

AIR RESOURCES BOARD

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SACRAMENTO, CA 95812



February 10, 1978

Mr. Eric O. Stork
Deputy Assistant Administrator
for Mobile Source Air Pollution
Control
U. S. Environmental Protection Agency
401 M Street SW
Washington, D.C. 20460

Dear Mr. Stork: *Eric*

As agencies responsible for the control of motor vehicle emissions, the Air Resources Board and the Environmental Protection Agency have endeavored to use test procedures which provide assurance that the emission reductions required by regulation will be realized in actual customer service. A recent study by the ARB staff indicates, however, that a few systems are now in use which, by their design, will not provide the level of emission control during high speed driving that would be expected based upon certification test results. More importantly, our recent communication with auto manufacturers has uncovered the fact that new systems are under development which may cause 1980 and subsequent model year vehicles to emit more NOx than current models despite the fact that the NOx emission standards will be lower.

Since the inception of the vehicle exhaust emission control program there have been two major adjustments made in the interest of improving the correlation between the level of emission control required by regulation and the level of control actually achieved in customer service. The first major change involved the replacement of the simplistic "7-mode" driving cycle and associated test procedures with the "LA4" driving cycle and cold start, CVS test procedures. The second major change was in the disallowance of "defeat devices" which was accomplished through Advisory Circular 24 (AC 24). The current EPA approach to identifying "defeat devices" has been effective in eliminating the use of systems which essentially deactivate emission controls during driving conditions which can be expected in metropolitan areas. For example, our analysis indicates that the level of NOx emission control required by the current standards is reflected in the "Highway Cycle" emissions of late model

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vehicles. As pointed out in the enclosed staff report, however, a few systems have recently been certified which cause NOx emissions during highway driving to be substantially greater than would be expected based upon the certification test results. The 1978 California model Chrysler vehicles using "Electronic Spark Advance" (ESA) controls exhibit NOx emissions on the EPA Highway Cycle which are approximately 2.2 times greater than LA4 cycle NOx levels. The ratio of Highway Cycle NOx to LA4 cycle NOx for pre-controlled passenger cars and the average 1978 California model car is approximately 1.15. Over 95% of the 1978 California models had Highway Cycle NOx emissions of less than 1.33 times the NOx standard applicable to the LA4 cycle.

A detailed evaluation of Chrysler's ESA system indicates that it is programmed to increase spark advance for improved fuel economy whenever the vehicle is driven at a prolonged cruise. This type of system operation is not considered inappropriate under the "defeat device" identification policy expressed in AC 24. Our understanding of the intent of AC 24, however, is that it is to prevent the use of systems which substantially reduce the effectiveness of emission control systems under typical vehicle operating modes which can be expected to occur in Air Quality Control Regions with automotive related air quality problems. AC 24 has worked effectively over the last few years to prevent the use of the devices which several auto manufacturers introduced on the 1972-73 models (e.g. temperature sensors which deactivate emission controls outside of the 68-86°F range of the official test procedure and sensors which deactivate emission controls when accessories, such as air conditioning which is not used during the official emissions test, are turned on), however, with the advent of more sophisticated systems such as Chrysler's ESA it is becoming apparent that AC 24 is inadequate. AC 24 basically requires that for any system to avoid classification as a "defeat device" it must be activated during the official certification test. Generally, systems cannot be used which are only activated during driving conditions which do not occur during the LA4 cycle. While conceptually this approach will be effective, systems such as the Chrysler ESA can meet the "letter" but not the "spirit" of AC 24. A system can be deemed acceptable under AC 24 even though its operation has an insignificant effect on LA4 cycle emissions but a major effect on Highway Cycle emissions.

To supplement AC 24, the ARB staff recently proposed that a ceiling be placed upon NOx emission levels during the EPA Highway Cycle "fuel economy test". During discussions of the proposal with automobile manufacturers, it has become apparent that limitations on Highway Cycle NOx emissions will prevent the introduction of a new wave of "defeat devices" which are now being developed to minimize Highway Cycle NOx control while conforming with the language of AC 24. Ford Motor Company seems to be furthest along in the development of such systems.

Ford has designed a Lean Combustion Control System (LCCS) for use on 3-way catalyst cars which is planned for 1979 model year introduction. Prior to our discussions with Ford regarding ARB's proposal to control Highway Cycle NOx emissions, our staff and the staff of your Emission Control Technology Division was unaware of the development of LCCS. The LCC system changes a 3-way catalyst system into a "lean burn" system during high speed, quasi-steady state operating conditions, causing not only an increase in NOx emissions from the engine but a total loss of the catalyst's ability to reduce NOx emissions at the tailpipe. Data on "conventional" 3-way catalyst systems such as that used on many 1977-78 Volvos indicates that the ratio of Highway Cycle NOx to LA4 cycle NOx should be about .5, a significantly lower ratio than typical of most current and pre-controlled vehicles. Data on the Ford LCC system indicates that it will cause Highway Cycle NOx levels to be nearly 3 times those measured on the LA4 cycle. A vehicle certified to 1.0 gpm NOx using such a system would emit more NOx emissions than the typical 1978 model certified at 1.5 gpm assuming a 50/50 split between LA4 and Highway Cycle-type operations within an air shed.

Ford has been counting on the use of LCCS as one of the least expensive options available to them for increasing composite fuel economy ratings by about 0.5 mpg. Other manufacturers may be less far along in the development of such systems since they did not oppose the concept of controlling Highway Cycle emissions as strongly as did Ford. In testimony before our Board at its public hearing of January 25, 1978, other manufacturers recognized the need for a new but uniform approach to controlling highway cycle emissions. Our Board adopted a new Highway Cycle NOx emission standard which requires that 1980 and subsequent model year vehicles emit Highway Cycle NOx at no greater than 1.33 times the applicable LA4 cycle standard.

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In order to prevent the use of a new generation of "defeat devices" in the 49 states, we suggest that EPA consider an immediate modification to AC 24 to include consideration of Highway Cycle NOx emissions in determining the acceptability of emission control systems. We are convinced this approach will be considerably more efficient than a modified definition which exclusively relates to the operation of emission control systems on the LA4 cycle. The control of Highway Cycle Nox will by no means ensure that in-use vehicle emissions during all conceivable operating conditions will reflect the level of LA4 cycle control; however, we believe it is a necessary step to take at this time while we continue to consider other means of improving emission control in customer service. I believe you have the authority to incorporate a Highway Cycle emission ceiling into AC 24 thereby avoiding regulatory action. The delay associated with new regulations may result in a significant loss in highway cycle emission control during the next few years.

I hope you will find the information contained in the enclosed ARB Staff Report to be useful. I have sent a detailed description of the Ford LCC system to Dr. Hellman of your staff for his review. If we can be of any assistance during your evaluation of this matter, please let me know.

Sincerely,



Thomas C. Austin
Deputy Executive Officer

Enclosure

cc: Mr. Hawkins
Mr. DeKany
Dr. Hellman

State of California
AIR RESOURCES BOARD

Notice of Public Hearing to Consider
Proposed Highway Cycle Emission Standard

NOTICE IS HEREBY GIVEN that the Air Resources Board, pursuant to the authority vested by Section 39601 of the Health and Safety Code, and to implement, interpret and make specific Sections 43100, 43101, and 43104 of the Health and Safety Code, will conduct a public hearing, at the time and place specified below, to consider changes to its regulations in Title 13, California Administrative Code.

The time and place for the public hearing on this matter are as follows:

DATE: January 25, 1978

TIME: 10:00 a.m.

PLACE: Ambassador Hotel
Embassy Room
3400 Wilshire Blvd.
Los Angeles, California

The increasing use of electronics by vehicle manufacturers to optimize their vehicles for emissions control fuel economy, and performance has the potential to result in emissions control systems which have good emissions performance during the official certification emissions test, but provide substantially less control during other types of driving. Although the Federal Test Procedure (FTP) is an accurate and representative driving cycle for the purposes of determining compliance with established standards, there are other driving cycles which are also representative of different types of driving commonly found in California, and, in particular in the major metropolitan areas of the state. An example of another representative driving cycle is the Federal Highway Fuel Economy Test (HWFET), which represents frequently encountered freeway driving patterns in California.

The Board is proposing to adopt an exhaust emission standard for 1980 and subsequent model passenger cars, light-duty trucks and medium-duty vehicles, based on these vehicles' performance on the HWFET. The purpose of this standard is to prevent vehicle manufacturers from designing emission control system calibrations which have substantially different emissions characteristics during typical customer use than during the FTP. The Board will consider requiring that HWFET emissions be no higher than the performance of the same vehicle on the certification FTP. The Board may also consider less stringent standards for highway cycle emissions.

Copies of the proposed amendments to Title 13, and to the Board's certification test procedures, together with the staff report for this item, will be available for inspection at or may be obtained from the Board's Haagen-Smit Laboratory, 9528 Telstar Avenue, El Monte, CA 91731 (Attention: Mr. G. C. Hass), at least 30 days before the scheduled hearing date.

NOTICE IS ALSO GIVEN that all interested persons may present comments, statements or arguments, orally or in writing, relating to this matter at the time of the public hearing. The Board requests that interested persons who have written statements to submit on this matter, submit 10 copies of the same at least seven days prior to the scheduled hearing date in order to provide adequate time for staff analysis and comment, and to allow early review by the Board. Interested persons are further advised that the Chairman may require oral testimony to be limited in scope or duration, as may be reasonable under the circumstances. All persons will be allowed at least five minutes for presentation of oral testimony. Following the hearing, the Board, upon its own motion, or at the instance of any interested person, may adopt the proposed amendments as set forth without further notice.

The Air Resources Board has determined that this action creates no additional cost to local government pursuant to Section 2231 of the Revenue and Taxation Code.

CALIFORNIA AIR RESOURCES BOARD

original signed by

Thomas C. Austin
Deputy Executive Officer

December 21, 1977