

Industry focuses on unleaded gas

Although the retreat from lead is on, petroleum companies fight rearguard actions

by Edward Gross

For years, leaded gasoline has been locked in battle with its critics who have demanded its elimination or at least reduction. Until this year, it has managed to hold the line. But in February the big breakthrough came when the major auto manufacturers announced that in 1971 they would be producing lower compression engines that would run on unleaded gasoline. After that the rout was on. Since then, Atlantic Richfield, Shell and Texaco have all announced they will make lead-free gasoline, and there is little doubt that lead additives will be eliminated from gasoline entirely. It is only a matter of time.

Although the retreat is on, there are still some rearguard actions being fought by petroleum companies and their allies in the lead and chemical industries. The main reason for eliminating leaded gasoline is to make possible the catalytic muffler (SN: 2/14, p. 167), a device which permits noxious auto emissions to be converted to nitrogen, carbon dioxide and water. Lead prevents this by poisoning the catalyst and thus shortening its life.

The official line of the American Petroleum Institute is that a systems approach must be taken, that it is not enough to look at just one aspect of the problem and decide on a specific cure for it. The problem, all the cures, the benefits, risks and costs must all be considered. From that standpoint, they say it is unwise to base a decision on the catalytic muffler alone, especially since it has not actually proved itself but is rather an expectation.

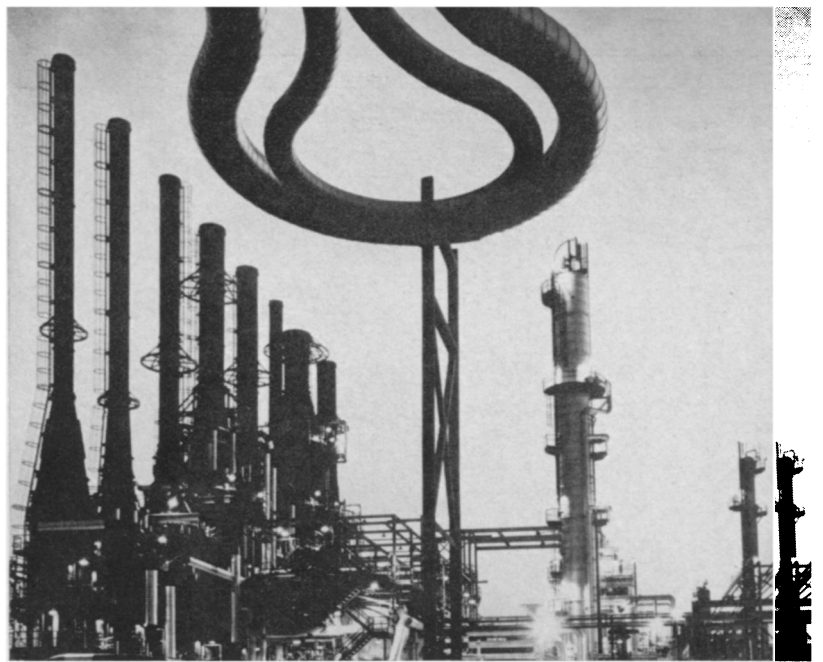
This is not universally accepted. A number of companies have developed mufflers that they feel are ready now. "We can go to catalytic mufflers tomorrow morning," says Charles E. Brooks, president of the Davison Divi-

sion of W. R. Grace Co.

Pro-lead forces contend that there are other devices that work just as well and do not require unleaded gasoline for their success. These come under the heading of thermal reactors, or more commonly, afterburners. Du Pont's thermal exhaust manifold reactor, which uses engine heat to burn up exhaust emissions, is one. Another is Ethyl Corp's lean reactor system which employs very lean fuel-air mixtures provided by a high velocity carburetor, modified ignition timing and exhaust recycling along with the lean exhaust reactor. Ford has a thermal reactor, and Universal Oil Products Co has a catalytic muffler that it says works on leaded fuels.

But the claim that these and others like them work is only partially true. They work up to a point. The trouble with all of them is that they do not last long enough under actual driving conditions. "We have not seen anything that will last the necessary 50,000 miles," says Charles Heinen, chief engineer of emissions control and chemical development at Chrysler. "All potential devices for 1975 have questions on them."

As far as the thermal reactors and the catalytic mufflers are concerned, Brooks will go so far to admit that they could be brought along. "Either system could work provided you had enough tooling in the country to do it," he says. And that is where the important technological difference lies. Thermal reactors are bulkier and so cannot fit easily under the hood; the muffler can go practically anywhere. This means that substantial engine redesign, along with special alloys because of the reactor's excessive heat, must be introduced if an alternative to the lead-susceptible muffler is selected.



Amoco

Amoco's refinery: Industry's answer raises questions.



Herman

Hurn: Trading knowns for unknowns.

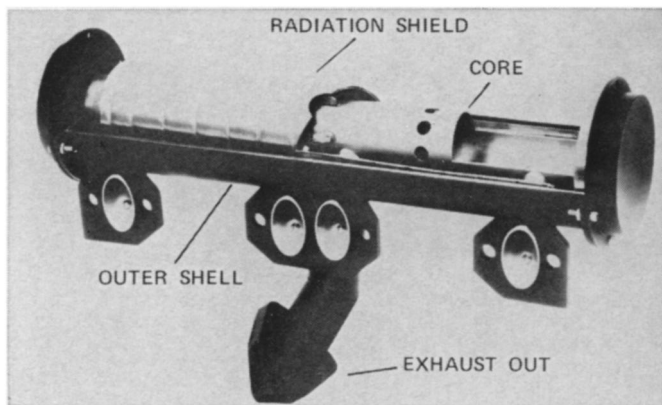
But there is another aspect to the problem. The removal of lead, its advocates maintain, would only trade knowns for unknowns. The effects of leaded gasoline and lead itself in the atmosphere have been studied for a long time and they are not as horrible to them as is the thought of unleashing a whole new set of compounds into the air.

These compounds would develop because the lower compression engines will be designed to work on fuel with a 91 octane rating.

Present regular-rate fuels tend to cluster around 94; if lead were not used, the octane rating would drop to about 85. To bring it up to 91 would require a different gasoline formulation.

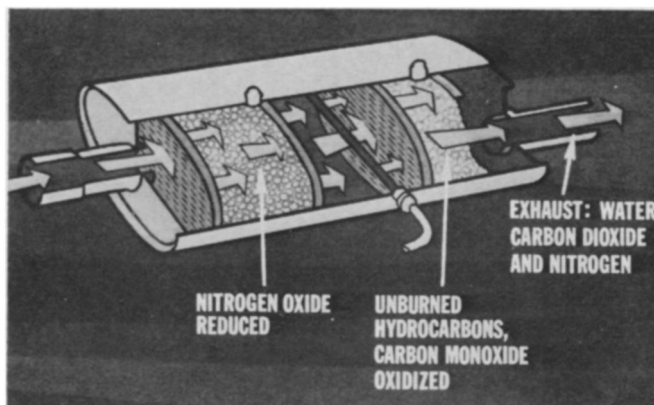
Specifically, more aromatic compounds, those based on the six-carbon benzene ring, would have to be added. The postulated result would be an increase in photochemical smog, more eye-irritating aldehydes and a greater

. . . lead



DuPont

Thermal reactor: Burning exhaust with engine heat.



Amoco

The catalytic muffler: So far, just an expectation.

health hazard because of the carcinogenicity of the aromatics.

In November, a report by the U.S. Bureau of Mines Petroleum Research Laboratory in Bartlesville, Okla., stated that photochemical air pollution "was increased by as much as 25 percent" with the unleaded gasoline, although emission amounts for both leaded and unleaded gasoline were the same. Testifying at hearings in March in California, Richard W. Hurn, project director of fuels research at Bartlesville, said that the photochemical effect could increase up to 38 percent if tailpipe emissions alone were considered.

Not everyone is prepared to accept these findings, however, the main objection being that the tests are done under laboratory conditions, which are not the same as those in the atmosphere.

"Some tests have suggested that aromatics may undergo a photochemical reaction in the atmosphere set off by sunlight," notes J. B. Duckworth, coordinator of products for American Oil Co.'s research and development department. "This reaction may convert aromatic emissions into aerosols which could conceivably have some effect on the atmosphere. But the evidence is far from conclusive."

Duckworth adds that with the catalytic muffler, the aromatic effects would be a temporary problem. As more and more newer cars having them supplant the older cars on the road, the problem will diminish. Because of these older cars, leaded gasoline would be gradually phased out rather than knocked out all at once.

There are indications that this process is already under way. The California Air Resources Board has recommended that no more than 0.5 gram of lead per gallon of gasoline be permitted in regular gasoline in the state after Jan. 1 and that no lead be allowed by January 1977. The Department of Health, Education and Welfare has a similar proposal, with the

0.5 gram to go into effect July 1, 1971, and all lead to go out of regular grade gasoline by July 1, 1974.

One of the consequences of such a move would be a reversal of the trend to higher compression and more efficient engines. "Low compression engines would be a step backward," says Daniel A. Hirschler, director of automotive research for Ethyl Corp. research laboratories. "Public acceptance is important" in determining if lead will be phased out, he says.

Two other things the public will have to accept are a greater strain on petroleum resources and higher gasoline prices. The reason for the increased petroleum consumption is that lead permits lower quality hydrocarbons to be burned without interfering with engine performance. With lead out of the picture, gasoline will have to contain more of the higher quality aromatics. To obtain more of this cream of the crop, refineries will have to process more crude oil.

In addition, they will have to revamp their processes, a move Ethyl Corp. estimates will cost the petroleum industry \$6 billion. Other estimates run to \$4 billion. But whatever the cost, it will be the motoring public who pays. American Oil Co., for example, estimates that its unleaded regular gasoline which it began marketing in June, will generally cost about three cents more per gallon.

Such costs are expected to be compensated for, however, by lower maintenance bills. Spark plugs, engine life, mufflers, tail pipes and general engine cleanliness are all expected to benefit from burning unleaded gasoline.

But this is not a one-way street. Hirschler sees an increase in particulate matter (carbon particles) from burning aromatics—as well as valve troubles. When exhaust valves run hot there is a welding action between the valve and its seating surface. Material is pulled off one on the other, and the valve burrows into the cylinder head,



Amoco

Duckworth: A temporary problem.

where it stays open. The result is that gasoline is pushed out of the engine before it burns, hence there is an increase in unburned hydrocarbons, losses in performance and fuel economy and the specter of a large repair bill.

"It is known that the welding action is prevented by leaded gasoline," says Hirschler. "How many cars would and would not be affected is hard to say, but some will."

Despite such arguments, the handwriting is on the wall. The defection to unleaded gasoline has even picked up support in the petroleum industry. In fact, most companies accept it as the wave of the future. Humble Oil's president Charles F. Jones was quoted in the June 8 CHEMICAL & ENGINEERING NEWS as saying, "We believe that in the long term a catalytic muffler and unleaded gasoline will emerge as the optimum system."

There are still some diehards, though. Union Oil's president Fred Hartley told a recent meeting of the National Petroleum Refiners Association that his company would stick by its guns until required by law to change its gasoline. However, he says, Union will be offering a 0.5 gram-per-gallon product. □