the vehicles were tampered with. The survey indicated that the tampering rate for areas which did not have an inspection maintenance program was 31%, areas with inspection maintenance programs had 17%, and areas with the inspection maintenance and anti-tampering programs was 11%. Tampering can have a substantial effect on HC and CO emissions. The rate for tampering increases with the age of the vehicle.

Model Variation: On the question of the effect of different automotive models and manufacturers on idle emissions, data provided by the State did indicate there were some variations. However, no discernible statistically significant differences were noted.

Atmospheric Conditions: On the question of the effect of variations in atmospheric conditions on idle emission testing, an old SAE paper (71-0835) indicated that there was a substantial effect on exhaust emissions due to changes in atmospheric inlet conditions. In summary, hydrocarbons and carbon monoxide generally decreased with increasing barometric pressure. For hydrocarbons no correlation of a correction factor could be determined. The correction factor for carbon monoxide improved the results of some engines and degraded the results of others. Both hydrocarbons and carbon monoxide generally increase with ambient temperature increases. For vehicles prior to model year 1981 which were not equipped with closed-loop feedback sensing systems the atmospheric conditions could substantially affect the idle emissions.

Task d.: Success in Effecting Reduction of Pollutants

One of the central technical issues concerning the Emissions Inspection Program is that of determining quantitatively how much atmospheric pollution has been avoided by mandating the Inspection/Maintenance (I/M) system. Ideally, one would like to have a direct measure of the reduction in ambient air pollutants which has resulted from the Program. Such information is, however, simply not directly available. The development of such information, however, may be approached in two steps. The first is to estimate what reductions in automotive emissions have been effected by I/M. The second is to estimate how these emission reductions have reduced the concentration of pollutants in the atmosphere.

REDUCTION OF EMISSIONS

It is possible, using the testing results that are available, to make reasonable estimates of the annual reduction of carbon monoxide (CO) and hydrocarbons (HC) that result from identifying those cars which do not meet the Connecticut standards and, after maintenance repairs, passed a subsequent test. The results reported here are from an analysis of 170,832 vehicles "matched" in the sense that they were tested in the first quarter of 1983 and were re-tested in the first quarter of 1984.

In order to perform the calculation, an empirical correlation is required between the actual emissions per mile of the average vehicle that passed or failed the Connecticut test, and the test cutpoints (a cutpoint is the idle emissions test level above which a vehicle fails the test). It is the opinion of the Task Group that such direct correlations do not exist. However, the EPA has attempted to correlate the emissions as measured by the Federal Test Procedure (FTP) and the idle test used in Connecticut. The best correlations are for the 1980 and post-1981 categories taken from Reference 3 and are shown in Table 4, below. The post-1981 measurements were made only on 1981-82 vehicles but it is assumed that they also apply for the 1983 year which had the same standards.

Table 4
Average FTP HC and CO Emissions of Vehicles Passing/Failing Idle Short Test with Cutpoints of 220 ppm HC and 1.2% CO

Vehicle Category	Passing Vehicles		Failing Vehicles	
	HC	CO	HC	CO
Federal 1980	0.47	6.49	1.75	27.53
Federal post-1981	0.32	3.02	2.81	59.16

A sample calculation was performed in detail for the 1980 automotive model year. Using the correlations of Table 4, the before-repair HC emissions are found to be 1.15×10^8 g HC/yr.

These are the emissions from (passed + repaired + waivered) vehicles for the 1980 models tested in the first quarter of 1983. After repair the average emissions from this group of vehicles drops to 1.04×10^8 g/yr, a 9.8% reduction in HC.

A similar calculation for CO indicates a potential production of 1.62×10^9 g/yr reduced to 1.43×10^9, a 12% reduction in CO. This calculation refers only to the matched vehicles tested in the first quarter. Projecting these results to annual periods one can estimate the total tons of pollutant avoided by identifying the most polluting vehicles by the idle test. A summary of such calculations for the years 1980-83 is given in Table 5.

Table 5
Percent Reduction and Amounts of Avoided Pollutants for Model Years 1980-83

Model Year	HC		CO	
	Percent	Tons/Yr	Percent	Tons/Yr
1980	9.8	85	12	1500
1981	14	91	28	2100
1982	9.6	50	20	1100
1983	6.6	3.5	14	77

Similar calculations are possible for model years 1975-1979 using the correlations from the "Portland Study" (4).

Under these assumptions the sums of the avoided emissions were calculated to estimate what one might hope to achieve by continuing the I/M program. Specifically, something in excess of 1,300 tons HC per year and 43,000 tons CO per year might be avoided by identifying the worst polluting vehicles by the idle test.

REDUCTION IN CONCENTRATION OF ATMOSPHERIC POLLUTANTS

It is virtually impossible to associate directly changes in the observed atmospheric air quality with any specific changes in one of the multiple source emissions, where automobiles are one of the sources. Efforts to identify the effects of various sources use various air quality models. For the current study, a simplified analysis will be used to examine the possible impact of the I/M program on the air quality.

Carbon Monoxide

Carbon monoxide is a non-reactive gas with a residence time of one month or longer that can be directly modeled using the above equation.

Analysis. A least squares fit of the carbon monoxide data was made. Initially the data at the beginnning of 1981 is used to develop a diffusion factor. Using the statewide emissions and a concentration of 4 ppm, a diffusion factor of 4.165×10^{-6} ppm-yr/tons is computed.

The results reported in the previous section of this Task demonstrated that the amount of carbon monoxide avoided in 1983 due to the I/M program was 43000 tons/year. Using this amount for emissions and the above diffusion factor yield a reduction in the concentration of .18 ppm in 1983.

The least square reduction of the observed concentration from 1981 to 1983 was about .6 ppm. Therefore, the I/M program contributed about a 1/3 reduction of the observed concentration decrease.

Ozone

Hydrocarbons are one of the precursors that lead to the formation of ozone. The previous section indicated that about 1300 tons/year of HC were avoided in 1983 by identifying the worst polluting vehicles by the idle test. Using the same method for HC as for CO yields a total production of 22083 tons/year, or a reduction of about 6% of the total.

The effect of the hydrocarbon avoidance in vehicles should appear in the atmosphere as a reduction in ozone. Unfortunately, the complexities of the chemical relationship and the substantial effects of atmospheric temperature variations make it not possible at this time to demonstrate a clear reduction in ozone attributable to the I/M program.

Task e.: Effects of Differing Fuels

There has been no statistically significant difference ever noted on a vehicle's exhaust emissions when different brands and grades of gasoline are used. Gasahol, a blend of gasoline and methanol (typically 5-10% by volume), does have a higher oxygen content than regular gasoline. The effect on the vehicle's idle exhaust emissions is to reduce the hydrocarbon and carbon monoxide emissions slightly due to the "leaning" effect, except for vehicles equipped with closed-loop oxygen sensing feedback systems.

There is little significant effect on a vehicle's idle exhaust emission characteristics when comparing leaded with unleaded gasoline other than the amount of lead added to the atmosphere.

Based on the principle of operation which the measurement system employs, one would expect only very slight differences in the hydrocarbon readings from vehicles using different fuel brands.

The conclusion of the Task Group on this question is that no evidence was found that fuel brand was a significant factor in emission results, and the probability that it is a factor is so low that further study of the question is not justifiable.

The contribution of diesel trucks to emissions is a separate issue, and depends in part on the relative sizes of the automobile and truck fleets operating in the state. For 1983, 77% of all of vehicles registered in the nation were automobiles, 22% trucks and .3% were buses. Trucks typically accumulate five to six times more road mileage than the average automobile, and their engines typically operate at much higher power levels. The registration percentage of trucks is somewhat misleading since one truck is often registered in several states. Therefore, this number is overstated but it is not known by how much. In general, one could assume that the truck population is being operated almost as much as the automobile population, making their exhaust emissions a significant factor in air quality.

It is therefore possible that the truck fleet is making a significant contribution to automotive emissions, but there is insufficient data to demonstrate this, both in the nation and in Connecticut. Nevertheless, there is the possibility of a relatively large contribution by trucks, which will become more important as the automobile contribution continues to decrease. It is therefore recommended that the data needed to determine the level of truck contributions be developed.

Task f.: Emission Control Benefits to Public Health

There are two essential questions regarding the health effects of carbon monoxide (CO) and hydrogarbons (HC) that must be answered in the context of the auto emissions program. They are, what are the health effects of these substances, and what contribution does auto emissions make to these health effects.

In the case of CO, it can be assumed that the residual CO content of blood is a faithful mirror of the atmosphere encountered. Agencies such as the World Health Organization have concluded that functional changes are first detectable when greater than 2.5% hemoglobin is present as carbonmonoxyhemoglobin (CO-hemoglobin). Numerous surveys of CO-hemoglobin levels have been taken. The results show first that self-administration of CO in cigarette smoke greatly exceeds that from any other source and, second, that, except in unusual environmental circumstances (traffic-tunnel workers, garage mechanics and the like), levels are not in the symptomatic range.

The impact of HC on health is more difficult to determine. HC does not accumulate in any discrete form; and, thus, there is nothing analogous to CO-hemoglobin that reflects exposure. Among the most polluted areas, severe episodes of dense smog have been associated with respiratory distress, bronchitis and asthma. By extrapolation it may be assumed that real though lesser degrees of disease occur in less-polluted environments. However, it must be remembered that respiratory defenses may be extremely efficient at low degrees of pollution. Disease results only at high levels when defenses are overwhelmed. Again, certain populations may be especially at risk. Moreover, chronic exposure to HC may well result in increased likelihood of carcinoma. Yet, the contribution of auto emissions to the process is difficult to document. It can be appreciated that a much stronger case can be made for the contributions of cigarette smoking and even here the epidemiological evidence has been slow to take hold.

In summary, it is difficult to demonstrate that the levels of CO and HC related to auto emissions are an important health risk to the general population.

Task g.: Observations on the Future of the Program

The Connecticut Motor Vehicle Emissions Inspection Program is both well conceived and well operated. It not only clearly reduces the levels of emissions, thereby satisfying Federal requirements, but it provides an excellent and accessible data base of the emissions behavior of all gasoline cars in Connecticut from which decisions for future action can be taken. It may be that as the fleet composition includes larger number of low-emissions, post-1981 models the percent of avoided emissions will decrease. But there remains the longer term behavior of such vehicles, and the entire question of possibly dealing with the diesel portion of the fleet. It is therefore recommended that consideration be given to continuing the program, possibly in some altered form to reduce costs such as less frequent testing of newer models but retaining the excellent data base system for future State decisions.

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5. M. A. Atwater, 1984, "Influence of Meteorology on High Ozone Concentrations." Paper at APCA International Specialty Conference on Evaluation of the Scientific Basis for Ozone/Oxidants Standards at Houston, Texas, Nov. 27-30, 1984.

6. M. A. Atwater and P. G. Bodner, 1984, "1983 Summer Ozone Study for Ohio," TRC Report to Ohio EPA, July, 1985, 45 pp.

7. M. A. Atwater, 1984, "Off Season Ozone Exceedances in Pennsylvania 1978-1982." TRC Final Report 2219-j81 to U. S. EPA, 44 pp.

8. A. Davidson, 1986, "Comment on Ten-year Ozone Trends in California and Texas," J. Air Pollution Control Association: 36:597-602.

9. H. C. McKee, 1986, "Comment on Long Term Ozone Trends," J. Air Pollution Control Association, 36:271-272.

10. H. M. Walker, 1985, "Ten-year Ozone Trends in California and Texas," J. Air Pollution Control Association, 35:903-912.

5649177

STATE OF CONNECTICUT

VEHICLE INSPECTION REPORT

**THIS REPORT IS REQUIRED IN ORDER TO RECEIVE A FREE RETEST.
IF LOST OR STOLEN IT CAN NOT BE REPLACED.**

Pursuant to Sec. 14-164C of the Connecticut General Statute, Motor Vehicle Emissions Systems and Inspection Facilities, your vehicle was inspected for exhaust emissions. If the results are PASS, the new sticker on the windshield shows the last day of the 2 week period for the next annual test. If the results are FAIL, the law provides 30 days to accomplish repairs and to return (with the reverse side of this form completed) for one no-charge retest.

Hydrocarbons **(HC)** are unburnt gasoline and cause smog. Carbon Monoxide **(CO)** is a colorless, odorless, toxic gas. Excessive levels of these pollutants are caused by engine malfunctions which cause poor gas mileage and shorten engine life.

NOTICE: This report must accompany the vehicle at the time of reinspection.

FINAL RESULT	FEE	STICKER	DIAGNOSTIC CODES

IDLE EMISSION DATA

		HC (PPM)	CO (%)
STATE STANDARDS			
TEST READING	1st IDLE		
	2nd IDLE		

CAUTION:
NEVER OPERATE A VEHICLE ENGINE IN A CONFINED OR UNVENTILATED AREA.

GENERAL INFORMATION

INSPECTION NO.	CUSTOMER	INSPECTION PERIOD	INSURANCE	TAX TOWN

IDENTIFIER

VEHICLE INFORMATION

REGISTRATION NO.	CLASS	VEHICLE IDENTIFICATION NO.	MAKE	MILEAGE (X1000)	YEAR	WT. CODE

FOR OFFICIAL USE ONLY

REGISTRATION NO.	VEHICLE IDENTIFICATION NO.	MAKE	YEAR	INSPECTION NO.

DATE	STATION NO.	LANE NO.	TEST MODE	TEST NO.	TIME

5649177

DIAG. CODE	CKSUM	RPEN	TPEN	PPEN	STICKER PERIOD

IF YOUR VEHICLE FAILED THE EMISSION INSPECTION, YOU MUST HAVE IT REPAIRED AND PASS REINSPECTION OR BE GRANTED A WAIVER WITHIN 30 DAYS. TO QUALIFY FOR REINSPECTION THE INFORMATION (REPAIR DATA) BELOW MUST BE PROVIDED. EXCLUDING AIR POLLUTION CONTROL DEVICES, EMISSION RELATED REPAIRS COSTING MORE THAN $40.00 ARE NOT REQUIRED.

MANUFACTURER'S WARRANTIES MAY COVER SOME REPAIRS.

THIS TEST WAS PERFORMED IN ACCORDANCE WITH 40, CFR, PART 85, SUBPART W, • EMISSIONS PERFORMANCE WARRANTY SHORT TESTS • REGULATIONS OF THE UNITED STATES ENVIRONMENTAL PROTECTION AGENCY.

DIAGNOSTIC CODE EXPLANATION

1. High CO at idle
2. High HC at idle
3. High CO at conditioning mode
4. High HC at conditioning mode

CODE	COMMON CAUSES OF FAILURE (most probable cause listed first)
1 OR 1, 2	a. Incorrect idle mixture and/or speed b. Restricted air intake (air cleaner, choke, air intake doors, etc.) c. Plugged PCV system d. Vacuum leaks (hoses, manifold, etc.) NOTE: Readjust idle mixture and speed after repairing vacuum leaks.
2	a. Vacuum leaks (hoses, manifold, EGR valve, carburetor, etc.) NOTE: readjust idle mixture and speed after repairing vacuum leaks. b. Incorrect ignition timing and/or idle speed. c. Incorrect carburetor idle mixture d. Ignition system malfunction (plugs, plug wires, points, dwell angle, etc.)
1, 3 1, 4 1, 2, 3 1, 2, 4 1, 3, 4 OR 1, 2, 3, 4	a. All items listed under Code 1 b. Internal carburetion or fuel injection problem (high float level, oversized jets, power enrichment, etc.) c. Computer controlled closed loop carburetion problem (oxygen sensor, etc.) - 1981 and newer vehicles only
2, 4	a. Items listed in code 2 b. Mechanical engine problem (valves, rings, sticking EGR, heat riser, plugged exhaust, etc.)
2, 3 OR 2, 3, 4	a. Items listed under Code 2 b. Items listed under Code 1, 3 c. Items listed under Code 2, 4

WT. CODE
0 - UP TO 5999 LBS.
1 - 6000 TO 8500 LBS.
2 - 8501 TO 10,000 LBS.

WAIVER REQUIREMENTS — If your vehicle failed the retest, the minimum requirements to qualify for a waiver are as follows:

1. Items 1 through 7 listed below under REPAIR DATA must be checked and repaired or adjusted if necessary.
2. A statement from a licensed repairer that emission related repairs, excluding air pollution control devices, totalling more than $40 are required to bring the vehicle into compliance.

In addition, the Commissioner or his representative may:

1. Inspect the vehicle to verify that repairs were made, check for the presence of properly connected air pollution control devices, or determine whether additional repairs are required.
2. Require additional repairs listed above, or other repairs, up to a limit of $40.

HOME REPAIR STATEMENT - THE MOTORIST MUST COMPLETE THIS SECTION IF THE VEHICLE IS REPAIRED BY THE MOTORIST OR SOMEONE OTHER THAN A REPAIR FACILITY. SHOW RECEIPTS FOR PARTS PURCHASED TO THE DMV REPRESENTATIVE AT THE STATION IF APPLYING FOR WAIVER.

______________________ ADDRESS

MOTORIST NAME (please print) ______________________

CITY ______ STATE ______ ZIP ______

MOTORIST SIGNATURE ______________________

( ) ______________________ AREA CODE AND TELEPHONE

REPAIR FACILITY STATEMENT — TO BE COMPLETED BY THE REPAIR FACILITY PERFORMING THE REPAIR.
I CERTIFY THAT THE WORK LISTED BELOW WAS COMPLETED BY:

REPAIR FACILITY NAME ______________ MECHANIC SIGNATURE ______________ TOWN ______________

R [ ][ ][ ][ ] GARAGE LICENSE #
X [ ][ ][ ][ ][ ] NEW CAR DEALER LICENSE #
D [ ][ ][ ][ ][ ] USED CAR DEALER LICENSE #

REPAIR DATA - Must be completed to qualify for re-inspection. See Diagnostic Code on opposite side of this form. You may wish to use the DIAGNOSTIC CODE EXPLANATION listing of "Common Causes of Failure" (appearing above on this page) as a guide to repair the vehicle.

Please indicate below what repairs have been made.	SERVICED OK	AFTER SERV. READINGS
1. Check idle speed, set to manufacturers specifications.	1 [ ]	__________ RPM
2. Check and adjust idle airfuel mixture, using manufacturers recommended procedures.	2 [ ]	
3. Check for vacuum leaks (readjust idle mixture and speed after repair)	3 [ ]	PART COST $ __________ .00
4. Check choke for proper operation - repair if necessary.	4 [ ]	
5. Check PCV valve - replace as necessary.	5 [ ]	
6. Check air filter - replace if required.	6 [ ]	LABOR COST $ __________ .00
7. Set dwell (if applicable) and ignition timing to manufacturer's specifications.	7 [ ]	**EMISSION ANALYZER READINGS**
8. Check spark plugs and plug wires - replace as necessary.	8 [ ]	Before repair: ________ HC (ppm) ________ CO (%)
9. Check for other ignition system problems.	9 [ ]	
10. Check remainder of PCV system.	10 [ ]	After repair: ________ HC (ppm) ________ CO (%)
11. Check carburetion/fuel injection system and controls.	11 [ ]	
12. Other emission related repairs performed.	12 [ ]	______________________

LEGISLATIVE PROGRAM REVIEW AND INVESTIGATIONS COMMITTEE
VEHICLE EMISSIONS INSPECTION SURVEY

1) What is your position at the above repair facility? (please circle the appropriate answer)

N=202

1) Owner (162)
2) Manager (37)
3) Chief mechanic (3)
4) Other (please specify)

2) Does your garage possess its own emissions analyzers for repair purposes?

Yes 160 No 44 N=204

3) Have you, or any of your mechanics, received any training in the use of the analyzers?

Yes 177 No 27 N=204

4) What is the approximate number of emissions-related repairs which are performed each month? (please circle the appropriate answer)

N=189

1) 1-20 (106) 2) 21-40 (36)
3) 41-60 (21) 4) 61-80 (10) 5) 80+ (16)

5) How many mechanics are employed at this garage?

______

6) How many mechanics, including yourself, perform emissions related repairs?

______

7) How many mechanics, including yourself, have taken a specialized course in emissions-related repairs?

______

8) If you or any of your mechanics have taken a course in emissions repairs, where was the course offered? (please circle the two best answers)

N=254

1) State vocational/technical school (59)
2) Vehicle manufacturers training course (94)
3) High school automotive repair course (12)
4) Apprentice (16)
5) Correspondence course (7)
6) Other (please specify) (66)

9) How do you, or your mechanics, keep up with changes in emissions-repair technology? (please circle the two best answers) N=364

1) Vehicle manufacturers bulletins (103)
2) Correspondence courses (7)
3) Trade journals or newsletters (100)
4) Commercial magazines (28)
5) State vocational/technical school courses (3)
6) Chiltons or other commercial repair manuals (99)
7) Mailings by the Department of Motor Vehicles (14)
8) Other (please specify) (10)

10) If you, or your mechanics have not taken a formal training course on emissions repairs, please indicate your reasons for not doing so. (please circle the two best answers) N=111

1) Not interested in taking course (13)
2) Did not know courses were offered (31)
3) Course is too expensive (3)
4) Course is too time-consuming (7)
5) Course is not offered at a convenient time (20)
6) Course is not offered at a convenient place (19)
7) Course will not increase expertise of workforce (18)

11) Would you, or any of your mechanics, be interested in receiving a periodical or newsletter from the Department of Motor Vehicles Emissions Division describing the latest trends in emissions repairs?

Yes 192 No 8 N=200

12) Would you or any of your mechanics be interested in being able to borrow or rent instructional videocassettes on emissions repairs from the state's Vehicles Emissions Division?

Yes 151 No 46 N=197

13) Would your garage be able to perform emissions inspections, in addition to emissions repairs, if offered the opportunity by the state?

Yes 166 No 32 N=198

14) Would your garage be interested in conducting emissions inspections, in addition to emissions repairs, if offered the opportunity by the state?

Yes 161 No 35 N=196

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General Assembly

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LEGISLATIVE PROGRAM REVIEW AND INVESTIGATIONS COMMITTEE

LEGISLATIVE OFFICE BUILDING, 18 TRINITY ST., HARTFORD, CT 06106 (203) 566-8480

TO: Department of Environmental Protection

FROM: Legislative Program Review and Investigations Committee

DATE: December 12, 1986

RE: Draft report on the Emissions Control Program

We have issued a draft report on the emissions control program in Connecticut. If you would like to have your comments included in the report's appendix they must be received by December 22, 1986, at 10:00 a.m. Contact Spencer Cain or Warren Pierce if you have any questions.

af

NO AGENCY RESPONSE

LEGISLATIVE PROGRAM REVIEW AND INVESTIGATIONS COMMITTEE

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