1999

Identification of Polluting Vehicles by Remote Sensing

Donald H. Stedman

Ground Transportation for the 21st Century

By
Frank Kreith
Dena Sue Potestio
Chad Kimbell
Center for Technical Information

ASME PRESS

The American Society of Mechanical Engineers

Three Park Avenue
New York, New York
10016

NATIONAL CONFERENCE *of* STATE LEGISLATURES
The Forum for America's Ideas

William T. Pound, Executive Director

1560 Broadway, Suite 700
Denver, Colorado 80202
(303) 830-2200

444 North Capitol Street, N.W., Suite 515
Washington, D.C. 20001
(202) 624-5400

August 1999

Appendix D. Identification of Polluting Vehicles by Remote Sensing

Air pollution violations have been decreasing nationwide (U.S. Environmental Protection Agency [EPA] statistics) and measured average on-road motor vehicle emissions have been getting smaller year by year. (Bradley, Stedman and Bishop, Chemtech, July 1999). This arises because the newest vehicles are built with low emissions and remain in that condition for a considerable length of time (Report by AIAM, 1997 among other sources discussed on the EPA web page under M6.EXH.008).

Adding zeros to an already skewed distribution makes it even more skewed, thus the average becomes a less relevant number and the total is dominated by an ever-smaller fraction of gross polluters. Many of these vehicles find various ways to cheat upon or avoid state and local inspection and maintenance (I/M) requirements (Stedman, Bishop, Slott and Aldrete, Env. Sci Tech. 1997 and Stedman, Bishop and Slott ibid. 1998)

Apparently, the U.S. EPA recognizes these facts and is formulating the new version of the MOBILE model so that emissions reduction credits from traditional I/M programs will be reduced by about a

---

This appendix was prepared by Dr. Donald Stedman, professor of chemistry at the University of Denver and foremost expert on identifying polluting vehicles by remote sensing.

factor of two (Ward's Automotive Report, May, 1999). An extensive program measured more than 18,000 on-road vehicle emissions in Chicago in a single week in 1997 and 1998 (Popp et al., presented to CRC San Diego, April 1999). The measurements include on-road emissions in mass of emissions per mass/volume of fuel burned for carbon monoxide, nitrogen oxide and hydrocarbons.

The average emissions for CO, HC and NO were 160, 12, and 16 gm/gallon, respectively. The average emissions of these pollutants for cars less than two years old were 3, 4 and 3, while the highest-emitting 10 percent in each group emitted 860, 50 and 15 gm/gallon for the same three gases.

For CO, which has been shown to be very good indicator of a broken vehicle, (Gorse et al., SAE, Fuels and Lubricants Conference, October 1993) only 10 percent of the vehicles produce 61 percent of the emissions. Similar data are found in IM240 analysis. In Colorado, IM240 failing vehicles average 80 gm/mile of CO, while passing vehicles average about 12 gm/mile. In the first few years after purchase, new cars averaged only 4 gm/mi.

All these statistics point to the fact that programs that treat all vehicles as equal (fuel changes, I/M programs, etc.) are unlikely to be cost-effective. An agency that can devise a program that succeeds in motivating continuous maintenance of well-tuned vehicles (and immediate repair of broken ones) so that they do not fail in use has the potential for significant further air quality improvements. Tighter new car standards also are shown by this logic to be of little value because new car emissions are already so low as to be irrelevant to air quality.

According to Lacey et al., (*ITS World*, September 1997) a single, unmanned remote sensor can carry out more than 3,000,000 emissions readings per year. In Colorado, 77 IM240 lanes with 310 employees make 772,835 emission tests per year (CDPHE, *Air Quality Control Commission report to the State Legislature*, 1998). The cost of the remote sensing sign, complete with remote sensor, is about $300,000. A single remote sensor with a van with necessary options sells for about $180,000. A complicating element is the fact that the company that manufactures and sells most of the sensors under exclusive license from the University of Denver is ESP (which recently purchased Envirotest). ESP is reported to make most of its income on scheduled off-road emissions testing programs in competition with remote sensing. How that conflict of interest situation emerged is discussed in the 1996 university lecture available on the web at www.du.edu under academics, departments, chemistry, don Stedman.

According to Klein and Koskenoja, *CATO Institute Policy Analysis No. 249*, Feb. 7, 1996: "A detailed examination of how a remote sensing program could be implemented in Los Angeles indicates that remote sensing would prove far more effective and about five times less costly than the current ... program." "Pseudoscientific evaluations are one of the most powerful tools used to sell I/M programs to the general public" writes Paul Coninx in a 1998 Fraser Institute (www.fraserinstitute.ca) *Critical Issues Bulletin* on the subject of vehicle emissions testing.

Lawson, et al., in *Program for the use of Remote Sensing Devices to Detect High Emitting Vehicles* (April 1996 report to South Coast Air Quality Management District) state that if roadside remote sensing had been able to pull over every passing high-emitting vehicle (HEV) for repairs, the identification costs would have been $9 per HEV. This should be contrasted with typical IM240 programs with approximately a 5 percent failure rate and a $20 cost per test, which result in a $400 cost for each HEV identified.

On-road remote sensing of gross polluters is being used routinely in Texas to supplement the Dallas/Fort Worth and Houston emission testing programs, and similarly in Phoenix, Arizona, although with some difficulties. It also is being used in Taiwan to replace an unsuccessful I/M program. The Missouri program recently has initiated a contract for a "clean-screen," in which on-road remote sensing is used to identify and allow low-emitting cars to waive their routine emission testing. However, this approach is not a low-cost method of identification of high polluters.