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Smog: Cause and Control

Part III. Progress Report

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On June 10, 1964, the California Motor Vehicle Pollution Control Board (MVPCB) approved four exhaust emission control systems for new cars. This means that the devices must be factory-installed on all 1966 and later automobiles sold in the state of California. Although the four approved systems (one ignition afterburner and three catalytic converters) are manufactured by auto accessory makers, the automobile industry announced on August 12 that they would have their own systems ready by the Fall of 1965.

First to win approval for its system from California was Chrysler Corp. in November 1964 (1). Chrysler's "cleaner air package" consists of a combination of improved carburetion, a deceleration device, and other engine design modifications which reduce the emission of pollutants by lowering the amount of combustible material entering the cylinders. General Motors and Ford are in the process of developing exhaust manifold air injection systems, while American Motors will probably make use of some combination of catalytic or ignition-type afterburners.

These steps show a good deal of progress in the opening rounds of the battle against smog, but there are still many problems in the way. For one thing, there are 10,000,000 motor vehicles in the state of California (2), and each vehicle presents its own problem. Each engine characteristically emits exhaust in different amounts and of different composition. In addition, the emissions of an individual engine vary with driving sequence, driver characteristics, altitude, ambient temperature, and humidity.

Enforcement of smog control legislation presents another serious problem. California drivers are now being forced to install smog control devices (of the crankcase breather type) on their cars at their own expense. There was at first an atmosphere of unwillingness or inability to cooperate and follow instructions (in spite of the loud public cry to "get rid of smog!") and the well meaning motorist often found himself forced to pay a high markup and installation price in order to get the unit installed. In addition, there is a great need for public relations, to educate the public as well as the service outlets as to the necessity for regular servicing (and consequent mandatory inspection) of the units. Lastly, it is quite difficult and often impractical to attempt total enforcement on so many moving vehicles.

Let us look for a moment at the probable cost to the consumer of effective exhaust emission control. According to the Air Pollution Control Association (APCA), a direct-flame afterburner system may be broken down as follows (3):

a) An air pump, 8 cfm or more ($25)
b) Materials to withstand 1500-2500F ($25)
c) A heat exchanger between the inlet and outlet pipes ($10)
d) A flow control system to maintain about 4% CO in the exhaust ($30)
e) A secondary ignition system ($10-15)
f) Piping and installation ($25)

There will be addition maintenance costs due to the necessary rich mixture:

g) Lower mileage ($40/yr)
h) Labor to maintain carburetor setting at rich limit, decreased spark plug, oil, and oil filter life ($10/yr)
i) Maintenance of the unit itself ($20/yr)

The addition of this type of system to a car will therefore cost its owner a minimum of $130 plus $70/yr. Similar APCA estimates place the cost of catalytic converters at $90 plus $30/yr maintenance. A manifold air injection system should cost only $35 plus $5/yr, but it will probably have to be used in conjunction with a limited mode afterburner ($55 plus $10/yr), a deceleration device ($5-30), or engine modifications ($10-40).

Since the APCA states that these estimates are low at best (and probably unattainable) one can see why California motorists are shocked by the cost of smog control, even after fighting so hard to get it. The MVPCB asked for comments on the proposed exhaust control devices this fall, and 99% of the letters received were against them because of their high cost (4).

The California Board's answer to these problems lies

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Management

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be put to use before it has time to become obsolete, and it can be acquired more effectively in such a course than by individual contact with outsiders.

Let me summarize what I have tried to say on the subject of engineering management in this way. The interest which you, as a group of prospective engineers, have shown in the subject of management is a reflection of the increasing number of engineers and scientists who are managers of industries today. This increase is the natural outcome of the tremendous growth of new industry based on scientific innovations in recent years.

Since more and more managers are scientists and engineers because of the need for their scientific background, it follows that a strong professional record of achievement in college and afterward in industry is a primary asset. Equally important both to the professional and to the manager is the ability to communicate his ideas effectively, both verbally and in written form. Some background in finance, marketing, and other business fields will be required by the manager when he reaches the top level in his particular business. This background can be acquired in a variety of ways, at or shortly before the time when it will be put to use. Because of the high rate of obsolescence today, it is not usually worthwhile to acquire knowledge now for use in the distant future.

My story has been somewhat one-sided in that I have not said anything about the rewards available to the man who decides to remain a professional in business rather than a manager. More and more large companies are recognizing their real need for senior professional employees and are revising their systems of compensation to pay top engineers and scientists salaries which are comparable to those of managers. But that is another topic which I will leave for someone else.

Inevitably, what I have said reflects my own personal experience and personal bias. I hope that some of it may be helpful to you as you look ahead to your career in business.

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Ammonia

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5. Kroch, E., *Ammonia—Fuel for Motor Buses,* Petroleum Institute Journal, Vol. 31, No. 259, 1945, pp. 213-223.
6. *Thermodynamics of Ammonia Synthesis and Oxidation,* Chemical Engineering Progress, July 1953, pp. 349-353.
7. *U. S. Army Request for Quotation #RFP 65-RE-503.*
8. *U. S. Army Single Cylinder Ammonia Fuel Test,* USAERDL, Ft. Belvoir, Va., 1964.

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in nothing more than a persistent and methodical campaign. One favorable factor is the competitive spirit shown by industry in attacking the problem. The different companies are competing to market smog control systems at a profit, and this competition provides the incentive for industry to place on the job teams of experience and talent which the state government could neither assemble nor support.

The MVPCB feels therefore that the smog menace can and will be licked. It intends to conquer motor vehicle pollution one step at a time, working to control exhaust emissions even while still attempting to completely understand them. In this way, California will pioneer in controlling air pollution from crankcase emissions, exhaust, diesel smoke, and eventually from evaporation and the emission of oxides of nitrogen. "The sewage which motor vehicles put into the air must be controlled if the public health is to be preserved. . . ."[1]

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Three companies are now competing to develop exhaust emission control devices for used cars. These devices are to be inexpensive, easy to install and maintain, completely universal, and effective over a long period of time and under a large variety of operating conditions. I have undertaken a senior project with the purpose of establishing the actual cost and universality of these devices and to determine how (if any) their installation effects the overall performance of an engine. Under the guidance of Professor Ernest Elsevier, I expect to begin tests this spring using the ME Lab's new Chevrolet 327 cu. in. engine (which was obtained for this project), and results should be available at the end of the semester.

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4. "Exhaust Control Device for Used Cars Rejected by California Agency." *Wall Street Journal* (date not available).
5. "Chrysler Gets Approval for Anti Smog System on '66 Cars in California." *Wall Street Journal,* November 19, 1964.

1. Jensen and Grant, "Status of Control of Motor Vehicle Emissions in California," *Journal of the APCA,* December 1964, p. 486.

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