

13th Modeling Conference - Session 1

George Bridgers:

Good morning. I think the sundial said it's 8:30. So, I'm excited to start this meeting.

[unintelligible] Good morning and welcome to the 13th Conference on Air Quality Models.

Appreciate everyone taking the time out of their very busy schedules to come and join us for the next two days of this conference and public hearing. I realized this morning that it took a little bit longer to go through security. I can't, for certain, you heard me say a little bit earlier, but I can't say for certain that it was because the Administrator is here today. But we will work with the facilities folks to try to speed things up tomorrow morning a little bit. And the other thing is, I'll make this announcement before lunch, but if anyone has more significant issues getting through security because your name wasn't on the list, come and see me so I'll make sure you're on the list for tomorrow morning and hopefully that'll straighten things out. And I'll make that announcement again before lunch.

So, this is a public hearing. All of our conferences are, and so I will formally call the meeting to order, and the entirety of today's bar is going to be a recorded and transcribed public hearing. We are required by the Clean Air Act to, every three years, hold an air quality conference. This is something that we've done fairly steadily since 1977, 1978. I think anybody in the room probably can do the math. We should be at 15th, not the 13th, but we've held true to it about every four years. Three years is what Congress mandated, and we're going to try to continue to keep that as close as possible. As I mentioned, everything is being transcribed. We'll put all of the proceedings of the next two days in this rule docket. If you've been in these conferences before, you're familiar with that. It is an interconnected docket because we do have a proposed rulemaking out there, so it's doing double duty. The transcriptions will be there, and I'll also post to everything on SCRAM. And that's probably going to be the easiest place for you to find the transcriptions and the presentations.

I know that there's some threat of a looming shutdown. I don't know any other news on that front, but I would try to have every presentation from today and tomorrow posted Thursday or Friday. So, in case they do shut down, they'll have access to them. Let's see. Since it is a conference and being transcribed, I'm going to ask everybody that comes up and presents, and you'll see this echoed throughout a bunch of my presentations. They need to identify themselves and their affiliation. So, with that being said, I'm your public hearing officer and your master of ceremonies for the next two days. My name is George Bridgers. I think most everybody may know that. I am the director of EPA's Model Clearinghouse. I work in OAQPS, and in the Air Quality Modeling Group.

So, this conference, the next two days, we're breaking this up into sort of two sessions. Today's session is going to be the conference session. Tomorrow is going to be the public hearing for the rule session. So, our talks today will be much more research-oriented, looking forward, talking about things that the Agency is doing with development of various tools, not just with AERMOD, but across our regulatory modeling suite. Although you'll hear everything more focused on AERMOD, doesn't always have to be. We'll also hear from some of our stakeholders offering comments back to us this afternoon with regards to areas they'd like to see us move our

air quality modeling world, and also some research that the external stakeholder community is involved in.

We are not going to do question and answers today or tomorrow like we did back with the 12th Conference. At the 12th Conference, we had expert panels, there was dialogue. Because of the nature of the rule-making that we're involved with, we've decided it would be easier to just go through our presentations. If anyone needed clarifying questions on anything that's presented today, you're more than welcome to follow up directly with the presenter. You can talk to him offline; you can send them emails. There's no issue there. Tomorrow, however, when we present, and that's the public hearing for the rule, we're going to be very stoic, we're going to present what's in the preamble, the foundational pieces, the support that's in the preamble and the proposal. If you have questions there, you need to submit them to the docket, it is a rulemaking. We're going to have to draw the line there, unfortunately.

But that being said, I don't think this will be much of a huge issue. I hope that it will make this not too controversial, but I just wanted to make sure that it was understood how we were doing questions and answers. And I also offer, either way, at the very end of the day, there'll be an opportunity, if you want to call it the open mic session, there'll be an opportunity for anyone in the room that wants to offer comments to the record. If there's anything you see across today that you agree or disagree with, and the spirit moves you, a concern or issue, and you want to say something at the end of the day, you absolutely have that option. Or afterwards, you can submit formally to the docket. That's also perfectly acceptable.

So, since this is a large meeting, I'm kind of required to go through some of the logistics. Obviously, if you've been through the security protocols getting into the building, the biggest number one point that I will draw, I don't even know if it's in my slides, it's off the top of my head, is don't go outside unless you want to go back through security again. And I know that it's somewhat nice, but you walk out the door, you're out, and you have to go through the same process that you did to get in this morning. That being said, we'll get to it when we get closer to lunch. If you're leaving for lunch, we've got an hour and a half allocated [unintelligible]. Some of you probably looked at the agenda, and are like why did you get an hour and a half? There's like three kiosks next door in the cafeteria, and that's how you order now. And there's probably 120 in the room right now. And you can do the math. And so, if you decide to leave the campus for lunch, just remember it's going to take a while to get back on. And so, we'll start right back up at one o'clock.

I don't know if everybody knows where the bathrooms are. If you came down the elevator, you passed them. But if you didn't, if you go out the doors here on this side of the room, back across the foyer, go around the bottom of the steps. The bathrooms are in the alcove toward the elevators on the left. There's male, a female, and a unisex bathroom that's over there. I already said snacks and lunch, the cafeteria across the way. I have no issue, facilities might fuss at me, I have no issue, if you want to bring food and drink back in this room. I'm not going to draw the line there, but I think the majority of the food should probably stay in the cafeteria, but if you go get coffee, obviously I have my coffee right under the desk. Again, an hour and a half for lunch, that should be more than sufficient.

In case of an emergency, this is one of those that, if there is an emergency, you've all heard the fire alarm support. These, in this building are absolutely obnoxious, but after the alarm goes off normally over the PA, there will be an announcement of what the emergency is, and so I'll just ask at that time everybody to follow me because I can tell you to head to Assembly Area 8. But, very few people know where Assembly Area 8 is, but primarily we're just going to walk, out, actually probably these doors straight out toward the lake. And so just exit the building there. Unfortunately, if there is an emergency and we do have to exit the building, we all have to go back through security again. That's just, it is a pain even when we're having fire alarms ourselves. And over the next day or two, if there are any issues, you can come find me. I've got more of the staff up here in our group, which I want to thank here just a minute. Find any of us EPAers and pull us to the side. It feels like maybe the air conditioner kicked in. We made a request already with facilities to try to get the air down because I can see people fanning. I knew I was already, so we're going to do that. But if there's any issues, email me or come find me and we'll try to resolve it.

As I mentioned, there's several people here in the front row. I'm thinking that you are all on the front row. Well, Chris is on that side regardless. But this meeting would not have been possible without this staff. It's not just something that George puts on. So, we've got two teams within the Air Quality Modeling Group. It's the same cast of characters. We've got the Dispersion Modeling Team and the Model Development Team, and it's the same alphabet soup. I lead the Dispersion Modeling Team. Clint Tillerson leads the Model Development Team. That's what the colors are all about on the slide, but we've got Chris Misenis. We've got Alyssa Piliero. We've got Matt Porter, James Thurman, and I have to give a shout out to Tyler Fox, who unfortunately is ill this morning and hopes to be here this afternoon.

And so, with that, if you looked at your agenda, the next thing that's on the small printed type agenda would be an opportunity for Chet Wayland to come and speak with us. As I mentioned, there was a situation where the Administrator is the building today, so Chet's preoccupied. Chet will join us when he can, I'm thinking around 9:30. So, I'm going to take the liberty to shift to my next presentation, which is a [unintelligible].

So, I mentioned Tyler is under the weather this morning. I don't think that we were going to flip coins or draw straws. I think I had this one. That's why my name's on the front slide. But the next few slides, since I didn't mention at the start of the conference that the docket is interconnected with rulemaking, we thought it was appropriate to just take a few minutes to talk about the rulemaking. We're not going to launch into great detail about it. That's what tomorrow is for. But we do realize there's a few people that are attending only for today. So, this would give the snapshot for that. A lot of the slides that I'm going to be presenting will be presented tomorrow in greater detail.

So, for the record, those that don't know, most everybody in the room who showed up today realizes The *Guideline on Air Quality Models* is published as Appendix W to 40 CFR Part 51. We call it Appendix W; we call it the *Guideline*. I joke at most of these meetings and say I'm pretty sure that the everyone in this room has some other four-letter word that they like to call the *Guideline*. We do too. But we also think it's a pretty good document, and Tyler often calls it, much like the Constitution. Now that's making it very lofty, but the aspects that it's malleable, it's

flexible, and we've been able to amend it with time to adjust to the times. And I know that there's a lot of things you guys probably think you see in the *Guideline*, or not see in the *Guideline*, but it has stood the test of essentially 40-ish years, since the late '70s in some form. Just to make sure that it's understood, one of the most important aspects of the *Guideline* is it defines the preferred air quality models, the techniques, and then the guidance around how they should be used.

The current version, if you didn't know, is the 2017 version. And I say that because I don't want there to be any confusion. We have a proposed 2023 version that's out there, but that is under consideration for rulemaking. So, if anybody is going to cite in a regulatory application, the version of the *Guideline* s should be the 2017 version, that is the current final version that's out there. That being said, as an aside, I don't think anybody would be faulted if they were to use some of the recommendations that we've updated in the 2023 version, but I would caution that 2017 version in the current version. And as I mentioned, it most importantly, defines the preferred air quality models, the models that the stakeholder community can use without question, as long as it's used with respect of the recommendations for their use. We have three preferred models, AERMOD, CTDMPPLUS, and OCD. And if anybody didn't know, AERMOD is the primary model that we can use for near-field dispersion.

So, what are we doing? So, we proposed updates to the *Guideline*. Last time we did this was in 2015. The 2015 update was a pretty holistic update, at least in the sense that we restructured aspects of the *Guideline* and then made some fairly significant updates, at least to the section with regards to ozone and PM_{2.5}. This time, it's a little bit lighter-built and hopefully a lot less controversial. We're proposing to add three formulation options to the AERMOD Modeling System. Again, we'll go into great detail tomorrow about this. One is putting your COARE algorithm in AERMET, the GRSM option as a Tier 3 NO₂ screening option, and then RLIN as a source type, primarily for mobile sources. I mentioned in the previous slide that we had three preferred models, and the models go through a promulgation process. Anytime we want to do scientific updates to a model, we have to take them through the rulemaking process.

So, there's the standard updates we do, and I think Clint will talk about this later, where we do bug fixes, and we add alpha options, or we add beta options, or we do enhancements for preprocessors. We can do that without rulemaking. But if we're putting it as a non-default regulatory option, or any kind of regulatory option, we have to go through the rulemaking process. So, we're only adding things to the model, we're not taking anything away. The other translation here is if you guys in the external community, whether you're a state or local, or you're an applicant, and you have an application already in process, you've already done a lot of modeling, you really shouldn't have to redo your modeling with the current version, the 23132 version of the model. You should still be able to use 22112.

That being said, every time we do an annual update to the model, you have to look at the Model Change Bulletin and make sure that we didn't do some other bug fix that may affect your source type. That's something you can work out with the regulatory authority and the Regional Office. But I'm saying this because there was some confusion about, and hopefully Clint will reiterate in his slides. There's some confusion about, should we use 23132, the version that we just released? And the answer is yes, caveat, just look at what you've done before and don't waste a lot of time, effort, and energy if you've already got most of the work done with 22112.

The other two things that we're doing with this rule revision in addition to the updates to the AERMOD Modeling System is there's more refinement to the recommendations for how you determine the appropriate background concentrations. This is in section 8.3 of the *Guideline*.

And then there was more of just a nuance with the federal printing office that we can no longer have appendices within appendices. So, all of those preferred models, AERMOD CTDMPPLUS, OCD, are in Appendix A to Appendix W in the 2017 version. Well, they told us no, we can't do that. It'll have to be Addendum A in 2023 and then moving forward. So, the Appendix A models are now becoming addendum models, Addendum A models. And James, I'm going to just call him out. James, the first thing he said is, well, the word dumb is in the name.

[laughter]

But we do have a website. This is sort of the Cliff Notes website on SCRAM. Basically, it follows the form of the preamble of the rule. This is not to circumvent the preamble, but this is hopefully to help you guys in the understanding what's in the preamble so you can go to that website there. And all of the supporting information for each of the updates is included, through links there. And finally, and I should caveat this way, this also, the comment period right now runs through December 22nd. I have no clue standing before you today what happens if we shut down. I have never worked a rulemaking through a shutdown, so it is my, I suspect, I'll say it this way, that if we have an extended shutdown, we may have to extend the comment period. I just don't know, more to come on that. But right now, the comment period runs through December 22nd.

I included this slide for the record. You guys don't need to know the 13 Conference is because you're at it. But we are required to do this conference every three years, like I said. And this is also a slide that I used with multiple state and local agencies and MJOs over the last few weeks. I want this in the record for reference so no one can say I was telling the states one thing and telling you guys something different. But again, this is the public hearing for the rulemaking as well. That's my slides. And so, with that, I think Alyssa, you're up next. I'll shift over.

Alyssa Piliero:

Good morning, everyone. My name is Alyssa Piliero, and I'm also a part of the Air Quality Modeling Group here at the EPA. And I will be giving a brief discussion on the AERMOD model development structure. Many of you, as you sit in this room, are very familiar with AERMOD, as well as how we have updated AERMOD and kind of tackled the model development of AERMOD over the past 5, even 10 years. But for those that are new in the room, as well as just to re-emphasize the process that we seek to use moving forward. So, of course, sitting in a room full of engineers and scientists, everyone understands why we need to update a computer model with time. But the main driver here is that AERMOD, like George said, is the preferred dispersion model for many regulatory applications, which means it is used consistently on a national level to support air quality modeling efforts related to New Source Review or PSD programs, state implementation plans, as well as many other air quality assessments that are required under EPA federal rule and regulation.

And so, one thing to note as we talk about updating AERMOD and adding new options, in any preferred version of AERMOD, especially the newer ones, there are regulatory and non-regulatory options. Now, these regulatory options may be used kind of off the shelf. Anyone can use them as they are if they are considered a regulatory option for their air quality assessments. Now, also in the model, we have non-regulatory options, which are now named ALPHA and BETA options in the model. And we include these in the model for testing and review purposes. We really, we put them in there so that user community is able to start to work with them, review them, and collaborate with us to work on their development to then push them towards becoming a regulatory option.

And so, no matter whether we're in a rule-making process or outside of that, we are continuously looking to update and improve AERMOD for its accuracy, its capability, and of course, address situations where the model does not perform well. Some of those situations are brought in from stakeholder community. Some of those, though, are also found through implementation of the AERMOD modeling system through the air quality programs. the alternative model approval process, it really helps highlight, although it gives the possibility to use the stakeholder community, it also helps highlight for us what areas that AERMOD may be deficient in or may not be the most appropriate model in that case, and it points out where we need to push for further improvement.

And so many of you guys are familiar, but updates to AERMOD generally include formulation updates, and those are the big scientific updates to source types or the dispersion equations within the model. But also, we can do model enhancements, with any computer model there's always bugs that get in there somehow, and we're always looking to fix those. And so, as you'll see with this rule-making process that we're going through right now, this is the only time that we're able to make formulation updates to the model because it requires updates to the *Guideline on Air Quality Models*. And so, through this process, as you sit through it, these options are proposed, and they undergo public review of the comment before they are then finalized in the *Guideline* as well as in the new version of AERMOD. And so, through this process, it allows these options or formulation updates to undergo some in-depth model development, evaluation, and review, where it is really heavily scrutinized by the stakeholder community as well as industry and environmental groups. And so, it really allows for us here as a model development group to see all sides of the picture and ensure that we are able to put out the best version of this option or formulation update as well as make sure it's being implemented properly and upholding the *Guideline* and the Clean Air Act.

And so, it also ensures that we continue community engagement through this process. As you've seen over the past couple of years, we've continued to push wanting to engage in the community more and more on our development process. And that's because we can't do it all ourselves. There's only five, six of us that work on the AERMOD model here at EPA. And so, we need, we appreciate the help and the thoughts that we are provided by the stakeholder community. Now, outside of these formulation updates, we are able to release our interim releases of AERMOD, where we are able to enhance the model through improve the model runtime or its usability of the code, as well as bug fixes and insert any non-regulatory updates to the AERMOD modeling system including alpha and beta options.

Now, for the bigger formulation changes as well as some smaller pieces, we generally have a procedure of how we like to implement these improvements into AERMOD and the process that we go through. And generally, the model enhancement is either proposed from the stakeholder community or we have decided as a model development team that it's something that we need to investigate further, usually through information that we've learned through the use of AERMOD in these air programs. And so, if there is technical and scientific basis on this topic, a white paper is developed that details the area of suggested improvement. And this document includes any sort of relevant field data, modeling files, as well as current literature, and any other key technical information that will assist in inserting this option or formulation update into AERMOD.

So, once we have a white paper and we have the topic more established, we, as a team, as the model development team here at EPA, we consider our various competing priorities for model development and either choose to propose the model improvement to include in the model or occasionally things have to take the back burner and we need to do some further research and development there. And so, after sufficient technical development and evaluation on the enhancement, the option is typically added to AERMOD as ALPHA option first and then can be promoted to BETA. In very few rare cases, options are able to go straight to a BETA option.

And so, like I was saying before, alpha options, these are experimental, they are developmental, and they cannot be used for regulatory use. We first added ALPHA options to the AERMOD modeling system in version 18018, or 81, sorry. And so, prior to that, you won't see any ALPHA options in those versions of the model. But from there, the alpha option is put in the model, it is used by the stakeholder community, and we gain feedback on it, and also continue development on our side. Then, BETA options that are in the model. These are peer reviewed options that are potentially ready for consideration for alternative models. And then in order for that BETA option to become a regulatory option, it must go through the formal promulgation through notice of proposed rulemaking or the process that we are going through right now.

And so, considerations to consider when, as a stakeholder community, if you're bringing us options and thinking about, okay, I want this enhancement in the model, I personally see it as an ALPHA or a BETA or whatever option, consider these various factors. And so, for an ALPHA option, it really needs to clearly address a deficiency in the model that could be demonstrated, and also provide a refinement or solution to any issues that are in the programmatic use of AERMOD. Like I said before, a lot of the programmatic pieces that AERMOD has used, it drives a lot of the development because that is the primary use of AERMOD. And we look and hope that you're able to provide a viable plan for the information of this option into the AERMOD's code so that we are able to collaborate together and easily and seamlessly include it into the code.

And then, of course, there needs to be an initial level of research and development as well as in the current literature to start to provide a baseline of information on how this is going to work in the code. And so, these ALPHA options can later be promoted to BETA status as long as they undergo sufficient review, testing, and refinement. And so, for BETA options, some of them may be used for alternative model use. However, they have to meet these requirements that are in Appendix W. And so, I've listed these here. I will not go through all of these, but essentially

there needs to be a solid evaluation of the option. There also needs to be some robust documentation comparing how the model performs to air quality data as well as scientific peer review of the technique. And that is one of the big pieces here is that we really look for our BETA options and especially before they go regulatory to have some form of scientific peer review that really evaluates and analyzes the performance of the option. And so, with that, that wraps up our information on ALPHA and BETA and how we pursue model development on the AERMOD modeling system. And I'll turn it back over to George.

George Bridgers:

Thank you, Alyssa. And I'll apologize to you, Alyssa, because I kept pointing to Clint earlier, saying, that Clint is going to mention it, and you had it all there in your slides.

Clint Tillerson:

Okay, we've heard about the conference, the public hearing, the release of the new model. So, what is actually in the release of the new model? So, I want to take just a few minutes to talk about that.

George Bridgers:

Introduce yourself.

Clint Tillerson:

Oh, yes, thank you. I was even thinking about that when I sit there. I'm Clint Tillerson. I'm also with EPA's Air Quality Modeling Group, and this presentation is the AERMOD Modeling System version 23132 update. And I'll say more about the version numbers here in just a moment, but we do want to just kind of walk through quickly, can't talk about all of the details because there's not enough time to talk about all of the details, but walk through quickly the things that are in the model of those templates. So, many of you know this. If you're newer to the air modeling world, this may be new to you in terms of why do they use version dates the way they do rather than version 1.0 and 1.1? I wanted to just give you a primer real quickly on the release date and the version. So, the release date was Monday, October 23rd, 2023. The version is 23132. We released AERMOD and AERMET with that version number. We also released MMIF version 4.1. So, Chris over there, he uses probably a much more acceptable, [laughs] I don't know if that's the right word, but what people are used to in terms of version numbers. So, our version number, numbering system, is the year, a two-digit year, the day of that year, and so not the day that it was released, but we have 23, which is the 112th day -- I didn't do that right. I think I messed up. I think I used the wrong slide.

[laughter]

So, it's the 132nd day of 2023. I'll fix that before it goes up on SCRAM. So, it's the 132nd day of 2023, which is Friday, May 12, 2023. And you look and you say, but you didn't release it until October 2023. Well, there's a reason why there's such a lag of time there. And I don't think that it was always this way, but we've tried to implement a system where we have a timeframe where we can say the code is done, essentially. The code is locked. So that date represents the day that we have all of the code merged from internal and external sources. And up until the last five or six years, basically all of the code was code that we developed or our contractor developed. But

with this system that paradigm, I like to call it, that Alyssa went through, we, and you'll see, we actually have quite a bit of code that comes from other sources that we put into the model.

We can't get everything into the model. We did have to evaluate and some things we'd like to put into the model, and it just has to wait because there's only so much time to do this. And so, at some point in time, the version dates are coded into the program, and we say there's no new code additions after that. So, there's no new options that are going to go into the model after that code is, what we say, locked. And I'll use quotation marks because that's kind of, it's a soft block. No new options, no new features, no new enhancements. If a new bug report comes in, then we have to evaluate and go ahead and wait to decide, okay, is this something that is just a real quick tweak in the code that's not really going to have any impact, or is it something that is going to take some time and it might delay the release? Or even if it's a small little thing, we just don't have time to do it, especially if it's not going to be of significance.

But we do, if there is something that comes up that we've just totally missed, we haven't seen, somebody brings it to us, we will evaluate it and decide, hey, if this takes us time to, this takes us time to get into the model, it's something that has to be fixed and will delay. So then what do we do after we have the code locked? We do testing. We generally find bugs in the stuff that we put in because we merged all of this code together. Generally, when we get code from external sources, it's something embedded in the last version of the code. And so, we have to pull all of this together into one version of the code, which will become the version that we release. And so there is a lot of testing that has to take place, a lot of review of the code. We try to take care of those bugs that we find that are related to the work that we did as we merged the code.

All of this typically takes about two months from the code lockdown to the release. We have to do all of the documentation. This release was not a typical release because it was concurrently proposed rule update, so we had all of the TSDs, but a lot more documentation that we had to do. We probably did the same amount of testing only. Well, actually we did more testing because it extended. So, we were continuously testing. And yet we know that you will find bugs, a few minor things have been reported. And I see somebody shaking their head [laughs]. So, you will find bugs. As Alyssa said, they are a part of the development. So that's how we get the version date, and how that relates to the release date, and it's very, very loose.

So, I wanted to take a minute about, and just tell you about our 23132 version number. Many of you know Roger Brode, he developed, or he devoted very, very much of his career to the development of AERMOD. He wrote a lot of code. He was involved in AERMOD development. I started working at PES with him in 1997. That was before the promulgation of AERMOD. He eventually came to EPA and that whole entire time was pretty much devoted to AERMOD. He passed away just two weeks after celebrating his 70th birthday, right about the time we were preparing to lock the code. And I think it was Matt, probably, that noticed, hey, if you look at his birthday, that's a palindrome. And Roger was known for assigning version dates that were easily remembered. He loved palindromes, if possible, but that wasn't always possible. And I guess probably he liked those because there were fewer numbers to remember. Fewer things, you know, just much easier to remember, just flip it around, you get it, which is what I tried to do, doesn't always work out too well. It just didn't work out too well.

So, his birthday happened to be a palindrome, 23132. It was right around that time that we locked the code. So, we thought, hey, that would be a good way to honor him. We let his family know, they were thrilled that we thought of him in that way. And so that's just our little, you know, nod to Roger in terms of, we miss you, we thank you for your work. He was a good friend. He was a great colleague. I had the pleasure of working with him as a colleague, working under him as a contractor, working for him and then working with him as a colleague again. So very much appreciate the work that he done, he did, and though it was not a palindrome, I think one of the first versions that he numbered in such a way, it's like, hey, this would be cool, is the version 12345. And so that, I say it's one of his more famous versions that people still talk about today. 12345, isn't that easy to read? So, we miss you, Roger.

So, what's in 23132? So, I see, as you know, released concurrent with publication of the proposed *Guideline* revisions. We released AERMOD, AERMET, and MMIF. There were bug fixes, enhancements, new ALPHA options, proposed formulation updates. And then there were a few extras that I don't know if people have paid much attention to, but there was a minor update in the AERSCREEN test cases. So, the test cases for AERSCREEN is a new zip file out there. The AERMINUTE user's guide was updated with a very minor update. The sample run and instructions had been out there, I think, for a long time in a poor state. So, they have been overhauled a bit and updated. So, check that out, especially if you're new to AERMOD. I think the case in there takes you through AERMAP, AERMOD, AERMET with, I think, pretty good instructions about how to run that. And then the AERPLOT instructions were updated.

So, this release package summary, this here I just put in there for convenience. When you download this presentation, all of the links to all of the documentation, all of the executables, the test cases that we put out there, that's all there linked out to SCRAM so you can get to it easily rather than having to search for it. So, notable bug fixes and enhancements for AERMOD. There is a list. I certainly could not go through all the list, nor would you want me to. I do have the link to the model change bulletin for AERMOD. But just real, real quickly, in a nutshell, there were corrections to error and warning messages, new error warning messages. There was a bug out there with the AREACIRC source type, where I think sources were being overridden in some circumstances that's been corrected.

We have data logic for the ARMRATIO min and max values. They didn't quite match what was added in the user's guide, and the user's guide was, what was in the user's guide was what we intended. Corrections to event processing of the BUOYLINE source. We'll talk more about the BUOYLINE source later. And the addition of elevated terrain to the RLINE and RLINEXT sources. And just, we'll mention, because it was pointed out to us that it was not clear in the user's guide, the RLINEXT is the source type that you have to use with depressed roadways and barriers. And up until this release, the code would not let you run RLINE or RLINEXT with elevated terrain. It forced you to use flat terrain. Now you can use elevated terrain with RLINE and RLINEXT, but you can't use elevated terrain if you're using the depressed roadways or the barrier options.

And just a note so that everybody is clear, if you do transportation conformity and hot-spot analysis and modeling, you need to check the latest OTAQ guidance because their guidance for a while now has been that whether you're using, I think whether you're using AREA or VOLUME

sources, I'm talking out of my area right now, everything has to be modeled as flat. And so, our addition of terrain is to make the RLINE source type more complete, but you need to follow OTAQ's guidance and check that to make sure modeling your transportation sources the way they would intend for you to do. And then we added additional debug options, urban temperature profiles. I think now the urban debug option gives you about three files now. We have a debug file for highly buoyant plume, which is a new ALPHA option, and then the aircraft plume rise.

Then for AERMET, correction to set surface winds to calm only if not missing. I'm speaking in James' territory here. I'm not, I think I probably communicated that correctly. But there was a time when, in the old version, in certain cases where it wouldn't set the winds, it didn't have any effect on the concentrations, but it wouldn't set the winds in a way that you would expect them to be in the output file and surface file. Correction to the on-site sub-hourly precipitation variables, additional QA on the number of observations for sub-hourly data. No longer requires multilevel data to be in ascending order. Correct issues with compilation under Linux OS. I don't know how many people try to compile under Linux, but there had been an issue. I believe that people were able to work around it. But anyway, that's been corrected. And then, of course, additional error trapping.

So real quickly, new ALPHA options. You heard Alyssa talk about ALPHA/BETA. So, we have three new ALPHA options, aircraft plume rise, and I've got here some credit for either who sponsored or who developed the code, and you see here that two out of the three of these were not EPA. So, we have aircraft plume rise, and Matt Porter is going to give a presentation on that later. But this was sponsored by the Federal Aviation Administration. I think their contractor is UNC. It's a way to characterize aircraft emissions from jet engines and it has taken the AREA and VOLUME sources and extended the parameters that you can attach to those source types to characterize your aircraft emissions. And then it takes care of plume rise. So that is an ALPHA option.

Area Meander, this is one that we worked on with our contractor, WSP, or I would say ORD, our group, not necessarily. You'll hear a presentation by Michelle Snyder, who did, I believe, all of the work on that. So, this is adding a plume meander to the AREA source types, and there are a number of area source types, not just AREA, but AREAPOLY, AREACIRC, and LINE. And so there are some caveats to that that you'll hear from Michelle about, but that's another ALPHA option. It's there if you want to look at it, play around with it. VOLUME sources and POINT sources, I believe, have always had meander formulated into them. AREA has not. So, this is an approach to see if this is a way that we could use meandering in AREA sources.

And the highly buoyant plume, and this, I'm hoping I have this right, Bob. Sponsored by every, the code was, work was done by AECOM. This is another ALPHA option. When you have a buoyant plume that penetrates the top of the mixed layer into the stable layer. The observation in the work that they have done is the plume can get mixed down to the ground, but it should stay aloft longer, and that can lead to elevated ground-level concentrations and prematurely or earlier than it should. And we don't have a presentation on that, but I did put the publication that backs the work that has been done there.

And then finally, the three proposed formulation updates that you will hear a lot on those tomorrow, so not much on this today, but James Thurman, he's going to give a presentation on, tomorrow, about putting the COARE algorithm, that's the Coupled Ocean-Atmosphere Response Experiment. This is an algorithm that takes observations from overwater or prognostic data from overwater, and it provides the marine boundary layer parameters. So AERMET is really written for over land. We've had a number of alternative model requests to use AERCOARE, which was developed a number of years ago, to use the COARE algorithm. So, James has taken that, put it into AERMET. We're proposing that as a formulation update. GRSM, you'll hear from Matt Porter tomorrow. This is the Generic Reaction Set Method. This is a new NO_x-to-NO₂ conversion option. It's been in AERMOD as a BETA for a couple of releases, I believe. It went to BETA last release. We're proposing that as another tier three screening option. And you'll hear from Matt as I said on that. And then RLINE has been in the model as well. It's been in as a BETA option. This was sponsored by FHWA, EPA, and then WSP did a lot of work on it along with ORD. James will also present on that on Wednesday, tomorrow. And so, this was adapted from the Research LINE model, which EPA developed and has been implemented into AERMOD to use for transportation conformity in hot-spot analyses. And so that's where you really have to pay attention to the OTAQ guidance, even though you can use your terrain now. If you're modeling for that, you need to check in the Guidance. [unintelligible]

George Bridgers:

Hi everyone. And I see that Mr. Wayland is going to join us. So, Chet, if you'd like to come up, we can get you in now. [unintelligible]

I have to get your mug up there...

[laughter]

Anyway, so it's my distinct pleasure to offer the podium to Chet Wayland, who's the director of the Air Quality Analysis Division.

Chet Wayland:

Thank you, George. Yeah, and I've seen the pictures a few years ago, so [unintelligible]. I just want to thank you all for coming. You know, when I pulled in this morning, I saw all the traffic jam at the back gate. I think we had a lot of people coming to the conference, which is great. And, you know, being here is really, really important because I think, I'm right in this, this is the only conference in the entire Agency, that is in the statutory language. It has to happen. And so, when they wrote the Clean Air Act of 1990, they obviously even then knew the importance of air quality modeling and what role it would play in air quality management across the country. So, the fact that they mandated we had this meeting every three years to me says that, you know, it's really, really important then and it's really, really important today. Probably more so important today than it's ever been because of where we're going, the standards where we're evolving around, looking at local issues versus regional scale issues. There's just so much in play today and you all are such a huge, huge piece of that. So, I really appreciate you all being here. Your presence here really makes a difference. It matters a lot.

And this one, also, we're having a public hearing, I think, tomorrow, as we roll out the updates to AERMOD and so forth and Appendix W. So, this one's kind of a twofer, which is great.

But I just wanted to thank you for coming. I apologize for the staff who isn't getting into the building. Security sometimes here can be a little interesting, but I'm glad you're here. I hope you will enjoy the next few days. And, you know, I encourage you to ask a lot of questions. The nice thing about having me here, is we've got all my folks here that can answer all the questions. And so, it's a great opportunity to interact and to share information, but also for us to hear back from you. The way these models get better is by constant feedback through the community. You know, it's not just us sitting up here saying, yes, we know what we need to do. Let's go do this. It's hearing from all of you as to what are the things that are on your mind, what are the things we need to be working on, what are the priorities, and then we can focus on that as we go forward, as we did with this recent update to AERMOD. Thank you so much for being here. I appreciate George squeezing me in into your agenda, and I look forward to seeing some of you. I've got to run to another meeting, unfortunately, right now, but I look forward to seeing some of you over the next two days while I'm here. So, thank you for coming, and I hope you have a great conference. Thank you.

George Bridgers:

[unintelligible] Chet put us back perfectly on time. Rolling right along. I going to piggyback on some things that Clint said. And Clint, I didn't think, we didn't know that we were setting each other up. Again, George Bridgers. I wanted to take a few minutes this morning to provide a status update on the Clearinghouse. And this is something that we do in each of our conferences.

If we could go to the next slide. That was interesting.

[unintelligible]

I'm not sure when the mic went.

Just one second.

[unintelligible]

Somehow your mic is on.

Male Speaker

[unintelligible]

George Bridgers:

Let's try that again. So somehow magically, me standing here made his computer unmute and the speakers come on.

[laughter]

So, as I was saying, we like to do this status update at each of the conferences on the Model Clearinghouse. I have here sorta three bullets that outline what we've done over the last, well

what we did over the last two conferences, and what we're going to do in this conference. So, at the 11th Conference, if you can think back in the 2015 time frame. It was also almost identical in the way that Chet said a two-for. It was almost identical the way we're running this conference. We had a proposed rulemaking out. We also did the conference. That one, we did more as just public hearing and I kind of felt bad that we didn't have a more interactive session like sort of what we're doing today and have the public hearing the next day. But at this time, we focused our Clearinghouse update on what we're doing with the reestablishment of the Clearinghouse, what had happened in the early 2010s, up to the mid 2010s, and into the 20-teens, you would say. And everything was focused on what we were updating, Section 3.2 with regards to the delegation to the Regional Offices. It was a pretty focused presentation in that respect. There had not been at that time under my watch, there had only been three or four Clearinghouse concurrences with Regional Office approvals.

Well, then we jump forward to 12th Conference, and this is a couple of years after we had finalized the *Guideline* updates in 2017 and in 2018 because of the administration at the time and the leadership within the Agency, there was a lot of focus on leaning things. And those words are now so pre-pandemic. Haven't heard the word leaning in a long time, but we were looking at making things more efficient and using visual management and all the catch phrases at the time. We went through a pretty important process in 2018. We brought Regional Offices in, we brought in a few state and local agencies, and we really took apart the Clearinghouse, looked at the process, from kind of soup to nuts, or simply from beginning to end, to understand where our bottlenecks were. A lot of bottlenecks were actually outside of the formal Clearinghouse process. That makes me happy, but it doesn't make you guys happy. You still have a long process you were involved with. And so, we were trying to analyze what we needed to do. And a lot of it was on the front end. It was communications and working with the local, of working with the Regional Offices and the coordination with headquarters.

And so, I spent a lot of time talking about the leading process of the 12th Conference. Well, what's been lost a whole long way is there's been a lot of Clearinghouse actions. There's been a lot of formal concurrences with the Regional Offices. There have been 26 of them in the last, you know, what, five to six years. So, this conference, I wanted to take a time just to talk about all of the different concurrences that we've done. So, we'll start off and we'll try to do this in the order that they were occurring and time and place. So, if you put us in a time and place of this 2015 and 2016 timeframe, what were we doing? Again, we were updating Appendix W. We're going through and adding different options in AERMOD and also updating the regulatory language and the *Guideline*. And one of the things that we were focused on at the time was bringing in ARM2 method, this ambient ratio method, as the Tier 2 option for NO₂ processing. And so, as has been explained in this Alpha Beta paradigm, use the word paradigm, I'll use that as well. In this Alpha Beta paradigm, ARM2 had come into the Beta world, it was being proposed as an option with the 2015 updates. Well, a lot of people really liked ARM2, and I can understand why.

And so, at the time, they were anxious to use it, as will be the case with the current proposed options, we'll get to that in a minute. We had put all the supporting information of why it should be a regulatory option out in the public record. And so, at the time, in 2015 and 2016, a lot of applicants were like, "Hey, we want to use ARM2," and they went to the rule docket, they pulled the supporting language for ARM2, they wrote their justification, and it's kind of hard for us to

deny approval of a BETA option through the alternative model process. When you step through the formal section 3.2 process, it's kind of hard for us to deny something that we're proposing as a regulatory option. It kind of makes sense. So, we had four, essentially, back-to-back ARM2 concurrences in various Regional Offices. I won't take up your time to explain the number and scheme. I could ask to figure it out. So, Clint, you had a nice slide on this one. It's the year, two-digit year, because we're going to break it again when we get to the year 3,000. And the Regional Office in Roman numerals and then the number would be incremented it 1, 2, 3, 4 every year. So that's what that is all about. But we had four back-to-back ARM2 concurrences.

In that regard, and we'll talk about this in another slide, but also once one makes it across the finish line and is out in MCHISRS, it's out in the public forum, everybody else is free to go in and plagiarize all the foundational material that is in there. I mean, that's why we put that out there and try to be as transparent as we are.

A success story. We proposed the option. We were able to finalize it in 2017, well, late 2016, and then it was deferred to 2017. But now ARM2 is a Tier 2 option, and you don't need to get the alternate model process anymore to use it. So, there's a success story.

Adjust U Star (ADJU*). Same thing. This was essentially the same time frame. We had a situation where there was an issue with AERMOD's tendency to over-predict concentrations in low wind stable conditions. And ADJU* was one of many things that we were working on, but it was what we put forward as a proposed update to the model to help correct them, to help solve that issue.

So that was promulgated in 2017. It was proposed in 2015. It's out there as a Beta option. Same thing. It's attractive, right? You decrease a model that's over predicting and make it more appropriate for using in compliance demonstrations. And so here as well, we had four different concurrences that we did with various Regional Offices. Most of these are a little bit later in 2016 and pushing closer to 2017. But here again, another success story where we've got Beta options that are out there. They're being proposed, all the supporting information for those Beta options are in the public record, and it makes it a lot easier for applicants to form their justification for alternative model approval. They got it. Of course, now, ADJU* is in the model, and you don't have to go through the alternative model process anymore.

The caveat here, unlike in ARM2, with this, with ADJU*, I will mention there is a caveat that you can't use ADJU* if you've got the measured turbulence data/site specific turbulence data. It's one or the other. And that's something that we're still looking at long-term as other corrections. I think we'll get into that one this afternoon a little bit [unintelligible]

[laughter]

We still have LOWWIND 3 and 4, and I think that Roger had a LOWWIND 5. Those are still on the drawing board somewhere. They actually may not have been erased from the white board upstairs. There's still some stuff pre-pandemic.

So again, this is going to be a repeated thing. This one is going to be a little different than the circumstances with ADJU* and ARM2, but we went through a process with the update in 2015 and 2017, proposed 2015 and then finalized 2017, to bring the BLP model into AERMOD. I've talked about this before. It really was taking, there was a cell phone commercial, again, probably pre-pandemic where they duct tape two cell phones together to try to get all the options together. We essentially duct taped BLP into AERMOD, but the Buoyant Line Source was put into the AERMOD. There were some circumstances on or around the time that we promulgated the model in 2017 and then kind of translated on into 2018 for some of these approvals in 2019, for one of them, where people wanted to use aspects of the older BLP model for the buoyancy aspects and then integrate it with the rest of the dispersion in AERMOD. I'm not going into the details on these. There are certainly links here, and as Clint did, all these hyperlinks will work when you get back, so you don't have to suffer through MCHISRS. You can just click on these and get all the information.

But in each of these five different situations, all slightly a bit different how they went about, but they all similarly used the BLP model to enhance some of the plume rise with regards to facilities. I will not say that there is a long-term success story here. It's not like we've totally fixed that problem, but we are continuing to look at situations, I think you mentioned highly buoyant plume earlier, they're not exactly the same, but they're interrelated.

We have a couple of case-specific, I don't know what to call this slide, the hodgepodge slide. This is the catch-all, or the extras. These tend to fit into ADJU*, ARM2, and the Hybrid BLP. But we did have two different case-specific approvals. One was Randy Robinson's. I got Randy's name, [unintelligible]. I got Randy's name in the conference. It was Randy Robinson swansong. It was with the Rhinelander facility. And it was a stack-specific approach for applying downwash. And there was some wind tunnel work that went into that. Again, a link there for all the different details, I won't suffer you through them today.

And then the last is one that's more recent with Alcoa Massena up in New York. And it is a situation, it's a low-flat building. There's a fair amount of fugitive heat that's being released by the facility. And so, we worked with the state and worked with the Regional Office to get an approval with regards to the way the lapse rate was determined over the facility's the first 100 meters, and also using the BPIPPRIME program. I will note, I don't have it in the slide, but I will note that this facility has since decided, or there was an understanding that the fugitive emissions weren't exactly characterized as they wanted, and they might be looking at a slightly different control technology and stack configuration.

I mention this because I just want to make sure that the regulated community understands if you have an alternative model approval and then you change the foundational aspects of your facility, you do have to go back through the Clearinghouse process again. It's not like blanket approval that we just get in the forward. And so, in this case, some of the pieces changed. And initially, I guess Bob it was about a year ago, I thought it was going to be a pretty quick turnaround, but then some other issues popped up. And so, this is something that we continue to work with the Region and with the facility. I maybe heard this morning, but we're getting closer, so there might be a second approval for Alcoa Massena in the coming weeks. Again, shutdowns withstanding.

But where we've spent a whole lot of time, so this is kind of dominated my life and dominated many of the Regional Offices over the last couple of years has to do with permitting offshore sources of the outer continental shelf, whether it be oil platforms or, more importantly, the offshore wind farms. We've had 11 different concurrences that we've done with regards to over-water modeling. We've got one that's currently, I would say, in process, and then there's one that's been kind of hanging around, and I think it's going to come to fruition at some point. As I said, most of them are with the offshore wind. Obviously, that is an initiative of the current administration, and so that means that when things don't go right, we actually are talking with the White House. I didn't think I was going to be in a whole lot of conversations with the White House, but that's been something that's happened over the last six months. So, the red phone does ring when people aren't getting their permits.

[laughter]

That being said, we are trying to work with the facility. We are trying to work with Regional Offices to come up with amicable solutions. Unfortunately, the marine environment is pretty stable some of the times. And when you put 6,000, 7,000 tons of NO_x emissions from some of these ships, that's a tough assignment. But we're getting there. Overall, OCD, I mentioned there was three models earlier this morning. There was AERMOD, there was the CTDMPPLUS, and then there's OCD. OCD is the preferred model. I would tell you there's probably more four-letter words that we would use for OCD than the *Guideline*. It is way outdated. We understand that. And it doesn't do the calculations in the current form of the standards, it's a post-processing process. It has to use buoy data in a certain way. It's a clunker. It also has some issues because it's not taking advantage of the more sophisticated meteorology that AERMOD has.

And so clearly when you're already in a situation that is a stress test of compliance, that people are desiring to use AERMOD. And so that kind of brings us to this end of what Clint was talking about with the need for AERMOD to be able to do their underwater processing. And so there really has been a desire by the community to use AERMOD in this sense. And this is where COARE comes in. I am certainly not the expert in this Coupled Ocean Atmospheric Response Experiment algorithm. But it's something that I guess I would say I cut my teeth on. It was my first, very first Clearinghouse action that I was involved with when I took over as Model Clearinghouse Director. That was all the way back in 2011, that was in Region 10. This is a situation at BP and there was a case-specific approval in the Chukchi and Beaufort Seas.

At this time, it was just COARE, COARE was run off or, yeah, offline is the right way to say it. It was run outside the model. It was implemented in AERMOD and there was a fairly involved, I would say at the time, probably on the order of 18-month process that we went through with the Regional Office, at the time Herman Wong with the help of actually some other Regional Offices to look at different supporting documentation to understand that COARE was reasonable to be used. And so, that was used and then things kind of got quiet and things fast forwarded all the way up until it got to 2018, 2019. And it was an oil and gas situation down in the Gulf of Mexico. And in that particular case, the COARE algorithm at that point had been put into this AERCOARE pre-process program. And so, it made it a little bit nicer, a little bit easier to use. We still had the same circumstance that OCD is the preferred model, but you know, there haven't been any challenges to the, I said BP, I meant Shell, hadn't been many challenges to the Shell

situation back in 2011 other than the ship around the ground and then something happened to the second ship and really they never got out of the program what they wanted to get out of it. At least alternative-model-wise they got approved.

But the situation that happened down in Region 6, and I have to get a huge shout out to Ashley Mohr in Region 6, because this was, at the time, I think the record holder for the fastest Clearinghouse concurrence that we had done. We actually got the request in, and we concurred with it within 24 hours. I'm not touting any horns, just Ashley did a fair amount of the lift. This is one action post-leaning of the Clearinghouse. She followed that process. There was a lot of good communication, so the bureaucratic process took 48 hours, tops. So that was a success point. But nonetheless, it's a marker in the sand. So now AERCOARE was approved by the Regional Office, concurred by the Clearinghouse, and all that information was out in MCHISRS.

So, lo and behold, all of the lease blocks are opened up along the Eastern Seaboard, and the energy sector really wants to get to work on putting wind farms in. And so, I won't spend a lot of time reading all the bullets on this slide, and it just goes through the lineage of what happens with this first wind farm. So, oil platform in the Gulf, now we just got to transpose it to a wind farm off of the upper-mid-Atlantic. We did work with Region 1 and the contractor because we wanted a little more justification that the marine conditions, the meteorological conditions off of the Eastern Seaboard matched that of the evaluation studies that were done before that were done for COARE in the Gulf and then off the coast of California.

And so, this is one where there's due diligence that was put in to make sure the meteorological conditions were commiserate to what was done for the evaluation study, and we were able to pretty quickly concur with the Regional Office and they approved that, AERCOARE for the use in wind farms. And again, I talk about it's in MCHISRS. You can take that information. You can, I don't want to say plagiarize it. It's not plagiarization, it's just you can take that information and use it. Then all of a sudden, boom. 2019, 22, 23. I mean, there's a pandemic in there. We'll forget that little that little block, but there's a lot of them here. So, 10 of them happened after the circumstantial Spot. Nine of them happen after the situation with Park City. And those nine that happened after it, every one of those justifications, I didn't have to spend much time reading them because they all looked the same.

So, I would say it's probably a big surprise, it shouldn't be a big surprise, that we're looking at adding the COARE algorithm to AERMET, because we have this, and there's this huge basis now that we have. It's used in permit applications throughout the Atlantic Seaboard and the Gulf of Mexico. There's some there, there, and none of these on these merits have been challenged by the external community. This is why our Alpha Beta, use of BETA in these certain circumstances, can be very helpful. I put that, well there's no AERCOARE Beta? There's a COARE Beta now, and that's what I want to get at. Moving forward, now that we've got 23132 version of AERMOD out there, and I'm saying this, you know, this is, you know, 120-ish people in this room, but the word will get out. For the next few applications that are working with the Regional Offices and wind farms or oil platforms, what have you, I really would strongly encourage the applicants to consider using the Beta version of COARE in AERMET in the 23132 version versus doing the AERCOARE route. It's the same algorithm. It should give the

same results. The justification package should look almost identical to what all of these other 11 applications, and it gives some weight to what we proposed.

So, is that a shameless plug? Yes, it's a shameless plug. But at the same time, I think this goes into, back to what I was talking about with ADJU* and ARM2, that we have these situations where we post things as Beta, please use them. Bring them back to us as alternative models. Use our words, won't say against us, with us. Use our justifications for their promulgation as your basis for being an alternative model. And in most cases, unless you're doing something really wonky, again, that's a technical term, wonky --

[laughter]

-- that we'll probably be nodding our head yes at you. I do have to, just like I did with ADJU* and the use of site-specific turbulence data, I do have to put the plugin with the COARE algorithm and with whether you're using AERCOARE or using the Beta version in AERMET. We still do have to take into consideration platform downwash. We still do have to take into consideration shoreline fumigation. For the most part, applicants have been able to fairly successfully justify the use of PRIME downwash and treating whatever structure as a solid structure. It's conservative over one that would have porous and wind moving under it. Typically, you would get higher concentrations, which were the PRIME2, or the PRIME algorithm, than you would using the platform downwash. That one's fairly easily to me, from my perspective, to justify.

Shoreline fumigation is just something you have to consider. How far are you from shore? What are the other nuances? So, you work with the Regional Office so that you can justify that both of these aren't issues. And then the Beta COARE in AERMET should be an option for you, again following Section 3.2's regulations. If platform downwash or shoreline fumigation are issues, we cannot circumvent the fact that OCD is still the preferred model. So, until we've finished model development, which we'll talk about more in this afternoon, those two areas, until we've finished that and promulgate or propose AERMOD to fully replace OCD, OCD is still the preferred model.

I mentioned the leaning. This is my next to last slide. I will not bore you guys any longer, I know that there's the break that's coming up, but I did want to mention, I did mention earlier the leaning process. This is the longer slide of what we did. Again, the main goal of leaning the Clearinghouse was trying to figure out where our bottlenecks were. There are several Clearinghouse concurrences that I've been involved with that were multi-year efforts. We don't want them to be multi-year efforts. They shouldn't be multi-year efforts. Six months, yeah. Yeah, I can see, especially if it's something new that no one else has done, that there is going to be some extra due diligence that you're going to have to put into it. If it's something like the AERCOARE or previously ADJU* or ARM2, work that has been done over and over again. And it's sort of old hat replicating others have done. That one's going to be easy. Like it might be a two or three months process. There is a bureaucratic process and so it's going to take a little while. I would say on the Regional Office and headquarters, a month is going to absolutely be involved in them writing memos, us review it, and us writing memos back. Hopefully, most permit timelines can suffer a month or two.

18 months to two years, I won't say it's unacceptable, but there needs to be other good reasons why it is taking that long. A lot of those, when we go back and looked at them, it was because the project kept changing scope. There would be a round of, "Well, we like this alternative approach," and it didn't quite meet muster. Well, then they had to go back to the drawing board, and so the next time they came to us, it was really a new alternative model. I'm not trying to justify it taking that long, but that was what the reason was. It wasn't the same alternative model. There may have been 10 different variations before we got the solution that works. I still call that a success-story at the end of the day, because we finally found a solution that worked in a complex situation. It's where everything else was breaking down and we finally got it across the finish line.

So anyway, if I had one thing out of the lean that I would say that I would stress to the room today, we talked about this back in the 12th Conference, is the "Big Call." And I was honestly sitting around, "What do you call this thing? Oh, a lot of people on a call, a Big Call." And we just came up with a, got a name for it. But, but that really is communications are the key and the Big Call has to happen early. So, if you are in the external community and [inaudible] where you have problems demonstrating compliance. I know you're probably not going to share that with everybody, but if you are having challenges and you're considering the alternative model pathway, absolutely don't just talk to the state. Tell the state, "We need to elevate this." Get the Region and the Region will get Headquarters on. Let's all have an open conversation on the front end because it's a lot easier, I'll probably regret my words here, to shoot something down in the very beginning. And I think it's fair to all of the applicants in the room. If it's just not going to float, if it's not going to work, you'd rather know that square one than after you've invested six months in it and then it comes up to Headquarters and we look at it and think that's not an option.

And so, it's a lot easier for you guys to work with information on the front end. That's what we're trying to get at. We may not, Headquarters might not be involved in that Clearinghouse process, in the alternative model process, I should say, much after the Big Call until we get back into the formal memos and everything. But at least we're aware and we're coordinating with the Region and then it's really helpful that we work with the applicant. So, I wanted to say one thing there, and that's just you got to keep this Big Call mentality at all times.

That being said, I think my last slide here was just to make sure that people could get to MCHISRS. I'm not going to apologize for MCHISRS. It works. I would say it works slightly better than the Fortran code that they write our models in, but it's outdated and something that hopefully in the next 5 or 10 years will find a different system than Cold Fusion, but that's the technology it has. So, with that, I think that was my last slide. With time, looks like we're just a few minutes from 10:00. So, let's take a quick break, and I say quick break, for a hundred and some people, 20 minutes is about what it is going to take. So, it's 10, let's just call it 10:05 right now. Let's meet back at 10:25. So, I will close the meeting for the next 20 minutes.

[CONFERENCE MORNING BREAK]

George Bridgers:

So, thank you for everyone assembling, I will [inaudible] the public hearing here. The first talk in the second session of the morning. Much like we did with the Clearinghouse, where we gave an update, kind of bookended what we had been doing with the Clearinghouse to make sure we got caught up, we thought it was important to bring a presentation to everyone on the Guidance for Ozone and Fine Particulate Matter Permit Modeling. I know that this was finalized last year, but I look back at the record for the 11th and 12th Conference, there were placeholders that were in the docket and said we're going to do this or we're going to do that, and we were in various forms of producing drafts of this guidance document. But, we didn't have a clear closure, at least in the record that we finalized this guidance. So, give me the next 10 minutes to go through this, because we just want to make sure that this was in the record for everyone, but this is things that people have seen because we finalized this guidance last July. And then did a webinar in the first part of August that probably everybody in the room sat through.

I will not go through all the laborious slides that we had there, but we will kind of hit the Cliff Notes here. So, what we have done in the last year, we've finalized this guidance for the modeling, the permit modeling for ozone and matter permit modeling, PM_{2.5}. It is our recommendations for how stationary sources that are seeking a PSD permit should demonstrate and, should, this is best practices, not a requirement, but a recommendation should demonstrate compliance with the NAAQS. That specifically the ozone and PM_{2.5} NAAQS. Everything that we put into the final guidance is, like we do with most of our guidance, is based on a lot of feedback that we got and also with the approach of the administration at the time that we had for finalizing the guidance.

So, the very, very brief historical context, and if you really want to know all the details here, absolutely go to the webinar slides. There is a step by step, and I said laborious, it is kind of a laborious, it takes you through the whole lineage, from where this started back in 2010 to where we finalized it in the 2022 context. That's 12 years. That's a pretty long time. But it all started with this Sierra Club petition grant in 2010, where we were challenged to, with reasonable particularity, define regulatory models and processes for analyzing ozone and PM_{2.5}. That was a large part of why we updated the *Guideline on Air Quality Models* in 2017. But the thing that we didn't have to go along with it was the guidance on how one should go about doing the compliance demonstration modeling. And so, I would be amiss. Chris Misenis is sitting on the front row and deals with MMIF work and also deals with meteorological data, but he also worked some with Kirk Baker on MERPS, the Modeled Emissions Rates for Precursors. It is an important compendium piece, or an important secondary piece that goes along with the Ozone and PM_{2.5} Permit Modeling Guidance, that hopefully is helping the stakeholder community and the external community with demonstrating compliance for the secondarily formed pollutants.

The big shift, and this is what was taking the largest amount of time, in the 2016-17 timeframe, was the approach that we had taken. The original guidance for PM_{2.5} Permit Modeling back in the 2012, 2013, 2014 is when we finalized it. We had an approach that was an Applicability Approach for the precursors. So, with Ozone, you only have precursors. We don't worry about direct Ozone. With PM_{2.5}, you've got the direct component of PM, and then you've got the two precursors with SO₂ and NO_x. And so, with the precursors, the Applicability Approach is back with that guidance, and then the first draft, not the second draft, but the first draft, of the Ozone and PM_{2.5} Permit Modeling Guidance. If you were applicable, you only assessed the component,

direct or precursor, that was over the significance level, over the SIL. And so, you may do an PM_{2.5} air quality analysis that only looked at SO₂. That changed with time. Again, there's administration aspects, there's feedback aspects, there's understanding of what we need to do to comply, and by talking with our lawyers.

But it was understood that what we should be doing is a Holistic Approach. And so, that was the big shift between the first and second draft. That's why we even did a second draft because there was a change that we felt that we needed to take back out for comment, informal, but we took it back out for comment before we finalized it. With the holistic approach, and I know it's widely popular right now, y'all don't need to laugh right now, but I know it's popular in the stakeholder community, sarcasm added, that if you are significant for any precursor or component piece of a pollutant, you need to assess the full pollutant. Because the way Clean Air Act is written is that you need to demonstrate that you will not cause or contribute to a violation of PM_{2.5} or of ozone. Not ammonium sulfate. Not ammonium nitrate. Not the NO_x amount of ozone, but for ozone. So that was an administrative and legal decision that we made. And so that's what when into the final is a Holistic Approach. And so it does mean, and I'll say this on the record, just so that it's transparent that I understand what it means and that even the Agency understands what it means, is if you can have forty-one tons of SO₂ and five tons of NO_x and one ton of PM_{2.5}, and you are going to be doing an AERMOD run for one ton of PM. I fully understand what it means, but we feel from a legal perspective, that is what has to happen. You are significant, but one of the precursors or component species of the pollutant, and you need to assess the pollutant fully.

So, if there's one takeaway that I wanted to kind of bookend and put in the record is just making sure that this was understood that we made this shift. Again, I was doing this as a sort of a bookend, not as a deep dive. Again, there's the webinar that you can go back and look at from last year, but I want to clearly say this is only guidance. This doesn't mean that you get to ignore it. We certainly put guidance out. It's our best practices, it's our recommendations. But I also want to point out that this, everything that's in the Ozone and PM_{2.5} Permit Modeling Guidance, it cites things that are in regulations, it puts forth what we think are the best practices, but at the same time, it doesn't, it does not institute a new requirement under the NAAQS. And so, I'm saying that not to say you get a get out of jail free card, but there are other ways that people could go about it. Well, there is photochemical modeling. I'm not suggesting that people should do photochemical modeling for all permits, but there are other avenues that one may take to demonstrate compliance with the NAAQS without having to do individual species the way we prescribe within that guidance.

And again, the MERPs guidance is out there, the Modeled Emission Rate for Precursors. And from everything that we can tell, that using the MERPs View tool that's on SCRAM to download the information from all the hypothetical sources that Kirk Baker has pulled together, and from the permits that we've seen is that MERPs is working well in most cases. There are a few isolated situations where some additional modeling may be warranted, and again, I don't want to go too far down a rabbit hole with photochemical modeling and permitting. But in most cases, those approaches have worked without a significant additional resource burden on the consultant world. It is our final guidance, for now. When I say final, and I'll say this every time I get up, whether it's a RSL or a confidence, our final guidance is as good as whatever year you're in. If we need to go back and review a guidance, update it, we'll do that.

To that end, if there's feedback on this guidance, or any other guidance document that we have, please send comments along. You don't have to wait for an informal or formal comment period. If you're having challenges, let us know. Because the only way that we're going to actually consider ever making updates is if we know there are problems with these documents. I want to make sure it's absolutely clear that what we released in 2022, it replaces a bunch of other things. So, anything that came before, the two drafts for the Ozone and PM_{2.5} Permit Modeling Guidance and the 2014 PM_{2.5} Modeling Guidance. If you find them on our website, it's because we're leaving them there for reference. But, they should not be followed. You should be following the July 29th one.

Moving forward, as I mentioned, we will continue to consider updates as we move forward. The MERPs came out about the same time as we released this guidance. I mean, that was just ahead of it because it's a tool that we thought was needed. We have taken feedback and there's been additional hypothetical sources that have been put into that database, based on feedback, like for parts of the country that we felt were unrepresented. Just recently, in this last year, our group went through and did some modeling for hypothetical sources offshore on the mid-Atlantic, because it's understood that the hypothetical sources on land weren't representative of overwater situations. And so, we did that to help the wind energy. And at this time, we're considering doing a few hypothetical sources in the Gulf of Mexico, because the air chemistry off the mid-Atlantic is different than the air chemistry in the Gulf. And so, we want to put those out there to help the community.

But that being said, if there are other strategies that states are using, we're always all ears. It doesn't mean that we're going to change things overnight, but it's something that we will take into consideration for future times. And with that, the other part that I will put forward, and this goes back to my Clearinghouse conversation and the Big Call mentality. If you're having challenges, and I know that there's going to be some eyerolls because consultants will be the last to bring forward when they're having some types of challenges to permit authority. But if you're having challenges and you're stuck, even if you have to hypotheticalize, if that's a word, if you have to randomize your source so you're not identifying things, bring the issue to the Region, bring the issue to Headquarters so that we can start working on it. Because sometimes it's just, there's, what Tyler said, the devils are in the details. As we peel back those layers of the onion, another saying of Tyler, maybe we can uncover some things that haven't been considered and help things move forward faster versus getting stuck with an, "Oh my God, we're going to have to do photochemical modeling, or we're just not going to be able to do this permit."

So, on this, with regards to the guidance, I'm the point of contact, not just because I'm standing up in front of you, but honestly, I am the point of contact. I really do love the feedback. Again, it doesn't have to be here. So, with that, that should bookend the Ozone and Particulate Matter Guidance. I hope I'm not talking to you about it at the 14th Conference. For the record, I'm not going to go through it, I put in the slides that will be available in the docket and online, some extra slides that were from that webinar presentation, and that's just so if anybody wanted to review and comment in the docket on this guidance document, there's a table three-one and three-two that give the assessment cases for both ozone and PM_{2.5}. They're pretty simple. There's a case one where you don't do anything. There's a case two where you do everything, but there

are some more details in there with the approach you can use either MERPs or full photochemical modeling.

And then there's some slides that go through how you would use the MERPs. Again, I did not take the time in the conference to go through and talk about how MERPs are applied, and then pulled into both the single source and the cumulative impact analyses. But they will be in there for people to review in the docket and on SCRAM.

With that, I think it's James, next up. If there's other questions again, and Chet kind of mentioned this, maybe he didn't hear my part about not doing questions during the conference. But if there are questions about the guidance, the Clearinghouse, and any other presentations, at least for today, come find us at the break, come find us at lunch. We'll engage on it. We just didn't want to do it in the open forum like this, just because it might cause issues with the rulemaking. Thanks.

James Thurman:

I'm James Thurman in the Air Quality Modeling Group at EPA. I'm going to shift gears a little bit. We've been talking about model development, model updates, guidance. This is a practical application of AERMOD. This is the CMAQ AERMOD hybrid modeling that we did for our AirToxScreen Toxics Assessment. It used to be called National AirTox Assessment, now it's AirToxScreen. Many people involved, several divisions in OAQPS. Just to go over the team in the air quality assessment division, these are the members. Our emissions group, our analysis group, monitoring group, modeling group, and the health division, HEID, they're our members, then we have communications, we have OTAQ to bring in the mobile component, and SPPD, which bring in, you know, the team leads for AirToxScreen are Caroline Farkas and Matt Woody. So, we have a look into the two main users of AirToxScreen.

So, what is AirToxScreen? If you haven't heard of it, it's a routine national screening level assessment of air toxics that includes model concentrations and then cancer risks are calculated from this concentration as well as non-cancer hazard indices for over 180 air toxics and diesel. We cover the contiguous U.S., Alaska, Hawaii, Puerto Rico, and the U.S. Virgin Islands. It began with the 1996 NEI. Actually, as a contractor, I was involved near the tail end of the 1996 NATA. and was involved in '99 and other years. Like I said, prior to 2017, this was called the National Air Toxics Assessment. It was done every three years and we try doing years. Beginning with 2017, we decided to be gluttons for punishment and do it every year and rename AirToxScreen. So, we did 2017, 2018, and 2019 within a year of each other to get them out. 2019 is the latest publicly available assessment. The 2020 is underway and will be released soon. But this presentation will focus on 2018 results.

So, the air quality characterization for AirToxScreen comes from a multi-pollutant platform. It's based on two air quality models. Community Scale Air Quality Model, or CMAQ, that's our photochemical model for this, and then the dispersion model comes from AERMOD, which everybody knows is the EPA's preferred near-field dispersion model. Both models use the same emissions and meteorological data from the WRF model, so we try to keep that the same, and then results from both models are combined with a hybrid approach to provide spatially representative average concentrations for each HAP, or hazardous air pollutant. This hybrid approach was first applied in 2011 NATA for continuous U.S. and then beginning with the 2018

aircraft screening was applied for Alaska, Hawaii, Puerto Rico, and Virgin Islands. So, the emissions and the models in the hybrid approach comprise the multi-pollutant plan.

So how does the framework, we have the emissions -- oops. Okay, so this is the multi-pollutant platform. If you can see, biogenics and fire emissions are fed into CMAQ, and then point sources, non-point sources, and mobile sources are fed into both CMAQ and AERMOD, WRF is fed into both models, and then concentrations from both models go into this hybrid block, and then we calculate concentrations here. Then AQAD hands off the concentrations to HEID to do the risk calculations, and then completes the puzzle. So, the CMAQ modeling for 2018 is version 5.3.1 CMAQ, 50-plus HAPs based on NEI. Again, four domains, all 50 states, and the CONUS at 12-kilometer resolution. Alaska is running at 9-kilometer resolution, and Hawaii and Puerto Rico are running at 3-kilometer resolutions. There are three CMAQ runs per domain. We have a base case where it's all the emissions, which are anthropogenic, the fires, both prescribed and wild, and then biogenics. Then we have a no-fire run, where it's only anthropogenic and biogenics, and then a no-biogenics run, which are the anthropogenic emissions and fires. We need these no-fire runs and no-biogenics runs for that hybrid so we can calculate primary fire and primary biogenics concentrations in the hybrid.

So here are the domains in the U.S. This is our normal 12-kilometer domain of the U.S. Here's Puerto Rico and Virgin Islands will be here. Alaska and then Hawaii. You know, Alaskan and CONUS take the longest to run because Alaska is so big, the other two 'run fairly quickly. So, the AERMOD modeling which I'm responsible for, the model 185 HAPs plus diesel PM. Again, all 50 states plus two territories. We have various receptor types which I'll get into. It can do source attribution that, you know, the AERMOD and the source groups, but we actually do that in post-processing. And it uses the WRF data for meteorology and the WRF resolution matches the CMAQ resolution in the domain. So, in the CONUS domain, the air model is based on 12 kilometers of WRF and then 9-kilometer in Alaska and then 3-kilometers in the others. And with the WRF data processed through MMIF, each source can have its own unique meteorology where it's the meteorology of the grid cells it's located in.

So, for AirToxScreen sources and receptors, we model a variety of source types and receptors within AERMOD. For sources, we model gridded sources, which are our non-point and mobile sources allocated to basically an area source that matches the CMAQ grid cell. So, in the U.S., it's 12-kilometer or 4-kilometer, depending on the source type. We also model point sources, airports, and ports. Of course, the receptors are the 2010 census blocks centroids, monitor locations for model evaluation later and then a network of gridded receptors that we use for the hybrid and the interpolation. The gridded receptor resolution is based on urban population in the U.S. For core-based statistical areas greater than one million people, it's one kilometer resolution, so you have 144 gridded receptors inside a CMAQ grid cell and 4 km elsewhere in the U.S., the rural areas. In Alaska, it's uniform at 3 km spacing and then 1 km in Hawaii and Puerto Rico and Virgin Islands.

So AERMOD is run with a unit emission rate, 10,000 tons per year, but in HAP specific concentrations like for benzene or formaldehyde are calculated during post-processing for block centroid receptors, monitor, and grid receptors. And then all these concentrations feed into the hybrid equation with the CMAQ total concentration. And then the ultimate output for

AirToxScreen are, they have specific concentrations at the census block centroids. So final output to the public is to tract average risk and then non-cancer hazards and then tract average concentrations. So, we go from census block and aggregate up to the census tract. So, what the hybrid approach does is combine the photochemistry, long-range transport, fires, and biogenics from CMAQ with near-field concentration gradients of AERMOD. AERMOD is then limiting the AERMOD results to 50 kilometers from source. The CMAQ zero out runs are used to calculate the fires, the primary concentration in biogenics. And then we have concentrations for each run group that I'll show in a second. Secondary contributions from like Formaldehyde, Acetone, and Acrolein, and then we have primary fires and primary biogenics.

So, here are the source groups that we have from AirToxScreen. Each one of these big blocks represents an AERMOD run group with the exception of CMAQ only. So, we'll do an AERMOD run for on-road and, actually it's two sets for on-road, 4 kilometer and then a 12 kilometer. WE have point, non-road is broken up into several air mod runs, and then non-point are broken up into two sets of AERMOD runs. We end up with roughly half a million AERMOD runs for each iteration of AirToxScreen, and we get those runs done within two months, depending on CPU availability across the street at the National Computing Center. So, I'm usually busy from May to August doing AERMOD runs every year. It's nice to apply the model once in a while just besides coding.

So why would you use a hybrid approach? We can use AERMOD and capture gradients and source attribution within the photochemical grid model framework, CMAQ is going to give you a number for that grid cell. The AERMOD can give you the texture within the grid cell. We have the high-risk HAPs with large secondary biogenics components such as formaldehyde and niacin aldehyde. We also have high-risk pollutants emitted by fires, and that approach counts for the variability in fires. So, we don't model all HAPs in CMAQ, but just the risk drivers. And it also allows for consistent treatment of criteria pollutants like ozone, PM, SO₂, and lead, which is actually kept in and out, in the HAPs and multi-pollutant analysis, so it's all one run. They're all treated the same. This hybrid approach was first demonstrated by a Detroit multi-pollutant study back in the early 2000s while still a contractor and has been applied at the national level since 2011, native.

So, here's the actual equation. Basically, you are relating, taking the ratio of the CMAQ primary concentration in the grid cell, divided up by the AERMOD average in the grid cell, and then that ratio is applied to each AERMOD receptor's concentration in the grid cell. Then you add in the fire, biogenesis, secondary. I like to think of the equation, move the AERMOD average under the AERMOD receptor, give you more of the texture and think of CMAQ as the basis of the concentration. So, here's an example for formaldehyde. We'll look at an area in Colorado, a little hot spot, and then here's the CMAQ grid cell. We'll take a look at these individual circles are individual AERMOD receptors. They can be census blocks centroids, monitors, or the gridded receptors. I think this one had one, had nine receptors, so it's four-kilometer resolution. These are the AERMOD concentrations inside the CMAQ cell, so concentrations range from around seven micrograms to around 16 micrograms.

So then what we do is we break this 12 kilometer grid cell into nine little mini grid cells at four kilometer resolution each. And then inside each one of these grid cells, like for this one, we

average these AERMOD concentrations in this grid cell, little mini grid cell, and that's an average of 13.6. We do that for each one of these. And then we average these numbers to get the AERMOD average of 13.27. We do the averaging of an average to kind of – so you don't have hotspots really. If you had a receptor right beside a facility that was a hotspot, you don't want that driving the whole average for the grid. So, you want that AERMOD average to kind of be on level with the CMAQ average. So, the AERMOD average here is 13.27, and it's being driven by mainly this one, these right here. So then here are the hybrid concentrations. So, if you were -- the CMAQ primary concentration was 8.43. We had a fire concentration of 0.22, biogenics of 0.1. The secondary is 0.64. The ratio of CMAQ to AERMOD was 0.6. So, these are the total hybrid concentrations. So, your AERMOD went from seven, a range of 7 to 16 now goes to high risk of a range of 4 from 7 to 10, and the hotspots are up here. So, then these concentrations are used to calculate the risk ultimately for the tracts.

So, we do model evaluation for each iteration of AirToxScreen. Sharon Phillips in the modeling group, she manages the CMAQ runs. She does this evaluation. These are some selective HAPs. We do the observations, concentration distributions, and then CMAQ only across all those monitors in the CONUS domain, then the AERMOD only, and then the hybrid. And then here's a comparison of that. So, we're getting underprediction from all three types of runs, CMAQ only, AERMOD, and hybrid for benzene. And then for lead, we're underpredicting as well. And then for nickel, we're actually, you know, doing fairly well. It's crossing this bias of zero difference of zero. So, again, it's not perfect, but the hybrid seems to be working okay.

So, what's the future for AirToxScreen? We're working on 2020 now. We've shifted to the 2020 census. And with that, we are, 2020 will be the first AirToxScreen results reported at the census block level. We've made updates to the modeling, however, to facilitate that approach. Instead of using the census block centroid in each census block, we have put in a network of gridded receptors within each census block. And the resolution of that gridded network is adapted based on the size of the grid census block. In urban areas, we may have one receptor inside the census block, but in the large rural blocks in Alaska, that's the 10 kilometers spacing. So, what will happen is we'll have a true average for a census block it won't just be one point it will be an average of concentrations but then with that network, we have to make sure we're not putting receptors on facilities. So right now, I'm going facility by facility for high risk and mapping out where the property lines and all that are to try to make sure we're not including non-ambient or non-represented concentrations in a block average.

So be on the lookout for those results for 2020 and the next few months. And 2021 will be coming soon and we'll be doing this every year. So, every summer, I will be doing AERMOD runs, half a million AERMOD runs every month. So don't complain about AERMOD being slow. We've got it. We've got it dialed in. And actually, AirToxScreen provided the impetus to do some updates to AERMOD. The command line option was brought in to AERMOD because of AirToxScreen. One of the reasons for the AERMOD overhaul is AirToxScreen, so we can put AERMOD faster over on the NCC on our Linux cluster. The old AERMET was not conducive to having several hundred AERMET runs going at one time because it's got, there's temporary files, but now with the new AERMET we can do that. So, what you can take days to 50,000 AERMET runs for the CONUS domain now can be done in a couple of hours. And here's the website for

AirToxScreen documentation. There's a visualization tool you can get to from there that shows emission versus concentration. So very useful, so check this link out.

George Bridgers:

Thank you, James. And after his success with overhauling AERMET, James has said multiple times that he would love to get his hands on overhauling AERMOD.

[laughter]

So, for our last talk before our lunch break, we wanted to come back and kind of frame things. We talked a lot about this morning sorta tidying up pieces from previous conferences and make sure we set the groundwork. But now we're going to start the forward-looking part, so this will be framing us for the afternoon where we'll be talking about a lot of the areas that are doing ongoing model development and then we'll have some research presentations. So, Clint.

Clint Tillerson:

Okay, yeah, and when we talk about forward-looking, we're not talking about hopefully years and years and years. The next release and what's going to happen shortly after that. So, imagine you're in your car with someone on vacation with the kids, and they keep asking, are we there yet? Are we there yet? And you say, we're never going to get there. Hopefully, that's what it feels like sometimes, like there is no there. We just continue going along and going along, going along. And so, pardon me, I wanted to use this a little bit to just remind folks that model development is a continuum. And I looked up a definition, just typed in "continuum meaning," and this is the first thing that popped up from vocabulary.com. And it says a continuum is something that keeps going on, changing slowly over time, like a continuum of the four seasons.

So, it really is a continuum. There's always stuff going on. We get to a release, but while that release is going on, there's all of this stuff happening in the background that has nothing to do with that release. It might have to do with releases two or three years down the road. We heard this morning that we do have interim releases, not just when we update the *Guideline*. Usually, those releases come every year. It hasn't been quite every year, but for the most part, every year. So just to give you an idea of the breadth of the work that has been going on and is going on and will continue to be going on after this regulatory update is complete, I wanted to just kind of walk down memory lane for some of you and just look at the different things, this is since the release of, since our last regulatory update. So, version 18181. This is when we first put the alpha beta paradigm for work. We had BETA options in there. It was kind of loose in terms of what a BETA option was. Now we have some more formal definition around what a BETA option is, what an ALPHA option is, and it put in low-wind, user defined parameters as ALPHA options. We had minimum wind speed, minimum sigma-v, maximum meander factor. They're still there. We've done some evaluation with them. You'll see in a minute there are even more in there now, and we're trying to figure out what to do about them.

Version 19191, we put in a number of building downwash options as ALPHA options, three developed by our ORD, three developed by the Air & Waste Management Association. They were all pulled into the code. They're there. You'll see in a minute that there have been a number of more options added. RLINE Mobile, that was put in, not for mobile, the RLINE Mobile

source site was put in as a BETA option. This is from the RLINE, the research line model developed by ORD. RLINEXT was put in as an ALPHA option. That's an extension of the RLINE source type. It's still an ALPHA option. There is a barrier and depressed roadway options that are ALPHA options that you can run with RLINEXT. They're still there. We're still working on them.

21112. So, the following in line with RLINE, there's now a one barrier algorithm, a two barrier algorithm. There is additional downwash options that were put in, two from A&WMA, additional low wind speed options, minimum sigma-w and what's called big T. I just put timescale here, the user can define what those are. The model, of course, has defaults. These are ALPHA options. You can play around with them, see how it changes your results. We also put in the Generic Reaction Set Method, which you'll hear more from Matt tomorrow. That was put in as an ALPHA option. It's now been updated to a BETA option, and we're proposing it as a regulatory option. Travel Time Reaction Method, TTRM. This is another NO_x-to-NO₂ conversion option. There is a standalone, which is TTRM. There's a TTRM2, which is integrated. We'll see in a minute on another slide. It's integrated into some of the NO_x-to-NO₂ conversion options. We also released at that same time this draft version of AERMET, where James had overhauled all of the code that he talked about. It reduced the run stages from three to two. It had the capability to read an additional upper-air data format, the Integrated Global Radiosonde Archive. He put in the PROG pathway for prognostic data with new parameters for overwater prognostic data. That was a draft version that was put out there for informal public comment, so it sat out there, I guess, for about a year.

When we released 22112, that's when AERMET, we replaced the legacy code with the overhaul that James did as version 22112. GRSM was upgraded into beta. We added the TTRM that I talked about that integrates TTRM with ARM2, OLM, PVMRM. If you don't know what those are, I'm just going to tell you, like we told you, just look them up, because I would probably get a tongue-tied. Platform downwash. We'll talk more about this later, but we integrated the platform downwash algorithm from OCD into AERMOD as an ALPHA option. We added this sidewash point, SWPOINT source. There is a behavior with AERMOD, with downwash, where if you have the wind angled to an elongated building, if you have what's been now coined, I guess, sidewash, where the cavity on the downwind side of the building has shifted. The model right now just has the cavity going down with the wind, and it actually gets shifted. This is to facilitate further research. It's very premature right now, but it's an ALPHA option. You can go in; you can play with it. Additional low wind options, minimum meander factor, the momentum energy balance. We have the maximum meander factor, we added the minimum, and now there is this alternative way to calculate the energy balance called PBAL.

23132, you've heard that from me already. We added terrain to RLINE, area meander, and aircraft plume rise. RLINE proposed as a BETA option. GRSM proposed as a BETA or proposed as a formulation update. And COARE added to AERMET, proposed as a regulatory formulation update. Those are all three data, just to make that clear. So, they are data in this version of the model. I did not stress again, as George had mentioned in my last presentation, that even though we're in the rule making process right now, again, as George said, version 23132 is the regulatory version. But these pieces that we are proposing as regulatory updates to the model are there, and so to use them would require an alternative model.

So, looking ahead, so these are the things that we hope to focus on really in the short term, but we know the short term is probably over the next few years. Overwater modeling, as you've heard already several times today, that has come into view. There have been all of these requests for alternative models for the AERCOARE. We've got COARE now in AERMET, proposing it as a regulatory update. We're working with BOEM. We have an interagency agreement with BOEM. I'll give a separate short little presentation just about what we're doing with BOEM. But basically, we've had, we just finished up one interagency agreement. We've just started a new interagency agreement. We put the platform downwash in as an ALPHA option. That research continues under the new agreement, and the bulk of that work, though, over the next three years to next year will be to figure out and implement a shoreline fumigation algorithm into AERMOD. And this will give us the ability to replace OCD with AERMOD. So that is the hope, to take OCD off the table as a preferred model, probably not our next regulatory update, but possibly our next regulatory update. It would be nice if it is.

Mobile source modeling, as we've said, a lot of work has been going on with the RLINE. We also have an interagency agreement with Federal Highway Administration. We just finished one. We started the new one. James is actually going to give a presentation on that this afternoon as well. The focus on that is vehicle-induced turbulence, specialized roadway configurations, and then possibly, I think it's been written into it, but I think there's some question about whether it'll actually take place, a scoping task for a future field study. We're also collaborating with the Office of Transportation and Air Quality within EPA. We talked about roadside barriers in the model as an ALPHA option. There's quite a bit of work to be done on the barrier algorithms. There's the issue that right now in the model, when you put a barrier in, you might have a road link, you know, this road is continuous, but you put in separate links to match the curvature of the road, and each link, if you have a barrier there that follows along the road, each link has an end-to-end barrier, so the barrier is not seen as continuous. The barrier is really continuous, so how do you treat continuous barrier when you have what are considered individual sources in the AERMOD? Barrier edge affects - what actually happens at the influence of the barrier, and then vegetative barriers. We don't have any sort of algorithm in there right now for vegetative barriers, but that is something that is important to act with them to continue that development.

The BUOYLINE source, you heard George talk about BLP and the hybrid alternative model that has been requested a couple of times. Back in version 15181, we ported the Buoyant Line source from BLP into AERMOD, and it was pretty much as is, and that's pretty much the way it has stayed. We made some improvements to it, but it was really developed for aluminum reduction plants, I think, when it was put in in that version 15181 really, nobody really knew that it was probably going to get as much use as it has. So, there's been a lot more focus on it because of that. Again, I said it has the original behavior as it did in BLP. So, it's somewhat isolated from AERMOD, with the exception of it takes the meteorology, it has some different stability model, so it has to do this conversion. I put the reference there for how that conversion is done to get from Monin-Obukhov length and surface roughness to a PG class.

And then beyond that, it does what it did in BLP for dispersion. And then it takes the basically the output concentrations and it uses AERMOD to do all of the averaging the way any of other sources do. It was originally put in, like BLP, there was a single buoyant line source. This is

confusing because a single buoyant line source could be made up of multiple lines, but they were assumed to be parallel. And so, you could have one source that was three or four or however many parallel lines, you know, the way you think of these reduction plants configured, the way they're set up, laid out. But you had to put in average parameters or average values for those parameters, like the building length, width, height, the line source width, and then the separation between the buildings, and then buoyancy. And it's also, I was trying to pull the graphic here out of the user's guide for BLP, showing the terrain, it's terrain following, which is different from AERMOD, with a correction.

So, looking ahead, this has become an area of focus because its use over the last several years, particularly with the SO₂ Data Requirements Rule and the designations and implementation and all of the work that has gone in with that. So, we did, in version 21112, extend it to have multiple "sources." And again, I put sources in quotes because the source can be made up of multiple lines in a parameter. Now you can have a group of parallel lines and then another group of parallel lines that are oriented differently. So, you can have multiple sources. So, it makes it a little bit more flexible. We added the urban option to the BUOYLINE source, and then we added capability for flagpole receptors. So, it makes it more along the line of other source types. But not quite like other source types, because it's still isolated from most of the AERMOD code. And so currently and into the future, we want to devote some time this year going forward doing that sensitivity analysis on the buoyancy parameter. This is something that Matt Porter has been digging into a little bit, and some work has started to look at the BUOYLINE source and what do we need to do to make it more like other AERMOD sources to take advantage of the science in AERMOD rather than the old science from the BLP model.

Building downwash, as I went through, you saw all the options that had been added incrementally as building downwash options to modify the PRIME algorithm that AERMOD currently uses. I know that we've talked a lot about building downwash over the last several years, really hoping that we'll promulgate or when we proposed an update to AERMOD, we would include some updates to building downwash from those ALPHA options. We did a lot of evaluation; our contractor did a lot of evaluation. We spent a lot of time. We never could get to a place where we felt like we were really comfortable putting something forward to propose at this point in time, because once we put it out there, and if it becomes part of the regulatory formulation of the model, then it's part of the regulatory model. And we kept finding places where, okay, it looks like this will fix this, but then we have an issue here. It will fix this other thing, but we have an issue here. So, we could never come up with any clear option or combination of options that would address the community concerns, and the concerns have to do with the overprediction and overprediction. So, we continue to assess those options. And we continue to collaborate with ORD and the Air & Waste Management Association. I know Ron Peterson is still working on downwash -- we heard a presentation from him just a couple of months ago that he's doing that.

So, in the interim, we're going to shift our primary downwash focus to BPIPPPRM. We put a draft version that I had on the timeline, you know, timeline there, maybe I had it on there. We put a draft version of BPIPPPRM out there that ORD had developed. Basically, they took the BPIPPPRM, as you have an elongated building, what it does is it rotates the building, and the perpendicular to the wind, that the wind is angled with the building, and rather than ending up

with a building that looks like this, you end up with a building that looks like this, because it keeps the original footprint, the vertices of the original building. So, what they did is they worked on that so that it would be more realistic, but only for rectangular buildings, so it's a short solution that we now want to extend to different building configurations. And we really, really hope that by the time we release the final version of AERMOD next year that goes along with this proposal and the final appendix W that we could have a new version of the BPIPPPRM out as well. And then also we're looking at researching alternatives. Has prime really, you know, has it timed out?

Surface characteristics. AERMET requires albedo, Bowen ratio, and surface roughness. You can input surface roughness by wind sector. That can become complicated for people now in terms of how you generate those sectors. And we also have some other complications thrown in that I'll talk about in a minute. But just to go through real quickly, AERSURFACE releases, you know, the first version of AERSURFACE was in 2008. And then we did some very minor rate updates in 2013. And then we released basically what's out there now as a draft in 2019, because the first version would only read 1992 data, and then right as we released that, the 2001 data came out. We thought, well, that'd be great, but that became some break point where they changed all the categories, they changed the scheme, and AERSURFACE wasn't equipped to do that.

And so then looking into what we needed to do to update AERSURFACE to read that data, we ran into a lot of complications, primarily with, and if you've heard me talk about AERSURFACE, the developed categories. There's open development, there's high intensity, medium intensity, low intensity, and they're very different categories from what you had in 1992, and so a lot of work was put in there, this is Roger's work as well. Little has been done to that since Roger put it in and we released this 19039_DRFT, and now version 20060 is what's out there currently, and we really haven't done anything to it since then. And I was just having a conversation this morning about we also now have the 2019 NLCD data and there's 2021. And the way AERSURFACE was originally written, it was bound to keywords that connect a year and data type. And when it was originally written, there was a very good reason for that because there wasn't a lot of data, and the data was mixed depending on the where. We asked that you use a year that has land cover, impervious, and canopy data. That's the way AERSURFACE works best right now. So that limits the years that you can use.

But now the way it's coded is it's difficult to think about how to use more recent data until we get a new release out there. So, I'll tell you a real quick trick. I've told several people, and I need to put something on the screen just to make it known to everybody. But the 2019 data, the 2021 data, and I haven't looked at these to see what data are actually available. I know that 2019 is pretty complete. But AERSURFACE, there's nothing in the data file that tells AERSURFACE necessarily that this is 2016 or 2019 or that it's impervious data or land cover data. So, the keywords are mainly for documentation. So, you can actually run the 2019 data by using the 2016 keywords because the data are the same. It just reads numbers. It knows how to read those numbers based on the information coded through TIFF tags and, what are called TIFF tags and geo keys. And you can run the 2019-2021 data, no problem. You just have to fool AERSURFACE to tell it to make it think that it's 2016 because doesn't know the difference.

So AERSURFACE needs some attention. So, there are some near-term priorities that we hope we'll have done by the finalization of Appendix W. So, at a minimum, this whole 2016 NLCD and 2016 MPRM, the canopy, we want to decouple that year and that data type. So going forward, it doesn't matter. Alleviate confusion over the definition of airport. This list was all wrapped around the 1992 data, whether it was airport or non-airport. And we've had to extend that same thinking to later data, but it goes beyond whether it's airport or non-airport. And so, we tried in the user guide to make that clear in terms of how we can determine whether a sector has higher roughness or lower roughness, and that equates to airport and non-airport. I won't go through all of that, but we need to make that more clear to the user. We're going to retain the current keywords for backward compatibility, and we're going to revisit the roughness values and the weighting of the developed categories. Just don't feel comfortable that what's been in there and has been in there for so long, we just need to revisit that to see based on comments that we've received over the years now.

And then current and ongoing, some method of evaluation of AERSURFACE. We don't have a good way to evaluate it. Our contractor is working on that. Revisit the averaging methods for each of the service characteristics. And Connecticut DEEP back in 2021 gave us a recommendation and some code for us to look at, review. We need to look at that, review it, and it has to do with just a modification to the way it derives a surface reference for a sector so that you're not looking at the whole sector, you're looking at individual regions of the sector. We need to look at that. Is it viable? We're not sure, but we have it, and they even gave us code to look at, experiment, play around with. So, we really hope to take a good look at that.

AERMAP. AERMAP was last updated as version 18181 and it was a very minor update. It was basically to put in the command line of arguments, like AERMOD and AERMET. I think that's all it has. But anyway, to make it consistent, and it would really be nice to release when we released a new version to release all of each of those three components. But AERMAP has kind of been set off to the side on the shelf. And it works for people. It gives them what they need. We know of a few bug fixes I've got listed there. But we also need to put in the new source types. There's the LINE, RLINE, RLINEXT, and BUOYLINE sources that you cannot represent in an AERMAP. control file like you can your POINT and your VOLUME sources. It's just recently been mentioned to me or suggested to me that we add an option to process sources only. James, when he heard that, he said, yes, we need to do that because that would help him greatly with air toxics as well. So that's on the list. That's something that we have to go ahead do quickly, make sure, you know, it's kind of like AERSURFACE, there'll be a minimum number of things that we're going to get done, and then some other things that we need to look at, like improvement processes, people are all the time about how slow AERMAP is, and that largely has to do with the number of receptors and the size of your domain, the number of files that it has to read.

And then also we have this issue that causes, I think, a lot of heartburn for some people, anyway, is the GeoTIFF files that you download from USGS National Map have to be converted. They have compression within the file, and there is a TIFF tag in there that tells you what kind of compression it is. And if you read the TIFF tags, it needs to say uncompressed. And theirs says TMZ or something like that. I used to know what that was. I haven't had to deal with it in such a long time. But we need to look at that and see if there's a way that we can easily update AERMAP so that people don't have, they can just take what comes off of the national map server

and use it as is without having to go through that conversion. I know I had to talk a few people through that over the phone.

So, the follow-up work, you're going to hear about aircraft plume rise, you're going to hear about area meander. Again, I've got the reference there for the highly buoyant plume. These are all in our sites to continue to work on the new ALPHA options and that we put into the model. There's certainly merit, some of these are more mature than others, but we fully intend for progress to go forward on these. And that's it.

George Bridgers:

Thank you, Clint. This is going to bring us to the lunch hour. A couple of housekeeping things, real quick. I think that temperature in the room has got to a point that it is comfortable, and actually I prefer it to be just a hair cooler. If you have issues with the room temperature, see me here in the lunch hour. I will continue to talk with facilities on that. I think I mentioned in the introductory slides, if you weren't here and missed that that we're doing an hour and a half for lunch, because it is going to take a while to go through the lunch line, they have kiosks now, and there is only a couple across the way, and you go in and select your order. There may be some grab-and-go lunch options, but again, you still have to go through the kiosk process, that's the bottleneck. So just give it time. Give it some patience. Somebody, we were joking about Disney World. Just get, "It's a Small World," in your head or something.

[laughter]

If you had a challenge getting in the door this morning, and not just a long time. You got through the security gate to the guard, and they were like we don't have you and we have to put you in the system. Over the lunch hour, you don't have to do it immediately. Just sometime over lunch or sometime this afternoon. We'll get a bigger notepad, right now it's a small notepad. Come write your name, the state you're coming from, your email address. I will get it into the Visitor Management System for tomorrow because the whole idea of that was to get you in the door faster. And that didn't work as well as I wanted it to. "Um," that's the word "um", and I want to see how that's going to be translated. I'm just trying to think of what else we need to do. Any other housekeeping things from my brethren in EPA?

Thank you for everybody's attention this morning. Find us over lunch. Again, I realize that we weren't having open session dialogue, but find us during lunch and talk to us about any of the presentations from this morning. Same thing with the afternoon during our breaks. Today is one where we can have some engagement. Tomorrow is the public hearing, you know, specific to the rule, that we will have to be more stoic on. Other than that, let me give you as much time as you have. It is 11:29. I will suspend the hearing until 1:00 p.m. So, you guys enjoy your lunch.

[CONFERENCE LUNCH BREAK]

[end of transcript]