

Federal Advisory Committee Act

Clean Air Act Advisory Committee

Mobile Sources Technical Review Subcommittee

Hybrid Meeting

U.S. EPA Region 5 Offices

77 W. Jackson Blvd, Chicago, IL

May 30, 2024

DFO Opening Remarks & MSTRS Introductions

The Designated Federal Officer (DFO), Jessie Fan, welcomed all members, the press, and the public to the Mobile Sources Technical Review Subcommittee (MSTRS) meeting. She noted that the meeting is open to the public, and there will be time later in the day for public comment. Ms. Fan reviewed the meeting agenda. She then asked for MSTRS members to introduce themselves.

Agenda

8:30 – 9:00 am (CDT)	Registration & Security Screening
9:00 – 9:30 am	DFO Opening Remarks & MSTRS Introductions
9:30 – 10:30am	Remarks from Sarah Dunham, OTAQ Office Director
10:30 – 11:00 am	Update from MSTRS Locomotives Work Group Chairs
11:00 – 12:30 pm	Lunch Break
12:30 – 1:00 pm	Understanding EV Fast Charging: Charging Profiles
1:00 – 1:30 pm	EV Exploratory Testing
1:30 – 2:30 pm	Discussion of “Future Consumer Information Metrics for Electric Vehicles” Charge
2:30 – 2:45 pm	Break
2:45 – 3:15 pm	EV Testing/Labeling Work Group Discussion
3:15 – 3:45 pm	Public Comments
3:45 – 4:00 pm	Final Remarks & Closeout
4:00 pm	Adjourn

Remarks from Sarah Dunham, Office of Transportation and Air Quality (OTAQ) Office Director

Ms. Dunham began her discussion by shining light on the three executive orders that have been driving several EPA actions in the 2021-2024 timeframe. These executive orders include (1) Protecting Public Health and the Environment and Restoring Science to Tackle the Climate Crisis, (2) Tackling the Climate Crisis at Home and Abroad, and (3) Strengthening American Leadership in Clean Cars and Trucks. Ms. Dunham reviewed the recent mobile source rules

addressing the goals of these executive orders, including the 2021 light-duty vehicle (LDV) rule for model years 2023-2026; in 2022, a rule that reinstated California authority under the Clean Air Act (CAA) for LDV greenhouse gases (GHG) and zero emission vehicles (ZEVs), the renewable fuel standards (RFS) volumes rule for years 2020-2022, the rule for aircraft particulate matter (PM) standards, and the heavy-duty (HD) vehicle NO_x rule; in 2023, an aircraft lead emissions endangerment finding, the locomotive preemption rule, the RFS set rule, and the release of the MOVES4 model; and so far in 2024, the LDV/medium duty (MD) vehicle rule for model years 2027+, and the HD GHG Phase 3 rule.

Next, Ms. Dunham reviewed the actions the EPA has taken under the Bipartisan Infrastructure Law (BIL) which granted \$5 billion to replace existing school buses with zero- and low-emission models, and the Inflation Reduction Act (IRA), which included over \$18 billion for climate protection projects. Through these funding sources, the EPA began offering funds in 2022. In 2022, the first clean school bus rebate opportunity started. In 2023, a second round of funding for clean school bus rebates and a clean school bus grant opportunity was offered. In 2024, the EPA has begun grant programs for clean ports, clean HDVs, and in conjunction with the DOE, advanced biofuels.

From this work in offering funding and through the recent rule development efforts, Ms. Dunham explained that there were several lessons learned that the EPA will be thinking about in future rule development actions and in releasing further project funding. These included (1) the EPA can learn from others, such as state agencies, who may have completed similar efforts already on a smaller scale, (2) the federal government works better when a “whole of government” approach is used, especially when considering the capabilities of new technologies, and (3) there are more than the traditional stakeholders that should be involved in future efforts, such as electrification partners.

Ms. Dunham wrapped up her presentation by noting the next efforts that OTAQ will be taking on. These included satisfying the obligations of the BIL and IRA, conducting compliance assurance activities, providing updated consumer information for vehicles, addressing non-highway sources of diesel emissions, working on a rule for aircraft lead emissions, addressing marine vessel emissions, establishing the RFS set rule for years 2026+, and addressing waiver requests from the California Air Resources Board.

Discussion

One MSTRS member asked what the EPA is doing to address ultrafine particulate emissions and emissions from tires. The member also asked if the EPA would be incorporating those emissions in the next version of the MOVES model. Ms. Dunham explained that the EPA is working on research about these emissions at its Office of Research and Development and remarked that these emissions are becoming a larger share of total emissions from mobile sources as other emissions the engines and other sources decrease. Bill Charmley added that the EPA is working to update data on tire and brake wear emissions, and some of that information will be ready and available to be incorporated in the next MOVES update. The MSTRS member suggested that tire and brake wear could be a good topic for the MSTRS group to discuss. The member encouraged

the EPA to look at issues like this holistically and break out of its silos. The member noted that MOVES focuses on vehicle emissions while they are in motion but does not include other emissions that occur over the vehicle life cycle or the supporting infrastructure.

One member asked whether the EPA was working to address emissions from lawn and garden equipment. The member noted that commercial equipment has lagged behind residential equipment in the uptake of electric-powered units. Ms. Dunham responded that as the EPA takes action for certain sectors, other sectors will become more important, as they will then represent a larger share of the total emissions. She noted that the agency is currently focused on reducing diesel emissions. Mr. Charmley added that while other mobile sources, such as lawn and garden equipment, are a lower priority right now, they could be one of the next areas the EPA addresses.

One member asked how the EPA balances rule stringency with the current limits of technology, especially for rules that are set to increase in stringency over time. Ms. Dunham replied that the EPA understands that it is important to balance feasibility with ensuring rule compliance. She suggested that perhaps the MSTRS could help shape how the Agency deals with this type of issue.

One MSTRS member stated that the EPA should be working with other agencies, such as the Department of Energy (DOE), as much as possible when it is developing rules. Ms. Dunham agreed and noted that the EPA is increasingly doing so on the rules it is working on.

Update from MSTRS Locomotives Work Group Chairs

Matthew Payne (EPA) and Zhenying Shao (ICCT) offered a MSTRS Locomotive Workgroup update. The two workgroup charge questions posed are, (1) What are the factors EPA should consider in developing emission standards for the existing fleet of locomotives when they are remanufactured or otherwise become new? and (2) What technologies should EPA consider in setting the next set of emission standards for freshly manufactured locomotives?

The group formation kick-off meeting took place on October 3, 2023. From a January 19, 2024, workgroup meeting, an initial schedule was developed, and the following chapters were proposed: Locomotive Technology, Railroad Operations, Monitoring/Enforcement/Compliance, Environmental Justice, and Public Health.

Currently (as of April 1, 2024), of the five chapters, Locomotive Technology and Railroad Operations have chapter leads, and an outline has been developed (sections drafted ~75%). The Monitoring/Enforcement/Compliance chapter has a lead and has identified a list of potential issues (sections drafted ~50%). Both Environmental Justice and Public Health chapters have no chapter leads. The current schedule proposes an initial draft by mid-June 2024, with peer review and feedback by the end of June. A final draft will be produced by the end of July. The final report will be shared with the MSTRS by the end of August.

In January 2024, AAR, BNSF, and UP conducted a Locomotive 101 Virtual training to expose the workgroup members to railroad operations. Topics discussed included: How railroads operate; interchange of locomotives across railroads; remanufacturing and modernization of locomotives; alternative fuels; and current testing of non-diesel locomotives.

The workgroup chairs then discussed lessons learned so far in this process:

- SharePoint, firewalls, and incompatible systems initially made document access problematic.
- EPA Teams has been functional for most participants.
- The team agrees monthly meetings with the full group and weekly meetings with the chapter sub-teams seem appropriate.
- Writing needs to commence earlier to allow more time for review.
- Knowledge sharing and education/training are essential in writing chapter sections with a technical background.
- Chapter leads have shouldered a significant burden of the work.

Discussion

One MSTRS member pointed out that getting the MSTRS and the CAAAC to approve the final report in such a short timeframe may not be realistic. It was clarified that the timeline referred only to MSTRS approval, not CAAAC.

One member asked how the workgroup addressed technical background needs, considering that most workgroup members do not have a technical background related to locomotives. The chairs responded that discussion during the workgroup meetings provided information and education on the spot as issues arose. They noted that the discussions have been very open and transparent, and they strive to have clear communications.

One workgroup member noted that they have a lot of content related to environmental justice (EJ) that could be added to the report. The member noted that having the railyard tour that occurred just prior to this MSTRS meeting should further inform the report, and the member hoped that content that has already been written will be reviewed to include anything learned from that tour. The member also noted that the report could include worker health, which was not a topic that had previously been considered. One workgroup member responded that the chapter teams would be open to any additional contributions that workgroup members would like to add.

One MSTRS member pointed out that technical discussions can be a way to exclude people from the conversation, so the workgroup should challenge itself to consider “technical” differently, such as including the lived experience in the discussion. Karl Simon noted that different people have different skill sets, and the EPA wants to hear from different viewpoints. However, the issues the EPA deals with are technical in nature and must be addressed from a technical standpoint. Ms. Dunham added that the EPA wants the workgroup process to take in all perspectives.

One workgroup member suggested that there could still be chapters on EJ and public health, rather than weaving the concepts into each chapter, and the member volunteered to provide outlines for the chapters.

MSTRS Chair Dr. Muncrief suggested that while the workgroup was given an initial goal for completion of its final report, the MSTRS could extend the deadline a bit to ensure the

workgroup can complete a good report. Ms. Dunham noted that more time could be provided, but the workgroup chairs should consider what amount of time is needed and how any extra time will provide value to the final report.

Understanding EV Fast Charging: Charging Profiles

Aaron Sobel (EPA OTAQ) began his presentation by discussing roadblocks for consumers in purchasing electric vehicles (EVs). Charging time is one of the primary cited reasons consumers provide for not purchasing an EV. Mr. Sobel noted that different EV manufacturers present their charging capabilities differently, making them hard to compare, and the lack of clear information leaves consumers confused.

Mr. Sobel shared a graph of 12 recent EV's ranges and peak advertised charge speeds. He cautioned that peak charging speeds can be deceptive because the rate of charge varies over the entire charging event and peak speeds are very rarely held for long. What is more important is the area under the charging curve for each individual EV; how much power a vehicle can accept while DC fast charging over the duration of the charging event. Vehicle efficiency and range also play a role since a more efficient vehicle needs to charge less and can travel further with the same amount of energy.

Mr. Sobel noted that charging power decreases significantly as the battery approaches 100% capacity. In other words, charging an EV from 0-80% can take the same amount of time as DC fast charging from 80-100%. With this in mind, Mr. Sobel provided an example road trip from Washington, DC to Ann Arbor, Michigan with EV charging stops. Route planners can help consumers know how and where to charge the battery for the fastest charging (i.e., not charging to 100% capacity) and fewest number of stops.

Three other considerations noted in EV charging were (1) battery pre-conditioning in hot or cold weather, which uses additional energy, but can allow for ideal charging speeds; (2) the State of Charge (SoC), i.e., how full the battery already is; and (3) software updates can change many of these factors after the vehicles are on the road. Mr. Sobel discussed the need to develop a procedure to measure charging curves. He stated that a common metric or metrics should be designated to allow consumers to better compare charging speeds and capabilities between EVs.

Discussion

One MSTRS member asked whether there should be a single metric for EV range. Mr. Sobel responded that the information should be kept as simple as possible for purchasers making a decision, but having a single metric may not be helpful for people with special considerations, such as those living in a cold climate.

Another MSTRS member stated that having EV information provided by a reputable source, such as the EPA, where the information would be standardized is preferable to having it provided by the manufacturers, who may not be reporting information in a uniform manner. Mr. Sobel pointed out that some information is already available from the EPA through fuelconomy.gov.

One MSTRS member remarked that it would be difficult to convey the information and data provided in this presentation to the general public.

An MSTRS member asked who regulates charging infrastructure. Mr. Simon remarked that the EPA does not regulate it, and maybe it falls under the purview of the Federal Highway Administration (FHWA).

One MSTRS member asked if there was any data on the impact of different charging speeds on battery life. Another MSTRS member replied that faster charging is harder on the battery, but manufacturers provide guarantees on the battery life for a certain number of years and miles.

EV Exploratory Testing

Jarrod Brown (EPA OTAQ) began his presentation by discussing external factors that impact EV performance. In the National Vehicle and Fuel Emissions Laboratory hot and cold test facilities, Mr. Brown and his team have studied multiple drive cycles, load profiles, and temperatures on EV battery efficiency. Testing cycles have been varied based on acceleration conditions, such as constant speed cruise, highway, or city driving. They also tested in extreme temperatures, with temperature test ranges of 20°F – 95°F. The use of the vehicle HVAC system in cold and hot temperatures was also studied. This research strove to consider the effects of the following factors on vehicle/battery performance:

1. Extreme temperatures
2. Variance of CAN vehicle signals within the same manufacturer
3. Unique HVAC strategies (heat pumps)
4. Battery SoC
5. High load / towing
6. Direct current (DC) fast charging
7. Battery chemistry

The results of their testing have shown that without the use of HVAC systems, power demand was relatively similar for ambient, cold, and hot temperatures. They also found that cold ambient temperatures demonstrate a higher power demand than hot or ambient conditions.

Their testing also considered high loads, which includes additional trailers or high weight. Under the High Power Operation Cycle (HIPO) at medium and high speeds, instantaneous power demand was not significantly greater than regular cycles, such as medium speed, medium power modes. Next, Mr. Brown shared the findings of testing for three DC fast charging systems. Across operating modes, EVs charged with alternating current (AC) slow charging versus DC fast charging produced similar instantaneous power demands when driven. Brown emphasized that efficiency does not translate to driving range. The research team desires to simulate more conditions in the future, such as more extreme temperatures, towing, hill climbs, and high loads.

Discussion

An MSTRS member suggested that the EPA could use on-board diagnostic data rather than using the current long test cycles. The member also suggested that the operating mode bins be reviewed for application to EVs.

Another MSTRS member offered that the main factor that affects EV range is the use of the HVAC system in cold weather. Mr. Brown rejoined that the efficiency of the EV is impacted by the HVAC system, which in turn affects the range of the vehicle. He also noted that there are many more variables to investigate related to temperature impacts on range, as they have only examined the impacts on miles/kw so far. An MSTRS member noted that the DOE is also doing some testing on other factors that may impact range.

One MSTRS member remarked that 95°F is not an extreme temperature anymore, and the EPA should consider testing at higher temperatures, such as 115°F. Mr. Brown agreed that more data is needed at both higher and lower temperatures; however, the EPA's laboratory is currently not capable of going beyond the current temperature extremes.

Another MSTRS member asked whether the EPA adjusts road loads for temperature. Mr. Brown replied that the operating modes they use take into account the road loads; however, it is possible that the results from the modes used in the lab testing would equate to a different mode on a real road.

Discussion of “Future Consumer Information Metrics for Electric Vehicles” Charge

This session started with multiple interactive Slido polls, in which meeting attendees answered the polling questions on their mobile phones. Questions related to EVs, such as, “What prevents you from purchasing an EV?” were asked. For this question, respondents reported that battery life and charge time were some of the greatest deterrents to purchasing an EV over a gas-powered vehicle.

The EPA has developed two charge questions it hopes to have explored by a MSTRS workgroup to help the EPA understand which EV metrics that are useful to consumers. These charge questions are:

1. What information is useful to consumers contemplating an EV purchase?
 - What information is not currently available?
 - What existing information could be improved?
 - What information is needed for understanding EV efficiency across battery electric vehicles (BEVs) and plug-in hybrid electric vehicles (PHEVs)?
2. What data and testing does EPA need to collect or conduct to provide the consumer information above?
 - Does all the information need to be derived from testing of individual vehicles, or can data be collected and used to estimate effects (like the effect of temperature on EV range)?

The EPA proposed a workgroup time frame:

Fall 2024 MSTRS Meeting- Members are asked to report findings for Question #1, providing insight on consumer metrics and where to display this information. Members should also outline outstanding work related to both questions. At this meeting, OTAQ will present an overview of current testing related to EV metrics. MSTRS members will self-select the leads and committee for evaluation of Question #2, building off the findings from Question #1.

Spring 2025 MSTRS Meeting- Members are asked to report findings for Question #2 and any outstanding work. Members are asked to develop a process and subcommittee to complete evaluations for both charge questions.

Fall 2025 MSTRS Meeting- Deliver report of findings from the evaluations for both charge questions.

Next, the EPA highlighted several 2022 MSTRS Future of Mobility Report recommendations. These included that the EPA should promote connectivity and automation in vehicles, as these advancements lead to greater improvements in fuel economy and reduced emissions; the EPA should consider whether there should be EV efficiency standards, considering existing market drivers; the EPA should evaluate the potential for emissions performance standards for transportation fuels; and the EPA should leverage its influence on consumer adoption of zero emission vehicles (ZEVs) by gathering and synthesizing data on the impact of financial incentives on ZEV sales.

Discussion

One MSTRS member asked whether the EPA had statutory authority to address EVs. Mr. Simon responded that it does, along with the DOE.

An MSTRS member asked whether the EPA collects the information noted under Charge Question #2 for internal combustion engine vehicles or whether the data the EPA is asking for regarding EVs is different from what the EPA already does for internal combustion engines. Byron Bunker replied that the EPA uses compliance data to inform consumers. He noted that for EVs, the EPA wants to determine whether it already has the data consumers want to know about or if other information needed.

One MSTRS member reported that California is re-doing its window label for EVs, and the member supports the MSTRS working on this issue also.

Another MSTRS member commented that it is important that include tire and brake wear for EVs, noting that criteria pollutants are not the primary emissions from these vehicles. The member also noted that a holistic approach should be used and that silos should be avoided. Mr. Simon noted that for this workgroup, there is a light-duty EV silo the EPA is interested in learning about, but other than that, the workgroup can explore everything it wants related to EVs.

An MSTRS member asked whether the workgroup should prioritize its findings. Mr. Simon indicated that it would be helpful if they did prioritize.

Another MSTRS member asked whether the workgroup would be comparing internal combustion engines to EVs or whether they should investigate the issues from an EV-only

standpoint. Mr. Simon replied that this is something the workgroup could consider. If they find that people are choosing between the two types, then maybe it would be helpful to frame the findings in that manner.

One MSTRS member encouraged future workgroup members to go beyond the current frame and think about what information consumers want and when they want it.

One MSTRS member noted that it is difficult to develop metrics for some of the benefits of EVs, such as quietness, smoothness, and always having them “full” if they are charged at home.

An MSTRS member asked what the bounds are for light-duty EVs, such as whether Hummers would be considered light-duty. Mr. Charmley stated that medium-duty personal vehicles would be included in this charge. The EPA is interested in hearing about personal EV passenger cars and trucks.

One MSTRS member asked whether information like vehicle-to-grid capability should be considered, as it is not clear who has authority for that. Mr. Simon replied that if something requires an act of Congress, the EPA is probably not going to act on that recommendation, but it could be flagged as an issue.

Another MSTRS remarked that under these charge questions, the workgroup should also consider critical mineral supplies and vehicle safety due to battery weight.

One MSTRS member said that they could ask colleagues currently shopping for EVs for their input. The member also noted that they have heard that people want to know whether the batteries will be recycled at the end of the vehicle life.

One MSTRS member remarked that the current vehicle labels were not designed with EVs in mind.

An MSTRS member commented that information is needed on the effects of how the vehicle is driven, such as the effects of speed and quick acceleration. The member noted that testing protocols are good, but crowdsourcing by using on-board sensing and reporting would also be good.

One MSTRS member asked whether another question is how best to reduce GHGs. Another MSTRS member opined that the workgroup should provide dispassionate information that guides choices.

An MSTRS member observed that it seemed that the workgroup could consider infrastructure, charging, and used vehicles.

EV Testing/Labeling Work Group Discussion

Dr. Muncrief opened the discussion about participation on the workgroup. She noted that participation is open to MSTRS members as well as non-members, so the EPA may seek participation from people outside this group. MSTRS members are also welcome to recommend others they know who might be interested in participating. Dr. Muncrief noted that if more that

50 percent of the MSTRS members are in the workgroup, there may be some hurdles to overcome, as this could represent a quorum of the MSTRS itself. She asked if anyone would like to volunteer to be part of the group today and noted that the EPA would also be sending an email to the members inquiring about interest in participation.

One member asked whether there may be other workgroups starting in the near future. Dr. Muncrief replied that no other workgroups would begin until the locomotives workgroup had completed their final report.

Another member asked how MSTRS members would inform non-members about the workgroup and whether there was a formal process for this. Dr. Muncrief stated that the first step would be to send the email out to members to get their participation interest first, and then outside participation would be considered.

Those expressing interest in being on the workgroup during the meeting included Clay Pope, Matt Barth, Sydney Vergis, Mike Geller, and Terry Reisen.

Public Comments

The floor was opened for public comment. No public comments were made.

Final Remarks & Closeout

Ms. Fan registered appreciation for everybody's engagement with the meeting and noted that the EPA can make accommodations for the CAAAC meetings, such as providing for interpreters, if they are informed in advance of the meetings that such accommodations would be needed. She stated that the presentations from the meeting will be sent to members via email and a Doodle poll will also be sent out to members to ask about dates for the next meeting. Ms. Fan thanked EPA staff and guest speakers for their participation and adjourned the meeting.

Attachment 1: Meeting Attendees (in -person and virtual)

MSTRS Members	
Name	Affiliation
Mary Arnold	Civics United for Railroad Environmental Solutions
Matt Barth	Institute of Electrical and Electronics Engineers
Michael Berube	U.S. Department of Energy
Chris Bliley	Growth Energy
John Boesel	CALSTART
Lori Clark	North Central Texas Council of Governments
Dave Cooke	Union of Concerned Scientists
Raquel Garcia	Southwest Detroit Environmental Vision
Michael Geller	Manufacturers of Emission Controls Association
Megan Green	Mecklenburg County Government
Michael Hartrick	Alliance for Automotive Innovation (member alternate)
Steve Henderson	Ford Motor Company (member alternate)
Steve Hurd	Caterpillar (member alternate)
Rachel Muncrief	International Council on Clean Transportation
Elaine O’Grady	Northeast States for Coordinated Air Use Management
Clay Pope	Capitol Access Partners
Tara Ramani	Texas A&M Transportation Institute
Terry Reisen	Marathon Petroleum Company (member alternate)
Michael Replogle	Institute for Transportation and Development Policy
Theresa Romanosky	Association of American Railroads (member alternate)
Joanne Rotondi	Hogan Lovells
Matt Rudnick	General Motors Company
Lubna Shoaib	East-West Gateway Council of Government
Sydney Vergis	California Air Resources Board
Other Attendees	
Jose Acosta	
Yasmine Angelidis	
Noelle Baker	
David Barker	
Clayton Batko	
Jarrod Brown	
Amy Bunker	
Byron Bunker	
Susan Burke	
Tommy Cardon	
Bill Charmley	
Kevin Chen	
Rehan Choudhary	
Mo Cormono	

Marc Corrigan
Gregory Cote
Jessica Daniels
Miles Disciullo
Sarah Dunham
James Fahy
Jessica Fan
Shawn Gallagher
Cecilia Garibay
Gil Grodzinsky
Alex Guillen
Michael Hambrick
Marilyn Herman
Erik Herzog
Aaron Hula
Jeff Jetter
Ali Kamal
Brian Kelly
Kristin Kenausis
Tom Lee
Caroline LeFevre
Cullen Leggett
Maria Lennox
Sonya Lewis-Cheatham
Reema Loutan
Britney McCoy
Rebecca Adler Miserendino
Xavier Morris
Athena Motarre
Bill Moyer
Brian Nelson
Charlotte O'Donnell
Simon Origal
Darby Osnaya
Matthew Payne
Russell Pietroutask
Mariah Pioche-Lee
Tara Ramani
Carlos Ramos
Shakeena Reeves
Gabriela Rivero

Sarah Roberts
William Robertson
Tess Russell
Greg Schroeder
Jason Schwartz
Zhenying Shao
Jenny Sigelko
Karl Simon
Matthew Simon
Hilary Sinnamon
Aaron Sobel
Joe Sorena
Lauren Steele
Lesley Stobert
Alan Stout
Jessica Suda
Abby Swaine
Taylor Thomas
Vanessa Thomas
Aminata Traore
Kathryn Valdez
Travis Webb