

FEDERAL ADVISORY COMMITTEE ACT
CLEAN AIR ACT ADVISORY COMMITTEE
MOBILE SOURCES TECHNICAL REVIEW SUBCOMMITTEE

CO-CHAIRS: MICHAEL WALSH AND ROBERT SAWYER

DESIGNATED FEDERAL OFFICIAL: PHILIP LORANG

*Minutes from the Quarterly Meeting of January 14, 1998
Doubletree Hotel - Washington National Airport*

Introduction

Michael Walsh, Co-Chair, opened the meeting and reviewed the schedule.

Margo Oge briefed the subcommittee on the accomplishments within OMS in the past year and the goals for the next year:

- OMS finalized the heavy-duty diesel truck initiative;
- OMS finalized the locomotives rule, including new and remanufactured engines;
- EPA proposed rules on off-road equipment;
- EPA published regulations for small off-road engines;
- She highlighted the subcommittee's success on modeling and in-use deterioration issues and the implications for MOBILE6;
- EPA has moved forward on state I/M programs; and
- EPA continues to work on climate change and this effort is expected to increase in the next few years.

For the next year, she highlighted the following projects and issues:

- The importance of the Tier II study and negotiations with Sierra Club on the timeline for the study;
- EPA will be preparing a staff paper on sulfur in fuels outlining the issues. Ms. Oge will be meeting with industry to review their research on the impacts of sulfur on LEVs;
- NLEV is a priority for the Agency and she expects a program to be in place;
- Reinventing the vehicle certification process; and
- Climate change efforts.

Phil Lorang announced:

- John T. White is taking over many of the administrative functions as Alternate Designated Federal Official (DFO).

- The Co-Chairs sent the subcommittee progress report to Richard Wilson, the Chair of the full Clean Air Act Advisory Committee (CAAAC);
- A letter from the Co-Chairs to Richard Wilson was prepared in response to the National Petroleum Refiners Association (NPRRA) comments on sulfur recommendations;
- Mr. Wilson also reviewed a handout on the costs associated with the Federal Advisory Committee Act (FACA); and.
- Jason Grumet, NESCAUM, a member of the CAAAC, was invited to become a member of the subcommittee.

FACA

Chris Rice, EPA coordinator for all FACAs, highlighted the benefits to the Agency of the 26 advisory committees assisting EPA. The newest committee is the Children's Health Protection Advisory Committee. Approximately 1,360 individuals act as members of these committees and approximately \$16 million dollars is spent to support these groups. EPA maintains a database of these experts to help identify special expertise when needed. He noted that the Agency has increased the funding to FACAs over the past 5 or 6 years. He reiterated that the work provided to the Agency is highly valued and he thanked the members for their continued assistance. Phil Lorang added that Mr. Rice is helping the MSTRS to identify environmental justice and other representatives to add more diversity to the subcommittee.

ROVER

Leo Breton, EPA/OMS, opened the discussion. He has developed an emission measurement system that can be temporarily installed on a vehicle to gather emissions data during on-the-road operation. He reviewed the need for the remote operation vehicle emission reader (ROVER) and how ROVER can supplement traditional testing.

He reviewed current test methodologies including the need for a dynamometer. For heavy-duty engines, only the engine is attached to the dynamometer. ROVER allows for testing vehicles in the environment that includes driver variables (HC, CO, CO₂, NO_x, and O₂). Particulate tests are under development.

ROVER provides for diagnostic tests that allow researchers to look at engine parameters (e.g., rpm, speed, throttle position) and emissions. In addition, ROVER can log location information via a GPS.

ROVER began as a means to log vehicle engine data to understand emissions under certain load conditions. The combination of all of these inputs along with emissions allows for a robust data set in real-time. All of the log data and calculations are in one database and a patent is pending on the system.

The flow meter measures the velocity of the exhaust gas via a differential pressure measurement. An exhaust emission analyzer, computer, and engine scan tool make up the bulk of the system. He reviewed several photographs of the system in place on both light- and heavy-duty tests. He noted that the heavy-duty setup currently takes 4-5 hours, but could be done in 2-3 hours if performed daily. Light-duty vehicles could be done in 1.5 hours.

The computer interface allows the user to check off which analyzers are in use and which parameters from the ECM should be logged. Additional analog inputs are available for other instruments. Emission levels and average values are shown along with miles per gallon (mpg). GPS system allows an additional speed calculation (instead of the engine computer value) to calculate grams per mile. Heavy-duty engines need to use the GPS system because there is no OBD system. Randy Guensler asked whether the 5th-wheel system had been used. Mr. Breton responded that this system could be used in digital or analog form. Catalyst efficiencies can be calculated using two analyzers: one before and one after the catalyst.

The data file lists documentation for the formulas so that calculations can be referenced.

Mr. Breton reviewed some data files to compare ROVER measurements to Federal Test Procedure (FTP) measurements for several pollutants. He offered to provide handouts to Phil Lorang for distribution to the subcommittee. He reviewed some diagnostic tests available in the system including examining effects of open- and closed-loop changes. Catalyst efficiencies can be tested. He provided a graph that showed that lean air/fuel ratios reduce the efficiency of the catalyst for NO_x.

Mr. Breton has developed a PM sampling system that needs to be calibrated. The PM measurement uses filters and is an end-of-test measurement. Research is underway to obtain real-time PM measurements using differential pressure across the filter. A diesel fuel-injection timing circuit has been developed. The NO_x converter changes NO₂ to NO to better account for total NO_x.

Future work includes placing ROVER on fleet vehicles to obtain multi-day data and implementing ROVER on small engines, e.g., lawn mowers. The basic system is expected to cost approximately \$10,000. The smoke system would cost approximately \$6,000.

He noted that real-time data would help the model estimates, the system is being used in enforcement, and the ROVER system is much less expensive than laboratory testing.

Robert Larson, EPA/OMS, continued the presentation. He discussed the application of this portable system that can measure across the full range of operating conditions. He noted the advantages for heavy-duty and off-road vehicles, especially in time and cost. The Agency is looking to ROVER to investigate emissions from these systems. ROVER will assist with modeling efforts and will be useful as a screening tool for compliance efforts. EPA would like to replicate this system (there is only one currently) and make it available for states to generate their own data. California has expressed their willingness to test the system and share data with EPA. New units are expected by this summer or sooner. An SAE paper is under way that describes the system. One member asked about a European system for OBM vehicles. Michael Walsh responded that one exists and may be available for EPA in March and April for comparison purposes. Leo Breton added that his light-duty vehicle (LDV) ROVER data, when aggregated, are within 10 percent of the FTP. A similar correlation experiment will occur at SwRI for HDEs.

GA Tech FACA Website

Randy Guensler, GA Tech, discussed the availability of this website. Pages are up for each workgroup and includes all formal work products. Files are generally posted in "Adobe" acrobat or HTML. Files should be sent to Randy Guensler via email or on diskette.

There is also a link from the EPA OMS page or from Randy Guensler's personal page. The FACA website is located at <http://transaq.ce.gatech.edu>.

In-Use Deterioration

Phil Lorang discussed the status of the in-use deterioration discussion. EPA re-examined the Ohio FTP data and presented the results to the modeling and in-use deterioration workgroups. He discussed the conversion of Ohio fast-pass data to a full IM240 test. The Ohio data were higher than the FTP data in some cases and below in others. The workgroup noted that the fast-pass conversion is a large adjustment and the mileage estimates should be re-examined using new survey data. EPA found that the Ohio results fall outside of the confidence intervals of the FTP data sets.

EPA and California are talking to each other to better ensure that their model estimates are similar. Once a draft of the new California EMFAC model is available, a better comparison can be made. EPA re-examined its Wisconsin data using its fast-pass method and another method developed by Resources For the Future that uses numerous regressions. RFF ran their method (which was developed on an Arizona data set) on the EPA Ohio data set. There appears to be little difference.

EPA's current plan is to add a correction to the FTP data; they will discuss this plan with the combined modeling and in-use deterioration workgroups. Randy Guensler noted that the documentation accompanying the algorithms are not thorough. Phil Lorang responded that papers are under development. Randy Guensler also asked that the data sets be placed on-line.

National Academy of Sciences (NAS)/National Research Council (NRC) - Evaluation of the MOBILE Model

Ray Wassel of NRC reported that the National Academy of Science (NAS) is preparing a review of the MOBILE model as requested by Congress in the FY97 appropriations. Studies are initiated in several ways: Congress can ask for a study; Agencies can ask for one; or the oversight boards may suggest a topic. A peer review of the model will be undertaken to evaluate the ability of the model to estimate real-world emissions. EPA and DOT have provided funding (\$357,000) to pay for this work. The study will address the adequacy of the model and look for ways to improve the model for the version entitled MOBILE7. The review committee has not been convened yet and the full scope of work has not been established. Approximately 12 individuals will be part of the review committee with a wide variety of expertise including the use of the model. The committee will have open sessions to receive input from interested parties. The study is expected to be complete in September.

The 1997 Federal Advisory Committee Act (FACA) exempts NAS/NRC from the act, but ensures that there is public access to their work products, primarily via the Internet (<http://www.nas.edu>--under current projects/environmental issues). Public notices will be provided for open meetings. Information gathered will be available to the public. Summaries will be made available of closed meetings. Reports will be made available electronically or printed for a reasonable charge. Key reviewers of the report will be made public in the report. Richard Gibbs asked about the scope of the review. The study will focus primarily on estimating emissions. Driving patterns and other inputs are an important part of the study. Virginia McConnell asked whether the emission reductions from specific programs (e.g., I/M) will be addressed. John Kowalczyk noted the discrepancy between the MOBILE model and source receptor studies. Neither of these last two points are specifically mentioned in the scope.

Recommendations to EPA

Phil Lorang discussed the recommendations already made by the subcommittee to EPA. He highlighted several areas.

- EPA agrees that states should be performing better IM240 tests and EPA will work with states to ensure better odometer readings, etc.;
- EPA is planning projects using large remote-sensing data sets from Arizona and Colorado, along with reviews of work already underway;
- EPA is very interested in clean screening techniques and is involved in several state projects and their consultants. In many cases, EPA will not be working in several areas in 1998 because of budget constraints. 1999 looks better financially and the Agency hopes to pick up additional projects next year.

Heavy-Duty Engine Workgroup

The heavy-duty engine report was distributed to the subcommittee. There was no oral presentation. John Kowalczyk asked about recent discussions regarding manufacturers using heavy-duty diesel engine control strategies that differ during normal operations from those used on EPA tests. Phil Lorang responded that the Agency is working on this, but there are many parts of the discussions that are not public at this point. There is some reason to believe that there are engines on the road that are emitting more than the models are estimating. It is unclear how much of the operating condition is outside the EPA test parameters and therefore different from the model estimates. He added that at some point in the future the issue will come before the Modeling Workgroup and the subcommittee. He expects a large amount of data to become available in the next 6 to 12 months.

CAP 2000

Jane Armstrong discussed the compliance assurance program. A final workgroup report was submitted in the fall of 1996. EPA began to work on the rule at that point. In the Fall of 1997, EPA shared draft language with industry to demonstrate how the initial concepts were turned into regulatory language. The changes in the program include:

- Initiating the changes for 2001 model year (2000 MY optional);
- De-emphasize pre-production work and enhance post-production efforts;
- Allowing conditional certification prior to EPA completing confirmatory testing;
- Given technology changes, emission performance is most dependent on catalyst efficiency;
- Durability groups will be used to match engine size with catalysts;
- Manufacturers must demonstrate that only one engine in a group meets requirements;

- Information requirements in the current program will be reduced;
- Manufacturers will be participating in in-use testing;
- All running changes are collapsed into one submittal at the end of the production year;
- EPA retains the right to require information if engineering analyses are needed; and
- Under the proposal, manufacturers perform in-use verification testing.
- Samples will be 2-6 vehicles at 10,000 miles and 50-70,000 miles (4 years). If half or more of the sample exceed standards, more testing is required. Manufacturers are required in certain circumstances to perform recall testing.
- Fuel economy testing is not being changed.
- EPA has agreed not to perform selective enforcement audits (SEAs) on assembly-line vehicles even though the authority to perform such tests remains unchanged. CARB has agreed not to require 2 percent testing of assembly-line vehicles. CARB and EPA have agreed to harmonize their certification procedures.
- An incentive program for good performance allows EPA to waive requirements for good performance. No details on this incentive program have been established.
- The proposal requires the FTP and supplemental FTP on all vehicles in the sample. In addition, there must be one cold CO test, one high-altitude test, and one evaporative test.

The proposal is expected to be at OMB for review by the end of February.

John Elston asked whether a third party will be reviewing the CAP 2000 program. He added that the costs to manufacturers if there is a problem will be astronomical and asked whether any costs have been calculated for stopping an assembly line. Ms. Armstrong responded that the manufacturers still test prototypes to obtain its certificates and this should minimize catastrophic failures.

Tina Vujovich, Cummins, asked that EPA consider building a similar program around the heavy-duty certification process.

Janet Hathaway, NRDC, asked how other parties can recommend modifications to the plan if so much has been discussed with industry. Ms. Armstrong has shared the draft language with Roland Hwang and other interested parties. With industry performing more in-use testing Ms. Hathaway asked how much of these data will be made available. Ms. Armstrong responded that much of the data submitted to EPA becomes public record. Phil Lorang added that the submitted data will be sufficient for EPA's modeling needs.

Gordon Allardyce noted that the time savings for the manufacturers will be greatly improved in the new process. Part of the information is submitted up front to obtain the conditional certificate, and this allows the manufacturers to ensure full utilization of their facilities. He noted that even though this was a "negotiated proposal," he still has concerns with the proposal and will air his concerns during the formal rulemaking process. He believes that the process worked well and should be considered for future EPA rulemakings.

Bill Becker cautioned that manufacturers can act--at their own peril--prior to certification. Once the industry begins to spend huge sums of money, will the government come in to change the system if the need for change is identified? Ms. Armstrong responded that the current confirmatory testing only tests 30 percent of the families, and tests at zero miles do not identify many failures. She added that the risk of EPA revoking a certificate is enormous for the manufacturers. Mike Walsh added that from his review of the data the assembly-line testing is of diminished value. He is not sure that the catastrophic failures would be identified in the current system. John Cabaniss commented that the new program focuses most of the testing resources on in-use testing and this has the higher environmental benefit.

MTBE in Water

Lori Stewart, EPA/OMS, discussed EPA efforts to address MTBE in water. Thirty percent of the nation's gasoline is reformulated and must contain 2 percent by weight oxygen. MTBE is used in 84 percent of RFG. MTBE is also used in winter oxygenate programs but ethanol is the prevalent oxygenate. MTBE is also used as an octane booster, but is used in small percentages by volume. She reviewed some of the findings from the Office of Science and Technology Policy (OSTP) Report of June 1997.

- Comprehensive national monitoring for MTBE has not been performed;
- Of 592 storm water samples, 7 percent showed low levels of MTBE in ppb;
- Of 1,500 groundwater wells, 5 percent showed MTBE and most in urban groundwater wells. Only seven wells showed levels higher than 10 micrograms/liter;
- Limited data were available from public water systems;
- MTBE is less degradable than other fuel constituents and migrates quickly; and
- The presence of MTBE does not rule out conventional remediation technology although it may be more costly.

Summary recommendations included:

- More complete monitoring is needed to characterize use and sources along with occurrences; and
- Complete behavior and fate research;

The situation that caused the level of concern is the contamination of Santa Monica wells at 600 ppb. This contamination caused Santa Monica to lose 50 percent of its water supply. California has begun requiring monitoring at public water systems. Three percent of the systems showed MTBE at low levels. California passed legislation to perform assessments of MTBE and other oxygenates. A drinking water taste and odor standard must be established by July 1998. A 5 ppb level is anticipated. A primary standard will be set by July of 1999. EPA has published a taste and odor range advisory for MTBE at 20-40 micrograms/liter and this range provides a wide margin of safety.

Senator Boxer (D-CA) has proposed that EPA:

- Set an emergency drinking water standard at 5 ppb;

- Study potential corrosive effects of MTBE on tanks and pipelines;
- Study health risks of MTBE; and
- Prepare an MTBE phase-out plan under EPA emergency authority.

EPA is preparing a response to this letter. Another legislator is looking to exempt California from the 2 percent oxygen requirement.

EPA is looking to establish a better health threshold level and is preparing to review a recent study from Italy. Scheduled visits by EPA have been canceled several times by the Italian researchers. The EPA Office of Water proposed the Contaminant Candidate List in August and MTBE was included on the list. Once the list is final, the Agency is required to make decisions on standards for at least five contaminants. MTBE is a strong candidate for the Unregulated Monitoring List; this would improve monitoring if no standard is set. EPA is also working with USGS to cooperate on USGS testing underway. EPA has a research strategy underway within ORD. The strategy will be published in March of 1998 for review in the *Federal Register*. An industry meeting is scheduled in the near future to review research efforts currently underway. In addition, industry soon will be required to perform additional inhalation studies on both MTBE and non-MTBE gasoline. The EPA Underground Storage Tank (UST) Program is expected to contribute the most to reducing contamination levels. Fuel releases of 178,000 have been remediated out of 340,000. USTs installed after 1988 must comply with more stringent requirements and others must comply by 1998.

Recreational watercraft contribute to surface water contamination. Researchers compared boat use (ramp fees) to MTBE levels and found a direct correlation. Once boating ceased, MTBE levels dropped off within a few days through volatilization.

Unlike more recently introduced products, MTBE was approved in the late 1970s as an oxygen enhancer and was "grandfathered" in when health effects research became required.

Ms. Stewart also touched on the benefits of reformulated gasoline. In Phase II, EPA expects volatile organic compounds (VOC) reductions of 27 percent, toxics reductions of 22 percent, and NOx reductions of 7 percent.

Janet Hathaway noted that other oxygenates have similar properties and these (e.g., ETBE, TAME) should be studied in anticipation of their use. She asked whether monitoring is underway. Ms. Stewart responded that these are included in many of the new studies. Ms. Hathaway asked whether EPA has examined their authority to reduce the oxygenate requirement on California. Ms. Stewart does not believe that EPA has the authority because the requirement is so explicit in the Clean Air Act.

Reformulated Gasoline (RFG) Workgroup

Debbie Wood, EPA/OMS, discussed the fleet testing program recommended by the Phase II RFG Implementation Workgroup. Earlier, the workgroup had recommended that funding for test fuel be sought from the oil, automotive, and oxygenate industries. API, OFA, and AMI agreed to provide funding for the test fuel. With the amount of funding available, the workgroup recommended fleet testing in Boston and Chicago beginning this winter and continuing through the spring season.

Part of the workgroup's fleet testing recommendation was that Phase II RFG with ethanol be tested in Chicago in the winter. However, RFA wrote EPA that ethanol should not be included in the fleet testing

program, because ethanol would not have a role in Phase II, according to RFA. As a result, EPA and Wisconsin DNR contacted six oil companies serving the Lake Michigan area about their plans for ethanol use. Five out of six plan to continue to use ethanol in the winter, assuming that the economics of the situation stay the same, and one plans to continue to use ethanol in the summer as well. As a result, the workgroup will test Phase II RFG with ethanol this winter in Chicago.

Janet Hathaway commented that she is concerned that the public will not be satisfied with the limited fleets proposed. She believes that the public and the media will ask questions that will not be answered by this research, particularly regarding the southern U.S., where no testing is planned. Technically, the program is valuable. However, Ms. Hathaway stated that the limited geographic scope of the test program may limit her ability to continue participating as an active media spokesperson for the program, since she serves in California.

OBD Workgroup

Ed Gardetto, EPA/OMS, briefed the subcommittee. The workgroup has been formed, but has not yet met. (Note: their first meeting will be January 15.) The members include industry, OBD test equipment manufacturers, and academics. The group will be discussing:

- OBD FTP testing and data from early tests (13 vehicles);
- Two EPA pilot lanes in Wisconsin where EPA is funding OBD diagnostic inspections on 2,500 cars;
- Following Davis County program that scans OBD lights; and
- A recent NPRM that delays implementation of OBD I/M until January 1, 2001.
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Laboratory Upgrade Workgroup

John Kargul, EPA/OMS, discussed the progress of the workgroup. The purpose of the workgroup is to advise OMS on their 5-year upgrade plan. The workgroup is to provide comments and recommendations to EPA. Specific proposals for recommendations have been made for light-duty vehicles (LDVs) and trucks, heavy-duty engines (HDEs) and ground care units (small engines). Fuels issues are included in each of these. All areas of the lab were reviewed including test cells, procedures, and construction. Tours of the facility were provided to the workgroup and subgroups as needed. General consensus has been reached on several issues. For example, industry looks to EPA to set gas standards and this should be a priority. Others recommendations include:

- Improving the technical capability of the staff;
- The lab should meet ISO 9000 standards;
- Low-emission vehicle (LEV) testing (including alternative fuels) is a core business;
- Dedicate test cells to vehicle types to limit contamination (e.g., ultra-low emission vehicle (ULEV) and diesel);

- Make sure that energy savings facilities improvements do not compromise testing. EPA expects at least a 40 percent energy efficiency reduction from its facility improvements;
- Enhanced evaporative tests is an area that the workgroup believes is outside the core business of the lab.

Recommendations for heavy-duty engines include:

- Examining better techniques to take exhaust samples, both before- and after-treatment devices.
- Emphasis on accurate HC and non-methane HC measurements.
- Ability to test alternatively fueled heavy-duty engines.

Lab safety, large engine testing (>500 hp), and large vehicle testing are other areas under discussion. Fuels issues have been discussed, but no recommendations have been made. The ground care subgroup has not prepared recommendations.

Each subgroup is preparing recommendations and fuel issues will be incorporated. Mr. Kargul expects to bring a draft report to the subcommittee at its April meeting. The lab has established the order in which they would like to introduce changes to the lab, but the timing is funding dependent.

Innovative and Incentive-based Transportation Policies Workgroup

Bruce Bertelsen, MECA, highlighted current projects. The initial focus is in three areas:

- Policies to improve the effectiveness of I/M;
- Improving the effectiveness of OBD; and
- Looking at ways in which information about vehicle emission performance could be used for existing and new vehicles.

With respect to I/M, the subgroup is looking at providing information to the repair industry and to the public on repair facilities. The group is looking at approaches to improve the evaluation of I/M programs to encourage program enhancements. The group is looking at funding for segments of society to cover costs of repairs.

The OBD subgroup is seeking strategies to ensure that once the light is on, the vehicle is brought in for repair.

The emission information group is examining ways to make emission performance information available to the public. For example, California places a smog index label on every vehicle. There is also a wealth of I/M data available, but it is unclear how reliable the data are.

The next workgroup meeting will be held in Los Angeles, California on March 25. California voters may provide over \$1 billion to provide subsidies and other monies to reduce motor vehicle emissions.

Bill Becker announced the North American Motor Vehicle Emission Control Conference (NAMVECC) to be held in Los Angeles at the Biltmore Hotel from March 23-25.

Clean Air Act Advisory Committee (CAAAC) Meeting

The CAAAC is interested in topics that members of the subcommittee might prepare and bring before the full committee. Bill Becker suggested a discussion of the Phase II RFG program including the California lessons learned. He noted that the discussion may bring further support to the RFG roll-out from CAAAC members.

Next MSTRS Meeting Topics

Bruce Bertelsen asked for a presentation on climate change for the next MSTRS meeting. Sulfur in gasoline, Tier II/LEV2, I/M program changes and NLEV are other proposed topics. John Kowalczyk noted that many of the automakers have announced "green" changes for their vehicles. Margo Oge agreed to approach the industry about making a presentation.

Mobile Sources Technical Review Subcommittee
Listing of Attendees - 1/14/98

Gordon Allardyce	Chrysler Corporation	(810) 576-8053
William Becker	STAPPA/ALAPCO	(202) 624-7864
Doug Berens	Ford	(313) 594-2914
Bruce Bertelsen	Manufacturers of Emission Control Assoc.	(202) 296-4797
John Cabaniss	AIAM	(703) 525-7788
Tom Cackette	California Air Resources Board	(916) 322-2892
Gregory Dana	AIAM	(703) 525-7788
Michael Eaves	Southern California Gas Company	(213) 244-5320
John Elston	New Jersey St. Dept. Of Environ. Prot.	(609) 292-6710
Steve Gerritson	Lake MI Air Directors Consortium	(847) 296-2181
Richard Gibbs	New York Dept. Of Environ. Cons.	(518) 485-8913
Randall Guensler	Georgia Institute of Technology	(404) 894-0405
Janet Hathaway	Natural Resources Defense Council	(415) 777-0220
Michael Ingham	Chevron	(510) 242-2654
John Johnson	Michigan Technological University	(906) 487-2576
Timothy Johnson	Corning, Inc.	(607) 974-7184
Robert King	Sun Oil Company	(215) 977-6599
John Kowalczyk	Oregon Dept. of Environmental Quality	(503) 229-6459
Alan Lloyd	Desert Research Institute	(702) 677-3107
Phil Lorang	EPA-Designated Federal Official	(313) 668-4374
Virginia McConnell	Resources for the Future	(202) 328-5122
David Merrion	Detroit Diesel Corporation	(313) 592-7276
Margo Oge	EPA-Office of Mobile Sources	(202) 260-7645

Mobile Sources Technical Review Subcommittee
Listing of Attendees - 1/14/98 (continued)

Michael Redemer	Texaco	(914) 253-7909
Robert Sawyer	UC-Berkeley	(510) 642-5573
John Shipinski	Toyota	(734) 995-3794
Richard Schoeneberg	U.S. DOT	(202) 366-4836
Robert Slott	Consultant	(508) 771-7699
Tina Vujovich	Cummins Engine Company	(812) 377-3101
Michael Walsh	Consultant	(202) 241-1297
Ray Wassel	NRC	(202) 334-2617
John T. White	EPA-Alternate Designated Fed. Official	(734) 668-4353