

**FACA Modeling Workgroup
July 15, 2002 Draft Conference Call Notes**

Participants

John Koupal	EPA/OTAQ
Connie Hart	EPA/OTAQ
David Brzezinski	EPA/OTAQ
Megan Beardsley	EPA/OTAQ
Chad Bailey	EPA/OTAQ
Jeff Sterniak	EPA/OTAQ (ALVA)
Ed Nam	Ford Motor Company
David Lax	API
Talane Key	New Jersey DEP
Carla Bedenbaugh	South Carolina
Matt Barth	UC Riverside
Mike Keenan	New York DEC
Bob Maxwell	AIAM
Dennis Perkinson	TTI
Mary McGarry Barber	TNRCC
Jennifer Farrugia	Ford Motor Company
Larry Caretto	Cal State Northridge
Mike Rodgers	Georgia Tech
Michael Reale	Chrysler
Mike Williams	Los Alamos National Laboratory
Chris Frey	North Carolina State University
Ted Younglove	UC Riverside
Jeff Long	ARB
Dilip Patel	ARB
Tom Darlington	AIR
John German	Honda

Meeting Notes:

This call is a followup to June meeting in DC. See materials from that meeting and OAQPS conference.

Main agenda item : follow up on workgroup concerns and issues from Feb. & June.

Issue list, from Feb workgroup presentation with additions from June.

Not all comments can be addressed.

More concrete comments with alternatives are more likely to be addressed.
Don't expect complete agreement.
Looking to independent peer review as final arbiter, or "tie breaker".

? What is independent peer review?

Under EPA guidelines, we're planning an independent panel. We plan to hire a contractor to set up a panel of 3-5 people. It will be an open process.

Issue Status – proposed categories:

Addressed

Next Steps

Lack of Agreement

Lack of Consensus

(no comments from workgroup)

1) Data Input Requirements--concern will be very burdensome

See "MOVES User Data Input Options: Selected On-Road Implementations"
Also, upcoming comprehensive design plan.

National Level--John explained

Mike Keenan– do not report national-level calculations on county level. It's misleading.

John– may use national defaults for states/counties without their own data, use specific numbers when possible.

Mike– how can it be a county number if using national defaults?

John--allocation methods such as VMT would be used --similar to NONROAD and current NEI.

Mike– Mileage doesn't track with population– for example large cities vs. suburbs.

John--So how do you come up with numbers for counties that states aren't providing?

Mike--try FHWA for better VMT than population

John– we would expect to use VMT; glad for advice on how best to allocate emissions.

Tom Darlington– In ideal world get data from all the states for a specific time, but there would always be improvements, would never be completely current. Must use national level defaults for some purposes, must accept that national and state estimates will differ.

John– Yes.

Tom– not sure what consequences are for states, but can't always work with absolutely latest data.

John--Issue is when you use the national approach. We propose for national rulemaking type analysis.

Tom– Seems like a good tool for estimating emissions for broad-based national controls, but not for estimating local effects of policies. Would need to use state inventories for air quality analysis.

John– There are needs for regulatory and trends analysis.

Domain Level Macroscale: Likely used for States and non-attainment areas

Would require local VMT estimates (by HPMS Vehicle Class) (need input from FHWA on how best to do this.)

Would require geographic allocation factors for sub-domains.

Could use defaults for all other inputs.

But could provide much more detail if desired.

Mike Keenan– What do you mean by HPMS Vehicle Class?

John– basically axle counts– 2 axle 4 tire; single unit trucks & combination trucks. FHWA splits that up, but those are the basic groupings. We're open to advice on this. Then we'd split into MOBILE-type groupings. For roadway, we'd use the 12 FHWA roadway classes.

Mike Rodgers, GA Tech– How will we split network & off-network travel. HPMS provides only on-network travel.

John– We'd have to use some of the same methods used now, some sort of estimate.

Mike Rodgers– that becomes another default and it can vary a lot by local area (example a gridded city vs. an interstate dominated town). It's not trivial. HPMS doesn't include off-network, but local estimates sometimes used to inflate these to account for off-network. Different states do different things.

John– we'd probably want to use locally adjusted values that account for off-network VMT.

Mike K– Changing to axle counts would be an improvement if it were to account for vehicle mix.

John– We’d use HPMS as “gold standard” for major splits, then would need to do further subdividing with some sort of mix.

Mike K.-- For SIPs have to use as much local data as we can find. Don’t think registration and population distributions would be optional. Have someone go through EPA guidance. Or is this geographic allocation?

John– No, geographic allocation would be finer divisions within the domain, for example, for grid cell level emissions.

Correct that guidance still needs to be determined.

Jeff Long– with respect to macroscale, similar to MOBILE6 in terms of required inputs, right?

John K– yes, issue is going to inventory rather than emission factor model. So VMT is new

Dilip– for ARB, use travel forecast info from all local organizations. Major areas give their own estimates of travel in base year and growth to 2025 or 2030 from travel demand models. Some regions don’t have travel forecasts, then use calculated estimates as population times mileage accrual rates.

John– could use travel demand model instead of HPMS

Domain Level Mesoscale

Mike R– TAZ is intended to account for non-link travel, provides VMT by TAZ

(missed some notes due to computer problems)

John–

Microscale:

Target, to work well with CAL3QHC dispersion modeling.

So, inputs depend on level of detail needed, but are similar to MOBILE6, except need VMT. We don’t think MOVES will be as cumbersome as originally anticipated. What does group think?

Keenan– so, you’re no longer being asked to put in accelerations and decelerations,

John– you could just use average speed, or enter more detail if you had it. This is the facility-based driving cycles option under macroscale. There are defaults, but you don't have to use them.

Mike Rodgers-- If use just average speed, also need info on way the average speed arose– for example, on class 1 arterial, could get low speed from high signal density or high volume. Travel Demand Model should be able to give you volume/capacity ratio, can tell you whether congested or uncongested.

John– Would Level-of-Service reflect this?

Mike R.-- Yes, but not vehicle focused. If put in avg speed and vol/capacity ratio, you could have different default driving cycles. This would be at mesoscale level. You won't get accel/decel/idling distribution. Problem is volume is calibrated. Speed is rarely calibrated, usually completely fictitious. Some jurisdictions calibrate volume & speed, but many people won't. So volume/capacity ratio may be better than average speed in many cases.

John– Wanted to bypass issue of best method to produce average speed from vol/capacity ratio. We're not the experts there.

Mike R.-- It's a very important guidance issue.

John– We could have multiple options at link or zone basis, without making it a macroscale requirement.

Does anyone feel we have not addressed the first issue?

(no comments)

We'll consider it addressed.

2) Emissions Analysis Approach

John--summarized what NCSU is currently looking at. Can we develop an approach that can develop emission rates from variety of data sources?

Changes from past reports– limit to 3 contractor approaches (not CMEM since not apples-to-apples) or aggregate approach (not fully developed). Also, show individual pollutant results with confidence bands (not full error propagation, just trip-to-trip variability--so are likely to small). All the methods fall within the uncertainty. Any of shootout methods could be pursued. We're pursuing data binning because want data driven approach, that can use lots of

kinds of data, used in efficient software, work across scales.

In past couple weeks, heard a lot about a physical model approach. Like CMEM but refined or expanded.

Mike Reale-- What do you mean?

John-- We'll get to that.

2a) Should look at individual pollutants. We've done this now.

John German-- I've been emailing John K. I understand the issues better now. Question of goals. Goal is to include inputs--not just speed and acceleration, but temperature, fuel effects, etc. Concern that shootout doesn't properly reflect goals of the project--only done for speed & acceleration. If goal is to come up with unified model that considers other factors, are we on the right track?

John K-- We've been having a lot of emails back and forth with John German. Today's meeting is an attempt to bring in rest of FACA.

Shootout is a pilot study. We did ask contractors how to address other factors. We will have to deal with everything. Moving ahead with GHG model because don't have to deal with as many issues, but know we have to show our approach will work for more complicated case.

All contractors agreed that lab data will still be needed, for example, for fuel effects like LEV sulfur corrections. We can't get away from that entirely. Either with modal bins or physical model, will still have additional processing or corrections.

John G.-- Problems with separate corrections (1) does your test group match the vehicles used for speed/accel profiles, and (2) cross effects--are effects multiplicative, additive, something else? If you use correction factors, you'll always struggle with this. CMEM has problem--have to gather consistent source of data, but once you're done, model will handle all the interactions--at least in theory (no one has developed a model where you can really test this.) But don't dismiss physical models just because others do as good a job for speed/acceleration effects.

John K-- Physical model is back on the table. It does have problems--requires very specific data, still have recruitment issues. Modal binning is meant to allow broader use of data and capturing high emitters. With CMEM, can't use data unless have engine-out emissions. We're looking at some sort of hybrid to incorporate or calibrate to more data. But, still have very limited data.

Chad-- Inventory models must have good description of a fleet. Physical model requires more

detailed description of fleet, for example catalyst efficiency. Not clear that we'll have that fleet and activity data. Physical model could be good at creating emission factors and not good for creating inventories.

John K- Could use physical model to populate modal bins.

Chad- That removes benefit of physical model of interactions.

John K- not necessarily, for example could bring in history effects.

Ed Nam- aggregate approach like binning or microtrips, covers up sources of error since don't know where variability comes from. Not necessarily wrong, but with a physical approach you can use emissions to see where variability is coming from, can better understand why things are happening, where high emitters are coming from.

John K- fyi, Ford is lending Ed to us 2 days per week, he'll be looking at a physical model approach. Think this will be good.

Larry Carreto- Uncertainty is more in terms of how people drive than in estimates of emissions effects. Example, Table 18. If we use on board data, what is the best way to do that? Maybe can use physical model to guide the way we do corrections.

John K- How does a physical model give you more information about where high emitters are coming from or what they contribute to the fleet. For example, NRC says we should look at IM program evaluation using IM and/or RSD; otherwise we're in danger of missing the high emitters.

?- You've got to bring that information in. UC Riverside recruited some high emitters. Still have to come up with distribution, but can look at interactions of temperatures, driving cycles, etc. Otherwise you're kind of guessing.

John K. - CMEM did look at high emitters, but there seem to be lots of different kinds of high emitters.

John German- Physical models have different strengths and weaknesses. Bothered that will start modeling with binning approach without fully evaluating physical model.

Mike Rodgers?- Getting hung up on emission factors. MOVES is an inventory model. Not just evaluating emission factors, also activity of the fleet. That's an important consideration. For example, high emitters are not randomly distributed through the fleet. Socioeconomics effects distribution. Models need to be able to account for variation in where and when vehicles will be operating.

??? (Tom?)-- Depends on modeling needs. Local modelers care about where the high emitters are. At the national level, more an issue of how many there are. But we're not overestimating emission factors. This is a critical juncture.

Mike-- You're making a trade off between detail on the fleet and on the vehicles. Both are important on meso-scale. Sources of data that are most important may differ with scale. No single approach will solve the problem. Each has potentially fatal flaws at one or more scales. Either too refined to get data or not refined enough. Important to have flexible framework so can change if different data sources become available or are found to have strengths or weaknesses. We don't know enough to choose approach now.

John German-- Don't think about tradeoffs, think of inventory and emission factors as independent.

Carretto-- But have limited time frame. Can build a flexible model, but also have to start modeling emissions. We need to get more input from local modelers on what data is really available and in what form? Does it even make sense to talk about High and Normal emitters.

John K-- We think our design will be flexible enough to disaggregate "to hearts delight". But also concern about meeting our schedule, and that means making decisions. We're focused on making a proposal. We have to make decisions and can't study forever. We will evaluate physical model approach in parallel with modal binning approach. Question is whether physical model can meet our needs. Still have to deal with uncertainties.. Issue of locking in a model, not an issue of emission factors, but distribution of emitters. We're looking at distribution of emitters for VSP bins. It's much more empirical. CMEM and MOBILE are a different approach with highs & normals and weighting. It's a big difference. But we are designing the model to be modular to try to be as flexible as possible.

So, we are considering a physical model approach. We've asked Ed to do this. Does this satisfy initial concern.

John German-- I'm just asking for an upfront evaluation.

John K--That's what we're committing to do in the fall time frame. We plan to make those public and to evaluate side-by side.

John German--That would address that.

?? Are you looking at evap too?

John K-- Yes, but with GHG don't have to focus on it now. But we are thinking about all processes in our general design.

2a) Shootout results aren't convincing.

Our reasons for moving ahead are based on modeling criteria. We're not locked into it, but want to move ahead with it. Do people understand why we're doing this?

???-- Sounds like haven't made a final decision that this is the way to go?

John K-- Right. Our next steps are to assess how modal binning looks when bring in broader set of data and compare to physical model. Can we agree that it's the logical next step?

??? Yes

??? Yes

John K-- So, next steps are evaluation of phase 2 results.

David Lax-- What is time frame

John K-- Phase 2 analysis planned for completion by end of Aug. Physical model will be about 3 month time frame--ie, October could do comparison. We're talking about 3-day workshop toward end of October, one day for MOVES, one for NONROAD, one for MOBILE. Maybe have modeling workgroup in conjunction with workshop. This would be time frame for comparison of phase 2 results and physical model evaluation.

2b) Concern with accuracy of aggregating modal results. Next steps: phase 2 evaluation would look at larger data set.

Tom D-- This was my issue. We agree that there are problems with MOBILE approach of taking a cycle and multiplying by lots of correction factors. But adding together little pieces into a cycle is a major change in approach. So it's very important that emission factor approach does a good job estimating HC, CO & NOx over a cycle under various conditions. HC & CO looked good, but NOx didn't. Don't want to over or under-predict by 30%.

John K-- this has to do with aggregating and model acceptability criteria.

Phase 2 will have validation.

Just got data from California

Will take distributions, add up according to CA cycles and compare. Should be a larger data set. That will be the comparison Tom is asking for.

Tom--yes

John– Question, whats good enough. We’ve side-stepped in the past by not producing uncertainty estimates.

But, we don’t know truth.

Tom– Truth is set of instruments running around on a car for 5-6 vehicles.

Chris Frey– Validation data in phase 1 of shootout, but activity and ambient data differ, so potential extrapolation. Phase 1 was a very small data set and a very stringent exercise. And some differences, such as humidity, and some things we couldn’t explain. And, there is a lot of inter-trip variability. Even for NO_x, within 96% prediction interval. So, while 30% off, still not statistically significant because data set so small.

Tom– ???

Ed Nam– Future criteria for accuracy. If bin entire fleet, distribution of emissions in a bin is not a measure of uncertainty, just of variability. So, uncertainty is not addressed.

Chris Frey– That’s right if talking about variability in emissions. That will not be normally distributed either. But confidence interval on mean would give a measure of uncertainty (although could be measurement errors too).

Ed– Back to question of whether bin approach is good for distribution of fleet on the road, then we can’t do studies such as answering how will emissions change if we get rid of all high emitters.

John K– Would store emission rate, distribution and distribution parameters. IM module would produce distribution that reflects reduction in high emitters in the fleet.

Tom– Validation process is a good one. If going to include a lot more vehicles in Phase 2 and include ARB data, that would be good. But my personal comfort level would be higher if can get within 5-10% on all three pollutants under a variety of conditions. But if are off by 30-40%, it’s a problem.

John– So we agree that next steps are to move forward with the Phase 2 validation.

Tom--yes

John--And question of goal– 5-10% of what? If 30% is within margin of error does it matter?

Tom– If you run a Tier 2 or LEV, uncertainty over cycle is low. Have to develop a test for how aggregating emissions.

John– You could run 5 FTPs with tight range of emissions, still don't know what happens in the real world.

Tom– Need to develop a benchmark for comparison.

John– Don't want to pick absolute number, but need to be within uncertainty bounds.

Tom– A large over or under predictions is a problem.

??-- Also might look at non-parametric statistics.

John– Yes, also need to look at systematic bias. But there is uncertainty. 30% compared to what?

Tom– Don't want to see major changes in emission estimates without good reason. Just want model to come reasonably close to the data.

??? 30% is also the limit for air quality models to match predictions.

John– We do plan on validation as part of model development. But short of instrumenting every single vehicle, we'll always be using different ways to characterize how well we're doing. For example, MOBILE6 validation is looking at different techniques.

Next steps– look at phase 2 validation. what else?

Tom– satisfied with looking again in Phase 2 with more vehicles and more conditions.

2d) Modal binning may be incorrect at microscale.

But, we're not looking at second by second, we are doing Phase 2, and we will look at physical model.

John G– Ok not to look at second by second, but need to validate with HC & NO_x– not CO And CO₂. Next steps address this.

John K

2e) Should consider physical model

Already addressed.

2f) How will bag data be used?

Phase 2 will look at this. NCSU presented some methods.

John G– concern that won't work well for more aggressive cycles or deteriorating vehicles or extreme temperatures. Don't do validation just on FTP conditions.

John K– most bag data is on the FTP or a few other cycles.

John G– so may not be a lot of value to bag data.

John K--but could develop modal data from bag data

John G– but then wrong to extrapolate to other non-FTP conditions

John K– so disconnect between FTP bins and high accel bins.

Larry C-- need to see if it matters to have some bins populated with richer data and some without. Could test by removing a portion of data to see how it matters.

John K– Yes, this is a limitation. But it's a problem no matter what for vehicles that we aren't going to do more testing for.

Larry – But, depending on bins you choose, might populate bins differently. Maybe could test what the error is.

Tom?-- How far back do you intend to get onboard data?

John K– We don't know.

Dave B– We are looking at it and setting priorities.

Tom– hypothetical, do onboard for Tier 1 and later, fake it for previous vehicles.

John– We're not that detailed yet, but we know we won't be able to cover everything.

Mike Rodgers– but you will have remote sensing and lab testing data.

??-- but still will be low load

Mike– can use remote sensing to select higher loads. Still make extrapolations, but get some data.

John K– fyi, MEASURE model does get modal data from bag data.

Mike Keenan– What about state data. Would you use New York State as only IM data?

John K– Similar to MOBILE6, would cull data with no IM effects. Just starting to talk about using program or RSD to estimate IM effects. Haven't discussed whether would be state-specific or more generic to program types. It's tricky because so many IM program options. If use only real-life data might have to limit to only those real life programs.

Keenan– But you'd have to exclude IM vehicles from non-IM baseline emissions.

Tom– Back to bag data, do we wait for Phase 2?

John K– Yes, Phase 2 analysis is next step. Any comments? Hearing none...

3) PEMS accuracy

Tom--industry has set up a little workgroup that John agreed to. Industry identified people who have expertise. Names have been given to Gene, Theyll work on accuracy issues. That's the next step.

John K– Question is how we can be sure that onboard data is accurate. We presented dyno correlations that we thought were good. Question is how that compares to real on-road data.

Mike Reale– This might be my issue. The analyzers may have shown great correlations, but no demonstration of correlation between onboard and bag measurement. But vehicle isn't really even moving.

? – Question of experimental design. Industry group should have ideas. Issue particular with aging system.

John K– So next step is to work with industry group.

Mike Rodgers– volunteer Jim Pierson to join the group.

John K– I'll talk to Gene about getting it started. Other volunteers.

Mike Rodgers– Try folks at Pittsburgh

John K

4) Implementation Plan and schedule– concerns GHG may delay MOVES implementation or lead to incorrect formulation

We don't think so.

John German– if its being used primarily to develop the activity side, that's ok, but don't get locked into emission side.

John K– can we call it addressed for now?

John G-Yes, for now.

John K.

5) How will model deal with areas with little or no data.

Similar to MOBILE6, we'll have to use assumptions, though physical models may have some advantages here. Will commit to document assumptions and make sure they are reviewed.

Tom– That's ok for now. Concern is how you actually implement the assumptions and model changes in emission standards. You have to be careful.

John– So thats a longer term next step, but we've done what we can for now.

Thanks.

Plan for meeting at time of October workshop– Detroit, late October.

