LAW OFFICES OF

CHARLES STEVENS CRANDALL

Railroad Square
1880 Santa Barbara Street, 3rd Floor
San Luis Obispo, CA 93401

CHARLES STEVENS CRANDALL*
*ALSO ADMITTED IN NEW JERSEY

TELEPHONE: 805/544-4787
FACSIMILE: 805/543-1081
E-mail: cranlaw@aol.com

April 9, 2002

Sent Via Federal Express

U.S. Department of Transportation
Docket Management Facility
Room PL-401
400 Seventh Street, S.W.
Washington, D.C. 20590-0001

Re: Docket No. FMCSA-2001-11060; Certification of Safety Auditors, Safety Investigators, and Safety Inspectors, Interim Final Rule; Request for Comments, 67 Fed. Reg. 12,776 (March 19, 2002)

Re: Docket No. NHTSA-02-11592; Notice 1, Record Keeping and Record Retention, Notice of Proposed Rule Making (NPRM), 67 Fed. Reg. 12,800 (March 19, 2002)

Re: Docket No. NHTSA-02-11593; Notice 1, Importation of Commercial Motor Vehicles, Notice of Proposed Rule Making (NPRM), 67 Fed. Reg. 12,806 (March 19, 2002)

On behalf of Public Citizen, the Environmental Law Foundation ("ELF"), California Labor Federation ("Cal Labor Fed"), International Brotherhood of Teamsters ("Teamsters"), Brotherhood of Teamsters, Auto and Truck Drivers Local 70 ("Local 70"), California Trucking Association ("CTA") and the Natural Resources Defense Council ("NRDC"), we are submitting the following materials for inclusion in the record:

1. The Declaration of Dale Hattis, Ph.D., and Exhibit 1, submitted in connection with plaintiffs' case pending in the Northern District of California (Case No. C-02-2115-CW) (hereinafter "Hattis Declaration");

2. The Declaration of James Michael Lyons, Ph.D., and Exhibit 1, submitted in connection with plaintiffs' case pending in the Northern District of California (Case No. C-02-2115-CW) (hereinafter "Lyons Declaration");

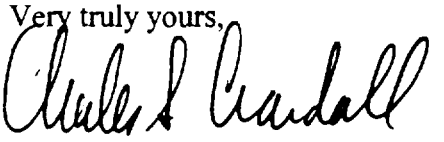
3. Sierra Research, Inc., Report No. SR02-04-01, dated April 16, 2002, and entitled Critical Review of "Safety Oversight for Mexico-Domiciled Commericial Motor Carriers, Final Programmatic Environmental Assessment," Prepared by John A. Volpe Transportation Systems Center, January 2002 (hereinafter "Sierra Research Report");

4. GAO Report 02-238, dated December 2001 and entitled North American Free Trade Agreement, Coordinated Operational Plan to Ensure Mexican Trucks' Compliance With U.S. Standards (hereinafter "GAO Report"); and,

5. Consent Decree in *United States of America v. Caterpillar, Inc.*, Civil Action 98–02544 and supporting appendices, filed July 1, 1999 (hereinafter "Diesel Consent Decree")

We will be submitting our comments on Monday, May 20, 2002, and will be referring to these materials at that time. Because of their volume we are submitting these materials ahead of time.

Very truly yours,



CHARLES S. CRANDALL

cc: Plaintiffs' counsel in Case No. C-02-2115-CW

MILBERG WEISS BERSHAD
HYNES & LERACH LLP
PATRICK J. COUGHLIN (111070)
RANDI D. BANDMAN (145212)
STANLEY S. MALLISON (184191)
100 Pine Street, Suite 2600
San Francisco, CA 94111
Telephone: 415/288-4545
415/288-4534 (fax)
- and -
WILLIAM S. LERACH (68581)
PATRICK W. DANIELS (190715)
401 B Street, Suite 1700
San Diego, CA 92101
Telephone: 619/231-1058
619/231-7423 (fax)
- and -
ALBERT H. MEYERHOFF (54134)
355 South Grand Avenue, Suite 4170
Los Angeles, CA 90071
Telephone: 213/617-9007
213/617-9185 (fax)

Attorneys for Plaintiffs Public Citizen, International Brotherhood of Teamsters, California Labor Federation, Brotherhood of Teamsters, Auto and Truck Drivers, Local 70, California Trucking Association and Environmental Law Foundation

ALTSHULER, BERZON, NUSSBAUM, RUBIN & DEMAIN
STEPHEN P. BERZON (46540)
JONATHAN WEISSGLASS (185008)
177 Post Street, Suite 300
San Francisco, CA 94108
Telephone: 415/421-7151
415/362-8064 (fax)

Attorneys for Plaintiffs International Brotherhood of Teamsters, California Labor Federation and Environmental Law Foundation

[Additional counsel appear on signature page.]

UNITED STATES DISTRICT COURT

NORTHERN DISTRICT OF CALIFORNIA

PUBLIC CITIZEN, et al., Plaintiffs, vs. DEPARTMENT OF TRANSPORTATION, et al., Defendants.	No. C-02-2115-CW DECLARATION OF DALE HATTIS, Ph.D, IN SUPPORT OF PLAINTIFFS' MOTION FOR A TEMPORARY RESTRAINING ORDER AND PRELIMINARY INJUNCTION DATE: To Be Determined TIME: To Be Determined COURTROOM: The Honorable Claudia Wilken

I, Dale Hattis, declare as follows:

1. I am a professional environmental scientist who has special expertise in the methodology for conducting quantitative health risk assessments for cancer and non-cancer health effects. I have been involved, either as a preparer or peer-reviewer, in numerous studies to determine the aggregate human health impacts of a wide variety of substances, and the risks and benefits of altering exposures to those substances. These have included studies to determine the effects of heavy-duty diesel engine emissions. I have been retained by plaintiffs' counsel as an expert witness and make this declaration in support of Plaintiffs' Motion for a Temporary Restraining Order and Preliminary Injunction.

2. In summary, it is my opinion that the increased emissions from Mexico-domiciled trucks (especially the fine particulate matter in these emissions) that are expected to result from the implementation of the federal regulations at issue in this lawsuit present a significant public health risk that should be fully evaluated in an Environmental Impact Statement before this federal action takes effect. Careful epidemiological comparisons of death rates among cities with different levels of fine particles in their air indicate that moderate (10 $\mu g/m^3$) differences in fine particle air pollution are associated with approximately a 4% difference in overall mortality – with a concentration in cardiovascular causes of death [Pope, C. A. 3rd, Burnett, R. T., Thun, M. J., Calle, E. E., Krewski, D., Ito, K., and Thurston, G. D. 2002 "Lung cancer, cardiopulmonary mortality, and long-term exposure to fine particulate air pollution," Journal of the American Medical Association March 6, 287(9):1132-1141]. Overall, these results indicate that fine particle air pollution is the single largest environmental public health problem at present in the United States. In aggregate it is expected that moderate decreases in these levels could prevent tens of thousands of premature deaths per year, predominantly from cardiovascular conditions. On the other hand, the increased emissions of fine particulate matter from Mexico-domiciled trucks can be expected to translate into incremental increases in premature deaths, an enhanced incidence of respiratory diseases, numerous lost work days and increased health care costs.

3. It is also my opinion that the federal government certainly has the wherewithal to perform a reasonable yet comprehensive health risk assessment as part of an EIS and that this should be accomplished so that the public and decisionmakers will know the full consequences of implementing the regulations that will allow more open access to Mexico-domiciled trucks.

A. **Professional Qualifications**

4. I received my Ph.D. in genetics from Stanford University in 1974 and my B.A. in biochemistry from the University of California at Berkeley in 1967.

5. For the past 12 years I have served on the faculty of Clark University as a Research Professor and Research Associate Professor with the Center for Technology, Environment and Development ("CENTED") of the George Perkins Marsh Institute in Worcester, Massachusetts. Prior to coming to Clark University, for sixteen years I was a Research Associate and Principal Research Associate at the Center for Technology, Policy and Industrial Development at Massachusetts Institute of Technology, Cambridge, Massachusetts. I have also been a Visiting Senior Lecturer at University of California at Irvine.

6. For the past twenty-seven years I have been engaged in the development and application of methodologies to assess the health, ecological, and economic impacts of regulatory actions. My work has focused on the development of methodology to incorporate data on variability in susceptibility among individuals into quantitative assessments for both cancer and non-cancer health risks.

7. I have conducted quantitative risk assessments for hearing disability in relation to noise exposure, renal effects of cadmium, reproductive effects of ethoxyethanol, neurological effects of methyl mercury and acrylamide, and chronic lung function impairment from coal dust, four pharmacokinetic-based risk assessments for carcinogens (for perchloroethylene, ethylene oxide, butadiene, and diesel particulates), an analysis of uncertainties in pharmacokinetic modeling for perchloroethylene and an analysis of differences among species in processes related to carcinogenesis.

8. I have been a Councilor and was recently named a Fellow of the Society for Risk Analysis, and I serve on the editorial board of its journal, "Risk Analysis."

9. I have had extensive prior involvement with diesel health risk issues. For example, in March 1998 I presented a report as an invited comment before the Scientific Advisory Panel that was reviewing an official OEHHA risk assessment for diesel particulates in preparation for advising the California Air Resources Board on the designation of diesel particulates as a toxic air contaminant.

10. I have peer reviewed the U. S. Environmental Protection Agency's Carcinogen Assessment Group (CAG) efforts to develop a diesel health risk assessment for diesel exhaust; I prepared a report for National Institute for Occupational Safety and Health (NIOSH) on the possible use of some short term

measurements to investigate rates of possible long term lung damage from diesel engines in underground mines; and I reviewed a risk assessment done by NIOSH based on animal tumor data and later published a paper related to a project for the U.S. Environmental Protection Agency to develop better methods to project human cancer risks from diesel particles from animal data.

11. I have served as a consultant to the U. S. Environmental Protection Agency's "Clean Air Scientific Advisory Committee" (which was then reviewing an EPA staff draft health assessment document for diesel particles), as a peer reviewer for the U. S. Occupational Safety and Health Administration (OSHA) of a plan by NIOSH for an epidemiological study of diesel-exposed workers in non-metal mines and again at OSHA's request as a peer reviewer of the risk assessment portion of a draft document by the U. S. Mine Safety and Health Administration (MSHA) relating to diesel-risk exposures of metal and non-metal miners. I also served at the request of the Health Effects Institute as a peer reviewer for a report by a panel of theirs on diesel epidemiology.

12. I have served as a litigation consultant on diesel-emissions cancer risks and also to assess the risks from radiation exposure and hexavalent chromium that resulted from discharges to the Columbia River from the various reactors and associated facilities in Hanford, Washington.

13. I currently serve on an EPA panel regarding risk assessment methodology. My complete resume, which is attached as Exhibit 1, lists 170 publications.

B. The Methodology for Assessing the Health Risks of Diesel Emissions from Mexico-Domiciled Trucks

14. I have been retained by plaintiffs' counsel to provide an analysis of the aggregate health risks to the population that are posed by the increased diesel emissions that are expected to be released from Mexico-domiciled truck engines that may shortly be allowed to operate throughout the United States as a result of ongoing federal rulemaking by the FMCSA.

15. By way of background, comprehensive research studies indicate that inhalation exposure to the fine particulate matter in the air such as that emitted by diesel engines may cause acute and chronic non-cancer respiratory effects, including mortality [C. A. Pope 3rd, D. V. Bates, and M. E. Raizenne, "Health Effects of Particulate Air Pollution: Time for Reassessment?" *Environmental Health Perspectives* 103, 472-480 (1995); J. Schwartz, "Air Pollution and Daily Mortality. A Review and Meta-Analysis,"

Environmental Research 64, 36-52; J. M. Samet, S. L. Zeger, F. Dominici, F. Curriero, I. Coursac, D. W. Dockery, J. Schwartz, and A. Zanobetti, "The National Morbidity, Mortality, and Air Pollution Study Part II: Morbidity and Mortality from Air Pollution in the United States," Health Effects Institute, November 2000]. Recently, a Harvard group has reported the results of using information on the chemical composition of fine particulates to separate the contributions of mobile sources, coal burning, and crustal weathering to the excess daily mortality associated with $PM_{2.5}$ exposures [F. Laden, L. M. Neas, D. W. Dockery, and J. Schwartz, "Association of Fine Particulate Matter from different Sources with Daily Mortality in Six U.S. Cities," *Environmental Health Perspectives* 108: 941-947 (2000)]. They find that a 10 $\mu g/m^3$ exposure to mobile source $PM_{2.5}$ is associated with a 3.4% increase in daily mortality (95% confidence interval 1.7-5.2%), in contrast to the smaller 1.1% response indicated for coal combustion $PM_{2.5}$ particles particulates (95% confidence interval 0.3% - 2.0%) and no detected response to $PM_{2.5}$ of crustal origin. There is thus limited information that indicates that airborne particles emitted by mobile sources (of which diesels account for a major fraction) are no less potent, and appear likely to be more potent in inducing short term changes in mortality than airborne particles originating from other sources of emission. There is also considerable scientific evidence indicating that diesel emissions increase lung cancer risk [Dawson, S. V., and Alexeef, G. V. (2001) "Multi-stage model estimates of lung cancer risk from exposure to diesel exhaust, based on a U. S. railroad worker cohort," *Risk Analysis* 21(1):1-18; Gerde, P., Muggenburg, B. A., Lundborg, M., and Dahl, A. R. "The rapid alveolar absorption of diesel soot-adsorbed benzo(a)pyrene: bioavailability, metabolism and dosimetry of an inhaled particle-borne carcinogen," *Carcinogenesis* 22:741-749; Larkin, E. K., Smith, T. J., Stayner, L., Rosner, B., Speizer, F. E., and Garshick, E. (2000) "Diesel exhaust exposure and lung cancer: Adjustment for the effect of smoking in a retrospective cohort study," *Am J. Ind. Med.* 38:399-409; Lipsett, M., and Campleman, S. (1999) "Occupational exposure to diesel exhaust and lung cancer: A meta-analysis," *Am J. Public Health* 89:991-993]. Indeed, diesel engine exhaust is listed under California's Proposition 65 as a chemical "known to the state to cause cancer." 22 C.C.R. §12000(b). Other conditions believed to be caused by diesel and other fine particles in the air include interactions with the processes mediating asthma and other respiratory symptoms [Nordenhall, C., Pourazar, J., Ledin, M. C., Levin, J. O., Sandstrom, T., and Adelroth, E. (2001) "Diesel exhaust enhances airway responsiveness in asthmatic subjects," 17(5):909-

915; Zemp, E., Elsasser, S., Schindler, C., Kunzli, N., Perruchoud, A.P., Domenighetti, G., Medici, T., Ackermann-Liebrich, U., Leuenberger, P., Monn, C., Bolognini, G., Bongard. J.P., Brandli, O., Karrer, W., Keller, R., Schoni, M.H., Tschopp, J.M., Villiger, B., Zellweger, J.P. (1999) "Long-term ambient air pollution and respiratory symptoms in adults (SAPALDIA study). The SAPALDIA Team," *Am. J. Respir. Crit. Care Med.* 159 (4 Pt 1):1257-1266], impairment of lung function [Schindler, C., Kunzli, N., Bongard, J. P., Leuenberger, P., Karrer, W., Rapp, R., Monn, C., and Ackermann-Liebrich, U. (2001) "Short-term variation in air pollution and in average lung function among never-smokers. The Swiss Study on Air Pollution and Lung Diseases in Adults (SAPALDIA)," *Am. J. Respir. Crit. Care Med.* 163(2):356-361], increases in the blood level of the clotting factor, fibrinogen, [Schwartz, J. (2001) "Air pollution and blood markers of cardiovascular risk," *Environmental Health Perspectives* 109(suppl 3):405-409], and decreases in the variability of heart rates [Creason, J., Neas, L., Walsh, D., Williams, R., Sheldon, L., Liao, D., and Shy, C. (2001) "Particulate matter and heart rate variability among elderly retirees: the Baltimore 1998 PM study," *J. Expo. Anal. Environ. Epidemiol.* 11(2):116-122; Pope, C. A. 3rd (2000) "What do epidemiologic findings tell us about health effects of environmental aerosols?" *J. Aerosol Med.* 13(4):335-54, Magari, S. R., Hauser, R., Schwartz, J., Williams P. L., Smith, T. J., and Christiani, D. C. (2001) "Association of heart rate variability with occupational and environmental exposure to particulate air pollution," *Circulation* 104(9):986-991]. The three last mentioned effects-lung function decrease, increase in serum fibrinogen, and decreased heart rate variability–tend to reinforce the conclusion that the connection between fine particle exposures and cardiovascular mortality is causal, because each of them has been shown in prospective epidemiological studies to be an independently predictive risk factor for general cardiovascular mortality [Knuiman, M. W., James, A. L., Divitini, M. L., Ryan, G., Bartholomew, H. C., and Musk, A. W. (1999) "Lung function, respiratory symptoms, and mortality: results from the Busselton Health Study," *Ann. Epidemiol.* 9(5):297-306; Folsom, A. R., Wu, K. K., Rosamond, W. D., Sharrett, A. R., and Chambless, L. E. (1997) "Prospective study of hemostatic factors and incidence of coronary heart disease: the Atherosclerosis Risk in Communities (ARIC) Study," *Circulation* 96(4):1102-1108; Kannel, W. B. (1997) "Influence of fibrinogen on cardiovascular disease," *Drugs* 54 Suppl 3:32-40; Kelleher, C. C. (1992) "Plasma fibrinogen and factor VII as risk factors for cardiovascular disease," *Eur. J. Epidemiol.* 8 Suppl 1:79-82; Tsuji, H., Venditti, F. J. Jr., Manders, E. S., Evans, J. C., Larson, M. G.,

Feldman, C. L., and Levy, D. (1994) "Reduced heart rate variability and mortality risk in an elderly cohort. The Framingham Heart Study," *Circulation* 90(2):878-883].

16. In attempting to roughly quantify the health effects of the proposed federal activity, I first needed to know the increases in emissions that can be expected from the increased presence of Mexico-domiciled trucks within the United States. I then translated these increased emission figures into increased exposures of the U.S. population to the fine particulate matter that is emitted as diesel exhaust. I then calculated the additional increment in health problems that can be expected as a result of such increased exposures.

17. With respect to the increases in emissions levels that can be expected to result from the new federal rulemaking, I have performed no independent calculations myself but am instead relying upon the Sierra Research Report prepared by Dr. Lyons covering expected changes in emissions for the San Diego and Houston areas only. If in future work, the Sierra researchers extend their emissions assessment nationally, it should be expected that the total expected change in emissions and associated health impacts will increase.

18. With respect to the human exposures that are likely to occur from these increased emissions, and the risk calculations assessing the variety of health problems that can be expected from these increase exposures, I am relying for the most part on modest adaptations of the results of a regulatory impact analysis concerning heavy duty diesel engines that was prepared and published in December 2000 by the U.S. Environmental Protection Agency ("EPA"), Office of Transportation and Air Quality, Assessment and Standards Division. EPA's analysis, which is entitled "Regulatory Impact Analysis: Heavy-Duty Engine and Vehicle Standards and Highway Diesel Fuel Sulfur Control Requirements" (EPA 420-R-00-026). This extensive report was designed to assess the societal impact of requiring certain modifications to heavy duty diesel engine emissions control technology and fuel standards starting in 2007.

19. In the cost/benefit analysis for its 2007 rulemaking, EPA estimates that requiring cleaner diesel engine technology and also requiring the use of low sulfur fuel will reduce the generation of fine particulate matter nationwide by approximately 109,000 tons per year by the time this new generation of diesel engines has completely replaced the old engine fleet (expected to be in the year 2030).

20. EPA also estimates that this reduction in particulate pollution will be associated with approximately 8,300 fewer premature deaths per year than would otherwise occur. In other words, removing particulate matter from the atmosphere will translate directly into saved lives. EPA makes similar calculations not only for reduced deaths but also for other health impacts such as acute bronchitis in children, chronic bronchitis in adults, hospital admissions for adults over 64 for pneumonia and chronic obstructive pulmonary disease, hospital admissions and emergency room visits for asthma, total asthma attacks, and work loss days and minor restricted activity days for adults age 18-65.

21. Using these same data, through simple multiplication and division I then calculated the changes in morbidity and mortality that could be expected per year per change in tons of particulate matter emitted each year. I then adjusted these rates to account for differences in the expected population of the United States between the present and 2030.

22. After calculating and adjusting these figures, I then converted the change in emissions data estimated in the Sierra Research Report for the San Diego and Houston areas only from tons per day (as in the Report) into tons per year (as per EPA's analysis), and then multiplied these figures by the expected changes in each category (e.g., deaths, bronchitis, pneumonia) per year per change in tons of diesel particles emitted.

C. The Health Risks Posed by Diesel Emissions From Mexico-Domiciled Trucks

23. My conclusions are that the increase in fine particulate matter estimated to result by the year 2007 in the Houston and San Diego areas alone from Mexico-domiciled trucks will translate directly into premature deaths, increased cases of disease, numerous lost work days and increased health care costs. More particularly, ***I would expect an annual impact of dozens of increased deaths, hundreds of additional asthma attacks, thousands of days of lost work, and tens of thousands of days of restricted activity in adults each year as a result of the increased emissions. There would also be several dozen increased cases per year of chronic bronchitis in adults and numerous additional hospital admissions due to pneumonia, cardiovascular problems, chronic obstructive pulmonary disease, and asthma.***

24. Aside from assuming the validity of the emissions changes in the Sierra Research Report, my preliminary numerical results also assume that:

(a) diesel fine particulate emissions have the same potency as PM 2.5. All are very small particles; diesel particulates are smaller than average and penetrate well into the deep lung. EPA made a similar assumption in its 2007 rulemaking analysis; moreover data from Laden et al. (2000), discussed in paragraph B2 above indicate that at least for the acute mortality effects, fine particles originating from mobile sources (including diesel particles) appear, if anything, more potent than fine particles originating from other types of sources (including crustal weathering and coal fired power plants);

(b) the dose/response relationships for the modest percentage changes in ambient fine particle exposures are well approximated by incremental linear relationships [This is reasonable because it is a well known mathematical result that even though a function may be highly nonlinear, it can be approximated by a straight line over a very limited range of the independent variable (air concentration in this case)];

(c) the transport and exposure patterns produced by emissions from the San Diego and Houston areas are similar to the national patterns of emissions and exposures modeled in EPA's 2007 rulemaking analysis [while this assumption clearly has some potential to introduce inaccuracies in the exposure assessment, because the prevailing winds are from the West to the East in the United States, much of the nation is likely to be down wind of San Diego and Houston most of the time. Therefore, with the long range transport expected for the fine particles emitted by diesel engines, the national ratio of inhalation to emissions from San Diego and Houston would not differ greatly from the typical national pattern used in EPA's 2007 analysis];

(d) the background levels of pollution in 2007 will be similar to those envisioned by EPA in its 2007 rulemaking analysis for the year 2030.

25. Therefore the estimates I have provided above, while a rough approximation, are nevertheless reasonable estimates of the overall health impacts that are likely to result from the increased emissions that are discussed in the Sierra Research Report.

I declare under penalty of perjury under the laws of the State of California that the foregoing is true and correct. Executed this 30th day of April, 2002, at Arlington, Virginia.

/s/ Dale Hattis, Ph.D.

Dale Hattis, Ph.D.

Exhibit 1

April 2002

CURRICULUM VITAE

Dale Hattis, Ph.D.

Research Professor
Center for Technology, Environment, and Development (CENTED)
Clark University, 950 Main Street, Worcester, Mass. 01610

(508) 751-4603; (781-641-0305); FAX (508) 751-4600
Email: DHattis@AOL.com; DHattis@clarku.edu;

Education

1974	Ph.D. -- Genetics Stanford University Stanford, California
1967	B.A. -- Biochemistry University of California Berkeley, California

Professional Experience

9/98-Present	Research Professor Center for Technology, Environment, and Development George Perkins Marsh Institute, Clark University Worcester, Massachusetts
1/90-5/98	Research Associate Professor Center for Technology, Environment, and Development George Perkins Marsh Institute, Clark University Worcester, Massachusetts
7/81-9/93	Principal Research Associate Center for Technology, Policy and Industrial Development* Massachusetts Institute of Technology Cambridge, Massachusetts
9/86-12/86	Visiting Senior Lecturer Program in Social Ecology University of California at Irvine Irvine, California

* Formerly named the Center for Policy Alternatives

4/75-7/81	Research Associate Center for Policy Alternatives Massachusetts Institute of Technology Cambridge, Massachusetts
1/75-4/75	Consultant Center for Policy Alternatives Massachusetts Institute of Technology Cambridge, Massachusetts
12/73-11/74	Senior Research Associate Complex Systems Institute Case Western Reserve University Cleveland, Ohio
6/70-9/70	Summer Intern, Food and Drug Administration Project Center for Study of Responsive Law Washington, D.C.

Summary of Experience and Training

Research: Methodology for quantitative health risk assessment for cancer and non-cancer health effects; Human interindividual variability in susceptibility to toxic effects; Pharmacokinetic and Monte Carlo simulation modeling; Implications of interindividual variability for population risk for both carcinogens and other toxic substances; Environmental/health, economic, and legal implications of alternative regulatory actions to control occupational exposure to noise, perchloroethylene, ethylene oxide, butadiene, glycol ethers, acrylamide, formaldehyde; setting priorities for control of toxic substances.

Consulting: Member, Environmental Health Committee, EPA Science Advisory Board. Member, Food Quality Protection Act Science Review Board. Review of the benefits analysis for the EPA standard for arsenic in drinking water. Past memberships: EPA peer review committee for PCB's, EPA peer review committee for Hazardous Air Pollutant emissions for electric generating plants; National Academy of Sciences/Institute of Medicine Committee on Evaluation of the Safety of Fishery Products; National Research Council Committee on Neurotoxicology and Risk Assessment; U. S. Food and Drug Administration (Office of Device Evaluation)--mercury dental amalgams and polyurethane breast implants. OSHA—cancer risk assessment policy and risks from occupational noise exposures in the construction industry; Natural Resources Defense Council and Occupational Safety and Health Administration, carcinogenesis by diesel exhaust; State of California (use of PBPK modeling and uncertainty analysis in risk assessment); International Life Sciences Institute--quantitative risk assessment for non-cancer effects; Risks of municipal water supply and wastewater treatment; Use of biomarkers

in assessing causation of radiation-induced cancers; Monte Carlo simulation analysis of uncertainties in carcinogenic risks from diesel particulates in air and from different substances in drinking water; Risks of occupational noise exposures, Dose response relationships for acute toxicity from chlorine or ammonia.

Other: Member, National Research Council Committee on Estimating the Health-Risk-Reduction Benefits of Proposed Air Pollution Regulations; Fellow, Society for Risk Analysis (awarded 12/00); Councilor, Society for Risk Analysis 12/97-12/00; Member, Editorial Board for Risk Analysis; Member, National Research Council Subcommittee on Methyl Bromide, Member, Massachusetts Department of Environmental Protection/Department of Public Health Advisory Committee on Health Effects. Past President, New England Chapter of the Society for Risk Analysis.

Teaching: Tools for Quantitative Policy Analysis (Clark University graduate course; MIT Summer Session); Quantitative Risk Assessment for Ecological Risks for Near-Shore Systems (in cooperation with the U.S. EPA's Narragansett RI Laboratory); Cancer, Science and Society (Clark University, undergraduate course).

Grants and Contracts Through Clark University

Connecticut Department of Public Health (subcontract from an original contract from EPA), Pharmacokinetic Parameters—Adult Child Comparisons and Interindividual Variability—15 months, 70K, beginning 4/99; extended 11/00-8/1/02 for an additional 175K.

U.S. Environmental Protection Agency, Interindividual Variability in Response to Particulates--3 year 190K project initiated by EPA personnel started 10/98 (Principal Investigator, with Rob Goble).

U.S. Environmental Protection Agency grant, "Human Variability in Parameters Potentially Related to Susceptibility for Noncancer Risks" 332K over 3 years, beginning 12/96.

State of California, Project on Electromagnetic Fields (Rob Goble, PI) 1 year effort beginning 12/97, 1.25 months of support.

State of Connecticut subcontract on work for the U.S. Environmental Protection Agency "Pharmacokinetic Modeling for Site-Acting Carcinogens" $52K, 11/15/96 - 11/14/97.

U.S. Environmental Protection Agency, via subcontract to Research Triangle Institute, "Considerations for Hazardous Waste Identification Rules--Development of Toxicity Values for Chemicals that Do Not Have Official RfD's " $10.8K, 12/96-9/97.

State of Connecticut subcontract on work for the U.S. Environmental Protection Agency "Pharmacokinetic Modeling for Site-Acting Carcinogens" $30K, 11/15/95 - 11/14/96

Ministry of Health, Canada, (Dale Hattis, Principal Investigator) "New Estimates Of Variability In Parameters Putatively Related To Individual Cancer Risk" $14K, 1/31 - 3/31/95

U.S. Environmental Protection Agency, Measures of Pollution Prevention (Sam Ratick, PI) 1994-95, 3 months of support.

Office of Technology Assessment (Rob Goble, PI) "Implementation of the Occupational Lead Standard the Secondary Lead Smelting Industry" 20K 7/1/94 - 9/30/94.

U. S. Environmental Protection Agency, "Principles of Ecological Risk Analysis and Management as Applied to Near-Coastal Waters" (two year project, with involvement by Halina Brown, Sam Ratick, Rob Goble, Andrea Lemerise, and Arshad Bahl) 2nd Year FY 1992 and 1993--$230K.

U. S. Environmental Protection Agency, "Interspecies Projection of Carcinogenic Risks per Unit of Active Dose Delivered to Target Sites" (with involvement by Rob Goble, Halina Brown, and Joanne Shatkin) 3 Years in FY 1991, 1992, 1993--$200K.

Health and Welfare Ministry, Government of Canada, "Pharmacokinetic Modeling of Lead in Primates--Parameters of Interest for Adapting Human Models and Representing the Effects of Pregnancy," (7 Month effort with involvement by Mary Ballew) $25K, FY 1991.

Publications

1. Ginsberg, G., Hattis, D., Sonawane, B., Russ, A., Banati, P., Kozlak, M., Smolenski, S., and Goble, R. "Evaluation of Child/Adult Pharmacokinetic Differences from a Database derived from the Therapeutic Drug Literature," Toxicological Sciences, Vol. 66, pp. 185-200, 2002.

2. Hattis, D., Ginsberg, G, Sonawane, B., Smolenski, S., Russ, A., Kozlak, M, and Goble, R. "Differences in Pharmacokinetics Between Children and Adults—II. Children's Variability in Drug Elimination Half-Lives and in Some Parameters Needed for Physiologically-Based Pharmacokinetic Modeling," Risk Analysis, in press.

3. Yu, R. C., Hattis, D., Landaw, E. M., and Froines, J. R. "Toxicokinetic Interaction of 2,5-Hexanedione and Methyl Ethyl Ketone," Arch. Toxicol. Vol. 75, pp. 643-652 (2002).

4. Hattis, D. "We Can Move Beyond the Rigidity of Single-Point 'Uncertainty' Factors," Risk Policy Report, pp. 31-33, September 18, 2001.

5. Zeise, L., Hattis, D., Andersen, M., John Bailer, A. J., Bayard, S., Chen, C., Clewell, H., Conolly, R., Crump, K., Dunson, D., Finkel, A., Haber, H., Jarabek, A. M., Kodell, R., Krewski, D., Thomas, D., Thorslund, T., and Wassell, J. T. "Research Opportunities in Dose Response Modeling to Improve Risk Assessment," Human and Ecological Risk Assessment, in press.

6. Hattis, D. "The LAX Master Plan and Draft EIR/EIS—Needs for Improvement to Assess Available Policy Choices," Prepared for the City of Inglewood, California, and Radcliff Frandsen & Dongell, LLP, May 7, 2001, available on the City of Inglewood, California web site www.cityofinglewood.org.

7. Hattis, D., Baird, S., and Goble, R. "A Straw Man Proposal for a Quantitative Definition of the RfD," in Final Technical Report, U.S. Environmental Protection Agency STAR grant # R825360, "Human Variability in Parameters Potentially Related to Susceptibility for Noncancer Risks," Paper presented 4/24/01 at the U.S. EPA/DoD symposium on Issues and Applications in Toxicology And Risk Assessment, Fairborn, Ohio. Full version available on the web at http://www2.clarku.edu/faculty/dhattis; shortened version Drug and Chemical Toxicology, in press.

8. Hattis, D., Russ, A., Goble, R., Banati, P., and Chu, M. "Human Interindividual Variability in Susceptibility to Airborne Particles," Risk Analysis, Vol. 21(4), pp. 585-599 (2001).

9. Hattis, D. "The Conception of Variability in Risk Analyses—Developments Since 1980," Presented at "Risk and Governance, An International Symposium," June 21-25, 2000, Airlee Conference Center, Warranton, Virginia, proceedings to be published in Risk Analysis and Society in the 21st Century: An Interdisciplinary Characterization of the Field McDaniels and Small (eds.) in press.

10. Hattis, D. and Swedis, S. "Uses Of Biomarkers For Genetic Susceptibility And Exposure In The Regulatory Context," Jurimetrics, Volume 41, No. 2, pp. 177-194, Winter 2001.

11. Hattis, D. "Draft Risk Analysis Ideals," Human and Ecological Risk Assessment, Vol. 6, pp. 913-919 (2000).

12. Hattis, D., Russ, A., Banati, P., Kozlak, M., Goble, R., and Ginsberg, G. "Development of a Comparative Child/Adult Pharmacokinetic Database Based Upon the Therapeutic Drug Literature," Report by Clark University and the Connecticut Department of Public Health to the U.S. Environmental Protection Agency under Cooperative Agreement #827195-0, October, 2000.

13. Evans, J. S., Thompson, K. M., and Hattis, D. "Exposure Efficiency: Concept and Application to Perchloroethylene Exposure from Dry Cleaners," JAWMA, 50(9):1700-1703, September, 2000.

14. Hattis, D., Banati, P., and Goble, R. "Distributions of Individual Susceptibility Among Humans for Toxic Effects--For What Fraction of Which Kinds of Chemicals and Effects Does the Traditional 10-Fold Factor

Provide How Much Protection?" Annals of the New York Academy of Sciences, Volume 895, pp. 286-316, December, 1999.

15. Hattis, D., Ryan, L., Schwarz, J., and Goble, R. "Technical Advisors' 2nd Year (1998-99) Report to the Community Assistance Panel, Massachusetts Military Reservation," Interim final Report to the Center for Disease Control and the Massachusetts Department of Public Health, October 13, 1999.

16. Anderson, E. L., Hattis, D., Kaplan, S., Kunreuther, H., and Lave, L. B. "Comprehensive Review of the Office of Risk Assessment and Cost-Benefit Analysis," Report to the United States Department of Agriculture by the Society for Risk Analysis, September, 1999.

17. Ginsberg, G. L., Chute, S. K., and Hattis, D. B. "Extrapolation of Gavage Bioassay Results to Other Dosing Methods: Case Studies with Four Carcinogens—Ethylene Dibromide, Chloroform, Vinyl Chloride, and Hydrazine," Report to the U.S. Environmental Protection Agency by the Connecticut Department of Public Health, Division of Environmental Epidemiology and Occupational Health under EPA Cooperative Assistance Agreement 824277-01-2, July, 1999.

18. Hattis, D., and Makri, A. "Expected Hearing Loss and Disability from Noise Exposures in Construction" Report to the Occupational Safety and Health Administration, May, 1999.

19. Hattis, D. Banati, P., Goble, R., and Burmaster, D. "Human Interindividual Variability in Parameters Related to Health Risks," Risk Analysis, Vol. 19, pp. 705-720, 1999.

20. Hattis, D., and Anderson, E. "What Should Be The Implications Of Uncertainty, Variability, And Inherent 'Biases'/'Conservatism' For Risk Management Decision Making?" Risk Analysis, Vol. 19, pp. 95-107 (1999).

21. Hattis, D. "Occupational Noise Sources and Exposures in Construction Industries" Human and Ecological Risk Assessment, Vol. 4, pp. 1417-1441, December 1998.

22. Hattis, D. "An Extended Probability-Tree Analysis of the Cancer Risk from Diesel Particulates" Report to the Natural Resources Defense Council, August, 1998.

23. Hattis, D. "What Can Mechanisms Tell us About Modeling Dose Time Response Relationships?" in Summary of the U. S. EPA Workshop on the Relationship Between Exposure Duration and Toxicity Office of Research and Development, U.S. Environmental Protection Agency, EPA/600/R-99/081, September 1998.

24. Hattis, D. "A Probability-Tree Interpretation of the California EPA's Analysis of the Cancer Risk from Diesel Particulates" Invited Comment submitted to the Science Advisory Panel of the California Air Resources Board, March 19, 1998.

25. Hattis, D. "Strategies For Assessing Human Variability In Susceptibility, And Using Variability To Infer Human Risks" In Human Variability in Response to Chemical Exposure: Measures, Modeling, and Risk Assessment, D. A. Neumann and C. A. Kimmel, eds., CRC Press, Boca Raton, FL, pp. 27-57, 1998.

26. Hattis, D. 1997. "Preliminary Analysis of OSHA Inspection Data for Noise Exposures in Construction." Report submitted to the Occupational Safety and Health Administration, 11/14/97.

27. Hattis, D., Banati, P., Sirovic, I., and Goble, R. "Preliminary Analysis of a Data Base of Human Interindividual Variability Observations--Implications for Generic Occupational Health Risk Assessments for Chronic Toxic Responses" Report to the Occupational Safety and Health Administration, May 27, 1997.

28. Hattis, D. "Variability in Susceptibility--How Big, How Often, For What Responses to What Agents?" Environmental Toxicology and Pharmacology, Vol. 4, pp. 195-208, 1997.

29. Hattis, D., and Minkowitz, B. "Risk Evaluation: Legal Requirements, Conceptual Foundations, And Practical Experiences In The United States," Originally presented at the International Workshop on Risk Evaluation, Schloss Haegerloch, Germany, June 20-21, 1994. Discussion paper No. 93, ISBN 3-932013-16-6, Center of Technology Assessment in Baden-Wuerttemberg, 1997.

30. Dickey, C., Santella, R. M., Hattis, D., Tang, D., Hsu, Y., Cooper, T., Young, T. L., and Perera, F. P. "Variability in PAH-DNA Adduct Measurements in Peripheral Mononuclear Cells: Implications for Quantitative Cancer Risk Assessment." Risk Analysis, Vol. 17, pp. 649-657, 1997.

31. Hattis, D. Invited Comment on Heitzman, M., and Wilson, R. "Low Dose Linearity: The Rule or the Exception." Belle Newsletter, 6:(1) pp. 21-24, March, 1997.

32. Hattis, D. "Variability in Susceptibility--How Big, How Often, For What Responses to What Agents?" Environmental Toxicology and Pharmacology, Vol. 2, pp. 135-145, 1996.

33. Hattis, D., and Minkowitz, W.S. "Risk Evaluation: Criteria Arising from Legal Traditions and Experience with Quantitative Risk Assessment in the United States." Environmental Toxicology and Pharmacology, Vol. 2, pp. 103-109, 1996.

34. Hattis, D. Review of "Cancer Wars: How Politics Shapes What We Know and Don't Know about Cancer, Robert N. Proctor American Scientist, Vol. 84, pp. 616-617, November-December, 1996.

35. Hattis, D. "Drawing the Line: Quantitative Criteria for Risk Management." Environment, Vol. 38(6), pp. 10-15, 35-39, July/Aug 1996.

36. Hattis D. "The Challenge Of Mechanism-Based Modeling In Risk Assessment For Neurobehavioral Endpoints." Environmental Health Perspectives, Vol. 104, Suppl. 2, pp. 318-390, April 1996.

37. Hattis, D., Glowa, J., Tilson, H., and Ulrich, B. "Risk Assessment for Neurobehavioral Toxicity: SGOMSEC Joint Report" Environmental Health Perspectives, Vol. 104, Suppl. 2, pp. 217-226, April 1996.

38. Hattis, D. and Barlow, K. "Human Interindividual Variability In Cancer Risks--Technical And Management Challenges" Human and Ecological Risk Assessment, Vol. 2, pp. 194-220, 1996.

39. Hattis, D., Review of "Biomarkers and Occupational Health--Progress and Perspectives, M. L. Mendelsohn, J. P. Peeters, M. J. Normandy, eds.," Science, Vol. 271, p. 770, Feb. 9, 1996.

40. Renwick, A. G., and Hattis, D. "Introduction to the Workshop on Variability in Toxic Response--Human and Environmental. Rapporteurs' Summary." Environmental Toxicology and Pharmacology, Vol. 2, pp. 79-84, (1996).

41. Ginsberg, G. L., Pepelko, W. E., Goble, R. L., and Hattis, D. B. "Comparison of Contact Site Cancer Potency Across Dose Routes: Case Study with Epichlorohydrin," Risk Analysis Vol. 16, pp. 667-681, 1996.

42. Hattis, D. "Human Interindividual Variability in Susceptibility to Toxic Effects--From Annoying Detail to a Central Determinant of Risk" Toxicology Vol. 111, pp. 5-14, 1996.

43. Hattis, D. "Radiation-Induced Cancers in DOE and Contractor Employees: Implications of Possible Alternative Workers' Compensation Settlement Policies and Assessment of the Possible Role of New Molecular Biological Techniques" Report commissioned by Ashford Associates, Cambridge MA under a contract with COMPA Industries, Inc. (Ref: DE-AC01-94EH89501) which in turn was under contract to the U.S. Department of Energy, October, 1995.

44. Hattis, D. "Suggested Distributional Assumptions for Human Physiologically-Based Modeling of Methylene Chloride," Report to the Occupational Safety and Health Administration, September, 1995.

45. Goble, R. and Hattis, D. "When the *Ceteris* Aren't *Paribus*---Contrasts between Prediction and Experience in the Implementation of the OSHA Lead Standard in the Secondary Lead Industry," Report to the Office of Technology Assessment, U.S. Congress, by the Center for Technology, Environment, and Development, Clark University, July, 1995.

46. Hattis, D. and Barlow, K. "New Estimates Of Variability In Parameters Putatively Related To Individual Cancer Risk" Report to the Ministry of Health, Government of Canada, by the Center for Technology, Environment, and Development, Clark University, March, 1995.

47. Hattis, D. and Crofton, K. "Use of Biological Markers of Causal Mechanisms in the Quantitative Assessment of Neurotoxic Risks" Chapter 53 in Handbook of Neurotoxicology, Vol. 3 Approaches and Methodologies Lewis Chang and William Slikker, eds., Academic Press, 1995, pp. 789-803, 1995.

48. Hattis, D. and Burmaster, D. E. "Assessment of Variability and Uncertainty Distributions for Practical Risk Analyses" Risk Analysis, Vol. 14, pp. 713-730, 1994.

49. Hattis, D., and Silver, K., "Human Interindividual Variability--a Major Source of Uncertainty in Assessing Risks for Non-Cancer Health Effects," Risk Analysis, Vol 14, pp. 421-431, 1994.

50. Hattis, D. "Saccharin Carcinogenesis--Two Approaches for Quantitative Risk Assessment Based on Observations in Two Different Kinds of Experimental Systems" Report to the California Department of Environmental Protection, June, 1994.

51. Hattis, D. "The Use of Well Defined Biomarkers (Such as Blood Lead) in Risk Assessment," Environmental Geochemistry and Health, Vol. 16, No. 3/4, pp. 223-228, December, 1994.

52. Hattis, D., Campbell, D., Dettman, E. H., Lemerise, A., Brown, W. A., and Ratick, S. J. "Expected Perturbations of Biota by Residual Chlorine and Nitrogen in Sewage Effluent Discharged into Greenwich Cove, Rhode Island--A Case Study of Quantitative Risk Assessment for Ecological Effects" Summary Report--USEPA/Clark University Cooperative Agreement No. 818679-01-3, CENTED, Clark University, May, 1994.

53. Ginsberg, G. L., Goble, R. L., and Hattis, D. B. "Slope Factor Comparison Across Dose Routes: Case Study with Epichlorohydrin," Report to the U.S. Environmental Protection Agency by TRC Environmental Corporation, April, 1994.

54. Hattis, D., and Goble, R. L. "Current Priority-Setting Methodology: Too Little Rationality or Too Much?" Chapter 7 in: Worst Things First? The Debate over Risk-Based National Environmental Priorities, A. M. Finkel and D. Golding, eds., Resources for the Future, Washington, D.C., 1994, pp. 107-131.

55. Hattis, D., White, P., and Koch, P. "Uncertainties in Pharmacokinetic Modeling for Perchloroethylene. II. Comparison of Model Predictions with Data for a Variety of Different Parameters" Risk Analysis, Vol 13, pp, 599-610, 1993.

56. Hattis, D. "The Importance of Exposure Measurements in Risk Assessment of Drugs" Archives of Toxicology, Supplement 16, pp. 201-210, 1994.

57. Rees, D. C., and Hattis, D. "Developing Quantitative Strategies for Animal to Human Extrapolation" Chapter 8 in Principles and Methods of Toxicology, 3rd Edition, A. W. Hayes, ed., Raven Press, New York, 1994, pp. 275- 315.

58. Hattis, D., and Silver, K. "Use of Mechanistic Data in Occupational Health Risk Assessment--The Example of Diesel Particulates," in Chemical Risk Assessment and Occupational Health--Current Applications, Limitations, and Future Prospects, C. Mark Smith, David C. Christiani, and Karl T. Kelsey, eds., Greenwood Publishing Group, Inc., Westport CT, 1994, pp. 167-177.

59. Hattis, D., Shatkin, J., and White, P. "Opportunities for Research into Interspecies Comparisons of Cancer Risks. Construction and Analysis of a Low Dose Potency Data Base for In Vitro Measurements of Metabolic Activation, Detoxification, and DNA Repair" Report to the U.S. Environmental Protection Agency by the Center for Technology, Environment, and Development, Clark University, November, 1994.

60. Hattis, D. "Going Beyond Uncertainty Factors--Opportunities for Quantitative Toxicology," In Beck, B. D., Conolly, R. B., Dourson, M L., Guth, D., Hattis, D., Kimmel, C., and Lewis, S. C. "Improvements in Quantitative Noncancer Risk Assessment--Symposium Overview," Fundamental and Applied Toxicology, Vol. 20, pp. 1-14 (1993).

61. Hattis, D., and Silver, K., "Use of Biological Markers in Risk Assessment," Chapter 10 in Molecular Epidemiology: Principles and Practices, P. Schulte and R. Perera, eds. Academic Press, pp. 251-273, 1993.

62. Hattis, D., "Using Indicator Information for Managing Risks," Chapter 14 in: Environmental Indicators and Shellfish Safety, C. R. Hackney and M. D. Pierson, eds., Chapman & Hall, New York, pp. 364-380, 1993.

63. Ahmed, F. E., Hattis, D., Wolke, R. E., and Steinman, D., "Human Health Risks Due to Consumption of Chemically Contaminated Fishery Products," Environ. Health Perspect., Vol. 101 (Suppl. 3), pp. 297-302, 1993.

64. Hattis, D. and Froines, J., "Uncertainties in Risk Assessment," In Conference on Chemical Risk Assessment in the DoD: Science, Policy, and Practice, Harvey J. Clewell, III, ed., American Conference of Governmental Industrial Hygienists, Inc., Cincinnati, Ohio, 1992, pp. 69-78.

65. Hattis, D., and Silver, K., "Projection of Human Lung Cancer Risks for Diesel Particulates from Animal Data--Effects of Using Measures of Internal vs. External Dose, and Possible Interactions with Smoking," report to the United Mineworkers by Ashford Associates, July, 1992.

66. Hattis, D., and Goble, R., "Expected Values for Projected Cancer Risks from Putative Genetically-Acting Agents," Risk Analysis, Vol. 11, pp. 359-363, 1991.

67. Ashford, N. A., Bregman, C., Hattis, D. B., Karmali, A., Schabacker, C., Schierow, L. J., and Whitbeck, C. Monitoring the Community for Exposure and Disease: Scientific, Legal, and Ethical Considerations, Report to the Agency for Toxic Substances and Disease Registry, Public Health Service, U.S. Department of Health and Human Services, M. I. T. Center for Technology, Policy, and Industrial Development, November, 1991.

68. Hattis, D., "Assessment and Management of Risks from Chemical Contaminants in Seafood--Opportunities for Improvement," In "Symposium on Issues in Seafood Safety," Farid E. Ahmed, Ed., Institute of Medicine, National Academy of Sciences, Washington, D.C., pp. 74-94, October, 1991

69. Silver, K., and Hattis, D., "Methodology for Quantitative Assessment of Risks from Chronic Respiratory Damage: Lung Function Decline and Associated Mortality from Coal Dust," M.I.T. Center for Technology, Policy, and Industrial Development, CTPID 90-9, May, 1991

70. Hattis, D., "Responsibilities of Scientists to Convey Uncertain Information of Potential Significance (And its Significant Uncertainties)," Presented at the annual meeting of the American Association for the Advancement of Science, February 18, 1991, Washington, D. C.

71. Ballew, M., and Hattis, D., "Pharmacokinetic Modeling of Lead in Primates--Parameters of Interest for Adapting Human Models and Representing the Effects of Pregnancy," Center for Technology, Environment, and Development, Clark University, March, 1991.

72. Hattis, D., "Use of Biological Markers and Pharmacokinetics in Human Health Risk Assessment," Environmental Health Perspectives, Vol. 89, pp. 230-238, 1991.

73. Goble, R. L., Hattis, D., and Socolow, R., "Uncertainties in Population Risk Estimates which Arise from Different Conditions of Exposure to Indoor Radon," Proceedings of the 29th Hanford Symposium on Health and the Environment, Indoor Radon and Lung Cancer: Reality or Myth October, 1990; 1992.

74. Silver, K., and Hattis, D. Human Interindividual Variability in Susceptibility to FEV_1 Decline from Smoking, M.I.T. Center for Technology, Policy, and Industrial Development, CTPID 90-8, October, 1990

75. Hattis, D., Modeling the Risk of Needlestick Transmission of HIV, M.I.T. Center for Technology, Policy, and Industrial Development, CTPID 90-7, June, 1990

76. Boswell, S. L., Finkelstein, S. N., and Hattis, D., Exposure of Health Care Workers to HIV-1--A Framework for Quantitative Analysis, M.I.T. Center for Technology, Policy, and Industrial Development, CTPID 90-4, May, 1990

77. Hattis, D. White, P., Marmorstein, L, and Koch, P., "Uncertainties in Pharmacokinetic Modeling for Perchloroethylene. I. Comparison of Model Structure, Parameters, and Predictions for Low-Dose Metabolism Rates for Models Derived by Different Authors," Risk Analysis, Vol. 10, pp. 449-457, 1990.

78. Hattis, D., Abdollahzadeh, S., and Franklin, C. A., "Strategies for Testing the 'Irritation-Signaling' Model for Chronic Lung Effects of Fine Acid Particles," JAPCA, Vol. 40, pp. 322-330, 1990.

79. Hattis, D., and Shapiro, K., "Analysis of Dose/Time/Response Relationships for Chronic Toxic Effects--The Case of Acrylamide," NeuroToxicology, Vol. 11, pp. 219-236, 1990.

80. Hattis, D., "Pharmacokinetic Principles for Dose Rate Extrapolation of Carcinogenic Risk from Genetically Active Agents," Risk Analysis, Vol. 10, pp. 303-316, 1990.

81. Hattis, D., "Three Candidate 'Laws' of Uncertainty Analysis" Risk Analysis, Vol. 10, p. 11, 1990.

82. Ashford, N. A., Spadafor, C. J., Hattis, D. B., and Caldart, C. C., Monitoring the Worker for Exposure and Disease: Scientific, Legal and Ethical Considerations in the Use of Biomarkers, Johns Hopkins University Press, Baltimore, 1990.

83. Hattis, D., Keeler, G. J., and Schierow, L., Building Perspectives for Assessing the Risks of Acid Particulates and Ozone, M.I.T. Center for Technology, Policy, and Industrial Development, CTPID 89-8, September, 1989

84. Hattis, D., "The Use of Pharmacokinetic Analysis in Risk Assessment--The Case of Butadiene," in Biological Data for Pharmacokinetic Modeling and Risk Assessment--Report of a Workshop Convened by the U. S. Environmental Protection Agency and ILSI Risk Science Institute, Asheville, North Carolina, May 23-25, 1988, U.S. Environmental Protection Agency Report No. EPA/600/3-90/019, August, 1989, pp. B-46 to B-52.

85. Ballew, M., and Hattis, D., Reproductive Effects of Glycol Ethers in Females--A Quantitative Analysis, M.I.T. Center for Technology, Policy, and Industrial Development, CTPID 89-7, July, 1989

86. Twersky, F., Whitbeck , C., and Hattis, D., Exposures of Health Care Workers to HIV--Factors Affecting Occupational Risks in San Francisco, Boston, and New York, M.I.T. Center for Technology, Policy, and Industrial Development, CTPID 89-6, June, 1989

87. Strauss, H., and Hattis, D., Estimation of HIV and HBV Infectious Titers in Human Fluids and Tissues M.I.T. Center for Technology, Policy, and Industrial Development, CTPID 89-4, June, 1989

88. Bailar, J. C. III, Finkel, A. M., Silbergeld, E. K., and Hattis, D., "Letter to the Editor, Re: Cancer-Causing Substances in Food, Drugs, and Cosmetics," New England Journal of Medicine, Vol. 320, p. 935, 1989

89. Brown, H. S., and Hattis, D. "The Role of Skin Absorption as a Route of Exposure to Volatile Organic Compounds in Household Tap Water: A Simulated Kinetic Approach," J. Am Col. Toxicol., Vol. 8, pp. 839-851, 1989.

90. Hattis, D., "Scientific Uncertainties and How They Affect Risk Communication," in Effective Risk Communication: The Role and Responsibility of Government and Nongovernment Organizations, V. T. Covello, D. B. McCallum, and M. T. Pavolova, eds., Plenum Publishing, New York, 1989.

91. Hattis, D., Welch, L. S., and Schrader, S. M., Male Fertility Effects of Glycol Ethers--A Quantitative Analysis, M.I.T. Center for Technology, Policy, and Industrial Development, CTPID 88-3, December, 1988.

92. Hattis, D., "The Use of Biological Markers in Risk Assessment," Statistical Science, Vol. 3, pp. 358-366, 1988.

93. Gobbell, J. V., Hattis, D., and Ashford, N. A., Possible Health Risks From Exposure to Chromium by Various Routes--Comparison of Exposures From Hazardous Waste Processing and Disposal in New Jersey with Exposures Originating from Other Sources, Center for Technology, Policy, and Industrial Development, CTPID 88-5, December, 1988.

94. Baskir, J. N., Hattis, D. Gross, D., and Ashford, N. A., Possible Health Risks from Exposure to Chlorinated Solvents by Various Routes--Comparison of Exposures From Hazardous Waste Processing and Disposal in New Jersey with Exposures Originating from Other Sources, Center for Technology, Policy, and Industrial Development, CTPID 88-2, November, 1988.

95. Hattis, D. and Shapiro, K., Analysis of Dose/Time/Response Relationships for Chronic Toxic Effects--The Case of Acrylamide, National Technical Information Service No. NTIS/PB89-109581, M.I.T. Center for Technology, Policy, and Industrial Development, CTPID 88-4, July, 1988.

96. Hattis, D. and Berg, R., "Pharmacokinetics of Ethoxyethanol in Humans," National Technical Information Service No. NTIS/PB88-221528, M.I.T. Center for Technology, Policy, and Industrial Development, CTPID 88-1, February, 1988.

97. Hattis, D., Erdreich, L., and Ballew, M., "Human Variability in Susceptibility to Toxic Chemicals -- A Preliminary Analysis of Pharmacokinetic Data from Normal Volunteers," Risk Analysis, Vol. 7, pp. 415-426, 1987.

98. Hattis, D., Bird, S., and Erdreich, L., "Human Variability in Susceptibility to Anticholinesterase Agents," M. I. T. Center for Technology, Policy and Industrial Development, CTPID 87-4, December, 1987.

99. Hattis, D. and Wasson, J., "A Pharmacokinetic/Mechanism-Based Analysis of the Carcinogenic Risk of Butadiene," National Technical Information Service No. NTIS/PB88-202817, M. I. T. Center for Technology, Policy and Industrial Development, CTPID 87-3, November, 1987.

100. Hattis, D., Wasson, J. M., Page, G. S., Stern, B., and Franklin, C., "Acid Particulates and the Tracheobronchial Region of the Lung--An 'Irritation-Signaling' Model for Possible Health Effects," Journal of the Air Pollution Control Association, Vol. 37, pp. 1060-1066, September, 1987.

101. Hattis, D., "A Pharmacokinetic/Mechanism-Based Analysis of the Carcinogenic Risk of Ethylene Oxide," National Technical Information Service Number NTIS/PB88-188784, M. I. T. Center for Technology, Policy and Industrial Development, CTPID 87-1, August, 1987.

102. Hattis, D., "The Value of Molecular Epidemiology in Quantitative Health Risk Assessment," in Environmental Impacts on Human Health--The Agenda for Long-Term Research and Development, S. Draggan, J. J. Cohrssen, and R. E. Morrison, eds., Praeger Press, New York, 1987.

103. Hattis, D. Book Review, of Ethnic Differences in Reactions to Drugs and Xenobiotics, W. Kalow, W. Goedde, and D. P. Agarwal, Eds., Alan R. Liss, Inc., New York 1986; Science, Vol. 234, pp. 221-222, (1986).

104. Tuler, S., and Hattis, D. "Carcinogenesis Risk Assessment of Two-Carbon Alkylating Agents Using Dynamic Simulation of Absorption and Metabolism," Presented at the Society for Risk Analysis, October, 1986.

105. Hattis, D., Tuler, S., Finkelstein, L., and Luo, Z., A Pharmacokinetic/Mechanism-Based Analysis of the Carcinogenic Risk of Perchloroethylene, National Technical Information Service, No. NTIS/PB88-163209, Report to the National Institute for Occupational Safety and Health and the National Institute for Environmental Health Sciences; M.I.T. Center for Technology, Policy and Industrial Development, Report No. CTPID 86-7, September, 1986.

106. Hattis, D. and Wasson, J., "Potential Short Term Measures of Long Term Damage From Diesel Particulates--Alkane Exhalation and Urinary Hydroxyproline to Creatinine Ratios," Report to the National Institute for Occupational Safety and Health; M.I.T. Center for Technology, Policy and Industrial Development, Report No. CTPID 86-10, September, 1986.

107. Strauss, H. S., and Hattis, D., "Constructing a Database on the Release of Microorganisms in the Environment: Preliminary Scoping of Available Data and Appropriate Categories of Information," Report to the Department of National Health and Welfare, Canada; M.I.T. Center for Technology, Policy and Industrial Development, Report No. CTPID 86-9, July, 1986.

108. Strauss, H. S., Ingram, C., and Hattis, D., "A Draft Questionnaire for Gathering Data to Assess the Risks of Releasing Microorganisms Into the Environment," Report to the Department of National Health and Welfare, Canada; M.I.T. Center for Technology, Policy and Industrial Development, Report No. CTPID 86-8, July, 1986.

109. Hattis, D., "Human Variability in Parameters that are Potentially Related to Susceptibility to Carcinogenesis -- Implications for Risk Assessment," Presented at the EPRI workshop, Investigation of New Approaches to Use of Data in Cancer Risk Assessment, March 24-25, 1986, Denver, Colorado.

110. Hattis, D. B., "The Promise of Molecular Epidemiology for Quantitative Risk Assessment," Risk Analysis, Vol. 6, No. 2, pp. 181-193, 1986.

111. Hattis D., and A. Smith, What's Wrong With Quantitative Risk Assessment? In: Biomedical Ethics Reviews 1986. Edited by R. Almeder and J. Humber, The Humana Press, 1986 pp. 57-105 (ISSN 0742-1796).

112. Hattis, D. and Kennedy, D., "Assessing Risks from Health Hazards: An Imperfect Science," Technology Review, Vol. 89, pp. 60-71, May/June, 1986.

113. Wagner, R. M., Hattis, D., Strauss, H., and Caldart, C.C., "Development of a Quick-Screen Toxicity Scoring System to Assist in Setting Priorities Under TSCA," MIT Center for Technology, Policy and Industrial Development CTPID 86-5, June, 1986.

114. Hattis, D., Erdreich, L., and DiMauro, T., Human Variability In Parameters That are Potentially Related to Susceptibility to Carcinogenesis--I. Preliminary Observations, Report to the Environmental Criteria and Assessment Office, U.S. Environmental Protection Agency; M.I.T. Center for Technology, Policy and Industrial Development, Report No. CTPID 86-4, May, 1986.

115. Hattis, D., and Strauss, H., "Potential Indirect Mechanisms of Carcinogenesis--A Preliminary Taxonomy," National Technical Information Service No. NTIS/PB89-120513, M.I.T. Center for Technology, Policy and Industrial Development, Report No. CTPID 86-3 to the National Institute for Occupational Safety and Health, February, 1986.

116. Harrison, K., Hattis, D., and Abbat, K., Implications of Chemical Use for Exposure Assessment: Development of an Exposure-Estimation Methodology for Application in a Use-Clustered Priority Setting System, M.I.T. Center for Technology Policy and Industrial Development, Report No. CTPID 86-2 to the U. S. Environmental Protection Agency, February, 1986.

117. Hattis, D., Erdreich, L., and Ballew, M., "Human Variability in Susceptibility to Toxic Chemicals -- I. Noncarcinogens," U. S. Environmental Protection Agency, Environmental Criteria and Assessment Office, ECAO-CIN-494, National Technical Information Service No. PB 87-101 242/AS, 1987.

118. Strauss, H. S., Hattis, D. B., and Ashford, N. A., "A Critique of the Vermont Hazardous Air Contaminant Program and an Alternate Approach for the Determination of Acceptable Ambient Levels for Air Contaminants," Report to the State of Vermont by Ashford Associates, January, 1986.

119. Hattis, D., "The Route from Mickey to Walt--By Magic Carpet Through Fantasyland or Step by Step through Frontierland. Comment on 'A Statistical Model for Species Extrapolation Using Categorical Response Data', R. C. Hertzberg and M. E. Miller' Toxicology and Industrial Health, Vol. 1, pp. 61-63, December, 1985.

120. Strauss, H., Hattis, D., Page, G. S., Harrison, K., Vogel, S. R., and Caldart, C. C., "Direct Release of Genetically-Engineered Microorganisms: A Preliminary Framework for Risk Evaluation Under TSCA," MIT Center for Technology, Policy and Industrial Development CTPID 85-3, August, 1985.

121. Harrison, K. and Hattis, D., "Containment of Genetically-Engineered Microorganisms: A Comparison of Expected Releases During Greenhouse Trials with Releases in Ordinary Research and Development," M.I.T. Center for Technology, Policy and Industrial Development CTPID 85-2, July, 1985.

122. Page, G. S., Harrison, K., and Hattis, D., "Industrial Innovation Based on Undirected Mutagenesis of Microorganisms--Implications for Regulation Under TSCA," M.I.T. Center for Technology, Policy and Industrial Development, CTPID 85-1, June, 1985.

123. Hattis, D., "Alkane Exhalation--An Index of Oxidant Damage to Human Lungs from Air Pollutants?" M.I.T. Center for Policy Alternatives, CPA 85-2, May, 1985.

124. Page, G. S., Wasson, J. M., and Hattis, D. B., "Health Effects of Long-Range Transported Acid Particulates--A Preliminary Mechanism-Oriented Model," M.I.T. Center for Policy Alternatives, CPA 85-3, May, 1985.

125. Caldart, C. C., Hattis, D. B., and Wasson, J. M., "Data Management for FIFRA and TSCA Enforcement: Needs, Accomplishments, and Opportunities, or What Fate for 'FATES'?" M.I.T. Center for Policy Alternatives Report CPA 85-04, January, 1985.

126. Hattis, D., P. Dolinger, R. Wagner, and S. J. Bird, "The Potential for Mechanism-Oriented Research Projects to Help Determine the Health Effects of Airborne Pollutants--An Analysis for Research Planning," M.I.T. Center for Policy Alternatives, CPA-84-06, October 1984.

127. Hattis, Dale and Tom DiMauro, "Health Benefits and Costs of Supplementary Measures to Improve Compliance with Workplace Exposure Limits for Asbestos in the Construction Industry," M.I.T., Center for Policy Alternatives, CPA 84-03, July 1984.

128. R. Wagner, K. Abbat, D. Hattis and J. Briskin, "Epoxides and Their Derivatives: -- Survey of Potential Uses in Relation to Chemical Structure," M.I.T, Center for Policy Alternatives, CPA 84-02, April 1984.

129. R. Willmer, D. Friend, D. Hattis, D. Reed and D. Young, "Proposed Siting Criteria for Low-Level Radioactive Waste Facilities in Massachusetts. Prepared for The Executive Office of Environmental Affairs and the Massachusetts Health Research Institute," March 1984.

130. Hattis, D., "Risk Assessment for Acute Exposures to Chlorine or Ammonia -- A Theoretical Toxicological Perspective," for Environmental Resources LTD. March, 1984.

131. K. Abbat, D. Hattis, R. Wagner, and J. Briskin, "Aromatic Amines and Their Derivatives: Survey of Potential Uses in Relation to Chemical Structure," M.I.T. Center for Policy Alternatives, CPA 84-01, January 1984.

132. W. Curtiss Priest, and D. Hattis, "An Evaluation of the SPHERE Pilot Systems: Appraisal of Its Utility, Scope and Direction, Preliminary Report to the Environmental Protection Agency," Cooperative Agreement Contract No. CR807352-01-1, CPA 83/13, June 1983.

133. R. Goble, D. Hattis, M. Ballew and D. Thurston, "Implementation of the Occupational Lead Exposure Standard," Report to the Office of Technology Assessment, Contract #233-7040.0, MIT Center for Policy Alternatives, CPA 83-20, October 1983.

134. Hattis, D., Robin Wagner, Katherine Abbat, and Carolyn Atwood, "Some Considerations for Possible Significant New Use Rules for Hydrazine Derivatives -- A Survey of Potential Uses in Relation to Chemical Structure," M.I.T. Center for Policy Alternatives, CPA 82-17, November 1983.

135. Hattis, D., "The Possible Carcinogenic Risk of Formaldehyde--Recent Projections, Supporting Data and Assumptions," M.I.T. Center for Policy Alternatives, March 2, 1983.

136. Hattis, D., Nicholas A. Ashford, J. Herbert Hollomon, "Regulation of Cancer-Causing Substances: Another Point of View," Chemical and Engineering News, December 13, 1982, pp. 35-37.

137. Hattis, D., "Monohalomethanes: A Preliminary A Priori Assessment of Relative Potencies for Carcinogenesis," Report to the National Institute for Occupational Safety and Health Under Purchase Order No. 82-2837, December 1982.

138. Hattis, D., Barbara Richardson, and N.A. Ashford, "Construction of a Common-Sense, Easily-Used Priority Scoring System for Toxic Substance Integration Efforts," Report to the U.S. Environmental Protection Agency under Contract #68-01-6473, CPA 82-17, October 1982.

139. Hattis, D. "Mechanisms of Carcinogenesis: Implications for Expectations About Dose-Response Relationships," in Workshop on Problem Areas Associated with Developing Carcinogen Guidelines, Brookhaven National Laboratory Associated Universities, Inc. Publication No. BNL 51779, June 1984

140. Hattis, D. "Quantitative Risk Assessment for Carcinogens," presented at the Workshop on Carcinogen Guidelines, Brookhaven National Laboratory, Upton, New York, September 7-8, 1982.

141. Hattis, D. "Issues in Defining Baselines for Analysis," in Analyzing the Benefits of Health, Safety, and Environmental Regulation, Final Report to the Environmental Protection Agency under Contract #68-01-5838, CPA-82-16, 1982.

142. Hattis, D. "From Presence to Health Impacts," in Analyzing the Benefits of Health, Safety, and Environmental Regulation, Final Report to the Environmental Protection Agency under Contract #68-01-5838, CPA-82-16, 1982.

143. Hattis, D., Robert Goble and N.A. Ashford, "Airborne Lead: A Clearcut Case of Differential Protection," Environment, Vol. 24, no. 1, January/February 1982.

144. N.J. Gorelick, D. Hattis, and N.A. Ashford, "Alternative Methods of Toxics Control: Encouraging Voluntary Measures to Minimize Exposure to Chlorinated Hydrocarbon Solvents from the Dry-cleaning Industry and Metal Cleaning Process, CPA/WP-82-2, May 1982.

145. M. Poulsen, D. Hattis, F. Neubacher, J. Briskin, and N.A. Ashford, "Development of a Methodology for Recognizing Potential High Priority Health Hazards from Emerging Chemical Technology," CPA-82-3, May 1982.

146. N.A. Ashford, D. Hattis, E.M. Zolt, J.I. Katz, G.R. Heaton, and W.C. Priest, "Evaluating Chemical Regulations: Trade-Off Analysis and Impact Assessment for Environmental Decision-Making," Final Report to the Council on Environmental Quality under Contract No. EQ4ACA35. CPA-80-13, 1981. NTIS # PB81-195067.

147. Hattis, D., "Needs for Public Health Intervention and Needs for New Research on Vinyl Halides and Their Polymers: A Public Policy Perspective," Environmental Health Perspectives, Vol. 41, pp. 227-231, 1981.

148. Hattis, D. "Dynamics of Medical Removal Protection for Lead - A Reappraisal" MIT Center for Policy Alternatives CPA-81-25, September 1981

149. Hattis, D., C. Mitchell, J. McCleary-Jones, N. Gorelick, and N.A. Ashford, "Control of Occupational Exposures to Formaldehyde: A Case Study of Methodology for Assessing the Health and Economic Impacts of OSHA Health Standards." Report to the U.S. Department of Labor under Contract #J-9-F-0106, MIT Center for Policy Alternatives CPA-81-17, April 1981.

150. Ashford, N.A., Clarence-Smith, E.P., Hattis, D., Hill, C.T., Mendez, W.M., and Owen, S.T., "Preliminary Design of a Modular Curriculum on Toxic Substances Management," MIT Center for Policy Alternatives CPA 80-07, 1980.

151. Hattis, D., and Barbara Richardson, "Noise, General Stress Response, and Cardiovascular Disease Processes: Review and Reassessment of Hypothesized Relationships" MIT Center for Policy Alternatives CPA-80-02, Massachusetts Institute of Technology, Cambridge, Massachusetts, June 1980

152. Hattis, D., W. Mendez, and N.A. Ashford, "Discussion and Critique of the Carcinogenicity Assessment Group's Report On Population Risk Due to Atmospheric Exposure to Benzene," Report to the Office of Air Quality Planning and Standards of the U.S. Environmental Protection Agency, CPA Publication No. CPA-80-1, May 1980.

153. Hattis, D., R. Andrews, J.W. Estes and S.T. Owen, "Relationships Between Aspects of Pharmaceutical Regulation, Innovation, and Therapeutic Benefits" -- Phase I Final Report, Report to the National Science Foundation under Grant No. PRA 77-22330 AOl, CPA Publication No. CPA/WP-80-3, March 1980.

154. Hattis, D., E. Rothenberg and N.A. Ashford, "Some Considerations for the Design of OSHA Policy on Medical Surveillance and Removal Provisions in Occupational Health Standards," Report to U.S. Department of Labor under Contract No. J-9-F-8-004, CPA Publication No. CPA/WP-79-9, November 1979.

155. Hattis, D. and W. Mendez, "Vinyl Chloride: What Happened in the U.S.?" Proceedings of the Workshop on Occupational Health Standards, November 8-ll, l979, Mont. Ste. Marie, Quebec, Canada.

156. Hattis, D., B. Ross, and E. Rothenberg, "Methodology for Assessing the Health Impacts of OSHA Health Standards --Task 1.2: Classification of Worker Exposures to Occupational Health Hazards," Report to the Department of Labor under Contract No. J-9-F-8-0106, CPA Publication No. CPA/WP-79-12, August 1979.

157. Hattis, D., C. Mitchell, B. Ross and W. Mendez, "Methodology for Assessing Economic and Health Impacts of OSHA Health Standards -- Task 1.3: Classification of Health Effects Produced by Exposure to Occupational Hazards," Report to the Department of Labor under Contract No. J-9-F-8-0106, CPA Publication No. CPA/WP-79-13, August 1979.

158. N.A. Ashford, D. Hattis, G.R. Heaton, and J.I. Katz, "Mobilizing National Resources for the Control of Occupational Cancer," Report to the Office of Technology Assessment under Contract No. OTA-C-78-293, CPA Publication No. CPA-79-4/a, June 1979.

159. N.A. Ashford, D. Hattis, G.R. Heaton, A. Jaffe, S.T. Owen, and W.C. Priest, "Environmental/Safety Regulation and Technological Change in the U.S. Chemical Industry," Report to the National Science Foundation under Grant No. PRA76-21368, CPA Publication No. CPA/79-6, March 1979.

160. W.C. Priest, W. Mendez, D. Hattis, and N.A. Ashford, "Calculation of Costs of Medical Removal Protection Provisions of OSHA Lead Standard with Phased-In Removal-Return Triggers," Report to the Department of Labor under Contract No. J-9-F-8-0044, CPA Publication No. CPA-78-16, August 1978.

161. Hattis, D., W. Mendez and N.A. Ashford, "Analysis of Available Evidence on Blood Lead-Air Lead Relationships Relevant to the Selection of a Permissible Occupational Exposure Limit for Lead in Air," Report to the Department of Labor Under Contract No. J-9-F-8-0044, CPA Publication No. CPA-78-13, July 1978.

162. Hattis, D., S. Owen, R. Gecht and N.A. Ashford, "A Strategic Plan for OSHA Occupational Disease Abatement," Report to the U.S. Department of Labor under Contract No. J-9-F-7-0089, CPA Publication No. CPA-78-11, April 1978.

163. Ashford, N.A., R.D. Gecht, D. Hattis, and J.I. Katz, "The Effects of OSHA Medical Removal Protection on Labor Costs of Selected Lead Industries," Report to U.S. Department of Labor under Contract No. 172646, Massachusetts Institute of Technology, Center for Policy Alternatives, CPA Publication No. CPA-77/11, December 1, 1977.

164. Hattis, D. and A.E. Murray, "Industrial Prospects for Chitin and Protein from Shellfish Wastes," MIT Sea Grant Program, Report No. MITSC 77-3, Cambridge, MA 1977.

165. Hattis, D. and A.E. Murray, "Approaches to a Practical Assessment of Supply and Demand for Chitin Products in the United States," First International Conference on Chitin/Chitosan, April 11-13, 1977, Boston, MA MIT Sea Grant, 1978.

166. Hattis, D., N.A. Ashford, E. Zolt, J.I. Katz, and G.R. Heaton, "Economic/Social Impact of Occupational Noise Exposure Regulations," Testimony presented at the OSHA Hearings on the Economic Impact of Occupational Noise Exposure, EPA 550/9-77-532, U.S. Environmental Protection Agency, Washington, D.C., September 1976.

167. Hattis, D., N.A. Ashford, A.E. Murray and K. Seo, "Industrial Applications of Chitin and Chitin Derivatives," in Interocean '76, Third International Conference and Exhibition for Ocean Engineering and Marine Sciences, June 15-19, 1976, Dusseldorf, Germany.

168. Hadzima, J., D. Hattis, A. Mesrobian, S. Hazen, J. Katz and N.A. Ashford, "A Case Study on the Regulation of Vinyl Chloride Emissions in the Workplace," Report to the Council on Environmental Quality under Contract No. EQ4ACA35, CPA Publication No. CPA-76-3/d, April 1976.

169. Hattis, D., J. Hadzima, J. Katz, S. Hazen and N.A. Ashford, "A Case Study on the FDA Regulation of PVC Food Packaging," Report to the Council on Environmental Quality under Contract No. EQ4ACA35, CPA Publication No. CPA-76-3/d, April 1976.

170. Hattis, D., G. Heaton, A. Mesrobian and N.A. Ashford, "A Case Study on the Suspension of Alkylmercury Seed Treatments," Report to the Council on Environmental Quality under Contract No. EQ4ACA35, CPA Publication No. CPA-76-3/e, April 1976.

171. Hattis, D., B. Lichter, G. Heaton and N.A. Ashford, "A Case Study on the Regulation of Mercury Water Discharges by the Chlor-Alkali Industry," Report to the Council on Environmental Quality under Contract No. EQ4ACA35, CPA Publication No. CPA-76-3/e, April 1976.

172. Hattis, D., S. Hazen, G. Heaton and N.A. Ashford, "A Case Study on Possible OSHA Regulation of the Storage and Transfer of Bulk Benzene," Report to the Council on Environmental Quality under Contract No. EQ4ACA35, CPA Publication No. CPA-76-3/c, April 1976.

173. Hattis, D. and A.E. Murray, "PCB's and Their Substitutes -- A Brief Look at Some Examples of Past Tradeoffs," in Proceedings of the National Conference on Polychlorinated Biphenyls, November 19-21, Chicago, Illinois, EPA 560/6-75-004, Washington, D.C., March 1976.

174. Hattis, D., N.A. Ashford, G.R. Heaton and J.I. Katz, Some Considerations in Choosing an Occupational Noise Exposure Regulation, EPA 550/9-76-007, U.S. Environmental Protection Agency, Washington, D.C., February 1976.

175. Hattis, D., P. Dollive and S.S. Epstein, "Information for Decision Making on Occupational Safety and Health Problems in Ohio--An Analysis of Available and Potentially Available Sources of Detailed Statistics," Report to the Ohio Occupational Task Force, 11/74.

176. Epstein, S. S. and D. Hattis, "Adverse Health Effects and Chemical Pollutants of the Environment," in Environment--Resources, Pollution, and Society, William W. Murdoch, ed., 2nd edition, Sinauer Associates, Inc., Stamford, Conn., 1975.

177. Hattis, D., "Proliferation of Antigen Binding Cells and Immunoglobulin Bearing Cells--and--Case Studies in the Use of Scientific Information in Social Decision-Making: Lead Arsenate as an Urban Insecticide and Sodium Nitrite as a Food Additive," Dissertation, Stanford University, December 1973.

178. Hattis, D., "The FDA and Nitrite--A Case Study of Violations of the Food, Drug, and Cosmetic Act with Respect to a Particular Food Additive," Presented in hearings before the Select Committee on Nutrition and Food Needs of the United States Senate, September 21, 1972, pp. 1692-1720.

DECLARATION OF SERVICE BY FACSIMILE

I, the undersigned, declare:

1. That declarant is and was, at all times herein mentioned, a citizen of the United States and a resident of the County of San Francisco, over the age of 18 years, and not a party to or interest in the within action; that declarant's business address is 100 Pine Street, Suite 2600, San Francisco, California 94111.

2. That on May 1, 2002, declarant served by facsimile the DECLARATION OF DALE HATTIS, Ph.D, IN SUPPORT OF PLAINTIFFS' MOTION FOR A TEMPORARY RESTRAINING ORDER AND PRELIMINARY INJUNCTION to the parties listed on the attached Service List.

3. That there is a regular communication by facsimile between the place of origin and the places so addressed.

I declare under penalty of perjury that the foregoing is true and correct. Executed this 1st day of May, 2002, at San Francisco, California.

/s/ Jerry Cohen

Jerry Cohen

PUBLIC CITIZEN vs. DEPARTMENT OF TRANSPORTATION
Service List - 05/01/02
Page 1

COUNSEL FOR PLAINTIFF(S)

• Stephen P. Berzon
Jonathan Weissglass
ALTSHULER, BERZON, NUSSBAUM,
RUBIN & DEMAIN
177 Post Street, Suite 300
San Francisco, CA 94108
415/421-7151
415/362-8064 (fax)

• Charles S. Crandall
LAW OFFICES OF CHARLES
STEVENS CRANDALL
1880 Santa Barbara Street,
3rd Floor
San Luis Obispo, CA 93401
805/544-4787
805/543-1081 (fax)

• Patrick J. Coughlin
Randi D. Bandman
Stanley S. Mallison
MILBERG WEISS BERSHAD
HYNES & LERACH LLP
100 Pine Street, Suite 2600
San Francisco, CA 94111
415/288-4545
415/288-4534 (fax)

• William S. Lerach
Patrick W. Daniels
MILBERG WEISS BERSHAD
HYNES & LERACH LLP
401 B Street, Suite 1700
San Diego, CA 92101
619/231-1058
619/231-7423 (fax)

• Albert H. Meyerhoff
MILBERG WEISS BERSHAD
HYNES & LERACH LLP
355 South Grand Avenue, Suite 4170
Los Angeles, CA 90071
213/617-9007
213/617-9185 (fax)

• David Vladick
PUBLIC CITIZEN
1600 20th Street, N.W.
Washington, D.C. 20009
202/588-1000
202/588-7795 (fax)

David Rosenfeld
VAN BOURG, WEINBERG, ROGER
& ROSENFELD
180 Grand Avenue, Suite 1400
Oakland, CA 94612
Telephone: 510/839-6600
510/891-0400 (fax)

PUBLIC CITIZEN vs. DEPARTMENT OF TRANSPORTATION
Service List - 05/01/02
Page 2

COUNSEL FOR DEFENDANTS

**Jocelyn Burton
Chief of Civil Division
United States Attorney's Office
450 Golden Gate Avenue, 11th Floor
San Francisco, California 94102
415/436-7200
415/436-7234 (fax)
jocelyn.burton@usdoj.gov

• Laurie Caramanian
Department of Justice
Environment and Natural
Resources Division
601 D Street, N.W., Room 3532
Washington, D.C. 20004
202/305-0436
202/305-0274 (fax)
lori.caramanian@usdoj.gov

• Denotes service via electronic mail and U.S. mail

**Denotes service via electronic mail and hand delivery

MILBERG WEISS BERSHAD
HYNES & LERACH LLP
PATRICK J. COUGHLIN (111070)
RANDI D. BANDMAN (145212)
STANLEY S. MALLISON (184191)
100 Pine Street, Suite 2600
San Francisco, CA 94111
Telephone: 415/288-4545
415/288-4534 (fax)
- and -
WILLIAM S. LERACH (68581)
PATRICK W. DANIELS (190715)
401 B Street, Suite 1700
San Diego, CA 92101
Telephone: 619/231-1058
619/231-7423 (fax)
- and -
ALBERT H. MEYERHOFF (54134)
355 South Grand Avenue, Suite 4170
Los Angeles, CA 90071
Telephone: 213/617-9007
213/617-9185 (fax)

Attorneys for Plaintiffs Public Citizen, International Brotherhood of Teamsters, California Labor Federation, Brotherhood of Teamsters, Auto and Truck Drivers, Local 70, California Trucking Association and Environmental Law Foundation

ALTSHULER, BERZON, NUSSBAUM, RUBIN & DEMAIN
STEPHEN P. BERZON (46540)
JONATHAN WEISSGLASS (185008)
177 Post Street, Suite 300
San Francisco, CA 94108
Telephone: 415/421-7151
415/362-8064 (fax)

Attorneys for Plaintiffs International Brotherhood of Teamsters, California Labor Federation and Environmental Law Foundation

[Additional counsel appear on signature page.]

UNITED STATES DISTRICT COURT

NORTHERN DISTRICT OF CALIFORNIA

PUBLIC CITIZEN, et al., Plaintiffs, vs. DEPARTMENT OF TRANSPORTATION, et al., Defendants.	No. C-02-2115-CW DECLARATION OF JAMES MICHAEL LYONS IN SUPPORT OF PLAINTIFFS' MOTION FOR A TEMPORARY RESTRAINING ORDER AND PRELIMINARY INJUNCTION DATE: To Be Determined TIME: To Be Determined COURTROOM: The Honorable Claudia Wilken

I, JAMES MICHAEL LYONS, hereby declare:

1. I am a Senior Partner and Senior Engineer at Sierra Research, Inc., a consulting firm that specializes in a wide range of air quality issues, including analyses of vehicle emissions, emissions control technologies, and the associated impacts on air quality. I have been retained by plaintiffs' counsel as an expert witness and make this declaration in support of Plaintiffs' Motion for a Temporary Restraining Order and Preliminary Injunction.

2. By way of summary, it is my opinion that the Program Environmental Assessment (PEA or EA) at issue in this litigation is seriously deficient in the following respects:

(a) It fails to account for emissions differences between Mexico-domiciled and U.S.-domiciled trucks that exist now and that will become even more significant in the future;

(b) It improperly assesses the air quality impact of the no action and proposed action scenarios by comparing the associated increase in emissions to total nationwide emissions from on-road mobile and all sources;

(c) It fails to assess the air quality impact of increased emissions and increased ambient pollutant levels in those areas where the impacts of the no action and proposed action scenarios are likely to be greatest, which include many areas that currently do not comply with existing federal air quality requirements and are likely to be out of compliance with future federal requirements;

(d) It fails to assess the localized air quality impacts of increased numbers of safety inspections;

(e) It fails to consider increases in emissions of toxic air contaminants resulting from the no action or proposed action alternatives, particularly within the context of the increase in local emissions due to increased numbers of safety inspections; and

(f) It fails to assess the air quality impacts of the no action and proposed action alternatives over more than a single year or beyond 2002.

A. **Professional Qualifications**

3. In 1983 I received my Bachelors of Science *cum laude* in Chemistry from the University of California, Irvine. In 1985, I received my Masters of Science in Chemical Engineering from the University of California, Los Angeles.

4. From 1985 until 1991, I was employed by the California Air Resources Board in a variety of capacities, including Engineer, Air Pollution Research Specialist, and Senior Air Pollution Specialist. In these positions I analyzed vehicle emissions data for trends and determined the effectiveness of various types of emissions control systems for both regulated and toxic emissions, examined the impact of diesel powered vehicles on ambient levels of toxic air contaminants and assisted in the development of emissions regulations for "gray market" vehicles. I assisted in the identification and control of emissions of toxic air contaminants from mobile sources and also in the determination of effects of compositional changes to gasoline and diesel fuel on emissions of regulated and unregulated pollutants. I developed new test procedures and emission standards for evaporative and running loss emissions of hydrocarbons from vehicles, oversaw the development of the California state plan to control toxic emissions from motor vehicles, and assisted in developing control technologies to reduce emissions of chlorofluorocarbons from motor vehicles.

5. From 1991 to present, my responsibilities at Sierra Research have included, among other things, the evaluation of the costs, emission benefits, and cost-effectiveness of measures intended to reduce emissions from mobile sources. I have also been involved with the organization and management of testing programs designed to evaluate the effectiveness of motor vehicle emission control programs, including inspection and maintenance programs; the analysis of motor vehicle emissions data; and the development of enhanced testing procedures for motor vehicles. I also provide assessments of the activities of federal, state, and local regulatory agencies with respect to motor vehicle emissions, and report to clients regarding such activities.

6. While at Sierra Research my diverse client base has included petroleum companies and associations (including the Western States Petroleum Association, the American Petroleum Institute, Mobil Corporation, and Texaco, Inc.), vehicle manufacturing associations (including the Alliance of Automobile Manufacturers and the former American Automobile Manufacturers Association), government agencies

(including the California Air Resources Board, Environment Canada, the Province of British Columbia Ministry of Environment Lands and Parks and the Greater Vancouver Regional District, and the New York State Energy Research and Development Authority), and other organizations (including Californians For a Sound Fuel Strategy and the Hybrid Vehicle Coalition). I am a member of the American Chemical Society and the Society of Automotive Engineers.

7. In the course of my career, I have authored or co-authored numerous publications analyzing Diesel vehicle emissions, fuels, control technologies, and their impacts on air quality, including the following:

8. "The Impact of Diesel Vehicles on Air Pollution," presented at the 12th North American Motor Vehicle Emissions Control Conference, Louisville, KY, April 1988.

9. "Preliminary Feasibility Study for a Heavy-Duty Vehicle Emissions Inspection Program in the Lower Fraser Valley Area," Sierra Research Report No. 92-10-01, prepared for the Greater Vancouver Regional District, October 1992; and "Phase II Feasibility Study: Heavy-Duty Vehicle Emissions Inspection Program in the Lower Fraser Valley," Sierra Research Report No. SR94-09-02, prepared for the Greater Vancouver Regional District, September 1994.

10. "Analysis of Diesel Fuel Quality Issues in Maricopa County, Arizona," Sierra Research Report No. SR97-12-03, prepared for the Western States Petroleum Association, December 1997.

11. "Future Diesel-Fueled Engine Emission Control Technologies and Their Implications for Diesel Fuel Properties," Sierra Research Report No. SR99-08-01, prepared for the American Petroleum Institute, August 1999.

12. "A Comparative Analysis of the Feasibility and Cost of Compliance with Potential Future Emission Standards for Heavy-Duty Vehicles Using Diesel or Natural Gas," Sierra Research Report No. SR00-02-02, prepared for Californians For a Sound Fuel Strategy, February 2000.

13. "Comparison of Emission Characteristics of Advanced Heavy-Duty Diesel and CNG Engines," Sierra Report No. SR01-05-01, prepared for Western States Petroleum Association, May 2001.

14. A true and correct copy of my curriculum vitae is attached hereto Exhibit 1.

15. At the request of plaintiffs' counsel, Sierra Research was asked to review the Program Environmental Assessment (EA) prepared by the Federal Motor Carrier Safety Administration (FMCSA)

considering several proposed actions (hereafter the "Final Rules") that would lift current restrictions that limit operation of Mexico-domiciled heavy-duty diesel vehicles to the immediate border region and thereby increase the number of such vehicles operating in the United States. In co-operation with Philip Heirigs and Lori L. Williams, I reviewed and analyzed the EA, identified serious deficiencies in the FMCSA's air quality impacts analysis contained therein, and then re-analyzed potential air quality impacts, incorporating proper methodologies and assumptions.

16. Mr. Heirigs is a Partner and Senior Professional at Sierra Research, Inc. His responsibilities include preparation of on-road and off-road mobile source emission inventories, evaluation of EPA and CARB emission factor models, and assessment of the costs and benefits of alternative mobile source control measures. Under contract to federal agencies and industry associations, Mr. Heirigs has conducted evaluations of EPA's MOBILE4, MOBILE4.1, MOBILE5a, MOBILE5b, and MOBILE6 emission factors models and CARB's EMFAC/BURDEN models, including detailed analyses of nearly every aspect of MOBILE5 and MOBILE6. Mr. Heirigs has also been responsible for the development of training materials and the delivery of training sessions on the MOBILE5 and MOBILE6 models. His separate efforts have assessed the accuracy of emission inventories developed for a wide range of Western communities and evaluated the emissions benefits of various motor vehicle control strategies. Prior to joining Sierra Research, Inc., Mr. Heirigs was a Senior Air Pollution Specialist for the California Air Resources Board. A true and correct copy of Mr. Heirigs' curriculum vitae is attached hereto as Exhibit 2.

17. Ms. Williams is an Associate Engineer at Sierra Research, Inc. Her responsibilities include the collection and analysis of data, as well as technical writing support, for a variety of stationary and mobile source emissions projects. Her recent work has included a review of federal, state and local support programs for alternative fuels and alternative fuel vehicles. Other projects have included trip cycle development, I/M program analysis, and statistical analysis of instrumented vehicle data for use in updating the MOBILE5a emission factor model. A true and correct copy of Ms. Williams' curriculum vitae is attached hereto as Exhibit 3.

18. In co-operation with Mr. Heirigs and Ms. Williams, I co-authored a report documenting the review of the EA, the identified deficiencies, and the findings of Sierra Research Inc.'s re-analyses. A

true and correct copy of our report is attached hereto as an exhibit to plaintiffs' complaint. This report was submitted to the FMCSA during public comment on the federal rulemaking.

B. The FMCSA's Deficient Environmental Assessment

19. On-road mobile sources include passenger cars and light-duty trucks, motorcycles and heavy-duty vehicles. Among their impacts, on-road mobile sources significantly contribute to total emissions of volatile organic compounds (VOC), oxides of nitrogen (NOx), and direct particulate matter (PM) emissions. Heavy-duty Diesel vehicles are of concern from an air quality perspective primarily because they emit substantial amounts of NOx and PM.

20. Ozone, formed by a complex series of reactions between HC and NOx in the presence of sunlight, is known to be a strong irritant to the lungs and eyes and at high concentrations causes shortness of breath and also aggravates asthma, emphysema, and other conditions. It is also well known that fine PM can penetrate deep into the lungs where it becomes deposited, causing or aggravating respiratory problems, decreases in lung function, and premature death.

21. The environmental assessment ("EA") prepared by the Federal Motor Carriers Safety Administration ("FMCSA" purports to analyze the potential significance of environmental impacts that may result from the operation of Mexico-domiciled trucks outside of the border region beginning in 2002.

(a) In Section 4 of the EA, the potential impacts of the proposed action on air quality are addressed.

(b) The basic methodology employed in the EA compares emissions from Mexico-domiciled vehicles operating in the U.S. in 2002 under each scenario to total U.S. emissions from all on-road vehicles in the U.S. and then to total emissions from all sources in the U.S. based on data developed by the U.S. EPA for 1999.

(c) Emissions of Mexico-domiciled vehicles were assumed to be equal to those of U.S.-domiciled vehicles. The numbers of Mexico-domiciled vehicles assumed to be operating in the U.S. under each scenario during 2002 were estimated by FMCSA. These estimates indicate that on the order of 30,000 Mexico-domiciled trucks will begin to operate inside the U.S. beyond the current border areas in 2002 alone.

(d) Emissions associated with proposed safety inspections of Mexico-domiciled vehicles are estimated separately for 2002 using the U.S. EPA MOBILE5b and PART5 emission factor models and are also compared to total U.S. emissions in 1999.

22. The air quality analysis in the EA is fatally flawed due to a number of serious methodological deficiencies and the use of a number of erroneous assumptions. As a result, the methodology used in the EA is completely inappropriate for assessing the relative air quality impacts of the "no action" and "proposed action" scenarios.

23. Among other deficiencies, the EA fails to consider impacts in the proper geographical regions. Second, it fails to evaluate any impacts beyond 2002. Third, it fails to account for differences in emissions between Mexico- and U.S.-domiciled trucks. Fourth, it fails to consider the impacts of emissions of toxic air contaminants.

24. Although we have described these deficiencies in our report in detail, I will summarize some of the basic problems in order to highlight for the Court the extent of the deficiencies in the government's EA.

25. One major defect is the evaluation of the emission impacts of the no action and proposed action scenarios in light of annual nationwide emissions from on-road mobile sources and all sources. This approach is completely invalid for the type of analysis in question and its use leads to a dramatic understatement of the significance of air quality impacts.

(a) Air quality issues are typically evaluated under State and federal law for relatively small geographical areas. For example, attainment and nonattainment designations with respect to the various National Ambient Air Quality Standards ("NAAQS") are generally cast in terms of limits on the maximum concentration of pollutants that the public can be exposed to during some period of time. Compliance with the NAAQS is determined for relatively small geographical areas (rather than the United States as a whole) based on air quality monitoring data. Indeed, NAAQS determinations may be limited to areas that represent only a portion of a single county.

(b) The air quality impacts of the proposed action will principally affect localized areas along major trucking corridors which pass through areas that are not in attainment with the current and

future ozone and fine PM NAAQS. *It is in these areas where the assessment of impacts needs to be performed.*

26. Another major problem is that the EA analyzes the impact of the no action and proposed action alternatives for only a single year–2002–without any explanation of why this single-year short-term scenario is an appropriate measure of potential air quality impacts or how this analysis can possibly suffice to assess impacts that will extend into the distant future and will change over time. The government's restricted short-term analysis is simply inadequate to measure the potential significance of air quality impacts, particularly long-term impacts, as we have detailed in our report. Any assessment of the actual impacts of operation of Mexico-domiciled trucks operating in the U.S. needs to consider both the short- and long-term impacts, since there are likely to be significant changes in the relative emissions levels and the amount of freight traffic handled by Mexican trucks operating in the U.S. over time. The EA completely ignores these important factors. An appropriate analysis should be carried out over a much longer period extending through 2020, at least.

27. The EA does not properly account for differences in the amount of emissions that results from the per-mile operation of Mexico- and U.S.-domiciled trucks. However, in general, emission levels of Mexico-domiciled trucks have not been, are not now, and will not be the same as those of U.S.-domiciled trucks.

28. In addition, emissions of toxic air contaminants (TAC) from heavy-duty Diesel vehicles are a major air quality concern. TACs that are emitted by Diesel vehicles include directly emitted Diesel particulate matter, benzene, 1,3-butadiene, formaldehyde, and acetaldehyde. The EA improperly failed to consider the issue of increased emissions of TACs whatsoever. As discussed below, Diesel emissions will assuredly increase in certain areas as a result of this action, and emissions of TACs from Diesels will increase as well. The failure to consider TAC impacts runs directly counter to the recent EPA rulemaking setting forth stringent standards for heavy-duty Diesel vehicles, intended in part to reduce public exposure to TACs. Given this, the impacts of the no action and proposed action alternatives on TAC emissions and ambient TAC levels must be addressed.

29. These are just several of the major defects that invalidate the government's EA with respect to air quality effects.

C. **Sierra Research's Analysis of Air Quality Impacts**

30. Given the major flaws associated with the EA, we conducted a limited assessment of environmental air quality impacts that would be associated with opening the border to Mexico-domiciled trucks. In conducting this study, we analyzed impacts within two of the geographic areas that will be affected, San Diego and Houston; analyzed both short- and long-term effects through 2020; and focused on emissions of nitrogen oxides, particulate matter, and VOCs. We used latest versions of the state-of-the-art emissions models developed by the United States Environmental Protection Agency (EPA) and the California Air Resources Board (CARB), U.S. EPA MOBILE6 and PART5, and CARB EMFAC2001. The MOBILE/PART and EMFAC emissions models have been developed by these agencies explicitly for the purpose of estimating current and future year emissions from on-road vehicles and are required to be used in the preparation of air quality plans for California areas (EMFAC) and other areas of the country (MOBILE/PART).

31. In order to illustrate the potential significance of the problem, we used these models to generate predicted gram-per-mile-traveled emission rates for the average Mexico- and U.S.-domiciled Class 8b heavy-duty Diesel trucks operated in the San Diego and Houston areas over time. Class 8b trucks are frequently employed in freight hauling over longer distances. Emission rates were calculated for 2002, 2007, 2010, 2015, and 2020.

32. We found that, on average, Mexico-domiciled trucks operating in the San Diego region would presently emit about 1.3 times more NOx, 1.9 times more particulate matter, and 2.0 times more VOCs than their U.S. counterparts. The emissions control deficit of the Mexican truck fleet will substantially worsen in the next 18 years in the absence of actions to apply the same emissions standards that will apply to U.S. trucks to Mexican trucks. By 2020, the average Mexican truck operating in the San Diego area will emit about 4.3 times more NOx, 4.0 times more particulate matter, and 3.1 times more VOCs than its U.S. counterpart.

33. Using a similar analysis for the Houston area, we found that the average Mexican truck would presently emit about 1.3 times more NOx, 2.9 times more particulate matter, and 3.0 times more VOCs than its U.S. counterpart. Again, the emissions control deficit of the Mexican truck fleet will grow substantially in the next 18 years unless actions are taken to apply existing U.S. emission regulations to

Mexican trucks. By 2020, the average Mexican truck operating in Houston will emit about 6.7 times more NOx, approximately 4 times more particulate matter, and 2.0 times more VOCs than its U.S. counterpart.

34. These differences in emissions have serious implications for the air quality within affected regions. It is highly likely that the increased Diesel emissions caused by Mexico-domiciled trucks operating in many areas will be in excess of the conformity thresholds established by the U.S. EPA to prevent federal actions from causing substantial delays in or preventing nonattainment areas from achieving compliance with existing federal air quality requirements.

(a) For example, based our assumptions the operation of Mexico-domiciled trucks in the Houston area, which is a severe ozone nonattainment area for ozone, would increase NOx emissions by about 35 tons per day in 2007, 42 tons per day in 2010, and 48 tons per day by 2020. In 2007, these NOx increases exceed the 0.07 ton per day conformity threshold value for NOx emissions in severe ozone nonattainment areas, by approximately 500 times (35 tons per day/0.07 tons per day).

35. In San Diego, which is a serious ozone nonattainment area, the operation of Mexico-domiciled trucks would, based on our assumptions, increase NOx emissions by about 8 tons per day in 2007, exceeding the 0.14 ton per day conformity analysis threshold that applies in serious ozone nonattainment areas by a factor of approximately 50.

36. In the South Coast Air Basin (including the Los Angeles area), which is an extreme ozone nonattainment area and a serious PM_{10} nonattainment area, the operation of Mexico-domiciled trucks in the South Coast Air Basin would, based on our assumptions, increase NOx emissions by more than 50 tons per day in 2010, exceeding the 0.03 ton per day conformity threshold by a factor of approximately 1,700. Their operations could increase direct PM_{10} emissions by about 1.2 tons per day in 2010, compared to the conformity threshold of 0.19 tons per day.

37. In sum, the federal government's conclusion that there will be no significant air pollution effects from its action and that a PEA was the appropriate vehicle for examining these impacts is erroneous. The implementation of the regulations may have potentially significant impacts on air quality, as well as serious impacts on the ability of many areas to attain and maintain compliance with federal air quality standards in many areas.

I hereby declare, under penalty of perjury under the laws of the United States and the State of California, that the foregoing is true and correct. Executed this 29th day of April, 2002, at Sacramento, California.

/s/ James Michael Lyons

JAMES MICHAEL LYONS

EXHIBIT 1

Résumé

James Michael Lyons

Education

1985, M.S., Chemical Engineering, University of California, Los Angeles

1983, B.S., Cum Laude, Chemistry, University of California, Irvine

Professional Experience

4/91 to present — Senior Engineer/Partner/Senior Partner
Sierra Research

Responsibilities include evaluation of the cost, emission benefits, and cost-effectiveness of measures intended to reduce emissions from mobile sources. Primary duties also include organization and management of vehicle testing programs designed to evaluate the effectiveness of motor vehicle emission control programs, including inspection and maintenance programs; analysis of motor vehicle emissions data; and the development of enhanced testing procedures for motor vehicles. Additional duties include assessments of the activities of Federal, state and local regulatory agencies with respect to motor vehicle emissions and reports to clients regarding those activities.

7/89 to 4/91 — Senior Air Pollution Specialist
California Air Resources Board

Supervised a staff of four professionals responsible for identifying and controlling emissions of toxic air contaminants from mobile sources and determining the effects of compositional changes to gasoline and diesel fuel on emissions of regulated and unregulated pollutants. Other responsibilities included development of new test procedures and emission standards for evaporative and running loss emissions of hydrocarbons from vehicles; overseeing the development of the state plan to control toxic emissions from motor vehicles; and reducing emissions of CFCs from motor vehicles.

4/89 to 7/89 — Air Pollution Research Specialist
California Air Resources Board

Responsibilities included identification of motor vehicle research needs; writing requests for proposals; preparation of technical papers and reports; as well as monitoring and overseeing research programs.

9/85 to 4/89 — Associate Engineer/Engineer
California Air Resources Board

Duties included analysis of vehicle emissions data for trends and determining the effectiveness of various types of emissions control systems for both regulated and toxic emissions; determining the impact of gasoline and diesel powered vehicles on ambient levels of toxic air contaminants; participation in the development of regulations for "gray market" vehicles; and preparation of technical papers and reports.

Professional Affiliations

American Chemical Society
Society of Automotive Engineers

Selected Publications (Author or Co-Author)

"Investigation of the Relative Emission Sensitivities of LEV Vehicles to Gasoline Sulfur Content - Emission Control System Design and Cost Differences," Sierra Research Report No. SR98-06-01, prepared for the American Petroleum Institute, June 1998.

"Costs, Benefits, and Cost-Effectiveness of CARB's Proposed Tier 2 Regulations for Handheld Equipment Engines and a PPEMA Alternative Regulatory Proposal," Sierra Research Report No. SR98-03-03, prepared for the Portable Power Equipment Manufacturers Association, March 1998.

"Analysis of Diesel Fuel Quality Issues in Maricopa County, Arizona," Sierra Research Report No. SR97-12-03, prepared for the Western States Petroleum Association, December 1997.

"Potential Impact of Sulfur in Gasoline on Motor Vehicle Pollution Control and Monitoring Technologies," prepared for Environment Canada, July 1997.

"Analysis of Mid- and Long-Term Ozone Control Measures for Maricopa County," Sierra Research Report No. SR96-09-02, prepared for the Western States Petroleum Association, September 9, 1996.

"Technical and Policy Issues Associated with the Evaluation of Selected Mobile Source Emission Control Measures in Nevada," Sierra Research Report No. SR96-03-01, prepared for the Western States Petroleum Association, March 1996.

"Cost-Effectiveness of Stage II Vapor Recovery Systems in the Lower Fraser Valley," Sierra Research Report No. SR95-10-05, prepared for the Province of British Columbia Ministry of Environment Lands and Parks and the Greater Vancouver Regional District, October 1995.

"Cost of Stage II Vapor Recovery Systems in the Lower Fraser Valley," Sierra Research Report No. SR95-10-04, prepared for the Province of British Columbia Ministry of Environment Lands and Parks and the Greater Vancouver Regional District, October 1995.

"A Comparative Characterization of Gasoline Dispensing Facilities With and Without Vapor Recovery Systems," Sierra Research Report No. SR95-10-01, prepared for the Province of British Columbia Ministry of Environment Lands and Parks, October 1995.

"Potential Air Quality Impacts from Changes in Gasoline Composition in Arizona," Sierra Research Report No. SR95-04-01, prepared for Mobil Corporation, April 1995.

"Vehicle Scrappage: An Alternative to More Stringent New Vehicle Standards in California," Sierra Research Report No. SR95-03-02, prepared for Texaco, Inc., March 1995.

"Evaluation of CARB SIP Mobile Source Measures," Sierra Research Report No. SR94-11-02, prepared for Western States Petroleum Association, November 1994.

"Reformulated Gasoline Study," prepared by Turner, Mason & Company, DRI/McGraw-Hill, Inc., and Sierra Research, Inc., for the New York State Energy Research and Development Authority, Energy Authority Report No. 94-18, October 1994.

"Phase II Feasibility Study: Heavy-Duty Vehicle Emissions Inspection Program in the Lower Fraser Valley," Sierra Research Report No. SR94-09-02, prepared for the Greater Vancouver Regional District, September 1994.

"Cost-Effectiveness of Mobile Source Emission Controls from Accelerated Scrappage to Zero Emission Vehicles," Paper No. 94-TP53.05, presented at the 87th Annual Meeting of the Air and Waste Management Association, Cincinnati, OH, June 1994.

"Investigation of MOBILE5a Emission Factors, Assessment of I/M Program and LEV Program Emission Benefits," Sierra Research Report No. SR94-06-05, prepared for American Petroleum Institute, June 1994.

"Cost-Effectiveness of the California Low Emission Vehicle Standards," SAE Paper No. 940471, 1994.

"Meeting ZEV Emission Limits Without ZEVs," Sierra Research Report No. SR94-05-06, prepared for Western States Petroleum Association, May 1994.

"Evaluating the Benefits of Air Pollution Control - Method Development and Application to Refueling and Evaporative Emissions Control," Sierra Research Report No. SR94-03-01, prepared for the American Automobile Manufacturers Association, March 1994.

"The Cost-Effectiveness of Further Regulating Mobile Source Emissions," Sierra Research Report No. SR94-02-04, prepared for the American Automobile Manufacturers Association, February 1994.

"Searles Valley Air Quality Study (SVAQS) Final Report," Sierra Research Report No. SR94-02-01, prepared for North American Chemical Company, February 1994.

"A Comparative Study of the Effectiveness of Stage II Refueling Controls and Onboard Refueling Vapor Recovery," Sierra Research Report No. SR93-10-01, prepared for the American Automobile Manufacturers Association, October 1993.

"Evaluation of the Impact of the Proposed Pole Line Road Overcrossing on Ambient Levels of Selected Pollutants at the Calgene Facilities," Sierra Research Report No. SR93-09-01, prepared for the City of Davis, September 1993.

"Leveling the Playing Field for Hybrid Electric Vehicles: Proposed Modifications to CARB's LEV Regulations," Sierra Research Report No. SR93-06-01, prepared for the Hybrid Vehicle Coalition, June 1993.

"Size Distributions of Trace Metals in the Los Angeles Atmosphere," *Atmospheric Environment*, Vol. 27B, No. 2, pp. 237-249, 1993.

"Preliminary Feasibility Study for a Heavy-Duty Vehicle Emissions Inspection Program in the Lower Fraser Valley Area," Sierra Research Report No. 92-10-01, prepared for the Greater Vancouver Regional District, October 1992.

"Development of Mechanic Qualification Requirements for a Centralized I/M Program," SAE Paper No. 911670, 1991.

"Cost-Effectiveness Analysis of CARB's Proposed Phase 2 Gasoline Regulations," Sierra Research Report No. SR91-11-01, prepared for the Western States Petroleum Association, November 1991.

"Origins and Control of Particulate Air Toxics: Beyond Gas Cleaning," in Proceedings of the Twelfth Conference on Cooperative Advances in Chemical Science and Technology, Washington, D.C., October 1990.

"The Effect of Gasoline Aromatics on Exhaust Emissions: A Cooperative Test Program," SAE Paper No. 902073, 1990.

"Estimation of the Impact of Motor Vehicles on Ambient Asbestos Levels in the South Coast Air Basin," Paper No. 89-34B.7, presented at the 82nd Annual Meeting of the Air and Waste Management Association, Anaheim, CA, June 1989.

"Benzene/Aromatic Measurements and Exhaust Emissions from Gasoline Vehicles," Paper No. 89-34B.4, presented at the 82nd Annual Meeting of the Air and Waste Management Association, Anaheim, CA, June 1989.

"The Impact of Diesel Vehicles on Air Pollution," presented at the 12th North American Motor Vehicle Emissions Control Conference, Louisville, KY, April 1988.

"Exhaust Benzene Emissions from Three-Way Catalyst-Equipped Light-Duty Vehicles," Paper No. 87-1.3, presented at the 80th Annual Meeting of the Air Pollution Control Association, New York, NY, June 1987.

"Trends in Emissions Control Technologies for 1983-1987 Model-Year California-Certified Light-Duty Vehicles," SAE Paper No. 872164, 1987.

DECLARATION OF SERVICE BY FACSIMILE

I, the undersigned, declare:

1. That declarant is and was, at all times herein mentioned, a citizen of the United States and a resident of the County of San Francisco, over the age of 18 years, and not a party to or interest in the within action; that declarant's business address is 100 Pine Street, Suite 2600, San Francisco, California 94111.

2. That on May 1, 2002, declarant served by facsimile the DECLARATION OF JAMES MICHAEL LYONS IN SUPPORT OF PLAINTIFFS' MOTION FOR A TEMPORARY RESTRAINING ORDER AND PRELIMINARY INJUNCTION to the parties listed on the attached Service List.

3. That there is a regular communication by facsimile between the place of origin and the places so addressed.

I declare under penalty of perjury that the foregoing is true and correct. Executed this 1st day of May, 2002, at San Francisco, California.

/s/ Jerry Cohen

Jerry Cohen

PUBLIC CITIZEN vs. DEPARTMENT OF TRANSPORTATION
Service List - 05/01/02
Page 1

COUNSEL FOR PLAINTIFF(S)

• Stephen P. Berzon
Jonathan Weissglass
ALTSHULER, BERZON, NUSSBAUM,
RUBIN & DEMAIN
177 Post Street, Suite 300
San Francisco, CA 94108
415/421-7151
415/362-8064 (fax)

• Albert H. Meyerhoff
MILBERG WEISS BERSHAD
HYNES & LERACH LLP
355 South Grand Avenue, Suite 4170
Los Angeles, CA 90071
213/617-9007
213/617-9185 (fax)

• Charles S. Crandall
LAW OFFICES OF CHARLES
STEVENS CRANDALL
1880 Santa Barbara Street,
3rd Floor
San Luis Obispo, CA 93401
805/544-4787
805/543-1081 (fax)

• David Vladick
PUBLIC CITIZEN
1600 20th Street, N.W.
Washington, D.C. 20009
202/588-1000
202/588-7795 (fax)

• Patrick J. Coughlin
Randi D. Bandman
Stanley S. Mallison
MILBERG WEISS BERSHAD
HYNES & LERACH LLP
100 Pine Street, Suite 2600
San Francisco, CA 94111
415/288-4545
415/288-4534 (fax)

• David Rosenfeld
VAN BOURG, WEINBERG, ROGER
& ROSENFELD
180 Grand Avenue, Suite 1400
Oakland, CA 94612
Telephone: 510/839-6600
510/891-0400 (fax)

• William S. Lerach
Patrick W. Daniels
MILBERG WEISS BERSHAD
HYNES & LERACH LLP
401 B Street, Suite 1700
San Diego, CA 92101
619/231-1058
619/231-7423 (fax)

PUBLIC CITIZEN vs. DEPARTMENT OF TRANSPORTATION
Service List - 05/01/02
Page 2

COUNSEL FOR DEFENDANTS

**Jocelyn Burton
Chief of Civil Division
United States Attorney's Office
450 Golden Gate Avenue, 11th Floor
San Francisco, California 94102
415/436-7200
415/436-7234 (fax)
jocelyn.burton@usdoj.gov

* Laurie Caramanian
Department of Justice
Environment and Natural
Resources Division
601 D Street, N.W., Room 3532
Washington, D.C. 20004
202/305-0436
202/305-0274 (fax)
lori.caramanian@usdoj.gov

* Denotes service via electronic mail and U.S. mail

**Denotes service via electronic mail and hand delivery

sierra research

Report No. SR02-04-01

Critical Review of "Safety Oversight for Mexico-Domiciled Commercial Motor Carriers, Final Programmatic Environmental Assessment," Prepared by John A Volpe Transportation Systems Center, January 2002

April 16, 2002

prepared by:

Sierra Research, Inc.
1801 J Street
Sacramento, California 95814
(916) 444-6666

Critical Review of "Safety Oversight for Mexico-Domiciled Commercial Motor Carriers, Final Programmatic Environmental Assessment," Prepared by John A Volpe Transportation Systems Center, January 2002

April 16, 2002

prepared by:

James M. Lyons
Philip L. Heirigs
Lori L. Williams

Sierra Research, Inc.
1801 J Street
Sacramento, CA 95814
(916) 444-6666

Critical Review of "Safety Oversight for Mexico-Domiciled Commercial Motor Carriers, Final Programmatic Environmental Assessment," Prepared by John A Volpe Transportation Systems Center, January 2002

Table of Contents

EXECUTIVE SUMMARY

The Federal Motor Carrier Safety Administration (FMCSA) is proposing several actions that may dramatically increase the number of Mexican-domiciled heavy-duty Diesel vehicles operating in the United States and that would lift current restrictions that limit operation of such vehicles to the immediate border. Under the National Environmental Policy Act ("NEPA"; 42 U.S.C. 4371 et seq., enacted in 1969), responsible federal officials must prepare, prior to undertaking "major Federal actions significantly affecting the quality of the human environment," a "detailed statement" (referred to as an Environmental Impact Statement, or EIS) addressing the following aspects of the proposed action: its environmental impact, any unavoidable adverse environmental effects, alternatives to the action, local short-term uses versus long-term productivity, and the commitment of any irreversible and irretrievable resources.

The threshold question in the NEPA process is whether the action is one that "significantly" affects the environment. In 1978, the Council on Environmental Quality (CEQ) adopted formal regulations (40 CFR 1500-1508) governing the NEPA process. The regulations contain a brief description of the process agencies must follow in determining the threshold question of significance. The key definitions are those for "effects" and "significantly." The definition of "effects" (40 CFR 1508.8) requires an examination of direct effects, and also indirect effects that are "reasonably foreseeable" as well as "cumulative." In addition to ecological impacts, the examination must consider "aesthetic, historic, cultural, economic, social and health impacts." The term "significantly" is defined (40 CFR 1508.27) in terms of two main general parameters, "context" and "intensity," with the latter broken down into ten distinct categories. If the answer to the threshold question of significance is in the affirmative, then an EIS must be prepared; if not, then a Finding of No Significant Impact (FONSI) is permitted.

The CEQ regulations (40 CFR 1501.3, 1501.4 and 1508.9) specify that, unless the project falls into a predetermined category under the lead agency's internal NEPA procedures, the preliminary question of significance is to be addressed through the preparation of an "Environmental Assessment", or EA. The EA is a "concise public document" that must (1) "briefly provide sufficient evidence and analysis" for determining whether an EIS or a FONSI must be prepared, (2) aid the agency in complying with NEPA when no EIS is prepared, and (3) facilitate preparation of an EIR when one is necessary. The EA must also include "brief discussions" of the need for the proposed action, alternatives, environmental impacts of the proposal and the alternatives, and a listing of agencies and persons consulted.

In this case, the FMCSA has made a FONSI based on an EA.* This report presents a detailed critical review of that EA, demonstrating that the EA is both inadequate in terms of scope as well as fatally flawed in terms of the methodology used to assess the significance of the air quality impacts associated with the proposed actions. Because of the inadequacy of the EA, we conclude that the FONSI is incorrect with respect to air quality impacts and that, based on NEPA, a complete EIS must be prepared for the proposed action.

The specific flaws in the FMCSA EA include the following:

- Failing to assess the air quality impacts of the no action and proposed action alternatives over more than a single year or beyond 2002;

- Improperly assessing the air quality impacts of the no action and proposed action scenarios by comparing the associated increase in emissions to total nationwide emissions from trucks;

- Failing to account for emissions differences between Mexican-domiciled and U.S.-domiciled trucks that exist now and that will become even more significant in the future;

- Failing to assess the air quality impacts of increased emissions and increased ambient pollutant levels in those areas where the impacts of the no action and proposed action scenarios are likely to be greatest, which include many areas that currently do not comply with existing federal air quality requirements and are likely to be out of compliance with future federal requirements;

- Failing to consider increases in emissions of toxic air contaminants resulting from the no action or proposed action alternatives, particularly within the context of the increase in local emissions due to increased numbers of safety inspections; and

- Failing to assess the localized air quality impacts of increased numbers of safety inspections.

The overall impact of both the no action and proposed action alternatives will be to allow the substitution of higher-emitting Mexican-domiciled trucks for lower-emitting U.S.-domiciled trucks for freight-carrying in the United States. In addition, the alternatives have the potential to increase overall U.S. truck traffic. Based on the available data, this will present a particularly significant issue in those areas of the southwestern U.S. that currently violate and are likely to continue to violate current and future health-based federal National Ambient Air Quality Standards (NAAQS) applicable to ozone and fine PM.

---

* "Safety Oversight for Mexico-Domiciled Commercial Motor Carriers, Final Programmatic Environmental Assessment," Prepared by John A Volpe Transportation Systems Center, January 2002.

Both the no action and proposed action alternatives are in direct conflict with federal law that requires compliance with the NAAQS by specific dates. Heavy-duty Diesel vehicles are widely recognized as contributing to high ambient levels of ozone and fine particulate matter and for that reason have been required to meet increasingly stringent and costly emission standards established by the U.S. EPA. Allowing higher-emitting Mexican-domiciled trucks that do not have to comply with the same emission standards as comparable U.S.-domiciled trucks will not only undercut the U.S. EPA standards but also promote the use of Mexican-domiciled trucks for hauling freight in the U.S.

In addition to the NEPA process, the U.S. EPA has promulgated conformity regulations (§51 and §93 of Title 40 Code of Federal Regulations) to assure that actions taken by the federal government are consistent with air quality goals in that they do not cause or contribute to any violation of a NAAQS in any area, or delay attainment with a NAAQS in any area. The FMSCA has not performed any conformity analyses for the current project despite the fact that the no action and proposed action alternatives are very likely to lead to emission increases that exceed the threshold levels above which a conformity analysis would be required in many existing nonattainment areas.

BACKGROUND

Freight Transport and Truck Emissions

Most freight carried by trucks in the United States is transported by heavy-duty Diesel vehicles. In turn, most of the freight carried by heavy-duty Diesel vehicles is transported by trucks with gross vehicle weight ratings of more than 60,000 pounds,* which are referred to as Class 8b trucks in most air quality arenas. The pollutants emitted by these vehicles that are of greatest concern from an air quality perspective are oxides of nitrogen (NOx) and particulate matter (PM). Emissions of volatile organic compounds (VOC) from heavy-duty Diesel vehicles are also of some concern although emission levels are generally much lower than applicable emission standards.

It is expected that both the no action and proposed action scenarios considered by FMCSA will result in an immediate increase in the use of Mexican-domiciled Class 8b trucks in the United States outside of the existing border areas as indicated in the EA. In addition, the use of Mexican-domiciled trucks in the United States outside of border areas is expected to increase in the future.** It is also expected that the no action and proposed action scenarios will result in Mexican-domiciled vehicles being used to carry freight that is currently being carried by U.S.-domiciled trucks and that it is possible that they may actually increase total truck traffic in the U.S. by reducing the costs associated with shipping freight by truck.***

If the emission levels of Mexican-domiciled trucks were equal to those of U.S.-domiciled vehicles in the past, present, and future, the only potential air quality impact associated with the no action and proposed action scenarios would be an increase in total truck traffic in the U.S. However, in general, emission levels of Mexican-domiciled trucks have not been, are not now, and will not be the same as those of U.S.-domiciled trucks for at least two reasons. First, as discussed in more detail later, the emission standards that have applied and will apply to Mexican-domiciled trucks are, in general, higher than those for comparable U.S.-domiciled trucks. Based on the best current information, it

---

*"Comprehensive Truck Size and Weight Study," U.S. Dept. of Transportation, August 2000.

**"NAFTA, Coordinated Operational Plan Needed to Ensure Mexican Trucks Compliance with U.S. Standards," U.S. GAO, December 2001.

***"North American Trade and Transportation Corridors: Environmental Impacts and Mitigation Strategies," ICF Consulting, August 2001.

appears that there will be a large difference in NOx, PM, and VOC emission levels between new U.S. trucks and new Mexican trucks beginning in 2007 when stringent new U.S. emission standards and a U.S. nationwide requirement for production of ultra-low sulfur Diesel fuel begin to be phased in. Secondly, Mexican-domiciled trucks tend, on average, to be older than those domiciled in the U.S. This, coupled with the fact that older trucks have higher emissions than newer vehicles, again leads to a situation where even if all other things were equal, Mexican-domiciled trucks would have higher emissions than comparable U.S.-domiciled trucks.

Based on the above, there are two air quality issues of concern with respect to the proposed action:

1. Higher emissions in the United States resulting from the operation of Mexican-domiciled trucks as replacements for U.S.-domiciled trucks, and

2. Higher emissions in the United States resulting from an increase in freight demand due to the lower costs associated with freight shipping with Mexican-domiciled trucks.

Although not properly addressed in the FMCSA EA, these issues are of concern both now as well as into the foreseeable future.

Relevant Air Quality Issues In the United States

In the United States, the federal government has established National Ambient Air Quality Standards (NAAQS) for a number of pollutants in order to protect public health. The NAAQS set exposure limits that are generally cast in terms of limits on the maximum concentration of pollutants that the public can be exposed to during some period of time. Compliance with the NAAQS is determined for relatively small geographical areas (rather than the United States as a whole) based on air quality monitoring data. Areas in which pollutant concentrations exceed those allowed are described as being in "nonattainment" with respect to the NAAQS.

With respect to the matter at hand—the EA for the proposed FMCSA action—potential adverse impacts on the ability of areas to achieve and maintain compliance with NAAQS for ambient ozone and fine particulate matter (PM)* represent significant air quality issues. Ozone is formed by a complex series of reactions between HC and NOx in the presence of sunlight. It is a strong irritant to the lungs and eyes and at high concentrations causes shortness of breath and also aggravates asthma, emphysema, and

*Particulate matter is generally characterized in terms of particle diameter, with PM_{10} referring to particulate matter with diameters of 10 microns or less and $PM_{2.5}$ referring to particulate matter with diameters of 2.5 microns or less.

other conditions. Fine PM can penetrate deep into the lungs where it becomes deposited, which causes and aggravates respiratory problems, decreases in lung function, and premature death. It should also be noted that there are two types of fine PM: (1) particles that are directly emitted from sources such as the exhaust of Diesel engines, and (2) so-called "secondary" particles that form in the atmosphere due to gas to particle conversion. NOx can be an important chemical species with respect to secondary particle formation.

It should also be noted that, although delayed by litigation, it appears that new NAAQS for both ozone and fine PM (in this case $PM_{2.5}$) will be enforced by the U.S. EPA. These new NAAQS are considered to be more stringent than the existing NAAQS for ozone and fine PM (PM_{10}). There are different degrees of "nonattainment" with the NAAQS that have been established. For the current one-hour ozone NAAQS, in order of increasing nonattainment, these are marginal, moderate, serious, severe, and extreme. For the current one-hour PM_{10} NAAQS, the categories are moderate and serious.

States in which nonattainment areas are located are required pursuant to federal law to develop plans that specify the actions that will be taken to reduce pollutant levels to the degree required to comply with the NAAQS prior to deadlines specified by federal law. Once compliance with the NAAQS is achieved, additional plans are required under federal law that specify the actions that will be taken to control emissions so that compliance with the NAAQS will be maintained in the future. Failure to come into compliance with NAAQS by the required deadlines and to maintain compliance can lead to the imposition of economic sanctions by the federal government and, in some cases, intervention by the federal government that involves the development and enforcement of a plan to bring the area into compliance.

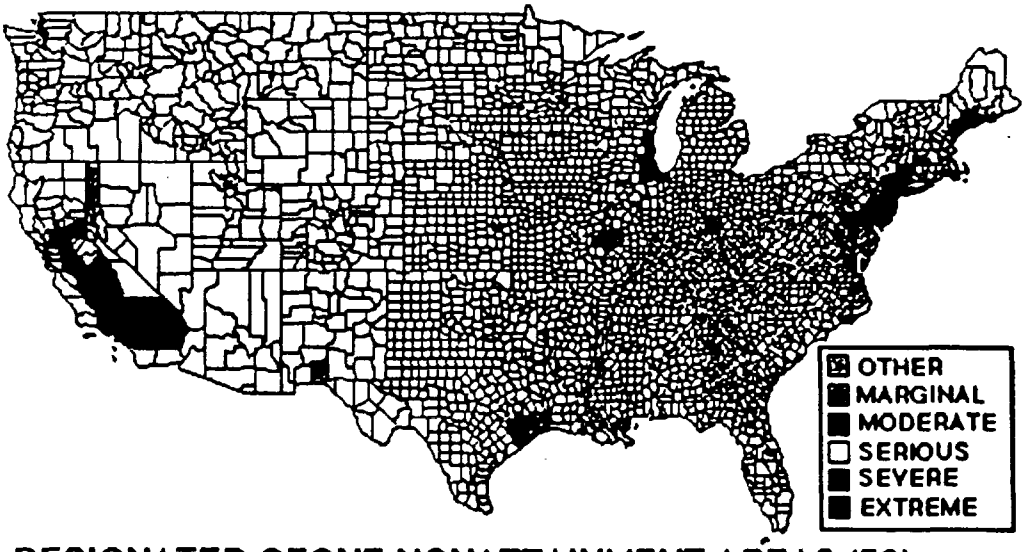
In addition to the legal requirements regarding the attainment of the NAAQS in given areas, there are legal requirements that compel federal government agencies to assess the impact of their actions on emissions levels in areas where there are currently or have been violations of the NAAQS. These requirements are referred to as "conformity" and the applicable provisions with respect to the no action and proposed action scenarios are found in §51 and 93 of Title 40, Code of Federal Regulations. As set forth in those sections, a conformity analysis may be required if the emission increases associated with an action equal or exceed the values shown in Table 1.

Currently, there are a number of areas of the country that are in nonattainment for either or both the ozone and PM_{10} NAAQS. These areas are shown in Figures 1 and 2 for ozone and PM_{10}, respectfully. All areas of the U.S. are required to come into attainment with the current ozone standard by 2010 and no later than 2007 (considering possible extensions) for PM_{10}.

As shown in Figure 1, many urban areas in the Southwestern U.S.—including the San Diego, Los Angeles, and Central Valley areas of California, Phoenix, Arizona; and Houston, Dallas, and El Paso, Texas—are currently in nonattainment with the existing ozone NAAQS. Similarly, Figure 2 shows that many of these areas and others are also in nonattainment with the current PM_{10} NAAQS.

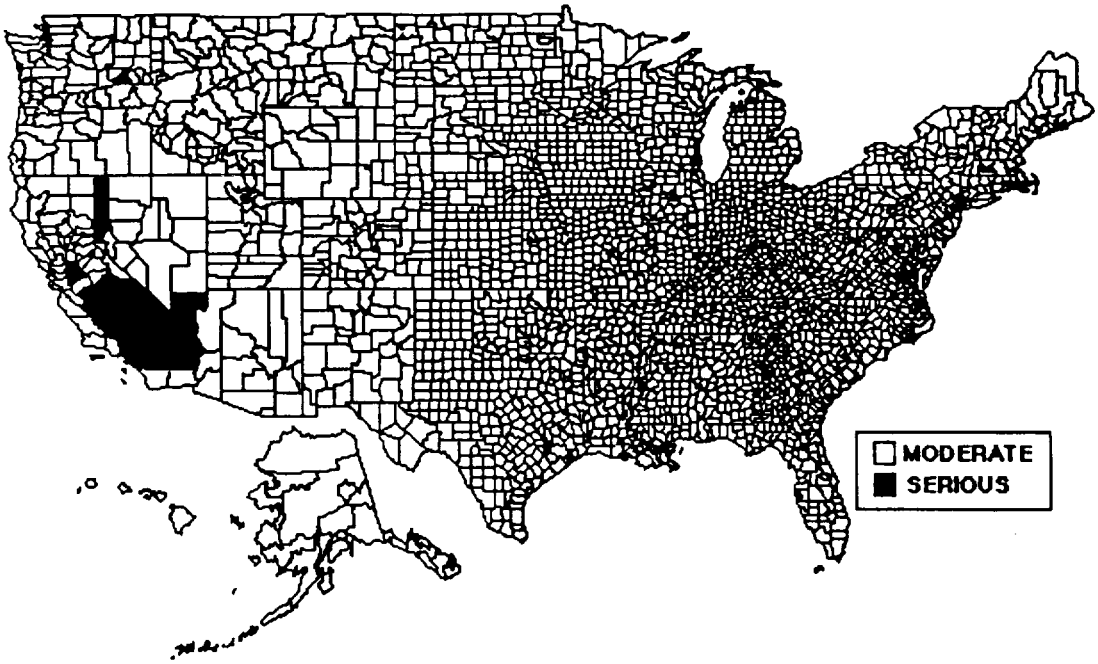
Table 1 Selected Emission Increases Associated with Federal Actions That Trigger Conformity Requirements (levels not to be equaled or exceeded)		
NAAQS/Area Designation	Pollutant	Emission Increase (tons per year/(tons per day))
Ozone/Extreme	VOC or NOx	10/(0.03)
Ozone/Severe	VOC or NOx	25/(0.07)
Ozone/Serious	VOC or NOx	50/(0.14)
Ozone/Other with Transport	VOC	50/(0.14)
Ozone/Other with Transport	NOx	100/(0.27)
Ozone/Other without Transport	VOC or NOx	100/(0.27)
Ozone/Maintenance	NOx	100/(0.27)
Ozone/Maint. with Transport	VOC	50/(0.14)
Ozone/Maint. without Transport	VOC	100/(0.27)
PM_{10}/Serious	PM_{10}	70/(0.19)
PM_{10}/Moderate	PM_{10}	100/(0.27)
PM_{10}/Maintenance	PM_{10}	100/(0.27)

Figure 1
Identification of Nonattainment Areas for the 1-Hour Ozone Standard



DESIGNATED OZONE NONATTAINMENT AREAS (56)
1-HOUR STANDARD
UNDER CLEAN AIR ACT AMENDMENTS OF 1990
AS OF JANUARY 15, 2002 1/2002
Source: Based upon U.S. EPA data interpreted by A.S.L. & Associates, Helena, MT

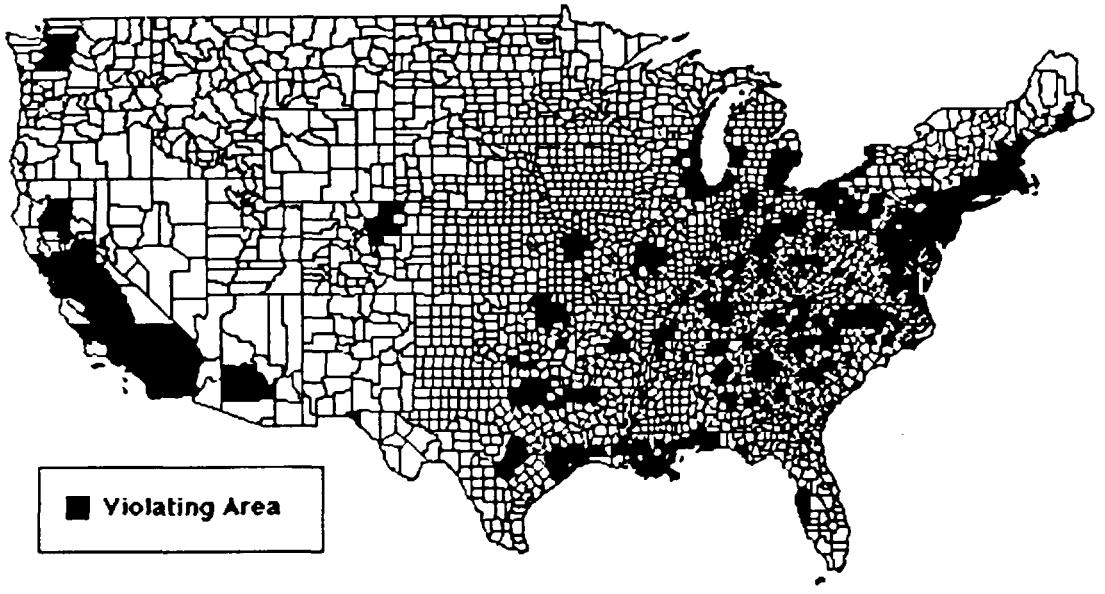
Figure 2
Current Nonattainment Areas for PM_{10} Standard



Source: A.S.L. & Associates, Helena, Montana USA

Similar figures showing likely nonattainment areas for the new federal ozone and $PM_{2.5}$ NAAQS are shown in Figures 3 and 4, respectively. As shown in Figures 3 and 4, these and more areas are projected to be in nonattainment with the new ozone and $PM_{2.5}$ NAAQS when the U.S. EPA makes formal determinations. Compliance deadlines with the new standards have not yet been set, although they are sure to extend beyond the deadlines for the current NAAQS.

Figure 3
Identification of Counties that May Violate the 8-Hour Ozone Standard
(Based on 1998-2000 Data*)



PROJECTED VIOLATION AREAS FOR THE 8-HOUR OZONE STANDARD
(1998-2000)

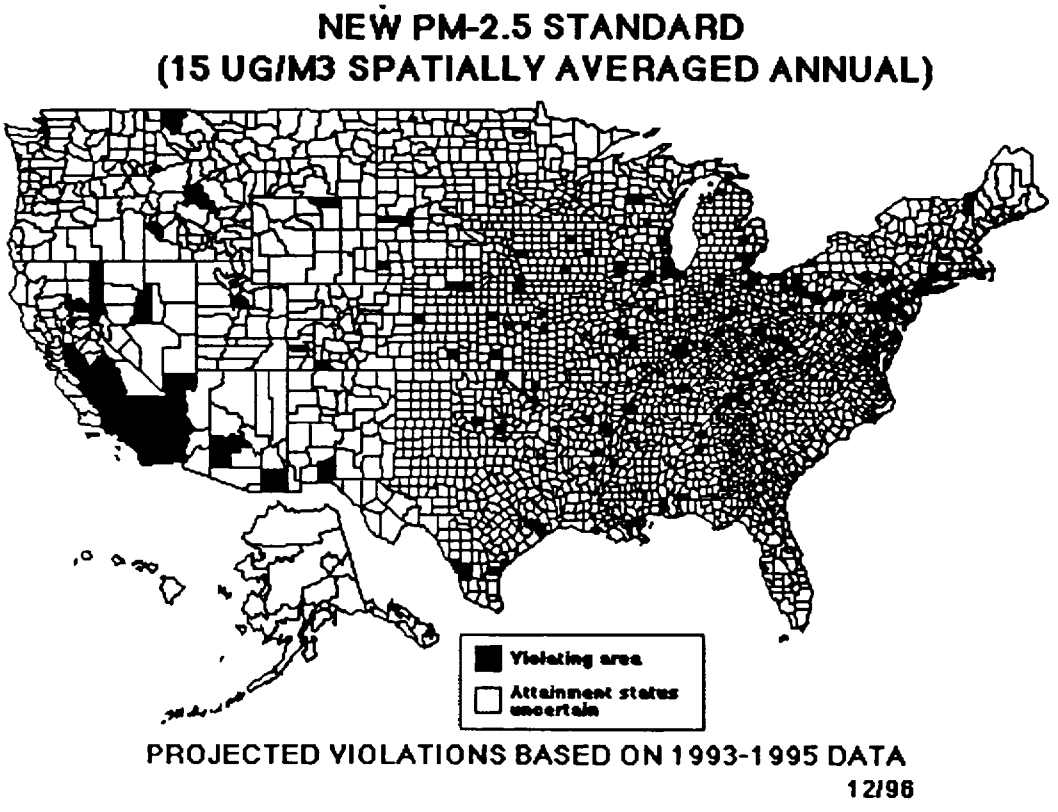
Source: Based upon U.S. EPA data interpreted by A.S.L. & Associates, Helena, MT
7/2001

Figure 5 depicts the expected U.S. freight corridors for U.S./Mexico truck traffic resulting from NAFTA as projected by the U.S. Federal Highway Administration for 2020. As seen by comparing this figure with the nonattainment area maps in Figures 1–4, major freight routes, where the amount of freight carried by Mexican-domiciled trucks may increase substantially, pass directly through many of the areas that are and will be in nonattainment of the ozone and fine PM NAAQS. Similar data for 1996 also show the same major freight routes for U.S./Mexico truck traffic.*

In addition to the NAAQS, the U.S. EPA also states in the preamble to the 2007 standards that it believes that Diesel exhaust "is likely to be carcinogenic in humans by inhalation" and notes that reductions in fine PM emissions along with emissions of the Toxic Air Contaminants (TACs) benzene, 1,3-butadiene, formaldehyde, and acetaldehyde resulting

*McCray, J.P., and Harrison, R., "NAFTA Trucks on U.S. Highway Corridors", Presented at the 78h Annual Meeting of the Transportation Research Board, Washington D.C., January 11-14, 1999.

Figure 4
Possible Nonattainment Areas for Spatially Averaged $PM_{2.5}$ 15 ug/m3 Annual Standard 1993-1995



from the 2007 standards will reduce public exposure to this hazard. As Mexican-domiciled trucks will not be subject to the same standards as U.S.-domiciled trucks, absent changes in Mexican requirements, they will present a greater toxics risk.

Finally, it should be noted that the state of California has established its own ambient air quality standards, which are in general more stringent than the federal NAAQS. The California Air Resources Board (CARB) is charged with reducing emissions sufficiently to attain both the federal and state standards. This is a difficult challenge as evidenced by CARB's recent release of a comprehensive Clean Air Plan* that indicates that the agency will be required to adopt increasingly costly emission reduction measures in order to achieve its goals. Increases in emissions associated with the operation of Mexican-domiciled trucks in California will hinder the state's ability to achieve those goals and require the adoption of even more costly measures than would otherwise be necessary.

---

* California Air Resources Board, Proposed "Clean Air Plan: Strategies for a Healthy Future, 2002 to 2020," March 15, 2002.

Figure 5
NAFTA—US/Mexico Truck Traffic on US Highway Network in 2020

Source: Federal Highway Administration, Office of Freight Management and Operations

Implications

As outlined above, many areas in the Southwestern and Southern United States currently violate and are likely to continue to violate health-based federal NAAQS applicable to ozone and fine PM. Federal law requires those areas to develop plans for reducing emissions to lower ambient concentrations of these pollutants and to come into compliance with the NAAQS by specific dates. Heavy-duty Diesel vehicles are widely recognized as contributing to high ambient levels of ozone and fine particulate matter and for that reason have been required to meet increasingly stringent emission standards established by the U.S. EPA. In addition, in light of this fact, the U.S. EPA recently adopted dramatically more stringent emission standards for Diesel vehicles and specifications for Diesel fuel to enable compliance with those standards, specifically to aid areas such as these in their quest to comply with the NAAQS.*

Now, in almost diametric opposition to the above, the federal government is proposing an action that may result in the operation of large numbers of higher-emitting Mexican-domiciled Diesel trucks operating in nonattainment areas. This clearly undercuts the

*Federal Register, Vol. 66, No. 12, 5002-5193, January 18, 2001

recent U.S. EPA rulemaking and will make compliance with the NAAQS more difficult than it would otherwise be (or perhaps impossible) for those areas. Further, the FMCSA EA upon which the FONSI with respect to air quality is based either ignores or improperly addresses these issues.

CRITICAL REVIEW OF FMCSA EA

Summary of FMCSA EA

The air quality related portion of the FMCSA EA is found on pages 3-9 through 3-12 of Section 3 entitled "Affected Environment" and on pages 4-14 through 4-24 of Section 4 entitled "Environmental Consequences," with additional details presented in Appendix C.

In Section 3, the EA recognizes the NAAQS and the air quality planning process for nonattainment areas (including the related transportation planning requirements), and notes that some of the counties directly on the Mexican border and in the location of the busiest border crossings are in nonattainment with either the current ozone or PM NAAQS or both.

The EA also notes correctly both that mobile sources make a significant contribution to total emissions of VOC, NOx, and PM emissions and that heavy-duty Diesel vehicles are of concern from an air quality perspective primarily because they emit substantial amounts of NOx and PM.

In Section 4, the potential impacts of the proposed action on air quality are addressed. The basic methodology employed in the EA compares emissions from Mexican-domiciled vehicles operating in the U.S. in 2002 under each scenario to total U.S. emissions from all on-road vehicles in the U.S. and then to total emissions from all sources in the U.S. based on data developed by the U.S. EPA for 1999. Emissions of Mexican-domiciled vehicles were assumed to be equal to those of U.S.-domiciled vehicles. The numbers of Mexican-domiciled vehicles assumed to be operating in the U.S. under each scenario during 2002 were estimated by FMCSA. These estimates indicate that on the order of 30,000 Mexican-domiciled trucks will begin to operate inside the U.S. beyond the current border areas in 2002 alone.

Emissions associated with proposed safety inspections of Mexican-domiciled vehicles are estimated separately for 2002 using the U.S. EPA MOBILE5b and PART5 emission factor models and are also compared to total U.S. emissions in 1999. Again, estimates of the numbers of vehicles tested and the characteristics of those inspections were developed by FMCSA and are not documented in the EA. In addition, emissions from Mexican trucks were apparently assumed to be the same as comparable U.S. trucks although it appears that the older age of Mexican-domiciled vehicles was taken into account to some degree in this limited section of the EA air quality impacts analysis.

Flawed Air Quality Analysis Methodology

The air quality analysis methodology used in the EA is fatally flawed due to a number of serious methodological deficiencies and the use of a number of erroneous assumptions. As a result, the methodology used in the EA is completely inappropriate for assessing the air quality impacts of the no action and proposed action scenarios. Because the air quality analysis is fatally flawed, the FONSI with respect to air quality is inappropriate because it is not supported.

The fundamental flaws with the air quality analysis contained in the EA include the following:

1. Failure to consider impacts in the proper geographical regions;
2. Failure to consider impacts over the proper time horizon;
3. Failure to account for differences in emissions between Mexican- and U.S.-domiciled trucks;
4. Failure to consider impacts of emissions of toxic air contaminants (TACs); and
5. Failure to properly assess the impacts on air quality.

The nature and import of these flaws are outlined below and should be addressed through an EIS. In addition, an assessment of the potential emission impacts of the no action and proposed action alternatives indicates that those impacts generally exceed the thresholds beyond which transportation conformity analysis requirements are triggered for affected nonattainment and maintenance areas.

Inappropriate Analysis Areas

The FMCSA EA evaluates the emission impacts of the no action and proposed action scenarios in light of annual nationwide emissions from on-road trucks. This approach is invalid and the results are meaningless with respect to the assessment of the significance of air quality impacts.

Air quality issues, including ozone and fine PM concentrations, are usually evaluated for relatively small geographical areas. For example, attainment and nonattainment designations with respect to the various NAAQS may be areas that represent only a portion of a single county. The reason for this is that local air quality particularly is determined primarily by local emissions and local meteorological conditions.

As shown previously in Figure 5 and the maps in Figures 1–4, the impacts of the no action and proposed action alternatives are likely to occur along major trucking corridors that pass through areas that are not in attainment with the current and future ozone and fine PM NAAQS. It is in these areas where the assessment of impacts needs to be performed. Obviously, even if an increase in emissions that represents only a small fraction of nationwide emissions occurs in an localized area with pre-existing air quality problems—such as San Diego, El Paso, Houston, or Dallas—that increase could either prevent or substantially delay attainment with the NAAQS.

The magnitude of the potential impacts of Mexican-domiciled trucks must be investigated in each of the major urban areas in the Southwest that are currently in nonattainment with ozone and PM NAAQS as well as those likely to be in nonattainment with the new ozone and fine PM standards and those where maintenance plans are in effect. In addition, analyses may need to be performed for other nonattainment areas that are much further from the border, including Baton Rouge, St. Louis, and potentially the major urban areas of the eastern seaboard. Again, it should also be noted that the purpose of U.S. EPA conformity requirements that apply in localized areas is to ensure that federal actions such as this do not result in the exceedance of delayed compliance with applicable NAAQS.

Inappropriate Analysis Period

The EA analyzes the impact of the no action and proposed action alternatives for only a single year—2002. No explanation is provided for why this is appropriate or how an analysis performed for only a single year is satisfactory to assess the impacts of the alternatives that will extend into the future and will change over time. As noted previously, the areas that may be adversely affected by the alternatives must come into compliance with current federal air quality standards late in this decade and with future standards probably sometime during the next decade. Therefore, the analysis should be carried out over a much longer period, in our opinion through at least 2020.

As shown above, Mexican-domiciled trucks will have higher emissions than U.S.-domiciled trucks, with the differences in emissions increasing over time. This fact must be taken into account in the EA. Further, it is clear from Section 3 of the EA that Mexican imports and northbound border crossings of trucks from Mexico are increasing over time. Further, the FHWA data shown in Figure 5 incorporate an estimated 3.4% annual increase in freight traffic into and out of Mexico from the U.S. in developing the estimates for 2020. This means that even without a shift in freight from U.S.- to Mexican-domiciled trucks, there will be greater numbers of the latter operating in the U.S. in the future.

It is also likely that there will be a shift in freight from U.S.- to Mexican-domiciled trucks that will further increase their operation in the U.S. over time. There are several reasons for this, including the following:

1. New Mexican trucks will likely be less expensive to purchase and operate than comparable new U.S. trucks because they will not be required to certify to the

same stringent emission standards (which require the use of expensive aftertreatment devices) and will not suffer the associated fuel economy penalties; and

2. The ability of U.S. trucks designed to comply with the 2007 U.S. EPA standards and to operate on ultra-low sulfur Diesel fuel will likely be limited (because of the required aftertreatment devices) if that fuel is not available in Mexico, as engine manufacturers probably will not honor warranties for vehicles that have been misfueled with higher sulfur Diesel fuels.

Therefore, any assessment of the actual operation of Mexican-domiciled trucks operating in the U.S. needs to consider both the short- and long-term impacts since there are likely to be significant changes in the amount of freight traffic handled by Mexican trucks operating in the U.S. over time. Again, the existing EA completely ignores this significant issue.

Differences In Emission Rates of Mexican- and U.S.-Domiciled Class8b Trucks

The EA assumes that the amount of emissions that results from the per-mile operation of Mexican- and U.S.-domiciled trucks is the same. This assumption is incorrect for two reasons. First, for a given model year, the U.S. truck will have been required, in general, to meet more stringent emissions standards. Second, based on available data, the average Mexican truck is older than the average U.S. truck and, again in general, will have higher emissions regardless of its state of repair because older trucks are certified to less stringent emission standards.

Dealing first with the issue of different emission rates and standards, Table 2 shows how, on the basis of emissions, Mexican-domiciled trucks translate to U.S.-domiciled trucks as a function of model year. The development of this table and the sources of information are described in detail in Appendix A, along with all required assumptions.

The data in Table 2 were then used in combination with the latest versions of the U.S. EPA (MOBILE6 and PART5) and California Air Resources Board (EMFAC2001) emission models.* assuming that the vehicles operated in the Houston or San Diego areas, respectively, to generate gram per mile traveled emission rates for the average Mexican-

*The MOBILE/PART and EMFAC emissions models have been developed by the U.S. EPA and CARB explicitly for estimating current and future year emissions from on-road vehicles and are required to be used in the preparation of air quality plans for California areas (EMFAC) and other areas of the country (MOBILE/PART). They are also used to evaluate the impact of proposed emission control measures.

Table 2 Emissions Equivalency Between Mexican- and U.S.-Domiciled Heavy-Duty Diesel Vehicles as a Function of Model Year	
Mexican Truck Model Year(s)	Equivalent U.S. Truck Model Year(s) for Emissions
1966-1969	1966
1970-1972	1968
1973-1974	1971
1975-196	1973
1977-1978	1975
1979-1980	1977
1981-1982	1979
1983	1980
1984-1985	1981
1986	1982
1987-1988	1983
1989-1990	1986
1991	1988
1992	1989
1993-2003	1993-2003
2004+	2003

and U.S.-domiciled class8b heavy-duty Diesel trucks. Rates were calculated for 2000, 2002, 2007, 2010, 2015, and 2020. As shown in Tables 3 and 4, the composite emission rates for U.S.-domiciled trucks are lower in all years using both models.

The data presented in Tables 3 and 4 do not consider differences in the average age of Mexican-domiciled trucks versus U.S.-domiciled trucks. Data regarding the differences in the ages of the two fleets were developed for use in estimating emissions of Mexican trucks from a "Mexicanized" version of the U.S. EPA MOBILE5 model prepared by Radian International under contract to the Western Governor's Association.*

Those data were used in combination with the data and models used to develop the information presented in Tables 3 and 4 to estimate the combined impact of different emission standards and older average ages on the relative per-mile emissions of Mexican-

*"Mexico Emissions Inventory Program Manuals, Volume VI, Motive Vehicle Inventory Development," Radian International, May 17, 1996.

Table 3
Comparison of Per-Mile Emission Rates of Mexican- and U.S.-Domiciled Class8b Heavy-Duty Diesel Vehicles
Accounting for Different Emission Standards Using MOBILE6/PART5

	Emission Rates (grams per mile of operation)							
	NOx		$PM_{2.5}$		PM_{10}		VOC	
Year	Mexican	U.S.	Mexican	U.S.	Mexican	U.S.	Mexican	U.S.
2000	25.70	25.45	0.66	0.56	0.73	0.62	1.29	1.05
2002	22.96	21.65	0.54	0.47	0.59	0.51	1.07	0.90
2007	16.69	13.00	0.34	0.31	0.38	0.34	0.72	0.60
2010	14.95	9.39	0.29	0.19	0.31	0.21	0.67	0.49
2015	13.46	4.45	0.23	0.08	0.25	0.09	0.61	0.37
2020	12.80	2.18	0.21	0.05	0.23	0.05	0.60	0.33

Table 4
Comparison of Per-Mile Emission Rates of Mexican- and U.S.-Domiciled Class8b Heavy-Duty Diesel Vehicles
Accounting for Different Emission Standards Using EMFAC2001 for San Diego

	Emission Rates (grams per mile of operation)							
	NOx		$PM_{2.5}$		PM_{10}		VOC	
Year	Mexican	U.S.	Mexican	U.S.	Mexican	U.S.	Mexican	U.S.
2000	21.53	19.13	0.58	0.45	0.63	0.48	1.34	0.96
2002	19.91	18.06	0.49	0.38	0.53	0.41	1.17	0.87
2007	16.60	12.83	0.29	0.23	0.32	0.26	0.81	0.63
2010	15.05	9.31	0.22	0.15	0.24	0.16	0.66	0.48
2015	13.89	5.23	0.18	0.08	0.19	0.09	0.56	0.32
2020	13.48	3.32	0.17	0.04	0.18	0.05	0.55	0.25

and U.S.-domiciled class8b trucks. The results are shown in Tables 5 and 6. As shown, the difference in average emission rates between the two fleets of vehicles becomes larger when both the effect of differences in emission rates and standards as well as the average age of the fleet are taken into account.

Additional details regarding the development of the data presented in Tables 3–6 can be found in Appendix A.

Table 5
Comparison of Per-Mile Emission Rates of Mexican- and U.S.-Domiciled Class8b Heavy-Duty Diesel Vehicles Accounting for Both Different Emission Standards and Differences in Average Vehicle Age Using MOBILE6/PART5

	Emission Rates (grams per mile of operation)							
	NOx		$PM_{2.5}$		PM_{10}		VOC	
Year	Mexican	U.S.	Mexican	U.S.	Mexican	U.S.	Mexican	U.S.
2000	31.54	25.45	1.49	0.56	1.63	0.62	3.33	1.05
2002	29.23	21.64	1.35	0.47	1.48	0.51	2.67	0.90
2007	24.62	13.00	0.82	0.31	0.90	0.34	1.34	0.60
2010	22.47	9.39	0.58	0.19	0.64	0.21	1.04	0.49
2015	18.03	4.45	0.29	0.08	0.32	0.09	0.71	0.37
2020	14.68	2.18	0.21	0.05	0.23	0.05	0.68	0.33

Table 6
Comparison of Per-Mile Emission Rates of Mexican- and U.S.-Domiciled Class8b Heavy-Duty Diesel Vehicles Accounting for Both Different Emission Standards and Differences in Average Vehicle Age Using EMFAC2001

	Emission Rates (grams per mile of operation)							
	NOx		$PM_{2.5}$		PM_{10}		VOC	
Year	Mexican	U.S.	Mexican	U.S.	Mexican	U.S.	Mexican	U.S.
2000	24.86	19.13	0.84	0.45	0.92	0.48	2.01	0.96
2002	23.16	18.06	0.72	0.38	0.78	0.41	1.77	0.87
2007	20.42	12.82	0.46	0.23	0.50	0.26	1.34	0.63
2010	18.30	9.31	0.33	0.15	0.36	0.16	1.08	0.48
2015	16.11	5.23	0.22	0.08	0.24	0.09	0.90	0.32
2020	14.43	3.32	0.18	0.04	0.20	0.05	0.78	0.25

Focusing on NOx and PM emissions, the impact of the operation of Mexican-domiciled trucks in the U.S. can be seen in Figures 6 and 7 in terms of the ratio of their emissions on a per-mile basis to those of U.S.-domiciled trucks. Figure 6 shows the ratio of Mexican-

Figure 6

Ratio of Per-Mile Mexican Domiciled Truck Emissions to U.S. Domiciled Truck Emissions (MOBILE6/PART5 - Houston)

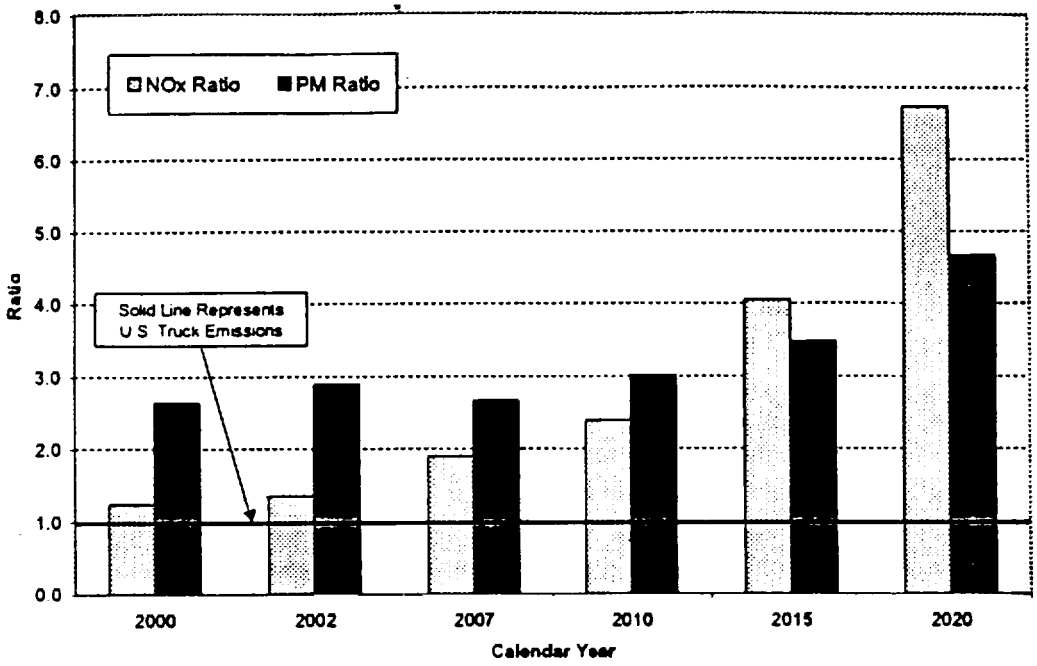
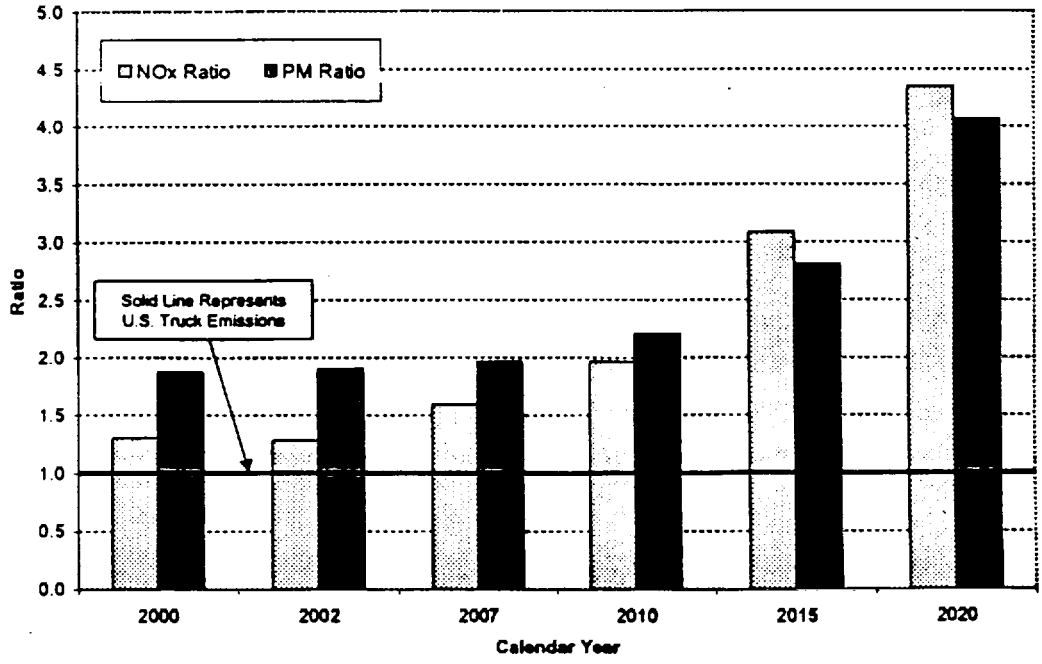


Figure 7

Ratio of Per-Mile Mexican Domiciled Truck Emissions to U.S. Domiciled Truck Emissions (EMFAC2001 - San Diego)



domiciled truck emissions to U.S. truck emissions for NOx and PM for the fleets in operation from calendar year 2000 to 2020 as estimated using the U.S. EPA MOBILE6/PART5 models and the data described above. In the figure, a ratio of one means that Mexican-domiciled truck emissions are exactly equal to those of U.S.-domiciled trucks while ratios greater than one indicate higher emissions from the Mexican trucks. As shown in Figure 6, Mexican-domiciled trucks will have higher NOx and PM emissions than U.S. trucks over the entire 20-year period examined. In 2007, the year that Houston is required to attain the ozone NAAQS, emissions of NOx and PM for each mile of travel by Mexican trucks will be equivalent to 1.9 and 2.7 miles, respectively, of travel by U.S. trucks. Further, this emissions differential will grow dramatically from 2010 to 2020. Figure 7 shows that similar results are obtained when the issue is examined using California's EMFAC2001 emission model and data for the San Diego area.

Failure to Consider Toxic Air Contaminant Impacts

Emissions of TAC from heavy-duty Diesel vehicles are also a major concern. TACs that are emitted by Diesel vehicles include directly emitted Diesel PM, benzene, 1,3-butadiene, formaldehyde, and acetaldehyde. These latter four compounds represent a subset of VOC emissions. The magnitude of the concern posed currently by Diesel vehicles is illustrated in a recent study performed by the South Coast Air Quality Management District.* In that study, it was reported that Diesel PM emissions accounted for about 71% of the total risk associated with exposure to all TACs in southern California, with the other four TACs (which are also emitted by gasoline vehicles) accounting for the bulk of the remaining risk.

As shown above, Mexican-domiciled trucks will have substantially higher PM emissions than U.S.-domiciled trucks and that difference in emissions will increase over time. As indicated by the data in Tables 5 and 6, the ratio of Mexican-domiciled truck VOC emissions to U.S.-domiciled truck VOC emissions ranges from about 1.5 to 2.5, meaning that the Mexican trucks emit approximately that much more of these TACs than do U.S. trucks.

The FMCSA EA fails to address the issue of increased emissions of TACs due to the no action or proposed action scenarios in any way. Emissions of TACs will clearly increase as a result. Given this, the impacts of the no action and proposed action alternatives on TAC emissions and ambient TAC levels need to addressed. This again is another area where the no action and proposed action alternatives run directly counter to the recent EPA rulemaking setting stringent standards for heavy-duty Diesel vehicles, which were intended in part to reduce public exposure to TACs.

*Multiple Air Toxic Exposure Study (MATES-II), South Coast Air Quality Management District, March 2000.

Failure to Properly Assess the Impacts on Air Quality in Specific Areas and to Perform Transportation Conformity Analyses

As noted above, the air quality impacts associated with the no action and proposed action alternatives must be considered in those nonattainment areas where they will actually occur. In addition, the potential emission increases associated with the alternatives need to be compared to the conformity thresholds in Table 1; if those thresholds are exceeded, a conformity analyses may be required.

As an example of the impacts that Mexican-domiciled trucks could have in the near term, we evaluated the effects associated with a 50% replacement of U.S. trucks by Mexican trucks on NOx and PM_{10} emissions occurring in three ozone nonattainment areas. This value has been used in previous analyses of the impacts of lifting the current restrictions on Mexican-domiciled truck operation in the U.S[*] as a reasonable estimate of the amount of U.S. domiciled-truck activity that could be replaced in the long term by Mexican-domiciled trucks in urban areas near the Mexican-U.S. Border. (That there could be significant NAFTA-related truck travel through these urban areas is, again, demonstrated by Figure 5.) It should also be noted that in this analysis the impacts of Mexican-domiciled trucks on NOx and PM_{10} emissions are linearly proportional to the assumed percentage displacement of U.S.-domiciled truck activity. Additional details regarding this analysis are presented below and contained in Appendix A.

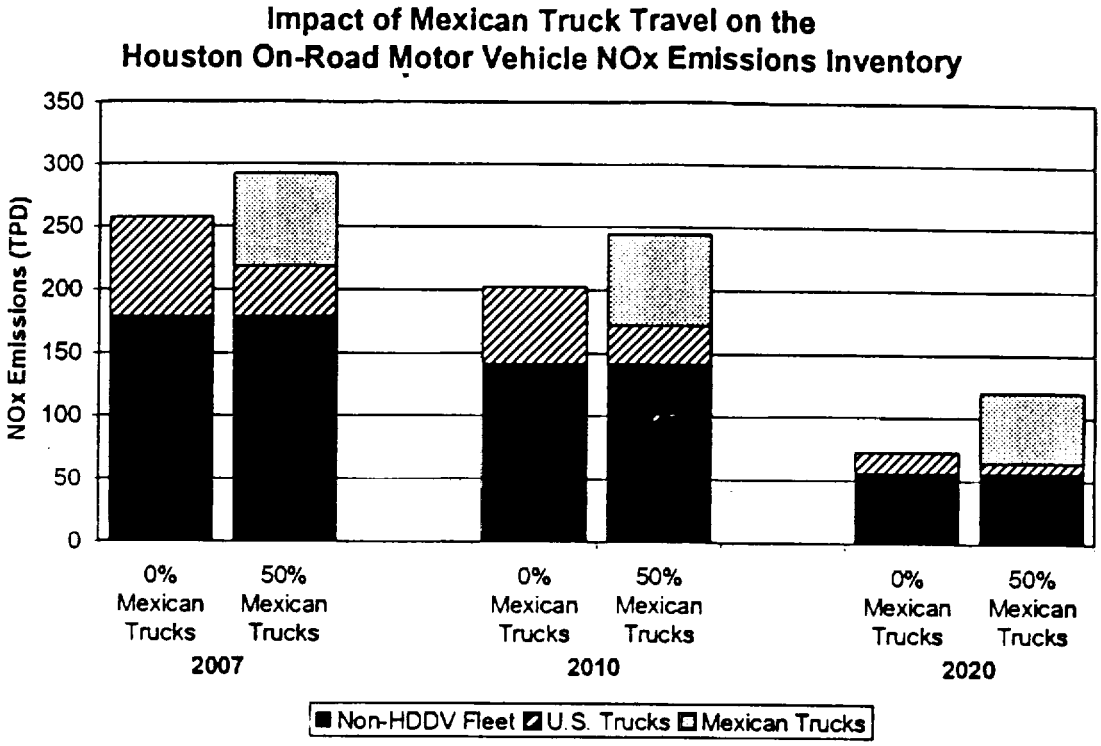
The first area analyzed was Houston, Texas, which is a severe ozone nonattainment area and is in compliance with the NAAQS for PM_{10}. NOx and PM_{10} impacts were evaluated for 2007 (the year that Houston must come into compliance with the ozone NAAQS), 2010, and 2020 using MOBILE6/PART5 relative to total emissions of these pollutants from the on-road vehicle fleet. As shown in Figure 8, using the assumptions stated above, the operation of Mexican-domiciled trucks in the Houston area would increase NOx emissions by about 35 tons per day in 2007, 42 tons per day in 2010, and 48 tons per day by 2020 relative to a baseline where only U.S.-domiciled trucks were in operation in the area. In addition, NOx emissions from Mexican-domiciled trucks would account for an ever-increasing fraction of the total on-road NOx inventory in the area and account for about 40% of the inventory by 2020.

The NOx increases shown in Figure 8 should be compared to the 0.07 ton per day conformity threshold value for NOx emissions in severe ozone nonattianment areas presented in Table 1. For the scenario analyzed, this threshold is exceeded by 500 times (35 tons per day/0.07 tons per day). To put these numbers in a slightly different perspective, in order to fall under the conformity threshold, Mexican-domiciled trucks would have to account for no more than 0.1% of heavy-duty truck operation in the Houston area in 2007 (50% of truck operation divided by a 500 times reduction in NOx emissions required to fall below the threshold in 2007) and smaller fractions in later years.

---

[*] "North American Trade and Transportation Corridors: Environmental Impacts and Mitigation Strategies," ICF Consulting, August 2001.

Figure 8



A similar comparison for PM_{10} emissions is presented in Figure 9. As shown, direct PM_{10} emissions from on-road mobile sources in the Houston area will be increased by 1.7 tons per day in 2007 by the operation of Mexican-domiciled trucks based on the stated assumptions, with that value declining to about 0.7 tons per day in 2020. These values should be compared to the conformity threshold level of 0.27 tons per day for areas maintaining compliance with the PM_{10} NAAQS. Again, the conformity threshold is greatly exceeded by the estimated emissions increase due to Mexican-domiciled trucks.

The second area analyzed was San Diego, which is a serious ozone nonattainment area and is in attainment with the current PM_{10} standards. The same assumptions noted above were again used in combination with the EMFAC2001 model. Figure 10 shows NOx impacts for 2007, 2010, and 2020. As shown, the results are similar to those observed for Houston, with the increase in NOx emissions due to the assumed operation of Mexican-domiciled trucks growing from about 8 tons per day in 2007 to about 15 tons per day in 2020. These NOx increases offset a substantial portion of the reductions that would be realized from the control of NOx emissions from U.S. domiciled trucks. Even the 8 ton per day value exceeds the 0.14 ton per day conformity analysis threshold by a factor of approximately 50. This means that in order for the threshold not be exceeded, Mexican domiciled trucks would have to account for 1% or less of truck operation in the San Diego area (50% of operation divided by a 50 times reduction required in NOx emissions).

Figure 9

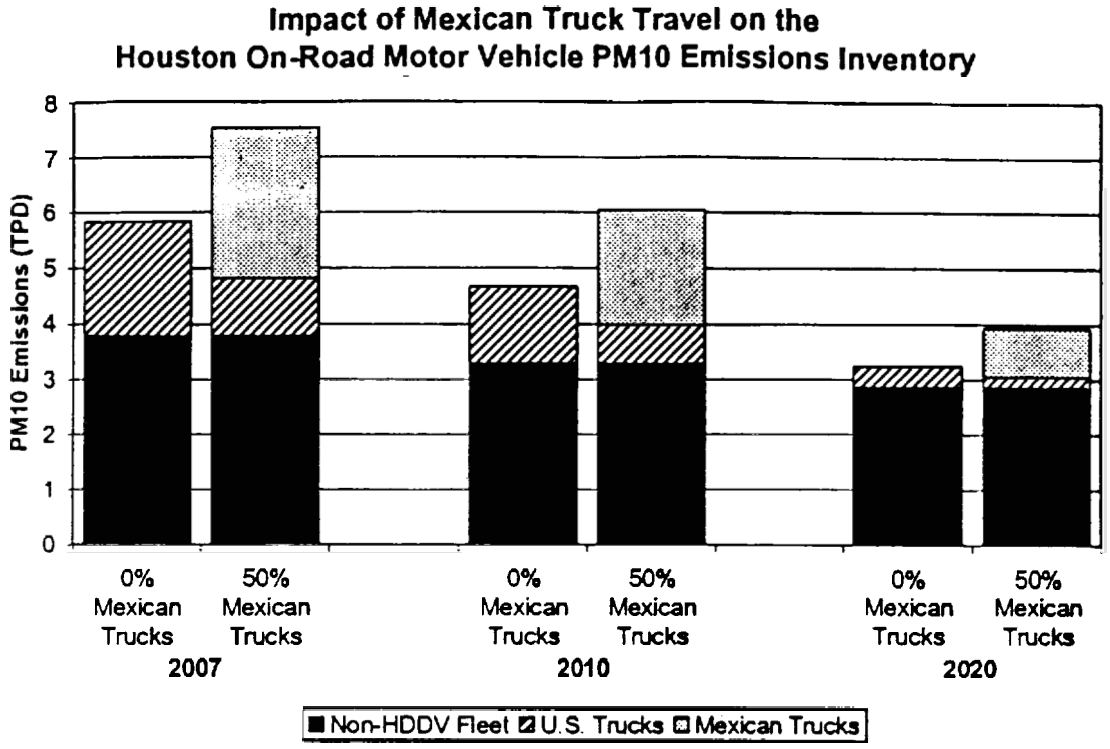
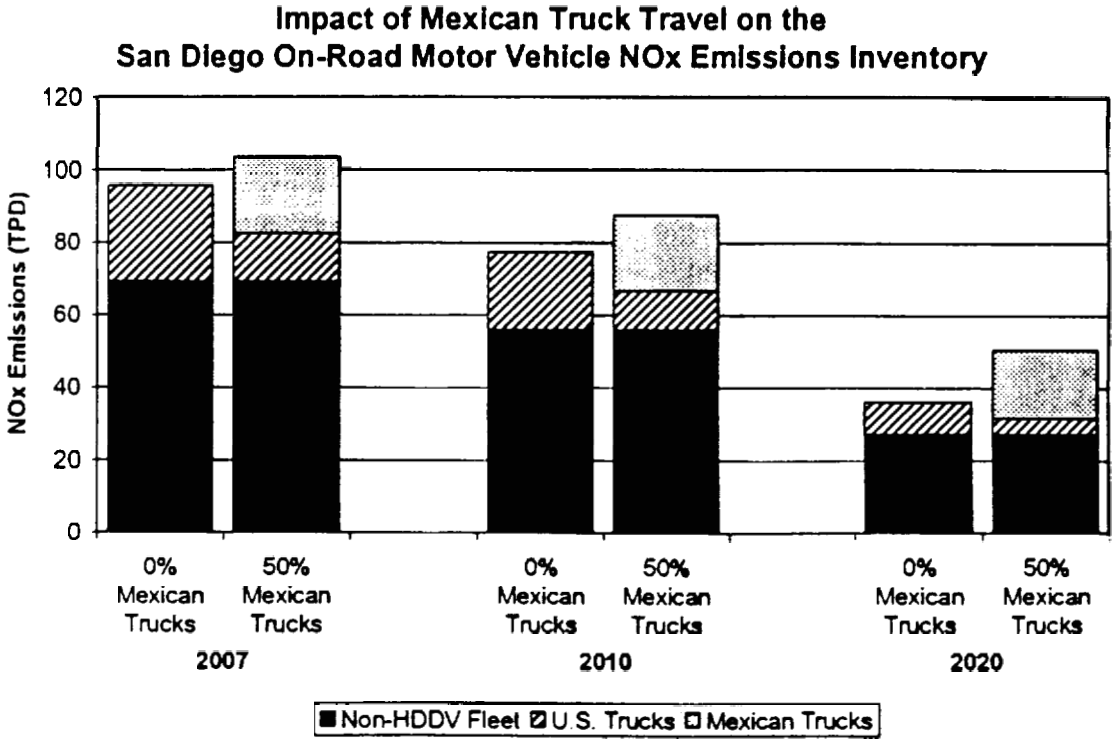
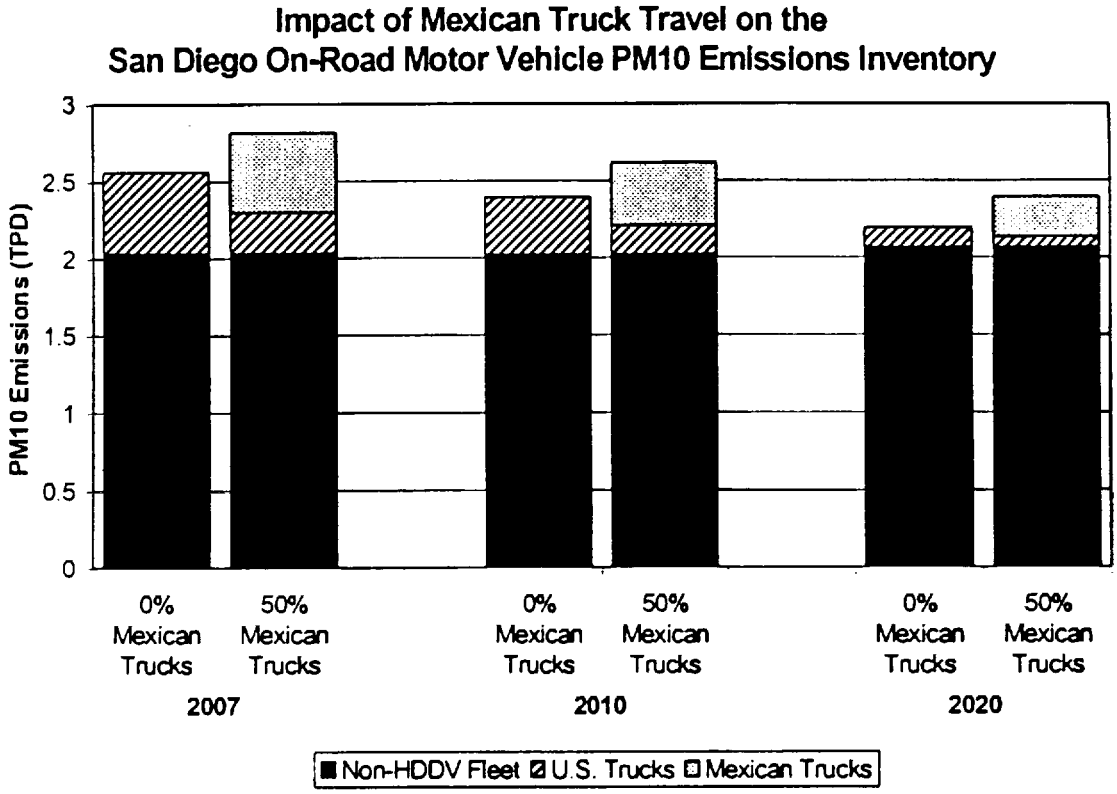


Figure 10



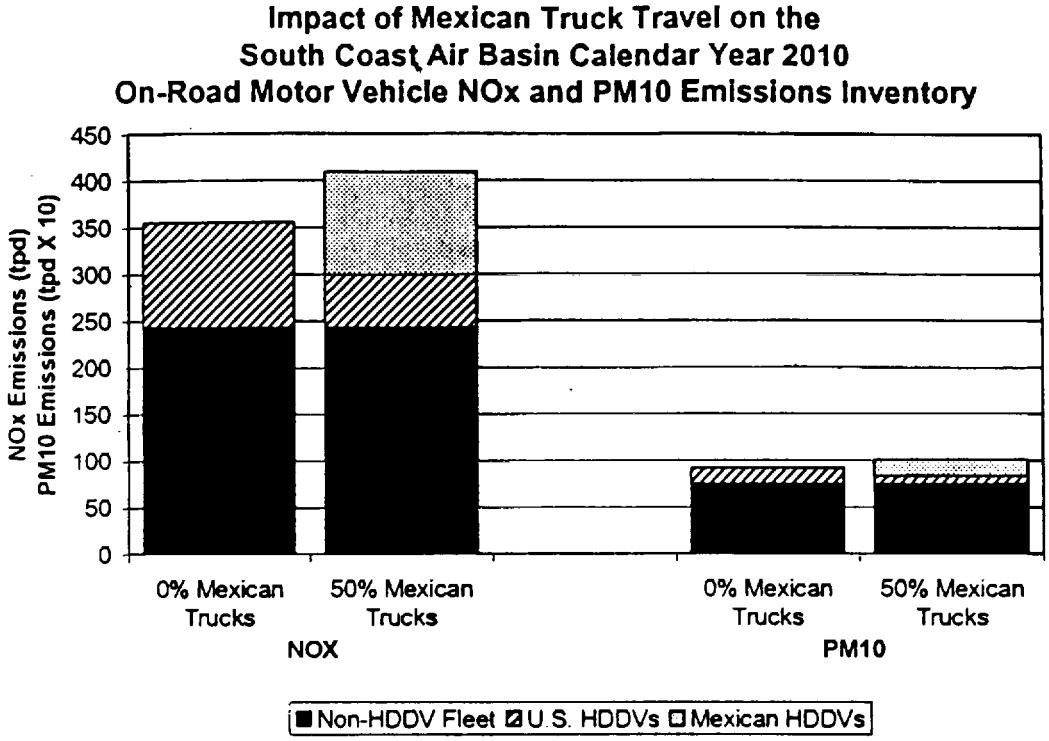
PM_{10} emission impacts for San Diego are shown in Figure 11. Again, they are similar to those observed for Houston but in this case do not exceed the conformity threshold of 0.27 tons per day that applies for areas maintaining compliance with the current PM_{10} NAAQS.

Figure 11



Finally, because it is currently the only extreme ozone nonattainment area in the U.S. as well as a serious PM_{10} nonattainment area, results are presented for the South Coast Air Basin for 2010, the year that this area must come into compliance with the ozone NAAQS. The results are presented in Figure 12 for NOx and PM_{10}. As shown, for the scenario analyzed, NOx emissions would be increased by more than 50 tons per day. Comparing this value to the 0.03 ton per day conformity threshold from Table 1 shows that the emissions impact of this scenario exceeds the conformity threshold by a factor of approximately 1,700. It also indicates that if the impact of Mexican truck operations is to fall below the conformity threshold, Mexican trucks can account for only 0.03% (50% operation divided by a required reduction of 1,700 times) of heavy-duty truck operations in the South Coast Air Basin in 2010. Similarly, direct PM_{10} emissions in 2010 would be increased by about 1.2 tons per day compared to the conformity threshold of 0.19 tons per day.

Figure 12



It should be noted, for all of the examples presented above, that the estimated PM increases do not account for the impact of higher NOx emissions and other factors associated with Mexican-domiciled truck operation on secondary PM levels.

In addition to the above, the impact of increased Diesel emissions due to an increase in the number of safety inspections needs to be examined on a highly localized basis that includes the inspection site itself and the area immediately surrounding the inspection site. Such analyses are routinely performed in response to local, state, and federal requirements for projects ranging from street widening to the construction of parking garages and new truck terminals and focus in particular on exposures to toxic emissions. No analysis of this type has been performed as part of the EA and, again, it is wholly inappropriate to compare the associated increase in emissions to total nationwide truck emissions for purposes of assessing the significance of impacts.

Appendix A

Estimating the Impacts of Mexican Truck Travel on Emissions from Heavy-Duty Diesel Vehicles in Houston and San Diego

The emissions impacts associated with increased Mexican truck traffic were quantified in terms of the increase in the mass of pollutants emitted per day, i.e., in units of tons per day (tpd). To calculate emissions from on-road motor vehicles, two parameters are generally needed:

- An emission factor (in grams of emissions per mile of vehicle travel, or g/mi), and
- The total number of miles traveled by the vehicles of interest.

By multiplying the g/mi emission factor by the number of vehicle miles traveled per day (mi/day), one obtains an estimate of the daily emissions associated with the vehicles operated in a given area.

For this analysis, it was necessary to generate separate emission factors for the Mexican vehicle fleet and the fleet of U.S.-based trucks operating in the Houston and San Diego areas. That is because the Mexican truck fleet is typically much older than the U.S. fleet, and it has been subject to less stringent emissions standards over the years. The discussion below describes how the emission factors were developed for the Houston fleet, the San Diego fleet, and for Mexican trucks operating in each of these areas. In addition, a sensitivity analysis was conducted for the South Coast Air Basin (SCAB) in California. The approach used for that analysis followed the San Diego analysis.

Emission Factors

The emission factors used in this analysis were derived from several different emission factor models. The California Air Resources Board (CARB) has its own emission factor model (EMFAC2001), which was used to generate the emission factors for the San Diego fleet. The remainder of the country uses the MOBILE6 and PART5 models, which were developed by the U.S. Environmental Protection Agency (EPA).* In addition, a Mexico-

* Note that the California emissions model, EMFAC2001, estimates emissions of ROG, CO, NOx , PM_{10}, and $PM_{2.5}$. On the other hand, EPA's MOBILE6 model estimates emissions of VOC, CO, and NOx, while the PART5 model is used to estimate emissions of PM10 and PM2.5.

specific model (MOBILE5-Mexico) was developed in 1996 by Radian International for the Western Governor's Association.* That model is based on an earlier version of MOBILE6 and incorporates model-year vehicle registration fractions (and resulting travel fractions) that are specific to the Mexican vehicle fleet. Since this model is a simplified version of MOBILE that has not been widely used or reviewed by industry professionals, Sierra did not use the model itself to generate emission factors for the Mexican fleet. Instead, as described below, the Mexico-specific travel fractions and some of the model-year-specific emission rate assumptions from the Mexican MOBILE model were applied to standard MOBILE6 model output and EMFAC2001 output to generate gram-per-mile emission factors for the Mexican heavy-duty Diesel vehicle (HDDV) fleet.

Houston-Area Emission Factors - EPA's MOBILE6 and PART5 models were used to generate emission factors for the U.S.-based fleet operating in the Houston area. These models were operated in their default modes, which assumes national average model-year registration distributions (i.e., the percentage of HDDVs within each model year).

Both models allow the user to select an optional model-year specific output format specifically for "Class 8B" heavy-duty Diesel vehicles. This output format was used to obtain individual g/mi emissions estimates, as well as travel fractions (i.e., the fraction of total HDDV mileage accumulated by each individual model year making up the fleet) for the 25 separate model years that are assumed to make up the in-use fleet. Composite emission factors for each calendar year analyzed are then calculated by multiplying each model-year travel fraction by its corresponding emission factor, then summing the total of these products. A sample calculation for NOx emissions in calendar year 2010 is shown in Table 1 for the MOBILE6 model.

Several points are worth noting with respect to the baseline MOBILE6 estimates contained in Table 1:

- Twenty-five different model years are assumed to make up the fleet, with newer vehicles contributing more to the total miles traveled than older vehicles (i.e., the travel fraction for newer vehicles is greater than it is for older vehicles). That is because there are more of newer vehicles in the fleet (older vehicles are removed through attrition) and newer vehicles are typically driven more than older vehicles.

- The travel fraction and emission rate for model year 2010 is assumed to be zero in the example above. That is because the model was run for a January 1 basis, and new HDDV sales are assumed to begin on January 1 of the calendar year being analyzed. This is slightly different than the case for light-duty vehicles, in which new model year sales are assumed to begin on October 1 of the previous calendar year.

---

* "Mexico Emissions Inventory Program Manuals: Volume VI - Motor Vehicle Inventory Development, Final," prepared by Radian International for the Western Governors' Association, Denver, Colorado, May 17, 1996.

Table 1

Sample Calculation of Calendar Year 2010 HDDV Class 8B NOx Emission Rate Based on MOBILE6 (January Basis)

Model Year	Vehicle Age	Travel Fraction	NOx Emission Factor (g/mi)	TF X EF (g/mi)
2010	0	0.0000	0.000	0.000
2009	1	0.1529	3.478	0.532
2008	2	0.1296	3.554	0.461
2007	3	0.1100	3.623	0.398
2006	4	0.0932	6.805	0.634
2005	5	0.0790	6.890	0.544
2004	6	0.0670	6.966	0.467
2003	7	0.0568	7.916	0.450
2002	8	0.0482	11.420	0.550
2001	9	0.0408	16.287	0.664
2000	10	0.0346	16.339	0.566
1999	11	0.0293	16.386	0.481
1998	12	0.0249	18.787	0.468
1997	13	0.0211	20.299	0.429
1996	14	0.0178	20.109	0.359
1995	15	0.0152	20.720	0.315
1994	16	0.0129	20.726	0.266
1993	17	0.0109	28.889	0.315
1992	18	0.0092	30.170	0.278
1991	19	0.0078	24.473	0.192
1990	20	0.0066	22.855	0.152
1989	21	0.0057	28.471	0.161
1988	22	0.0048	27.679	0.132
1987	23	0.0041	26.477	0.108
1986	24	0.0175	26.477	0.464
		Fleet-Average Emission Rate (= Sum of TF X EF):		9.39

Note that two adjustments were made to the $PM_{2.5}$ and PM_{10} emission factors generated by the PART5 model to reflect recently promulgated EPA rules that are not accounted for in the base version of that model: (1) a 90% reduction in HDDV exhaust PM emission rates was applied to 2007 and newer model year vehicles; and (2) the sulfate portion of the exhaust emission rate for pre-2007 model year vehicles was reduced to reflect low-sulfur Diesel fuel requirements (i.e., 15 ppm sulfur) that are implemented nationwide in 2007. Note that the NOx elements of the 2007 HDDV rule are incorporated in the base MOBILE6 model.

For the sake of consistency, the HDDV travel fractions generated with MOBILE6 were used to calculate the composite emission factors from both models. We chose to use the MOBILE6 travel fractions rather than those from PART5 because the MOBILE6 fractions are more current and are therefore a better representation of the in-use fleet.

San Diego Area Emission Factors - CARB's EMFAC2001 model (version 2.07) was used to calculate the emission factors for the San Diego area. The model was run such that

model-year-specific emissions were selected.* However, EMFAC2001 calculates emission factors for as many as 45 different model years, with 1965 being the oldest model year considered by the model. This fundamental difference in the modeling approaches for the MOBILE6 vs. EMFAC2001 models results in a slightly greater percentage of emissions assigned to higher-emitting, older vehicles in the EMFAC2001 result than in the MOBILE6 result. This effect is slightly offset by the fact that older vehicles do not travel as many miles per year, so the total gram-per-mile emission factors are comparable between the two models.

Inspection of the EMFAC2001 output showed that although the 2007 heavy-duty vehicle NOx standards recently adopted by both the EPA and CARB are reflected in the modeling results, the new 2007 PM standards are not. Starting in 2007, the PM certification standards are due to be reduced by 90%. To account for this apparent error in the base EMFAC2001 model, Sierra reduced the 2007 and newer model year EMFAC PM emission rates by 90%.

Mexican Fleet Emission Factors - As noted above, the Mexican MOBILE model is not widely used. Therefore, to generate model-year emission factors for the Mexican fleet, the model-year output from the MOBILE6, PART5, and EMFAC2001 models was modified to represent Mexican HDDVs via the application of a model-year mapping system. This mapping system essentially involves synchronizing the model-year Mexican HDDV emission standards and the U.S. model-year emission factors to which they most closely correlate. Mexico adopted its first HDDV standards in 1993 - standards identical to the Federal US HDDV standards already in place at that time. In addition, Mexico followed the US EPA's lead and adopted the more stringent PM10 and NOx standards which were required beginning in 1994 and 1998, respectively. The U.S. subsequently adopted even more stringent HDDV certification standards that go into effect in 2004 and 2007, but Mexico has not followed suit. Thus, it was assumed that the emissions from U.S. and Mexican trucks directly correlate for model years 1993 through 2003 (while their certification standards were identical) but that Mexican trucks sold after 2003 have no better emissions than the equivalent of a U.S.-certified 2003 model year truck.

Such a mapping strategy was described in the Mexican MOBILE model documentation, but on close inspection did not appear to accurately reflect the Mexican fleet, as represented by the past and current Mexican certification standards. Therefore, Sierra has modified this mapping strategy as follows.

Mexican Model Years 1966-1992 - The first Mexican HDDV standards did not go into effect until 1993, which means any model-year mapping for the years 1966-1992 would require knowledge of those model year specific Mexican HDDV emission rates. In the absence of any such data, the mapping strategy included in the Mexican MOBILE model was used for these model years, as shown in Table 2.

---

* The output from EMFAC2001 is tons per day of pollutant. Because daily vehicle miles traveled are also reported in the model output, it was possible to divide the emissions estimates (in tons per day) by the daily VMT to arrive at a g/mi value for each model year considered by the model.

Mexican Model Years 1993-2003 - From 1993 to 2003, the Mexican and U.S. certification standards for HDDVs were identical. Therefore, it was assumed that the emissions for these model year vehicles are the same for U.S. and Mexican trucks, as shown in Table 2.

Mexican Model Years 2004-2020 - Mexico adopted the 1998 U.S. HDDV certification emission standards but has not adopted either the 2004 or 2007 standards, which are progressively more stringent. Therefore, in the absence of any other data, Table 2 shows that we have assumed the emissions from 2004 and subsequent model years are equal to the US 2003 levels—the last year the U.S. and Mexican certification standards were synchronized.

Table 2
U.S. to Mexican Model Year Mapping

Mexican Fleet Model Year	Equivalent U.S. MY for Emissions	Mexican Fleet Model Year	Equivalent U.S. MY for Emissions	Mexican Fleet Model Year	Equivalent U.S. MY for Emissions
1966	1966	1979	1977	1992	1989
1967	1966	1980	1977	1993	1993
1968	1966	1981	1979	1994	1994
1969	1966	1982	1979	1995	1995
1970	1968	1983	1980	1996	1996
1971	1968	1984	1981	1997	1997
1972	1968	1985	1981	1998	1998
1973	1971	1986	1982	1999	1999
1974	1971	1987	1983	2000	2000
1975	1973	1988	1983	2001	2001
1976	1973	1989	1986	2002	2002
1977	1975	1990	1986	2003	2003
1978	1975	1991	1988	2004+	2003

Model-Year-Specific Emission Rates - The mapping strategy described above was used to determine model-year-specific emission rates for Mexican HDDVs. The emission rates for HDDVs operating in the San Diego area were calculated by applying this mapping strategy to model-year output from the EMFAC2001 model. Likewise, MOBILE6 emission rates were used to calculate the Houston area Mexican HDDV emissions. For example, Table 1 shows that a 1990 model year Mexican truck has emissions comparable to a 1986 US truck. Therefore, emissions from a 1990 model year Mexican truck were assumed equal to the 1986 EMFAC2001 HDDV emission rates in San Diego, and equal to the 1986 MOBILE6 HDDV emission rates in Houston.

For the Houston emission rates, a number of additional adjustments were made to MOBILE6 estimates to best reflect the impact of off-cycle NOx emissions and the "Defeat Device" Consent Decree that was signed by EPA and the engine manufacturers

on Mexican-domiciled trucks. Three primary assumptions were made regarding off-cycle NOx emissions:

- Off-cycle NOx impacts were set to zero prior to model year 1993 and after model year 2001 for Mexican-domiciled trucks;
- The impacts of the Rebuild Program were not included in the Mexican-domiciled truck emission rates; and
- The impacts of the Pull-Ahead Program (i.e., early introduction of the 2004 standards) were not included in the Mexican-domiciled truck emission rates.

Similar adjustments were also made to the San Diego-based Mexican truck emission rates. However, because EMFAC2001 does not contain an explicit adjustment for the rebuild program, no adjustment was made to the Mexican-domiciled trucks to reflect the lack of a rebuild program.

Model-Year Travel Fractions - As discussed above and as shown in Table 1, composite calendar year emission rates are calculated by multiplying the model-year-specific emission rates by the corresponding travel fraction for each model year, and summing these products. The MOBILE5-Mexico model estimates emissions for five different regions in Mexico—Mexico City, Interior Urban, Interior Rural, Border Urban, and Border Rural. However, only three distinct HDDV travel fractions are calculated by the model: (1) Mexico City; (2) Interior Urban; and (3) Interior Rural, Border Urban, and Border Rural. These three sets of travel fractions, along with an average of the three, are shown in Figure 1. For estimating Mexican truck emission factors for this project, the average was used.

It is interesting to compare the Mexican truck travel fractions to the travel fractions predicted by the MOBILE6 and EMFAC2001 models. That comparison is shown in Figure 2. The estimates from the MOBILE5-Mexico model generally show a maximum travel fraction for vehicles in the 10 to 15 year range, while both MOBILE6 and EMFAC2001 show a maximum travel fraction for the newest vehicles. Because older vehicles typically have higher emissions than newer vehicles (because of emission control system deterioration and standards differences through time), a Mexican fleet would have higher emissions than a U.S. fleet even if the emission standards were the same between Mexico and the U.S. for all model years. Thus both the age of the fleet (and resulting travel fraction differences) and the standards differences contribute to higher average emissions from the Mexican fleet relative to the U.S. fleet.

Figure 1

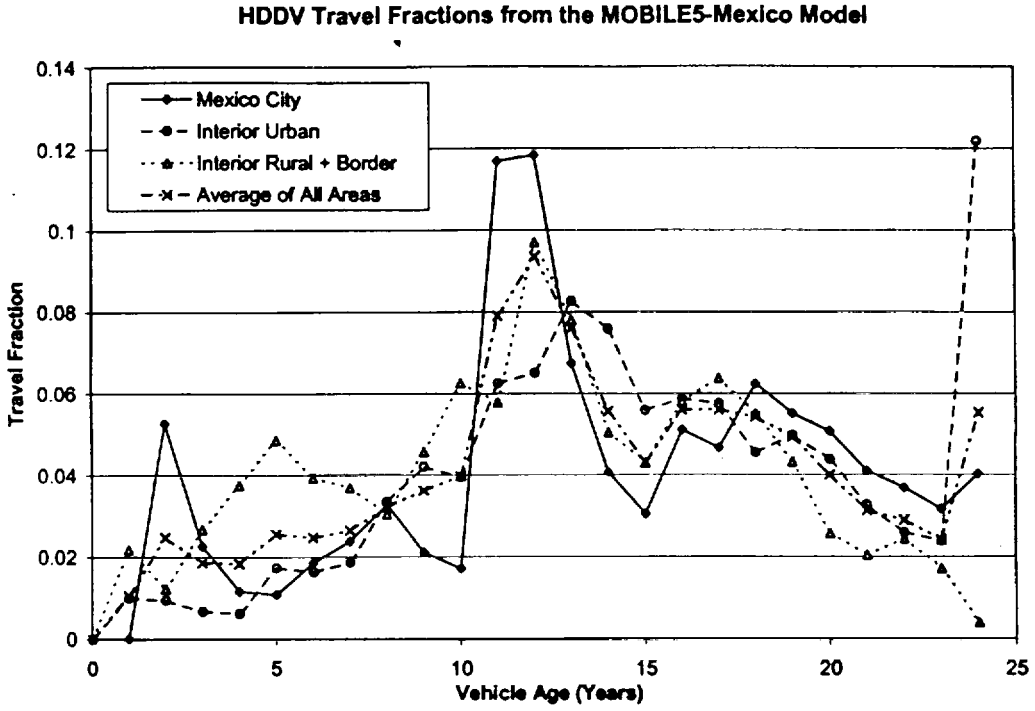


Figure 2

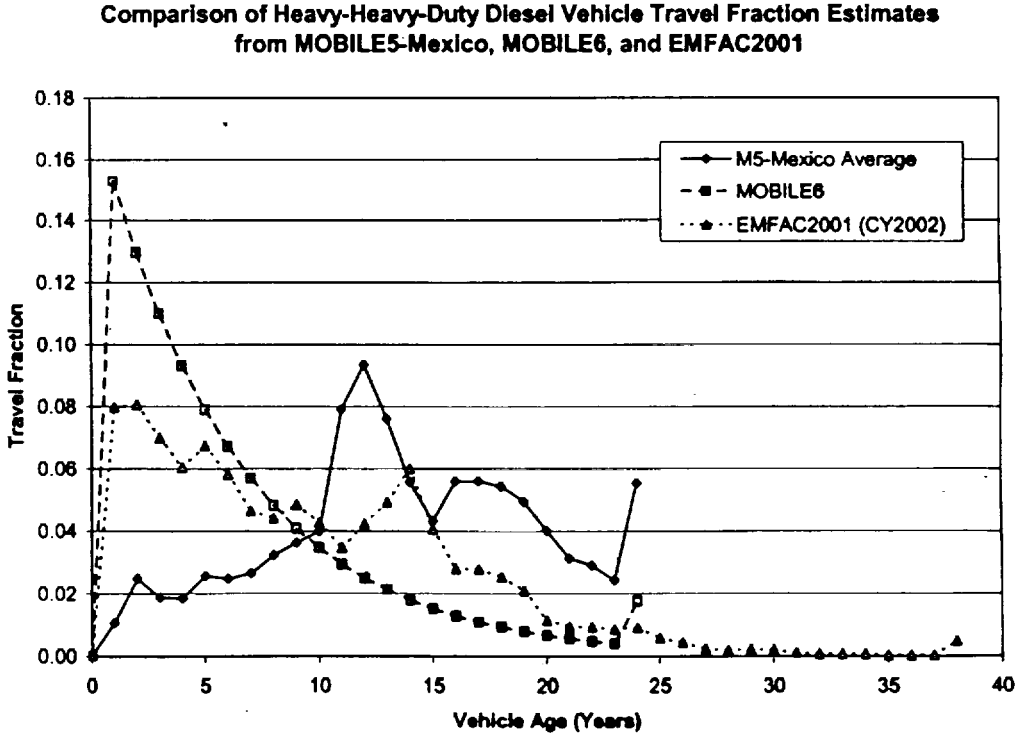


Table 3 compares of the Class 8B HDDV g/mi emission rates calculated for the Mexican fleet and the U.S. fleet (i.e., Houston) based on the MOBILE6 and PART5 models. Two estimates are given in the table—one based on only standards differences and the other based on both standards differences and travel fraction differences between the U.S. and the Mexican fleets. Similar results from EMFAC2001 for San Diego are presented in Table 4.

Table 3

Comparison of Gram-Per-Mile Emission Rates of Mexican and U.S.-Domiciled Class 8B HDDVs Using MOBILE6 and PART5

Standards Differences Only -- Travel Fractions the Same

	NOx (g/mi)		PM2.5 (g/mi)		PM10 (g/mi)		VOC (g/mi)	
CY	Mexican	U.S.	Mexican	U.S.	Mexican	U.S.	Mexican	U.S.
2000	25.70	25.45	0.66	0.56	0.73	0.62	1.29	1.05
2002	22.96	21.65	0.54	0.47	0.59	0.51	1.07	0.90
2007	16.69	13.00	0.34	0.31	0.38	0.34	0.72	0.60
2010	14.95	9.39	0.29	0.19	0.31	0.21	0.67	0.49
2015	13.46	4.46	0.23	0.08	0.25	0.09	0.61	0.37
2020	12.80	2.18	0.21	0.05	0.23	0.05	0.60	0.33

Standards and Travel Fractions Differences Included

	NOx (g/mi)		PM2.5 (g/mi)		PM10 (g/mi)		VOC (g/mi)	
CY	Mexican	U.S.	Mexican	U.S.	Mexican	U.S.	Mexican	U.S.
2000	31.54	25.45	1.49	0.56	1.63	0.62	3.33	1.05
2002	29.23	21.65	1.35	0.47	1.48	0.51	2.67	0.90
2007	24.62	13.00	0.82	0.31	0.90	0.34	1.34	0.60
2010	22.47	9.39	0.58	0.19	0.64	0.21	1.04	0.49
2015	18.03	4.46	0.29	0.08	0.32	0.09	0.71	0.37
2020	14.68	2.18	0.21	0.05	0.23	0.05	0.68	0.33

Table 4

Comparison of Gram-Per-Mile Emission Rates of Mexican and U.S.-Domiciled Class 8B HDDVs Using EMFAC2001 for San Diego

Standards Differences Only -- Travel Fractions the Same

	NOx		PM2.5		PM10		VOC	
CY	Mexican	U.S.	Mexican	U.S.	Mexican	U.S.	Mexican	U.S.
2000	21.53	19.13	0.58	0.45	0.63	0.48	1.34	0.96
2002	19.91	18.06	0.49	0.38	0.53	0.41	1.17	0.87
2007	16.60	12.82	0.29	0.23	0.32	0.26	0.81	0.63
2010	15.05	9.31	0.22	0.15	0.24	0.16	0.66	0.48
2015	13.89	5.23	0.18	0.08	0.19	0.09	0.56	0.32
2020	13.48	3.32	0.17	0.04	0.18	0.05	0.55	0.25

Standards and Travel Fractions Differences Included

	NOx		PM2.5		PM10		VOC	
CY	Mexican	U.S.	Mexican	U.S.	Mexican	U.S.	Mexican	U.S.
2000	24.86	19.13	0.84	0.45	0.91	0.48	2.01	0.96
2002	23.16	18.06	0.72	0.38	0.78	0.41	1.77	0.87
2007	20.42	12.82	0.46	0.23	0.50	0.26	1.34	0.63
2010	18.30	9.31	0.33	0.15	0.36	0.16	1.08	0.48
2015	16.11	5.23	0.22	0.08	0.24	0.09	0.90	0.32
2020	14.43	3.32	0.18	0.04	0.20	0.05	0.78	0.25

Inventory Estimates

Emission inventory estimates for NOx, $PM_{2.5}$, PM_{10}, and VOC in units of tons per day (tpd) were generated for the San Diego and Houston areas for two scenarios: (1) no Mexican truck travel, and (2) 50% of the heavy HDDV (Class 8B) travel being made up of Mexican trucks. Because different models were used for the San Diego and Houston areas, they are covered separately below.

San Diego - As noted above, the San Diego emissions estimates were prepared with the EMFAC2001 model. That model contains estimates of daily vehicle miles traveled (VMT) as well as emission factors, and an emissions inventory (in tons per day) can be generated directly with the model. As a result, it was a straightforward process to prepare the emissions inventories for San Diego. Two estimates were prepared for this analysis: one assuming no travel by Mexican trucks and one assuming that Mexican trucks would make up 50% of the miles traveled by Class 8B HDDVs. For the first scenario, the model was run in its baseline configuration and the inventory estimates were used directly, with a slight modification to the $PM_{2.5}$ and PM_{10} estimates to reflect the 2007 HDDV standards as discussed above. For the second scenario, the heavy HDDV portion of the inventory was adjusted to reflect 50% Mexican truck travel. This adjustment was performed using the fleet emission factors developed in the previous section for the baseline fleet and the Mexican vehicle fleet. For example, the 2010 NOx emission factors for heavy-HDDVs were calculated as:

- U.S.-Domiciled NOx = 9.31 g/mi
- Mexican-Domiciled NOx = 18.30 g/mi

and the baseline heavy-HDDV NOx inventory is estimated by the model to be 21.27 tpd. To reflect 50% Mexican truck travel, the inventory estimate was adjusted as follows:

50% U.S. Truck Travel = 21.27/2 = 10.63 tpd
50% Mexican Truck Travel = (21.27/2)*(18.30/9.31) = 20.90 tpd

and the resulting heavy-HDDV NOx inventory is 10.64 + 20.90 = 31.53 tpd. This was then added to the non-heavy-HDDV fleet emissions to obtain the total impact of 50% Mexican truck travel on the San Diego inventory.

A summary of the inventory results for San Diego for calendar years 2007, 2010, 2015, and 2020 is contained in Table 5. Note that estimates were also prepared for the South Coast Air Basin (greater Los Angeles area) for 2010 using the same methodology outlined above for San Diego.

Table 5

Baseline San Diego Inventory (tpd) -- Adjusted for 2007 PM Standard

	Total On-Road Inventory				Heavy-HDDVs			
CY	NOx	PM2.5	PM10	ROG	NOx	PM2.5	PM10	ROG
2007	95.67	2.36	2.56	57.89	26.36	0.48	0.53	1.29
2010	77.26	2.21	2.39	46.86	21.27	0.34	0.37	1.09
2015	51.24	2.06	2.23	34.25	13.32	0.20	0.22	0.82
2020	36.06	2.03	2.20	26.96	8.7	0.12	0.13	0.66

San Diego Inventory (tpd) -- Assuming 50% of Heavy HDDV Truck Travel is Mexican Trucks

	Total On-Road Inventory				Heavy-HDDVs			
CY	NOx	PM2.5	PM10	ROG	NOx	PM2.5	PM10	ROG
2007	103.48	2.60	2.81	58.62	34.17	0.71	0.78	2.02
2010	87.52	2.42	2.62	47.56	31.53	0.55	0.59	1.79
2015	65.12	2.24	2.43	34.99	27.20	0.38	0.42	1.56
2020	50.59	2.21	2.39	27.68	23.23	0.29	0.32	1.36

Houston - The emission factors developed for the Houston area were based on EPA's MOBILE6 and PART5 emissions model. However, in order to generate a ton-per-day inventory estimate, the g/mi emission factors need to be combined with an estimate of vehicle miles traveled (VMT). Unlike the EMFAC2001 model, neither MOBILE6 nor PART5 contain VMT estimates. Instead, the emission factors and VMT estimates are combined outside of the model to prepare an emissions inventory.

The emission factors for Class 8B HDDVs were prepared for Mexican-domiciled trucks and for U.S.-domiciled trucks as described above. However, because it was desired to compare the Mexican truck emissions impacts relative to the entire motor vehicle fleet, it was necessary to prepare inventory estimates for the entire fleet of on-road vehicles. This

and PART5 ($PM_{2.5}$ and PM_{10}) with VMT estimates for the Houston area. The VMT estimates were obtained from the 2022 Metropolitan Transportation Plan for the Houston-Galveston area,* which consists of Brazoria, Chambers, Fort Bend, Galveston, Harris, Liberty, Montgomery, and Waller Counties. Those estimates are as follows:

- 2007 - 138 million miles per day;
- 2010 - 146 million miles per day; and
- 2020 - 170 million miles per day.

Using the above VMT estimates with the MOBILE6 and PART5 emission factors,** emission inventory estimates were prepared for two cases: one assuming no travel by Mexican trucks and one assuming that Mexican trucks would make up 50% of the miles traveled by Class 8B HDDVs. The resulting inventories for 2007, 2010, 2015, and 2020 are summarized in Table 6.

Table 6

Baseline Houston Inventory (tpd) -- Adjusted for 2007 PM Standard								
	Total On-Road Inventory				Heavy-HDDVs			
CY	NOx	PM2.5	PM10	VOC	NOx	PM2.5	PM10	VOC
2007	257.08	5.51	5.83	127.93	78.33	1.86	2.05	3.58
2010	201.97	4.45	4.67	103.32	60.28	1.25	1.37	3.17
2015	115.99	3.42	3.52	75.41	31.04	0.58	0.64	2.58
2020	72.52	3.18	3.24	58.28	16.55	0.34	0.37	2.48
Houston Inventory (tpd) -- Assuming 50% of Heavy HDDV Truck Travel is Mexican Trucks								
	Total On-Road Inventory				Heavy-HDDVs			
CY	NOx	PM2.5	PM10	VOC	NOx	PM2.5	PM10	VOC
2007	292.05	7.06	7.53	130.18	113.30	3.41	3.75	5.83
2010	243.97	5.70	6.04	105.07	102.28	2.50	2.75	4.92
2015	163.29	4.13	4.31	76.61	78.34	1.30	1.43	3.78
2020	119.94	3.80	3.93	59.61	63.97	0.97	1.06	3.81

* "Update of Metropolitan Transportation Plan 2022," Houston-Galveston Area Council, Adopted March 22, 2002.

** Note that the Houston MOBILE6 run prepared for this effort assumed that light-duty cars and trucks would be subject to an inspection and maintenance program as described on the Texas Natural Resource Conservation Commission web page (http://www.tnrcc.state.tx.us/air/ms/motoristchoice.html). In addition, it was assumed that reformulated gasoline would be in place. The MOBILE6 input file used for the baseline inventory development is attached.

Attachment

Baseline MOBILE6 Input File for Houston Inventory Development

```
***************     Header Section     ***************
MOBILE6 INPUT FILE

POLLUTANTS          : HC NOX

RUN DATA
***************     Run Section     ***************

> ASM Exhaust I/M program for pre-1996 MY LDGV/T
I/M PROGRAM         : 1 1983 2050 1 TRC ASM 2525/5015 PHASE-IN
I/M MODEL YEARS     : 1 1981 1995
I/M VEHICLES        : 1 22222 11111111 1
I/M STRINGENCY      : 1 20.0
I/M COMPLIANCE      : 1 96.0
I/M WAIVER RATES    : 1 3.0 3.0
I/M GRACE PERIOD    : 1 2
I/M EXEMPTION AGE   : 1 25


> OBD Exhaust I/M program for 1996+ MY LDGV/T
I/M PROGRAM         : 2 1983 2050 1 TRC OBD I/M
I/M MODEL YEARS     : 2 1996 2050
I/M VEHICLES        : 2 22222 11111111 1
I/M STRINGENCY      : 2 20.0
I/M COMPLIANCE      : 2 96.0
I/M WAIVER RATES    : 2 3.0 3.0
I/M GRACE PERIOD    : 2 2
I/M EXEMPTION AGE   : 2 25

> OBD Evap I/M program for 1996+ MY LDGV/T
I/M PROGRAM         : 3 1983 2050 1 TRC EVAP OBD
I/M MODEL YEARS     : 3 1996 2050
I/M VEHICLES        : 3 22222 11111111 1
I/M STRINGENCY      : 3 20.0
I/M COMPLIANCE      : 3 96.0
I/M WAIVER RATES    : 3 3.0 3.0
I/M GRACE PERIOD    : 3 2
I/M EXEMPTION AGE   : 3 25

* Assume refueling is included in area source inventory
NO REFUELING        :

* Detailed HDDV results
EXPAND HDDV EFS     :

MIN/MAX TEMP        : 77.0  96.0
FUEL RVP            : 6.7
FUEL PROGRAM        : 2 S

* Need to specify season because we are doing a January-based inventory
* to be consistent with MOBILE5-Mexico

SEASON              : 1

***************     Scenario Section     ***************
```

```
SCENARIO RECORD     : Baseline Houston - CY2007
CALENDAR YEAR       : 2007

SCENARIO RECORD     : Baseline Houston - CY2010
CALENDAR YEAR       : 2010

SCENARIO RECORD     : Baseline Houston - CY2015
CALENDAR YEAR       : 2015

SCENARIO RECORD     : Baseline Houston - CY2020
CALENDAR YEAR       : 2020

***************      End of This Run      ***************
END OF RUN
```

United States General Accounting Office

GAO

Report to Congressional Requesters

December 2001

NORTH AMERICAN FREE TRADE AGREEMENT

Coordinated Operational Plan Needed to Ensure Mexican Trucks' Compliance With U.S. Standards

GAO-02-238

Contents

Figures

Abbreviations

CVSA	Commercial Vehicle Safety Alliance
DOT	Department of Transportation
EPA	Environmental Protection Agency
FMCSA	Federal Motor Carrier Safety Administration
GSA	General Services Administration
LTSS	Land Transportation Standards Subcommittee
NAFTA	North American Free Trade Agreement

GAO
Accountability * Integrity * Reliability
United States General Accounting Office
Washington, DC 20548

December 21, 2001

The Honorable John D. Dingell
Ranking Minority Member
Committee on Energy and Commerce
House of Representatives

The Honorable James L. Oberstar
Ranking Democratic Member
Committee on Transportation and Infrastructure
House of Representatives

The Honorable Edolphus Towns
Ranking Minority Member
Subcommittee on Commerce, Trade, and Consumer Protection
Committee on Energy and Commerce
House of Representatives

The Honorable Robert A. Borski
Ranking Democratic Member
Subcommittee on Highways and Transit
Committee on Transportation and Infrastructure
House of Representatives

As part of the North American Free Trade Agreement (NAFTA), commercial trucks from Mexico were to be allowed to travel throughout the United States beginning in January 2000. Because of concerns about the safety of these vehicles, the United States has limited Mexican truck operations to commercial zones near the border. In February 2001, a NAFTA arbitration panel ruled that the United States' blanket refusal to process applications by Mexican trucking companies to provide cross-border services beyond the commercial zones violated its NAFTA obligations. The panel noted, however, that the United States could require Mexican motor carriers to meet U.S. safety requirements. In February 2001, the administration announced that it would give Mexican trucks access to all U.S. highways by January 2002. The Department of Transportation and Related Agencies Appropriations Act for Fiscal Year 2002, enacted in December 2001, provided increased funding for safety activities related to Mexican motor carriers and set forth a series of requirements that the Department of Transportation (DOT) must meet before Mexican trucks can travel beyond the commercial zones.

In response to your concerns about the safety of Mexican trucks, we examined (1) the extent to which Mexican-domiciled commercial trucks are likely to travel beyond the U.S. border commercial zones once the border is fully opened, (2) U.S. government agencies' efforts to ensure that Mexican commercial carriers meet U.S. safety and emissions standards, and (3) how Mexican government and private sector efforts contribute to ensuring that Mexican commercial vehicles entering the United States meet U.S. safety and emissions standards. To address these objectives, we met with and obtained documents from a wide variety of officials from the U.S. and Mexican governments and industry representatives. (See app. I for a detailed discussion of how we conducted our work.)

Results in Brief

Relatively few Mexican carriers are expected to initially operate beyond the commercial zones once the United States fully opens its highways to Mexican carriers. Specific regulatory and economic factors that may limit the number of Mexican carriers operating beyond the commercial zones include: (1) the lack of established business relationships beyond the U.S. commercial zones that would permit drivers to return to Mexico carrying cargo, (2) difficulties obtaining competitively priced insurance, (3) congestion and delays in crossing the U.S.-Mexico border that make long-haul operations less profitable, and (4) high registration fees. Over time, improvements in trucking and border operations may increase the number of Mexican commercial vehicles traveling beyond the commercial zones. For example, innovations such as automated clearance systems could reduce the need for time-consuming paperwork reviews at the border.

The Department of Transportation does not have a fully developed or approved operational plan in conjunction with border states to ensure that Mexican-domiciled carriers comply with U.S. safety standards. The Department has not secured permanent space at any of the 25 southwest border ports of entry where commercial trucks enter the United States, and, at present, only the state of California has established permanent inspection facilities. The Department also has not completed agreements with border states on how 58 federal inspectors (projected to increase to 141 in fiscal year 2002) and 89 state inspectors (some of whom work part-time) will share inspection responsibilities along the border. States are responsible for ensuring that Mexican trucks adhere to U.S. emissions standards. California is the only southwest border state with a truck emissions inspection program in place at the border—testing is conducted at two of its four commercial ports of entry. In addition to these infrastructure and personnel challenges, the fiscal year 2002 DOT appropriations act establishes new requirements for DOT. These include

deploying advanced technology to weigh trucks, requiring the electronic verification of Mexican commercial drivers' licenses, and ensuring that staff and adequate space are available for truck inspections. These additional requirements highlight the importance of having an approved operational plan and timeline.

While the Mexican government has developed truck safety regulations and taken steps to enforce safety and air emissions standards, these efforts are relatively recent and it is thus too early to assess their effectiveness. With DOT's support, Mexico has developed five databases with important information on the safety records of its commercial drivers and motor carriers. However, as of October 2001, the commercial driver's license database covered less than one-quarter of Mexico's commercial drivers. Mexico has also participated in NAFTA-related efforts to make motor carrier safety regulations compatible across the three member nations. Apart from government efforts, Mexican private sector and industry groups also report conducting activities to improve the safety of Mexican commercial vehicles.

This report contains a recommendation that DOT develop and implement a coordinated operational plan for truck safety at the southwest border. This plan should include reaching agreements with the border states and other federal agencies on space, staffing, day-to-day operations, and a timetable for when these actions will occur. DOT officials agreed with our recommendation. However, they strongly emphasized that they were well advanced in their efforts to fulfill our recommendation as well as respond to the requirements contained in DOT's fiscal year 2002 appropriations act. We disagree with DOT's comments that they are well advanced in their efforts to implement our recommendation as well as the many requirements contained in the appropriations act. Even prior to the act, DOT had not reached agreements with the states on how to allocate their inspectors or with other federal agencies on the space needed to conduct additional truck inspections.

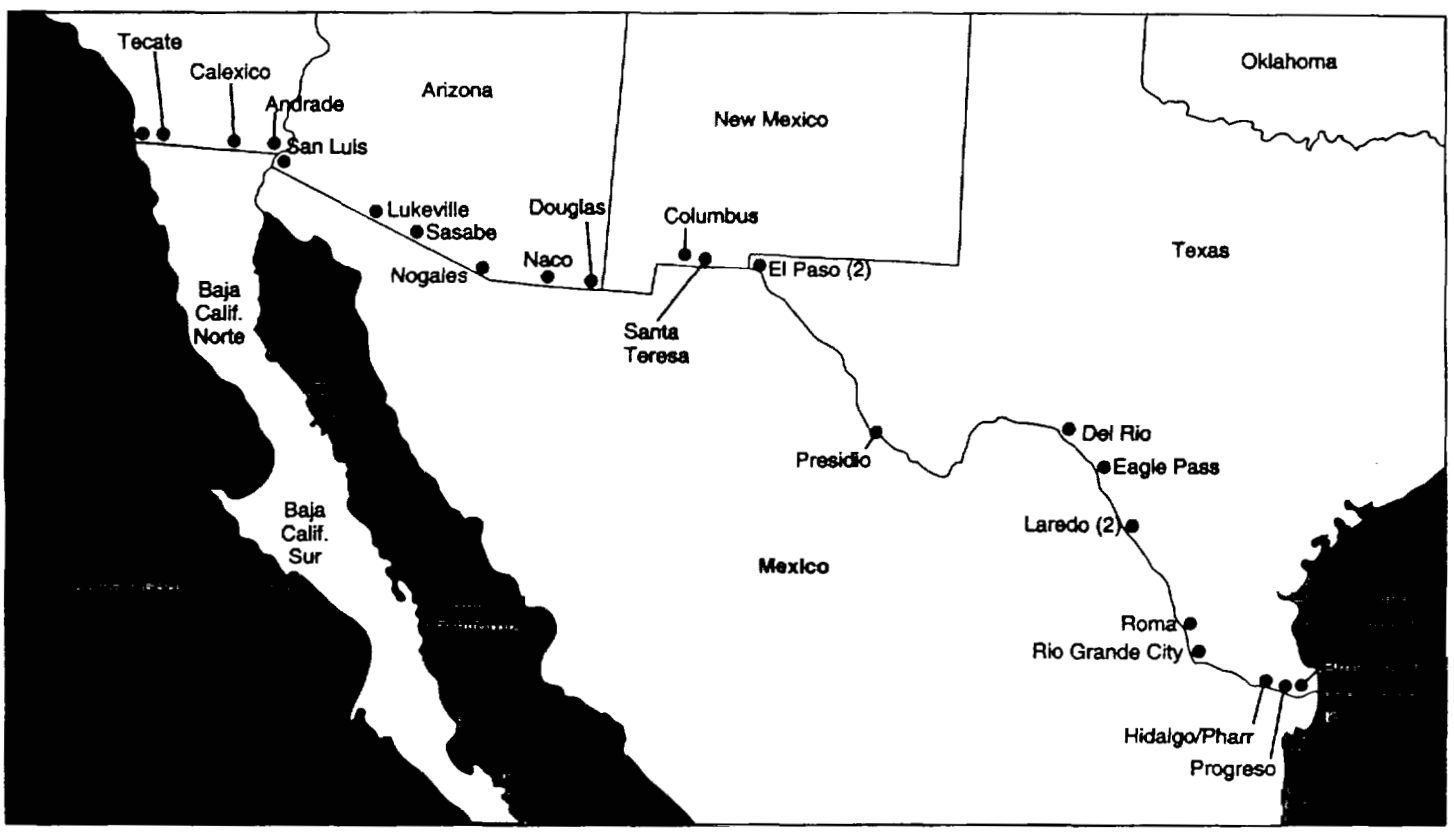
Background

Since NAFTA's implementation, trade between the United States and Mexico has more than doubled, growing from $100 billion in 1994 to $248 billion in 2000.[1] Enhanced trade has increased the number of northbound

[1]NAFTA was agreed to by Canada, Mexico, and the United States in 1992 and implemented in 1994.

truck crossings from 2.7 million in fiscal year 1994 to more than 4.3 million in fiscal year 2001. According to DOT, about 80,000 trucks crossed the border in fiscal year 2000, 63,000 of which were estimated to be of Mexican origin. Trucks from Mexico enter the United States at border crossing points in four U.S. states (see fig. 1), but most of the crossings occurred at five ports of entry in fiscal year 2001: Laredo, El Paso, Hidalgo/Pharr in Texas, and Calexico and Otay Mesa in California.

Figure 1: Commercial Ports of Entry Along the U.S.-Mexico Border



Note: Numbers in parenthesis indicate the number of ports of entry for those with more than one.

Source: GSA and DOT.

Commercial truck traffic at Texas and California ports of entry, which handle approximately 91 percent of truck crossings from Mexico, has grown just over 60 percent since NAFTA went into effect. Table 1 lists the principal commercial ports of entry and the number of truck crossings that occurred at each port in fiscal year 2001.

Table 1: Truck Crossings From Mexico Into the United States, Fiscal Year 2001

Location	Truck crossings	Percentage of total crossings
Texas		
Laredo	1,419,165	33%
El Paso	656,257	15
Hidalgo/Pharr	367,991	9
Brownsville	255,231	6
All others	223,159	5
Total Texas	**2,921,803**	**68**
California		
Otay Mesa	700,453	16
Calexico	259,174	6
All others	63,970	1
Total California	**1,023,597**	**23**
Arizona		
Nogales	251,474	6
All others	90,424	2
Total Arizona	**341,898**	**8**
New Mexico	**34,851**	**1**
Total	**4,322,149**	**100%**

Source: U.S. Customs Service.

Under NAFTA, barriers have gradually been reduced for trade in goods and services among Canada, Mexico, and the United States. Among other things, NAFTA allows Mexican commercial vehicles greater access to U.S. highways to facilitate trade between the two countries. Under NAFTA's original timeline, Mexico and the United States agreed to permit commercial trucks to operate within both countries' border states no later than December 18, 1995, and beyond the border states by January 1, 2000.[2]

However, due to U.S. concerns about the safety of Mexican trucks and the adequacy of Mexico's truck safety regulatory system, the United States postponed implementation of NAFTA's cross-border trucking provisions and only permitted Mexican trucks to continue to operate in designated commercial zones within Arizona, California, New Mexico, and Texas.[3]

[2]Canada and the United States have permitted each other's trucks complete access to all highways since 1982.

[3]Commercial zones are designated areas where Mexican commercial vehicles are allowed to (1) transfer their cargo to U.S. carriers or (2) unload their cargo for later pick-up by U.S. carriers. Commercial zones generally encompass areas extending between 3 and 20 miles north of U.S. border cities.

DOT's Office of Inspector General and GAO have reported that out-of-service rates for Mexican trucks operating in the commercial zones exceeded those of U.S. trucks in the nation as a whole. The Inspector General has also reported that the percentage of Mexican trucks placed out-of-service in the commercial zones declined from 44 percent in fiscal year 1997 to 36 percent in fiscal year 2000.

In 1998, Mexico challenged the United States' delay in implementing NAFTA's schedule for cross-border trucking. In February 2001, a NAFTA arbitration panel ruled that the United States' blanket refusal to review and consider Mexican motor carrier applications for operating authority to provide cross-border trucking services beyond the commercial zones violated its NAFTA obligations. The panel indicated that under NAFTA, the United States is permitted to establish its own safety standards and ensure that Mexican trucking firms and drivers comply with U.S. safety and operating regulations. However, the panel also noted that due to differing regulatory regimes in each country, the United States need not treat Mexican carriers or drivers exactly the same as those from the United States or Canada, provided that such different treatment is imposed in good faith with respect to a legitimate safety concern and conforms with relevant NAFTA provisions.

In February 2001, the administration announced that it would comply with its NAFTA obligations and allow Mexican commercial carriers to operate beyond the commercial zones by January 2002. In May 2001, DOT issued three proposed rules that would revise existing regulations and application forms and establish a two-tiered application process for Mexican carriers seeking authority to operate within and beyond the commercial zones.[4] Under the proposed rules, a carrier's authority would be conditioned on satisfactory completion of a safety audit within 18 months of receiving conditional operating authority.[5] According to the Federal Motor Carrier Safety Administration (FMCSA), the agency primarily responsible for enforcing U.S. truck safety regulations, the final regulations would ensure that FMCSA receives adequate information to assess an applicant's safety program and its ability to comply with U.S. safety standards before it is

[4]Among other things, the rules would require carriers to (1) describe their operations, (2) self-certify that they understand and will comply with U.S. safety standards, and (3) describe their recordkeeping procedures relating to drivers and accidents.

[5]These safety audits are expected to focus on reviewing a carrier's records and not individual truck inspections.

authorized to operate in the United States.[6] As of December 2001, DOT had not finalized these rules. DOT officials said these rules were not finalized because the Department was waiting for the outcome of the congressional appropriations process. Additional statutory requirements that must be met before Mexican commercial trucks can travel beyond the commercial zones are contained in the fiscal year 2002 DOT appropriations act. These include a range of inspection requirements and facility enhancements, such as adding weigh-in-motion scales at the 10 highest volume crossings. Additional requirements are discussed later in this report.

Relatively Few Mexican Carriers Initially Expected Beyond Border Commercial Zones

U.S. border state and Mexican transportation officials and representatives of U.S. and Mexican trucking organizations we interviewed said they believe few Mexican carriers will initially apply for authority to travel beyond the commercial zones. Further, they suggested that any increase in truck traffic would be gradual. As of October 2001, fewer than 200 Mexican trucking companies had applied to DOT to operate in the United States beyond the border commercial zones.[7] Regulatory and economic factors may affect Mexican trucking companies' interest and ability to operate vehicles beyond the commercial zones in the short run, but long-term trends in cross-border trade operations could increase interest in operating beyond the commercial zones.

Regulatory and Economic Factors May Limit Mexican Carriers' Willingness to Seek Access Beyond the Commercial Zones

A number of regulatory and economic factors may limit the number of Mexican carriers operating beyond the commercial zones in the near term. For example, U.S. and Mexican officials identified the lack of established business relationships in the United States as a factor likely to reduce the number of Mexican trucking companies willing to operate beyond the commercial zones. According to U.S. and Mexican officials, many Mexican trucking companies lack distribution ties outside the commercial zones and thus do not have immediate access to "backhaul" cargo from the

[6]FMCSA's responsibilities include: ensuring that eligible foreign motor carriers operating in the United States comply with U.S. federal motor carrier safety regulations; promoting information exchange regarding truck safety among the NAFTA countries by providing U.S. enforcement personnel the capability to verify information on foreign carriers, drivers, and vehicles; granting authority to Mexican carriers to operate in the United States; and enforcing compliance.

[7]More than three-fourths of these applications were made in 1996 and 1997. Mexican officials and FMCSA have concluded that Mexican carriers stopped applying for operating authority once they realized that the United States was not processing applications to operate beyond the commercial zones.

United States to Mexico that would allow them to operate profitably. The officials noted that it would take time to develop these business relationships.

The cost and availability of insurance may also affect the number of Mexican carriers operating beyond the commercial zones. According to the National Association of Independent Insurers, newly established trucking companies and Mexican trucking companies wanting to operate beyond the commercial zones face a competitive disadvantage in obtaining affordable insurance. According to companies currently providing insurance to Mexican trucking companies and an insurance industry representative, premiums for Mexican trucking companies will initially be set at the highest level and gradually decline as the market matures. These individuals stated that it would take time for the insurance industry to become familiar with the financial and safety records of Mexican companies and drivers and to develop effective means to access information for underwriting purposes. Further, large U.S.-based and multinational insurers are likely to gradually enter the Mexican market as demand for insurance in the Mexican trucking industry increases. The number of U.S.-based firms currently providing insurance coverage for Mexican trucks entering the United States is unknown. According to insurance company officials, fewer than 10 U.S. firms may be providing insurance for daily trips into the United States by Mexican trucking companies.

Also, according to Mexican private industry representatives and U.S. researchers, congestion and delays in crossing the U.S.-Mexico border result in added operating costs for Mexican carriers. These costs make it less profitable to use newer, more expensive vehicles to wait in lines at the border. Mexican government and private sector officials stated that delays in crossing the border have increased since the terrorist attacks on September 11, 2001. These delays could limit long-haul operations and encourage further reliance on the existing cross-border shuttle (drayage) system.[8]

Like other carriers, Mexican carriers must pay registration fees to each state in which they operate in the United States. The International Registration Plan was created to facilitate the payment and reduce the

[8]Drayage trucks provide shuttle freight service within the commercial zones on both sides of the border.

cost of these fees by allowing one member state to collect registration fees and distribute them to other jurisdictions as necessary. However, Mexico is not a member of the plan so Mexican companies must instead purchase individual trip permits for each state in which they travel.[9] According to an International Registration Plan representative, since these individual trip permits cost more in the aggregate, Mexican carriers could be at a competitive disadvantage. For example, a Mexican truck traveling from Nuevo Laredo, Mexico, to Tulsa, Oklahoma, must purchase trip permits before traveling through Texas and Oklahoma. Table 2 depicts the costs for an International Registration Plan member and a non-member traveling through these states once a week for a year. As seen in table 2, a non-member truck would pay about $5,600 more annually than a member truck.

Table 2: Registration Fees for International Registration Plan Members and Non-members

	Registration fees assessed by each state*	
	Member truck	**Non-member truck**
Texas	$588	$5,200
Oklahoma	$303	$1,248
Total	**$891 per year**	**$6,448 per year**

*Based on an 80,000 pound gross weight truck traveling round-trip once per week for one year between Nuevo Laredo, Mexico, and Tulsa, Oklahoma

Source: GAO analysis based on International Registration Plan data.

According to an American Trucking Associations official, a medium-term solution for Mexican trucking companies to take advantage of the cost savings and convenience associated with the International Registration Plan would be to register in a state that is a plan member. A Mexican trucking company may participate in the International Registration Plan by selecting a member state and establishing a business presence such as a sales or service office in that state. However, establishing such a presence may entail additional costs such as federal and state taxes. When we discussed these registration fees and potential taxes with Mexican public and private officials in October 2001, they were unaware that they needed to pay them. In commenting on a draft of this report, DOT officials said

[9]Not all states issue individual trip permits. For example, California requires an annual registration fee for non-members of the International Registration Plan.

they have discussed these registration fees with Mexican government officials.

The small scale and size of Mexican trucking operations could also limit travel beyond the commercial zones. Mexico's truck fleet is relatively small compared with that of the United States, and Mexican trucking association representatives said that their members' fleets have fewer trucks than their U.S. counterparts. For example, there are nearly 600,000 trucking companies with approximately 6.3 million tractors and trailers in the United States, according to DOT. Mexico, in contrast, in 2000[10] had approximately 83,000 federally registered commercial cargo carriers with approximately 277,000 tractors and trailers (trucks may also be registered by Mexican states if they do not drive on federal highways).[11] Further, the overall age of the Mexican commercial vehicle fleet may also limit the number of Mexican carriers able to operate beyond the commercial zones. According to Mexican registration data, in 2000 only 20 percent of the commercial cargo trucks registered for use on Mexican federal highways were manufactured after 1994. Mexican industry officials told us that trucks manufactured in Mexico prior to this date were not built to U.S. safety and emissions standards. Mexican carriers can apply to have older vehicles certified to be in compliance with U.S. safety standards. However, Mexican industry officials told us that these vehicles might have difficulties meeting U.S. emissions standards.

Uncertainty about DOT's final rules for obtaining operating authority has reduced the number of Mexican carriers that will initially apply for authority to operate beyond the commercial zones, according to Mexican government and private sector representatives. According to these officials, this uncertainty makes it difficult to plan for the future since union contracts allowing travel beyond the commercial zones and distribution ties must be established in advance.

[10]Secretariat of Communication and Transportation, *Estadistica Basica del Autotransporte Federal*. (Mexico City, Mexico: 2000).

[11]An additional 23,000 vehicles of all types are operated by private trucking companies. Private trucking companies own and operate their own fleet.

Increased Efficiency in Trucking and Border Operations Is Needed Before a Rise in Long-haul Commercial Vehicle Operations Will Occur

Cross-border trucking beyond the commercial zones may increase as firms seek to eliminate inefficiencies associated with the current system of drayage operations. Restrictions on cross-border commercial vehicle traffic have led to a transport system that typically requires three tractors and/or trailers to carry goods from the interior of Mexico to the U.S. interior. For example, a long-haul vehicle is used to bring cargo to the Mexican border from an interior Mexican state, where it is transferred to a short-haul drayage truck that moves the goods across the U.S. border into the commercial zones. To carry a shipment beyond the commercial zones, it must be transferred to a third vehicle domiciled in the United States. This system is cumbersome and inefficient, according to the Office of the U.S. Trade Representative, trucking industry representatives, businesses, and academic researchers. For example, as we reported previously, nearly half of the containers crossing the border from Mexico into the United States in 1998 were empty because they left products or raw materials in Mexico—yet still had to be processed by U.S. Customs.[12] According to U.S. industry representatives and researchers, the time required to complete transfers within the border commercial zones hinders the "just-in-time" nature of many assembly plants (maquiladoras) and agricultural industries, and can result in additional costs. They note that a single-truck transport system would be more efficient, practical, and less costly. In addition, government officials who monitor hazardous materials shipments contend that minimizing transfers and the handling of these loads would decrease the risk of dangerous accidents and spills.

According to researchers and Mexican government officials, technological and other innovations, such as an automated clearance system requiring carriers to provide documentation electronically, would also encourage the development of cross-border trucking beyond the commercial zones by reducing the need for time-consuming paperwork reviews at the border. According to Mexican customs officials, new programs, such as the U.S. Customs Service's Business Anti-Smuggling Coalition, could encourage the growth of such cross-border trucking by reducing the time spent waiting in lines at the border.[13]

[12]See *U.S.-Mexico Border: Better Planning, Coordination Needed to Handle Growing Commercial Traffic* (GAO/NSIAD-00-25, Mar. 3, 2000).

[13]The Business Anti-Smuggling Coalition is a business-led, U.S. Customs-supported initiative created to combat narcotics smuggling via commercial trade.

The United States and Most U.S. Border States Are Not Prepared to Ensure That Mexican Commercial Carriers Meet U.S. Safety Standards

DOT faces a number of challenges in implementing a coordinated truck safety system—including acquiring adequate infrastructure and deploying personnel—at the U.S.-Mexico border.[14] Few permanent facilities are in place for truck safety inspections and DOT only began taking steps to secure its own space for these inspections in August 2001. It also has not fully integrated its inspection personnel and their activities with those of the border states. With regard to emissions inspections, the Environmental Protection Agency (EPA) relies on state governments to establish and apply their own enforcement procedures. These operational challenges must be reconciled with a number of new requirements contained in the fiscal year 2002 DOT appropriations act.

Few Permanent Truck Safety Inspection Facilities Exist at U.S. Southwest Border Ports of Entry

Although we reported in 1997 and 2000 that FMCSA needs to be more proactive in securing inspection facilities at planned or existing border installations, the agency only began taking steps to secure its own space in August 2001 and has been occupying temporary space provided by Customs without the benefit of interagency agreements. [15] Currently, only 2 of 25 commercial ports of entry have permanent inspection facilities—both are state facilities in California. Other state facilities are being constructed or planned in the other three border states. However, federal and state officials have not formally agreed on how federal and state facilities will complement each other.

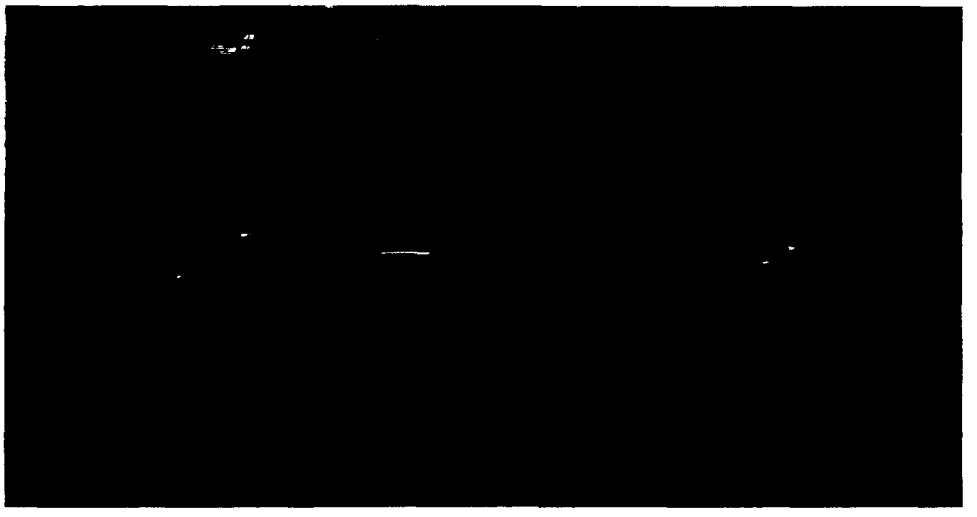
Permanent truck inspection facilities allow for more rigorous inspections, provide scales and measuring devices to screen trucks for weight and size, protect inspectors from the extreme heat prevalent at the border, and signal a commitment to enforce truck safety standards. At the three states without permanent facilities—Texas, Arizona, and New Mexico—Customs typically allows state and federal truck safety inspections on the agency's property on a temporary basis; however, if capacity is reached for storing trucks placed out-of-service, inspectors are unable to conduct additional safety inspections (app. II describes the amount of space designated for

[14]FMCSA and the border states have worked with the Mexican government, carriers, and industry associations to develop an enhanced commercial carrier safety regime and help carriers understand U.S. safety standards. These actions are discussed in the following section.

[15]See *U.S.-Mexico Border: Better Planning, Coordination Needed to Handle Growing Commercial Traffic* (GAO/NSIAD-00-25, Mar. 3, 2000) and *Commercial Trucking: Safety Concerns about Mexican Trucks Remain Even as Inspection Activity Increases* (GAO/RCED-97-68, Apr. 9, 1997).

truck inspection activities at southwest border ports of entry). For example, the Laredo, Texas, ports of entry handle the greatest number of northbound trucks, accounting for approximately 33 percent of all northbound commercial traffic. In Laredo, Customs has designated space for 33 trucks to be inspected or placed out-of-service, yet according to the U.S. Customs port director in Laredo, approximately 5,500 to 6,100 trucks cross at the two Laredo ports on an average day.[16] As fig. 2 shows, spaces used by federal truck safety inspectors at the World Trade Bridge in Laredo are not covered, nor is there lighting available for inspectors to conduct safety inspections at night.

Figure 2: Truck Inspection Space at the World Trade Bridge, Laredo, Texas



In light of the limited amount of temporary space for truck inspection activities, FMCSA has recently begun to take steps to acquire its own space in anticipation of increasing border enforcement personnel. FMCSA submitted its space needs for border port of entry facilities to the General Services Administration (GSA) in August 2001 in an attempt to secure space at federal ports of entry.[17] However, it is not clear when or if inspection space at these facilities can be acquired. According to a GSA

[16]The port of entry facilities in Laredo include the World Trade Border Station and the Colombia Border Station.

[17]GSA either owns or leases the commercial port of entry facilities to federal agencies working at the southwest border.

official, GSA and Customs must first conduct site surveys to determine the amount of vacant space available at port of entry facilities for truck inspections. As a result of heightened security in response to the September 11, 2001, terrorist attacks on the United States, Customs is reassessing its space needs at these facilities, with important implications for truck inspection activities. In discussions among FMCSA, GSA, and Customs held in October 2001, Customs said it will no longer allow trucks placed out-of-service for safety violations to remain on Customs compounds due to safety concerns related to allowing mechanics and tow truck operators on the compound. [18] Instead, federal and state inspectors must escort these vehicles off the facility. For example, in Texas a tow truck meets out-of-service vehicles at the Customs gate and tows them off the compound. A FMCSA official in Texas said these vehicles are rarely towed to Mexico unless they are empty. It is unclear what effect this development will have on the number and type of truck inspections that can be conducted in both the near and long term at federal ports of entry.

As noted, only 2 of the 25 commercial ports of entry have permanent truck inspection facilities—both state-operated facilities located in California. As permanent facilities dedicated to truck safety inspections, they have space to perform inspections and to place vehicles out-of-service (see figs. 3 and 4).

[18]The U.S. Customs Service is responsible for ensuring compliance with trade regulations and contraband/drug interdiction at border ports of entry.

Figure 3: California State Truck Inspection Facility at Otay Mesa With Covered Inspection Bays

Figure 4: Permanent Inspection Facility Staff in Calexico, California, Select Trucks for Inspection

Note: A California Highway Patrol observer visually inspects vehicles to determine if they should be more thoroughly inspected and obtains weight data from weigh-in-motion scales.

Figure 3: California State Truck Inspection Facility at Otay Mesa With Covered Inspection Bays

Figure 4: Permanent Inspection Facility Staff in Calexico, California, Select Trucks for Inspection

Note: A California Highway Patrol observer visually inspects vehicles to determine if they should be more thoroughly inspected and obtains weight data from weigh-in-motion scales.

The three border states without permanent truck inspection facilities at border ports of entry—Texas, Arizona, and New Mexico—are planning to build facilities at some crossings. To construct truck safety inspection facilities, DOT officials said they plan to make the following allocations based on the fiscal year 2002 DOT appropriations act: $12 million for Texas, $54 million to be divided among the four border states, and $2.3 million for federal facility improvements. Texas plans to build eight permanent truck safety inspection facilities that would be adjacent to the Customs ports of entry.[19] The facilities would be similar in function to California's truck inspection facilities. City officials in Laredo and El Paso, however, object to the facilities being so close to the border, arguing that these facilities would interfere with the flow of commerce. Local opposition to placing truck inspection facilities at the border and constraints on state funding have impeded progress. State officials estimate that the permanent facilities will not be completed until 2004.

In the interim, Texas has established one temporary truck inspection site in El Paso directly adjacent to a federal port of entry facility and began inspecting trucks there in July 2001. Texas also plans to establish four other temporary truck inspection sites directly adjacent to port of entry facilities in Laredo, Eagle Pass, Pharr, and Brownsville. The state plans to lease or purchase 5 acres of land for each of these temporary sites and provide a trailer for office space. As of November 2001, state officials had not implemented plans for the four temporary truck inspection sites.

Arizona and New Mexico have each begun work on a permanent truck inspection facility. In 1998, Arizona acquired a 10-acre lot adjacent to Customs' port of entry in Nogales on which to construct a permanent truck inspection facility. According to Arizona officials, this project is scheduled for completion in 2002. New Mexico has also started construction of a truck inspection facility in Santa Teresa. According to New Mexico officials, funding is currently available only for the groundwork. Further construction will not be scheduled until funding is available to complete the facility.

[19]Two facilities each are planned for Brownsville, Laredo, and El Paso, and one each in Pharr/McAllen and Eagle Pass.

DOT Is Increasing the Number of Safety Inspection Personnel But Has Not Integrated Its Efforts With the Border States

According to DOT officials, the fiscal year 2002 DOT appropriations act provides funding to hire and train additional federal and state safety inspection personnel. However, federal and state officials have not yet agreed on the level of staffing needed at temporary and permanent truck inspection facilities to achieve safety goals. For example, in Texas, there are no formal agreements between the state and FMCSA about coordinating inspection responsibilities at the ports of entry, or agreements establishing the number of federal and state inspection personnel at the proposed temporary and permanent sites. As of October 2001, there were 58 federal officials inspecting trucks on the southwest border. FMCSA officials said that $9.9 million in fiscal year 2002 funding would permit them to increase the number of enforcement personnel at ports of entry to 141. In addition, FMCSA will also use these funds to hire 134 staff who will perform safety audits and conduct compliance reviews of Mexican motor carriers seeking authority to operate beyond the commercial zones. The appropriations act requires that 50 percent of these safety audits and compliance reviews be conducted "on-site." Mexican officials stated that they would only allow these reviews within their country in the presence of a Mexican inspector.

As of October 2001, the 4 border states had assigned 89 inspectors to border crossings to inspect trucks entering the United States from Mexico—43 in Texas, 41 in California, 3 in Arizona, and 2 in New Mexico.[20] The fiscal year 2002 DOT appropriations act also provided $18 million for the border states to hire truck safety inspectors. Prior to passage of the act, Arizona planned to add a total of 11 inspectors and New Mexico planned to add a total of 9 inspectors in 2002 and 2003. Texas did not plan to increase the number of its inspectors until federal and state funds were committed to build inspection facilities. California was unsure how budgetary considerations would change its staffing levels.

[20]Staffing levels reflect the number of inspectors assigned to facilities and do not represent full-time equivalents. In California, inspectors have been permanently assigned to the truck inspection facilities. In contrast, inspectors in the other border states are not permanently assigned to ports of entry and devote only a portion of their time to truck safety inspections at the ports of entry. In Laredo, Texas, for example, state troopers inspect trucks at the two commercial ports of entry approximately 20 hours a week.

Emissions Inspections of Commercial Trucks Vary by State

Under the 1990 Clean Air Act, EPA is required to establish minimum national standards for air pollution and individual states are assigned primary responsibility to ensure compliance with the standards through state implementation plans. Such plans can include truck emissions inspections. Since 1994, EPA's primary role in regulating commercial truck emissions has been to certify compliance of commercial truck engines at the factories where they are manufactured. EPA relies on the commercial truck engine manufacturers to certify that their products meet air emissions standards and conducts spot checks at engine factories.

Some U.S. states have implemented emissions testing requirements for heavy-duty diesel trucks as part of their efforts to meet EPA air quality standards for non-attainment areas.[21] State testing programs differ significantly, with some states requiring yearly checks of trucks and others operating both annual and more frequent roadside inspection programs. California, which has a large number of areas that do not meet federal air quality standards, including the state's two southern border counties, conducts emissions tests at the border. Since 1999, California has assigned two inspectors each to the ports of entry at Calexico and Otay Mesa to monitor the emissions of U.S. and Mexican heavy-duty vehicles. According to California state officials, in 2000, the failure rate for U.S. trucks was approximately 8 percent, while the failure rate for Mexican trucks was 12 percent.

Arizona also operates an emissions testing program for commercial trucks, but testing is conducted on a yearly basis for trucks registered in the state's two non-attainment areas, Phoenix and Tucson—neither of which are located at the border. Neither Texas nor New Mexico performs emissions inspections at the border.

Meeting New Statutory Requirements for Southwest Border Truck Safety Inspections Will Require Additional Planning and Coordination

The fiscal year 2002 DOT appropriations act provides increased funding for activities related to the safety of Mexican carriers and sets forth a number of new requirements that DOT must meet before Mexican motor carriers can be granted authority to operate beyond the commercial zones. Meeting these requirements could entail significant operational and facility planning by DOT in coordination with the border states and other federal agencies. DOT officials said in December 2001 they are unsure when they

[21]EPA defines a non-attainment area as a geographical region that exceeds scientifically accepted levels for certain air pollutants.

will be able to meet the requirements and fully open the border given the short time these requirements have been in place. Among other things, DOT must

- equip all U.S.-Mexico commercial border crossings with scales suitable for enforcement action. Five of the 10 highest volume crossings must have weigh-in-motion scales, and the remaining 5 highest volume crossings must have such scales within 12 months;
- require federal and state inspectors to electronically verify the status and validity of the license of each Mexican commercial driver transporting certain quantities of hazardous materials, drivers undergoing specified inspections, and at least 50 percent of other Mexican commercial drivers;
- require Mexican commercial trucks to cross into the United States only where there is a safety inspector on duty and adequate capacity exists to conduct a sufficient number of meaningful safety inspections and accommodate out-of-service trucks; and
- require Level I inspections and Commercial Vehicle Safety Alliance (CVSA) [22] decals for all Mexican commercial vehicles that wish to operate beyond the commercial zones but do not display such decals.[23]

DOT's Plans to Assess Compliance with U.S. Safety Standards

According to FMCSA's Associate Administrator for Enforcement and Program Delivery, FMCSA plans to measure the progress of Mexican carriers in complying with U.S. safety standards by using truck out-of-service rates, traffic fatality rates, and accident rates. FMCSA's goal will be for Mexican carriers' rates to be comparable to those for U.S.-domiciled carriers. Currently, available data do not permit differentiating between drayage (cross-border shuttle) and long-haul carriers operating at the border. Differentiating between these two classes of vehicles in terms of calculating out-of-service rates will be important in determining the extent to which the safety goals are being met.

[22]CVSA is a non-profit organization of federal, state, and provincial government agencies and representatives from private industry in the United States, Canada, and Mexico dedicated to improving commercial vehicle safety. According to FMCSA officials, only law enforcement personnel can affix CVSA decals. CVSA decals are issued when a vehicle passes either a Level I or a Level V inspection. A Level I inspection consists of an examination of both the driver and vehicle. A Level V inspection includes all of the steps involved in a Level I inspection, except for an inspection of the driver. The decals are valid for a 3-month period.

[23]This excludes Mexican motor carriers that have been granted permanent operating authority for 3 consecutive years from this provision.

Mexico Has Taken Steps to Improve Commercial Vehicle Safety and Emissions, But Extent of Compliance With U.S. Standards Remains Unclear

The Mexican government has developed truck safety regulations and reports taking steps to enforce safety and air emissions standards but these efforts are relatively recent and it is too early to assess their effectiveness. With support from DOT, it has also developed key databases related to commercial vehicle safety and it has participated in trinational efforts to make U.S., Canadian, and Mexican land transportation standards more compatible. Some Mexican private sector and industry groups have also made efforts to improve the safety of Mexican commercial vehicles by implementing safety programs and purchasing new vehicles.

Mexico Has Begun Implementing New Safety and Emissions Standards

Mexico has developed new regulations establishing specifications for vehicle safety equipment, transportation of hazardous goods, vehicle inspection standards, and maximum limits for emissions of certain chemicals. According to Mexican officials, prior to 1992, Mexico had few vehicle manufacturing and operating safety standards, and those that did exist were very general. Since 1992, Mexico has developed and implemented specific federal regulations dealing with commercial vehicle safety. These include regulations establishing specifications for buses, license plates, vehicle weights, and dimensions. Mexico has also created operating safety standards, including speed limits for commercial motor vehicles. According to DOT, Mexico is considering implementing additional vehicle manufacturing standards, which could be modeled after U.S. or European standards.

In addition, Mexico has developed and implemented standards related to the transportation of hazardous goods. These standards address labeling, classifying, inspecting, documenting, storing, and shipping hazardous goods. According to DOT and Mexican officials, the standards are based on the United Nations Recommendations on the Transport of Dangerous Goods.

In July 2000, Mexico finalized its first regulation establishing the criteria and authority for roadside commercial vehicle inspections. According to CVSA and Mexican officials, this regulation is modeled after the CVSA inspection procedures and out-of-service criteria. The regulation establishes the procedures used by federal officials for inspecting commercial vehicles and placing them out-of-service. It also establishes a time frame for inspecting these vehicles, ranging from 20 minutes for buses and commercial vehicles carrying hazardous materials to 30 minutes for commercial vehicles carrying general cargo. According to Mexican

officials, prior to July 2001 when the regulation was fully implemented, there were no rules for placing commercial vehicles out-of-service and only the most serious violations would have resulted in putting a vehicle out-of-service.

Mexico has also developed and implemented standards limiting commercial vehicle emissions. These standards establish limits for air emissions of hydrocarbons, carbon monoxide, nitrous oxide, and vehicle smoke from new diesel engines. They also establish limits for vehicle smoke for diesel engines in use, as well as a program for inspecting diesel emissions. According to Mexican officials, commercial vehicles are subject to emissions inspections every 6 months.

Mexico's Commercial Vehicle Inspection Personnel and Activities

Mexico's commercial vehicle inspections are performed by 350 inspectors from the Secretariat for Communication and Transportation—the agency primarily responsible for inspecting commercial vehicles traveling on federal highways. In addition, 5,000 inspectors from the Federal Preventive Police have been trained to conduct inspections.[24] Many of these inspectors were trained by U.S. border state inspectors. During 2000, Mexican inspectors performed a total of 114,138 roadside vehicle inspections and found 12,929 vehicles in violation of safety standards. In 1999, they conducted 88,490 roadside vehicle inspections and found 5,367 vehicles in violation of safety standards. Mexican federal inspectors also performed compliance reviews of motor carriers at their place of business, conducting 2,441 compliance reviews in 2000 and 1,003 in 1999.[25] While it is encouraging that the Mexican government is making efforts to inspect more commercial trucks, we have no information on the nature of the violations found or whether any sanctions or penalties may have been assessed for them. Further, as noted above, inspections conducted in 1999 and 2000 were not covered under Mexico's recently implemented (July 2001) commercial vehicle inspection regulations.

[24]According to Federal Preventive Police officials, police officers must observe a violation of traffic laws before stopping a vehicle to conduct a safety inspection. By contrast, Secretariat of Communication and Transportation inspectors have no such limitations.

[25]We were not able to determine the extent to which Mexico's compliance reviews are comparable to those done in the United States because we did not have the opportunity to observe these operations in either country.

According to the Secretariat of Communication and Transportation, Mexico plans to increase the percentage of commercial vehicles inspected each year, from 28 percent of the total fleet in 2000 to 50 percent in 2006. The 2001 program set the following minimum inspection activities and inspection-level goals:

- increase the total number of roadside inspections by 27 percent and the total number of carrier compliance reviews by 5 percent over 2000 levels;
- maintain a permanent enforcement presence in each of 10 main transportation corridors; and
- conduct 90 roadside inspections and 9 compliance reviews per year per inspector.

In June 2000, Mexico participated in the CVSA-sponsored "Roadcheck 2000" program, a trinational exercise carried out over a 3-day period with the United States and Canada. During this exercise, Mexican officials inspected a total of 1,428 Mexican commercial vehicles along federal highways, putting 246, or about 17 percent, out-of-service. However, as of October 2001, Mexico was not issuing CVSA decals. Mexican officials told us they were not issuing CVSA decals because the decals are not required by Mexican law.

Permanent Truck Inspection Facilities Modeled After California Facilities Planned

According to Mexican officials, Mexico is in the process of constructing 7 permanent truck inspection facilities similar to stations in California, with an additional 13 planned. All seven facilities under construction are to be completed by the end of 2001, with an additional six facilities scheduled for completion in 2002 and the remaining seven scheduled for completion in 2003. According to Mexican officials, three of these facilities—Mexicali, Matamoros, and Nuevo Laredo— are being constructed on highways leading to the border. The purpose of these stations, in part, is to inspect and weigh vehicles and thus reduce the number of accidents caused by overweight and unsafe commercial vehicles. According to Mexican officials, the stations will include weigh-in-motion scales and areas to inspect vehicles and remove noncompliant vehicles from circulation.

New Commercial Driver Training Requirements Planned

Mexican officials stated that they conducted a study to determine the factors causing accidents involving commercial vehicles. The study found that more than 80 percent of all accidents were caused by driver errors. To reduce the number of accidents, Mexico is developing and implementing new training requirements that would require each new commercial driver to receive a minimum of 420 hours of driver training, 70 percent of which

constitutes instruction on the road. Drivers renewing their licenses would have to undergo 40 hours of instruction. This expanded training requirement is expected to be fully in place by 2005. Commercial vehicle drivers responsible for hazardous materials would need to meet additional requirements. At present, drivers can obtain commercial driver's licenses without such training.

Databases Constructed and Being Updated

Since NAFTA was signed, the Mexican government, with the assistance of FMCSA and TML, a private contractor, has developed and is adding information to several databases. These databases include (1) carrier and vehicle authorizations, (2) commercial driver's licenses, (3) accidents by Mexican commercial carriers and drivers, (4) results of inspections and audits, and (5) infractions. According to TML, it began working with Mexico to construct these databases in 1995. The databases are an integral piece of Mexico's motor carrier safety information system. While important for Mexico's internal purposes, they also provide information needed by U.S. law enforcement to verify driver and carrier information. Two of the five databases were available to U.S. law enforcement in 2000 and the remaining databases were to be available in 2001.

The first database, the Carrier and Vehicle Authorization Information System, was completed in 1998 to assist the Mexican government in issuing carrier operating authority permits, vehicle license plates, and vehicle highway permits. According to TML, as of June 2001, the database included all Mexican commercial cargo carriers registered with the federal government. According to Mexican government statistics from 2000, there are approximately 83,000 commercial cargo carriers comprising approximately 8,000 corporations and 75,000 sole-proprietorships. These carriers maintained about 372,000 vehicles of all types. U.S. federal inspectors have been able to access this database since October 2000. According to private sector officials, an estimated 75,000 other commercial trucks are registered in Mexican states and are not in this database. Mexican federal officials said that border drayage vehicles also would not be in the federal database since they do not travel on federal highways and thus are not subject to inspection by federal inspectors.

The second database, the Licencia Federal Information System, contains Mexican federal commercial driver's licenses.[26] It was completed in 1999

[26]We were not able to obtain data on the number of commercial driver's licenses issued by Mexican states.

to maintain records on commercial drivers and includes driver identification, license status, and medical certifications. According to TML, this database went on-line in January 2000, and as of December 2000, all 46 of Mexico's field offices issuing commercial driver's licenses had complete access to it. As of October 2001, 70,150, or 23 percent, of an estimated 300,000 federal commercial driver's licenses had been entered into the database. However, Mexican government officials say the database has information on 90 percent of the Mexican commercial drivers now crossing the border. Mexican government officials are entering records into this database as drivers renew their licenses and expect the database to contain all records by 2003. U.S. federal and state inspectors have been able to access this database since 2000. FMCSA policy requires that as of November 1, 2001, all Mexican commercial drivers entering the United States had to have a valid Mexican federal commercial driver's license in the database. If these drivers do not have a valid Mexican federal commercial driver's license in the database, FMCSA officials said they would be refused entry into the United States.

The third database, the Accident Reporting Information System, was completed in 2000 and records all accidents on Mexico's federal highways.[27] It includes an accident overview; vehicle, driver, and passenger identification; insurance information; information on damages; and other data. According to TML, phased implementation and interface with the United States were slated for completion by August 2001 but have been delayed because of the change of administrations in Mexico.

The fourth database, the Inspections and Audits Information System, was completed in 2000 to record the results of inspections and audits of motor carriers and their facilities. It includes inspection reports, as well as information on violations, infractions, and complaints. Mexican officials told us that these compliance reviews are conducted over a 15-day period. As of June 2001, there were 222 carrier audit records and 7,273 vehicle inspection records. We were unable to obtain information on what these inspections uncovered.

The fifth database, the Infraction Information System, was completed in 2000 to process and report infractions committed by Mexican vehicles and drivers on federal highways. Phased implementation of this database began in 2001. According to TML, as of June 2001, there were about 6,000

[27]Accidents on state or municipal roads are not included in this database.

interstate commerce vehicle infractions and about 7,000 intrastate and private vehicle infractions. Infractions on state or municipal roads are not included in this system.

Mexico Has Participated in Trinational Efforts to Harmonize Land Transportation Standards

Since NAFTA was signed, Mexico has participated in trinational efforts to make U.S., Canadian, and Mexican land transportation standards more compatible. These efforts have included participation in NAFTA's Land Transportation Standards Subcommittee (LTSS). [28] In addition, Mexico has entered into bilateral agreements with the United States on specific commercial motor vehicle safety issues.

According to an LTSS document, the subcommittee has made major accomplishments in the following areas:

- commercial driver's licenses—agreement on a common age (21 years) for operating a vehicle in international commerce;
- language requirements—agreement on a common language requirement (the driver must be able to communicate in the language of the jurisdiction where the commercial vehicle is operating);
- drivers' logbooks and hours-of-service—agreement on safety performance information each country will require from motor carriers; and
- driver medical standards—recognition of several binational agreements as the basis for recognizing driver medical standards.

The LTSS reports that regulatory differences among the countries have made reaching compatibility in some areas difficult. For example, according to a DOT official the three NAFTA countries have not been able to reach agreement on commercial vehicle weight standards, maximum weight limits for truck axles, and dimensions (Mexico's regulations focus on the total length of commercial vehicles while U.S. regulations focus on the length of the trailer).

The United States and Mexico have also entered into binational agreements to ensure the compatibility of commercial vehicle safety standards. Among these are agreements on standards for drug and alcohol tests for drivers and acceptance of commercial driver's licenses issued by

[28]The Transportation Consultative Group and the Automotive Standards Council were also created to assist in efforts to harmonize non-standards related measures and automotive manufacturing standards.

the other country. For example, Mexican officials plan to obtain certification for a Mexican federal government laboratory to conduct drug and alcohol tests by 2002. DOT officials said the United States is continuing to work with Mexico on a variety of commercial vehicle safety issues including manufacturing standards and vehicle size and weight limitations.

Mexican Private Sector Reports Making Efforts to Improve Commercial Vehicle Safety

The Mexican private sector reports conducting activities designed to improve the safety of Mexican commercial vehicles. These efforts include conducting inspections to ensure that Mexican vehicles crossing the border meet U.S. safety standards; purchasing new commercial vehicles; and implementing safety rules that, according to Mexican private sector officials, exceed the Mexican government's requirements. Moreover, according to representatives of Mexican private trucking associations, their members have adopted operating standards similar to those of large U.S. trucking companies. Mexican government officials stated that most trucks now used in border drayage operations would not meet their safety standards.

Mexican government officials said that some Mexican trucking companies are purchasing new vehicles in anticipation of operating beyond the commercial zones. According to the Mexican government, the average age of federally registered truck tractors in Mexico is 16 years. In contrast, Mexico's private trucking association, made up of companies that own and operate their own trucking fleets, said that its members' vehicles are relatively new, averaging less than 5 years of age. According to association officials, these newer vehicles are the ones most likely to engage in cross-border trucking beyond the commercial zones.

In Nuevo Laredo, Mexico, a local trucking association established an inspection station to ensure that vehicles belonging to association members meet U.S. standards. According to association officials, this facility is staffed by private maintenance personnel trained by the Texas Department of Public Safety, and inspections are provided free of charge to all member trucking companies. According to a FMCSA state director, this inspection facility, while not able to affix CVSA decals, represents a positive step toward assuring compliance with U.S. and Mexican safety standards.

According to Mexican private industry officials, some Mexican trucking companies have implemented driver education and other operating safety requirements that go beyond the Mexican federal requirements. For

example, officials of a Mexican private trucking association said that their members require extensive driver education and use computerized monitoring devices to track driver performance and compliance with company hours of service requirements.

Conclusions

In the 7 years since NAFTA was implemented, the United States and Mexico have taken a number of steps toward achieving closer economic integration. However, despite a strong trading partnership and other ties, cross-border truck safety issues continue to be challenging. Mexico has taken important steps to enhance its regulatory capabilities, including developing key databases containing driver and carrier information and hiring and training inspection personnel. However, Mexico's efforts to increase regulation of its motor carrier industry are relatively new; therefore, it is too early to assess their effectiveness. The U.S. border states and DOT have been increasing the number of safety inspectors inspecting trucks entering the country from Mexico, but it is unclear where additional inspectors will work and how they will share inspection responsibilities. California has built permanent truck safety inspection facilities at two ports of entry and Arizona has work under way to construct another one. At other major crossings, however, only makeshift facilities, at best, are available, and it will be several years until permanent facilities can be built in Texas.

Although some progress has been made, there is continued uncertainty about the extent to which Mexican commercial trucks meet U.S. safety standards. While evidence indicates that limited numbers of Mexican carriers will initially operate beyond the commercial zones, additional work is needed if DOT is to reach its goals of having commercial trucks from Mexico meet U.S. safety standards and achieve similar safety performance results. Further, there is still no coordinated operational plan for how truck safety inspection activities will be conducted or agreements with border states on how best to implement them. There is also no clear agreement on the type and size of facilities that are needed, where they will be located, when they will be finished, or whether state and/or federal inspectors will work there. Such agreements and a coordinated operational plan will become increasingly important to develop and implement as DOT works to address statutory requirements and as cross-border trade grows.

Recommendation for Executive Action

To ensure that Mexican trucks meet U.S. standards, we recommend that the Secretary of Transportation direct the Administrator of the Federal Motor Carrier Safety Administration to develop and implement a coordinated operational truck safety plan at the southwest border. In addition to meeting statutory requirements, this effort should include

- establishing inspection goals;
- taking steps to improve the quality of data to evaluate whether safety goals are being met for both drayage (cross-border shuttle) and long-haul carriers;
- reaching agreements with states and other federal agencies on where inspection facilities will be built, how they will be staffed, and who will operate them; and
- developing a specific timetable for when these actions will be completed.

Agency Comments and Our Evaluation

We received written comments on a draft of this report from the Customs Service, which are reprinted in app. III. We obtained oral comments from DOT, including FMCSA's Associate Administrator for Enforcement and Program Delivery and other officials; the Office of the U.S. Trade Representative, including the Deputy Assistant for Mexico and NAFTA; GSA, including the head of the Border Stations Center; and the Mexican embassy in Washington, D.C. We also provided copies to the Department of State, which did not provide comments, and EPA, which provided two technical comments.

The Office of the U.S. Trade Representative, GSA, and the Customs Service generally agreed with our report's findings and recommendation. DOT officials agreed with our recommendation that they develop a coordinated operational plan to inspect Mexican trucks at the border. However, they strongly emphasized that they were well advanced in their efforts to fulfill our recommendation as well as respond to the new truck safety requirements contained in the fiscal year 2002 DOT appropriations act. DOT officials stated that numerous actions critical to the border's opening are underway or completed and that program implementation timelines and legislative implementation plans are being developed and will be issued shortly. FMCSA officials noted that they are completing detailed planning for hiring and allocating staff; securing new high technology equipment to assist them in accomplishing their mission; and that they have completed a system to track Mexican drivers' U.S. traffic violation history. DOT officials noted that since the passage of DOT's fiscal year 2002 appropriations act, high ranking Department officials will begin meeting immediately with border state officials to coordinate state

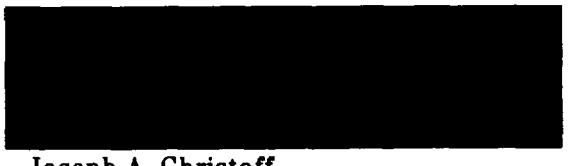
activities and discuss actions needed to open the border. They noted that detailed work is underway with GSA and Customs to address infrastructure needs at each border port of entry and with the Mexican government to reach agreements on requirements included in the act. DOT officials stated that their past efforts and the efforts they intend to undertake in response to the act provide a comprehensive approach to ensure the safety of Mexican trucks crossing the border. DOT officials also noted that our draft report was completed approximately two weeks before the Congress passed the appropriations act and therefore the information contained in our report predates the requirements specified in the act that the Department must undertake before it can fully open the border.

We have updated the report to reflect the requirements in the fiscal year 2002 DOT appropriations act—requirements that further highlight the importance of our recommendation that DOT develop a coordinated operational plan for truck safety at the Mexican border. We disagree with DOT's comments that they are well advanced in their efforts to implement our recommendation as well as the many requirements contained in the appropriations act. Even prior to the act, DOT had not reached agreements with the states on how to allocate their inspectors or with other federal agencies on the space needed to conduct additional truck inspections. These are basic operational issues that have become more complex with new provisions in the appropriations act, such as the requirement for weigh in motion technologies at the 10 busiest border crossings. In addition, our concerns about DOT's readiness were seconded in comments we received from Customs officials. Customs officials noted that, as of December 2001, they and GSA were still surveying federal facilities along the border to determine where additional space for DOT truck inspections could be found. The additional space becomes more important as a result of the act's provisions for more inspectors, more inspections, and the heightened probability that more space would be needed for Mexican trucks placed out of service. Customs officials expressed continued concern that DOT has not fully developed adequate operational plans to conduct truck safety inspections at federal border facilities.

State and agency officials also provided technical comments to the report. We incorporated these comments, where appropriate, throughout the report.

As agreed with your office, unless you publicly release its contents earlier, we plan no further distribution of this report until 30 days from its issue date. At that time, we will send copies to congressional committees with responsibilities for trade and transportation safety issues; the Secretary of Transportation; the Secretary of State; the U.S. Trade Representative; the Commissioner of the U.S. Customs Service; the Administrator, Environmental Protection Agency; the Administrator, General Services Administration; and the Director, Office of Management and Budget. We will also make copies available to others upon request and on our home page at http://www.gao.gov.

If you or your staff have any questions about this report, please contact me at (202) 512-8979. Key contributors to this report are listed in appendix IV.



Joseph A. Christoff
Director, International Affairs and Trade

[redacted]

To estimate the extent to which Mexican-domiciled commercial trucks are likely to travel beyond the commercial zones, as well as the factors inhibiting or encouraging Mexican carriers to operate beyond these zones, we contacted U.S. federal, state, and local officials, as well as trucking industry representatives, public interest groups, insurance companies and associations, and academics familiar with the Mexican trucking industry. We also reviewed applications filed with the Department of Transportation (DOT) by Mexican commercial motor carriers wishing to operate beyond the commercial zones. In addition, we interviewed Mexican government officials and industry and union representatives, and reviewed statistical data on the Mexican trucking industry.

To obtain information on U.S. government agencies' efforts to ensure that Mexican trucks entering the United States meet safety and emissions standards, we interviewed officials with the Federal Motor Carrier Safety Administration, Federal Highway Administration, Environmental Protection Agency, and the U.S. Trade Representative in Washington, D.C. We also interviewed state and local government officials in the border states and visited ports of entry in Laredo, Texas, Otay Mesa and Calexico, California, and Nogales, Arizona. We reviewed documents provided by DOT, attended congressional hearings on the issue, and reviewed DOT's Notices of Proposed Rulemakings and comments regarding the entry of Mexican trucks into the United States. In addition, we reviewed data contained in DOT's motor carrier management information system to understand its reliability and limitations.

To understand how Mexican government and private sector efforts contribute to ensuring that Mexican commercial vehicles entering the United States meet U.S. safety and emissions standards, we met with officials from the Mexican Embassy in Washington, D.C., as well as the Secretariats of Communication and Transportation, Economy, External Relations, and Environment and Natural Resources in Mexico City. We also reviewed Mexico's regulations dealing with commercial vehicle safety and emissions. However, because of time constraints we were unable to visit the inspection facilities under construction or observe enforcement actions taking place. To understand how the U.S. and Mexican commercial vehicle and driver safety databases function and interconnect, we met with officials from TML, the private contractor working to develop and connect these databases, as well as U.S. and Mexican government officials. We also observed the databases in use in Laredo, Texas; Otay Mesa, California; and Mexico City. To understand the private sector's efforts to improve the safety of their vehicles and their compliance with U.S. safety and emissions standards, we met with Mexican government and private

sector officials, toured a large Mexican trucking firm interested in conducting operations beyond the commercial zones, and visited a privately funded inspection facility in Nuevo Laredo, Mexico. To describe efforts to harmonize safety and emissions standards, we attended a conference co-sponsored by the United States and Mexico dealing with vehicle safety and emissions standards, and interviewed DOT and Mexican officials involved in the Land Transportation Standards Subcommittee and other groups.

We conducted our work in accordance with generally accepted government auditing standards from June to November 2001.

The U.S. Customs Service allows state and federal truck inspectors to inspect trucks on its compounds. However, because interagency agreements among FMCSA, GSA, and Customs have not been established, space at such locations is temporary and available only as long as Customs allows its continued use. The exception is in California, where the state operates two permanent truck inspection facilities—Calexico and Otay Mesa–that are located just outside the federal ports of entry. Truck inspection activities do not occur at the federal facilities in California. Table 3 provides an overview of the amount of space currently designated for truck inspection activities at commercial ports of entry along the southwest border.

Table 3: Space Designated for Truck Inspection Activities at Southwest Border Commercial Ports of Entry, as of November 2001

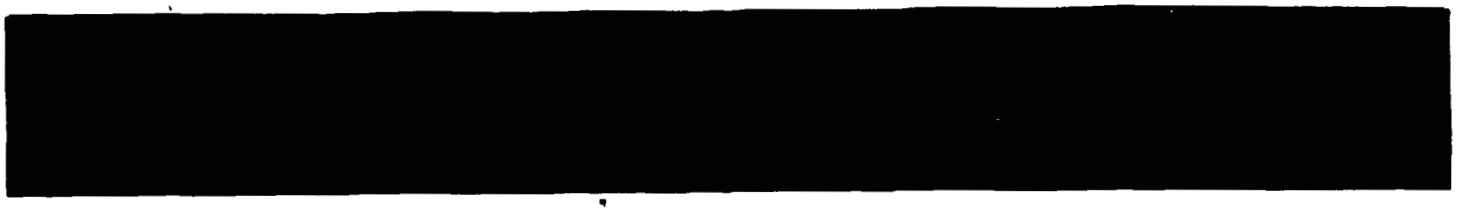
Facility	Number of spaces for state truck inspections	Number of spaces for federal truck inspections	Number of out-of-service spaces for state inspections	Number of out-of-service spaces for federal inspections	Office space for state inspectors (in square feet)	Office space for federal inspectors (in square feet)
Texas						
Veterans International Border Station, Brownsville	2	2	0	10	None	544
Los Indios Border Station, Los Indios	1	2	0	12	None	None
Pharr Border Station, Pharr	2	2	0	8	None	384
Rio Grande City Border Station, Rio Grande City	N/A	3	N/A	3	N/A	None
World Trade Border Station, Laredo	2	12 inspection and out-of-service	0	(see number of spaces)	None	384
Colombia Border Station, Laredo	1	3	0	15	None	384
Eagle Pass II Border Station, Eagle Pass	2	2	0	8 outside of the compound	160	384
Ysleta Border Station, El Paso	3	2	0	8	None	384
Bridge of the Americas Border Station, El Paso	N/A	6	N/A	10	N/A	384
Roma Border Station, Roma	N/A	1	N/A	0	N/A	160
Del Rio Border Station, Del Rio	1	3	0	4	None	None
Presidio Border Station, Presidio	N/A	N/A	N/A	N/A	N/A	N/A

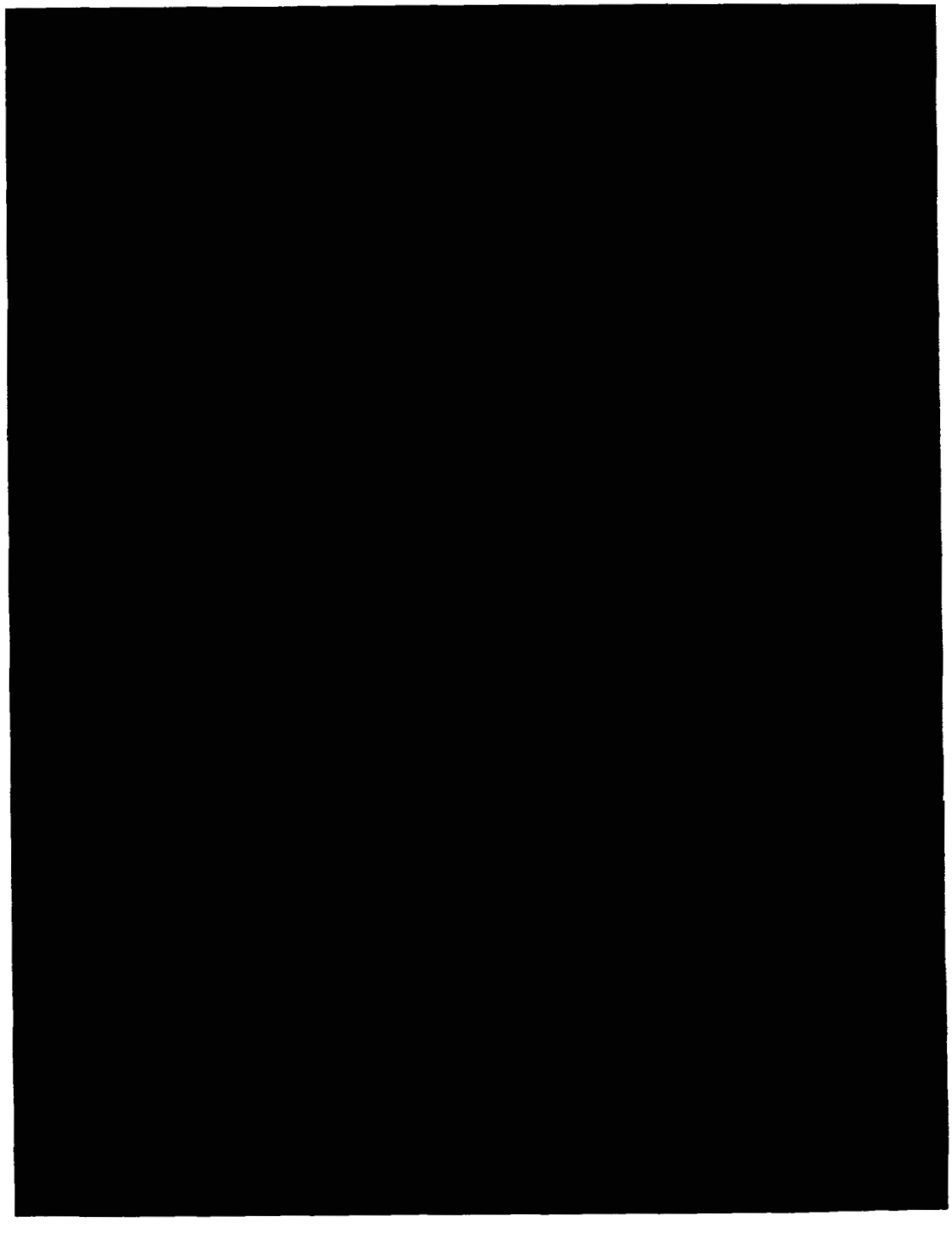
Facility	Number of spaces for state truck inspections	Number of spaces for federal truck inspections	Number of out-of-service spaces for state inspections	Number of out-of-service spaces for federal inspections	Office space for state inspectors (in square feet)	Office space for federal inspectors (in square feet)
Progreso Border Station, Progreso	N/A	1	N/A	0	N/A	160
California						
Tecate Border Station, Tecate	N/A	N/A	N/A	N/A	N/A	N/A
Andrade Border Station, Andrade[a]	N/A	N/A	N/A	N/A	N/A	N/A
Otay Mesa Border Station, Otay Mesa	4 bays	N/A	20	N/A	7,900	N/A
Calexico Border Station, Calexico	4 bays	N/A	20	N/A	7,900	N/A
Arizona						
Naco Border Station, Naco	1	N/A	0	N/A	840	N/A
Sasabe Border Station, Sasabe	1	N/A	0	N/A	460	N/A
Lukeville Border Station, Lukeville	1	N/A	0	N/A	460	N/A
Nogales Border Station, Nogales	1	3	0	0	460	200
Douglas Border Station, Douglas	1	N/A	0	N/A	460	N/A
San Luis Border Station, San Luis	N/A	1	N/A	0	N/A	0
New Mexico						
Columbus Border Station, Columbus	N/A	1	N/A	0	N/A	0
Santa Teresa Border Station, Santa Teresa	N/A	5	N/A	0	N/A	72

N/A – Not applicable. Space has not been designated for truck inspection activities at these ports of entry.

[a]The Andrade Border Station is no longer an official U.S. commercial port of entry.

Source: GSA and California Highway Patrol.





[redacted]

GAO Contact

Phillip Herr (202) 512-8509

Acknowledgments

In addition to the person listed above, Jason Bair; Patricia Cazares-Chao; Janey Cohen; Peter Guerrero; Elizabeth McNally; Jose M. Pena, III; Sarah Prehoda; James Ratzenberger; Maria Santos; and Hector Wong made key contributions to this report.

GAO's Mission

The General Accounting Office, the investigative arm of Congress, exists to support Congress in meeting its constitutional responsibilities and to help improve the performance and accountability of the federal government for the American people. GAO examines the use of public funds; evaluates federal programs and policies; and provides analyses, recommendations, and other assistance to help Congress make informed oversight, policy, and funding decisions. GAO's commitment to good government is reflected in its core values of accountability, integrity, and reliability.

Obtaining Copies of GAO Reports and Testimony

The fastest and easiest way to obtain copies of GAO documents is through the Internet. GAO's Web site (www.gao.gov) contains abstracts and full-text files of current reports and testimony and an expanding archive of older products. The Web site features a search engine to help you locate documents using key words and phrases. You can print these documents in their entirety, including charts and other graphics.

Each day, GAO issues a list of newly released reports, testimony, and correspondence. GAO posts this list, known as "Today's Reports," on its Web site daily. The list contains links to the full-text document files. To have GAO e-mail this list to you every afternoon, go to www.gao.gov and select "Subscribe to daily e-mail alert for newly released products" under the GAO Reports heading.

Order by Mail or Phone

The first copy of each printed report is free. Additional copies are $2 each. A check or money order should be made out to the Superintendent of Documents. GAO also accepts VISA and Mastercard. Orders for 100 or more copies mailed to a single address are discounted 25 percent. Orders should be sent to:

U.S. General Accounting Office
P.O. Box 37050
Washington, D.C. 20013

To order by Phone: Voice: (202) 512-6000
TDD: (202) 512-2537
Fax: (202) 512-6061

Visit GAO's Document Distribution Center

GAO Building
Room 1100, 700 4th Street, NW (corner of 4th and G Streets, NW)
Washington, D.C. 20013

To Report Fraud, Waste, and Abuse in Federal Programs

Contact:

Web site: www.gao.gov/fraudnet/fraudnet.htm,
E-mail: fraudnet@gao.gov, or
1-800-424-5454 or (202) 512-7470 (automated answering system).

Public Affairs

Jeff Nelligan, Managing Director, NelliganJ@gao.gov (202) 512-4800
U.S. General Accounting Office, 441 G. Street NW, Room 7149,
Washington, D.C. 20548

UNITED STATES OF AMERICA
Plaintiff,

v.

CATERPILLAR, INC.,

Defendant.

Civil Action 98-02544
(HHK)

ORDER

Presently before this court is the motion of the United States to enter the Consent Decree between the United States and Caterpillar, Inc. ("Caterpillar") that was filed with this court on October 22, 1998. The Consent Decree resolves the claims of the United States against Caterpillar for alleged violations of the Clean Air Act, as amended, 42 U.S.C. §§ 7401, et seq.

Upon consideration of the United States' motion and a thorough review of the submissions that accompany the motion, including the comments from the public relating to the Consent Decree and the Consent Decrees in related cases and the United States' responses thereto, the court concludes that the Consent Decree is fair, reasonable and consistent with public policy. Consequently, the Consent Decree will be approved.

Accordingly, it is this 1st day of July 1999, hereby

ORDERED that the Consent Decree between the United States and Caterpillar is hereby **APPROVED AND ENTERED.**

Henry H. Kennedy, Jr.
Henry H. Kennedy, Jr
United States District Judge.

IN THE UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF COLUMBIA

UNITED STATES OF AMERICA,	)	
	)	
	)	Civil Action No.
Plaintiff,	)	
	)	
v.	)	
	)	
	)	
CATERPILLAR INC.,	)	
	)	
	)	
Defendant.	)	

CONSENT DECREE

WHEREAS, Plaintiff, the United States of America, at the request of the Administrator of the United States Environmental Protection Agency ("EPA"), and by authority of the Attorney General, filed the Complaint herein against Defendant, (Caterpillar Inc. ("Caterpillar")) alleging violations of the Clean Air Act, as amended, 42 U.S.C. §§ 7401 et seq., (the "Act") in connection with certain heavy-duty diesel engines manufactured and sold by Caterpillar, and has filed similar complaints in related actions against other heavy-duty diesel engine manufacturers; and

WHEREAS, Caterpillar denies the violations alleged in the Complaint; and

WHEREAS, the United States and Caterpillar have consented to entry of this Consent Decree without trial of any issue; and

WHEREAS, EPA is charged with primary responsibility for enforcing the Clean Air Act; and

WHEREAS, EPA has conducted an extensive investigation of the matters which are the subject of the Consent Decree; and

WHEREAS, the United States has determined that the comprehensive relief set forth in this Consent Decree will provide protection of the health and welfare of the people of the United States; and

WHEREAS, the United States and Caterpillar agree, and the Court by entering this Consent Decree finds, that this Consent Decree has been negotiated by the United States and Caterpillar in good faith, that implementation of this Consent Decree will avoid prolonged and complicated litigation between the Parties, and that this Consent Decree is fair, reasonable, and in the public interest;

NOW, THEREFORE, before the taking of any testimony, and without trial or adjudication of any issue of fact or law and without this Consent Decree constituting an admission by any Party with respect to any such issue, and the Court having considered the matter and being duly advised, it is hereby ORDERED AND DECREED as follows:

I. JURISDICTION AND VENUE

1. This Court has jurisdiction over the subject matter of this action and the Parties to this Consent Decree pursuant to 28 U.S.C. §§ 1331, 1345, 1355, and Title II of the Act, 42 U.S.C. §§ 7521-7590.

2. For purposes of this action and this Consent Decree, Caterpillar does not contest that venue is proper in this District pursuant to Sections 204 and 205 of the Act, 42 U.S.C. §§ 7523 and 7524.

II. DEFINITIONS

3. Unless specifically defined in this Section or elsewhere in this Consent Decree, terms used herein shall have the meanings currently set forth in Sections 216 and 302 of the Act, 42 U.S.C. §§ 7550 and 7602, and any regulation promulgated under Title II of the Act, 42 U.S.C. §§ 7521-7590. The following definitions shall apply for purposes of this Consent Decree.

"Act" means the Clean Air Act, as amended, 42 U.S.C. §§ 7401 et seq.

"A,B&T" means the motor vehicle engine emission averaging, banking and trading program set forth in 40 C.F.R. §§ 86.091-15, 86.092-15, 86.094-15, and 86.004-15.

"AECD," or "Auxiliary Emission Control Device," means any device or element of design that senses temperature, vehicle speed, engine RPM, transmission gear, manifold vacuum, or any other parameter for the purpose of activating, modulating, delaying, or deactivating the operation of the emission control system.

"California Settlement Agreement" means the agreement between Caterpillar and the California Air Resources Board resolving California claims with respect to matters addressed in this Consent Decree.

"CARB" means the California Air Resources Board.

"Certificate of Conformity" or "Certificate" means a certificate issued by EPA pursuant to Section 206 of the Act, 42 U.S.C. § 7525.

"Consent Decree" or "Decree" means this Consent Decree, including the Appendices specifically identified herein.

"Date of Entry" means the date on which this Consent Decree is entered as a final judgment by the United States District Court for the District of Columbia.

"Date of Filing" means the date this Consent Decree is filed with the Clerk of the United States District Court for the District of Columbia.

"Day" means a calendar day. In computing any period of time under this Consent Decree, where the last day would fall on a Saturday, Sunday, or Federal holiday, the period shall run until the close of business of the next working day.

"Defeat Device" means an AECD that reduces the effectiveness of the emission control system under conditions that may reasonably be expected to be encountered in normal vehicle operation and use, unless:

(a) such conditions are substantially included in the Federal emission test procedure;

(b) the need for the AECD is justified in terms of protecting the vehicle against damage or accident; or

(c) the AECD does not go beyond the requirements of engine starting.

"Emissions Surface Limits" means the EURO III Test Protocol-based maximum allowable emission levels set forth in Paragraphs 14,

16, 17, 19 and 20, as determined in accordance with Section 1 of Appendix C to this Consent Decree.

"Engine Rebuild" means an activity occurring over one or more maintenance or repair events involving:

(a) disassembly of the engine, including removal of the cylinder heads; and

(b) the replacement or reconditioning of more than one Major Cylinder Component in more than half the cylinders.

"EPA" means the United States Environmental Protection Agency.

"EURO III Composite Value Limits" means the EURO III Test Protocol-based maximum composite value emission limits set forth in Paragraphs 14, 16, 17, 19 and 20, as determined in accordance with Section 1 of Appendix C to this Consent Decree.

"EURO III Limits" means, collectively, the EURO III Composite Value Limits and the Emissions Surface Limits.

"EURO III Test Protocol" means the test protocol for measuring diesel engine emissions specified in Section 1 of Appendix C to this Consent Decree.

"FTP" means the Federal Test Procedure for HDDEs specified in 40 C.F.R. Part 86.

"HDDE" means a diesel (as defined in 40 C.F.R. § 86.090-2) heavy-duty engine (as defined in 40 C.F.R. §§ 86.082-2(b)), for which a United States Certificate of Conformity is sought or required.

"HHDDE" means an HDDE certified as a motor vehicle heavy heavy-duty engine in accordance with the definition of "primary intended service class" in 40 C.F.R. § 86.085-2.

"Interim Engines" means all new electronically controlled LMB Engines manufactured on or after November 1, 1998, until compliance with the provisions of Paragraph 16 are achieved; and all new electronically controlled Truck HHDDEs manufactured on or after December 31, 1998, until compliance with the provisions of Paragraph 20 are achieved.

"LHDDE" means an HDDE certified as a motor vehicle light heavy-duty engine in accordance with the definition of "primary intended service class" in 40 C.F.R. §§ 86.085-2.

"LMB Engine" means an LHDDE or MHDDE manufactured by Caterpillar, or any HDDE manufactured by Caterpillar and offered for sale or intended for installation in an Urban Bus.

"Low NOx Rebuild Kit" means the software and/or minor hardware included by Caterpillar in a rebuild kit offered for sale in the United States for purposes of complying with Section IX.B.

"Major Cylinder Component" means piston assembly, cylinder liner, connecting rod, or piston ring set.

"MHDDE" means an HDDE certified as a motor vehicle medium heavy-duty engine in accordance with the definition of "primary intended service class" in 40 C.F.R. § 86.085-2.

"Model Year" means (a) for on-highway engines, the period defined at 40 C.F.R. Part 85, Subpart X; and (b) for Nonroad CI Engines, the period defined at 40 C.F.R. § 89.2.

"NMHC" means non-methane hydrocarbon.

"NOx" means oxides of nitrogen, as defined in 40 C.F.R. § 86.082-2.

"Nonroad CI Engine" means a compression-ignition engine subject to the regulations in 40 C.F.R. Part 89.

"NTE Limit" means the Not to Exceed Emission Limit, i.e., the maximum allowable NOx, NOx plus NMHC, and PM emission levels set forth in Paragraphs 14, 16, 17, 19 and 20, as determined in accordance with Section 2 of Appendix C to this Consent Decree.

"NOx plus NMHC Limit" means the maximum allowable NOx plus NMHC emission levels, which are set forth in Paragraphs 17 and 20 of this Consent Decree, when an engine is tested using the applicable FTP.

"Opacity Limit" means the maximum opacity level set forth in Paragraphs 14, 16, 17, 19 and 20 that is applicable within the Not to Exceed Control Area specified in Section 2 of Appendix C.

"Paragraph" means a portion of this Consent Decree identified by an Arabic numeral.

"Parties" means the United States and Caterpillar.

"PM" means particulate matter.

"Pre-Settlement Engines" means all electronically controlled engines equipped by Caterpillar with Cruise Mode Strategies or other electronic strategies and manufactured, with respect to LMB Engines, prior to November 1, 1998, and, with respect to Truck HHDDEs, prior to December 31, 1998. Appendix A to this Consent Decree lists Caterpillar's Pre-Settlement Engine Families.

"Section" means a portion of this Consent Decree identified by a Roman numeral.

"Settling HDDE Manufacturers" means Caterpillar Inc., Cummins Engine Company, Inc., Detroit Diesel Corporation, Mack Trucks, Inc., Renault V.I., and Volvo Truck Corporation.

"Smoke Limit" means the maximum emission levels set forth in Paragraphs 14, 16, 17, 19 and 20, as measured in accordance with Appendix C, applicable within the Not to Exceed Control Area specified in Section 2 of Appendix C to this Consent Decree.

"TNTE Limit" means the "Transient Load Response Not To Exceed Limit," i.e., the TNTE Test Protocol-based maximum emission levels set forth in Paragraphs 23 through 25 and determined in accordance with Section 2 of Appendix C to this Consent Decree.

"TNTE Test Protocol" means the test protocol for measuring diesel engine NOx plus NMHC and PM emissions during hard accelerations which is set forth in Appendix C to this Consent Decree.

"Truck HHDDE" means an HHDDE manufactured by Caterpillar, except any HHDDE specifically included in the definition of LMB Engine herein.

"United States" means the United States of America.

"Urban Bus" means an urban bus as defined at 40 C.F.R. § 86.093-2.

"Useful Life" means the applicable useful life of an engine as presently defined in 40 C.F.R. Parts 86 and 89.

III. APPLICABILITY

4. This Consent Decree applies to and is binding upon the United States and Caterpillar, its agents, successors, and assigns. Any change in Caterpillar's ownership or corporate or other legal status shall in no way alter Caterpillar's responsibilities under this Consent Decree. In any action to enforce this Consent Decree, Caterpillar shall not raise as a defense the failure of its officers, directors, agents, servants, contractors, or employees to take actions necessary to comply with the provisions hereof.

IV. FACTUAL BACKGROUND

5. Caterpillar has manufactured and sold, offered for sale, or introduced or delivered for introduction into commerce in the United States new motor vehicle engines, including the Pre-Settlement Engines.

6. Each Certificate of Conformity issued to Caterpillar by EPA during the time period relevant to the claims alleged in the

Complaint provides that the Certificate covers only those new motor vehicle engines which conform in all material respects to the engine design specifications provided to EPA in the Certificate application for such engines, except any Certificate of Conformity issued by EPA for engines Caterpillar intended or intends to sell only in California provides that the Certificate covers only those new motor vehicle engines which conform, in all material respects, to the engine design specifications described in the application submitted to CARB. In addition, each Conditional Certificate of Conformity issued to Caterpillar for Model Year 1998 specifically provides that the Certificate does not cover engines equipped with Defeat Devices.

7. Caterpillar has installed on engines manufactured for sale in the United States certain computer-based strategies to adjust the timing of fuel injection, including, but not limited to Cruise Mode Strategies on all of its Pre-Settlement Engines. The United States alleges in its Complaint that these strategies have the effect of advancing injection timing relative to the injection timing used by Caterpillar to control NOx emissions on the FTP. The United States further alleges that these strategies have an adverse effect on the engine's emission control system for NOx, that they were not adequately disclosed to EPA, that they are Defeat Devices prohibited under the Act, and that these engines are not covered by an EPA-issued Certificate of Conformity.

8. Caterpillar denies the material allegations of the Complaint and contends that its engines fully comply with NOx emissions limits, that it fully and adequately disclosed its emission control systems to EPA, that it did not employ Defeat Devices prohibited by the Act, and that these engines are covered by an EPA-issued Certificate of Conformity.

V. OBJECTIVES

9. Caterpillar has represented that it cannot immediately eliminate the current injection-timing strategies at issue by recalibrating the engine computer software without causing such damage to the engine in-use as to make the engine unmarketable. Caterpillar has agreed to develop and to use new technology to change existing electronic injection-timing strategies and meet the emission levels specified herein as quickly as is technologically feasible, and Caterpillar represents that the schedule of emissions reductions set forth in Paragraphs 16, 17, 19 and 20 herein is, based on the best information currently available, the most expeditious schedule technologically feasible by Caterpillar. Accordingly, the objectives of this Consent Decree are: (i) to resolve the United States' claims for injunctive relief as described in Sections VI through X and XVIII through XIX and Paragraph 116(a), as follows: (a) to have Caterpillar reduce emissions from Interim Engines and meet specified emission levels in accordance with the schedule set forth herein by modifying the current injection-timing strategies and implementing new technology;

(b) to resolve disputed claims arising under the Act and ensure compliance with the Act by having Caterpillar replace the strategies that the United States alleges are defeat devices and providing for emissions and compliance monitoring during the term of this Decree through supplementary test requirements, auditing procedures, in-use testing of engines, and reporting requirements; (c) to have Caterpillar reduce ambient levels of air pollutants by accelerating implementation of more stringent on-road HDDE and Nonroad CI Engine emission standards and other emission reduction programs; and (ii) to resolve the United States' claims for civil penalties as described in Paragraphs 113 and 137.

VI. REQUIREMENTS FOR ON-ROAD HDDEs

A. Requirements for Applications for Certificates of Conformity

10. In each application for a Certificate of Conformity submitted by Caterpillar for an Interim Engine family, Caterpillar shall state whether the application covers LMB Engines or Truck HHDDEs. If, based on reasonable evidence, EPA concludes that the engines covered by an application for Truck HHDDEs are intended for use as LMB Engines, EPA may deny the application, notwithstanding any statement by Caterpillar to the contrary.

11. Commencing with applications for Certificates of Conformity for 1999 Model Year engines, Caterpillar shall comply with all AECD reporting requirements found in 40 C.F.R. Part 86, Subpart A, consistent with EPA's regulations and written guidance of October

1998 or by reference to Appendix B-1 through B-4, as applicable under this Consent Decree, including the requirements to identify and provide a detailed description of all AECDs and to provide a justification for each AECD, consistent with the applicable Appendix B-1 through B-4 requirements and EPA's guidance, that results in a reduction in the effectiveness of the emission control system.

B.
Applicability of Additional Compliance Requirements

12. All EURO III, NTE, TNTE, and Smoke (or alternate Opacity) Limits specified in Paragraphs 14, 16, 17, 19 and 20 shall apply to all normal vehicle operation and use. Subject to the provisions of this Paragraph, Caterpillar shall meet all requirements specified in Paragraphs 13 through 20, and 23 through 25, of this Consent Decree throughout the Useful Life of the engine. Compliance by an engine family with the NOx plus NMHC limits prior to Model Year 2004 shall not subject the engine family to the longer Useful Life requirement promulgated by EPA and published at 62 Fed. Reg. 54694. The specific Useful Life requirements applicable to engines produced before Model Year 2004 shall be as follows:

(a) For Interim Engines manufactured on or before December 31, 1999, the definition of Useful Life contained in 40 C.F.R. Part 86 shall apply for all applicable limits. Caterpillar shall apply the deterioration factors, if any, developed for the FTP in order to demonstrate compliance with the EURO III and NTE standards. Caterpillar may increase the applicable EURO III or NTE deterioration

factors for the engine family if, after completion of engine testing, deterioration factors applicable to EURO III or NTE Limits are found to be greater than the deterioration factors used to determine compliance with the FTP standards. The EURO III or NTE Limit for such engine family may then be increased by the difference between the FTP factor and the applicable EURO III or NTE factor for the purpose of any in-use determination of compliance. Caterpillar must generate and submit to EPA with its Model Year 2000 applications for Certificates, data supporting a change in the original deterioration factors, but all such data must be submitted prior to December 31, 1999.

(b) For an HDDE manufactured on or after January 1, 2000, or when Caterpillar has determined a specific deterioration factor for the EURO III and NTE Limits for a particular engine family, whichever is sooner, the Useful Life for all such limits under this Consent Decree shall be the Useful Life set forth in 40 C.F.R. Part 86 for HDDEs manufactured before Model Year 2004, with no adjustments when determining in-use compliance.

(c) Beginning with Model Year 2004, the Useful Life for all limits under this Consent Decree shall be the Useful Life set forth in 40 C.F.R. Part 86 for HDDEs manufactured in Model Year 2004 and later.

C. Additional Requirements Applicable to LMB Engines Only

13. Subject to the provisions of this Consent Decree, Caterpillar shall not employ a Defeat Device in any electronically controlled LMB Engine manufactured on or after November 1, 1998. Notwithstanding the foregoing sentence, and without either Party to this Consent Decree conceding that any such strategy is or is not a Defeat Device, Caterpillar's LMB Engines that are Interim Engines may employ the injection-timing strategies as described and specified in Appendix B-1 and B-2 to this Consent Decree, provided that, at the time of certification, such engines are in compliance with all requirements of Paragraph 14. These strategies are used: (a) for engine startup; (b) to prevent engine or vehicle damage or accident; (c) to protect the engine from excessive deterioration during sustained high speed or high load operation; and/or (d) to control emissions of unburned hydrocarbons at low ambient temperatures.

14. For all electronically controlled LMB Engines manufactured on or after November 1, 1998, including the engines specified in Paragraph 13, Caterpillar shall comply, except as described and specified in Appendix B-2, with the following: (a) all applicable FTP standards when tested in accordance with the FTP for HDDEs; (b) EURO III Composite Value Limits of 6.0 g/bhp-hr for NOx (i.e., 1.5 times the applicable FTP standard for NOx), 1.0 times the applicable FTP standard for all other regulated emissions when tested using the EURO III Test Protocol in accordance with Appendix C of this Decree, and the associated Emissions Surface Limits specified in that Appendix;

(c) an NTE limit of 7.0 g/bhp-hr for NOx (i.e., 1.75 times the applicable FTP standard for NOx) in accordance with Appendix C to this Consent Decree; and (d) either a Smoke Limit of 1.0 or a thirty second average smoke opacity of 4% for a 5 inch path limit for transient testing, and a ten second average smoke opacity of 4% for a 5 inch path limit for steady state testing.

15. Without either Party to this Consent Decree conceding that any such strategy is or is not a Defeat Device: (a) no electronically controlled LMB Engine manufactured by Caterpillar on or after July 31, 1999, shall employ any of the injection-timing strategies described in Appendix B-1, of this Consent Decree, unless EPA determines that the strategy is not a Defeat Device; but (b) Caterpillar's electronically controlled LMB Engines manufactured on or after July 31, 1999 and prior to October 1, 2002 may employ the strategies as described and specified in Appendix B-2 and B-3, provided that, at the time of certification, such engines are in compliance with all requirements of Paragraph 16, and provided that beginning in Model Year 2000, Caterpillar's LMB Engines may employ such strategies only if, at the time of certification, they comply with, or are revised to conform to, the applicable limitations set forth in Appendix B-4.

16. All electronically controlled LMB Engines manufactured on or after July 31, 1999, shall comply, except as described and specified in Appendix B-2 and B-3, and as limited by B-4, with the

following: (a) all applicable FTP standards when tested in accordance with the FTP for HDDEs; (b) EURO III Composite Value Limits of 4.0 g/bhp-hr for NOx (i.e., 1.0 times the applicable FTP standard for NOx), 1.0 times the applicable FTP standard for all other regulated emissions when tested using the EURO III Test Protocol in accordance with Appendix C of this Decree, and the associated Emissions Surface Limits specified in that Appendix; (c) an NTE Limit of 5.0 g/bhp-hr for NOx (i.e., 1.25 times the applicable FTP standard for NOx) in accordance with Appendix C to this Consent Decree; and (d) either a Smoke Limit of 1.0 or a thirty second average smoke opacity of 4% for a 5 inch path limit for transient testing, and a ten second average smoke opacity of 4% for a 5 inch path limit for steady state testing.

17. No LMB Engine manufactured by Caterpillar on or after October 1, 2002, shall employ any of the injection-timing strategies described in Appendix B-1, B-2, B-3 and B-4 to this Consent Decree, unless EPA determines that the strategy is not a Defeat Device. In addition, all such LMB Engines (whether mechanically or electronically controlled), shall comply with the following: (a) an FTP Limit of 2.4 g/bhp-hr for NOx plus NMHC, or 2.5 g/bhp-hr for NOx plus NMHC if NMHCs do not exceed 0.5 g/bhp-hr; (b) EURO III Composite Value Limits of 2.4 g/bhp-hr for NOx plus NMHC, or 2.5 g/bhp-hr for NOx plus NMHC if NMHCs do not exceed 0.5 g/bhp-hr (i.e. 1.0 times the applicable NOx plus NMHC Limit), and 1.0 times the applicable FTP standard for all other applicable emissions when tested using the

EURO III Test Protocol in accordance with Appendix C to this Consent Decree; (c) all associated Emissions Surface Limits specified in Appendix C; (d) an NTE Limit of 3.0 g/bhp-hr for NOx plus NMHC, or 3.125 g/bhp-hr for NOx plus NMHC if NMHCs do not exceed 0.6250 g/bhp-hr (i.e., 1.25 times the applicable NOx plus NMHC Limit), in accordance with Appendix C of this Decree; (e) an NTE Limit of 0.1250 g/bhp-hr for PM (i.e., 1.25 times the applicable FTP standard for PM), except the applicable NTE limit for PM for Urban Bus engines shall be 0.06250 g/bhp-hr and 0.08750 g/bhp-hr for in-use testing purposes, in accordance with Appendix C of this Decree; and (f) either a Smoke Limit of 1.0 or a thirty second average smoke opacity of 4% for a 5 inch path limit for transient testing, and a ten second average smoke opacity of 4% for a 5 inch path limit for steady state testing.

D. Additional Requirements Applicable to Truck HHDDEs Only

18. Subject to the provisions of this Consent Decree, Caterpillar shall not employ a Defeat Device in any electronically controlled Truck HHDDE manufactured on or after December 31, 1998. Notwithstanding the foregoing sentence, and without either Party to this Consent Decree conceding that any such strategy is or is not a Defeat Device, Caterpillar's Truck HHDDEs that are Interim Engines may employ those injection-timing strategies as described and specified in Appendix B-1, B-2 and B-3 to this Consent Decree,

provided that, at the time of certification, such engines are in compliance with all requirements of Paragraph 19, and provided that beginning in Model Year 2000, Caterpillar's Truck HHDDEs may employ the strategies as described and specified in Appendix B-1, B-2 and B-3 only if, at the time of certification, they comply with, or are revised to conform to, the applicable limitations set forth in Appendix B-4. These strategies are used: (a) for engine startup; (b) to prevent engine or vehicle damage or accident; (c) to protect the engine from excessive deterioration during sustained high-speed or high load operation; and/or (d) to control emissions of unburned hydrocarbons at low ambient temperatures.

19. In addition, all electronically controlled Truck HHDDEs manufactured on or after December 31, 1998, including engines specified in Paragraph 18, shall comply, except as described and specified in Appendix B-2 and B-3, and as limited by B-4, with the following: (a) all applicable FTP standards when tested in accordance with the FTP for HDDEs; (b) EURO III Composite Value Limits of 6.0 g/bhp-hr for NOx (i.e., 1.5 times the applicable FTP standard for NOx), 1.0 times the applicable FTP standard for all other regulated emissions when tested using the EURO III Test Protocol in accordance with Appendix C of this Decree, and the associated Emissions Surface Limits specified in that Appendix; (c) an NTE Limit of 7.0 g/bhp-hr for NOx (i.e., 1.75 times the applicable FTP standard for NOx) in accordance with

Appendix C to this Consent Decree; and (d) either a Smoke Limit of 1.0 or a thirty second average smoke opacity of 4% for a 5 inch path limit for transient testing, and a ten second average smoke opacity of 4% for a 5 inch path limit for steady state testing.

20. No Truck HHDDE manufactured by Caterpillar on or after October 1, 2002, shall employ any of the injection-timing strategies described in Appendix B-1, B-2, B-3 and B-4 to this Consent Decree, unless EPA determines that the strategy is not a Defeat Device. In addition, all Truck HHDDEs (whether mechanically or electronically controlled) manufactured on or after October 1, 2002, shall comply with the following: (a) an FTP Limit of 2.4 g/bhp-hr for NOx plus NMHC, or 2.5 g/bhp-hr for NOx plus NMHC if NMHCs do not exceed 0.5 g/bhp-hr; (b) EURO III Composite Value Limits of 2.4 g/bhp-hr for NOx plus NMHC, or 2.5 g/bhp-hr for NOx plus NMHC if NMHCs do not exceed 0.5 g/bhp-hr (i.e., 1.0 times the applicable NOx plus NMHC Limit), and 1.0 times all other applicable regulated emissions when tested using the EURO III Test Protocol in accordance with Appendix C of this Decree; (c) all associated Emissions Surface Limits specified in Appendix C; and (d) an NTE Limit of 3.0 g/bhp-hr for NOx plus NMHC, or 3.125 g/bhp-hr for NOx plus NMHC if NMHCs do not exceed 0.625 g/bhp-hr (i.e., 1.25 times the applicable NOx plus NMHC Limit), in accordance with Appendix C of this Decree; (e) an NTE Limit of 0.125 g/bhp-hr for PM (i.e., 1.25 times the applicable FTP standard for PM); and (f) either a Smoke Limit of 1.0 or a thirty second average

smoke opacity of 4% for a 5 inch path limit for transient testing, and a ten second average smoke opacity of 4% for a 5 inch path limit for steady state testing.

E. Averaging, Banking and Trading

21. Caterpillar shall have 7465 Megagrams NOx credits for HHDDEs and 0 NOx credits for MHDDEs from its A,B&T account at the end of Model Year 1997 for use during the 1998 and 1999 Model Years. All other NOx credits in Caterpillar's A,B&T account at the end of Model Year 1997 shall be deemed void, and Caterpillar shall not trade such credits or use them to offset emissions at any time in the future. In addition, any of the available credits identified above that are not used by the end of Model Year 1999 shall expire, and Caterpillar shall not trade such credits to offset emissions at any time after Model Year 1999. Caterpillar's available HHDDE NOx credits, described in this Paragraph, shall only be used to offset emissions from mechanically controlled 3406C and 3306C HHDDE engines for the 1998 and 1999 Model Years. Notwithstanding the provisions of Paragraph 23, the use of NOx credits available under this Paragraph by an engine family shall not have any effect on the applicable non-FTP limits under this Consent Decree that must be met by that engine family.

22. Except as specified in Paragraphs 21 through 23, the applicable A,B&T regulations shall apply only to the FTP standards of this Consent Decree.

(a) For purposes of averaging and generating credits, the Family Emissions Limit ("FEL") of the engine family shall be compared to the FTP limit applicable under this Consent Decree.

(b) The A,B&T regulations applicable to Model Year 2004 and later engines shall apply to all engines certified to the NOx plus NMHC Limits.

(c) Credits generated from engines not certified to the NOx plus NMHC Limits may be used in A,B&T for engines not certified to the NOx plus NMHC Limits. Credits generated from engines not certified to the NOx plus NMHC Limits may be used in A,B&T for engines certified to the NOx plus NMHC Limits, but only for engines manufactured on or after January 1, 2003, and only if the credit-generating engines are also certified to a EURO III Composite Value Limit equal to or less than 1.0 times the NOx FEL for such engines.

(d) An HDDE manufactured after October 1, 2002, and before January 1, 2003 may be certified to the 4.0 g/bhp-hr NOx FTP standard only if the manufacturer has previously generated enough engine-credits within the same class of engines (i.e., HHDDE, MHDDE, and LHDDE) to offset the engine-credit used by the engine. Any such engine manufactured prior to October 1, 2002, and certified to the NOx plus NMHC Limit, with an FEL less than or equal to the NOx plus NMHC Limit shall

generate one engine-credit. Any such engine manufactured after October 1, 2002, certified to the 4.0 g/bhp-hr NOx FTP standard shall use one engine-credit. In addition, an engine-credit may only be used for an offset under this Subparagraph if the engine generating the credit was manufactured at least as many days before October 1, 2002, as the engine using the credit was manufactured after October 1, 2002.

(e) A Nonroad CI Engine covered by Paragraph 60 of this Consent Decree and manufactured after January 1, 2005, and before July 1, 2005, may be certified to the emission limits that would otherwise apply to the engine prior to January 1, 2005, only if the manufacturer has previously generated enough engine-credits within the same A,B&T class of engines to offset the engine-credit used by the engine. Any such engine manufactured prior to January 1, 2005, and certified to the emission limits applicable under Paragraph 60, with a FEL less than or equal to such emission limits, shall generate one engine-credit. Any such engine manufactured after January 1, 2005, certified to the emission limits applicable under Paragraph 60 shall use one engine-credit. In addition, an engine-credit may only be used for an offset under this Subparagraph if the engine generating the credit was manufactured at least as many days before January 1, 2005, as the engine using the credit was manufactured after January 1, 2005.

23. Except as specified in Paragraph 21 of this Consent Decree, if Caterpillar declares a NOx, NOx plus NMHC, or PM FEL for an engine family, then the applicable EURO III, NTE, and TNTE Limits shall be as follows:

(a) the EURO III Composite Value Limits for NOx and PM shall be the applicable multiplier times the NOx and PM FEL. The EURO III Composite Value Limits for NOx plus NMHC shall be the NOx plus NMHC FEL;

(b) the NTE Limits shall be the applicable multiplier times the NOx, PM, and NOx plus NMHC FELs; and

(c) the TNTE Limits shall be 1.7 times the PM FEL and 1.3 times the NOx plus NMHC FEL, unless modified in accordance with Paragraph 25.

F. TNTE Limits

24. On or after October 1, 2002, all HDDEs manufactured by Caterpillar shall meet the TNTE Limits set forth below, or the alternate limits established pursuant to Paragraph 25, when tested in accordance with the TNTE Test Protocol specified in Appendix C to this Consent Decree. Subject to the provisions of Paragraph 25 of this Consent Decree, the TNTE Limit for NOx plus NMHC shall be 3.12 g/bhp-hr for NOx plus NMHC, or 3.25 g/bhp-hr for NOx plus NMHC if NMHCs do not exceed 0.65 g/bhp-hr. The TNTE Limit for PM shall be

0.08 g/bhp-hr for Urban Bus engines (0.12 g/bhp-hr for in-use testing purposes) and 0.17 g/bhp-hr for all other heavy-duty diesel engines.

25. Prior to October 1, 2000, EPA and Caterpillar shall review all TNTE test data submitted to the Agency by Caterpillar pursuant to Paragraph 26(b) of this Consent Decree, and information on current and anticipated technologies, to determine whether the above TNTE Limits should be modified to ensure that the TNTE Limits are the lowest achievable given the technology available at that time. The Parties agree that the same TNTE Limits should apply to all Settling HDDE Manufacturers, and deliberations regarding the appropriate TNTE Limits should therefore be among EPA (after consultation with CARB) and all Settling HDDE Manufacturers. If EPA and Caterpillar determine that different TNTE Limits are appropriate, or a different compliance date is appropriate, the Parties shall jointly petition the Court to modify the Consent Decree. If EPA and Caterpillar disagree on the appropriateness of the TNTE Limits or the compliance date, the matter shall be resolved through the dispute resolution procedures in Section XVI of this Consent Decree, except: (a) any final TNTE Limits determined through mutual consent of the Parties shall be agreed upon only after consultation with, and the agreement of, all Settling HDDE Manufacturers; and (b) the Parties hereby consent to the consolidation of any judicial dispute resolution proceedings under this Consent Decree with respect to the final TNTE

Limits with dispute resolution proceedings regarding the same issue under a Consent Decree with any other Settling HDDE Manufacturer, and to intervention of any Settling HDDE Manufacturer in judicial dispute resolution regarding this issue. Should any Settling HDDE Manufacturer seek judicial dispute resolution regarding the final TNTE Limits, Caterpillar agrees to be bound by the final TNTE Limits determined by the Court in such proceeding, even if Caterpillar has not sought judicial dispute resolution regarding this issue.

VII. FEDERAL CERTIFICATION, SELECTIVE ENFORCEMENT AUDITING, ADMINISTRATIVE RECALL, AND RECORD KEEPING AND REPORTING REQUIREMENTS ASSOCIATED WITH THE EURO III, NTE, TNTE, SMOKE (OR ALTERNATE OPACITY) AND NOx PLUS NMHC LIMITS

26. With respect to the EURO III, NTE, TNTE, Smoke (or alternate Opacity) Limits, and NOx plus NMHC Limit, Caterpillar shall be subject to and comply with all requirements of EPA's regulations and the Act, and shall be entitled to invoke the administrative procedures of EPA's regulations and the Act, that would be applicable if those limits were emission standards and procedures adopted under Sections 202(a)(3) and 206 of the Act, 42 U.S.C. §§ 7521(a)(3) and 7525, including the requirements and procedures relating to certification, warranty, selective enforcement auditing under Section 206(b) of the Act, 42 U.S.C. § 7525(b), administrative recall under Section 207(c) of the Act, 42 U.S.C. § 7541(c), and record keeping and reporting requirements, subject to the following:

(a) Caterpillar shall comply with all record keeping and reporting requirements associated with certification testing done to demonstrate compliance with the EURO III Composite Value Limit and the NOx plus NMHC Limit found in Paragraph 14, 16, 17, 19, 20, and 23 of this Decree, but need only submit the compliance statements required in Appendix C of this Decree to demonstrate compliance with all other EURO III, NTE, TNTE, and Smoke (or the alternate Opacity) Limits. Caterpillar shall keep and provide to the United States, within 30 days of a request, all emission test results, engineering analysis, and any other information which formed the basis for making such compliance statements;

(b) beginning with the 1999 Model Year, Caterpillar shall submit TNTE test results conducted in accordance with Appendix C of this Decree for all of its certification engines as part of its Certificate applications. For applications submitted prior to March 1, 1999, submission of TNTE test results may be delayed until March 1, 1999. TNTE test results shall include the following speeds: the lowest speed in the Not to Exceed Control Area ("ESC"), the 15% ESC speed, the 25% ESC speed (Speed A), the 50% ESC speed (Speed B), the 75% ESC speed (Speed C), and the 100% ESC speed (Speed D);

(c) any dispute arising under or relating to the parties' obligations under this

Consent Decree regarding the EURO III, NTE, TNTE, and Smoke (or alternate Opacity) Limits shall not be subject to the provisions of Section 307 of the Act, 42 U.S.C. §7607, but instead shall but be resolved through the dispute resolution procedures in Section XVI of this Consent Decree;

(d) Section 304 of the Act, 42 U.S.C. § 7604, shall not apply to compliance with the EURO III, NTE, TNTE, Smoke (or the alternate Opacity), or the NOx plus NMHC Limits;

(e) For any hearing regarding compliance with the EURO III, NTE, TNTE, Smoke (or alternate Opacity), or the NOx plus NMHC Limits, at which, if they were standards under existing regulations, an administrative law judge would otherwise preside, EPA shall appoint a hearing officer who shall preside at such hearing; and

(f) any SEA testing of engines for conformance with EURO III, NTE, or TNTE Limits shall be conducted consistent with written EPA guidance.

27. Except as provided in Paragraph 26, EPA may exercise any authority under its regulations or the Act, including certification, warranty, selective enforcement auditing under Section 206(b) of the Act, 42 U.S.C. § 7525(b), administrative recall under Section 207(c) of the Act, 42 U.S.C. § 7541(c), and taking enforcement actions under Sections 204 and 205 of the Act, 42 U.S.C. §§ 7523 and 7524, that

would be applicable if the EURO III, NTE, TNTE, Smoke (or the alternate Opacity), and the NOx plus NMHC Limits were emissions standards and procedures adopted under Sections 202(a)(3) and 206 of the Act, 42 U.S.C. §§ 7521(a)(3) and 7525.

28. For LMB Engines and Truck HHDDEs that are Interim Engines, EPA agrees not to deny, suspend, withdraw, or revoke a Certificate of Conformity under the terms of 40 C.F.R. Part 86 on the grounds that an engine or engines contain one or more of the strategies specifically described in the applicable portions of Appendix B-1 through B-4 to this Consent Decree.

29. Beginning with Model Year 1999, with respect to any EURO III, NTE, TNTE, Smoke (or the alternate Opacity), or NOx plus NMHC Limit that becomes more stringent before the end of a Model Year, any Certificate of Conformity for that Model Year issued prior to the date the limits change shall cover only those engines manufactured before the date the limits become more stringent. Beginning with Model Year 1999, Caterpillar shall apply for a new Certificate to cover any engine it intends to manufacture and sell, or offer for sale, for the rest of the Model Year by submitting information sufficient to show that the engines will comply with the more stringent limits. Caterpillar shall have the option of satisfying the requirements of this Paragraph by designating engines as the following Model Year.

30. Except as specifically provided herein, this Decree does not modify, change, or limit in any way the rights and obligations of the Parties under the Act and EPA's regulations with respect to the control of emissions from HDDEs.

VIII. COMPLIANCE AUDITING AND IN-USE TESTING

A. Compliance Auditor

31. Within 120 days of the entry of this Decree, Caterpillar shall designate and provide to the United States, subject to the United States' disapproval, the name, current employment position, and qualifications of a Compliance Auditor responsible for auditing Caterpillar's progress in meeting the requirements of this Decree. The Compliance Auditor proposed by Caterpillar shall be deemed approved by the United States unless disapproved within 30 days of the date when the information described in the preceding sentence is provided by Caterpillar. Should the United States disapprove a proposed Compliance Auditor, Caterpillar shall designate and provide to the United States the name, current position, and qualifications of an alternative Compliance Auditor within 20 days of the notice of disapproval. Any dispute regarding the United States' disapproval of any proposed Compliance Auditor shall be resolved through the dispute resolution procedures of Section XVI of this Consent Decree. Any successor to the Compliance Auditor must also be approved in accordance with the procedure set forth in this Paragraph.

32. The Compliance Auditor: (a) shall be an employee of Caterpillar; (b) shall have not less than ten years of practical experience in diesel engine design and/or manufacturing; (c) shall not have any direct responsibility for Caterpillar's development of engines or technology to comply with the requirements of this Consent Decree; (d) shall not report to or be supervised by anyone below the level of the Chief Executive Officer ("CEO") having any responsibility for Caterpillar's development of engines or technology to comply with the requirements of this Consent Decree; and (e) shall spend a minimum of 500 hours per year through compliance with the certification requirements of Paragraphs 17 and 20, at which time the minimum hours shall be reduced to 100 hours per year, fulfilling the duties described herein. In addition, with respect to the performance of the compliance auditing requirements of this Consent Decree, the Compliance Auditor shall report directly to the CEO for the purpose of carrying out the provisions of this Section, and shall provide copies of all reports required by this Section directly to the CEO. The Compliance Auditor shall execute his or her responsibilities under this Consent Decree in a manner consistent with the relevant provisions of the Institute of Internal Auditors' Codification of Standards for the Professional Practice of Internal Auditing.

33. Caterpillar's Compliance Auditor shall be responsible for auditing Caterpillar's progress in developing and implementing the

technology needed to meet the EURO III, NTE, TNTE, Smoke (or alternate Opacity), and the NOx plus NMHC Limits. The Compliance Auditor shall also be responsible for auditing Caterpillar's progress in developing and implementing technology needed to meet the Low NOx Rebuild and Nonroad CI Engine standard pull-ahead requirements specified in Paragraphs 60 and 64 of this Decree.

34. Caterpillar shall make available to the Compliance Auditor all of Caterpillar's records, except for privileged attorney-client communications, and all records of any contractor utilized by Caterpillar to assist in the development and implementation of technology needed to meet the requirements specified in this Decree. These records shall include, but not be limited to, records pertaining or relating to decisions to pursue or to abandon potentially available technologies or strategies, and the level of funding requested, budgeted, or provided, to achieve compliance with this Consent Decree. Caterpillar shall provide the Compliance Auditor with access to any facility where requisite technology is being developed, tested, or implemented. Caterpillar shall also provide all reasonable assistance to allow the Compliance Auditor to monitor Caterpillar's progress in meeting the requirements, including: making employees or contractors available to answer questions, to provide updates, and to discuss next steps; and providing a running total of all monies spent in developing and implementing the requisite technology. Caterpillar does not waive,

and specifically reserves, all privileges applicable to information provided to the Compliance Auditor.

35. The Compliance Auditor shall submit quarterly reports to the United States and to the CEO providing his or her independent, unreviewed assessment and analysis of: Caterpillar's progress in developing and implementing the requisite technology; the likelihood of Caterpillar's meeting the compliance schedules set forth in this Decree; the adequacy and sufficiency of the resources being provided by Caterpillar for the purposes of this Decree; and the needed measures beyond those being taken by Caterpillar so as to ensure compliance with the requirements of this Decree. The Compliance Auditor's assessment and analysis shall be supported with citations to relevant documents, test results, discussions with company officials, and other sources regarding Caterpillar's progress in meeting the requirements of this Decree. Any statements of the Compliance Auditor shall be deemed to be his or her own personal opinions and shall be neither binding on, nor admissions of, Caterpillar with regard to any issue. Prior to any public release of a report by the Compliance Auditor, or its contents, the United States shall provide Caterpillar with an opportunity to designate all or part thereof as confidential business information in accordance with 40 C.F.R. Part 2. In addition, the quarterly reports shall include the following:

(a) a summary of the relevant technologies being developed by Caterpillar;

(b) the names and addresses of any contractor being used by Caterpillar to develop the relevant technology and a summary of what tasks the contractor has been hired to perform;

(c) a summary of the developmental work done over the last three months by Caterpillar or any such contractor hired by Caterpillar;

(d) a summary of any testing done by Caterpillar with respect to any relevant technology being developed, including all significant test results pertinent to Caterpillar's progress in meeting the requirements of this Decree;

(e) a summary of Caterpillar's activities over the previous three months regarding the implementation of any relevant technology needed to meet the requirements of this Decree, including developmental work done on secondary components such as the radiators to accommodate NOx reduction technologies, coordination with truck builders to accommodate engine changes, and the development of supply contracts;

(f) an accounting of the money and resources expended by Caterpillar over the previous quarter to develop and implement relevant technology;

(g) the budget for, and summary of, all relevant activities expected to take place in the next quarter; and

(h) the Compliance Auditor's statement or opinion regarding the need to modify Caterpillar's development and implementation plan, including next steps that may be necessary to achieve compliance with the schedules set out in this Decree.

36. The first report pursuant to Paragraph 35 shall be submitted to the United States within 180 days following the Date of Entry and shall include all of the above information with respect to all activities undertaken by Caterpillar up to the time of the first report, including activities predating entry of this Decree, if any. Subsequent reports shall be provided within 30 days after the close of each calendar quarter, commencing with the first full quarter following the initial report, and shall provide the information described above with respect to the quarter covered by the report. Upon reasonable notice, the Compliance Auditor shall also be available to answer oral and written questions from the United States regarding the activities of Caterpillar in meeting the requirements of this Decree. Any statements of the Compliance Auditor shall be deemed to be his or her own personal opinions and shall be neither binding on, nor admissions of, Caterpillar with regard to any issue.

37. Attorneys for Caterpillar may be present during any communication between the government and the Compliance Auditor where the government is represented by an attorney or an EPA Office of Enforcement and Compliance Assurance staff person.

B. In-Use Testing Program

38. Caterpillar shall perform, by itself or in conjunction with other Settling HDDE Manufacturers, an In-Use Testing Program to ensure diesel engines manufactured or modified by Caterpillar meet the requirements of this Consent Decree when driven under conditions which can reasonably be expected to be encountered during normal vehicle operation and use, and to evaluate the effectiveness of modifications to engine design made in response to the requirements of this Consent Decree in reducing emissions. Specifically, Caterpillar shall conduct testing to assess in-use mobile monitoring technologies, establish calibration and operating procedures for selected monitoring technologies, establish a baseline emission characterization, and conduct on-road testing to monitor in-use compliance on representative HDDEs manufactured by Caterpillar. This Program shall be conducted in four phases. Caterpillar is obligated to spend the sum of $2,000,000 on the In-Use Testing Program, allocated in accordance with the percentages set forth below.

39. Should Caterpillar elect to perform the In-Use Testing Program, or any phase thereof, in conjunction with other Settling HDDE Manufacturers, the references in Paragraphs 38 through 59 to Caterpillar shall refer to Caterpillar and all other Settling HDDE Manufacturers who elect to perform the obligations of Paragraphs 38 through 59 jointly, but the amount Caterpillar itself is required to

spend on the In-Use Testing Program shall not be changed by such election. In the event Caterpillar elects to perform any of the obligations of Paragraphs 38 through 59 jointly with any other Settling HDDE Manufacturer(s), it shall so notify the United States in the Scope of Work for each Phase of the Program to be implemented jointly, and provide the names of the other Settling HDDE Manufacturers with whom Caterpillar is going to perform the work. If Caterpillar elects to perform any obligation under Paragraphs 38 through 59 with other Settling HDDE Manufacturers, Caterpillar shall remain obligated to fulfill all of the requirements of Paragraphs 38 through 59, and shall be liable for stipulated penalties pursuant to Paragraph 116 for any failure to the same extent as if the obligation were undertaken solely by Caterpillar.

40. In Phase I, Caterpillar shall conduct engineering studies to determine the correlation, accuracy, precision, and repeatability of existing mobile monitoring technologies. The purpose of the engineering studies is to assess the technology or technologies in terms of their ability to provide accurate data regarding the mass of regulated gaseous emissions and actual engine torque, so this information can be incorporated in the use of mobile monitoring equipment for the on-road testing required under Phases III and IV. Phase I shall also include engineering studies to determine the highest degree of accuracy and precision of reported engine output torque achievable consistent with good engineering practices.

41. Not later than January 1, 1999, Caterpillar shall submit to the United States and CARB, for review and approval by each, a single Scope of Work for Phase I. The Scope of Work shall identify the mobile monitoring technology(ies) to be evaluated, the procedures for evaluating in-use monitoring equipment, the facility that will conduct the evaluation, the companies that will participate in the program, and the schedules for implementing those tasks.

42. Within thirty (30) days after submission of the proposed Scope of Work, the United States shall approve the Scope of Work or propose modifications. Within 10 days following EPA's proposed modifications Caterpillar shall incorporate the proposed modifications; but, if Caterpillar disputes the proposed modifications, or if the modifications requested by the United States conflict with modifications requested by CARB, the dispute shall be governed by the dispute resolution provisions of Section XVI. The work set forth in the Scope of Work, as approved, shall be completed by September 1, 1999.

43. If, prior to the conclusion of Phase I, Caterpillar believes the expenditure of additional funds in excess of the amount allotted under the Scope of Work would materially improve the capabilities of the mobile monitoring equipment, it may petition the United States to increase the percentage of Caterpillar's obligation allocated to Phase I. The United States reserves the right to

disapprove such a request, and any denial of such a request shall not be subject to dispute resolution.

44. Caterpillar shall include in the quarterly reports submitted pursuant to Paragraph 105 a description of the progress of testing under Phase I, and shall submit a final report within 30 days of the completion of the work, summarizing the study, and including all test data and other information not previously provided with the periodic reports.

45. Caterpillar shall submit to the United States, within 60 days of the completion of the work under Phase I, a description of its proposed monitoring equipment for use in Phases III and IV. Such report shall include any modification to improve its correlation, accuracy, precision, and repeatability, which Caterpillar proposes should be incorporated into the proposed monitoring equipment. The United States shall review and approve or disapprove the proposed modifications within 30 days. Any disapproval of a proposed modification shall not be subject to dispute resolution.

46. Caterpillar shall implement any approved or agreed-upon improvement to the in-use monitoring equipment approved pursuant to Phase I by February 1, 2000. The cost of any such modification relating to improving the accuracy and precision of reported engine output torque shall be borne by Caterpillar and shall not be deducted from the amount Caterpillar is obligated to spend in accordance with Paragraph 38 and 83. The cost of any other approved modification,

and the cost of procuring the equipment for the Phases III and IV studies, shall be considered to be part of the amount Caterpillar is obligated to spend in accordance with either Paragraph 38 or 83 or both, to be determined by the United States in its unreviewable discretion.

47. Caterpillar may not avoid its obligation to do testing under Phases III and IV on the basis of any claimed inadequacy in mobile monitoring technology. Notwithstanding the foregoing sentence, nothing herein shall constitute a waiver of rights any Party may have under applicable principles of law with respect to the use of test results in any proceeding to enforce this Consent Decree or the Act.

48. In Phase II of the In-Use Testing Program, Caterpillar shall develop in-use testing procedures to be used in connection with Phases III and IV of the In-Use Testing Program. The development of in-use testing procedures shall be based on testing of HDDEs engaged in a variety of typical on-road missions, and in a variety of seasonal conditions, and shall utilize engines extending over various stages of their Useful Life. The testing procedures shall include the identification of candidate driving routes representing typical urban, suburban, and highway driving. The candidate routes shall be of sufficient length to take 45 minutes when driven at posted speeds. At least one (1) candidate driving route shall include a portion

where at least 15 minutes of operation at 65 mph or greater is permitted and generally attained by trucks.

49. Not later than March 1, 1999, Caterpillar shall submit to the United States and CARB, for review and approval by each, a single Scope of Work for Phase II, identifying the testing procedures for in-use monitoring equipment and driving routes to be evaluated during Phase II. Within thirty (30) days after submission of the proposed Scope of Work, the United States shall approve the Scope of Work or propose modifications. Caterpillar shall incorporate the proposed modifications within 30 days of receiving the proposed modifications; but, if Caterpillar disputes the proposed modifications, or if the modifications requested by the United States conflict with modifications requested by CARB, the dispute shall be governed by the dispute resolution provisions of Section XVI. Caterpillar shall implement the Plan as approved.

50. Caterpillar shall complete Phase II no later than November 1, 1999.

51. Caterpillar shall submit to the United States and CARB, no later than 30 days after completion of Phase II, a single report that includes a summary of all test data, recommended test procedures, and identification of candidate driving routes for use in Phases III and IV. Within thirty (30) days after submission of the report, the United States shall approve the report or propose modifications. Caterpillar shall incorporate the proposed modifications; but, if

Caterpillar disputes the proposed modifications, or if the modifications requested by the United States conflict with modifications requested by CARB, the dispute shall be governed by the dispute resolution provisions of Section XVI. The report, as approved, shall form the basis for the testing which Caterpillar shall conduct in Phases III and IV.

52. Caterpillar shall spend no more than 20% of the amount set forth in Paragraph 38 on Phases I and II.

53. In Phase III Caterpillar shall conduct emissions testing on a variety of its in-service diesel engines to characterize real world emissions from such diesel engines. The purpose of this testing is to establish a baseline set of emission data on a wide range of in-use engines of varying age and service characteristics in order to demonstrate the effectiveness of the changes made to engines produced or modified in accordance with the Consent Decree. The focus of this testing shall be 1988 through 1998 Model Year engines, and shall include a mix of on-road and laboratory testing.

54. Caterpillar shall submit to the United States and CARB, for review and approval by each, a single Scope of Work for Phase III no later than November 1, 1999. The Scope of Work shall identify the proposed engines to be tested, the test schedule, and any testing routes or facilities. Within thirty (30) days after submission of the proposed Scope of Work, the United States shall approve the Scope of Work or propose modifications. Caterpillar shall incorporate the

proposed modifications within 30 days of receiving the proposed modifications; but, if Caterpillar disputes the proposed modifications, or if the modifications requested by the United States conflict with modifications requested by CARB, the dispute shall be governed by the dispute resolution provisions of Section XVI. Caterpillar shall implement the Scope of Work as approved.

55. Not later than February 1, 2000, or, if EPA agrees, one month after the improvements to the in-use monitoring equipment are implemented, Caterpillar shall commence testing for Phase III. Testing data shall be reported quarterly throughout Phase III.

56. Caterpillar shall complete Phase III eight months after commencement, and shall submit to the United States a report describing tests as performed, test conditions, engines tested, and test results. Caterpillar shall spend no more than 20% of the amount set forth in Paragraph 38 on Phase III.

57. In Phase IV, Caterpillar shall conduct on-road compliance monitoring on its HDDEs using the monitoring technology and previously defined testing procedures and driving routes approved pursuant to Phases I and II, until the funds set forth in Paragraph 38 have been fully expended. In addition to using the previously defined testing procedures and driving routes, Caterpillar shall follow the vehicle selection procedures and data reporting requirements set forth in Appendix D.

58. Caterpillar shall submit to the United States and CARB, for review and approval by each, a single proposed Scope of Work for Phase IV consistent with Appendix D no later than November 1, 1999. The Scope of Work shall include an itemized cost estimate of the testing identified in Appendix D and shall require testing to begin with Model Year 2000 HDDEs. Within thirty (30) days after submission of the proposed Scope of Work, the United States shall approve the Scope of Work or propose modifications. Caterpillar shall incorporate the proposed modifications within 30 days of receiving the proposed modifications; but, if Caterpillar disputes the proposed modifications, or if the modifications requested by the United States conflict with modifications requested by CARB, the dispute shall be governed by the dispute resolution provisions of Section XVI. Caterpillar shall implement the Scope of Work as approved. Testing data shall be reported monthly throughout Phase IV.

59. Caterpillar shall submit to the United States quarterly Phase IV reports which include the amount of money spent on testing required by this Paragraph. If, at any time, Caterpillar contends it cannot complete the required testing with the funds remaining, it shall notify the United States, provide a detailed explanation of the reasons it cannot complete the required testing with the remaining funds, and propose modifications to the Phase IV Scope of Work to conform the remaining testing obligation to the available funds. Within thirty (30) days after submission of the proposed

modifications, the United States shall approve Caterpillar's proposed modifications or propose its own modifications. Caterpillar shall incorporate the proposed modifications within 30 days of receiving the proposed modifications; but, if Caterpillar disputes the proposed modifications, or if the modifications requested by the United States conflict with modifications requested by CARB, the dispute shall be governed by the dispute resolution provisions of Section XVI. Caterpillar shall implement the modified Scope of Work as approved, but in no event shall Caterpillar be obligated to spend more than the amount specified in Paragraph 38.

IX. ADDITIONAL INJUNCTIVE RELIEF

A. Nonroad CI Engine Emissions Standard Pull-Ahead

60. All Nonroad CI Engines manufactured by Caterpillar on or after January 1, 2005, with a horsepower equal to or greater than 300 but less than 750 shall meet 3.0 g/bhp-hr for NOx plus NMHC when measured on the applicable FTP for those engines. In addition, all Nonroad CI Engines manufactured by Caterpillar on or after January 1, 2005, with a horsepower equal to or greater than 300 but less than 750 shall comply with all other requirements that would apply as if the engines were Model Year 2006 engines. The standards set forth in this Paragraph shall be met throughout the Useful Life of the engine.

61. With respect to the limits specified in Paragraph 60 of this Decree, Caterpillar shall be subject to and comply with all

requirements of 40 C.F.R. Part 89 and of the Act, and shall be entitled to invoke the administrative procedures of EPA's regulations and the Act that would be applicable if those limits were emission standards and procedures adopted under Sections 202(a)(3) and 206 of the Act, 42 U.S.C. §§ 7521(a)(3) and 7525, including all certification, warranty, selective enforcement auditing under Section 206(b) of the Act, administrative recall under Section 207(c) of the Act, 42 U.S.C. § 7541(c), and record keeping and reporting requirements, except as follows:

(a) any dispute arising under or relating to the parties' obligations under this Consent Decree regarding such limits shall not be subject to the provisions of Section 307 of the Act, 42 U.S.C. §7607, but instead shall be resolved through the dispute resolution procedures in Section XVI of this Consent Decree;

(b) Section 304 of the Act does not apply to compliance with the requirements of Paragraph 60 of this Decree; and

(c) For hearings regarding compliance with Paragraph 60 of this Decree, EPA shall appoint a hearing officer who shall preside at any hearing at which an administrative law judge would preside if the standards were in effect in Model Year 2005.

62. EPA may exercise any authority under its regulations found at 40 C.F.R. Part 89 or under the Act, including certification, selective enforcement auditing, administrative recall, and taking enforcement action against prohibited acts that would be applicable

if the limits specified in Paragraph 60 of this Decree were emissions standards and procedures adopted under Section 213 of the Act.

63. Except as specified, this Decree does not modify, change, or limit in any way the rights and obligations of the Parties under the Act and EPA's regulations with respect to the control of emissions from Nonroad CI Engines.

B. Low NOx Rebuild Program

64. Caterpillar shall implement, in accordance with this Section, a program to reduce NOx emissions from Caterpillar's Low NOx Rebuild Engines (as defined below) through certain software and/or minor hardware changes made to the engines through the use of a Low NOx Rebuild Kit. The term "Low NOx Rebuild Engines" means: Caterpillar's Model Year 1994 and later MHDDE and HHDDE Pre-Settlement Engines if Caterpillar elects Option A below; or Model Year 1993 and later MHDDE and HHDDE Pre-Settlement Engines if Caterpillar elects Option B below, but shall exclude, in either case, Caterpillar's low-volume ratings representing not more than 10% in the aggregate of the total volume of MHDDE and HHDDE Pre-Settlement Engines manufactured during the applicable Model Years to avoid requiring unique calibrations or other modifications for such ratings where it would be unduly burdensome in relationship to the number of engines involved and the expected emission reductions.

65. Within 90 days of the Date of Filing, Caterpillar shall submit to the United States and CARB, for review and approval by

each, a single plan for the implementation of its Low NOx Engine Rebuild Program. Each Low NOx Rebuild Kit designed and developed by Caterpillar shall meet the emission limits under either Option A or Option B:

Option A:

for MHDDEs only:

(a) EURO III Composite Value Limits for NOx of 6.0 g/bhp-hr for Model Years 1994-1998 engines, 1.0 times the applicable FTP standard for all other regulated pollutants when tested on the EURO III Test Protocol in accordance with Appendix C of this Decree, and the associated Emissions Surface Limits specified in that Appendix;

(b) an NTE Limit for NOx of 7.5 g/bhp-hr for Model Years 1994-1998 engines.

for HHDDEs only:

(c) EURO III Composite Value Limits for NOx of 7.0 g/bhp-hr for Model Years 1994-1998 engines, 1.0 times the applicable FTP standard for all other regulated pollutants when tested on the EURO III Test Protocol in accordance with Appendix C of this Decree, and the associated Emissions Surface Limits specified in that Appendix; and

(d) an NTE Limit for NOx of 8.75 g/bhp-hr for Model Years 1994-1998 engines.

Option B:

for *MHDDEs* only:

(a) EURO III Composite Value Limits for NOx of 6.5 g/bhp-hr for Model Years 1993-1998 engines, 1.0 time the applicable FTP standard for all other regulated pollutants when tested on the EURO III Test Protocol in accordance with Appendix C of this Decree, and the associated Emissions Surface Limits specified in that Appendix;

(b) an NTE Limit for NOx of 8.1 g/bhp-hr for Model Year 1993-1998 engines.

for HHDDEs only:

(c) EURO III Composite Value Limits for NOx of 7.5 g/bhp-hr for Model Year 1993-1998 engines, 1.0 times the applicable FTP standard for all other regulated pollutants when tested on the EURO III Test Protocol in accordance

with Appendix C of this Decree, and the associated Emissions Surface Limits specified in that Appendix; and

(d) an NTE Limit for NOx of 9.38 g/bhp-hr for Model Year 1993-1998 engines.

66. If, prior to or after submission of a plan pursuant to Paragraph 65, Caterpillar determines that it cannot meet the applicable limits specified in Paragraph 65 for any HDDE individual engine rating (referred to in this Paragraph as a "subject rating") with software and minor hardware changes, it shall submit to the United States and CARB, for review and approval by each, a single alternative or revised Low NOx Rebuild Plan in accordance with this Paragraph. The alternative or revised plan shall state the NOx emissions that it proposes to achieve for each subject rating and shall describe how Caterpillar will offset a NOx emission limit higher than the limits in Paragraph 65 within the same class of engines subject to the Low NOx Rebuild Program. Caterpillar may elect to use a production-weighted average approach within the applicable HDDE class (i.e., HHDDE or MHDDE) to demonstrate compliance with the applicable limit specified in Paragraph 65. The NOx production-weighted average shall be calculated by multiplying the NOx emission level that will be achieved for each rating through the use of the appropriate Low NOx Rebuild Kit by the production volume for the rating, summing those terms, and dividing by the total production Low NOx Rebuild Engines. Caterpillar's alternative or revised plan

submitted pursuant to this Paragraph shall demonstrate that Caterpillar's Low NOx Rebuild Kits would, on a production-weighted NOx average basis, achieve the applicable limits specified in Paragraph 65. As an alternative, if Caterpillar contends that any individual rating cannot meet the applicable limits, it may elect to increase the quantity of engines included in the Low NOx Rebuild Program by including portions of earlier Model Year engine families, such that the product of the quantity of additional engines and associated NOx reduction shall be equivalent to the product of the quantity of engines for the subject rating from the original Low NOx Rebuild Plan and the NOx exceedance for that rating.

67. In addition to software and minor hardware needed to meet the requirements specified in Paragraph 65, all Low NOx Rebuild Kits shall include a label meeting the requirements of Paragraph 77.

68. Caterpillar shall make available Low NOx Rebuild Kits for distribution and sale for Low NOx Rebuild Engines according to the following schedule:

i. Beginning 180 days after entry of this Consent Decree, or 90 days following EPA's approval of the Low NOx Rebuild Plan required in Paragraph 65, whichever is later, Caterpillar shall begin supplying Low NOx Rebuild Kits.

ii. Within 90 days following the applicable date in Paragraph 68(i), Caterpillar shall make available Low NOx Rebuild Kits in

quantities necessary to meet expected demand for engine families representing at least fifty percent of the engines for which Low NOx Rebuild Kits must be produced under the Low NOx Rebuild Plan.

iii. Within 360 days following the applicable date in Paragraph 68(i), Caterpillar shall make available Low NOx Rebuild Kits in quantities necessary to meet expected demand for all engine families for which Low NOx Rebuild Kits must be produced under the Low NOx Rebuild Plan.

69. Beginning on the date a Low NOx Rebuild Kit is available for any engine family under Paragraph 68, Caterpillar shall sell and use, and authorize the sale and use of, only Low NOx Rebuild Kits for any Low NOx Rebuild Engine in that family in the case of any Engine Rebuild for:

(a) any HHDDE that has accumulated mileage greater than 290,000 miles, or any MHDDE that has accumulated mileage greater than 185,000 miles; or

(b) any HHDDE or MHDDE that has accumulated less than the applicable mileage specified in Paragraph 69(a), where the service event includes replacement or reconditioning of more than one Major Cylinder Component in all of the engine's cylinders.

70. A Low NOx Rebuild Kit may not increase any regulated emission beyond applicable limits when tested on the FTP.

71. Caterpillar shall install, and shall authorize its authorized dealers, distributors, repair facilities, and rebuild facilities to install only Low NOx Rebuild Kits as required under Paragraph 64 at no added cost to the owner above the amount the owner would otherwise pay to have the engine rebuilt or repaired. In addition, subject to the provisions of Paragraph 72, Caterpillar shall make available, either directly or through its affiliated distribution networks, at no added cost, the appropriate Low NOx Rebuild Kit to any non-affiliated engine rebuilder or person who requests it. For the purposes of this Section, "at no added cost" shall mean:

(a) if a Low NOx Rebuild Kit contains parts normally replaced at engine rebuild, Caterpillar shall not charge more than the then-current price for the original part; and

(b) if a Low NOx Rebuild Kit requires a part not normally replaced during rebuild, then such part shall be included without charge. Caterpillar shall make arrangements to reimburse its authorized dealers, distributors, repair facilities, and rebuild facilities, so that the ultimate purchaser of a Low NOx Rebuild Kit will not be charged for any required reprogramming through its authorized dealers, distributors, repair facilities, and rebuild facilities, including any computer connection fees.

72. Notwithstanding the provisions in Paragraph 71, Caterpillar, its authorized dealers, distributors, repair facilities, and rebuild facilities may impose an additional fee for engine control software that includes both the low NOx reprogramming and other software enhancements for purposes unrelated to reducing NOx emissions, provided that:

(a) The customer is given the option of obtaining Low NOx Rebuild reprogramming alone at no cost; and

(b) The customer chooses the option that includes such other software enhancements.

73. Each Low NOx Rebuild Kit shall be clearly marked with an identifiable characteristic allowing the United States to determine whether a Low NOx Rebuild Engine has been rebuilt with the appropriate Low NOx Rebuild Kit. This identifiable characteristic may be a unique part number or other marking on the engine control module, or may be a readily accessible software identification parameter, including engine code marker or calibration marker.

74. Caterpillar shall take all reasonable steps to inform its authorized dealers, distributors, repair facilities, and rebuild facilities about the requirements of this program and the availability of Low NOx Rebuild Kits, including, but not limited to, sending written notification to these entities within 120 days after Caterpillar's Low NOx Rebuild Plan is approved.

75. In addition to any requirement set forth above:

(a) Caterpillar shall include as part of its Low NOx Rebuild Plan, submitted under Paragraph 65, the following:

(i) A description of each engine family to be covered by a Low NOx Rebuild Kit, including the Model Year, model, and such other information as may be required to identify the engines to be rebuilt with Low NOx Rebuild Kits, and any engine rating otherwise covered by the Low NOx Rebuild Program which Caterpillar has elected to exclude under the ten percent exclusion for low-volume ratings.

(ii) A list of all Caterpillar's authorized dealers, distributors, repair facilities, and rebuild facilities who will

install the Low NOx Rebuild Kits, and a statement that these persons will be properly equipped and instructed to install such kits.

(iii) A description of the procedure to be followed by non-affiliated engine rebuild facilities or persons to obtain Low NOx Rebuild Kits.

(iv) A description of the system by which Caterpillar will ensure an adequate number of Low NOx Rebuild Kits will be available to be installed by affiliated and non-affiliated engine rebuild facilities, including the method to be used to ensure the supply of Low NOx Rebuild Kits remains both adequate and responsive to engine rebuild facilities' demand.

(v) An example of the written notification to be sent to all of Caterpillar's authorized dealers, distributors, repair facilities, or rebuild facilities.

(b) Caterpillar shall submit to EPA, 30 days prior to the date any Low NOx Rebuild Kit will be made available, the following additional information:

(i) A statement of the NOx limits each Low NOx Rebuild Kit achieves, and a certification that these limits meet the limits applicable under Paragraph 65, or, if Caterpillar asserts such limits cannot be achieved, the submissions required under Paragraph 66.

(ii) A copy of all necessary instructions to be sent to those persons who are to install Low NOx Rebuild Kit. This shall include designation of the date on or after which the Low NOx Rebuild Kits will be available from Caterpillar and the time reasonably necessary to perform the labor required to install the kits.

(iii) A description of the impact of the proposed changes on fuel consumption, driveability, and safety for each class or category of Low NOx Rebuild Engines and a brief summary of the data, technical studies, or engineering evaluations which support these conclusions.

76. The written notification to be sent to all Caterpillar's authorized dealers, distributors, repair facilities, and rebuild facilities shall contain the following:

(a) A copy of EPA's letter to rebuild facilities regarding the use of Low NOx Rebuild Kits.

(b) A clear description of actions that will be taken in the rebuild and an identification of the components that are affected by the Low NOx Rebuild.

(c) A description of the procedures which non-affiliated engine rebuilders should follow to obtain appropriate Low NOx Rebuild

Kits and the time reasonably necessary to perform the labor required to install the appropriate Low NOx Rebuild Kit.

77. The Plan for Caterpillar's Low NOx Rebuild Program submitted to the United States shall provide that any of Caterpillar's authorized dealers, distributors, repair facilities, or rebuilders who install a Low NOx Rebuild Kit shall be instructed to complete and affix a label to the engine. The label shall contain a statement with appropriate blank spaces for the rebuilder to indicate when and by whom the Low NOx Rebuild Kit was installed on the engine. The label shall be placed in such location as approved by EPA consistent with State law and shall be fabricated of a material suitable for the location in which it is installed and not readily removable intact. Caterpillar shall also provide such label to any non-affiliated engine rebuilder who installs one of its Low NOx Rebuild Kits and instructions on how to complete the label and where to affix the label.

78. The United States (after consultation with CARB) shall provide Caterpillar with notice of approval or disapproval of its Low NOx Rebuild Plan within 30 days of its submittal to the United States. If the plan is disapproved, the United States shall provide the reasons for disapproval, and Caterpillar shall have 30 days to submit a revised Low NOx Rebuild Plan for approval. Any dispute between the Parties regarding the Low NOx Rebuild Plan shall be resolved in accordance with the dispute resolution provisions of Section XVI of this Decree (including circumstances where modifications requested by the United States conflict with modifications requested by CARB). Caterpillar shall implement the Plan as approved.

79. Caterpillar shall send to the United States a copy of all written communications directed to 5 or more persons which relate to the Low NOx Rebuild Plan directed by Caterpillar to engine rebuilders and other persons who are to install Low NOx Rebuild Kits under the Low NOx Rebuild Plan. Such copies shall be mailed to the United States contemporaneously with their first transmission to engine rebuilders and other persons who are to install Low NOx Rebuild Kits under the Low NOx Rebuild Plan.

80. Caterpillar shall provide for the establishment and maintenance of records to enable the Parties to monitor the implementation of the Low NOx Rebuild Program. The records shall include the following:

(a) the number of engines that will be subject to Low NOx Rebuild; and

(b) a cumulative total of the number of Low NOx Rebuild Kits sold, by part number.

81. Caterpillar shall maintain in a form suitable for inspection, such as computer information storage devices or card files, lists of the names and addresses of engine rebuilders who were provided Low NOx Rebuild Kits and the number of kits provided. The records described in this Paragraph shall be made available to the United States upon request.

82. The records required by this Section shall be retained in accordance with the provisions of Paragraph 142 (Record Retention) of this Consent Decree. Caterpillar's obligations under Section IX.B shall terminate ten (10) years from the date of introduction of the first Low NOx Rebuild Kit pursuant to Paragraph 68(i). Caterpillar accepts as a condition of such termination that, after termination, Caterpillar will only make available for Engine Rebuilds on Low NOx Rebuild Engines the software and/or minor hardware that corresponds to the Low NOx Rebuild Kit described in Paragraphs 64 through 67 and that complies with Paragraphs 70 and 73.

C. Additional Injunctive Relief/Offset Projects

83. As further injunctive relief, Caterpillar shall implement or perform, in accordance with the provisions of this Section, projects to reduce the amount of NOx emitted into the environment nationwide from mobile and stationary sources. Subject to the provisions of Paragraph 84, Caterpillar shall be obligated to spend $35,000,000 for performance of these projects.

84. Caterpillar may satisfy up to $10,000,000 of its obligation under Paragraph 83 through projects (referred to below as "Incentive Projects") to achieve verifiable reductions in NOx emissions from HDDEs manufactured by Caterpillar, beyond those required by law or by other provisions of this Consent Decree, up to 200,000 tons of NOx. For example, Caterpillar may satisfy a portion of its offset obligation under Paragraph 83 by reducing emissions from Pre-Settlement Engines, other than Low NOx Rebuild Engines, with the vehicle owners' consent, at the time the engines are brought in for service. Any emission reductions used in the Incentive Projects shall not be used to satisfy any other Consent Decree obligations or in the A,B&T program. The dollar reduction in Caterpillar's obligation under Paragraph 83 shall be as follows: $5,000,000 for the first 120,000 tons, $500,000 for each additional 8,000 tons (up to an additional $5,000,000), for a total of $10,000,000. NOx calculations will be based upon the EPA assumptions used in 1998.

85. Caterpillar's obligation under Paragraph 83 net of any reduction it elects to pursue through Incentive Projects under Paragraph 84 (the "Net Project Funds") shall be satisfied as follows:

(a) 20% of the Net Project Funds shall be spent on the projects agreed to in, or selected pursuant to, the California Settlement Agreement with respect to Caterpillar's California Pre-Settlement and Interim Engines. Caterpillar's satisfaction of its obligations under the California Settlement Agreement with respect to this 20% of the Net Project Funds shall fully satisfy its obligation to the United States under this Consent Decree with respect to such amount.

(b) 25% of the Net Project Funds shall be spent on projects to be proposed by Caterpillar consistent with the criteria set forth in Paragraph 89, after giving due consideration to projects submitted by third parties during the public comment period under Paragraph 149 of this Consent Decree (the "Company Proposed Projects").

(c) 55% of the Net Project Funds shall be spent on the projects set forth in Appendix E to this Consent Decree (the "Appendix E Projects").

86. Within 120 days of entry of this Decree, Caterpillar, if it chooses to perform Incentive Projects, shall submit to the United States and CARB, for review and approval by each, a single plan for the performance or implementation of its Incentive Projects. Within 120 days of entry of this Decree, Caterpillar shall submit to the

United States a plan for performance or implementation of its Company Proposed Projects and its Appendix E Projects (collectively, the plans required to be submitted pursuant to this Paragraph are referred to as "the Plans"). The Plans shall include a general description of each project Caterpillar proposes to perform or implement, including the timetable for implementation of each project and an estimate of the emission reductions that each project will achieve. Caterpillar shall include in the Plans the amount of money to be spent on the Company Proposed Projects and Appendix E Projects. Each date for commencement of a project shall be the earliest practicable, given the nature of the project, after the United States' approval of the Scope of Work in accordance with Paragraph 92.

87. The Incentive Projects shall be completed no later than six years after entry of this Consent Decree. All Company Proposed Projects and Appendix E Projects shall be completed no later than eight years after entry of the Consent Decree.

88. Caterpillar's monitoring, administrative, or overhead costs associated with the implementation of any Company Proposed Projects or Appendix E Projects shall not be included in the amounts spent on the projects, except to the extent such costs would be deemed reasonable, allocable, and allowable under 48 C.F.R. Part 31, Subpart 31.2.

89. Any Company Proposed Projects shall be consistent with the following priorities and shall meet the following criteria:

Priorities:

(a) projects providing the greatest amount of NOx emission reductions that are readily quantifiable, verifiable, and cost effective;

(b) projects providing such emission reductions in the near-term;

(c) projects that will leverage the use of funds from other sources;

(d) projects that will reduce NOx in those areas most severely affected by ozone and acid deposition; and

(e) projects that will focus on heavy-duty engines, unless other NOx reduction opportunities are shown to be more cost-effective and efficient.

(f) projects providing the greatest amount of PM reductions that are readily quantifiable, verifiable, and cost effective;

Criteria:

(a) the project may not be for emission reduction obligations already placed on Caterpillar under any federal, state or local law or which have been proposed for adoption as a mandatory federal, state, or local program;

(b) the project may not duplicate programs already funded by the United States or that the United States is required by statute to perform;

(c) if it is a research and development project, the project shall demonstrate technologies having the goal of reducing HDDE NOx plus NMHC emissions below 1.5 g/bhp-hr and/or PM emissions below .05 g/bhp-hr and having the greatest likelihood of resulting in maximum long-term NOx or PM reductions. The results of such research programs shall be reported annually and shall not be considered confidential business information;

(d) the project should have broad impact or should address areas significantly affected by ozone and acid deposition; and

(e) the project must be one Caterpillar would not otherwise be legally required to perform outside of this Consent Decree or one previously planned by Caterpillar. For this purpose, a project shall be deemed to have been previously planned by Caterpillar if the project is reflected in a written plan approved by management on or before February 1, 1998.

90. The United States shall, within 30 days, review and either disapprove or approve the Plans. If the United States disapproves any of the Plans, in whole or in part, it shall provide Caterpillar with proposed modifications, and Caterpillar shall have 30 days to submit a revised version of the disapproved Plan(s) to the United States incorporating the United States' proposed modifications; but, if Caterpillar disputes the proposed modifications, the dispute shall be governed by the dispute resolution provisions of Section XVI.

With respect to the Incentive Project Plan(s), if the modifications requested by the United States conflict with modifications requested by CARB, the dispute shall be governed by the dispute resolution provisions of Section XVI. In reviewing Caterpillar's Company Proposed Projects Plan, the United States may consider, in addition to the priorities and criteria set forth above, whether the proposed projects, when viewed together with the proposals of the other Settling HDDE Manufacturers, will achieve maximum environmental benefit in terms of NOx and PM reductions nationwide, and are cost-effective in terms of expected NOx and PM reductions.

91. Within 90 days of the United States' approval of each of the Plans, or resolution of any dispute by the Court, Caterpillar shall submit a Scope of Work for each project in each approved Plan, including the manner in which it will be implemented, the timetable for implementation, the expected reductions in the emission of air pollutants, the location in which each project will be performed or in which the NOx reductions are likely to occur, and any issue that must be resolved for the project to be successful. With respect to any Incentive Project, Caterpillar shall submit to the United States and CARB, for review and approval by each, a single Scope of Work.

92. The United States shall review and approve or disapprove each proposed Scope of Work submitted under Paragraph 91 within 30 days of receiving it. If a Scope of Work is disapproved, the United States shall provide Caterpillar with an explanation as to why it is being disapproved along with proposed modifications. Caterpillar shall incorporate the proposed modifications within 30 days of receiving the proposed modifications; but, if Caterpillar disputes the proposed modifications, the dispute shall be governed by the dispute resolution provisions of Section XVI. With respect to the Scope of Work for each Incentive Project, if the modifications requested by the United States conflict with modifications requested by CARB, the dispute shall be governed by the dispute resolution provisions of Section XVI.

93. Following the United States' approval of each Scope of Work, Caterpillar shall commence implementation of the project covered by that Scope of Work by the date set out in the Scope of Work and shall comply with the implementation schedule set forth in the Scope of Work. Caterpillar shall be granted an extension of the final completion date for any project for good cause shown.

94. Each Scope of Work shall provide a certification that, as of the date the certification is submitted, Caterpillar is not required by any federal, state, or local law to perform or develop any of the projects it proposes to implement or perform, nor is Caterpillar required to perform or develop the projects by any agreement, other than this Consent Decree, by grant, or as injunctive relief in any other case. Except as set forth in Paragraph 85, Caterpillar shall further certify that it has not received, and is not presently negotiating to receive, and will not seek, credit for the projects in any other environmental enforcement proceeding.

95. The United States' approval of a Plan or a Scope of Work under this Section shall not be construed as a permit, modification to a permit, or determination concerning compliance with any local, state or federal law.

96. Caterpillar shall submit to the United States a completion report for each project no later than 30 days after the completion date. The report shall contain the following information:

(a) with respect to each approved project: (i) a detailed description of the project as implemented, including a summary for public disclosure; and (ii) certification that the project has been implemented or performed in accordance with the requirements of this Consent Decree and the applicable Scope of Work;

(b) with respect to each approved project of the Company Proposed Projects or Appendix E Projects: (i) a detailed analysis of full costs; and (ii) a description of the environmental or public health benefits resulting from implementation of the project (including, where applicable, an estimation of the emission reduction benefits); and

(c) with respect to each approved project included in the Incentive Projects, a certification that the emission reduction amounts required under Paragraph 84 to receive

the corresponding dollar reductions in its obligation under Paragraph 84 have been achieved.

97. Caterpillar shall submit a report as required by Paragraph 105 for any quarter in which project implementation activities have occurred, or project expenditures are made, or in which problems related to a project are encountered. Such report shall include a summary of such activities, expenditures with respect to projects, or problems and their solutions.

98. In itemizing its costs in the completion reports for Company Proposed Projects and Appendix E Projects, Caterpillar shall clearly identify and provide adequate documentation to substantiate all project costs.

99. Within 30 days following the date for completion of its Incentive Projects, Caterpillar shall certify to the United States that it has fully implemented its Incentive Projects and has achieved all the emission reductions required for the dollar reduction set forth in Paragraph 84. If Caterpillar cannot make the required certification, then any dollar reductions that Caterpillar has not qualified to receive shall become available for the implementation of Supplemental Offset Projects. Twenty percent of the available funds shall be spent on projects agreed to in, or selected pursuant to, the California Settlement Agreement, and eighty percent shall be spent on projects approved by the United States in accordance with this Section. Within 120 days following the deadline for completing the Incentive Projects, Caterpillar shall submit a Supplemental Offset Project Plan proposing projects consistent with the priorities and criteria set forth in this Section. The Supplemental Offset Project Plan shall be subject to the United States' review and approval or disapproval in the same manner as set forth in Paragraph 90 above, and Caterpillar shall submit Scopes of Work and implement any approved Scope of Work in the same manner as set forth in Paragraphs 92 and 93 above, except that all Supplemental Offset Projects shall be completed within 3 years from the date of EPA's approval of the applicable Scope of Work.

100. During the term of this Consent Decree, in any prepared public statements, oral or written, made by the Caterpillar about the projects under this Section, Caterpillar shall include the following language: "This project was undertaken pursuant to an agreement with the United States in connection with settlement of disputed claims in an enforcement action under the Clean Air Act."

101. Except as provided herein, Caterpillar shall not use or rely on the emission reductions generated as part of any projects undertaken pursuant to the approved Scope of Work in any Federal or State emission averaging, banking, trading or other emission compliance program. If Caterpillar proposes to implement a project to research and develop new technology or new fuels, the project must include a field demonstration of the technology, if practicable. No emission reductions generated by the engines required by the project may be used or relied on for purposes of Federal or State emission averaging, banking, trading, or other emission compliance programs. However, if Caterpillar thereafter employs that technology in engines other than those specifically required by the project, nothing herein shall prohibit the use of the credits generated from the additional vehicles in Federal or State emission averaging, banking, trading, or other emission compliance programs.

X. ADDITIONAL DATA ACCESS, MONITORING, AND REPORTING REQUIREMENTS

A. Access to Engine Control Module Data

102. Within 90 days after the Date of Entry of this Consent Decree, Caterpillar shall provide EPA with current decoder tools, passwords, and any other device or information required to obtain access to data from Caterpillar's HDDEs necessary to determine reported output torque from an engine. Thereafter, Caterpillar shall provide EPA with any modified tool or device and any changed information promptly after any modification or change is made, so as to ensure EPA's continuing capability to access such data. At the time that Caterpillar provides to EPA any device or information required by this Paragraph, Caterpillar may designate all or a portion of the information provided to EPA, or obtainable by EPA

through the use of the device or information provided directly, as Confidential Business Information in accordance with 40 C.F.R. Part 2.

103. Beginning with Model Year 2000 engines, Caterpillar shall configure the engine control modules installed on HDDEs manufactured by Caterpillar to calculate and report engine output torque (in ft-lb), engine speed (in RPM), and commanded fuel injection timing (in degrees before top dead center ("DBTDC")) at a minimum update rate of 5 Hz. Subject to the phase-in provisions of this Paragraph, Caterpillar shall demonstrate to the highest degree of precision and accuracy achievable consistent with good engineering practices at the time of certification that: (a) the reported output torque is equal to actual output torque; (b) the reported output RPM is equal to actual engine RPM; and (c) the commanded injection timing is equal to actual commanded injection timing in DBTDC. The obligation to make a demonstration with respect to reported output torque imposed by this Paragraph shall be phased in as follows: Beginning with Model Year 2000, at least 25% of the total volume of HDDEs manufactured by Caterpillar shall be configured to provide reported output torque to the degree of precision and accuracy established pursuant to this Paragraph; and beginning in Model Year 2001, all HDDEs manufactured

by Caterpillar shall be so configured. All of the required data outputs specified above shall be made compatible with industry standard data links.

B. Compliance Representative

104. Within 15 days of entry of this Consent Decree, Caterpillar shall designate a duly authorized representative whose responsibility shall be to oversee Caterpillar's program for implementation of the measures specified in Section VI (Requirements for On-road HDDEs), Section VIII.B (In-use Testing Requirements), Section IX (Additional Injunctive Relief), and to file such reports and certifications as are required under this Consent Decree. This person may not be the same individual as Caterpillar's Compliance Auditor. The designated representative shall also attend the progress meetings among the Parties as provided for in Paragraph 106, and shall be responsible for providing all additional information and documentation requested by the United States in accordance with Paragraph 105 of this Consent Decree.

C. Progress Reporting

105. In addition to any other requirement of this Consent Decree, Caterpillar shall submit to EPA written quarterly progress reports that: (a) describe the actions which have been taken toward

achieving compliance with this Consent Decree during the previous quarter; (b) include a summary of all research and development activity, investigatory activity and procurement activity engaged in during the quarter which relates to the development, procurement, or implementation of technology to assist in meeting any of the compliance obligations of this Decree; (c) include the information required by Paragraphs 44, 55, 59 and 97; (d) describe all actions, including, but not limited to, actions related to compliance with the EURO III, NTE, TNTE, Smoke (or alternate Opacity), and NOx plus NMHC limits of this Decree, and actions related to implementation of the Section IX.C requirements, and the In-Use Testing Program; (e) include the current running total of Low NOx Rebuild Kits provided to engine rebuilders; and (f) include a summary of all tests conducted in order to comply with the requirements of this Consent Decree, with documentation for such tests being made available by Caterpillar to the United States upon request. Caterpillar may designate all or a portion of a report as Confidential Business Information in accordance with 40 C.F.R. Part 2.

106. Caterpillar shall submit an initial progress report to EPA within 45 days of the close of the quarter during which this Consent Decree is entered and within 30 days of the close of each

quarter thereafter, through and including the quarter in which this Consent Decree is terminated pursuant to Section XXVI of this Consent Decree, containing the information required by Paragraph 105. If requested by the United States, Caterpillar shall provide briefings for the United States to discuss the progress of implementation of this Consent Decree.

107. Each notice, submission, or report required by this Consent Decree, except for any report required to be submitted by the Compliance Auditor, shall contain the following statement signed by a responsible corporate official: "To the best of my knowledge, after thorough investigation, I certify that the information contained in or accompanying this submission is true, accurate and complete. I am aware that there are significant penalties for knowingly submitting false information, including the possibility of fines and imprisonment for knowing violations." Each notice, submission or report shall be accompanied by a transmittal letter referencing the appropriate Paragraph of this Consent Decree. Caterpillar shall not object to the admissibility in evidence of any such notice, submission, or reports, except on the grounds of relevancy, in any proceeding to enforce this Consent Decree.

108. Compliance with the reporting requirements of this Consent Decree shall not relieve Caterpillar of its obligation to comply with any other reporting requirements imposed by any applicable federal, state, or local laws, regulation, or permit.

XI. NON-CIRCUMVENTION PROVISIONS

109. Caterpillar shall not, directly or indirectly through its dealers, distributors, or other third parties (including any present or future manufacturer of HDDEs or Nonroad CI Engines), circumvent the requirements of this Consent Decree through leasing, licensing, sales, or other arrangements, or through stockpiling (i.e., build up of an inventory of engines outside normal business practices before a new limit under this Consent Decree takes effect).

110. All HDDEs and Nonroad CI Engines manufactured at any facility owned or operated by Caterpillar on or after January 1, 1998, for which a Certificate of Conformity is sought, must meet all applicable requirements of this Decree, regardless of whether Caterpillar still owned, owns, operated, or operates that facility at the time the engine is manufactured.

XII. NOTICE AND SUBMITTALS

111. Whenever, under the terms of this Consent Decree, a notice, submission, report, or other document is required to be sent

by one Party to another, it shall be directed to the individuals at the addresses specified below, unless those individuals or their successors give notice of a change to the other Party in writing. All notices and submissions shall be considered effective upon receipt, unless otherwise provided.

Such notice shall be sent to the Parties as follows:

As to the United States:

Chief
Environmental Enforcement Section
Environment and Natural Resources Division
U.S. Department of Justice
P.O. Box 7611, Ben Franklin Station
Washington, D.C. 20044

and

Director, Air Enforcement Division (2242A)
U.S. Environmental Protection Agency
401 M Street, S.W.
Washington, D.C. 20460

As to Caterpillar:

Compliance Administrator
Office of the Vice President
Performance Engine Product Division
Caterpillar Inc.
PO Box 600 MOS 20
Mossville, IL 61552-0600

and

Vice President/General Counsel and Secretary

Caterpillar Inc.
100 N.E. Adams
Peoria, IL 61629

112. Any Party may change the address for providing notices to it by serving all other addressees identified above with a notice setting forth such new address.

XIII. CIVIL PENALTY

113. Caterpillar has agreed to pay an aggregate civil penalty of $25,000,000 under this Consent Decree and the California Settlement Agreement to resolve the federal and state claims described in those agreements. Accordingly, under this Consent Decree, within 15 days of entry of this Consent Decree, Caterpillar shall pay $18,750,000 to the United States in the manner described in Paragraph 114. Late payment of the civil penalty to the United States is subject to interest and fees as specified in 31 U.S.C. § 3717.

114. Payment shall be made by Electronic Funds Transfer by 4:00 p.m. Eastern Standard Time on the due date to the Department of Justice lockbox bank in accordance with specific instructions to be provided to Caterpillar upon entry of this Consent Decree and shall

reference Department of Justice Case No. 90-5-2-1-2255____ and the civil action number of this matter. Caterpillar shall transmit notice of such payments to the United States.

115. Penalty payments made pursuant to Paragraph 113 of this Consent Decree are civil penalties within the meaning of Section 162(f) of the Internal Revenue Code, 26 U.S.C. § 162(f) and are not tax deductible for the purposes of Federal Law.

XIV. STIPULATED PENALTIES AND OTHER PAYMENTS

116. Caterpillar shall pay stipulated penalties and other payments to the United States as follows:

(a) If Caterpillar seeks certificates of conformity for any affected HDDEs, but cannot certify compliance with any applicable EURO III, NTE, TNTE, Smoke (or alternate Opacity), or NOx plus NMHC Limits, or the Nonroad CI Engine standard pull-ahead requirements, Caterpillar shall make payments to the United States as follows:

(i) For failure to certify to the applicable EURO III Limits for CO or HC, per engine non-conformance penalties ("NCPs") shall be $200;

(ii) For failure to certify to the applicable Smoke or alternate Opacity Limits, per engine NCPs shall be $200;

(iii)For failure to certify to the applicable EURO III, NTE, or TNTE Limits for NOx, NOx plus NMHC, or PM, the NOx plus NMHC Limits, or the Nonroad CI Engine standard pull-ahead requirements, NCPs shall be calculated using the NCP procedures, equations, and values specified in 40 CFR Part 86, Subpart L as if they were failures of the regulatory FTP limit for HDDEs, with the following exceptions:

(A) For HDDEs manufactured prior to October 1, 2002, the applicable EURO III and NTE "upper limit" (the UL value in the equations found at 40 CFR 86.1113-87) for NOx shall be 1.0 g/bhp-hr plus the applicable EURO III or NTE Limit. For HDDEs manufactured on or after October 1, 2002, the applicable EURO III, NTE, and TNTE upper limit for NOx plus NMHC shall be the upper limit for NOx plus NMHC for Model Year 2004 engines set out in the regulations minus 2.5 g/bhp-hr plus the EURO III, NTE or TNTE Limit--i.e.,

$$(UL_{NOx + NMHC} - 2.5 \text{ g/bhp-hr}) + S;$$

however, if no upper limit is set by regulation for NOx plus NMHC for Model Year 2004 engines, then the applicable EURO III, NTE, and TNTE upper limit for NOx plus NMHC shall be 1.5 g/bhp-hr plus the EURO III, NTE or TNTE Limit. For HDDEs, except Urban Bus Engines, the applicable EURO III, NTE, and TNTE upper limit for PM shall be 0.15

g/bhp-hr plus the applicable EURO III, NTE, or TNTE Limit. For Urban Bus Engines, the applicable EURO III, NTE, and TNTE upper limit for PM shall be 0.02 g/bhp-hr plus the applicable EURO III, NTE, or TNTE Limit. For Nonroad CI Engines at or above 750 horsepower, the applicable upper limit for NOx plus NMHC shall be 6.9 g/bhp-hr;

(B) For HDDEs manufactured prior to October 1, 2002, the COC_{50}, COC_{90}, MC_{50}, and F values and the factor used to calculate the engineering and development component of the NCP for NOx shall be those found at 40 CFR 86.1105-87(h). For HDDEs, except Urban Bus engines, the COC_{50}, COC_{90}, MC_{50}, and F values and the factor used to calculate the engineering and development component of the NCP for PM shall be those found at 40 CFR 86.1105-87(f)(2). For Urban Bus engines, the COC_{50}, COC_{90}, MC_{50}, and F values and the factor used to calculate the engineering and development component of the NCP for PM shall be those found at 40 CFR 86.1105-87(g)(3).

(C) The "S" value used in the equations found at 40 CFR 86.1113-87 shall be the applicable emission limit that is exceeded under this Decree;

(D) For purposes of calculating the annual adjustment factor (the "AAF" values used in the equations found at 40 CFR 86.1113-87), the first model for which an NCP shall be considered

available shall be the first Model Year that an emission limit is applicable or becomes more stringent;

(E) For HDDEs manufactured on or after October 1, 2002, subject to the exceptions specified in Paragraph 116(a), NCPs for failure to certify to the EURO III, NTE, TNTE, or NOx plus NMHC emission limits shall be calculated in accordance with the NCP procedures, equations and values found in 40 CFR Part 86, Subpart L applicable to Model Year 2004 HDDEs. If no COC_{50}, COC_{90}, MC_{50}, and F values or factors used to calculate the engineering and development component of the NCP for Model Year 2004 HDDEs are established by regulation, then the values and factors shall be those applicable to the 1998 Model Year multiplied by 1.5. Payment of NCPs pursuant to Subparagraph 116(a)(iii)(E) will satisfy any NCPs that are otherwise owed to the United States as a result of a failure to certify to the regulatory FTP limit for NOx plus NMHC;

(F) For failure to certify to the Nonroad CI Engine standard pull-ahead requirements, subject to the exceptions specified in Paragraph 116(a), NCPs shall be calculated in accordance with the NCP procedures, equations and values found in 40 CFR Part 86, Subpart L applicable to Model Year 2004 HHDDEs. If no COC_{50}, COC_{90}, MC_{50}, and F values or factors used to calculate the engineering and development

component of the NCP for Model Year 2004 HHDDEs are established by regulation, then the values and factors shall be those applicable to 1998 Model Year HHDDEs multiplied by 1.3.

(G) If the "compliance level" for an engine family exceeds the applicable upper limit, then NCPs will be determined by calculating the applicable NCP as if the compliance level were equal to the upper limit and then multiplying the resulting NCP amount by the following:

$$1 + \frac{[.25 \times (CL - UL)]}{[(UL - EL)]}$$

where:

CL = The actual compliance level
UL = The upper limit
EL = The applicable emission limit under this Decree;

(H) A separate NCP shall be paid for each pollutant where there is a failure to certify to any emission limit imposed by this Consent Decree. For example, if a particular engine configuration exceeds the applicable NTE Limit for both NOx and PM, then Caterpillar shall be liable for separate NCPs based on the amounts determined under this Subparagraph for both the NOx and PM exceedances of the NTE Limit. However, if an engine configuration exceeds more than one emission limit under this Decree for the same pollutant (e.g., an engine configuration fails to meet the applicable NOx limit for both the EURO III Composite Value Limit and the NTE Limit), Caterpillar shall be liable for only one NCP. To determine the per engine NCP where an engine configuration exceeds multiple emission limits for the same pollutant, Caterpillar shall calculate the applicable per engine NCP in accordance with this Subparagraph for each limit exceeded, and the per engine NCP shall be the one resulting in the largest payment;

(I) Any dispute arising under or relating to this Consent Decree regarding whether a compliance level has been appropriately calculated shall be subject to the administrative hearing procedures found at 40 CFR 86.1115-87. However, any appeal

of a final decision by the Environmental Appeals Board shall not be subject to the provisions of Section 307 of the Act, 42 U.S.C. § 7607, but instead shall be resolved through the dispute resolution procedures in Section XVI of this Consent Decree. For any hearing under Subparagraph 116(a)(iii)(I), EPA shall appoint a hearing officer who shall preside at any hearing at which, under existing regulations, an administrative law judge would otherwise preside; and,

(J) Payment of NCPs under this Subparagraph shall be made in accordance with the procedures found at 40 CFR 86.1113-87(g), except that the quarterly payments shall be payable to the "Treasurer, United States of America," and sent to the Office of the United States Attorney for the District of Columbia, referencing the civil action number of this matter. A copy of the transmittal letter and check and the information required to be submitted quarterly to EPA pursuant to 40 CFR 86.1113-87(g)(3) shall be sent to the United States.

(b) In-use Compliance. This Subparagraph (b) applies only to HDDEs installed in vehicles and introduced into commerce. The stipulated penalties set forth in Subparagraph (b) apply only to engines manufactured on or after January 1, 2000, and only to NOx or

NOx plus NMHC violations of the EURO III, NTE, TNTE, and NOx plus NMHC limits and requirements set forth in this Consent Decree. Stipulated penalties may be assessed only once under Subparagraph (b)(i) and once under (b)(ii) for an affected population of engines, unless the subsequent emissions exceedance is the result of a separate, previously unidentified cause. In evaluating the scope of the affected population for purposes of this Section, there shall be a rebuttable presumption that the affected population is the engine family to which the tested engines belong. No engine may be used to establish the existence of an emissions exceedance if the engine or vehicle in which it was installed was subject to abuse or improper maintenance or operation, or if the engine was improperly installed, and such acts or omissions caused the exceedance.

(i) The stipulated penalties set forth in this Subparagraph apply when a population of engines, in-use, exceeds an applicable emission limit by 0.5 g/bhp-hr or more. For purposes of this Subparagraph, the "emissions threshold" shall mean (A) for a test using vehicle test equipment (e.g., an over-the-road mobile monitoring device such as "ROVER", or a chassis dynamometer), the applicable maximum NOx emission limit plus the greater of 0.5 g/bhp-hr or one standard deviation of the data set established pursuant to Subparagraph (b)(i)(A) below; or (B) for a test using an engine

dynamometer, the applicable maximum NOx emission limit plus 0.5 g/bhp-hr.

(A) Where an engine dynamometer or vehicle test shows an apparent exceedance of the emissions threshold, the party conducting the original test shall repeat such test under the same conditions at least nine times. If the mean of the tests does not exceed the emissions threshold, Caterpillar shall not be obligated to take further action under Subparagraphs (b)(i)(B),(C), or (E) based on the results of the tests. If the mean of the tests exceeds the emissions threshold, then the party conducting the tests shall notify the other party to this Decree within 30 days of completing testing, and Caterpillar shall perform the engineering analysis and/or conduct further testing in accordance with Subparagraphs (b)(i)(B) and (C).

(B) If the testing conducted under Subparagraph (b)(i)(A) was performed using vehicle test equipment, then Caterpillar may elect to conduct additional tests of that engine using an engine dynamometer, provided that all environmental and engine operating conditions present during vehicle testing under Subparagraph (b)(i)(A) can be reproduced or corrected consistent with Subparagraph (b)(i)(D). If Caterpillar elects to conduct such additional engine dynamometer tests, it shall provide EPA with at least three business days notice

prior to commencement of such testing. If based on such additional tests Caterpillar demonstrates that the engine does not exceed the emissions threshold, Caterpillar shall not be obligated to take further action under Subparagraphs(b)(i)(A),(B),(C), or (E). Otherwise, Caterpillar shall conduct further testing in accordance with Subparagraph (b)(i)(C) and/or perform an engineering analysis to determine the percentage of the affected population that exceeds the emissions threshold and the emission levels of the exceeding engines. However, Caterpillar may not determine the percentage of the affected population or the emission levels solely on the basis of an engineering analysis unless it demonstrates that such analysis alone is sufficient under the circumstances.

(C) Such testing shall be conducted as follows unless Caterpillar otherwise resolves the issue with EPA or EPA approves an alternate procedure. Within 60 days of receiving notice of an exceedance under Subparagraph (b)(i)(A) if EPA was the party that conducted the testing, or within 60 days of completing testing under Subparagraph (b)(i)(A) that demonstrated an exceedance if Caterpillar conducted the testing, Caterpillar shall commence testing of not less than ten additional in-service engines. Caterpillar may conduct

these tests using vehicle testing equipment, or using an engine dynamometer, at Caterpillar's option. If on two prior occasions in any one calendar year, Caterpillar was notified by EPA pursuant to Subparagraph (b)(i)(A) (or CARB pursuant to Paragraph 116 (b)(i)(A) of the California Settlement Agreement) of apparent exceedances and established that there were no exceedances of the emission threshold in the affected populations as a result of testing conducted under Subparagraph (b)(i)(C), then for the remainder of the calendar year Caterpillar shall not be obligated to perform further testing under this Subparagraph, but nothing herein shall be construed to limit EPA's authority to conduct such testing.

(D) The testing of additional engines under Subparagraphs (b)(i)(B) and (C), above, shall be conducted under conditions that are no less stringent than the initial test in terms of those parameters that may affect the result, and, at Caterpillar's option, may be limited to those emission limits and conditions for which apparent exceedances have been identified. Such parameters typically, but not necessarily, include relevant ambient conditions, operating conditions, service history, and age of the vehicle. Prior to conducting any testing, Caterpillar shall submit a test plan to

EPA for its review and approval. EPA shall approve the test plan or propose modifications to the test plan within 10 days of receipt. Within 30 days following EPA's proposed modifications, Caterpillar shall incorporate the proposed modifications; but if Caterpillar disputes the proposed modifications, the dispute shall be resolved in accordance with the dispute resolution provisions of Section XVI of this Consent Decree. Caterpillar shall implement the test plan as approved. Special conditioning of test engines shall not be permitted. Where Caterpillar elects to conduct the additional testing utilizing an engine dynamometer, it shall reproduce relevant engine operating and environmental conditions associated with the initial exceedance; provided, however, that correction factors may be used to reproduce temperature, humidity or altitude conditions that cannot be simulated in the laboratory. Regardless of the testing equipment utilized, the test results shall be adjusted to reflect documented test systems error and/or variability in accordance with good engineering practices.

(E) Caterpillar shall pay stipulated penalties under Subparagraph (b)(i) for each engine in the affected population estimated, based on an engineering analysis or testing conducted under Subparagraph (C) and using standard statistical procedures and

good engineering judgment, to have an emission level equal to or in excess of the emission threshold, as follows:

HHDDE Engines	**≥ Emission Threshold, but < Emission Threshold Limit + 1.5 g/bhp-hr**	**≥ Emission Threshold Limit + 1.5 g/bhp-hr**
1 - 4,000	$250 per engine	$500 per engine
4,001-12,000	$250 per engine	$250 per engine
> 12,000	$100 per engine	$100 per engine

LHDDE/MHDDE Engines	**≥ Emission Threshold, but < Emission Threshold Limit + 1.5 g/bhp-hr**	**≥ Emission Threshold Limit + 1.5 g/bhp-hr**
1 - 4,000	$125 per engine	$250 per engine
4,001-12,000	$125 per engine	$125 per engine
> 12,000	$ 50 per engine	$ 50 per engine

(ii) The stipulated penalties set forth in this Subparagraph apply when the mean emissions of a population of engines, in-use, exceeds an applicable NOx or NOx plus NMHC emission limit by less than 0.5 g/bhp-hr. In such circumstances, the United States shall have the burden of proving, by a preponderance of the evidence in a de novo proceeding in this Court, that the mean emissions of the affected population exceeds the applicable emission limit. In determining the mean emission level of an affected

population for purposes of Subparagraph (b)(ii), any engines for which a penalty is due or has been paid under Subparagraph (b)(i)(E) shall not be included in the calculation. If the Court determines that the mean emissions of the affected population exceeds the applicable emission limit, then Caterpillar shall pay a stipulated penalty for each engine in the affected population as follows:

HHDDE Engines	$ PER .1 G/BHP-HR EXCEEDANCE
1 - 4,000	$50 per engine
4,001-12,000	$40 per engine
> 12,000	$20 per engine

LHDDE/MHDDE Engines	**$ per .1 g/bhp-hr exceedance**
1 - 4,000	$25 per engine
4,001-12,000	$20 per engine
> 12,000	$10 per engine

(iii) In any case where an emissions exceedance under Subparagraphs (b)(i) or (b)(ii) above is identified and Caterpillar agrees with EPA to recall or otherwise take steps to modify the affected engines to correct the emissions exceedance, the stipulated penalties otherwise due under this Subparagraph shall be adjusted and shall be payable as follows: the affected population for purposes of calculating the penalty amount due shall be reduced by the number of

engines modified within one year of when the stipulated penalty would otherwise be due; and the penalty, plus interest at the rate specified in 31 U.S.C. 3717, shall be due and payable one year plus 30 days after the date when it would otherwise be due under this Section.

(c) AECD Reporting: for failure to comply with AECD reporting requirements of Paragraph 11, a stipulated penalty of $25,000 per certification application;

(d) Defeat Device: for violations of Paragraphs 13 and 18, a stipulated penalty of $500 per engine, provided however that if the device involved was disclosed by Caterpillar as an AECD in accordance with Paragraph 11, no stipulated penalty will be assessed;

(e) Submissions and Testing: stipulated penalties for each separate failure: to submit a Low NOx Rebuild Program Plan within the time set forth in Paragraph 65; to complete any test required by the in-use testing requirements of Section VIII.B; to submit a quarterly report within the time required by Paragraph 106 of this Decree; or to comply with any requirement of Section XIX:

Days of Non-compliance or violation	Penalty per violation per day
1st to 30th day	$100
31st to 60th day	$250
After 60 days	$500

(f) Low NOx Rebuild: stipulated penalties for failure to comply with the schedules in the approved Low NOx Rebuild Plan within the time frames required by Paragraph 68:

Days of Non-compliance or violation	Penalty per Violation per day
1st to 30th day	$500
After 30 days	$2,000

(g) Compliance Auditor: for failure to identify a Compliance Auditor as required by Paragraph 31 of this Decree, a stipulated penalty of $1,000 per day;

(h) Plan and Scope of Work: stipulated penalties for failure to submit a Plan or a Scope of Work within the times set forth in Paragraphs 42, 49, 54, 58, 59, 86, 90, 91, 92 and 99 as follows for each day of delay:

Days of Non-compliance or violation	Penalty per Violation per day
1st to 30th day	$250
31st to 60th day	$500
After 60 days	$750

(j) stipulated penalties for failure to complete any project of an approved Offset Scope of Work within the times required by Paragraph 93 and the Scope of Work, or agreed to by the Parties, for each day of delay for each project:

Days of Non-compliance or violation	Penalty per Violation per day
1st to 30th day	$250
31st to 60th day	$750
After 60 days	$1,500

(k) For failure to comply with the requirements of Paragraph 141, a stipulated penalty of $5,000 per day per violation.

117. Upon entry of this Consent Decree, the stipulated penalty and other payment provisions of this Consent Decree shall be retroactively enforceable with regard to any and all violations of, or noncompliance with, the Consent Decree that have occurred after the date of filing but prior to the date of entry of the Consent Decree.

118. Stipulated penalties provided for in this Consent Decree shall automatically begin to accrue on the day performance is due or the non-compliance occurs, and shall continue to accrue through the day performance is completed or the non-compliance ceases. Nothing herein shall be construed to prevent the simultaneous accrual of separate stipulated penalties for separate violations of this Consent Decree. The amounts specified in Subparagraph 116(a), (b), (d), (e), (f), and (g), shall be the maximum NCPs or stipulated penalties under those Subparagraphs for which Caterpillar shall be liable, whether paid to the United States, CARB, or both. Payment of stipulated penalties as set forth above is in addition to, and the United States specifically reserves all other rights or remedies which may be available to the United States by reason of Caterpillar's failure to comply with the requirements of this Consent Decree, or any federal, state or local law or regulation applicable to Caterpillar's HDDEs. Payment of NCPs pursuant to Paragraph 116(a) shall constitute compliance with the provisions of this Consent Decree applicable to the limits for which the NCPs were paid.

119. Stipulated penalties from the date of accrual are due and payable upon demand by the United States on or before the thirtieth day following the demand and shall be due and payable monthly thereafter. Late payment of stipulated penalties shall be subject to interest and fees as specified in 31 U.S.C. § 3717. All stipulated penalties shall be paid by cashiers or certified check or electronic funds transfer, payable to the "Treasurer, United States of America," and sent to the Office of the United States Attorney for the District of Columbia, referencing the civil action number of this matter. A copy of the transmittal letter and check shall be sent to the United States.

120. Stipulated penalties shall continue to accrue during any dispute resolution process. Should Caterpillar dispute its obligation to pay part or all of a stipulated penalty, it shall place the disputed amount demanded by the United States in a commercial escrow account pending resolution of the matter and request that the matter be resolved through the dispute resolution procedures in Section XVI of this Consent Decree. In the event the Court resolves the dispute in Caterpillar's favor, the escrowed amount plus accrued interest shall be returned to Caterpillar.

121. If the United States prevails in an action to enforce this Consent Decree, Caterpillar shall reimburse the United States for all its costs in such action, including attorney time. Claims for such costs, including attorney time, shall proceed in accordance with to Fed. R. Civ. P. 54(d).

122. Notwithstanding any other provision of this Section, the United States may, in its unreviewable discretion, waive any portion of stipulated penalties that have accrued pursuant to this Consent Decree.

XV. FORCE MAJEURE

123. "Force Majeure," for purposes of this Consent Decree, shall mean any event arising wholly from causes beyond the control of Caterpillar or any entity controlled by the Caterpillar (including, without limitation, Caterpillar's contractors and subcontractors, and any entity in active participation or concert with Caterpillar with respect to the obligations to be undertaken by Caterpillar pursuant to this Decree), which prevents timely compliance with the requirements of this Consent Decree. The requirements of the Consent Decree include an obligation reasonably to anticipate any potential Force Majeure event and best efforts to address the effects of any potential Force Majeure event (1) as it is occurring and (2) following the potential Force Majeure event, such that the delay is minimized to the greatest extent possible.

124. "Force Majeure" does not include technological infeasibility, financial inability, or unanticipated or increased costs or expenses associated with the performance of Caterpillar's obligations under this Consent Decree.

125. If any event occurs or has occurred that may delay compliance with any requirement of this Consent Decree, whether or not caused by a Force Majeure event, Caterpillar shall notify, either in

writing or orally, the United States within 5 days of when Caterpillar first knew that the event might cause a delay. Within 10 days thereafter, Caterpillar shall provide in writing to the United States an explanation and description of the reasons for the delay; the anticipated duration of the delay; all actions taken or to be taken to prevent or minimize the delay; a schedule for implementation of the measures to be taken to prevent or mitigate the delay or the effect of the delay; and Caterpillar's rationale for attributing such delay to a Force Majeure event if Caterpillar intends to assert such a claim.

126. Caterpillar shall include with any notice, the documentation supporting its claim that the delay was attributable to a Force Majeure event. Failure to comply with the requirements of Paragraphs 123 and 125 shall preclude Caterpillar from asserting any claim of Force Majeure for that event for the period of time of such failure to comply, and for any additional delay caused by such failure. Caterpillar shall be deemed to know of any circumstance of which Caterpillar or any entity controlled by Caterpillar knew or, through the exercise of due diligence, should have known.

127. If the United States does not dispute that the delay or anticipated delay is attributable to a Force Majeure event, the time for performance of the obligations under this Consent Decree affected by the Force Majeure event will be extended for such time as is necessary to complete those obligations. An extension of the time for performance of the obligations affected by the Force Majeure event shall not, of itself, extend the time for performance of any other obligation under the Decree.

128. If the United States does not agree that the delay or anticipated delay has been or will be caused by a Force Majeure event, it will notify Caterpillar in writing of its decision. Within 15 days of receiving written notice from the United States of such disagreement, Caterpillar may submit the matter to the Court for resolution. If Caterpillar submits the matter to the Court for resolution, Caterpillar shall have the burden of proving by a preponderance of the evidence that the event is a Force Majeure as defined herein, that Caterpillar used best efforts to avoid a Force Majeure or minimize the delay; the duration of any delay attributable to the Force Majeure; and that it met the requirements of Paragraph 125. If, upon submission to the Court, the Court determines that the delay was caused by a Force Majeure event, as defined herein, the delay shall be excused, but only for the period of the actual delay resulting from the Force Majeure event. If, upon submission to the Court, the Court determines that the delay was not caused by a Force Majeure event, as defined herein, Caterpillar shall pay the stipulated penalties attributable to such delay, plus accrued interest, in accordance with Paragraph 118. Any such payments shall be made within 15 days from the court's decision.

XVI. DISPUTE RESOLUTION

129. The dispute resolution procedures of this Section shall be the exclusive mechanism to resolve all disputes arising under or with respect to this Consent Decree unless otherwise expressly provided for in this Consent Decree. However, the procedures set forth in this Section shall not apply to actions by the United States to enforce obligations of Caterpillar that have not been disputed in

accordance with this Section. In reviewing any dispute under this Section, the Parties agree that the Court, or any hearing officer appointed under this Consent Decree, should consider the effect of the resolution on other Settling HDDE Manufacturers. The United States and Caterpillar consent to intervention by CARB for purposes of resolution of disputes arising under Paragraphs 42, 49, 51, 54, 58, 59, 66, 78, 90 and/or 92 of this Consent Decree, or as otherwise necessary for the proper administration of this Consent Decree.

130. Any dispute regarding the meaning of this Consent Decree shall be reviewed in accordance with applicable principles of law.

131. Existing administrative hearing and other procedures applicable to currently enforceable emission limits shall apply to any dispute which arises with respect to emission limits set forth in this Consent Decree regarding EURO III, NTE, TNTE, Smoke (or the alternate Opacity), the NOx plus NMHC Limit, NCPs under Paragraph 116(a), or pursuant to Paragraph 60 of this Consent Decree (regarding the requirements specified in Section IX.A of this Decree), subject, however, to the following:

(a) EPA shall appoint a hearing officer who shall preside at any hearing at which, under existing regulations, an administrative law judge would otherwise preside; and

(b) Review by the Court shall be as if it were review of final agency action under 5 U.S.C. § 706.

132. Any dispute that arises under or with respect to this Consent Decree, other than the disputes subject to Paragraph 131 of this Decree, shall in the first instance be the subject of informal negotiations between the Parties. The period of informal negotiations shall not exceed 20 days from the time the dispute arises, unless the Parties agree to extend the time period for informal negotiations. The dispute shall be considered to have arisen when one Party sends the other Party a written Notice of Dispute. Judicial review of any dispute governed by this Paragraph shall be governed by applicable principles of law.

133. In the event the Parties cannot resolve a dispute by informal negotiations under the preceding Paragraph, then the position advanced by the United States shall be considered binding, unless, within 30 days after the conclusion of the informal negotiation period, Caterpillar invokes the formal dispute resolution procedures of this Section by serving on the United States a written Statement of Position on the matter in dispute. This Statement of Position shall include, but not be limited to, any factual data, analysis or opinion supporting that position and any supporting documentation relied upon by Caterpillar.

134. Within 30 days after receipt of Caterpillar's Statement of Position, the United States shall serve on Caterpillar its Statement of Position, including, but not limited to, any factual data, analysis, or opinion supporting that position and all supporting documentation relied upon by the United States.

135. Following receipt of the United States' Statement of Position, Caterpillar shall have 10 days to file with the Court and serve on the United States a motion for judicial review of the dispute; otherwise the United States' Statement of Position shall be binding on Caterpillar. Caterpillar's motion for review shall set forth the matter in dispute, the efforts made by the Parties to resolve it, the relief requested, and the schedule, if any, within which the dispute must be resolved to ensure orderly and timely implementation of the Consent Decree. The United States may file a response to Caterpillar's motion within 10 days of service of that motion.

136. The invocation of formal dispute resolution procedures under this Section shall not extend, postpone or affect in any way any obligation of Caterpillar under this Consent Decree, unless the United States or the Court agrees otherwise. Stipulated penalties with respect to the disputed matter shall continue to accrue but payment shall be stayed pending resolution of the dispute as provided in Paragraph 120 of this Decree. Notwithstanding the stay of payment, stipulated penalties shall accrue from the first day of noncompliance with any applicable provision of this Consent Decree. In the event Caterpillar does not prevail on the disputed issue, stipulated penalties shall be assessed and paid as provided in Section XIV of this Decree.

XVII. EFFECT OF SETTLEMENT

137. Satisfaction of all the requirements of this Consent Decree, and payment of $6,250,000 to CARB under the California Settlement Agreement, constitutes full settlement of and shall resolve all

civil liability of Caterpillar to the United States for the civil violations alleged in the Complaint, and for any civil violations that could hereafter be alleged under the Clean Air Act or regulations promulgated thereunder based on: (i) the use of the injection-timing strategies described in the Complaint on Pre-Settlement Engines; and (ii) the use of electronic engine control strategies on HDDEs in accordance with Appendix B-1, B-2, B-3 and B-4, and this Consent Decree.

138. With respect to LMB Engines manufactured before July 31, 1999, EPA shall not base a determination under Section 207(c)(1) of the Act, 42 U.S.C. § 7541, that any class or category of the Pre-Settlement or Interim Engine does not conform to the regulations prescribed under Section 202 of the Act, 42 U.S.C. § 7521, or a determination under Section 206(b) of the Act, 42 U.S.C. § 7525(b), to suspend or revoke a Certificate of Conformity, on the basis that the engine contains one or more of the injection-timing strategies specifically described in Appendix B-1 or B-2, as limited by B-4 in Model Year 2000, if all other requirements applicable to that engine found in this Decree and the regulations are met.

139. With respect to LMB Engines manufactured before October 1, 2002, EPA shall not base a determination under Section 207(c)(1) of the Act, 42 U.S.C. § 7541, that any class or category of the Pre-Settlement or Interim Engine does not conform to the regulations prescribed under Section 202 of the Act, 42 U.S.C. § 7521, or a determination under Section 206(b) of the Act, 42 U.S.C. § 7525(b), to suspend or revoke a Certificate of Conformity, on the basis that the engine contains one or

more of the injection-timing strategies specifically described in Appendix B-2 or B-3 (after July 31, 1999), as limited by B-4 in Model Year 2000, if all other requirements applicable to that engine found in this Decree and the regulations are met.

140. With respect to Truck HHDDEs manufactured before October 1, 2002, EPA shall not base a determination under Section 207(c)(1) of the Act, 42 U.S.C. § 7541, that any class or category of the Pre-Settlement or Interim Engine does not conform to the regulations prescribed under Section 202 of the Act, 42 U.S.C. § 7521, or a determination under Section 206(b) of the Act, 42 U.S.C. § 7525(b), to suspend or revoke a Certificate of Conformity, on the basis that the engine contains one or more of the injection-timing strategies specifically described in Appendix B-1, B-2 or B-3, as limited by B-4 in Model Year 2000, if all other requirements applicable to that engine found in this Decree and the regulations are met.

XVIII. RIGHT OF ENTRY

141. Until termination of this Consent Decree Caterpillar shall allow the United States, and its authorized representatives, contractors, consultants, and attorneys access, at reasonable times and with reasonable advance notice, to any facilities owned or controlled by Caterpillar relating to the manufacture of diesel engines and to any facilities owned or controlled by Caterpillar where activities related to compliance with this Decree are being performed, for the purpose of: monitoring the progress of activities required by this Consent Decree; verifying any data or information submitted by Caterpillar

to the United States; inspecting records; or conducting testing. This provision is in addition to, and in no way limits or otherwise affects, any right of entry, inspection or information collection held by the United States pursuant to the Act or other applicable federal law or regulations promulgated thereunder.

XIX. ACCESS TO INFORMATION AND RETENTION OF DOCUMENTS

142. Caterpillar shall preserve, for five (5) years after termination of the applicable Section of this Consent Decree, an original or a copy of all data and final documents and records (including all electronic documents and records, but excluding drafts, where a final version exists, and notes) and information within its possession or control or that of its contractors or agents relating to implementation of and compliance with this Consent Decree, including, but not limited to, testing, analysis, production records, receipts, reports, research, correspondence, or other documents or information related to compliance with the Consent Decree.

143. Caterpillar shall provide to the United States, upon request, originals or copies of all documents and information within its possession or control or that of its contractors or agents relating to implementation of and compliance with this Consent Decree, including, but not limited to, testing, analysis, production records, receipts, reports, research, correspondence, or other documents or information related to compliance with the Consent Decree.

144. All information and documents submitted by Caterpillar to the United States pursuant to this Consent Decree shall be subject to public inspection, unless identified and supported as confidential business information by Caterpillar in accordance with 40 C.F.R. Part 2.

145. Caterpillar may assert that certain documents, records and other information are privileged under the attorney-client privilege or any other privilege recognized by federal law. If Caterpillar asserts such a privilege in lieu of providing documents, Caterpillar shall provide the United States with the following: (1) the title of the document, record, or information; (2) the date of the document, record, or information; (3) the name and title of the author of the document, record, or information; (4) the name and title of each addressee and recipient; (5) a description of the contents of the document, record, or information; and (6) the privilege asserted by Caterpillar. However, no document, report or other information required to be created or generated by this Consent Decree shall be withheld on the grounds that it is privileged. If a claim of privilege applies only to a portion of a document, the document shall be provided to the United States in redacted form to mask the privileged information only. Caterpillar shall retain all records and documents it claims to be privileged until the United States has had a reasonable opportunity to dispute the privilege claim and any such dispute has been finally resolved in Caterpillar's favor.

XX. NON-WAIVER PROVISIONS

146. This Consent Decree does not pertain to any matters other than those expressly specified in Paragraphs 7 and 137 of this Decree. Nothing in this Consent Decree shall relieve Caterpillar of its obligation to comply with applicable Federal, State and local laws and regulations, and this Consent Decree does not release the liability, if any, of any person or entity for any civil claims other than the civil claims referred to in Paragraph 137, or for any criminal claims.

XXI. THIRD PARTIES

147. This Consent Decree does not limit, enlarge or affect the rights of any Party to the Consent Decree as against any third parties. Nothing in this Decree shall be construed to create any rights in, or grant any cause of action to, any person not a Party to this Consent Decree.

XXII. COSTS

148. Each Party to this action shall bear its own costs and attorneys' fees.

XXIII. PUBLIC NOTICE AND COMMENT

149. The Parties agree and acknowledge that final approval of this Consent Decree by the United States is subject to the public notice and comment requirements of 28 C.F.R. § 50.7, which requires, inter alia, notice of this Consent Decree and an opportunity for public comment. The United States may withdraw or withhold its consent if the public comments demonstrate that entry of this Consent Decree would be inappropriate, improper, or inadequate. After reviewing the public

comments, if any, the United States shall advise the Court by motion whether it seeks entry of this Consent Decree. Caterpillar agrees to the entry of this Consent Decree without further notice.

XXIV. MODIFICATION

150. There shall be no modification of this Consent Decree without written approval by the Parties to this Consent Decree and Order of the Court.

XXV. RETENTION OF JURISDICTION

151. This Court retains jurisdiction over both the subject matter of this Consent Decree and Caterpillar for the duration of the performance of the terms and provisions of this Consent Decree for the purpose of enabling any of the Parties to apply to the Court at any time for such further order, direction, and relief as may be necessary or appropriate for the construction or modification of this Consent Decree, or to effectuate or enforce compliance with its terms, or to resolve disputes in accordance with the dispute resolution procedures set forth in Section XVI.

XXVI. EFFECTIVE DATE AND TERMINATION

152. This Consent Decree shall be effective upon the Date of Entry.

153. Termination of all or any part of this Consent Decree shall occur only as provided in this Section. Termination of a part of this Consent Decree pursuant to Subparagraphs 154(a) or (b) below shall not terminate any other part.

154. (a) The certification requirements in Section VI of this Consent Decree shall terminate as of the earlier of December 31, 2004, or two years after the date in 2002 when Caterpillar has received Certificates of Conformity for all of its engine families required to meet the NOx plus NMHC Limit (the "Termination Date"), provided that Caterpillar certifies to the United States, at least 30 days prior to the Termination Date, that Caterpillar has met all of the requirements of Paragraphs 13 through 20 and 23 through 25 of this Decree, and provided further that the United States, prior to December 31, 2004, does not dispute Caterpillar's certification under the dispute resolution provisions of this Consent Decree. If, after the date of filing of this Consent Decree, regulations under the Act are promulgated imposing an emission standard or other requirement set forth in Section VI of this Consent Decree, Caterpillar shall not be liable for stipulated penalties or other payments (or interest thereon) associated with compliance with the corresponding Consent Decree requirements for engines manufactured after the effective date of the new regulations. For engines manufactured before the Termination Date, or before the date such new standard or other requirement becomes effective, whichever is earlier, the stipulated penalties associated with the Section VI requirements shall remain in effect through, and shall terminate at the end of, the Useful Life of such engines.

(b) The certification requirements in Section IX.A of this Consent Decree shall terminate as of December 31, 2005, provided that Caterpillar certifies to the United States, at least 30 days prior to such termination date, that it has met all of the requirements of

Section IX.A of this Decree, and provided further that the United States, prior to December 31, 2005, does not dispute the certification under the dispute resolution provisions of this Consent Decree. Notwithstanding termination of the certification requirements of Section IX.A pursuant to this Paragraph, requirements imposed for the Useful Life of engines subject to Section IX.A of this Consent Decree shall remain in effect through, and shall terminate at the end of, the Useful Life of such engines.

(c) The entire Consent Decree may be terminated by further order of the Court if Caterpillar certifies to the United States that: (i) Caterpillar has paid all civil penalties, interest, and stipulated penalties due under the Consent Decree; (ii) Caterpillar has fully and successfully completed all of the requirements of Sections VI, VII, VIII, IX, and X; (iii) no matter subject to dispute resolution pursuant to Section XVI remains unresolved; (iv) no action to enforce the requirements of this Consent Decree is pending; and (v) if Sections VI and IX.A have not been previously terminated, the requirements in Subparagraph 154(a) and (b) above have been met. Notwithstanding this termination, the United States retains the right to enforce the Useful Life requirements set forth in Subparagraphs 154(a) and (b) above even after the termination of the entire Consent

Decree, and the United States may reopen the Consent Decree for purposes of such enforcement.

155. Any dispute regarding termination of all or any part of this Consent Decree shall be resolved pursuant to the dispute resolution provisions of Section XVI of this Consent Decree.

XXVII. ENTIRE AGREEMENT

156. This Consent Decree contains the entire agreement between the United States and Caterpillar with respect to the subject matter hereof. The Parties acknowledge that there are no representations, agreements, or understandings relating to the settlement other than those expressly contained in this Consent Decree.

XXVIII. SIGNATORIES

157. The Assistant Attorney General of the Environment and Natural Resources Division of the Department of Justice and the undersigned representative of Caterpillar each certify that he or she is fully authorized to enter into the terms and conditions of this Consent Decree and to execute and legally bind the Party he or she represents.

United States v. _____ Consent Decree --

Signature Page _____

FOR PLAINTIFF, UNITED STATES OF AMERICA

_____

Lois J. Schiffer
Assistant Attorney General
Environment and Natural Resources Division
U.S. Department of Justice
10th & Pennsylvania Avenue, N.W.
Washington, D.C. 20530

_____

Trial Attorney, Environmental Enforcement Section
Environment and Natural Resources Division
U.S. Department of Justice
1425 New York Avenue, N.W.
Washington, D.C. 20005

_____

Steven A. Herman
Assistant Administrator
Office of Enforcement and
Compliance Assurance
U.S. Environmental Protection Agency
401 M Street, S.W.
Washington, D.C. 20460

_____

Bruce C. Buckheit, Director
Air Enforcement Division
Office of Regulatory Enforcement
Office of Enforcement and
Compliance Assurance
U.S. Environmental Protection Agency
401 M Street, S.W.
Washington, D.C. 20460

_____

Attorney-Advisor
Air Enforcement Division
Office of Regulatory Enforcement
U.S. Environmental Protection Agency
401 M Street, S.W.

Washington, D.C. 20460

FOR Caterpillar, _____

_____
Daniel M. Murphy
Vice President
Performance Engine Product Division
Caterpillar Inc.
PO Box 600 MOS 20
Mossville, IL 61552-0600

So entered in accordance with the foregoing this _ day of _____ _____.

_____
United States District Judge

APPENDIX A - ENGINES SUBJECT TO THE DECREE
Caterpillar Inc. Pre-Settlement
Electronically Controlled HDDE Engine Families

1987 MODEL YEAR		1988 MODEL YEAR	
SALES MODEL	CERTIFICATION FAMILY	SALES MODEL	CERTIFICATION FAMILY
3406B PEEC	HCT0893FZC0	3406B PEEC	JCT0893FZC7

1989 MODEL YEAR		1990 MODEL YEAR	
SALES MODEL	CERTIFICATION FAMILY	SALES MODEL	CERTIFICATION FAMILY
3176	KCT0629FZD6	3176	LCT0629FZD5 (1)
3406B PEEC	KCT0893FZC6	3406B PEEC	LCT0893FZC5
---	---	3406B PEEC	LCT0893FZD6 (2)

(1) Particulate banking FEL 0.48; (2) 460hp Family & particulate banking FEL 0.48

1991 MODEL YEAR		1992 MODEL YEAR	
SALES MODEL	CERTIFICATION FAMILY	SALES MODEL	CERTIFICATION FAMILY
3176	MCT0629FZD4	3176	NCT0629FZD3 (3)
3406B PEEC	MCT0893FZD5	3406B PEEC	NCT0893FZD4

(3) Particulate banking FEL 0.23

1993 MODEL YEAR		1994 MODEL YEAR	
SALES MODEL	CERTIFICATION FAMILY	SALES MODEL	CERTIFICATION FAMILY
3176	PCT0629FZD1 (3)	---	---
3176B	PCT0629FZE2 (4)	3176B	RCP629EZDARA
3406B PEEC	PCT0893FZD2	---	---
3406E	PCT0893FZE3 (5)	3406E	RCP893EZDARA

(3) Particulate banking FEL 0.23; (4) Particulate banking FELs 0.14, 0.12; (5) Particulate banking FELs 0.15, 0.12, 0.10

1995 MODEL YEAR		1996 MODEL YEAR	
SALES MODEL	CERTIFICATION FAMILY	SALES MODEL	CERTIFICATION FAMILY
3116	SCP403DZDARK (6)	3116	TCP403DZDARK (6)
3126	SCP442DZDARK	3126	TCP442DZDARK
---	---	3126	TCP442DZDAAK (7)
3176B	SCP629EZDARK	3176B	TCP629EZDARK (8)
C-10	SCP629EZDARM	C-10	TCP629EZDARM (8)
C-12	SCP729EZDARL	C-12	TCP729EZDARL (8)
3406E	SCP893EZDARK	3406E	TCP893EZDARK (8)

(6) HEUI model 3116; (7) High HP 3126 w/ catalyst; (8) NOx banking FEL 4.7

1997 MODEL YEAR		1998 MODEL YEAR	
SALES MODEL	CERTIFICATION FAMILY	SALES MODEL	CERTIFICATION FAMILY
3116	VCP403DZDARK (6)	---	---
3126	VCP442DZDARK	3126	WCPXH0442HRK (10)
3126	VCP442DZDAAK (7)	3126	WCPXH0442HSK (11)
3176B	VCP629EZDARK (8)	---	---
C-10	VCP629EZDARX (8)	C-10	WCPXH0629ERK
C-12	VCP729EZDARX (8)	C-12	WCPXH0729ERK
3406E	VCP893EZDARX (8)	3406E	WCPXH0893ERK
3406E	VCP967EZDARK (8)(9)	3406E	WCPXH0967ERK (9)

(6) HEUI model 3116; (7) High HP 3126 w/ catalyst; (8) NOx banking FEL 4.7; (9) 15.8L 3406E; (10) Low HP Family; (11) High HP Family

APPENDIX B – CONTROL STRATEGY DESCRIPTION

Appendix B-1

[FILED SEPARATELY UNDER SEAL]

Appendix B-2

For the fuel injection timing strategies specifically described and limited below, the emissions limits, except FTP Limits, in Paragraphs 14, 16 and 19 shall not apply to emissions associated with the use of these strategies, except as provided by Appendix B-4.

[FILED SEPARATELY UNDER SEAL]

Appendix B-3

For Model Year 1999 only, except as set forth in Appendix B-4, Caterpillar may install the following AECD to protect the engine or vehicle from damage due to overheating: timing may be advanced when coolant temperature and/or intake manifold temperature rises 5° F or more above cooling fan-on temperature even if emissions exceed the applicable EURO III and NTE Limits. This feature must be inactive when the coolant temperature and/or intake manifold temperature is below 5° F above fan-off temperature. For modulated or variable-speed fans, fan-on temperature refers to the temperature at which the fan drive is fully engaged, or at which the fan is set to maximum speed; and fan-off refers to the point at which the fan drive begins to modulate off, or at which the fan is set to less than maximum speed. If the fan is not controlled directly by the engine control module, then set points for AECD activation and deactivation shall be referenced to fan-on and fan-off temperatures specified by Caterpillar, and subject to the above temperature difference limits and fan control state definitions.

Appendix B-4

The AECDs in Appendix B-1 shall not be active unless engine operating conditions are generally correlatable to sustained highway operation (vehicle speed of 50 mph or greater) or generally correlatable to sustained high load operation (greater than 85% of maximum load at that RPM for a one minute rolling average or greater than 75% of maximum load at that RPM for a two minute rolling average). Such AECDs shall return the engine to the injection timing values used to meet the FTP NOx levels when engine operations return to transient conditions.

The AECD described in Appendix B-3 (correlated to coolant temperature and/or other engine operating parameter(s)) is the only timing strategy that may be employed for overheat protection. This strategy may only be employed where Caterpillar's specifications for cooling system, charge air cooler, and/or other requirements are such that the engine can operate without the need for such AECDs at both ambient temperatures below 100 degrees F and loads below 75 percent maximum at that RPM. Such specifications shall be determined by establishing engine cooling and other system requirements based on testing at conditions at least as severe as 75 percent load and 100 degrees F ambient air and representative operating conditions. This AECD shall be limited to the lowest practicable NOx level for the purposes of overheat protection.

Any Altitude AECD described in Appendix B-2 may not be active at pressure above 82.5 kPa (below 5500 feet equivalent) and is limited to the lowest practicable NOx level after consideration of unburned hydrocarbons, black smoke and engine protection.

Any White Smoke AECD described in Appendix B-2 to control unburned hydrocarbons shall be limited to the lowest practicable NOx level after consideration of unburned hydrocarbon emissions, and engine misfire. In addition, Caterpillar must justify any White Smoke AECD that is active at conditions correlatable to an intake manifold temperature greater than 60 degrees F.

Any Idle AECD described in Appendix B-2 shall be limited to the lowest practicable NOx level after consideration of unburned hydrocarbon emissions, engine misfire, and engine protection and must be correlated with any relevant engine operating parameter.

Emission levels are limited to EURO III, NTE and TNTE Limits when the AECDs described in Appendix B-1 are the only active AECDs. Emissions levels are limited to EURO III, NTE and TNTE Limits except as follows: (i) the altitude, acceleration, misfire and overheat protection AECDs, pursuant to footnote 1 of the test protocol, to the extent needed; (ii) the White Smoke AECD for LMB Engines after July 31, 1999, shall be limited to 1.5 times the then-applicable EURO III Limits, except that, upon showing of need, higher emission limits shall be authorized; and (iii) the White Smoke AECD for Truck HHDDEs shall be limited to 1.0 times the applicable EURO III Limits, except that, upon a showing of need, higher emission limits shall be authorized.

APPENDIX C – TECHNICAL REQUIREMENTS FOR EURO III, NTE, TNTE, SMOKE (OR ALTERNATE OPACTIY) PROTOCOLS[1]

1. EURO III Requirements. Engines must meet the weighted average emission limit values applicable to the EURO III test set forth in this Consent Decree, when tested using the EURO III steady state test and emission weighting protocols identified as the "ESC test" in Annex III to the Proposal adopted by the Commission of the European Union on December 3, 1997. [2] The modal test point definition and weighting factors

---

[1] These emissions limits and testing requirements are in addition to any requirements applicable under the Code of Federal Regulations, and are subject to provisions for record keeping, reporting, testing and liability for non-compliance established under the Consent Decree. The waiver of the requirement to submit test data for certain emissions found in 40 C.F.R. 86.094-23(c)(2)(i) applies to these provisions. Except as specifically noted herein or in the Consent Decree, all existing EPA regulations and policies shall apply to any testing conducted under this test protocol. EPA may allow exceedances of the EURO III and Not to Exceed Limits if the manufacturer demonstrates during the certification process that the excess emissions are due to the requirements of engine starting, or conditions resulting from the need to protect the engine or vehicle against damage or accident and there are no other reasonable means to protect the engine or vehicle. In addition, during the term of this Consent Decree, EPA may allow such exceedances if the manufacturer demonstrates during the certification process that the excess emissions are due to extreme ambient conditions and that there are no reasonable means of meeting such limits under such ambient conditions. All procedures set forth in this Consent Decree shall be implemented in accordance with sound engineering practice.

[2] Proposal adopted by the Commission of the European Union on 3 December 1997, for presentation to the European Council and Parliament, titled A draft Proposal for a Directive of the European Parliament and the Council Amending Directive 88/77/EEC of 3 December 1987 on the Approximation of the Laws of the Member States Relating to the Measures to be Taken Against the Emission of Gaseous and Particulate Pollutants From Diesel Engines for Use in Vehicles." Fuel meeting the specifications of 40 C.F.R. 86.1313-94(b) for

will be taken directly from Annex III. Except as specifically stated in this Appendix, in all other respects testing shall be conducted in accordance with 40 C.F.R. Part 86, unless Caterpillar proposes, and EPA approves, an alternative procedure. Engines must meet the applicable weighted average emission levels when new and in-use throughout the Useful Life of the engine and during all normal operation and use.

---

exhaust emissions testing will be substituted for the fuel specified in this Directive.

1.1. As part of the certification process, the manufacturer must provide ESC test results to EPA. Weighted average emissions of all regulated emissions from the ESC test must comply with the applicable limits set forth in this Consent Decree. In addition to the weighted average data, the manufacturer must supply brake specific gaseous emission data for each of the thirteen test points in the ESC test, and for up to three supplemental points selected by EPA (unless EPA advises the manufacturer otherwise) and communicated to the manufacturer in a timely manner prior to the test according to the ESC protocol.[3] In addition, for each of these sixteen test points, the manufacturer must provide upon request the concentrations and mass flow rates of all regulated gaseous emissions plus CO_2, as well as exhaust smoke opacity ("k" value) and the values of all emission-related engine control variables at each test point. Weighted average PM shall be measured and reported by the manufacturer in the Certification Application.

1.1.1 The ESC test must be conducted with all emission-related engine control variables in the highest brake-specific NO_x emissions state which could be encountered for a 30 second or longer averaging period at the given test point. The manufacturer must include a statement in the Certification Application that the test results correspond to the maximum NO_x producing condition for a 30 second or longer averaging period reasonably expected to be encountered at each test point during normal engine operation and use.

1.1.2 Any regulated gaseous emissions at any of the test points, or any interpolated points in the ESC control area, shall be at or below the Not-to-Exceed Limits if within the Not-to-Exceed Region as defined in Section 2 below.

1.1.3 As part of its certification application, the manufacturer must submit a statement that its

---

[3] The ESC test protocol includes only a NO_x check at the supplemental test points. However, under the Consent Decree and this Test Protocol all regulated gaseous emissions are included.

engines will comply with the applicable EURO III limit values and testing requirements during all normal engine operation and use, including the limits described in Sections 1.2-1.4.

1.1.4 For the purposes of submission of the certification application, the manufacturer shall conduct the ESC test within the temperature range of 68° F to 86° F.

1.2 For gaseous emissions, the 13 ESC test point results described in Section 1.1, along with the four-point linear interpolation procedure of the ESC test protocol (Annex III, Appendix 1, Sections 4.6, 4.6.1, and 4.6.2) for intermediate conditions, shall define maximum allowable emission limits including up to three supplemental points selected by EPA (See Figure 1). The ESC control area extends from the 25% to the 75% engine speeds, at engine loads of 25% to 100%, as defined in Annex III.

1.2.1 If the weighted composite ESC test result for any gaseous emission is lower than required in the Consent Decree, the 13 ESC test values for that pollutant shall first be multiplied by the ratio of the limit value to the composite value and then by 1.05 for interpolation allowance before determining the maximum allowable emission limits of Section 1.2.[4]

1.3 The weighted average ESC emissions limits described in Section 1.1 and the maximum allowable emission levels defined in Section 1.2 apply to testing of certification engines, production line engines, and in-use engines.

---

[4] The 10% allowance for NOx at interpolated points found in Section 6.2.3 of Annex 1 of the December 1997 Directive for evaluating compliance within the limit values of the Directive is reduced to 5%.

ESC Maximum Allowable Emission Limits
Sample - For Illustration Only

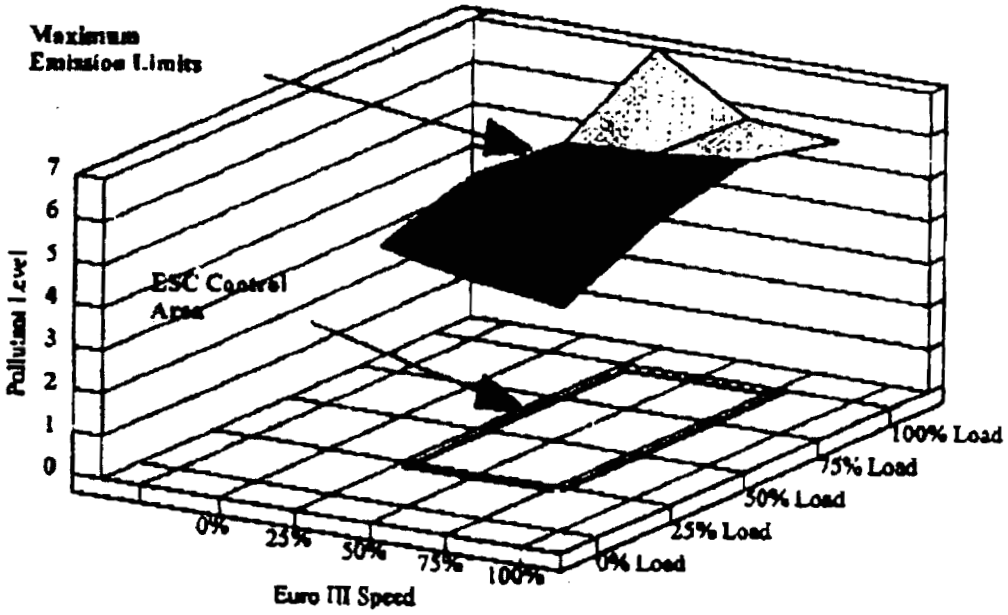


Figure 1

1.4 In addition to the steady state testing protocols of the ESC test, in accordance with existing regulations and the provisions of the Consent Decree, EPA may require that engines be tested under conditions that may reasonably be expected to be encountered in normal vehicle operation and use. The engine may be tested in a vehicle in actual use or on a dynamometer, under steady state or transient conditions and under varying ambient conditions. Test results within the ESC control area shall be compared to the maximum allowable emission limit for the same engine speed and load to determine compliance. The engine, when operated within the ESC control area, must comply with the maximum allowable emissions limits.

1.4.1 Where the test conditions identified in 1.4 require departures from specific provisions of Annex III or 40 C.F.R. Part 86 (e.g., sampling time) testing shall be conducted using good engineering practice. The manufacturer shall submit a detailed description of any departures from the specific testing provisions of Annex III or 40 C.F.R. Part 86 and the justification for

modifying the test procedures along with the test results submitted to EPA under testing required by Paragraph 1.4.

1.4.2 If EPA requires engine dynamometer testing by the manufacturer under non-FTP conditions, such testing shall be done at the manufacturer's facility on existing equipment, and must be carried out only within the limits of operation of the manufacturer's available test equipment with regard to ambient temperature, humidity and altitude. EPA may conduct its own confirmatory, production line or in-use testing at any ambient temperature, humidity or altitude.

1.4.3 When tested under transient conditions, emission values to be compared to the maximum allowable limits shall represent an average of at least 30 seconds.

1.4.4 Manufacturers shall collect test data documenting the effects of humidity and temperature on NOx and PM emissions for EPA to use jointly with engine manufacturers in establishing appropriate correction factors for NOx for humidity and for NOx and PM for temperature. One set of correction factors shall be established and used by all manufacturers. NOx emissions shall be corrected for humidity to a standard level of 75 grains of water per pound of dry air. Outside the temperature range of 68-86 degrees F, NOx and PM emissions shall be corrected to 68° F if below 68° F or to 86° F if above 86° F.

1.4.5 Until January 1, 2000, the humidity correction factors found in 40 C.F.R. Part 86 shall be used for NOx, and the interim temperature correction factors developed by the manufacturers and approved by EPA by December 1, 1998 shall be used for both NOx and PM.

1.4.6 Beginning January 1, 2000, the manufacturers shall use the temperature and humidity

correction factors developed as follows. By December 1, 1998, the manufacturers shall submit a test plan to EPA to develop temperature correction factors for NOx and PM and humidity correction factors for NOx over a wide range of ambient temperatures and humidity. EPA shall review and approve or disapprove the plan by December 31, 1998. If EPA disapproves the plan, it shall state the reasons why, and the manufacturers shall have 30 days to revise their plan to the satisfaction of EPA or to submit the matter for Dispute Resolution under Section XVI of the Consent Decree. The manufacturer shall implement the plan as approved by EPA or directed by the Court following any Dispute Resolution proceeding. By July 31, 1999, the manufacturers shall submit the results of their testing to EPA along with their suggested temperature correction factors for NOx and PM and humidity correction factors for NOx. By September 1, 1999, EPA shall review the test results and all other data and information collected or generated in connection with testing under the approved plan and approve or disapprove the suggested correction factors. If EPA disapproves the suggested correction factors, it shall state the reasons why, and the manufacturers shall have 30 days to revise their correction factors to the satisfaction of EPA or to submit the matter for Dispute Resolution under Section XVI of this Consent Decree .

2. Not To Exceed Limits . Engines must also meet the Not To Exceed, Smoke or alternate Opacity, and Transient Load Response Limits stated in the Consent Decree and more specifically defined in the following Sections. Engines must meet the applicable Not To Exceed, Smoke or alternate Opacity, and Transient Load Response Limits when new and in-use throughout the Useful Life of the engine.

2.1. Except as described in Paragraph 2.1.2, the Not To Exceed Control Area includes all operating speeds above the "15% ESC Speed" calculated as in Section 2.1.1, and all engine load points at 30% or more of the maximum torque value produced by the engine. In addition, notwithstanding the provisions of Section

2.1.2, the Not To Exceed Control Area includes all operating speed and load points with brake specific fuel consumption (BSFC) values within 5% of the minimum BSFC value of the engine, unless during Certification the manufacturer demonstrates to the satisfaction of EPA that the engine is not expected to operate at such points in normal vehicle operation and use. Current engine designs equipped with drivelines with multi-speed manual transmissions or automatic transmissions with a finite number of gears are not subject to the 5% minimum BSFC additional NTE region.

2.1.1. The 15% ESC Speed is calculated using the formula $n_{lo} + 0.15(n_{hi} - n_{lo})$, where n_{lo} and n_{hi} are the low and high engine speeds defined in Annex III, Appendix 1, Section 1.1 of the earlier referenced December 3, 1997 Proposal of the Commission of the European Union.

2.1.2. The area below 30% of the maximum power value produced by the engine is excluded from the Not to Exceed Control Area. In addition, the area defined in either (a) or (b) below, as applicable, is excluded from the Not to Exceed Control Area for PM.

a) To the right of the line from 30% of maximum torque or 30% of maximum power (whichever is greater) at the B speed to 70% of maximum power at 100% speed (n_{hi}) if the C speed is below 2400 rpm (See Figure 2(a)); or

b) To the right of the line from 30% of maximum torque or 30% of maximum power (whichever is greater) at the B speed to 50% power at 2400 rpm to 70% of maximum power at 100% speed (n_{hi}) if the C speed is above 2400 rpm. (See Figure 2(b).)

Figure 2(a)

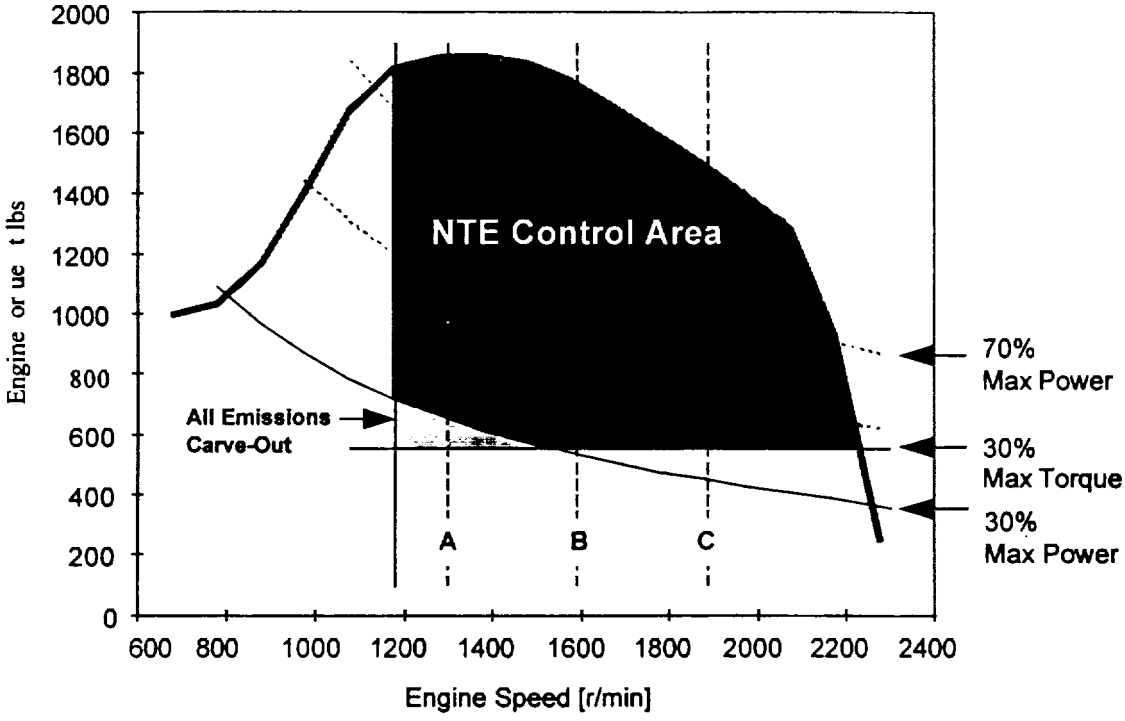
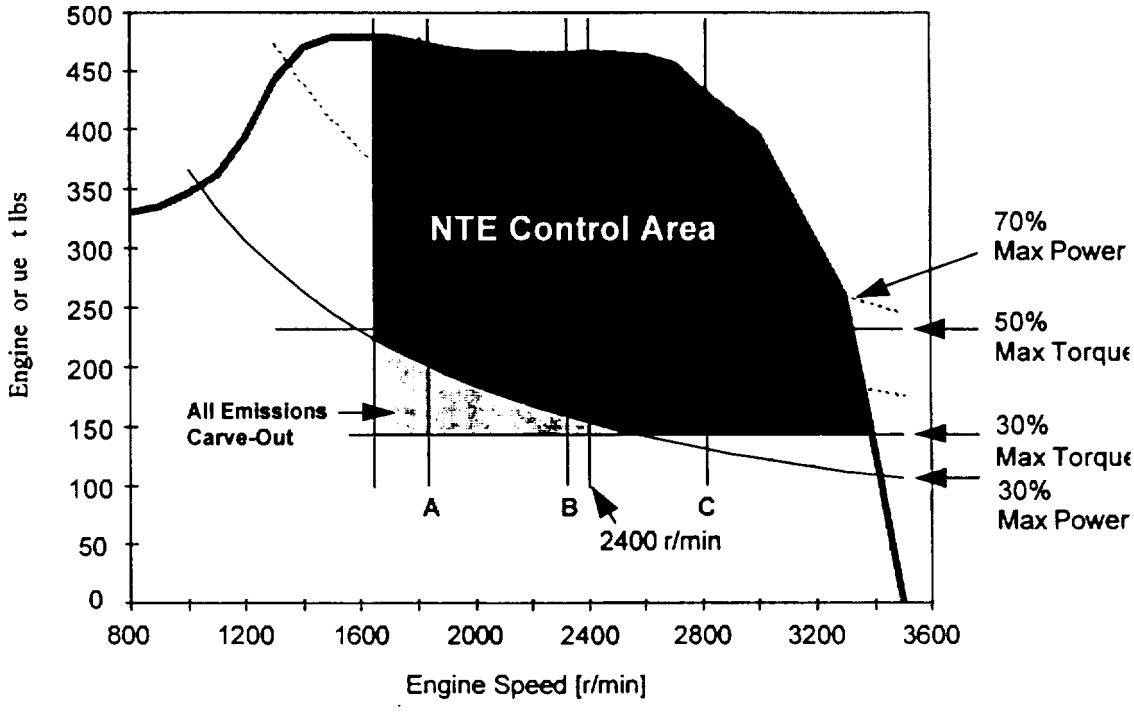


Figure 2(b)



2.2. Within the Not To Exceed Control Area, emissions of NO_x (or NO_x plus NMHC where applicable) and PM, when averaged over a minimum time of 30 seconds, shall not exceed the applicable Not to Exceed limit values specified in the Consent Decree. In addition, within the Not to Exceed Control Area, smoke and opacity shall not exceed the applicable Smoke or alternate Opacity limit values specified in the Consent Decree. In accordance with existing regulations and provisions of the Consent Decree, EPA may require that engines be tested under conditions that may reasonably be expected to be encountered in normal vehicle operation and use. If EPA requires engine dynamometer testing by the manufacturer under non-FTP conditions, such testing shall be done at the manufacturer's facility on existing equipment, and must be carried out only within the limits of operation of the manufacturer's available test equipment with regard to ambient temperature, humidity and altitude. EPA may test the engine in a vehicle in actual use or on a dynamometer, under steady state or transient conditions and under varying ambient conditions.

2.2.1 The Not To Exceed and Smoke or alternate Opacity limit values apply to certification, production line, and in-use engines.

2.2.2 As part of its certification application, the manufacturer must submit a statement that its engines will comply with the applicable Not To Exceed and Smoke or alternate Opacity limit values under all conditions which may reasonably be expected to be encountered in normal vehicle operation and use.

2.2.3 The interim correction factors to be established pursuant to Section 1.4.5 shall apply until January 1, 2000. Beginning January 1, 2000, the correction factors developed in accordance with Section 1.4.6 shall apply. Correction factors shall be used as follows:

2.2.3.1 Prior to October 1, 2002, NOx emissions shall be corrected for humidity to a standard humidity level of 75 grains of water per pound of dry air. Outside the temperature range of 68-86 degrees F, NOx and PM emissions shall be corrected to 68° F if below 68° F or to 86° F if above 86° F.

2.2.3.2 On and after October 1, 2002, NOx emissions shall be corrected for humidity to a standard humidity level of 50 grains if below 50 grains, or to 75 grains if above 75 grains. NOx and PM emissions shall be corrected for temperature to a temperature of 55° F if below 55° F or to 95° F if above 95° F. No temperature or humidity correction factors shall be used within the ranges of 50-75 grains or 55-95° F.

2.3 Within the Not To Exceed Control Area, engines may not exceed the Transient Load Response Limit set forth in the Consent Decree. In accordance with existing regulations and provisions of the Consent Decree, EPA may require that in-use testing be done under conditions which may reasonably be expected to be encountered in normal vehicle operation and use. If EPA requires engine dynamometer testing by the manufacturer under non-FTP conditions, such testing will be done at the manufacturer's facility on existing equipment, and must be carried out only within the limits of operation of the manufacturer's available test equipment with regard to ambient temperature, humidity and altitude. EPA may test the engine in a vehicle in actual use or on a dynamometer, and under varying ambient conditions.

2.3.1 The Transient Load Response Limit values apply to certification, production line, and in-use engines.

2.3.2 As part of its certification application, the manufacturer must submit a statement that its engines will comply with the applicable Transient Load Response Limit under all conditions which may reasonably be expected to be encountered in normal vehicle operation and use.

2.3.3 The temperature and humidity correction factors developed in accordance with Section 1.4.6 of this Appendix shall be used as follows. NOx emissions shall be corrected for humidity to a standard humidity level of 50 grains if below 50 grains, or to 75 grains if above 75 grains. NOx and PM emissions shall be corrected for temperature to a temperature of 55° F if below 55° F or to 95° F if above 95° F. No temperature or humidity correction factors will be used within the ranges of 50-75 grains or 55-95° F.

2.4 The transient load response test sequence is as follows: beginning at any point within the Not To Exceed Control Area, the engine fuel control shall be moved suddenly to the full fuel position and held at that point for a minimum of two seconds.

2.4.1 When tested on a dynamometer, this sequence shall be carried out at a constant speed setting. When tested in a vehicle, engine speed will be determined by the characteristics of the vehicle being tested.

2.4.2 The test sequence of Section 2.4 may be repeated if, for example, necessary to obtain sufficient sample amount for analysis.

3. Supplemental Emissions Test Smoke Measurements. Supplemental emissions tests may require steady-state or transient smoke measurements. Steady-state smoke measurements may be conducted using opacimeters or filter-type smokemeters. Opacimeter types include partial-flow and full-flow. Only full-flow opacimeters may be used to measure smoke during transient conditions.

3.1 For steady-state or transient smoke testing using full-flow opacimeters, equipment meeting the

requirements of CFR 40, Part 86, subpart I "Emission Regulations for New Diesel Heavy-Duty Engines; Smoke Exhaust Test Procedure or ISO/DIS-11614 "Reciprocating internal combustion compression-ignition engines - Apparatus for measurement of the opacity and for determination of the light absorption coefficient of exhaust gas" is recommended.

3.1.1 All full-flow opacimeter measurements shall be reported as the equivalent % opacity for a 5 inch effective optical path length using the Beer-Lambert relationship.

3.1.2 Zero and full-scale (100% opacity) span shall be adjusted prior to testing.

3.1.3 Post test zero and full scale span checks shall be performed. For valid tests, zero and span drift between the pre-test and post-test checks shall be less than 2% of full scale.

3.1.4 Opacimeter calibration and linearity checks shall be performed using manufacturer's recommendations or good engineering practice.

3.2 For steady-state testing using filter-type smokemeter, equipment meeting the requirements of ISO-8178-3 and ISO/FDIS-10054 "Internal combustion compression-ignition engines - Measurement apparatus for smoke from engines operating under steady-state conditions - Filter-type smokemeter" is recommended.

3.2.1 All filter-type smokemeter results shall be reported as a filter smoke number (FSN) that is similar to the Bosch smoke number (BSN) scale.

3.2.2 Filter-type smokemeters shall be calibrated every 90 days using manufacturer's recommended practices or good engineering practice.

3.3 For steady-state testing using partial-flow opacimeter, equipment meeting the requirements of ISO-8178-3 and ISO/DIS-11614 is recommended.

3.3.1 All partial-flow opacimeter measurements shall be reported as the equivalent % opacity for a 5 inch effective optical path length using the Beer-Lambert relationship.

3.3.2 Zero and full scale (100% opacity) span shall be adjusted prior to testing.

3.3.3 Post test zero and full scale span checks shall be performed. For valid tests, zero and span drift between the pre-test and post-test checks shall be less than 2% of full scale.

3.3.4 Opacimeter calibration and linearity checks shall be performed using manufacturer's recommendations or good engineering practice.

3.4 Replicate smoke tests may be run to improve confidence in single test or stabilization. If replicate tests are run, 3 additional valid test will be run, and the final reported test results must be the average of all the valid tests.

3.5 A minimum of 30 seconds sampling time will be used for average transient smoke measurements.

APPENDIX D - IN-USE TESTING PROCEDURES

A. Selecting Test Vehicles and Process to be Used for In-Use Testing

1. Caterpillar shall test at a minimum four vehicles in each engine family selected by the United States using the mobile monitoring technologies agreed to in Phase I. The United States will identify engine families for testing not later than June 1 of the calendar year corresponding each model year. In general, the United States will select 3 engine families per model year for testing.

2. These four vehicles shall represent a mix of mileages within the statutory Useful Life of the engines, and shall be tested in a manner consistent with the test procedures and driving routes identified in Phase II of this project. In addition, two of the vehicles shall be reprocured by Caterpillar and retested over the same road routes when the vehicles have accumulated over 150% of statutory Useful Life mileage.

3. Caterpillar may rely on fleet contacts and agreements for supply of test vehicles, or may identify test vehicles through any other sources including contractor services. However, the four test vehicles for each engine family must come from at least two different sources. Within an identified fleet, engines shall be randomly selected for testing.

4. For vehicles with fifth-wheel trailering capability and a GVWR of 80,000 lbs or more, the route shall be driven with an appropriate trailer loaded to yield a Gross Vehicle Weight (GVW) of approximately 60,000 lbs. A second run over the same road route shall be run with the vehicle loaded to approximately 80,000 lbs. GVW. Testing of fifth-wheel equipped trucks at GVW's other than specified above (such as trucks rated below 60,000 - 80,000 lbs. GVWR) shall be conducted with the vehicle loaded to within 5% of GVWR (unless an alternate weight is approved by the United States prior to testing for good cause shown).

5. For non-fifth-wheel vehicles (i.e. school buses, vocational trucks, straight trucks, etc.), the test routes shall be driven once with the vehicle loaded to within 5% of GVWR (unless an alternate weight is approved by the United

States for good cause shown). The GVW must be reported with the test results. In no cases shall a vehicle be loaded so as to exceed the maximum GVWR or any axle weight limits.

6. Notwithstanding any test procedures developed in Phase II of this project, the driver of the test vehicle shall only have information normally available to an operator of the vehicle. The driver shall not have access to any displays or other information about which vehicle operating parameters will be monitored, and shall have no additional information during the road testing except those normally available to the operator of the vehicle.

B. Test Deadlines and Other Provisions

1. Testing of the four vehicles within statutory Useful Life shall be completed within thirty months of selection of the engine family by the United States. Retesting of the two vehicles over 150% of statutory Useful Life mileage shall be completed within forty-two months of selection of the engine family by the United States.

2. The United States may observe any portion of the test program. Caterpillar shall designate a point of contact through which the United States can correspond regarding all aspects of this program.

3. Any adjustments or other pre-test maintenance of test vehicles shall be approved in advance by EPA.

4. Results of the compliance monitoring shall be reported to the United States on a monthly basis throughout the duration of this phase, and shall include for each test the engine serial #, rated horsepower, rated speed, engine calibration, test date, start time, test GVW, starting humidity and starting ambient temperature. In addition, the results shall include the emissions, engine speed, engine torque, fuel injection timing, oil temperature, coolant temperature, and intake manifold temperature, and other reasonable parameters requested by EPA for specific vehicle/engine applications on a second-by-second basis for the entire test.

APPENDIX E - ENVIRONMENTAL PROJECTS

Appendix E-1: Caterpillar Environmental Project For United States and California

IN-USE EMISSION REDUCTION OF NONROAD CI ENGINES

Purpose

Develop retrofit kit(s) for specific Nonroad CI Engines to reduce NOx. This project would target Nonroad CI Engines operating in urban non-attainment areas based upon the NOx reduction potential.

Development Program

Phase 1a: Identify Caterpillar Nonroad CI Engines that have high usage in urban non-attainment areas and identify the probable future usage of these Nonroad CI Engines.

Phase 1b: Identify suitable options to reduce tons of NOx. These options would include: engine modifications to reduce engine out emissions, aftertreatment technology to retrofit on existing engines and/or Nonroad CI Engine replacement with lower emissions engines. This investigation will also include cooling system and other modifications required to retrofit the engine emission control system changes. The result of this Phase will be the list of potential tons of NOx reduction from Nonroad CI Engines in non-attainment areas and the associated costs. The goal will be to identify the maximum practicable NOx reductions that can be achieved in a cost-effective manner.

Phase 1c: Finalize the specific proposal for Phase 2, based upon consideration of total tons of potential NOx reduction, cost to achieve the NOx reduction, dollars per ton reduction and the impact on urban non-attainment areas.

Phase 2a: Develop the specific engine and/or aftertreatment technology identified in Phase 1. Validate the reliability and durability of the changes using laboratory endurance tests.

Phase 2b: Design and develop the machine hardware required to retrofit the engine emissions control system into the target applications.

Phase 3: Procure hardware for several Nonroad CI Engine applications (number to be determined) and place in non-attainment urban field sites. Record operating and maintenance data and perform periodic inspections of the machines to identify any operational problems with the low emissions control system configuration. Field testing will continue for at least two years to determine emissions, performance, and life results.

Phase 4. Help fund the cost of procurement and installation of the Nonroad CI Engine technology in non-attainment areas. Where possible, selection of areas for implementation of this phase will be identified based upon the opportunity to maximize the environmental benefit in a cost-effective manner. Documents and other statements prepared and used solely with individual customers are not subject to the provisions of Paragraph 100.

Impact to Environment

Reduce NOx that is a precursor to ozone and secondary particulate emissions.

Cost Allocation

United States: $9,000,000

California: $4,000,000

Appendix E-2: Caterpillar Environmental Project For United States

HYBRID ENGINE SYSTEM PROJECT

Purpose

Demonstrate, in a greater than 8500 pound GVW hybrid vehicle, the emissions equivalent to 1.0 g/hp-hr (NOx + HC) and .05 g/hp-hr particulate in a conventional vehicle. Also demonstrate improved performance and fuel economy and reduced CO2 emissions over that of a conventional vehicle. Development priority will be for low PM.

Development Program

Phase 1: Concept a HDDE engine hybrid system and determine system component requirements using analytical models to determine component size and efficiency to meet vehicle performance requirements.

Phase 2: Develop components to meet the targets determined in Phase 1 for a conventional engine powered hybrid system. Develop the conventional engine and hybrid system to achieve the emissions targets, using EGR, and advanced aftertreatment systems as required.

Phase 3: Demonstrate the total vehicle. Demonstrate performance and emissions over a typical pickup and delivery cycle.

Phase 4: Demonstrate the emissions and performance goal in the field by conducting a 1 year 3 - 5 vehicle field test.

Impact to environment

Reduce NOx, which is a precursor to ozone, and primary and secondary particulate emissions. Improve fuel economy and reduce CO2 emissions.

Project Cost

United States: $4,800,000

Appendix E 3: Caterpillar Environmental Project For California

DUAL FUEL ENGINE PROGRAM

Purpose:

Currently Power Systems Associates, a Caterpillar dealer offers conversion kits which convert the Caterpillar C-12 and 3126 diesel engines to dual fuel operation. Dual fuel operation involves burning LNG, LPG or CNG with diesel fuel pilot ignition. The market penetration of these cleaner engines could be increased through several initiatives.

Possible Programs:

Product Development: Develop the C10 one year earlier than planned, develop a dual fuel 3406E, develop a propane 3126 and C12.

Channel to Market: Develop the dual fuel engines to become factory offerings rather than diesel conversions. This change would increase chassis availability since several OEMs are reluctant to offer dual fuel engines from their factory unless they are Caterpillar factory offered engines.

Owning and Operating Costs: The overall cost of owning and operating the vehicle must be advantaged by using natural gas. Today in California, a tax bill is expected to be signed into law will provide grants to cover the incremental cost of the vehicle. Grant money is available as well to fund a portion of the investment in fueling stations. Natural gas fuel today in the form of LNG is slightly higher than diesel because of costs of transporting the fuel from outside the state. Local liquefaction is needed to bring down the price of LNG to the California market. With such supplies, LNG could be delivered at prices including all taxes 10% to 25% below diesel on an equivalent BTU basis.

Development Program

The specific program will be developed with the after determining of the greatest opportunities for NOx reduction.

Impact on the Environment

The dual fuel engines are certified at 2.5 NOx. Therefore, the dual fuel engines are further advancing the 2004 regulations.

Project Cost:

California: $1,000,000