U.S. ENVIRONMENTAL PROTECTION AGENCY

10TH CONFERENCE OF AIR QUALITY MODELS

DAY ONE

U.S. EPA

109 T.W. ALEXANDER DRIVE

RESEARCH TRIANGLE PARK, NC

MARCH 13, 2012

8:30 A.M.

GUEST SPEAKERS:

BRET ANDERSON, US FOREST SERVICE
GEORGE BRIDGERS, US EPA - OAQPS
ROGER BRODE, US EPA - OAQPS
CHAT COWHERD, MIDWEST RESEARCH INSTITUTE
CHRIS DRESSER, US EPA - OTAQ
TYLER FOX, US EPA - OAQPS
GALE HOFFNAGLE, TRC ENVIRONMENTAL CORP.
ROBERT PAINE, AECOM
MEG PATULSKI, US EPA - OTAQ
RON PETERSEN, CPP, INC.
RANDY ROBINSON, US EPA - REGION 5
JAMES THURMAN, US EPA - OAQPS
RICHARD (CHET) WAYLAND, US EPA - OAQPS

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MR. BRIDGERS: Good morning everyone and welcome to North Carolina. Welcome to the EPA RTP facility. As we kick off the 10th Conference on Air Quality Modeling, I am glad that we have got a pretty full house today. Hopefully, everybody made it through security, and visitor parking and all of that without a whole lot of hassle. I imagine the next couple of days it will get a little more fluid after this morning. Before we start the conference in earnest, I wanted to go through just a few logistics about the meeting room and about some things with respect to the conference. I wanted to point out up front for everybody -- this is like you are on the telephone call where it says, "this call may be recorded for various uses." This meeting is a Public Hearing and off to my right is a transcriptionist. And so everything that is presented or is said in the conference is going to be recorded. So, don't say anything that you don't want said back to you later. But, to that end, it is also very important that when we engage in our dialogue during the Question and Answer sessions, and then those that are presenting, that everybody identify themselves so that

that can go on the transcription.

So, I will do that now. My name is George Bridgers. I am with the Office of Air Quality Planning and Standards here at EPA, and I will have more about myself later. We have an extremely full schedule, and that is why at 8:30 I wanted to go ahead and "crack the whip" and let us get started. I would not trust the clocks in the room. Some have been set for Daylight saving time and some have not. So, trust the watch that is on your arm or just follow everybody. And the other thing is that we are going to ask that all of the speakers -- I know that some of these presentations are ten minutes, some of these presentations are fifteen minutes, and it is a very tight schedule. So, we are going to go ahead and thank everybody up front for being conscientious of the time and being respectful for the other speakers that are on the agenda.

Also, I want to make sure that everybody is aware of the security protocols . I know that there was some confusion coming through the metal detector this morning. Some people got through the metal detectors, some got to bypass the metal detector -- the rule of thumb is if the guard with the gun says "go through the metal detector," go through the metal detector. I will try to get some clarity over the next day whether we can bypass that or not, but typically, everybody has to go through that level of screening. The other thing is this is a secure campus. And so, outside of the common areas of this foyer, the bathrooms, and the Lakeside Cafe, you need an escort. So, if you want to go visit some friends in other parts of the "C" building or any other part of the campus, you will need somebody to escort you, and thank you for understanding that.

Since we have such a large crowd, I also want to just do a real quick briefing on emergencies. The exits are all around, but primarily, the exits to your right will take you out of the building either to the lake or up the steps back out to which you came in this morning. If there is a campus emergency, or if you have an emergency, "911" on the campus is "1-2900" on any telephone that you find. Most of them actually have on the handset have "1-2900." And that will get the guard desk and then they can further call "911"or what not, but normally, the EPA folks will handle that. If an evacuation order is given, it is probably not going to happen -- but if it is, the small visitor parking lot where we all -- where you came in up at the top of the stairs, that is our evacuation point. So, thank you for listening to that.

We are going to try to have a break every hour and a half to two hours, but you are more than welcome to get up if you need to, to have a bio break. For those that don't -- haven't found it yet, the bathrooms -- if you go out in the foyer, go across the foyer, not into the Lakeside Cafe -- the bathrooms are just before the elevators. And for lunch -- if you would like to leave the campus, you are more than welcome to. You are not going to make it back in an hour -- I can guarantee you that. So, we do have a Cafe that -- and I am not trying to promote the Cafe, it is there. You can also bring your lunch. Oh, it is kind of late for those that are here now -- to bring your lunch. But for tomorrow, if you wanted to bring something, you can eat in the cafeteria without having to pay for it. And, they have breakfast and coffee in the morning, and then after we get through the lunch time span, I think the cafeteria stays open in some capacity through the afternoon if you need a granola bar or something of the like.

So, without further ado, I want to turn the mike over to our Key Note this morning, to Mr. Chet Wayland.

MR. WAYLAND: Thanks, George, and good morning to everyone and welcome to North Carolina for those of you coming from out of town and the 10th Conference on Air Quality Models. I am Chet Wayland, and I am the Director of the Air Quality Assessment Division here at OAQPS, and I am really pleased to welcome all of you here today to the conference. While we are required to hold this conference by the "Clean Air Act," it is something that the Act says we have to do every three years, it has historically become a great venue for us to share technical information and to gather with peers and others across the country to talk about Air Quality Modeling. And I think this year's conference will be, you know, no exception to what we have seen in the past.

Dispersion Modeling is a key component of EPA's regulatory program, and it has been used successfully for many years in the PSD program, as well as in the NAAQS SIP world. With recent changes to the NAAQS for NO2 and SO2, the tools we have used historically are becoming even more critical to the Air Quality Management program. I think this conference comes at an ideal time, and I think you all agree for EPA, states, locals, and tribes and industry to come together and talk about the uses and benefits of these models.

Science doesn't stand still. Science moves forward and as sciences move forward, the models we have today are much more sophisticated and can simulate the real atmosphere in a better fashion than many of the more simplistic models we had years ago. With that sophistication also comes a challenge. It has become more and more important for those using these models to fully understand and appreciate the sophistication of these tools and fully understand the implications of the inputs to these models, their formulation and parameterization and the best way to apply these models. Improved knowledge over the years along with better technology has yielded better models for today. That does not mean that we still do not face challenges, because we do. Just as with modeling science, our understanding of the impacts of the air quality on human health also moves forward, leading to review of our air quality standards. Clean Air Act says we should look at these standards every five years. Historically, we have not always done that for many of these, but through legal challenges, we have been required to do that now, and I think the saying goes right now -- it is all NAAQS all the time around EPA because we really are looking at six and seven standards all at the same time right now. But as these air quality standards change, we must continue to make sure our models support implementation of those standards. As we better understand the health impacts from air pollution, we must also better understand how models simulate air pollution and the range that these health effects are witnessed. That is how we will continue to move forward and protecting public health, and that is really the great benefit of this conference -- is looking at the tools that we have, how they are used to actually protect public health that comes from the setting of the NAAQS.

This conference provides the modeling community at large an opportunity to come together on a regular basis and share information that will continue to lead to improve models and improve guidance on how these models can be used in the regulatory and non-regulatory arena. Now, obviously, it takes a lot of work to put together a conference like this, and so at this time I would like to acknowledge the EPA Modelers from OAQPS, whose hard work and new guidance and model updates will be discussed at length during this conference. Roger Brode -- if you could wave your hand there -- James Thurman, you've already met George Bridgers. George just joined us a year ago as our Model Clearinghouse Director, and we also have a new employee, Chris Owen, who just joined us yesterday. So, what a great way to introduce him to the Modeling community. So, I really appreciate all of the efforts that they have done to plan for this conference. We have got a record turnout, and I think that the prep that they have done to get the presentations together and get the agenda put together has just been fantastic. So, I really appreciate their efforts, and Chris welcome aboard -- I'm really glad to have you here as well.

But, we have also benefitted greatly from our EPA Regional Modelers and if there are any of the EPA Regional Modelers, if they could please stand just to -- so they could be recognized that are here today. Great, thank you guys -- it has been a nice team effort across the EPA from within Headquarters and the Regions working on many of these things to get ready for this conference. But, lastly, we have also greatly benefitted by working with our state, local and tribal agency modelers, so, those of you that are representing state, local or tribal agencies, if you could please stand as well -- don't be shy. Great, thank you guys very much for all of your efforts as well. I think the community owes a great deal to these folks, as they have worked hard -- especially over the past few years, and we know that our future success will depend upon our continued close communication, coordination, and collaboration across Federal, State, Local and tribal agencies.

However, it doesn't stop there. We have also taken steps to work closer with other stakeholders and, in particular, established a technical work group to assist the EPA in the development of the conference agenda and identify speakers and panelists. We look forward to continue to use this work group as an important avenue for communication, coordination of our activities, and follow up to the conference, and collaborations where appropriate and mutually beneficial. We obviously can't do it all ourselves, so we greatly value the time and contributions of these work group members and look forward to continued interactions moving beyond this conference. It is wonderful to have over 250 people registered for this conference and here today. It truly shows the level of interest in this topic. I hope the next three days will be enlightening for all of you, as I am sure it will be for me. The talent of the participants ensures that there will be many strong opinions and lively debate. I hope everyone will be respectful of each other's opinions and will look at this conference as an opportunity for the Regulatory Modeling Community to work together to help address what are challenging issues. This has always held true in the past conferences, and I am confident that it will hold true again this year.

Thank you all for being here. I look forward to the many presentations to come and for the positive dialogue that will follow. And remember, by being here, you do make a difference -- because if you are not here, your opinions would not be heard, and we greatly appreciate you being here. Gathering information and learning from that information is how we will all move forward and face these challenges. Let's move forward together during this conference, and with a commitment to continue the interactions and dialogue afterwards -- to then realize the necessary improvements in our models and guidance. And I just want to add one thing at the end, this has been an incredibly challenging time period for all of us in the modeling community. We have been faced with new challenges of tighter standards, using models sometimes in ways that, you know, they have not been used in the past, more sophistication than we have had in the past -- I have been really impressed with the cooperation across all sectors of people here today. We have had state, local, tribal agencies working with the EPA. We have had many of our industry partners to come in here on separate occasions and work with us on specific issues. We have tried to address as many of those issues as we can. We have put out guidance where we could to try to alleviate some of the challenges that have, you know, come to us -- however, we know there is still a lot of other things to do -- a lot more challenges out there. I am really personally looking forward to this. I am glad you all are here. I think it is a great opportunity for us at EPA to hear what some of the concerns are that you have, for you to hear some of the things that we have to share, and know about where we are today, and where we need to go in the future.

So, I hope this will be a very open dialogue and a very positive dialogue with everyone here. You know, if you want to grab people in the hallways at breaks and at lunch, please do so. We are here to listen as well as to present. So, I am really, really thrilled to have this many people here and this opportunity.

Janet McCabe, our Assistant Deputy Administrative for Air will be here on Wednesday, not for the conference, but for some other things. I am hopeful maybe she can slide in and hear a little bit of the presentations on Wednesday if her schedule allows. She has got a full schedule down here for other meetings, but I am really hopeful and she is interested, if possible, to slide in and listen to some of this as well. From her standpoint and from Gina McCarthy's standpoint, I wanted to relay that they are aware of the many challenges that folks are facing with the new standards and some of the modeling issues that you guys have been talking about for the last several months and, trust me, they are with us as we try to work through these together. So, thank you very much for being here. I look forward to a very positive and enjoyable conference. And if there is anything I can do for any of you during the next three days, please don't hesitate to let me know. Thank you very much.

MR. FOX: Well, I would like to add my welcome to all of you. Thanks for traveling here to North Carolina to join us for this 10th Modeling Conference. Our group has become one of the most popular groups here at EPA, and this is evidenced by all of you attending here, and all of the visits that we get by various folks since we have been facing a number of challenges with new NAAQS and new models and the like -- so, what I would like to do is start off in terms of an update and status of Appendix W by going back to my first modeling conference, which was the 8th Modeling conference back in 2005.

At the time, we were awaiting the promulgation of AERMOD. I think at the time I said "let's pretend as if it is already promulgated." Some of you were a little suspicious of that but, within a month later, we actually did promulgate AERMOD and get it out there, and it became full use for permit modeling and the like. We were only two years removed from the promulgation of CALPUFF in 2003. So, what we needed to do was within the group, come up with a vision that would move us forward in terms of addressing the challenges that we faced -- at least at that time, and to provide four essential elements related to achieving that vision. And so, I would like to go back to that vision and those elements here this morning to see how far we have come since 2005 but, more importantly, highlight that we still have a lot of work to do and as Chet said, this conference is where we will begin that work in terms of engaging with you all and defining that path to updating Appendix W for the first time since we gathered back in 2005.

So, our vision was a simple one -- to lead and promote collaborative efforts on near-field air quality modeling and to improve source culpability assessments. At the time, we were introducing two next generation models as I mentioned both AERMOD and CALPUFF, and we were just beginning to learn about the challenges in implementing those models in the permit process as well as SIP provisions and the light. And also at the time, we had absolutely no idea of what the changes were in store for us in the coming years in terms of NAAQS revisions -- both the 1-hour NO2 and SO2 NAAQS or related policy changes in terms of moving away from the PM10 surrogacy policy and needing to explicitly address PM2.5 and permitting.

So, our first essential element was to foster a collaborative environment aimed at strengthening our technical expertise and working relationships across the EPA, other Federal agencies, and the scientific community to regain our leadership role and promote the use of best science and evaluation methods. In doing that, we have strengthened the Model Clearinghouse, which at the time had really got to a point of not being supported as it should. ISC and other questions related to our legacy models had largely been addressed, but we realized that with the new models we needed to have a strong presence in engaging with the regions, the state and local agencies, and we now have George Bridgers, who joined us last year, to man that Clearinghouse and to effectively work with the states and local agencies as well as the regions on a case-by-case basis. He also promotes more regular interaction, to get heads up on issues, sooner rather than later, which is always beneficial -- and, hopefully, then to avoid situations at the eleventh hour that we have to deal with on a permitting situation.

We also established and effectively utilized the AERMOD implementation work group. First, with Al Cimorelli leading us, then with Randy Robinson, and now under the leadership of James Thurman and Erik Snyder, who you will hear later tomorrow, about the efforts to gather the regional offices, state and local modelers and evaluate the current guidance and maybe potential changes in that guidance under the new 1-hour standards. We also collaborated with the Office of Transportation Air Quality on their hot spot PM2.5 modeling guidance for conformity and Meg Patulski will be joining us in talking about that later today. We also continued our collaborations and strong relationships with the Federal Land Managers, including our joint work on evaluating long-range transport models, chemistry models, and last year signing a

Memorandum of Understanding between EPA, Department of Interior, and the U.S. Department of Agriculture on NEPA analyses.

We have continued to try and engage with the scientific community. The past two years we have been active participants in the Harmonization Conference in Europe, to engage with modelers there, and to compare notes -- if you will, in terms of their experiences and ours. And, we continue to attend specialty conference sponsored by AWMA and others to try and engage directly and in more depth on these issues. And then finally, at last year's Regional State Local Modeler's Workshop for the first time in 30 years, we extended that workshop to an additional day and had private sector participation, and thought that was a very useful and valuable exercise -- both for us to communicate where we were going and what we were seeing, and to receive information from the community at large. And I hope that we can continue that into the future.

The second element was to promote and facilitate the use of gridded meteorological data, including state of the practice National Weather Service Meteorological Analyses, to improve modeling science and performance for near-field modeling applications for permits, toxics and direct PM. So after years of development and testing with the Federal Land managers, we released a beta version of the mesoscale model interface program, MMIF, just prior to this conference -- and, in fact, got a number of comments within the first couple of days in terms of bug fixes and the like, and we greatly appreciate that, and expected that that would happen. And that tool specifically allows for the direct feeding of MM5 or WRF meteorological data into CALPUFF, AERMOD, and SCICHEM. Therefore, helping us move forward in our evaluation of those models and for potential use in the future in terms of permitting, and that would need to be associated -- come with some guidance and the like. So, we look forward to comments and input on that.

As part of that release, we also provided the MMIFSTAT program to facilitate evaluation of those meteorological data prior to feeding the Air Quality model, which we feel is a critical aspect of what we do and what we need to do as a community. And we have also developed and improved the AERSURFACE and AERMINUTE modules to facilitate use of representative met data in the AERMOD modeling system.

The third essential element was to promote continual development of appropriate model evaluation methods to evaluate areas of improvement in our modeling system including emissions and met inputs, as well as the science in terms of the formulation of the model, to prioritize the research agenda across the modeling community and, ultimately, to improve the model performance and critical policy in science areas. Obviously, with the new challenges of 1- hour NO2 and SO2, this is very relevant and important, as well as for PM2.5. And we have made a number of attempts to align our model evaluation methods with the use of those models in the regulatory and even non-regulatory aspects following a "fit for purpose" paradigm, if you will. That is expected to improve the performance evaluations that we rely upon, and give people more confidence in terms of the use of those models in the various applications that we have, and to base those methods on proven techniques and approaches that are out there in the community -- those that have been used in the SIP modeling community with photochemical regional models, as well as peer reviewed literature and the like. And you will see a number of discussions about that throughout this conference.

The fourth essential element was to promote a community approach to model development and acceptance. The champions that use the best science supports continual improvement in the modeling science and data, and timely model acceptance for use in the regulatory arena. We have made a number of attempts to improve upon this. We have developed tools to streamline the approach to updating the models to address bug fixes and the like -- that is evidenced by the CALPUFF update tool. We have also continued to provide evaluations support for updates to AERMOD -- most recently, when we issued clarification memos under the 1-hour NO2 and SO2 NAAQS. We revisited the evaluations and reported those evaluations for the 1-hour time step in terms of AERMOD to hopefully support and justify the continued use in that context. But we recognize that we need to continue to improve those methods as we get more challenges in terms of the NAAQS and the situations that you all deal with on a day-to-day basis that challenge our models. We also look forward to working with the model developers and addressing these issues to give greater confidence in these models, and to extend their use to the needs that we have. And we will talk about those needs, and we will talk about the emerging models and techniques tomorrow. And a number of those techniques are already in practice, and we need to better understand those and learn from those applications. And some of those models are in need of improvement, and we need to work with the science community and the research community to give us those important and critical inputs.

We also have been striving to provide these in a timely manner and in a fully transparent manner for review. We do ask that there be respect to the process that we have to go through in conducting those assessments and putting those out there, but we have worked very hard to put those out in terms of conferences, the workshops and conferences that we host, the specialty conferences or other types of conferences that we attend and the like. And then, ultimately, providing EPA reports and peer reviewed articles as necessary.

So, change is afoot, and we -- we basically formally begin that with this conference. There is a lot of work that we have done leading up to this conference that you will see in the presentations today and tomorrow. We look forward to the input from the community. On Thursday, we have expanded that to be a full day in anticipation of increased attendance and interest in what we are doing but, suffice it to say, we will be focusing on the current status and updates to our current suite of regulatory models and evaluate the needs there that can be done both in the near term through guidance or the longer term in terms of updating Appendix W more formally. The permit modeling of PM2.5, now that we are in a post-PM10 surrogacy policy era, and the issues that we need to address there. The challenges, as Chet mentioned, we all know very well of modeling and demonstrating compliance of the new 1-hour NO2 and SO2 NAAQS, and the emerging models and techniques to account for chemistry for both long-range transport as well as ozone and PM2.5 impacts as we have made a commitment formally through Gina McCarthy, to move forward on that approach in granting the Sierra Club petition, and we will be going into that in more detail tomorrow as well.

So, with that, I will turn the mike over to, I believe, George for the Clearinghouse update and again, appreciate all of the active participation that we will be getting in the coming days and as Chet said,.we are very excited to have all of you here, and don't hesitate to pull us aside to ask any questions throughout the conference. Thank you.

MR. BRIDGERS: Thanks, Tyler. Once again, since this is being recorded, I am George Bridgers. Tyler actually hit on several of the points that I was going to make, so I can probably just yield my time to Roger. Roger has got a presentation with what, 180 slides or whatever it is coming up -- so you all didn't really come to hear me talk, but real quick.

Tyler hit on the point that over the past -- this actually goes back to the 9th Modeling Conference -- maybe slightly before. The OAQPS, there is throughout the Agency, there has been a realization that the Model Clearinghouse needed to be revitalized. Tyler hit on a point that there is a flurry through the years of activity in the Clearinghouse with ISC and then we get, you know, to a steady state to where things are running along pretty well. The importance of the Clearinghouse is somewhat diminished and when the light is not focused, you know, the resources get shifted around. Then we had the promulgation of CALPUFF and AERMOD, and all of a sudden we have got a whole new suite of issues and, more recently, we have had the revision of the 1-hour NO2 NAAQS, and that has further put a stress or put a point of emphasis on the need for coordination -- and detailed coordination between the regional offices and the program office here. So, I am not going to read all of the things in the slides. It will be part of the record, I kind of hit the high points.

Just a little bit about me -- My pedigree, I spent 12 years with the State of North

Carolina -- a little over 12 years sort of was a "Jack of all trades." I started in the Ambient Monitoring Program putting out PM2.5 monitors in 1998, back when we were starting that whole program. I have spent a great deal of my time on the SIP and photochemical modeling side of the regulatory house. So, the dispersion aspect of my job -- I left to some other friends that are actually in the room, in Jim Roller's group with the State but, nonetheless, I was very connected with what was going on there. I did quite a bit of public speaking through the public hearings and what not, and fortunately, had the opportunity to play with a bunch of toys like SYSADMIN from our LINUX class. Last year we have got some radar profilers that I was operating, so that was the fun part of the job. And then I landed at the Clearinghouse and so where it says, "effective January 3rd," that was my start date. It took a little bit to -- just to kind of get into the groove, and there was an e-mail or a memo that went out to all of the regional offices in April -- but I had already then been quite a bit in coordination and context with the regional offices at that point leading up to our regional, state and local modeler's workshop last year.

So really quickly, what is the Model

Clearinghouse? It could be interpreted in a bunch of different ways, but it's a process as much as it is a person, as it is an activity within the Agency to which we honestly are looking for national consistency on a variety of issues. An issue pops up in a region with a particular application and we have a process that is now -- that has been in place for years and years and years, and we are refocusing on to try to resolve some of these issues in a way that is consistent across the country. There is statutory authority. It is written in the Appendix W and this is closely associated with the consultation process that is in Appendix W. Like I said, really the stride that I have is to promote this national consistency. And I am not trying to use words that are oxymoronic, like urban planning and no offense to people that are in that realm, but just as a funny -- timely, okay -- and again, I said I wasn't going to joke -- but timely interpretation of guidance, I know that there are issues that some have had in the past with the word "timely" but there again, I will talk about the process in a minute. When the process is honored, then the timely factor actually can come into play. It minimizes bad press to be right honest with you. It helps us not have mud in our eye, where we have got something going on in one part of the country that is uniquely different than something that is going on in the other part of the country, and they are the same issue. And so that is really what my goal is -- is to get everybody talking, and get everybody coordinating internally. The Clearinghouse to me is not just this act of the region, requesting something of the program office and giving a response. It is making sure that on a day-to-day, a week-to-week, a month-to-month process that we are talking -- and that we are getting together not so much at this particular meeting, but at other meetings and other contexts to make sure that we are all on the same page. And, obviously, this is -- my wife loved this statement, "the Clarification Memorandum and Guidance Development through consensus building." So we're, you know, the team effort.

So far as you know, when we we look at internally, as things come to the Clearinghouse, if they are technical issues, I will work with the internal staff of the Air Quality Modeling Group. If there are particular issues that come to us that look like -- and this is actually often is the case -- things that come to us that have the appearance they are a technical issue, but it is a policy call, it has something to do with ambient air, for example, then I will work very closely with the New Source Review Group and other people within the Policy Division -- so just that we can try to get resolution with the regional office and then back to the applicant, and there may be other things that we need to elevate and have OGC, the Office of General Counsel, look at -- basically, the lawyers to approve.

But, let's talk about the process because this so often in the past has gotten circumvented -- where there is this thought that people come straight in contact with the program office and that -- because they have an issue. And I can speak from being with the state of North Carolina, OAQPS was just across, you know, town -- it was just out here, it was easy to pick up the phone and talk to people in the Agency, and Region IV, at least in my case, often got circumvented. So this is where the state really needs to be talking with the region. If that communication isn't there, there is a problem. So, the state is in coordination with the regional office on particular permit applications, the applicant is not directly talking with the regional office without the state or local agency involved.

In the case of the Clearinghouse, the regional office actually should go ahead and make some type of a determination -- that would be done in coordination with us, but they are going to send us a very formal memo that has the statement of the issue, they are going to have the desired approach that this is -- you know, from the regional office's perspective and the justification for it. And then we are going to take and evaluate that, and then like I said earlier, if we need to talk with the policy group, or OGC, or what not, that we will work on that and then we will summarize in a response back to the region and then, ultimately, to the applicant.

There is a couple of points down here that we are trying to do, and I'll have a slide on it in a few minutes about MCHISRS to make the decisions that are made with them, and the recommendations that are sent to the Clearinghouse, and the decisions that are made back to the regions. Such that they are available to everybody and that is through this MCHISRS database. We also do report outs at the regional, state and local modeler's workshop and as Tyler had mentioned a few minutes ago, last year was the first year that we actually had a public session invited for the people from the industry, the trade groups and what not -- to come in, and we hope to do that again in the future, although, the conference that we have got coming up this year is a week-long one -- the workshop in Chicago. So, not this year, but we will look to do it again next year. And, sometime, I will write an annual report, and that is overdue -- And like I said before, that if we need to go to through the policy group to develop additional memorandas or clarifications, we will do so, or ourselves -- we may issue clarification guidance that Roger will talk a lot about that in a minute.

I think Tyler already hit the points on this slide that again, that the importance of the Clearinghouse has been raised again with the promulgation of these new two models -- or now, not so new models. But, I wanted to point out on this slide at the bottom on the protocol and this comes back to the consultation -- there needs to be good consultation between the applicant, state and local agency and the regional office because that gives the regional office the opportunity to review the modeling protocol and to foresee issues ahead of schedule. This is that "getting out ahead of time" and I know that there is some angst out there between the state and locals and regions, and that is something that we as the community definitely have to work on. But when protocols are submitted to the regional office and when the regional office reviews them, these issues should come to light and, with my coordination with them, then that should come back to this timely aspect of it. And, this was just some points again about the respecting the roles -- I won't read down those. They are in for the record.

That is -- in the interest of time, I just want to jump right ahead. These are the Clearinghouse Actions, the formal actions that have occurred since the 9th Modeling Conference, and there's five of them. Three of them are somewhat related -- the AERMOD ones, a CALPUFF and one is otherwise. The first -- this was right out of the bat, this was 2009, this was in Region 8. We had a request that came in about certain aspects of a BART analysis, and I won't read through all of the specifics, you have got it there in front of you, but in general, we concurred with the regional office here about an issue with the use of one kilometer grid resolution -- it not being adequately justified in what had been submitted.

We also concurred here that the blending of the National Weather Service observations with prognostic model data is the most technically sound approach for developing met fields for the application within CALPUFF. There was another issue there that we deferred back to the regional office and to the Federal Land Managers with respect to post-processing. It was from this Region 8 CALPUFF, with respect to BART response, that we actually went further. I think Bret Anderson is in the room, there is a few others that were involved in this -- that there was some recommendations that were then made in response to the IWAQM Phase 2 recommendations, and there was another document -- there was a reassessment document that is posted on SCRAM that was written very shortly after that action.

I didn't see Stan this morning, Stan Krivo, but if he is in the room, he gets the honor of having the actual first official Model Clearinghouse activity with respect to AERMOD. And this one actually had to do with one of the pre-processors to AERMOD that had to with some issues with surface roughness. The regional office actually was seeking a review of a situation in concurrence on their determination of use of a non-default radius for surface reference determination. We responded with a disagreement at least on their determination of this technical justification for something other than one kilometer. And it was through this and I defer to Roger Brode to talk in great length about the issues with AERSURFACE and the surface roughness estimates and then at this time was introduced this gust factor method, that was introduced as a way of helping collaborate the surface roughness in this case. And I think that is all I have got to say on that.

Region 6, followed up -- this was in 2010, this was an issue with respect to PM2.5 compliance that we will talk about later in the conference. Here the issue was with an application, modeling demonstration down in Louisiana. The regional office in this case had actually already seen the protocol. There's some issues on timing here but, nonetheless, when we saw the Clearinghouse request, with respect to a couple of different issues, we concurred on one and we had to disagree on another. The concurrence was with respect to the monitoring site that was determined for the background concentrations and then the disagreement -- and this actually became an issue that was further explained in the Page memorandum -- the March 23, 2010 Page memorandum that is the standing PM2.5 Modeling Guidance, is that the use of the 8th highest modeled 24-hour, is not appropriate. We were recommending -- at that time we recommended and continue to recommend that you should average the highest model concentrations across the five years. At least -- for your cumulative impact assessment -- and that is what this slide actually goes into much greater detail. And there is a caveat at the bottom, and I won't read it. It has to do with the aspects of -- just because we are talking about five years of modeling data, does not to be confused with the three-year averaging period for the design value.

More recently, and this comes up under my peer view, this was after I had come in as the Model Clearinghouse Director, we had two different issues. This one was earlier in the year, this had to do with Offshore Continental Shelf drilling in the Region 10 region, and -- kudos to Region 10 for sending us a very well prepared package with respect to the COARE algorithm being added in to AERMOD as an alternative model. It made my first Clearinghouse action -- I won't say easy, but it made it at least the steps of it a lot less complicated than it had to be. But, nonetheless, you've got this coupled ocean atmospheric response experiment or the core flux algorithm. The response here, though, was to very specific application in the Beaufort and Chukchi Seas of the Arctic Ocean, but it wasn't -- as we issued this clarification back to the regional office, it wasn't to be that this can only be applied in these seas, but it was that if you had a similar application in a different part of the world -- or the domestic United States, that you could use this algorithm, but you needed to engage with the regional office early such that they could have in coordination with us a decision.

So, that was more recent, and the most recent -- and this is the one that -- and Roger, you are going to -- we are going to have more discussion on this as we go along, but this is the one that probably has the most implications to this room right now, and this had to do with an Alcoa facility in Iowa, and in this case there was an issue with the fluid modeling or the wind tunnel derived equivalent building dimensions that were to be used in BPIPPRM . In this case, there was a variety of issues that were elevated to us from the regional office, and this is one that there had been -- there is a long history. It predates me -- that is fine, I am now part of the Agency, so it dates me here. But, nonetheless, there was a lot of consultation back and forth to the regional office. We had a lot of discussions with them, with the contractor and with the facility. In the end, we agreed with the assessment of the regional office that there had been an insufficient technical justification for the use of these particular EBDs. In particular, there were some flaws as we saw it in the particular design of the wind tunnel. Specifically, there was an addition of some additional surface roughness elements to simulate the actual facility in the EBD test. When the actual EBD structure was put in, these additional surface roughness elements were actually larger than the EBD itself and that created quite a bit of a problem.

Also, there is an aspect, and this is probably the most important aspect of this Clearinghouse Action, is that we agreed with the regional office that there is a host of technical challenges that are right now have been introduced with the promulgation of AERMOD. All of the previous guidance, with regards to equivalent building dimensions, had been done under a previous model such as ISC. Through this action, we suspended, and this is until further notice, all past, previous -- however you want to say it, EPA guidance relating to the determination of EBDs. Now I say that, there is a caveat at the bottom -- this does not mean that it is forbidden forever. It doesn't mean that someone can't start a project right now with a wind tunnel to determine EBDs for an application. But what it does mean, back on this consultation side, is there needs to be early engagement with model protocol, with the regional office, and then the regional office needs to be in close coordination with us because we, as a community, need to move forward on redeveloping the guidance and making sure that these determinations for EBDs are appropriate with the new internal structure of AERMOD. Did I say that right, Roger? That is fine.

Real quick and then I will yield a bunch of my time, not that I have a whole lot of time left, to Roger and his 80 slides is MCHISRS, and this is not a four-letter word for those in the room that have tried to use it. It is actually -- we are trying to improve MCHISRS. Through the years it was an internal database that we -- a number of years ago made available to the public. There is a variety of things in MCHISRS. There's phone memos and there is a bunch of informal information in there from years past because it was an internal database tracking system. What we are trying to do is clean it up, we are trying to make sure that all of the records that are formal -- the ones that would have signatures on them, are available in their PDF forum so you can actually see the signature, and we are going to go back and make sure with time, that all of the records that are there are text searchable -- such that if you need to copy and paste, it is not just an image file. So, we are working on that. Of the over 1,400 records that are in MCHISRS, about 250 to 260 are formal ones where the regional office had requested of us and we responded back. And of those -- and this is very fluid, these numbers, because we have been engaging with the regional offices on these updates, we are now at about somewhere between a half to two-thirds complete on making sure that we've got the original -- not just a text file, but the original signed copies. And for those in the room, and it is not a misspelling at the bottom, I was trying to be cute with the word "sensitive", the search database now is case sensitive, so you can type things upper case, lower case or however you want to, and it should report back from the record.

So, there is the link to the Clearinghouse, my contact information, and the two minutes that I have left, I am going to yield to Roger.

AUDIENCE MEMBER: Shouldn't it be case insensitive?

GEORGE BRIDGERS: Yes, it is case insensitive. Yes, sorry.

AUDIENCE MEMBER: We weren't trying to make it more difficult for you --

GEORGE BRIDGERS: We were trying to make it more difficult, I can add that in right now.

ROGER BRODE: Good morning. I already am going to yield some of my time in the next presentation to this one, so I didn't really need that. But, yes, as far as Stan bringing the first official Model Clearinghouse action to AERMOD, I thought that was a milestone and thought it might be appropriate to give him some type of reward to acknowledge him for that, but given the fact that we had to disagree with him, I think that disqualified him for that particular recognition.

So, clarification memo is going to -- some of this is a rehash that was already presented at the last modeling conference, but it is good to remind ourselves -- talk about the role of clarification memoranda in general -- what process we go through here when we feel the need to issue such memos, review some of the Appendix W references to clarification and consistency which sort of underpin the need for these types of actions, and sort of briefly mentions the clarification memos that have been issued since the last modeling conference as well as discuss some pending memos.

Once again, these memos address issues that may arise from broad applications or broad implications. They don't come in the context of a specific application. The formal Model Clearinghouse process is what is set up to handle that and George just summarized some of the recent cases that fit into that mode, but this is more general -- may be in the interactions with the regional offices or wherever -- we might get a sense that there is some issues in terms of how guidance is being interpreted that need to be clarified. And these service reminders and, again, consistency is another important part of that -- to foster national consistency in how Appendix W recommendations are applied.

Once again, it might rise through the normal process of interacting with the regional offices or other assessments going on and also, more recently, a couple of examples are in response to new or revised NAAQS where -- from the standard change, some issues come up in relation to that that need to be clarified, and these memos go through a pretty good detail or thorough internal review here through the Air Quality Assessment Division, with Chet as Director. Sometimes they may come from Chet as the Division Director. We often coordinate with the Air Quality Policy Division because there is certainly a lot of overlap in some of the issues that we deal with on the technical side.

You know, sometimes hard to distinguish between technical versus policy -- that line is a little bit blurry. And also, the Office of General Counsel, the lawyers try to keep us out of trouble, though sometimes we need to actually go as high as them to make sure we are keeping them out of trouble -- or I don't know which is it.

Anyway, we also give the EPA Regional Office Modeling Contacts an opportunity to review the memos before they are issued, so we are all on the same page within that particular family. And they're issued to EPA Regional Offices either through the modeling contacts or the Air Division Directors, sort of depending on the level of importance, or controversial nature of it. Perhaps, it depends upon the scope of the memo. So, these memos once they are finalized are distributed to the committee -- a broader committee through the SCRAM website. They will be identified under the "recent additions" portion of that, but they are also archived on a separate SCRAM webpage with the link from the Permit Modeling Guidelines page. And right now, we are taking action in addition to what George mentioned about the formal Clearinghouse actions that are documented in MCHISRS. We also are working to try to incorporate these clarification memos in there to further facilitate public access.

So, this is one of the SCRAM webpages down at the bottom under Appendix W guidance is a link -- if you can see it, for clarification memos. This lists the clarification memos that are posted there. There have been quite a few since the last Modeling Conference. But again, through a review of Appendix W mentions several places about the importance of consistency, the industry and control agencies both agree on the need for consistency in application of models for regulatory purposes. So, one of the reasons we have the modeling conference is to facilitate that. So, these opportunities for applications sometimes result in revisions to the guidelines. So, to a certain extent, the clarification memo may be considered sort of a small step towards something that might, ultimately, have to be formalized through rule making in revision to Appendix W. At least it gives us an opportunity to sort of clarify where we are now, meet the current needs because rule making can be a very lengthy process.

But, again, Appendix W makes -- several points mention the role of the Model Clearinghouse in terms of providing clarification, fostering consistency and so on. So, here is a list of the clarification memos that have been issued since the 9th Modeling Conference. A couple relate to CALPUFF in terms of the recommended settings for CALMET. But three of them relate to sort of new NAAQS. I mean PM2.5 NAAQS was not new at the time, but I guess from our perspective in terms of PSD permit modeling, it was sort of new because we were still living under the PM10 surrogacy policy until quite recently. So, as George referenced, the page memo in March 2010 sort of laid out some recommendations for how to do permit modeling for PM2.5 of direct emissions through AERMOD and how to couple that with monitor background to account for the secondary PM2.5 component and then, more recently, two memos related to the new 1-hour SO2 and NO2 NAAQS. One each, I guess, certainly after they -- those new NAAQS were promulgated, I think the NO2 was a little bit lagged behind the actual promulgation or effective date of the new NO2 memo. SO2 is a little bit more prompt. There are some similarities in these in terms of addressing the form of the standards, what that implied as far as data analysis, how to determine significant impact levels or significant contributions to model violations and so on. NO2 is a little bit more complex because of the role of chemistry involved. Most of the emissions are in the form of NO, but the standard is in the form of NO2. So, we clarified the applicability of the tier three, three-tiered approach in Appendix W to address NO2, NO2 NAAQS that was written in the context of the annual standard, but that we feel like guidance is still applicable to the new 1-hour standard. There may be some additional issues or concerns that might be more important in the context of the hourly standard, which we highlighted. But, at least people need to understand, you know, where we are with that.

But, more recently, we issued another memo in March of 2011, sort of additional clarification regarding applicability of Appendix W to the 1-hour NO2 NAAQS, that sort of went beyond sort of the basic information provided in the earlier one. Went into more detail about the issues involved in determining which background sources need to be included in the cumulative impact assessment, options and issues to consider in terms of how to combine model to concentrations with marked background for cumulative assessments, and so on. And a lot of that general information in that March memo is also applicable to the 1-hour SO2 NAAQS, and we pointed it out in the memo. And, more recently, just clarifying the sort of regulatory status I guess, if you want to call it that, of AERSCREEN as the recommended screening model now.

The promulgation package -- the preamble to promulgation for AERMOD in 2005 actually referenced the existence of AERSCREEN, which was under development at the time, and indicated once that was completed that it would essentially replace SCREEN3 as the recommended screening model. So, I have some slides to sort of summarize some of these memos. I don't want to go into a lot of detail here, probably everybody is very familiar with them, and I hope that my voice holds out.

But, again, this PM2.5 memo was issued in response to the expected transition away from the PM10 surrogacy policy where applicants were not required to do dispersing modeling to show compliance of PM2.5 emissions to show compliance with the PM2.5 NAAQS. That if you showed compliance with the PM10 NAAQS, that was assumed to be an appropriate surrogate. We no longer live in that world, so we are trying -- this was sort of the first major step toward addressing these new needs and emphasize use of AERMOD as the preferred model for estimating near-field impacts from primary PM2.5 emissions. AERMOD does not include any chemistry to account for secondary PM2.5 formation. But also, again, addressed some of the methods and metrics for combined modeled and monitored concentrations, given both the nature of ambient PM2.5, the secondary PM2.5 can play a significant -- it is typically a significant portion of the monitored background and that is not something we account for directly in the AERMOD modeling, but also due to the form of the standard, which is a bit different.

So, for the 1-hour NO2 and SO2 NAAQS, again clarifying their use of AERMOD as the preferred model for estimating the impacts under these new standards, and again describing the applicability of the three-tier approach for NO2, to the 1-hour NO2 standard. But again, some of the -- we are still working under that -- sort of three-tiered approach for the 1-hour NO2 standard, but some of the issues may be more important with the 1-hour standard than were with the annual standard. In fact -- I mean the biggest change, of course, is the level of the NAAQS prior to the 1-hour NO2 NAAQS. We rarely had to go beyond tier one, at least as far as we knew from OAQPS. Many applicants were able to show compliance with the annual standard by just assuming full conversion of NO to NO2. That is certainly no longer the case in most situations.

Part of it was clarifying where PVMRM fit in this as well. Appendix W explicitly includes OLM, the ozone limiting method, as an example of a tier three more detailed screening approach. PVMRM is sort of in that same category. In fact, they are based on the same chemical mechanism, they are just implemented somewhat differently but in more detail for both of these in terms of the form of the standard based on the annual distribution of daily maximum 1-hour values, and the analysis procedures necessary to first do a design value showing the cumulative impacts, but also what appropriate metric used to compare it to the SIL in terms of determining the significant impact, or the interim SIL, I guess.

Also clarified that monitoring guidance, regarding the three-year average used to -- for the model design value doesn't really pre-empt Appendix W requirements for use of five years of airport data or at least one year of site specific data. So, we state that the model design value is based on the average across the number of years model to be consistent with that particular form of the standard.

So, we also clarified some of the procedures, as I said in terms of how to determine significant impact analysis whether your project emissions are contributing significantly to model violations of the standard. In this more recent memo, we get into more detail about that. Also recommended a default tier two ambient ratio of .8 for the 1-hour standard. In the earlier memo, we said that the .75 tier three ambient ratio or tier two ambient ratio is actually described as being -- representing sort of annual and sort of equilibrium conditions which would be more appropriate for an annual standard than an hourly standard. So, we didn't -- we cautioned that it may not be as appropriate for the hourly standard, but we haven't gone too far. But based on review of some information, thought it was appropriate to recommend a .8 as a default tier two. So, tier two, basically you run the model with your NAAQS emissions, get the result, and multiply it by that number -- .8, so it's a very simple tier to implement. It may not buy you much, but it might help some.

And then the other key issue that we highlighted in the earlier memos was the more increased importance of the in-stack NO2 and Nox ratio as one of the inputs to the AERMOD model when you are operating -- implementing these three -- tier three options -- OLM or PVMRM, and what we had indicated is, prior to the 1-hour standard -- I think .1 or 10 percent in- stack ratio is pretty much assumed to be a default. I think it had been defined as a default for OLM way back when, but PVMRM never actually defined it as a default, at least when it was an AERMOD. But we sort of said that there really isn't a default in-stack ratio that we felt would be appropriate for the 1-hour NO2 standard due the nat -- you know, it's a short-term standard. It is -- it certainly may be more appropriate for the annual standard, but -- so, we looked at the available data, there is an effort to try to compile information on what in-stack ratios would be appropriate for different source categories and, hopefully, we'll get to the point where it will have more information available for people to reference or draw upon. But we decided that it was appropriate to -- in this latest memo, indicate -- recommend .5 as an appropriate default in-stack ratio, but I want to emphasize the underlying part in the absence of more appropriate information. We are not saying that this is the ratio that you have to use. We are just saying "if you don't have any other information, we are okay if you use .5." If you have information then that is more appropriate to that source, then please use it. If it's over .5, just don't tell us about it!

But another very big issue that emerged in terms of the 1-hour NO2 standard, in particular, was the importance of intermittent emission sources. Emergency generators, for example, often are large emitters of

NOx concentrations. They are intermittent, they are not operating all the time. They weren't really an issue under the annual standard. Not sure exactly how they were handled under the annual standard in terms of modeling but certainly wasn't that much of an issue, with the hourly standard that is suddenly a much bigger issue. So, we looked at the available guidance -- what we have in Appendix W, tried to understand whether it is appropriate or not, and we made some suggestions that we thought would be appropriate that -- if you have an intermittent source that doesn't contribute significantly to the annual distribution of daily maximum 1-hour values, then it may not -- .may be appropriate to exclude that source from the modeling. Exactly what that means and how to interpret it in a given context is, you know, more complicated than that. But we did provide a few examples. For example, if it's -- if you have an emergency generator that is permitted to operate 500 -- up to 500 hours a year, that is a pretty typical permit condition that we have seen for emergency generators. But records show that you rarely operate it more than 30 hours a year, and you never know when you are going to, and it is sporadic. It might be 30 hours in a row or something. That is something that probably won't contribute significantly to the annual distribution of daily maximum 1-hour values. And you don't want that -- the assumption of that operating all of the time should not be the basis for your compliance demonstration. On the other hand, if you have sort of a peaking unit that starts up, shuts down pretty frequently depending, you know, maybe every afternoon or whatever, such that you -- it might emit or operate for an hour, or two, or three every day possibly, then even though the number of hours may not be that much more than the other case, in terms of the permit condition, given the form of the standard, it could contribute significantly to the annual distribution of daily maximum 1-hour values. So, it would be less appropriate to exclude that.

So, that's -- again, the details and how to apply or interpret that in a given case, you know, can be difficult and we haven't got a lot of feedback, so I'm not sure exactly how that is being implemented in real cases but, hopefully, it's been a useful clarification. But the other concern we have had, and we kind of expressed it up front, is sort of a longstanding practice, I guess you would call it, of using the 1990 -- is it -- NSR Workshop Manual, the Puzzle Book, which was never been other than draft and it is out of date, but it lays out very detailed descriptive procedures that you could go through if you want to do a modeling analysis to show compliance with a standard under PSD regulations. It is very detailed, it goes into a lot of detail, you run the model, you see how far out the model impacts are above the SIL, that is your significant impactor, then you go 50 kilometers beyond that, you look at all of the sources in that domain and whatever. So, I mean it is a very detailed step-by-step procedure and that is what a lot of people would like to have -- a detailed step-by-step procedure because I know what to do. I don't have to necessarily think about it that much or justify it that much -- just do it, done, get an answer, I am okay. And that -- there is nothing necessarily wrong with doing that. That may be a sufficient method for doing a demonstration, but it may not always be necessary. So, that's what we are trying to make a distinction there, and we have a concern that parts of that -- the recommendations are -- I guess I don't want to put recommendations -- some of the suggestions documented in that draft workshop manual don't necessarily conform completely with Appendix W guidance in terms of nearby sources. So, we're sort of getting people to try to rethink that process. Try to look at the application, understand the nature of the nearby sources, where they are distributed, how they operate, what kind of ambient background concentrations are available, and how all of the different pieces can fit together in a whole that actually makes sense for that application and for that standard, and try not to overdo it -- try to do enough, but try not to overdo it. So, we discussed the criteria in Appendix W regarding -- now, what nearby sources should be included and what Appendix W says is -- those sources which cause a significant concentration gradient in the vicinity of your source. So, that is the criteria in Appendix W. That doesn't necessarily say draw a circle at your maximum significant impact level, add 50 kilometers to that, and then take all of those sources and dump them into the model. Again, if you want to do that, we are probably going to be okay with it, but if you do that and you come up with a result that is way over the standard, then maybe you need to rethink how you did it, so -- I don't want to overly belabor that point, but -- it is an issue that we are concerned about and, you know, we have tried to clarify well -- why does Appendix W -- Appendix W doesn't say any more than that -- significant concentration gradient, but what does that mean? You know, how can I understand that and try to apply it in my case? So, we have tried to provide some discussion that we hope is helpful. In time, we might be able to go further and go into more detail, provide more examples, and so on.

So, I'll pause now since the next phase is the important stuff. I wasn't going to spend that much time on that, but since I have already yielded myself time. How much time do I have? Ten minutes plus thirty? Okay. So, I guess the more important part maybe is the pending clarification memos, or maybe I should have said "still pending clarification memos," since we have identified both of these as pending memos at the 9th Modeling Conference. I guess clarification memos grow better with time, so there have been some new developments related to both of these issues that we will describe now. So, I am going to go into some detail about both of these -- the first one relates to the use of ASOS, airport data, automated surface observing system, which began being deployed in 1992 to replace the standard observer based approach at airports for reporting surface weather observations. And then the treatment of missing airport data in AERMOD, so there is some -- a lot of details there. And then the other major one is how the EPA formula height has been implemented in the model in terms of a criterion for whether downwash should apply or not and with the promulgation of AERMOD, which includes the PRIME downwash algorithms, some significant issues have come up related to that. I do want to exert a caveat or clarify that these pending clarification memos I have are not final, they are still under development in internal reviews but, hopefully, this will give you an idea of where we are and where we are going with this. So, first point, realized when AERMOD was promulgated, there were issues that came up. We became aware that people were sort of applying the same approach they used for ISC3 with AERMOD. So, the ISC3 model under the regulatory default mode required a 100 percent data completeness. If you had missing data, there was a missing data processing option that treated missing data like calm -- even though calm were treated like missing, I guess you couldn't treat missing as missing, but -- anyway, that was part of the regulatory default option under ISC. So, if you had missing data, you either had to fill it in every hour or use a non-default -- turn off the default option. So I want to re-clarify that AERMOD did not have that requirement. It wasn't an oversight that was intentional. It might be nice to have all of the data, but it was not a requirement under the regulatory default option. So, I wanted to clarify that and try to make sure people aren't just carrying forward that process unnecessarily.

But, I guess, one of the bigger motivators was that -- again with the advent of ASOS, there is a lot more missing data. I mean one of the initial concerns about ASOS was that with the cloud cover -- this goes way back -- Tom Pierce actually helped write a report on that with Bruce Turner back in the '80's trying to influence the weather service and FAA or whoever -- if you are going to do this, here's some of our concerns, our needs of this data, please consider this when you go forward. And I guess they didn't either hear you, or they just ignored you, so I mean FAA, airports, pilots -- they don't really care about light wind conditions, so who cares if less than three knots is a calm? So there are some issues there, but one of the initial concerns was that the ceilometer that they were going to use had a vertical limit of 12,000 feet. So, clear below 12,000 feet from ASOS might actually mean overcast at 16,000 feet. Well again, that might not be important to a pilot or the terminal at the airport, but for dispersion modeling actually that could make a big difference. It could be a difference between stability class A or D with ISC. So, what are we going to do about that? Well, we have found later -- we redid a ASOS sensitivity study that was done for ISC using AERMOD and actually showed much less sensitivity to those issues than ISC, which is good. But, the big issue is that there is a lot more missing data now. Prior to ASOS, you would rarely see missing airport data -- an hour here or there maybe unless a hurricane went through maybe and knocked the tower out, but with ASOS there is a lot more missing data -- both due to calms -- increased frequency of calms. We have documented about a factor of two increase in the number of calm hours before -- after versus before ASOS. And then the adoption of the METAR standard in July '96, which introduced the variable wind code. So you could have winds -- valid wind speeds up to six knot, but the wind direction is variable -- which means for us missing. So that is another hour that is tossed out.

This is just one slide from the ASOS sensitivity study showing AERMOD's on the left -- this is a 55 meter stack with downwash. Comparing results with model results using ASOS clouds versus airport -- you know, in observer based clouds. And I don't know if you can see that, but -- so AERMOD is showing very, very little sensitivity to the cloud cover issue, which was the main issue in the beginning with ASOS. ISC showed quite a bit of sensitivity for this source, but it is almost always biased higher with ASOS than not. And again, this is a case for a tall stack, you might have 1-hour again where it is clear below 12,000 feet with ASOS means Astability, but maybe it really was overcast at 16,000 feet, which meant D-stability if it was an observer. Well, for a tall stack, A- to D-stability is a pretty big difference and you can have -- but the tend is going to have much higher concentrations with the ASOS data. And that was one reason why we said -- didn't say -- well, don't use ASOS data because if there was a bias, it tended to be in the direction that was -- that we were more comfortable with. But, at least the good news, AERMOD, it just threw away because 1-hour of clear versus overcast doesn't really affect the results as much because the convective boundary layer evolves over time in AERMOD and so on, so it's -- that sensitivity is much reduced. And this is a plot showing the frequency of calms before ASOS versus after ASOS -- almost every dot there is above the one to one line -- meaning more calms with ASOS. And on average, we have seen about a factor of two increase.

So, the other issue is that these data gaps -- calm winds and variable winds are both biased towards low wind speeds which increase the concern about the representativeness of the ASOS data for some applications. And I don't want to pick on Birmingham, Alabama but it's a case where we actually had a need to look at Birmingham a while back, and it is a good poster child for some of the ASOS issues. So, an example, for 2010, just the standard ASOS data from the ISHD file, quoted at 32 percent calm hours and 4 percent variable. That is a lot, but the reason for the clarification memo, or one of the needs, is that Appendix W doesn't explicitly address data completeness requirements for NWS or other airport data. I mean we say "NWS," we also mean FAA, airport -- so just it is a terminology, but -- but again, prior to ASOS, missing airport data was very rare.

So, Appendix W does provide some recommendations or references the met monitoring guides for regulatory applications in terms of data completeness requirements for site specific data, and that is where it recommends at least 90 percent completeness before substitution, and that should be reached variable separately as well as the joint variable. So, you need to have all of the data available to run the hour 90 percent of the time to meet the requirement, but has to be done on a quarterly basis.

Appendix W also recommends in the Section on Site Specific Data that after validated retrieval requirements have been met, hours in the record having missing data should be treated according to an established data substitution protocol provided that data from an adequately representative alternative site are available. So, to add some emphasis there and I will repeat it again -- so that I think is a very important phrase which fits right into -- well, what are we going to do about missing ASOS data? So, most of the data that is missing is due to missing winds either due to calm winds or variable winds, so wind data is probably the worse thing. So we just kind of stumbled on this one-minute ASOS data archive that NCDC had been archiving for a while -- so, they have archived its two-minute average wind speed direction reported every minute for beginning in 2000 this one-minute AR -- this one-minute ASOS wind data was available for all of the major NWS sites all of the way up to the present. The secondary stations data became available in, I think, March 2005, but we now have five years of data for that as well. So, it fits very neatly into Section 3, 3, 2, (C), since it comes from the same site and instrument. So, it has definitely got to be a representative alternative site. It is the same site.

So, we think that one-minute ASOS wind data clearly as representative as a standard data, but the standard data is based on a single two-minute value reported sometime before the hour and also reported to the nearest knot, but also truncated to the whole knot as we found later. And the wind directions are reported to the nearest ten degrees. Whereas, the hourly average winds based on one-minute data generated by AERMINUTE actually more appropriate inputs to AERMOD, we think. AERMOD uses a 1-hour time step, so you actually have hourly average and wind speed direction, and eliminates the need to randomize the wind directions.

So, we haven't stated this on paper yet. We have certainly discussed it with the regional offices and so on, but we recommend that AERMINUTE should routinely be used to supplement the standard airport data with hourly average winds based on the one-minute ASOS data when it is available. Again, now it should be available for just about any station. So, when this is applied for the Birmingham, Alabama 2010 example, it reduces the number of calms from 32 percent to 1.2 percent, and the number of variables from 4 percent to 1 percent. That is a pretty significant change. So, again, Appendix W doesn't establish a minimum requirement for daily completeness for NWS data, but we think the 90 percent joint capture by quarter is certainly a useful benchmark, so we would suggest if the NWS data completeness is less than 90 percent by quarter with the use of AERMINUTE, then the representativeness of that data may be suspect and alternative sources maybe should be considered for, you know, if you can substitute from representative data this -- then that is appropriate as well, but you are not required to achieve a 100 percent data completeness as you had to with ISC.

So, I am going to show some examples for Birmingham. This is a plot of wind speed versus wind direction for 2010 using the one-minute winds, and sort of see quite a bull's-eye down there -- pretty low wind speeds, half meter to a meter per second. It is sort of a lull, you know, stable light wind drainage flow that occurs near the airport, which we saw in an earlier study. This is what you would get without AERMINUTE. So, you have discrete speeds because the winds are reported in whole knots. Since any wind below three knots is considered a calm under METAR and the fact that the winds are actually truncated to three to whole knots, the minimum speed that you would get without one-minute data would be about 1.8 meters per second. But it does kind of pick up a similar pattern overall, but a lot less detail. But actually, you know, the actual raw data has wind directions to the nearest ten degrees, so that's what the raw data looks like without AERMINUTE.

And once again, it is sort of similar, but not quite the same. So that is frequency of calms by hour of day -- so, it shows that even though 32 percent is a lot, for the nighttime hours, it is actually more like -- well, here is the percentage -- it is more like 50 percent during the night, so if you had a source that only operated between noon and five p.m., actually the data might be pretty representative. But if it is operating all of the time, then there is some serious concerns.

So, we know that there are some concerns and issues about use of low wind speeds near (Inaudible) for 1-minute data, and we will talk about those in other presentations, but we also note Appendix W does state that measured site specific data less than a meter per second, but higher than this threshold of the instrument, should be set to one meter per second for steady state improved models, but the same section goes on to say "but not for AERMOD" because that point has been raised.

I have 10:15, right -- total. But, I'll talk faster -- Okay, so we are just time managing here, which would be difficult with me, but anyway -- so -- but since the alternative to the use of airport data under Appendix W is to collect site specific data, and since the guidance regarding site specific data does not require wind speed thresholds from less than half a meter per second, we believe that it is reasonable and appropriate to allow users to apply a threshold of half meter per second to hourly average winds to arrive for one-minute data. It might not make everybody happy, but we think that that is a reasonable and appropriate thing to allow, and we have a pending update to AERMET, which is almost done -- hoped it would be released, but hopefully very soon, that includes an option to specify a wind speed threshold for a one-minute ASOS wind data in Stage 3. In such that hours -- any hour where the average wind speed from AERMINUTE was less than the threshold, after being adjusted for the truncation, would be considered a calm. And so this is what it would look like with that threshold. So, it just kind of skims stuff off at the bottom, but still captures a lot of the information that was added with the use of the one-minute data. So, that is with and without the threshold. So, that's one of the pending clarification memos, the other one -- It has to do with how the EPA formula height has been implemented in the model as the criterion for whether downwash effects should be applied. It is something that AERMOD inherited from ISC -- all previous models, but prior to Version 11059, the AERMOD model ignored building downwash if the stack height was greater than or equal to the EPA formula height, which was again consistent with all previous versions of AERMOD before PRIME was incorporated in previous versions of ISC and ISC-PRIME, but significant discontinuities and concentrations had been reported for stack heights that straddled that EPA formula height -- even by, you know, .1 meters. In fact, there is one case that was eight orders of magnitude difference for with maybe a .1 meter per second change in stack height.

So, those significant discontinuities didn't occur before PRIME or if they were -- they were less significant. This issue actually came up when ISC-PRIME was originally proposed by EPA to replace their ISC for applications where downwash was important. At the 7th Modeling Conference in 2000, the AB-3 Committee actually recommended that EPA modify

ISC-PRIME to do exactly what we did, AERMOD, to eliminate those discontinuities. EPA's response at the time was that current implementation was requirement under GEP's stack height regs promulgated under Section 123 of the Clean Air Act. And that was sort of -- sort of the -- I don't want to say "knee- jerk response," but certainly the widely held belief. But the magnitude of these discontinuities kind of finally prompted reassessment of that decision, and that reassessment has concluded that AERMOD should be modified to remove this criterion for ignoring downwash influences. And that change was finally implemented with Version 11059.

So GEP stack height regs define GEP height as the greater of 65 meters, the de minimus height or the EPA formula height, that one or the older one, the grandfathered, or a height determined by fluid modeling or field stay demonstration. So, first, the formula height doesn't even apply for stacks below 65 meters based on the definition. But the criterion for determining GP height through fluid modeling or field study is a height needed to avoid excessive concentrations, which are defined as "where downwash influences or an increased concentration is at least 40 percent compared to no downwash." So if you go through and determine GEP height for your source, you have already shown that that is the height you need to avoid excessive concentrations, but excessive concentrations are at least 40 percent. So, I am not aware of anywhere else in the Clean Air Act where we are willing to discount your results by 40 percent. I mean a lot of people might like to be able to do that, but to ignore downwash for stacks that are at or above the EPA formula height for GEP or GEP height itself, is ignoring at least 40 percent increase in concentration.

So, we think that is inappropriate and it is certainly not supported by the regulations, so -- and the regulations, as I said, provide no basis or justification for ignoring at least a 40 percent increase in concentration due to downwash -- which is the criterion. So, before PRIME, the vertical extent of the wake was actually formulated pretty much consistent with the formula heights so there was little, if any, discontinuity for stacks straddling the height. But, with PRIME, the vertical extent of wake influences is significantly higher than the formula height in some cases and there is plenty of data to support the fact that downwash influences can be significant for stacks above the EPA formula height -- this cites one in 1993 by Roger Thompson that the EPA fluid modeling facility -- and he actually makes that point that the formula is not adequate to define that height. But, even going back further, the technical support document for the GEP stack height regs has a figure that shows wake heights, so that is the formula height line right there. But, most of the data points are actually higher than that. So the wake height is mostly higher than that and, in fact, the notice of proposed rule making for the 1985 GEP stack height regs actually states that "EPA has found that the formula represents not an average, but a lower limit of the height needed to avoid a 40 percent increase in pollutant concentrations." So, rather than being distributed uniformly, the height needed to limit impact of downwash to 40 percent increase tends to be skewed towards greater than formula height. So, the formula height itself is actually a conservative estimate of the height needed to avoid excessive concentrations -- i.e., at least 40 percent. So that means that the EPA formula height impacts are usually greater than the 40 percent increase. Yet, from the GEP stack height perspective, the purpose of the GEP stack height regs is to limit the credit you can take due to downwash and setting your emission limit -- or the credit you can take for raising your stack and setting your emission limit. So, ignoring downwash effects for a stack of EPA formula height would essentially allow a source to take a higher limit, emission limit, than they would otherwise be able to take if downwash influences were included. And that is completely at cross purposes to the GEP stack height regs. So, we believe that the technical evidence is very clear and non- controversial. The downwash effects can significantly increase concentrations above formula height -- that ignoring downwash effect influences would actually go counter to the purpose of the GEP stack height regs and although we haven't issued the memo yet, we have consulted with Office of General Counsel and they have fully concurred with this assessment regarding EPA formula height.

But, again, this issue matured with time and, more recently, come to the realization that the -- that we have reassessed the appropriateness of the 5L limit -- the distance limit on the structure influence zone for buildings incorporated in BPIPPRM. Again, this goes back to GEP stack height regs, define which building or structures you can account for in setting your GEP -- your credible GEP height -- and there you can include nearby structures and "nearby" is defined as "those structures that are less than five times the lesser of the height or width," so within 5L as the distance limits, so in GEP stack height regs, if you have a building that is 6L from your stack, you can't account for that building in justifying a higher stack height to avoid downwash influences. It doesn't mean that this 6L building is not going to cause downwash influences. But again, the data are very clear -- buildings can influence concentrations significantly beyond a distance of 5L. But that is incorporated in BPIPPRM as a hard line, any building beyond that is ignored, and we don't think that's appropriate either, so that will be documented more fully in this memo.

So, again, it is similar to the formula height issue only in the lateral instead of the vertical direction. So, there is a summary of the key points, but the disclaimer -- the GEP stack height regs are very complex and this presentation is not intended to fully address the issues that may arise in applying these regulations to specific cases, but -- this is our assessment of that important issue, and -- how much time do I have -- and that is where?

Okay, this will be an air modeling update and a very fast one -- so, AERMOD, we had a few major updates since the last modeling conference -- 9, 09, 292 -- a lot of them have dealt with sort of --

clean up the model, fixing it, but a lot of them have been motivated by the new hourly NO2 and SO2 NAAQS including option to more fully support those standards. That has been a big focus -- certainly, the tier three options that are in there, there have been some bugs there that needed to be fixed. There was what we call a "formulation bug fix," I guess, an issue that AERMIC was aware of before it was promulgated, that the urban option AERMOD enhances turbulence during nighttime stable hours to account for the urban heat island effect. But, as soon as it turns convective in the morning, all of that enhanced turbulence goes away -- at least based on what the model had thought. So, it is an issue that actually came up in applying the model for the NO2 risk and exposure assessment in Atlanta and where the MOBILE source were calling fairly high concentrations for the first convective hour, and so we have fixed that in the model, we have shown -- prior to evaluation results -- so, this is Indianapolis tall stack elevated source -- so this is the observed -- no, this is the observed is the green -- this is what the model produces with the fix -- this is a particular day -- distance concentration by distance for the first convective hour, and the original previous version predicted that because it ignored, you know, or enhanced turbulence for the urban need island disappeared. So, there is another example that shows much better agreement.

This is for the Atlanta Risk and Exposure Assessment, these were low level sources, it kind of goes the other way -- here is an example of a peak value -- hourly value that was influenced by this issue and after the fix, you are down here, and so it significantly reduced those outliers that overestimated impacts due to this concern. There's minor updates come along and buck fixes to the max D contribution option. AERMOD, again same thing -- a lot of infrastructure, trying to clean it up -- make the air reporting better, but also allow for support of the one-minute ASOS data. Let's see -- you know, the operatives, some changes were made there to give more flexibility that may have implications outside the U.S. more so, but let's see -- AERMAP, really there weren't a lot of big changes other than, you know, supporting newer data formats, the net data in addition to DEM data, and so on. For the future plan priorities, we would like to get a point line source option in AERMOD. This has come up as an issue a number of times where a source maybe has a blunt line as part of it, but that is not all they have, so what do they want to do -- you know, do you run BPIP and AERMOD and combine the results where you are using different meteorologies. So, we would like to try to address that eventually and possibly appoint areas for its option -- we are looking at the NOx -- you know two options, especially PVMRM, we will be talking about that more based on some work that API has been doing on that. What I would like to do is develop a MAXDCONT event processing option, so you didn't have to do it as part of an internal post process thing, that would give a little bit more flexibility. And AERMET, we've got a pending release that has a couple bug fixes -- more the HUSWO wind probably not that important because it may only happen if the day has been reformatted to HUSWO, the cloud cover -- ASOS's cloud covers are being misinterpreted. Currently, a bigger issue is issue with the convected mixing height calculation that has been kind of out there for a while, we finally worked through and resolved that -- and there will be some changes to the convective mixing heights. We have redone some of the field study evaluations, not all of them, but overall, it doesn't seem to have that much impact on model performance, but we are going to pursue and document that more fully. And then, as I mentioned earlier, we are adding an Option Stage 3 to for the users specified by a threshold for the one-minute ASOS wind data. And, we would like to continue to try to pursue the use of met inputs derived from prognostic models with development of the MMIFTOOL. I think maybe we will -- and some new staff, maybe we will be able to make some further progress there, and we also need to update and finalize the APTI Air Pollution Training Institute, advanced course in modeling to reflect AERMOD. So, almost --

MR. THURMAN: Okay, we will briefly go over AERSCREN, the status and update. It has been released since the 9th Modeling Conference. I just want to acknowledge Jim Haywood from Michigan DEQ for doing a lot of work on AERSCREEN before I arrived at EPA, and then I inherited it. Just a brief release history. A Beta version was released in August of 2010 when we allowed the public to comment -- there was a 30-day comment period to report bugs. Comments and suggested changes -- March 11th of 2011, we released the -- what we called a "final version" that incorporated bug fixes and suggestions from the modeling community. And then a week later, found a bug that didn't pick up on before related to complex terrain processing, and then a couple of months later, we had to modify our screen to read "output from error map" for source elevations that had the 12 character source ID that was done for AERMAP and AERMOD, and also corrected a minor bug in a subroutine that reads the input file.

Roger touched on AERSCREEN's status as the EPA recommended screening model. We did release the clarification memo in April of 2011 -- that should be 2011 -- recommending AERSCREEN model and, as you know, SCREEN3 has been the recommended model. Like Roger said, the Preamble mentions AERSCREEN, it was supposed to have been out in Fall 2005, we only missed it by about a few months. So, the Preamble states "AERSCREEN would be the recommended model" -- like -- and also since AERSCREEN is based on AERMOD, the EPA preferred near-field dispersion model, we feel it is appropriate to use AERSCREEN, whereas SCREEN3 is based on ISC and subject to the same limitations as ISC.

Just some changes since the beta release, this is Version 11126, the latest version that is out there. There is more QA of the inputs. You can see the model change bulletin number 1 on the screen for that. Make sure you don't put letters in where you should have numbers, you know -- AERSCREEN won't crash, it won't just abort, it will stop and tell you there is something wrong. The probe distance is now entered in meters instead of kilometers. When the beta version went out, people were putting in 50,000 meters for 50 kilometers and AERSCREEN thought it was 50,000 kilometers. So, you were going up to the moon or something.

We also changed the receptor spacing methodology. We used -- now you can use the domain, XY keyword added to the AERMAP processing part, that is so you don't have to use the whole NED file or DEM file, or whatever elevation file you are using -- it will speed up the processing. Basically, that is 1.1 times the probe distance. You can also specify the ten discrete distances for receptors in addition to the regulator space receptors -- this would be if you had -- you were running AERSCREEN location, you may want to have a distance from a source to a school or, you know, a subdivision, or something, you could add the distances in. Right now, that is not direction depended, it would put those distances in for all directions. And one thing we were actually thinking about was adding that, maybe a direction dependent to that.

Also, corrected a bug related to receptor placement for area sources, and that did impact the maximum concentration estimates from

AERSCREEN, so we corrected that.

Per suggestions from the user community, you can specify an output file name other than the default AERSCREEN.OUT. If you are doing sensitivity test on a source, you know, checking meteorology or no downwash versus downwash, or controls, no controls -- AERSCREEN will use that -- uses the file prefix for the maximum concentration file, that's the file that has maximum concentration by distance. And it will also rename your new AERSCREEN input file using that naming convention in the AERSCREEN log file. So, you will have this whole set of files specific to that particular AERSCREEN run.

Also, we added the capability for AERSCREEN and model NOx to enter to a conversion using PVMRM or OLM. The user would specify the in-stack ratio and a representative ozone concentration with the units of PPB, PPM or micrograms per meter cubed. It uses the fall equilibrium ratio of .9, so you don't enter that. If the necessary executable, such as AERMOD, MAKEMET, AERMAP and BPIPPRM are not in the current working directory, or wherever you're running AERSCREEN, before AERSCREEN would just stop and tell you they couldn't find the executables, now AERSCREEN will ask you where those are and copy them over. And also AERSCREEN checks that the BPIP input file has the correct process flag, the PRIME flag, and only one stack. This is if you are using an existing BPIP input file for, you know, complicated building geometry. So, a lot of the changes made were just to do a lot more QA so AERSCREEN doesn't just crash and you lose all of your inputs.

Just a quick word on AERSCREEN and the new 1-hour NAAQS, you could use it to screen sources to determine inclusion or exclusion in refined modeling. It is conservative. It outputs the max 1-hour concentration, but not the design value. So, if the source exceeds the NAAQS level with AERSCREEN, that doesn't necessarily mean it is going to violate the NAAQS when a design value -- you should probably just consider including the refined modeling, and you may also want to use it to compare results using surface characteristics from your met station that you will use for refined modeling and the surface characteristics from the source.

Just some brief word on future modifications, we have talked about maybe allowing a user to input their own receptor network -- maybe an existing AERMAP output file so you don't have to run AERMAP. We are going to look into that, so what does that mean to run AERSCREEN for a grid versus, you know, a straight line distance? Also, I have been toying with the idea of modifying the input file to make it easier to add variables. Right here is the current file structure -- you know, each line represents a -- you know, a different pathway and if you want to add variables, it gets a little difficult to keep adding line -- adding data to the end of the line, the line gets longer and longer. So, I thought about maybe changing the file structure to like a keyword that's like in AERMOD now. This is just an example, you know each line will be a different keyword and variables and that way in the future, as we modify your screen, it will be easier to update. If we were to go this route, AERSCREEN would be able to read the old file structure and this new file structure, so you wouldn't have to necessarily change your files. So, that is where AERSCREEN is and we have questions later, and I think we are back on track with the schedule.

Oh, and I also want to acknowledge Tom Baker in our group, he did a lot of work for the SO2 NAAQS and with AERSCREEN. We did some screen of sources to determine if, you know, what kind of emission thresholds would give us problems. So, he has done a lot of work with that with me and he actually found one of the bugs related to terrain processing.

MR. BRIDGERS: Well, somehow we ended up five minutes early. So Roger, did you want to come back and say anything about any of the clarifications? So, let's go ahead and take our break and I just conferred with Tyler, I say -- let's go ahead and take it until 10:30, that will give us some time for some cross talk, and then we will start right back up at 10:30. Thank you, guys.

(WHEREUPON, a break was held from 10:10 a.m. to 10:32 a.m.)

MR. BRIDGERS: Okay, as everyone takes their seats, I am going to go ahead and introduce James Thurman, and he is going to give an update on AERMINUTE.

MR. THURMAN: Okay, I am going to go ahead and get started. I am talking about AERMINUTE. This presentation will just go over how AERMINUTE works. It won't get into low wind speed issues or anything. First thing I want to do is acknowledge the AERMOD Implementation Work Group, especially the meteorology subgroup chaired by Alan Dresser of New Jersey and Joe Simms formerly of Alabama, who is now enjoying retirement. They were a big part of the development of this program, so I just want to thank them for that. Alan wrote out the first methodology for the program, and we started off from that.

So, basically, what is the purpose of AERMINUTE? Is to calculate hourly average winds from the two minute ASOS winds. These are the rolling two minute averages reported every minute, and those are from the...what they called the 6405 format files. In AERMET, you would replace the standard hourly observation with an AERMINUTE hourly average wind unless the AERMINUTE output is calm or missing so there is no substitution. If you have on-site data, that still takes precedence. The purpose of the program is to reduce the number of calms in variable winds output from AERMET due to the METAR coating and the introduction of the ASOS observation system that Roger talked about. Basically, the program is to reclaim data that was lost due to those...the METAR code, and that would make the station more representative of an area. The purpose of the AERMINUTE is not to introduce conservatism in a model, but like I said, reclaim lost data. Just in a METAR code, how it calms and variable winds reported...calm is a wind speed less than three knots. Variable wind, the wind speed is up to six knots, and the wind direction varies by more than 60 degrees in a two minute average. So, the wind speed would be there, but the wind direction is reported as missing in the AERMET output, and obviously, AERMOD cannot calculate hourly concentrations for hours with calm or variable winds. Either you don't have a wind speed or you don't have a wind direction, and usually those light wind conditions are going to be those of most concern for the new, one-hour NAAQS.

Just a release history, the initial version was released in February 2011, 11059, that was released at the same time as those versions of AERMOD and AERMET. We released a new version in December to modify the QA routines to account for newly discovered file formatting issues. And, speaking of issues, those are the data file formats. On the NCDC website for the 6405 files, there is a description of the file format...they describe a format, but obviously, they didn't follow it. They do not fit that regular format, and it varies from station to station and year to year, and from within the files themselves.

Another issue is that winds were reported in whole knots, so they rounded...you know if they are truncated or rounded to whole knots...so that is an issue as well. Here is an example of a file, this is for RDU, back in 2003...the string of characters that starts with RDU, that is the date and time...it gives the time in local time, as well as Greenwich Mean Time...the program doesn't use the Greenwich Mean Time, it uses the local time. And then, a string of columns, these are extinction co-efficients, then the wind direction, wind speed for the two minutes, and then the 30 and the 5 will be the gust wind direction and speed. So, if you look, that is the wind direction, that is the wind speed in knots, but then you see these in the red rectangles, the file does not fit the regular format. If you didn't try to do any kind of QA on the file, you would see a wind...you would think that this two would be a wind direction, and you would have a wind speed at 648 knots, which I guess if you are on Jupiter, that is true. But, actually, what that is, it looks like they have tried to jam another observation in to the file, so I don't know how they do that...what program, but. Then, you look at these other ones...this one is kind of offset, it is not in the right columns, so the date has been shifted over, and then this last one is kind of similar to this one up here with the two. It looks like they have tried to jam in a record. So, that was a lot of the problem with writing the program was actually just trying to read these files, and get the formats, and try to get something useful out of them when they are not in a clean format. So, the program does a very...I think it is ten steps of QA on the files.

These are the inputs that go into the AERMET input file, when you execute AERMINUTE, it asks you for the name of the input file that controls the processing. This is that file. The start end key word, that is just the start month and start year and end month and end year. The next one is the IFW Group, this is the station part of ice free winds group, and I will get into that. For this example, we are saying, "yes," so you put a "Y." Then you put in the start month, day, and then year of when it would become part of the ice free winds group. And I will get into that in a minute. The data files starting key word, "data key word," and "data file finish," let AERMINUTE know these are the two-minute winds files to read, and these are in a 6405 format file. You can have files outside of the data period you are processing, they will just, you know, ignore them. And also, they don't have to be in order. You could December 2005 first followed by 2000...March of 2005. The program doesn't have to have them in order.

The next is the surf data. This is the optional list of the ISHD files to use for data comparisons. It doesn't effect the hourly averaging in

AERMINUTE, it is just the compare the minutes in the 6405 files to the standard observations that are in the ISHD file, and right now it only reads ISHD data, not like HUSWO or SAMSON data.

And, finally, the hour files, the hour file is the file used by AERMET and the outputs in local standard time. The SUM file is a summary file that lists for each hour of the data period how many minutes were read in, how many are calm, how many even minutes were used, how many odd minutes were used, MIN, MAX and average wind speed and wind direction. Then, the COMP file if you are going to compare it to the standard ISHD file, it would list that output of comparison of minute by minute output. There is also three other files of output called "Good Records.DAT and Check Records.DAT, those are just repeats of the data that is in the data files. The good records are the ones that are used in the hourly averages. Check records are those files...those records that they look like they could be valid, but they are suspicious. They don't quite fit the format...but they are not used, and then the bad record files are just, you know, the bad records, and you can usually tell they are really bad. So, actually, you could rerun the program with the good records file after renaming it, and you will get the same output. And the check records file, if you look at that data and you think it is okay, but it just needs to be shifted over like a column or two, you can do that...rename it, and rerun it with the good records file, and you know, get more output.

Now, the ice free winds group key word, beginning in I think around 2003, the weather service began replacing cup and vain anemometers with the sonic anemometers at the NWS and FAA sites. Basically, no moving parts, they say "ice free," but I have heard that birds like to use them to make nests...it makes a good nest. The commission date of the sonic anemometer at a stations input for AERMINUTE, it determines how AERMINUTE is going to treat winds less than two knots. So, when you are running AERMINUTE, if the station has become part of the ice free winds group before or during the data period you are processing, you would put a "OY," and then the commission date on that line...same line. If it is not part of the group during the data period being processed, you can enter an "N" for no, and you don't have to put a date. However, if the commission date is after the data period, and the user enters a "Y" and the date, AERMINUTE will say, "okay, it is after this data period, I am going to change it to "NO." So, you could still put it in AERMINUTE and it would interpret it correctly, not worry about it.

So, how does AERMINUTE treat winds less than two knots? So, for observations before stations ice free wind commission date, or a station that is not part of the ice free winds group, as of October 2009, I don't think all of the stations had been converted over yet. That is the latest update I have seen. So, for those observations, their winds of zero or one knot, because it is whole knots, are reset to one knot. The wind speed will be used in the hourly average wind speed, but we won't use the wind direction in the hourly wind direction. And that observation is just flagged as a calm for bookkeeping purposes. Now, if for observations after a station's ice free wind commission date, all wind speeds are considered valid. There are not resetting of winds below two knots. So, zero and one are treated as zero and one, because AERMET will take care of that truncation issue that we have talked about. After a station's ice free wind commission date, you should see no calm hours in the AERMINUTE output.

Continuing with the treatment of winds, hourly winds are calculated from valid, calm, even minutes first, and then any non-overlapping odd minutes. And for a given hour, say one o'clock, it is going to use winds such as 12:02, 12:04, 12:06, et cetera...just the hour before. So, what it does, it gets all of the even minutes, and then it checks for any non-overlapping odd minutes that it could use. An hour is considered valid if it has at least two non-calm observations in the first half of the hour, or at least one non-calm observation in the last half of the hour. Now, you are using one observation now to represent an hour in standard days, so at least one in the last half an hour, still okay. Also, if the hour has more than 50 percent non-calm observations for the whole hour, an hourly wind will be calculated. Otherwise, the hour is going to be flagged as calm, and AERMINUTE output will have a zero wind speed and zero direction. And AERMET won't substitute that wind speed and direction for a standard observation.

If the hour does not meet those requirements of the...of these two requirements here, it is considered invalid, and no hourly winds are calculated. So, they will be set to missing in the AERMINUTE output. And here is just an example for Springfield, Vermont in 2006 to 2010, the pie chart on the left is if you don't have AERMINUTE data in the...and the right is with use AERMINUTE. So, you can see without AERMINUTE data, you have 51 percent calms and 10 percent missing wind data, and after incorporating AERMINUTE data, it goes down to three percent calm and four percent missing. So, we are reclaiming data, and this could help make this station be used, you know, considered representative. And, also the ice free winds commission date was November 7, 2005.

These are the wind class frequencies...blue, is without AERMINUTE and red is with AERMINUTE. As you can see, the calms go from over 50 percent down to less than ten. And the .5 to 2.1 with AERMINUTE almost corresponds to the same number. I don't know if this is the exact same hours or not, I would have to go back and check. And then as you see, as you increase wind speed, you know, they become more alike, and actually you get fewer higher wind speeds with AERMINUTE. And these are just NO2 design valued concentration ratios unpaired in space for this station for example...for a CO EGU, a pulp and paper facility, and a fuel oil turbine, these are from our AIWG work, and we will talk about AIWG tomorrow. But, these are just the ratios, design values with AERMINUTE divided by without AERMINUTE and green are rural, yellow would be urban...so, as you can see, we get quite a spread of ratios for NO2. And, we also...I think I used OLM with a constant background...ozone concentration for fuels from on the rural ratio are lower than urban, so you get more of a difference with urban in some cases. And then for SO2, the rural, or the ratios are pretty tight distribution...the tails are the men in MACHs, the box represents the 25th and 75th percentiles, the horizontal line through the box is the median, and then the red dot is like the average ratio. So, you get more of a spread with the urban option than you do with the rural, just for this station in particular. So, this is just an example of sensitivity for this particular station. You may not see this every single time, it depends on how much data was filled in. So, just some links of interest...the executable can be found on SCRAM, along with Source code in the User's Guide. The link to the monthly files are listed at NCDC FTP site. Their files are arranged by year, and they are named by the station call sign, and so it is monthly files, and important...most importantly, they are free. Then, also, there is a link to a PDF file that lists the ice free wind commission dates. That is as of October 2009, and I don't...haven't seen an update since then. And like I said, I think there are still a few stations that aren't listed in that list.

So, and I think that is it for AERMINUTE.

MR. BRODE: Okay, I think there is going to be somewhat of a common theme between James' presentation and the AERSURFACE update in terms of...I think of the issues we have been dealing with is sort of finding and being able to utilize new data resources, like the one- minute data, but at the same time dealing with problems and issues with those data. Like, the weird formats and things like that. In fact, the winds are truncated instead of rounded to whole knots, which apparently, they are in the process of maybe trying to sometime fix...so, we have heard, but we don't know how we are going to find out if they have fixed it for a given station. But apparently, the new...the latest update to the ASOS software is the last item on the list to fix it...was to correct that, so we are going to try to find out any way we can get information on that, but George made a point, and I saw it in the slides that actually with...with the AERMINUTE data, some of the peak winds actually disappear because the non ASOS one-minute data is a single two-minute average wind speed, and you will get some outliers on the high side that show up for particular two minute average, but of the hourly average quite often that is lower. So, this is the

AERSURFACE update...oh, is there something else we were going to say...so, this is a long presentation, but we will plow through it.

Just review the current air surface tool, and discuss some implementation issues with air surface, and there is quite a few of them. Talk about some efforts we have undertaken to try to validate air surface in terms of the surface roughness...estimates in particular and plans for enhancing it. Just to kind of review, AERMOD met data needs, AERMOD was designed explicitly to accept the same basic met inputs in terms of ISC in terms of National Weather Service and Upper Air data, and it was also designed to accept much more real but site-specific data, if available, including multiple levels of wind, and temperature, and turbulence. But, the more advanced boundary layer algorithms in AERMOD require user specified service characteristics...the albedo, sort of measure of reflectiveness of the surface. Bowen ratio, could have an indication of moisture, and surface roughness...those are the three inputs, and requirement for these inputs in the sensitivity of the model to service characteristics has been one of the main implementation issues with AERMOD that we have been working with.

So, AERSURFACE was developed as a tool to assist with determining service characteristics for input to AERMET as well as AERSCREEN, and the initial version, which is still the current version of AERSURFACE was released in January 2008. And the AERMOD implementation guide, which we haven't updated in a while, but it explicitly describes the methodology included in AERSURFACE for estimating surface roughness and so on. But, at this point, AERSURFACE is not considered part of the regulatory modeling system for AERMOD, unlike AERMET and AERMAP, so basically, you don't have to use AERSURFACE, it is a tool that we think is useful, and but it has some issues, but it is not a requirement. And part of that is due to the issues...limitations with the data that we have, and other issues and complexities that we...determining effective surface roughness is a technically challenging topic.

So, as I mentioned, the AERMOD implementation guide actually documents recommended method for estimating surface roughness in Section 3.1, and that method is what is implemented in AERSURFACE. I would point out this method is quite different from the method that was included in the AERMET users guide prior to the release of AERSURFACE, especially in terms of surface roughness. So, the AERMET user's guide actually suggested using a simple area weighted average of surface roughness within three kilometers of the measurement site. One ratio albedo, I think we are also three kilometers. So, it was a pretty big change when we released AERSURFACE to use something different. And what we have changed to was an inverse distance weighted geometric mean of the roughness values within a default radius of one kilometer of the measurement site, and that is another part is AERSURFACE...I mean, our recommendation is, that the surface roughness should be representative of the measurement site where the winds are collected, because the wind data and the surface roughness go into AERMET to determine the turbulence properties of the atmosphere. Bowen ratio and albedo are a little bit different. The calculation method is different. It is for a bowen ratio it is the gridded geometric mean of the gridden bowen ratio values across the ten by ten kilometer domain without any sector or distance dependent. Typically, that may be centered on the same location for surface roughness, the met tower, but the AERMOD implementation guide indicates that if the majority of sources are elevated releases, where those parameters may be more important, then it may be appropriate to determine bowen ratio and albedo for your application site. So, basically, surface roughness influences all types of sources, but it certainly is dominant for low level releases, peak concentrations for low level releases typically occur during stable conditions. Bowen ratio and albedo only influence the convective hours. So, they are not even going to come into play at all for those. So, for elevated releases, peak concentrations, typically occur during the day time due to convective conditions that bring the plume down, and so bowen ratio albedo play a more important role in those cases, and that is one of the reasons for that, you know, making that distinction. Right now, you would have to run AERSURFACE twice if you wanted to do that.

Current version supports the 1992 land cover data in LCD...land cover data has 21 land cover categories at a 30 meter horizontal resolution. There is a number of options. User can define the number of sectors and the widths within certain limits. Ask whether you want monthly, seasonal, or annual resolution of the surface characteristics. You know, if the moisture conditions for use with the bone ratio and so forth. One of the key things is the AERSURFACE ask at might an airport or not an airport, and there is a reason for that. This is a table of the 1992 land cover categories, and one of the categories we are going to talk about is, you know, for the developed you have low intensity, high intensity residential, and then commercial, industrial transportation is one category there. This is the look-up table that is incorporated in AERSURFACE for surface characteristics for roughness in particular, so for each of those categories, we have a representative surface roughness value based on five seasons. Everybody thinks there is four, but mid-summer with vegetation, autumn unharvested crop land, late autumn after harvest, and then winter with or without snow, and then winter with snow, and then spring. So, there is basically distinguished as being between autumn with and without...before and after harvest, but any way. This is an example of '92 data for North Carolina. Zoom in a little bit closer that Durham area, you can pick up the footprint o f the RDU Airport pretty clear. The orange is that...one of the categories is the urban recreational grass. The red category, that is the runways and so on. So, one of the issues is, we have uncertainties about the ASOS METAR location, that is a key input. You tell AERSURFACE where my METAR is, and then it has a one kil...it looks at a one kilometer radius around that to determine the surface roughness.

National Climatic Data Center has an Excel spreadsheet on their website with ASOS station locations, which is really nice, except for the fact that it is completely unreliable as far as the location. But, how we found out about that was there was a cyclone wind study that was done where...I don't know, grad students or somebody went to about 200 ASOS sites, took pictures of the met tower, estimated roughness of the around the met tower, and then reported some coordinates, which happened to be different than the others filed. Maybe quite different, in fact, the median difference between the NCDC's list and that list was about 500 meters. And where folks saying, that is not good. And at RDU, which I have actually been to, difference was about over two kilometers. So, we are looking at one kilometer radius by the met tower and the met tower location is off by two kilometers. That is not a good situation.

So, these are the stations in the ASOS wind study. There is the comparison, there is the difference there, and let's see...Orange Municipal Airport 1.3 kilometers, JFK 3.6 kilometers, 300 kilometers...there are a few that stick out like that, and that is where they were...you know, they had an error, it was actually three degrees off longitude or latitude. But any way, here are some ideas...we highlight this in the AERSURFACE Users Guide that that information may be unreliable. You should try to verify the tower location if you can. There is a number of different things you can do. NCDC does have station history for all of the ASOS sites...it includes aerial photos if you know how many times to click and where to click. It is called the "Multi-Network Meta Data System," but that is not always reliable...but, it might be, and actually shows the history. But, you can actually zoom in, and on Google Earth aerial photos, you might actually be able to identify the tower location if it is a high resolution thing, but there might be some other installations at the airport that look like a met tower, so you have to be careful about that. I am hoping over time, maybe state agencies will have compiled what they think are reliable information on this and share them, but on the ISHD data format, the you know, sort of standard data format we are working with actually has a station location in their coordinates, but that may not be reliable. In fact, it may vary depending on the type of observation. And we found for Reagan National Airport, on certain types of observation, it had the right coordinates, on others it didn't, so. So, these are the fun issues we have to deal with, so. One of the biggest issues with AERSURFACE and the land cover data is that commercial industrial transportation category, which includes the runway, the roadways around the airport, parking lots, parking decks, any kind of industrial complex nearby, or commercial buildings...including the Sears Tower...not to pick on that, but so that kind of spans the complete range of surface roughness in one category. And, we have no idea, you know, how do we distinguish between them other than looking at the site. That is a big issue, and that is a very important issue especially at airports. So, that is why we have this airport or non-airport option in AERSURFACE. And generally, you would want to say it is an airport, if you are using airport data, but there may be some exceptions. So, if you say "airport," we are going to assume a different weight and weight it more towards runways and roadways and less towards buildings and if it is non airport, we will skew it more towards buildings, but. Like I say, it would be nice if the data were a little bit more designed for our purposes. The 2001 land cover data is actually not any better, and in some ways worse, which we will see later.

Well, we will see a little bit right

here, so...and I was going to add another box there, so...the categories are different, that is one thing quite different. There is no urban recreational grass category, that sort of orange area around the runways at RDU that you saw...that is a nice category to have because we know it is low roughness, but it is not in there, so that area would show up as developed open space in 2001. So a little bit less vague, and so there is four developed categories. The only distinction is the percent impervious land cover. Open space less than 20 percent, low intensity 20 to 50, medium 50 to 80. High is over 80. So, we also don't have low intensity residential or high intensity residential. So, low intensity residential, we kind of assume it is buildings, and some trees, and maybe some grass. So, we don't know where, that is probably maybe in here, but it is just hard to tell. So, even at a runway from the grassy area next to the runway open space to partly on the runway. It is low intensity and if it is a wide enough runway, we will actually have some high intensity developed category, and then go back to low. So, just going back to the grass, across the runway to the grass, we could span all four categories. So, it is unfortunate, but we are doing the best we can to deal with it. So, that is one of the issues. Another issue is the temporal representativeness of the data, where right now we are only supporting 1992 land cover data. We hope to be able to support newer data very soon. But, if you are processing data from, you know, 2004 to 2009, or something...you know, it is a legitimate question whether '92 data land cover data is still representative. So, this actually was an issue that was highlighted in the Region 4 Model Clearinghouse memo regarding the non-default radius. And I don't know if you can see it, it was Bowling Green Airport, so there the met tower from 1993 sometime, and you can sort of see the outline and it may be a golf course starting to be built in there, and then you go to 2004, and you have got a completely built residential community with a golf course and all kinds of nice stuff that is within about 50 meters of the met tower. And, with '92 land cover data, none of that showed up. So, one of the things we have been looking at is a gust factor method. I will talk more about that later, but it uses a gust factor approach. You look at the ratio of the peak wind to the mean wind, as an indication of the level of turbulence in the atmosphere, and where Inga...I can't remember his first name, developed a method to estimate roughness from the distribution of those gust factors. So, again we had the one-minute data resource, so we are using it to supplement the very calm and variable winds, but we are also using it to estimate roughness because the one-minute data has two minute average wind speeds, and then the peak wind for two minutes. So, it has got two columns...the average speed and the peak. So, we actually can get that from the data, which has turned out to be pretty useful. So, this shows the results from AERSURFACE, which shows pretty low roughness towards the north, and if you look at...you know, if there is nothing there, that is actually the most open sector around the met tower, at least in '92, with the gust factor, it shows that is the highest roughness. So, it reflects...clearly reflects the influence of those land cover changes in the data.

Another issue that has shown up is sometimes the land cover categories are mis-classified in the data for a particular site, so users should really try to have a look at that and compare the land cover data, learn the categories, and then compare it to other information...aerial photos, or whatever to assess the representativeness of the land cover data. And Google Earth, again, may be an option because you can actually look at aerial photos for different times depending on what is available for that site. And here is an example for Albany, where much of the area around the airport was actually classified as low-intensity residential rather than what might be more appropriate the urban recreational grass. So, that is the aerial photo. Here is the met tower, one kilometer radius, so yes, that area kind of typical...you have the runway, and then you have this very open area, which looks like a nice grassy area. Here is th eland cover data, picks up a little of the oranges, the urban recreational grass, but that light pink, which kind of dominates that area, that is low intensity residential. So, that one theory at the time was that there must have been Lilliputians living at the airport in '92, they didn't show up on the Google Earth. So, if you ran with the '92 land cover data, you would get roughnesses up here about .2 to .25 meters for roughness. The gust factor actually...this thing is kind of losing its duct...shows that it significantly overestimates roughness for that site.

Let's see, Implementation Number 3, what are we on...one of the users had commented that some of the categories under the land cover we used an arithmetic mean average across different categories. Like, for example, low intensity residential has probably got some houses, which is buildings, maybe some trees, and then maybe some lawn, so some mix of those categories. And we have categories for trees and buildings and houses, so...but we use an arithmetic mean average, which they said is not consistent with what you do inside air surface, which is using a geometric mean...weighted geometric mean. And that was a legitimate comment. So, we revisited those, and we have actually made some adjustments to those tables, look-up tables for four categories...low intensity residential, the commercial industrial transportation and so on, and the new values tend to be slightly lower than the originals, but not a lot. But, we also adjusted the weighting that we used. So they were weighted, area weighted. But in doing that, I think the weights that we developed for the geometric mean values are actually more appropriate given the definition of the categories. So, these are the categories...the low intensity residential went from about .5 to .4 or so. Again, generally, slightly lower, and that's...those changes aren't in the version that is on the screen now, but they will be in a very soon to be released update.

So, another implementation issue as I mentioned, we went from what the AERMET User's Guide recommended, three kilometer area weighted averages, especially for roughness to the one kilometer distance. Some concerns have been expressed about making that revision, and the justification for the default one kilometer radius had been sort of questioned. And certainly, it was the...this issue was the issue that prompted the first model Clearinghouse action for AERMOD. So, this issue sort of highlights the need to kind of see what we do to validate AERSURFACE. How do we know if one kilometer radius is right or not. So, that is where the gust factor comes in, and that is what we have been doing some work on. Warringah published a paper, and BAMS, Bulletin of the American Meteorological Society in 1980 that...for estimating effective roughness based on gust factors. And what we have seen so far is that the gust factor results appear to be very reasonable based on what the site actually shows. You saw for the Bowling Green example, it very clearly picked up the influence of those land cover changes to the north, and they generally compare pretty well to AERSURFACE estimates when the land cover data going into AERSURFACE is, you know, pretty well defined. That there aren't issues there. You know, can't highlight the significant impact of temporal changes, may also highlight some issues with land cover definitions. For example, you saw that at Albany. You know, there was a pretty significant bias in the AERSURFACE results for Albany compared to the gust factor..well, that is because the land cover data were wrong. It may even flag cases where the tower location is in error. I have seen a couple like that. That is how the gust factor works...recommends two minute averages for winds greater than ten knots, and I also want to point out the met monitoring guidance, Section 663, actually recommends the recommended method for estimating effective roughness link is a single level gustiness. So, Sigma U, the wind speed fluctuation over the average speed relates to Zee naught, and recommends using the median value for winds over a half meter per second. And Warringah actually referred to the gust factor method as a poor man's version of this. So, what we are doing with the gust factor method is very consistent with recommendations...the recommended method to estimate roughness for site specific data.

So, again the one minute data lent themselves to this, and there are some issues there. One of the issues is one of the parameters U of T is the gust wave length, which is a function of the anemometer specs...the response time of the instrument and the sampling time. So, that is an issue we have been kind of working with is, you know, the response time of sonic is different than a non-sonic in an airport. So, that is going to affect it. But, the other change is before...for the non- sonic sites, the peak winds is a five second average...block five second average. The two minute averages are based out of those five second values. If it is sonic, then it uses a rolling three second average for the peak wind. So, it is a shorter averaging period, but it also is a rolling average, so it could...for a given two minute average wind speed, you could actually...the peak wind for that could actually reflect samples from outside that two minute period. So, that may tend to bias things a little bit higher for sonic, but RDU, as it turns out, is one of the better sites to sort of understand what is going on. You have got met tower there, you have got...you know, typical area of runway and grass, and then you have a very clear discontinuity with trees to the northwest. And then, there is even an issue with land cover change. This is I-540, which did not exist in '92, but does exist now, and shows up in the 2001 land cover. Again, that is the urban recreational grass category. That reddish is that, you know, commercial industrial transportation. So, it covers a lot of different things. This is the 2001 data for the same site, and you can see 540 showing up there as developed. But, you can see the developed open space...orange is developed open space, but then you just...hard to distinguish between grass and runway and building. There is some of the photos. I mentioned cyclone wind study...RDU was one of them. That's...if you are using any of those stations kind of on the east coast to south coast, then that is a very useful resource. It might help determine where the tower actually is based on that. Here are some of their preliminary results. A lot of lines there, but looking at the gust factor for each year from 2001 to 2008 compared to AERSURFACE estimates for '92 and 2001 data, that is a beta version. Overall, they kind of follow a pretty good trend. 2001 tends to underestimate a little bit for the peak winds, but the peak roughness is in the direction you would expect based on that tree line. But you notice that there is trees about just at one kilometer and beyond to the southeast, but you really don't see much showing up there in the gust factor data. So, it kind of confirms that one kilometer radius may not be that bad. This just shows the average gust factor...again, it matches '92 better. So, this is what we would get for RDU, that top line using the original method...which produced very high roughnesses over one meter for many sectors. And that was actually...the first version of AERSURFACE that we had developed internally actually included that method, and that is what we saw, and that is when I started to realize...gee, that doesn't make sense, you know, what is going on there? So, whereas, we are down at the gust factor data is...way down here. So, you would have to really assume a tremendous amount of bias in the gust factor estimates to believe that that is more appropriate. There is the three kilometer radius which brings in a lot more high roughness. How much time have I got? Two minutes, and then I have got AERMET after that. No problem.

Another interesting site is Atlanta. This is around 2000, showing the runways, there is the met tower, and then some trees and residential area pretty close by. That is the '92 land cover, so that is the urban recreational grass, and then the develop...you know, the transportation thing, and then there is light...low intentional residential, high intentional residential plus some trees. There is the 2001 land cover data, which you could sort of pick up the runways there, but the grass area is just the low intensity...developed open space. But, not sure what is going on there, so you can actually see the trees to the south there. So, the initial test was...let's see, looking at 2001, the 2000 gust factor to 2006 gust factor...the first two years...that is 2000, and that is 2001, show pretty significant increase in roughness towards the south, which makes sense with those trees down there. AERSURFACE with '92 data picks that up pretty well too, and then much lower on the other sectors. That is where the runways are. When I ran a beta version with 2001, it shows up down here...kind of missed that all together. First, I thought...okay, you know, what is going on because we know that at some point they got rid of the trees and put in a new runway. So, that certainly changed the roughness. So, is that why 2001 missed it or what? Well, so here is the land cover data for 2001, but you know, with 2001, we don't just have the land cover data, but we can actually take another slice through the same data and get a canopy file. So, this is just the percent canopy cover out of the same data set, and you notice this area just south of the met tower is that developed open space...well, it turns out there are a lot of trees there. So, what we discovered was that if you have developed open space, and it is let's say a golf course, the trees may not show up. So, we can't distinguish between a golf course, which has a lot of trees, and the grassy area next to the runway. That is why I say 2001 is not really any better and in some ways worse, but at least we have that...that may help. But, you know, there is certainly that temporal change...removing the trees, put in a runway, and this shows up in the average speeds by direction by year. So, yes, the lowest speeds for winds from the south which would kind of make sense because of all of that roughness. But you see a pretty clear trend for the wind and average wind speed to increase after that to about a meter per second difference, which is quite a bit when you are down in two to three meters a second...that is a pretty significant change wind speed, and that kind of highlights the point that if you...If you have the trees there, and you don't account for that...the fact, I mean the trees are there, means the wind speeds are lower. You get rid of the trees, the wind speed goes higher. So, there is this interaction between the roughness elements and the wind speed. If you run a high wind speed with a high roughness that is not representative, you are going to get maybe not appropriate results, or vice versa. So, it just kind of highlights that point.

So, what we want to do is try to evaluate AERSURFACE more thoroughly. Kind of mentioned the gust factor method, now this is the new effected...so, this is an issue that AERMIC talked about, so I can skip part of my next presentation. And, you know, given the issues of the data, but you know, how do we know one kilometer is the right radius? I mean it is a very complex process. They are probably site dependencies. There could be met dependencies, and so on. But, AERMIC, actually in response developed an alternative approach based on an internal boundary layer approach to...which we are calling the effective roughness method. And, it is based on what distance do you need to build the boundary layer up to the appropriate height at the measurement site to determine the effective roughness? And so it is related...instead of putting a radius into AERSURFACE, you would put in a measurement height. And it determines the boundary layer height based on that is the multiplier. And what we found is that the multiplier of six seems to be pretty reasonable, but it is pretty consistent with Warringah, another paper he wrote on this. He referred...suggested 60 meters as a roughness blending height. So, that seemed to be pretty good. So, here is the effective roughness method, I am not going to go into detail. But, it basically accounts for the influence of changes in land cover, changes in the boundary layer...an internal boundary layer development due to changes in land cover. And, so we want to take into account what the characteristics actually are at the site, and that sort of illustrates boundary layers.

So, what we do is we start at the met tower with this method, and we calculate the boundary layer...internal boundary layer growth out to the point where it reaches that reference height, which right now is six times the anemometer height. Well, we want to know what the roughness is for winds coming towards the tower, but...so, this is going to tend to weight land cover close to the tower more, because the boundary layer is still kind of low at that point. So, what we do is we would go to that point, and then we would turn around and go back the other way, and build the boundary layer towards the tower, which will tend to weight land cover further from the tower more, which is not necessarily ideal either. But we iterate that until we sort of get the outward radius/inward radius in about the same, and then what we do is we take the effective roughness each way and take the geometric mean, which seems to work pretty well. So, that is the current method that we have been working it with. Again, one of the issues in the gust factor is the wave length, and I sort of had an idea what the range might be depending on what type of instrument...But, you know documentation for the specs for ASOS instruments isn't all that clear, but you know, there is this difference between pre and post sonic, and how do we treat that? So, recently, thanks to Region 5, looked at Peoria Airport, which is the metric...what am I looking for...it was the key I was looking to sort of try to pin down U of T, because Peoria has some pretty clearly defined sector influences with the trees there. Peoria hasn't changed much over the last ten or so years. And, we also went to commission sonic in September 2006, we actually have at least five years of pre-sonic and five years of post-sonic data at a site that hasn't really changed much, that has some pretty clear roughness signals. So, based on those comparisons, I have sort of come to the point where our current recommendation would be 60 for a pre-sonic and 10 for post-sonic data. And this kind of shows that, so there is the pre-sonic data plotted year by year, compared to the pre-sonic average and post-sonic average. So there is pretty good consistency there. Then, you go the other way, and there is pretty good consistency there. So, I feel pretty good about that. Comparing it to the effective roughness methods, it is not too bad, but if you go back to RDU, so there is the gust factor range for RDU...again, it picks up the signal, but there is a little more noise. And then there is pre and post-sonic. There is not that much post-sonic...or, that is the post-sonic, so there is only a couple of years there, but there is some consistency, so this is the key point I am getting to. So, this compares the roughness estimates for RDU with the effective roughness method we just talked about...compared to the gust factor estimates, and it shows both 1992 land cover data plus the 2001 land cover data...hopefully, you can see those. And that actually shows pretty good. I mean, the north sector is a little bit complicated there...one thing is a lot fewer winds that come from the north at the airport, so the gust factor results are a little bit more scattered. But overall, that is pretty good agreement. 2001 and '92 land cover estimates matched up pretty well with each other and the gust factor . If we go back to the old method, with those slight adjustments, '92 still looks pretty good, but 2001, actually underestimates for that northwest sector. So, if we go back here, you can see the '92 data doesn't have the I-40/I-540 corridor...2001 does. The met tower is up around here somewhere. So, that little area is within one kilometer of the met tower.

So, what happened is, with 2001, going out to one kilometer, it picks up that area there, which if it is an airport site, it is going to assume it is low roughness. So, that introduces a biased underestimate the roughness for 2001 with the old way. But, with the effective roughness method, it actually doesn't go out that far...the effective roughness is just short of that, an so it actually matches up pretty well. So, that is very encouraging that this effective roughness method, you know, picks up some signals like that and seems to overall compare better to gust factor methods...or gust factor results.

So, let's see how much more time...Atlanta, is kind of an interesting one...so, there is the gust factor at different values of U of T. The blue one is kind of what we are targeting, and 2001, with the impervious and the canopy picks up part of it, but not this part. If you just run 2001, the ERM3.5 is sort of what we are on now. So, if we had used 2001 land cover data with the effective roughness method, but without the canopy file, it just misses the trees all together. So, bringing in the canopy layer sort of addresses that problem, but we have got this issue out here to the southeast, where there is actually some new buildings fairly nearby, and play a more important role there than the trees, and so there is the buildings. And if we go in and use the non-airport option for that...to skew things more toward the building, it actually brings it into much better agreement. So, this is encouraging. So, the plans are to first, get an update to the current version that has those Zee naught adjustments I talked about, also addresses some bugs in terms of the GeoTIFF file structure, better air handling there, and also addresses what has shown up in some cases...sensitivity to the distance of the tower location from the center of the pixel. So, that is sort of the near term release...hopefully, very, very soon. But we would like to plan to release a beta version of this effective roughness method, not necessarily to replace the other one, but as another option to get some more testing. There are still some issues that remained...what do I do if I have site specific data and my measurement height is 50 meters? Do I still go up six times that? There are some issues that we are looking in there...but, we also plan to release the gust factor tool as well once we clean it up a little bit, and make it a little bit more user friendly, and develop guidance on how to use it. It may not be a replacement for AERSURFACE, but it certainly could be from what we have seen...a useful supplement to AERSURFACE could identify issues with the land cover data, or as we have shown here, and it may actually be appropriate if...I mean one of the issues with using it in place of AERSURFACE is...I have yet to be able to see it pick up a seasonal signal, so if you have a site where there isn't much seasonal variation, then it actually may be appropriate to just use a gust factor if you have the one minute data as your basis.

There is other future plans which we have talked about for AERSURFACE that have been kind of on hold for a while being with all of these other issues, but we, you know, have discovered that the NED and SRTM that shuttle research or mission or whatever, that SRTM data reflects the top of the reflecting surface. So, it actually...if you have buildings, it shows the elevation of the top of the building. NED is supposed to reflect ground elevations. If you take the difference of elevation between the two, it actually can give you some idea of whether there is an obstacle there and what its height might be. So, it might allow us to distinguish between highly developed grid cells that are runways or buildings, but there are some difficulties and complexities...they no longer provide the SRTM data in the seamless server, where you get the

NED data. They moved it somewhere, I am not sure where. But, just a real quick example...for the airport, that is the NED data, you can sort of see the footprint of the airport there pretty clearly. The SRTM is a little fuzzier. If you run AERMAP on both of it, take the difference in elevation, you get...you know, a pattern there of some higher differences...not much difference here. You overlay that with the land cover, and it actually picks up the elevations, the trees that are there a little bit. It picks up the signal of the terminal buildings, which aren't that large. Another quick one is D.C..., you know it doesn't...not a lot of obvious differences between NED and SRTM here, but there is the land cover for DAC, that is the Washington Monument right there, and if you take the difference, it actually...you know, picks up the Washington Monument by doing that. So, that is a resource we still haven't been able to tap into due to other things, but we still hope to, and it may address some of the issues. So, there is the summary. How much time do we have?

I don't know whether anybody has any questions before we move to the next one. Oh, that is right...oh, I can use up that time, too...no, okay. I thought I would try...So, this is the AERMIC update.

It got a lot bigger than I thought it was going to be, but I will try to get to the highlights as quickly as possible. So, to get a little bit of history of AERMIC, and so on. So, basically AERMIC was developed as CMAS Regulatory Model Improvement Committee that was formed in 1991 to develop a replacement for ISCST, and AERMOD was the result of that. It only took 15 years, but once it was promulgated or close to promulgation, AERMIC kind of wasn't sure what its status was, but you know, in December 2006, we reconstituted it, indicating that we didn't see AERMOD's promulgation as the end of the line for AERMOD, that we want to continue to do what we can to improve it, and address needs, so a new committee was formed. Most of the previous members were included. I served as co-chair with Jeff Weil at NCAR and Vlad Isakov from ORD was not around at that time, so he was added. And we had a bunch of meetings, initially AERMIC was focused on urban formulations concerns about you know, you have to specify a population that is say, how bad the urban issue is. There is just some implementation issues that felt could be improved, but also recognized that there is a lot of overlap among issues in terms of the urban and the surface characteristics and met data, you know, and so on. If you have met data that represents the urban influences, how do you deal with that? But, we also started to recognize opportunities to address some of these by utilizing newly available data...like, the land cover data, the SRTM and NED differences, and so on.

So, in addition to...so, basically AERMIC sort of laid out some broader plans to try to move the modeling system forward. But there are some specific issues that came up, and you know, we have talked about low end conditions. We have gotten sort of thus far, but haven't been able to move it that much further...but that is an issue that we have looked at. It is an important issue that we want to, you know, refocus on. Line sources were some concerns there, spent some time on that. Again, AERMET got involved in developing the effective roughness method that I showed you, and we also talked about some of the issues related to building downwash, and some concerns about the building parameters coming out of the prime...coming out of BPIP to go under PRIME, especially for the elongated building at an angle to the wind...that is something that we had identified at the 9th modeling conference as a concern. And AERMIC also was involved in terms of the change we made to AERMOD to address the urban morning transition formulation bug fix. So, they provided some feedback on that. I'm not going to go through this in detail, but again, it is something that fits into broader longer term plans maybe that AERMIC had started to develop for AERMOD. But, since I showed you the airport, I am going to show you downtown Durham. So, there is the ballpark on the left NED data, there is the aerial photo, and there is the differences. So, it actually picks up some of the buildings downtown reasonably well. The ballpark shows up...it is a little roughness, but there has been a lot of changes down there now. So, again, we are going to try to do something with that. And, so AERMIC had talked about building on some of these things, and actually be able to use some of that information to make adjustments to the meteorology to the measurement site to the application site. So, we have some pretty ambitious plans. I wish we had made more progress on those since we last met, but they are still there. But, if we can do there...address a number of implementation issues, so...but like I say, down in the balance side, it is probably not going to make AERMOD any faster.

But, we...as far as downwash, that is more of an immediate concern right now, and talked about incorporating the building processing into the model, which would give some more options, and there is a number of issues with BPIP that we will talk about, and AERMIC talked about...developed some alternative approaches maybe to define them. And, talked about mobile sources...I am not going to spend too much time on that right now, and try to come up with a...one of the issues with AERMOD, though is that the horizontal meander algorithm within AERMOD is not applied to area sources. Although, it does for volume and point sources. So, we would like to sort of eliminate that inconsistency if we can. AERMIC is...has done some work toward that end. We are not quite there yet, but we hope to be...fix that at some point. So, building downwash, there are a number of issues that have come...were expressed at the last conference, more have come to light. But, the original criterion in the BPIP program before PRIME was to just pick the tier that influenced the stack, that had the highest GEP height, and that is still the main criterion in PRIME. And, but due to the fact that PRIME actually takes into account the location of the stack in relation to the building, while the degree of the building influence will depend on that. And the old model didn't know the difference. It assumed they were co-located. So, it was less of an issue there, but now, if you have a slightly smaller building but closer to the stack, that in most cases, could have more downwash influence, but right now BPIP PRIME is not going to pick that up. So, that is one of the biggest issues. There is also the...a number of issues here...how much time do we have? Yes...so, we sort of this split building phenomena...where we discovered if you split a long building in two, and put it in it's two halves, you could get lower concentrations because...first, it picks the tier with the highest GEP height...well, if I have two tiers with the same GEP height, it picks the one with the smaller width. Well, the split...the halves are going to be smaller within the fold, so it is going to pick one or the other, but since they are the same width, I think it picks the first one. So, that is an issue that we need to resolve...that still hasn't been resolved. And, if anything, with the way PRIME is formulated, it would probably be more important to...you should use the one with the larger width, but we haven't made that change yet, because there...it is a more complex issue than that, but the other problem is, if you actually...so, long narrow buildings, the projected building length could be much longer than the long wind fetch for some wind angles, and that has implications. The whole geometry of the cavity region and the wake are in relation to the projected buildings, so the cavity will be displaced further down wind than it really should be...could actually extend beyond the fence line when maybe it really shouldn't. So, there is just quite a few issues there. And, we also at the last modeling conference identified some concerns about the EBD approach to estimated building dimensions based on guidance, it was developed before AERMOD when PRIME came along that may not take into account these kinds of concerns. So, that was a subject we talked about earlier. Another issue is horizontal meander, which is part of AERMOD that is not actually incorporated within the PRIME. PRIME and AERMOD were kind of stitched together after they were proposed separately, and now...there is a long story there. So there is that something that has not been resolved yet. And PRIME does account for partial entrayment of the plume into the cavity, but not into the wake itself. That is still an all or nothing switch, and maybe...especially, if you have defective conditions with a lot of updraft and downdraft...maybe sort of a partial plume entrainment into the wake is something worth looking at. So, there is another couple of things, so AERMIC actually looked at this and is focusing on the elongated building issue, suggests it use...keeping the projected building width, because that is still what it is, but redefine an effective building length based on the footprint of the area of the building divided by the width. So, basically, it conserves the footprint or volume of the building. That was the recommendation that was made way back then. And then, even for a building on that idea, if you had a building that had maybe a tier or two rather than treat each tier separately, so that is another situation where you are using the highest EPA formula height as the criteria, you might have a Penthouse on a building that gets picked as the controlling structure, and it is going to ignore the rest of the building if that is the case. And the rest of the building may have far more influence, but it may be the Penthouse could be added in to develop and effect the building height. So, these are some ideas that AERMIC had developed. We have the issue that we talked about earlier about the 5L distance, and there are some other issues that have come up besides that, as far as structures should be combined in BPIP, one...a distance to a gap of less than L is defined as whether two structures should be combined. It looks like BPIP is actually used in the sort of minimum distance between actual distance between the two structures or tiers rather than the projected gap, and I think based on the GEP regs, that regs should be the projected gap. So, in going back to the split building rather than saying...well, use the building with...because with the split building it still combined the two, because there was no gap between them, so it looked at the combined building as a structure, but again, it was a larger width, so it wasn't picked. But if you step back and think about it, if I actually had two tiers that were like, really close but not the same building, if they are close enough to be combined, well, why would you want to...why would you care about, you know, one half versus the other half? I mean, if BPIP thinks they should be combined, that their influence is a combined phenomena, then you should only look at them as a combined structure. At least that is one opinion. So, that is something that we are considering. So, there is a lot of issues there, and given the range of issues, it is going to take some time to address them all. But, right now, we intend to focus on some of the simpler issues that maybe have easier fixes such as...you know, correct BPIP PRIME, to use a rejected gap between nearby structures to determine whether they could be combined or not. You know, modify it to ignore individual tiers when those individual tiers are deemed to be combined. Then, maybe incorporate some internal checks to flag if I have two tiers that are really close to each other, and they are almost the same height but not quite, well...maybe they should be treated as the same to avoid the issue where it picks the one with the higher height, and maybe develop some guidance on what kind of information to input to BPIP in those situations.

So, the structure influence zone is going to have to be revisited based on that reassessment of the 5L. That is going to take some time to sort that all out. And, we would like to evaluate these options to...especially effect the parameters, so we have some very preliminary results...the effective length...try to skim those as fast as I could. So, not a lot of data, but we used some data from a wind tunnel study that Alan Huber did...published in 1989, where he looked at elongated buildings at an angle to the wind, and we focused on a couple of examples, so...we looked at two where a stack is located at the downwind corner of the building that is twice as wide as is high, and so in the same building, but stacked at the center of the downwind...downwind center of the building. And, I'm going to compare some of these results. These are very preliminary at this point, but...and they have all been normalized to match at zero orientation where the effective length and projected length would be equal. So, the effective length takes into account the actual fetch along the building to some extent. So, that is the downwind corner of the building, and it ranged from rotated from -30 degrees to 60 degrees...so, for minus...the negative angles, there actually was a fetch cross ability in that the other angles were...it was on the corner. And then at the downwind center, same building, same stack, just moved to the center. So, at least that should be pretty symmetrical there. So, these results for the corner of the building, so, the blue line is extracted from the Huber paper, showing the concentration as a function of distance. Ground level concentrations at three building heights downwind. The red line is what AERMOD would predict with BPIP PRIME inputs. So, it certainly picks up that it is higher over here, but it is...that is kind of what we are looking at, is trying to eliminate that overestimation. With the effective lengths, it actually picks up that pattern and surprisingly well. So, that is encouraging.

This is the same situation, these are

the elevated receptors, and you know, it is...there is a lot of...kind of...interpretates of noise in here, but overall, it looks pretty reasonable. It does pick up this peak on this side better than BPIP PRIME does, but it also acknowledges that it is lower there. This is for the stack at the center of the building...again, you have got some symmetry there, and there is not as much, but with the BPIP...current BPIP inputs, you still do see some overestimation for that kind of elongated building at a larger angle. So, the effective length seems to mitigate that pretty well. So, also looked at Bowline, which one of the field studies we had, there is Bowline Power Plant, two stacks...and only two monitors, but it actually turned out to be a more appropriate example than I thought, because you have those two tall buildings, they kind of control things, and for most of the wind come along there, you know, they do get combined. That is where I realized that it wasn't combining them necessarily when it should, but that it is kind of an elongated building and angle to the wind. So, it was a better fit than I thought at first. So, these are some QQ plots, that's overall one hour QQ plot, all conditions both monitored, not too different, but a little bit lower with the effective roughness or effective length, a little bit better. That is a 24-hour average is again slightly better, lower...less lower prediction. If the Bowline point, the further monitor, again, matches up pretty well through the top part, but you start to see a little bit more difference at the closer end monitor, where they are pretty similar there, but you reduce some of the overestimation further down the distribution. But if you go by wind speed category at the closer monitor, you start to see more differences where the effective length does much better than the BPIP. Same thing here for high wind...low wind...no...yes, high wind unstable, and high wind stable. So, that is where the differences really show up, and using both the Cox-Tikvart protocol for evaluating the model, even though the differences overall aren't that difference in the rural highest concentration, for example...if you apply the method, it will still get a statistically significant difference, or statistically significant improvement in model performance, because the improvements are sort of very set clear and systematic. They are not kind of a random, and even using the BOOT program, there are statistics there, there is the confidence intervals on the BOOT statistics for the effective lengths, so better is appeared zero for actual bias there, so that is better. So, the fact that they don't overlap even with the BOOT program recognizes a statistically significant improvement in performance with the effective lengths. So, that is encouraging that some fairly simple changes to the building inputs could actually improve the modeling and reduce some of the overestimate that we are concerned about. So, there is...that is about it.

So, in the meantime we might...if you have just an elongated building by itself, maybe just develop a separate tool that could be used once we kind of finalize this to say...here is your alternative, and I guess the one point I want to make is...probably is good...is that Clearinghouse, in the past, has indicated that building parameterizations are source characterizations not alternative models, so that is a basis for using EBDs. So, it is a little bit different path, a little bit lower hurdles to use alternative building parameters to input to the model, than if you just change the model all together. So, I am hoping to try to make as many improvements as we can through modifying BPIP to address some of the concerns. Thank you.

MR. BRIDGERS: And, what we are going to do is for the question and answer session, everybody that spoke in the first session, we are going to sit up here at the table, and what I ask is, for those that do have questions, please come up and use one of the stand mikes...and again, identify yourself before you ask your question. And, Roger, can save his breath for a moment. Not all at once.

AUDIENCE MEMBER: Bob Paine at AECOM. I had a couple of comments. There is a lot of new material presented here, Roger, and hopefully you will have detailed documentation in addition to your presentation material.

MR. BRODE: Yes.

AUDIENCE MEMBER: Some of these building issues I would think are more than just a "bug fix," and I think they ought to be subject to public comment. And, would they change...for example, the creditable stack height that came out of the 1985 stack height rule? I am not sure, but maybe they would, but...and, what happens with stacks build...already built with the existing models? So, those are questions that come up.

MR. BRODE: Those are questions that come up, and we do intend to address...grand fathering in a general way in the clarification memo, I think...it should be for the standard grand fathering, is you really don't need to remodel unless you have to for some other reason. But, from my perspective, we are not changing anything in the GEP stack height regs as far as how you would determine the credible stack height and so on. We are just trying to improve the models ability to account for downwash influences appropriately.

AUDIENCE MEMBER: Just as a follow up, so you...if a stack is higher than the formula height, it seemed like you were inclined that you would have to model the downwash from the stack higher than the formula height?

MR. BRODE: Well, that is the whole point of the pending clarification memo is that our reassessment that it is inappropriate for the model to ignore downwash effects automatically for stacks that equal or exceed the formula height. There is no technical or policy basis for making that the first and only criterion. Now, just because it is higher than the formula height, it doesn't mean that there will or won't be downwash. Then, it would depend on what the...based on the input provided, there is a criterion within the PRIME algorithm that determines whether a particular plume for a particular source an hour will be influenced by downwash.

AUDIENCE MEMBER: Tony Sadar, Allegheny

County Health Department. Roger, on the gust factor method, can you comment on whether aircraft take-offs and landings effect, you know, the gust versus the average...especially with a metar two minute observations?

MR. BRODE: It is possible, but you know, it...I don't know that we could pick up a signal for that since...I mean they go by pretty fast...you know, rolling three second for the sonic gust or peak wind, but it is the median of the distribution of gust ratios, so yes, I mean I don't know that that would really influence the representativeness of the gust factor information that much...unless, it hit the tower, I guess...but...

AUDIENCE MEMBER: Larry Simmons of Energy & Environmental Management. It was nice to see that buoyant BLP may find its way into AERMOD, I think we talked about that pretty seriously back in 2000 at one of these meetings, and it is nice to see that is at the top of the list now for AERMOD. And I would...in that same vane of taking time to get things in the system, I was wondering...we had talked a while about Sigma Thetas coming out of AERMINUTE, and I was wondering if anybody has continued to think about that...of trying to squeeze that information out of the two minute wind direction data.

MR. BRODE: We have thought about that, and AERMIC even talked about that, and they didn't really present much. I had a case study recently that was very interesting, but it is a case study for a data set that I can't really talk about yet. But, that is something that we looked at, and I was a little encouraged by the results. I don't think it would be appropriate for pre-SONIC ASOS data most likely, but we also have talked about, and I looked at, you know, some sort of sub- hourly...if we have the full record of winds for the hour, maybe doing six ten-minute averages, for example, and in this particular case, it was very...produced a very interesting result, because the outliers in...I won't say too much...but the outliers...two outliers, in the mile to mile comparisons were cases where half of the hour it was blowing at the downwind monitor, the other half of the hour it was blowing at the upwind monitor. And, the model validation was based on the downwind modeled concentration versus the difference between the downwind monitor and upwind monitor. So, basically, they you know, when we...when I did...six, ten-minute averages, it actually reduced the bias to about a factor of five or six down to maybe twenty percent.

So, I mean there is a lot of issues, and questions, and complications there, but I think it is something that we are interested and looking at and seeing if it is something that makes sense. Now, I would point out that in that particular case with that particular field study to compare a model result at a particular monitor, you know, that was extremely important. Now, whether that phenomena is that important from a permitting context, maybe is less...I am sure it is less important, but it is it important enough to be critical is a little bit less clear.

MR. BRIDGERS: Any other questions?

AUDIENCE MEMBER: Steve Sherman, Indiana DEM. Theoretically, what if...I don't know of any particular example of this that I can imagine it happening, what if a source for say, one hour SO2 modeled above the standard, that is above GEP, with buildings in...but if with buildings off, it was below this one hour standard?

MR. BRODE: Then, I would say that downwash influences were contributing to the results.

AUDIENCE MEMBER: Okay.

MR. BRODE: I mean it is going to be a complex issue to work through...I mean one question that has come up is well...could we use the modeled concentrations to demonstrate what height we need to build the stack to avoid excessive concentrations. With...before the PRIME downwash algorithm mode I would say, clearly, no, absolutely not. I mean, the limitations of the old algorithms were at...just assume the stack was collocated with the building no matter what. I mean there were just a number of issues there. I think we are much closer to that being maybe a viable possibility, but it is...again, it is a complex...anything that touches on GEP stack height regulations, you know, has a lot of complexity associated with it. So, I don't know where that path will go forward, but I would mention that the stack height regs, if you want to demonstrate a credible GEP height that is different than the formula height, you do that through a fluid modeling or a field study demonstration that, that is the height you need to go to avoid excessive concentrations, which again is defined as 40 percent higher with the building than without. While I can understand the fluid modeling demonstration, but it is not clear to me how you would actually do a field study to demonstrate that where you can remove the building and see what you get, and then put it back in. I don't know, but...I mean, one idea may be we need to talk about is, well, what if I actually do a valid field study at my source that shows how good the downwash algorithms are for that source, could that kind of field study be used to justify the credible height based on the modeling? I mean you still include the downwash in the model when you get there, I mean because I mean GEP doesn't mean no downwash. It is very clear in the definition. So, I mean, again, if we could just slice 40 percent off all of the NAAQS, I am sure a lot of people in the room would be very happy, but...I don't think we can do that, so. So, it is something that we have talked about. I don't know where that path is going to lead yet, but it is certainly worth looking at.

AUDIENCE MEMBER: Mike Henderson with TRC. I have listened to the comments on the GEP formula height, and certainly, the one hour SO2 standard is going to raise some circumstances under which existing sources are going to be modeled and run into that conundrum that was just discussed. There is another aspect...my particular interest is, I appreciate the details of the AERSURFACE and Sigma Z and so forth, but or Zee, but the things that concern me greatly are those that involve discontinuities or previous points of predictions where certain assumptions were made that the GEP stack height being one of them, and the second being the minimum wind speed that is in the...in the dispersion calculation of concentration. And now that half a meter wind speeds are being used, one would think that the predictions are going to be larger for those cases, and I am specifically saying how much evaluation of the actual code in the model has been done in terms of how well it predicts for those low wind speeds, and I realize this may not be a short answer question, but that is a topic of concern to me.

MR. BRODE: Well, it is a topic of concern for me too, and I...there has been some work done, and I think we are going to hear about some of that later today. I mean, I would point out that low winds, stable conditions is probably the least ideal situation in which to conduct the field study. I mean usually you kind of look for cases where you know the wind is going, and it is going to hit the monitor or not. So, and given that you have very narrow plumes under those conditions, you know, a slight error in the wind direction that you input to the model, could completely miss the monitor when it actually hit it or vice versa. So I think that there is...it is something to keep in mind that I think there is some additional level of uncertainty in how you interpret the model to monitor comparisons, and that kind of an illogical condition. And, not to say that, you know, ignore all of it, but it is just something that needs to be kept in mind, so. I mean, there are some, you know, plans that we have looked at, and hope to pursue, I guess in terms of managing the evolution of the AERMOD model. It is now the promulgated model, so you know, we are going to have to walk very carefully as far as you know, changing the model formulation in a way that would require rule making. So, that is something that we have to be mindful of, and you know, we are being mindful of that. I didn't say, you don't go there, just the path forward in some of those issues is a little bit different than other issues that we are trying to address also.

MR. FOX: Well, and in that context, there is both the near term solutions through guidance and the like that can alleviate or remedy those situations, but then as we talked about here at this conference, getting information and doing the things necessary to inform any update to Appendix W would be something that we would need to do, and if when we plan to do that, then those would need to be done, you know, in the next three years or so to inform that...so that is one of the issues or items to think about in terms of the prioritization of those aspects of the formulation that would need to be revised or reviewed such that we could make those types of rule making changes.

AUDIENCE MEMBER: This is Qiguo Jing, from Breeze Trinity Consultants, I have two questions. First one is air model can be used up to 50 meters and how do you justify to the use the one dominion of AERMET over the two dominion of AERMOD especially over the unihomogenous service. The other question is, we are developing the parallel for your air model to speed up, however, some common agency prevented the use of, you know, the parallel modeling, my question is, is EPA in the future to disown, you know, kind of speed up thing to speed it up? Yes, you especially do the sensitivity study if you have a lot of sources and receptors.

MR. BRODE: Okay, I am not sure I understood your first question. As far as speeding it up, we would certainly like to speed it up. Right now I don't think it is our highest priority within our group given other issues that we are dealing with. I mean, I would also point out that there are less and more efficient ways to apply a model in terms of how dense the receptor grid you are using, and how many sources you have included, and things like that. But, and there are other third party, you know, parallel versions of AERMOD, and we have addressed the status of these proprietary versions of AERMOD in a clarification memo back in I forget when, but a few year's ago...so I mean, Appendix W does address the status of a model. If it is a preferred model that has been changed somehow, what its status is and we laid out what those requirements are, so I am hoping that is an issue that can be worked out between the applicant and the reviewing authority whether an adequate demonstration of equivalency has been provided, basically. But it is not something that we really want to have to get in the middle of.

AUDIENCE MEMBER: Kendall Necker from McVehil-Monnett and Associates. Is there any idea that we can use low wind speeds that you will not get in that hour and an receptor that is, that has the concentration will not be addressed, because in that hour it will not get there past, like three kilometers?

MR. BRODE: I guess the decision on which sources to include in a cumulative impact assessment is pretty complicated. It depends on, you know, the size of the source, characteristics of it...I mean, but I don't...you know, as far as saying that if the plume is not going to get to that receptor in an hour, then we should ignore it. I don't know that that is really a valid reason for ignoring it. We realize it is a steady state plume model. It has certain limitations, but the plume itself is not going to stop after an hour, it is going to keep going. Impacts need to be accounted for in some way, so...but, we certainly do understand and acknowledge that there are limitations of a steady state plume model, but we think it is still a very viable option for a wide range of applications.

MR. BRIDGERS: Tyler, I was going to make mention to the audience, I know that Roger had a lot of words on a lot of slides, and it was harder to see some of that at the back of the room, but all of the presentations from today will be posted this afternoon on the web, on the SCRAM website. So, you should be able to download it in your hotel room, or back wherever you are staying.

AUDIENCE MEMBER: George Schewe, with Trinity. What is the status of AERLINE?

MR. BRODE: Are you talking about United Airline or?

MR. FOX: That is a question for the Office of Research and Development, so they are still working on that. We have yet to see the most recent round of development and results from that, and so when they get to a point of testing and evaluating that, I am sure we will engage with them, and then consider that from a standpoint of how it can be brought into the AERMOD modeling system.

MR. BRIDGERS: I think we should break for lunch now. Real quick, if you think of questions during the lunch hour or what not, we also have another question and answer session coming up specific to the applications of AERMOD. Try to be back by 1:00, and if you are eating in the cafeteria, please note that we do recycle and compost, so pay attention when you are bringing your tray to the end.

(WHEREUPON, a lunch break was taken.)

MR. BRIDGERS: Thanks to everybody for making your way back in after lunch. We'll get started here in, like, a minute or two.

Well, such that we won't get too far off schedule, it looks like we've got critical mass. The others can filter in.

Hopefully, everybody was able to make it through the lunch line. It looked like it was pretty lengthy, but I've heard from a few that said things moved pretty quickly once you got into the cafeteria.

This afternoon, the first session deals

with applications of AERMOD. You've heard a lot of EPA folks talk over the morning, but now we have some invited presentations. First up, we have Ron Petersen and Ron, I'll just let you go ahead and grab your title.

MR. PETERSEN: Thank you, George.

I'm going to speak about the use of equivalent building dimensions in AERMOD and first, let me say that I'm presenting this on behalf of the Air and Waste Management Association AB3 Committee, who will also be presenting some more on Wednesday.

A kind of a brief outline, just give you a brief background on EBD, current status, kind of my take on it. Cases where the BPIP inputs clearly will not work and a review of the EPA evaluation of the past EBD study and then kind of what I see as a suggested path forward.

Basically, equivalent building dimensions, for those who aren't familiar with them, are the height, width, length, and position that are input into AERMOD in place of the BPIP dimensions when you need more accurate estimates for situations where BPIP clearly is not appropriate or will not work.

The guidance for doing these studies was originally developed when ISC was the preferred model and kind of the notorious Tikvart 1994 memorandum kind of summarize that, that guidance. And I must say that original guidance was developed in a collaborative fashion. Working with industry and EPA, we put together some guidelines on how to conduct those studies.

Several studies were conducted after that time using that original guidance for ISC applications, kind of a list of them there. Most of those studies, the results were approved. The very first study was actually done before the guidance was put out for Amoco and then, I think it was Cape Industries, was the one where the guidance was actually formalized.

Since that time, since AERMOD was the preferred model, there's been a couple, a few studies, conducted using the same guidance. Some have been approved. Morant. The recent memorandum talked about the Alcoa study which was not approved.

So, that's kind of a little bit of history on the situation.

Now, the current status in the EPA memorandum, Roger probably hit on some of this, but it says all past EPA guidance related to determined EBDs through wind tunnel modeling is hereby suspended until further notice. In other words, the Alcoa study was also disapproved at this point.

Many in industry actually have talked to me and interpreted this to mean that EBD studies cannot be used and, furthermore, it sounded like all of the past ones were disapproved.

Now, I don't know about the past ones or what's happened there. Maybe that will be a comment for later, but I think many didn't read on in the appendix or the guidance because right after that it said that this should not be taken to imply that all such studies will be rejected. It does say that any studies being considered should be discussed with the appropriate agency and the clearinghouse early in the process.

So, in a sense, the main thing that's changed here, really the only thing that's changed is the guidance was disapproved. So, a new method for conducting the studies is needed to be worked out. The use of the studies was not disapproved. It was really the guidance for conducting the studies. That's my take on it.

And the original memo acknowledged the evolving nature of the guidance. As a matter of fact, when I worked with Joe Tikvart and John Irwin on this, John Irwin said we'll probably get about 20 of these studies. We'll file them. Look them over and then revise this sometime in the future. Well, it sounds like that future time is now here.

The important thing about it, as Roger mentioned, the studies are still classified as a source characterization study which means it's not a new model. The approval process is much easier to do an EBD study.

The major problem areas identified in the clearinghouse memo was the recent study for Alcoa, the high roughness used during EBD testing. And so that's just something that needs to be worked out how to do that. Maybe lower roughness needs to be used. The method needs to be firmed up in that case.

The other aspect is a different downwash algorithm is now in PRIME because now, as you can see in this picture here, the old study, the ISC, the building was always positioned directly upwind of the stack and the building was a one to two to one specific shape of building.

AERMOD PRIME now, the building can moved upwind, downwind, it can have any number of shapes. So, that's one of the major differences in the two methods.

I must say, on some of the recent AERMOD EBD studies we've done, we have moved the building around. So, that part of it has already been incorporated in some of the new EBD studies.

Ultimately, a PRIME needs the building shape and position that places the stack in the air flow region for which the model was defined or developed. Now, these pictures show the wind tunnel database that was used to develop the formulas in the downwash algorithm. And so, ideally, you would like to put in a building that matches the theory. And so, that's really the purpose of the equivalent building dimension is to find a building shape that matches the theory. A simple building, one building that goes in to represent your whole site, basically, or whatever geometry you have.

So, here's a few cases where BPIP is clearly going to have some problems.

Like an urban area there. What do you, you know, what do you pick for the one building that goes in? It may be, in those cases, the background turbulence is higher than the building wake effect. So really, no building may be appropriate of high roughness.

A porous or lattice structure. The

theory just doesn't work for that. Here's a case, some of the slides kind of floated a little bit there, but the first top picture shows what the plume looks like downwind of a lattice structure. Now, the equivalent building would find a plume that looks just like that and we found out from that study the solid building was about half the height of that structure that gave you the same result.

The BPIP profile is on the bottom there. So, the solid building of the same height as the lattice structure, you can see the plume is heading down. So, that's going to give you high concentrations.

Now the -- another recent example here is a case, if you can see those, there was a lattice structure downwind of the stack, upwind of the stack, and then a solid building of actually a shorter height and you can see the solid building, the plume is sucked upwind. So, clearly an entirely different plume behavior when you have a lattice structure in there when the plume actually goes right through the latticework. There is some downwash effect, but it's much less than if you put in the whole solid building height. So, the equivalent building will find the height to put into the model that will make the model work for that situation.

Some other cases, hyperbolic cooling towers that are streamlined. Again, they're going to be treated as a rectangular block, much more downwash that you'd, you know, you're going to get higher numbers.

A short building with a large footprint which was talked about in some air and waste management papers last and last year also in detail and this is actually the Alcoa footprint, actually. And clearly the theory is not going to work there because it's outside the bounds of the original PRIME model. It's much wider, shorter than anything that was ever evaluated.

Some other structures that might be interesting, air-cooled condenser units. They have latticework underneath. Solid at the top. Clearly, the wake is going to be much less than a solid building.

Multi-tiered sloped and porous structures, again, what do you put in for the height? How do you account for a shroud that's around a stack that is porous? 50 percent porous? You know, that's going to create some downwash, too, but how do you put it in? Do you put it in as a solid object? I mean, those are kind of the challenges that BPIP can't handle.

The second part here, I'll kind of just, a review. There was an attachment to the memo where AERMOD or EPA compared the wind tunnel against AERMOD. There was some comparisons. And the results of that appendix or that attachment were used to provide additional justification regarding the use of that large roughness. So, it was kind of some justification documentation.

In looking that over, it appears that some of the inputs that were used were not correct. Basically, it appears that the EPA was using model wind speeds when full scale speeds should have been input. They were assuming stable conditions when the wind tunnel is actually neutrally stratified and there was really, technically, not enough data collected in the wind tunnel to do that comparison because if you're going to do a comparison between the field or between the AERMOD and the wind tunnel, you have to collect more data. Turbulence, profiles, you can input those, the theories in AERMOD so, that's what needs to go in. Turbulence and wind profiles.

So, my conclusion there was that the Appendix was flawed and, in this case, I just recommend some collaboration here would have been useful. We could have, I think, done a good -- a much better model evaluation comparison and maybe the conclusions wouldn't change, but at least we would have had a better result, I think, in that appendix.

So, kind of in summary there, this is kind of a summary of the differences that EPA inputs what we estimated, see, and like I said, we didn't have enough data so, we had to estimate the inputs that we thought were appropriate. The first thing you have to do is scale model operating conditions back to full scale which is something only fluid modelers can do accurately. I mean, it's fairly hard to do. And so, we did that and you can see in the table here some of the differences. Exit temperatures were different. Exit velocities. The stable versus unstable. Neutral, actually, so you want to have an infinitely negative Monin Obukhov length. The wind speed at stack top was 4.6, but for EPA 10.23. And so on.

There were a lot of differences and the way we, the inputs really weren't listed so, we actually, what we did was we took the results. Here's the BPIP results on this line here. And here is the equivalent building results using AERMOD and re-replicated that, tried to reproduce that since we didn't have the inputs and that was the table I just showed you. That's how we got the good agreement.

Now, if we use what we think are the appropriate results, here is, again, the two curves to look at are this curve. These are AERMOD predictions. The middle lines here are the wind tunnel. It's the site structures present and the equivalent building. Well, let's see. The site structures, yes, and the equivalent building that was selected in the wind tunnel.

Now, when we use the appropriate inputs, you can see that, actually, the lines change dramatically. You might get different conclusions here, but clearly, you have a different result there when you get the correct inputs there.

So, anyhow, what's the recommended path forward here? I mean, that's kind of the issue here. How do we move forward?

Option one, I think, would be to create kind of an industry EPA work group to develop a guideline for conducting these studies and then publish the guideline much like we already have an EPA fluid modeling guideline that was authored by Snyder some years back in 1981.

Option two would be to wait for the next EBD protocol to be submitted, have that reviewed by the clearinghouse, EPA and then work in a collaborative fashion to, you know, come to some kind of an agreement that this is the way we're going to do the study. Get final approval on the protocol.

Now, one thing I'll mention is that we've had trouble getting approval of the protocols before we do it. So, one thing is good to get approval ahead of time and then, when we're doing the study, I'd recommend conducting the study in a collaborative fashion where there is some real-time feedback, let's say, because if things, maybe something you developed in the protocol looks strange. You're getting some strange results along the way and well, maybe you want to change it on-the-fly and do that before you publish the report and then find out the problem after you've submitted your final report.

So, in that case, I'd say, you know, when you've finished the study you know you really have an approved study and before the report is even submitted and then use that protocol as kind of a template. Just say that template you've worked out for future studies.

So, that's kind of what my recommended path forward is and kind of a brief summary of the EBD input to AERMOD.

Thanks.

MR. BRIDGERS: And much like we did this morning, we'll bring everybody back up for questions at the end of the session.

So, up next, somebody that probably does not need introductions, but I will. We have Bob Paine.

MR. PAINE: Thank you.

I'm going to discuss a low wind speed evaluation study we did after the last conference, but a couple of years ago, I'd like to acknowledge contributions from a couple people here, Jeff Connors and Steve Hanna. The study was funded by API and UARG.

Let's see, okay, I wanted to know, of course, why are low wind speeds a concern? That's pretty obvious. I'll mention that a little bit. I'm going to review the current AERMOD formulation, how we approach the evaluation study which was done in two parts. A meteorological evaluation and as well as a Tracer study concentration and evaluation and our findings and recommendations.

This is just review of, in the past, there had been discussions of these items being imported. At the last conference this was also mentioned. And also the fact that AERMOD has had limited evaluation for conditions of wind speeds less than one meter per second, especially for near ground releases. The only experiment among the 17 original ones is a Prairie Grass had only one data point at less than one meter per second. It was .92 meters per second and four out of the 44 were less than two meters per second so, not very good representation.

Currently, AERMOD computes the friction velocity, USTAR , which is an important issue for mixing height, sigma Z, and sigma Y at night. And it also involves a combined solution of a coherent plume, which is the traditional Gaussian plume, any random or pancake plume and it does a weighting of these two solutions depending upon, in some sense, the prediction of USTAR.

USTAR is a function of not only the wind speed, but also of the roughness length and those parameters have been changing in terms of sonic anemometers giving us lower and lower wind speeds down to zero and air surface which has changed the formulation of the roughness length.

So, we initiated a new evaluation study to get at really low wind speeds and try to evaluate AERMOD under these conditions with both research grade meteorological databases, as well as low wind speed Tracer databases. We confined our analysis to the current, then current AERMET and AERMOD in 2009, as well as modifications of those which I'll discuss.

We did collaborate with the U.S. EPA and AERMIC. I don't know if AERMIC has provided much review. I haven't seen it, but I'm encouraging that to happen.

The phase one which was requested by EPA, was to look at the prediction of USTAR to get that evaluated first and then do the Tracer evaluation. So, we looked at research grade databases with fast response meteorological data so that we could get the actual correlation of U-PRIME, W-PRIME, and the observed USTAR.

We had two databases that were nocturnal low wind speed condition dominated. One was Carrington in the United Kingdom and the other nocturnal one was the FLOSS II fluxes over snow surfaces in Northern Colorado. A mostly convective database was Bull Run, although we had meteorological data daytime and nighttime for that database.

We found that the single level, which is the basic AERMET prediction, the single level friction velocity predictions at night were found to be too low and we have an adjustment that we have suggested which have greatly improved the prediction of the observed

USTAR values and we have tested those, that adjusted formulation, on all three meteorological databases.

This just shows you that -- let me see if I can get this. I guess I can't. Anyway, you can see that the USTAR on the y-axis and U on the x-axis show the formulation of how AERMET predicts the USTAR from the U and we can see that there is a quadratic equation that ends at a transition point, which is connected to the origin zero zero by a straight line.

That area was never really tested in any evaluation so, we decided to test it. The white dots indicated the current AERMET formulation and the blue dots indicate some of the observed values of USTAR. Obviously, we can see that the observed values are higher than the predicted values and so we decided to join the origin to a point higher up on the curve. Some of these curves are for different cloud covers and that ended up having a much better, much better performance for the prediction of USTAR.

Actually, an independent evaluation done by Ashok Luhar in Australia, indicated that on the left we see USTAR versus USTAR, predicted versus observed. Under-predicting on the left, the lower level, the lower values of USTAR that were observed were under-predicted by the current formulation, but the improved formulation had a more unbiased prediction of the low values of USTAR.

So, we concluded from the meteorological evaluation that the current AERMET formulation would under-predict USTAR in low wind speed stable conditions. This would be, this would end up resulting in higher predictions because of lower dilution speeds, lower dispersion.

We have a suggested fix to this that we believe and was subsequently evaluated to show that the model will perform better in predicting concentrations.

So, we carried that into the Tracer evaluation phase of the study. We looked at three Tracer databases; Bull Run, a tall stack buoyant plume database done by EPRI in 1982, Idaho Falls and Oak Ridge are old NOAA databases both involving low level releases in stable conditions.

We looked at three candidate models. Basically, the current AERMET, then current AERMET and AERMOD. Then changing AERMET as number two, but not changing AERMOD. Then changing both AERMET and AERMOD. Changing AERMOD with a minimum sigma V doubled from the .2 meter per second to the .4 meter per second which ended up looking like it would perform better.

Why did we decide to adjust the minimum

sigma V which is the lateral turbulence? We actually took the debug information and put it into an Excel spreadsheet and looked at it very carefully and found that the sigma V became very important in determining both the lateral dispersion and the fraction of the random plume used to calculate the total concentration. The coherent plume was dominating that weighted average and the coherent plume uses that sigma V and it's a very important component.

So, we found that the model is over-predicting significantly for light winds when the lateral dispersion was underestimated and the fraction of the random plume was underestimated. And so, we found that doubling that minimum sigma V would work out better and then we put that into the model and then tested the databases fully with that formulation change.

We found that with Bull Run and convective conditions no change was really needed because the predominant corrections were needed for stable conditions.

So, I'm going to talk about the two databases with stable conditions, we see that for the first one, Idaho Falls, we have the predicted on the y-axis and the observed on the x-axis. In various distances, in 100, 200, and 400 kilometer, I mean meter arcs, the 100 meter arcs resulted in the highest observed and certainly predicted concentrations, whereas the base model had an over-prediction by about a factor of six with Idaho Falls with a near surface release, with no sigma theta observations accounted for.

When we instituted the changes to AERMET, we improved it by about a factor of two.

And then when we instituted the changes to AERMET and AERMOD, we got a further improvement and so, with that database, we found that our suggested improvements would ameliorate some of the over-predictions in stable conditions for low winds.

Going to the other database, well, first of all, let me give you the overall results for Idaho Falls. The over-predictions were clearly evident at 100 meters with somewhat better model performance further up, but the highest predictions were at 100 meters.

Used in sigma theta observations tended to reduce the over-predictions, but if we decided that we wanted to withhold the sigma theta data, we found that the better AERMET with a higher USTAR predictions would reduce the concentration over-predictions by about a factor of two due to the higher dilution of wind speed and the higher turbulence levels.

And then when we increased the minimum sigma V, we had additional performance improvements. We found that the bulk Richardson number and the multiple level AERMET worked about as well as a single level AERMET when we instituted these improvements.

Now, going to the one other stable low-end and low-level release, we found that with Oak Ridge we had about a factor of 20 over-prediction with the base model at the 100 meter arc and, basically, that slope was pretty much evident at the other distances as well. Instituting the change to AERMET improved things, again, by about a factor of two, but still over-predicting by about a factor of ten. Then, instituting the sigma V minimum upgrade still got me about a factor of two to three over-prediction and that's where we basically stopped because some of the data points, you can see at the further distances, are approaching a factor of between one and two over-predicting.

And so, the overall results for Oak Ridge were, again, substantial over-predictions for the base model during stable hours, especially during unstable hours, again, AERMOD did reasonably well. We decided that we needed to have a larger lateral spread of the plume and a better estimate of USTAR and so we found that the minimum sigma V of .4 meters per second substantially improved the model performance.

So, the overall findings and recommendations are that, first of all, it's been two years since API provided all of these results, code, and the modelers archive EPA and we're all anxiously waiting for the EPA to do something about it. We encourage EPA to certainly either accept the changes or provide another alternative formulation along these lines which, I think we have found important mischaracterizations and things that need to be corrected in the current model.

Also, the fact that, as we drive USTAR lower and lower, where lower wind speeds and lower mixing height, lower that is, lower surface roughness, as we get lower mechanical mixing heights which have led to other issues, like very low plume spreading for releases above the mixing height.

And that concludes that presentation.

MR. BRIDGERS: Thanks, Bob.

Rolling right along, we have Mr. Randy Robinson from EPA Region 5.

MR. ROBINSON: Okay. Thanks, George.

As he mentioned, my name is Randy Robinson. I'm with the EPA Region 5 and I'm going to change gears a little bit here. Pardon the pun. I'm going to talk about Haul Roads and, in particular, the Haul Roads Workgroup and our final report out.

I'm going to touch on a little bit of background and talk about the activities that we've done over the last couple of years and then discuss final recommendations.

Our workgroup final report was posted up on SCRAM a few weeks ago and just to characterize that, this is, it's posted up there. It's our workgroup final effort. I guess we're looking for comments. We're looking for feedback. We're looking for some additional information, if needed, and it doesn't necessarily represent an EPA position on Haul Roads, but this is the workgroup position and, if needed, a final EPA recommendation will come out.

So, and just to clarify the issue that we're talking about. This is not tailpipe emissions. We were looking at how to best characterize the dust that's kicked up from industrial trucks. Sometimes, similar to what you see up there.

Our group started back after the regional and state modelers workshop in 2009 which seems like a long time ago now. And it was made up mostly of state agency representatives, some local agency representatives, and some EPA folks. And it was really put together because there were some concerns with how to model Haul Roads.

For one, the model impacts from these kinds of sources can be significant. Sometimes, they can overwhelm an attainment demonstration.

These kinds of sources are more difficult to characterize than some of the other sources we're used to dealing with and there was a lack of state-to-state consistency, in general, with how this was being dealt with, including not modeling of them at all.

So, the workgroup got together and the first thing we did was to, sort of, identify the issue and scope the problem. This was in no way a research project. We focused on activities that would get at how to best characterize dispersion from these kinds of sources. We also decided that we weren't going to dive into the emission factor issue. We felt that we didn't have the expertise for that and other groups are looking at that as well.

But what we did focus on was gathering information from existing state approaches from how they're modeling Haul Roads to get a sense of what sort of the range of options is out there.

We conducted a sensitivity analysis to better understand how important the variables were involved in modeling these kind of sources.

And then lastly, to the extent we could, we examined available journal articles and field study data to see what we could gain there.

What we found, I'm sure we missed some field study information and journal articles, what we tended to find was that most of the field study work was geared toward getting a better picture of emission factors and was really geared toward emissions and not so much sort of plume characterization.

Here's just some samplings of the variety of approaches that we saw out there when we gathered information, mostly from the states. I'd say what we saw was there were typically more volume source kind of examples out there, with volume heights or top of plume heights ranging anywhere from, you know, two times the vehicle height. 1.7 times the vehicle height was a fairly popular option. In some cases, the volume height was as low as one meter which is, I think, people were simulating the tire height in those kind of examples.

The sigma values were typically based on the volume heights. Widths ranged, you know, anywhere from truck widths, truck widths to six meters. Road width times two. Or, in some cases, they would have set widths depending on if it was one lane traffic or two lane traffic.

There was also a fair number of areas source examples out there. Release sizes, release heights as low as zero meters surface release. In a lot of other cases it was half, sort of, vertical extent and widths for area sources tended to be kind of the width of the driving lane or the width of the roadway.

We did a sensitivity analysis just to get a little bit of an idea of just how AERMOD were to some of these parameters and what we did was we varied, basically varied the top of plume height ranging from a surface release of zero meters up to a ten meter top of plume height.

The other figure that we varied was the sigma-y which ranged from a three meter width which we kind of assumed was maybe a typical truck width, to a 10 meter width which may be is kind of a typical roadway width, to 16 meters which would be a roadway plus three meters on either side which was a popular option that we saw out there.

So, we did, we set up this sensitivity analysis. What we did is we used AERMOD. We set up intersecting roadways and looked at volume sources, both alternate and adjacent volume sources. We looked at area sources. We used one year of real MET data, a variety of MET data as supplied by the states.

What we found was not, wasn't really all that surprising. It did give us some good information. We found typically increasing the release heights led to lower concentrations. Increasing the sigma-y for alternate and adjacent volume sources lowered concentrations as well.

For the area sources, when we increased the lateral dimension, that tended to lower the concentrations for the lower release heights. It didn't have much impact on the one and a half and three meter release heights that we looked at. And then for area source, adding a sigma Z lowered the concentrations for the surface release heights, but increased the concentrations for the higher release heights and .5 meter had some mixed results.

The adjacent runs gave us typically higher concentrations than the alternate runs.

We also looked at a little bit of

simulation using point sources to characterize the Haul Roads. It consisted of putting stacks to represent the wheels of a vehicle and then using the vehicle dimensions to simulate the downwash.

We did just a little bit of that and found that, you know, that approach was fairly sensitive to stack height. A little sensitivity to stack diameter. And, as I said, we ran multiple MET data sets here and saw the same trends with the one on-site data set that we had with the National Weather Service. That may be likely due to the lower winds with the on-site MET data.

So, we came up with some -- we took the information we had and we came up with some general recommendations and I would say our -- which consists of characterizing these Haul Roads as a volume source and I would say that there wasn't an overwhelming conclusion that they should be volume sources, but we felt that the fact that volume sources did contain the meander algorithm was an important factor. And again, some limited model monitor study data that we had from the Cordero Mine, tended to indicate that meander was an important factor there.

So, our recommendation on what would be a reasonable and technically supportable approach would be volume sources and here's some details on what we felt were reasonable ways to characterize a volume source.

Again, top of plume height, we focused in on the 1.7 times the vehicle height based on, that's sort of based on a 2005 atmospheric environment paper. The release height would be half of that top of plume height. Plume width, we used the vehicle width plus six meters, focusing on the vehicle width because that's what generates the emissions and the six meters we pulled from a 1992 CO monitoring guidance document. That talked about a three meter buffer from the roadways, as the distance needed to get out of the turbulence created by the roadway. So, I think that's where the six meter originated from a lot of the state work that was done.

So, our plume width recommendation is a reasonable recommendation was vehicle width plus six meter for a single lane. If you've got multiple lanes, considering the road width plus six meters. And then for sigma Z, was simply the top of plume height divided by 2.5. For sigma-y is -- was the width of the plume divided by 6.5 and recommended the use of adjacent volumes.

As I said, the volume source wasn't an

overwhelming recommendation, but we did feel like the meander algorithm was important.

If there are situations where one of the disbenefits of the volume source is that you can't put receptors. If you need to evaluate a receptor very nearby, you can't place a receptor in a volume source. So, in those cases where you need to look at nearby receptors, we recommend the use of an area source. And again, the length would simply be the length of the roadway. The widths recommended are similar to the volume source of vehicle with plus six meters and the road width plus six meters. Top of plume height again is 1.7 times the vehicle height. Release height is half of the plume height. And sigma Z is calculated the same as the volume.

Interestingly enough, you know, when you run an area source this way with a sigma Z, it ends up being fairly comparable, at least in our sensitivity work, to a volume source characterization, although it gave us slightly higher concentrations.

So, those are the recommendations that we came out with and, again, we just felt like these were reasonable, technically supportable recommendations and look forward to any comments or additional information that the community might have.

We had some suggestions for future efforts. As I mentioned, the field studies, we had trouble finding field studies that really were geared towards sort of plume dimensions, so we encouraged, to the extent that we can influence that, more field studies looking at that. Also, looking at the impact of vehicle speeds.

The point source work we did, we thought, had some potential and one of the real benefits there would be the ability to examine downwash from buildings that are nearby the Haul Roads so, we supported further work along that -- further study of that approach.

And then the new line source work that is somewhere in development here, that ultimately may replace the need to model these sources as either fugitives or area sources, so we wanted to make sure we kept that in mind.

And lastly, we had a very good workgroup here. Mick Daye, Region 7, was co-chair, but as I said, the workgroup was made up of mostly state agency representatives and local area representatives and they did -- they really did a lot of work, particularly with the sensitivity modeling and assisting with the report, so I'd really like to thank them again.

Thank you.

MR. BRIDGERS: And Randy now has us back on time.

So, up next, Chat, the podium is yours.

MR. COWHERD: Let's do advance down here with that.

MR. BRIDGERS: You can and this also works.

MR. COWHERD: Good afternoon. I'm glad to have the opportunity to speak with you today and the title of my presentation is Modeling Concerns for Fugitive Sources in the Iron, Steel, and Mining Industries.

This problem of trying to characterize fugitive sources is a very thorny one. Everything that we've heard about trying to model dispersion from continuously emitting ducted sources, like stacks and vents, we have to add a whole other level of complication to the fugitive sources because they're also called open sources and those sources are those that emit particularly gaseous air pollutants directly into the atmosphere, but they do not pass through a confined, well-defined flow stream in the process of discharging the pollution into the atmosphere. So, you can't, unlike stack testing where you can put a probe in the stack and you can scan across the dimensions of the stack and get a good estimate of, you know, true emission rate. It's much more difficult to do that with fugitive sources.

These sources also tend to be highly variable in time and space around an industrial facility and they are normally associated with batch operations. The stack emissions tend to be relatively continuous. Not always, but the fugitive emissions tend to be associated with batch operations that are highly variable in time which makes it a lot more difficult to use a steady state plume model to represent dispersion from these sources.

So, we have issues such as emission and factor development. It's been brought up briefly. We have particle size data. I'll be talking mostly about fugitive dust today. How do you represent the sources? And what about some new effects on PM-10 and PM-2.5 depletion phenomenon?

We know that AERMOD is best suited to steady state emissions from unobstructed stack flows. You do have building downwash and other issues to try to account for that effect, but these kinds of sources do not represent many of the types of sources at iron and steel and mining facilities.

Fugitive sources pose increasing challenges for accurate air modeling and the kinds of sources we're talking about, some have already been mentioned, the roadways for example, the Haul Roads. The handling of materials around the sites -- the industrial sites where you have to load and unload materials sometimes form storage piles. You load them back into trucks and take them to another location et cetera. You have building roof vents from which emissions can come. You have slag pits. You could have a water cooled material handling operation and you could have a pit at a mining facility where you're below grade. You're significantly below grade when you're actually loading the trucks to take them to the crusher. What happens to the emissions that do not escape from the pit?

So, the characteristics of the fugitive sources I've already mentioned. They're diffuse in nature with spatial and temporal variations and many of them are low level releases. A release from a roadway. A release from a building, perhaps near the ground in an area where storage piles exist and you have strong effects of obstructions to air flow.

Now, we have proposed, the American Iron and Steel Institute, kind of a collaborative effort to try to evaluate all of these factors in more detail and to address these problem sources before requiring modeling for NAAQS compliance. So, we really need to look at these in more detail and see what we can do to address the complications of fugitive sources. And this just shows a building that has roof vents and, you know, possible points of releases. It's a very complex structure. There tends to be small spaces between buildings. You have roads passing between buildings so, it's a very complex type of situation to try to model.

Now, the emission factors, and I was involved in a lot of this original work back in the 70s and 80s, and EPA was interested in what are, you know, what is the magnitude of fugitive emissions? Do we really have to worry about fugitive emissions and fugitive dust and such in dealing with cleaning the atmosphere, meeting air quality standards, or do we just worry about stack emissions and stop there. And we had a budget to go out and try to look at industrial sources and non-industrial sources like agriculture, construction, and so forth, and try to come up with test methods.

Test methods were not developed prior to this work. Unlike stack testing where collaborative work has gone on for virtually every stack testing method, you can look at it in the Federal Register. You can get an exact prescription of the procedure you have to follow in order to do the measurement.

This is not the case for these kinds of sources.

And we also -- the idea, if you're going to go out to an industry for the first time, you'll probably look for the dustiest sources. You want to make sure that you hit the top level because the bottom level is -- maybe is zero, but you want to bracket the top of the emission range and so you want to look for those and if you're on a limited budget, you're just going to pick some dusty sources and work on those and then hopefully you can do adjustments later to give you a better average representation of the operation.

Now, we know that in the Title-V era and so forth over the many years since a lot of this work was done, there have been improvements to work practices. And these improvements were made with safety in mind, with equipment maintenance in mind, and other factors, as well as air quality so, there have been improvements in the practices which we feel are reflected in emission factors if you were to go out and redo some of the tests.

I would like to point out that back when we were doing the tests and we worried about total suspended particulate matter, there was no definition of particle size at that point, believe it or not, and so then we said well, down the road there's going to be something about inhalable particulate matter or something that represents a particle size so, we better collect some of that data, but we just kind of did that on the fly so-to-speak.

And then the test methods themselves were, as I said, never -- never fully standardized and there was only one collaborative -- EPA collaborative test of the profiling method which my company developed and that was at a steel plant in the Chicago area and the four organizations were out there applying the method side-by-side.

So, I'd like to say that we know that the dispersion models are going to have problems with regard to predicting impacts from these non-Gaussian fugitive sources and a lot of these effects appear to be leading to over-prediction of the transportability and the air quality impacts of these sources.

There are depletion processes going on. We found that -- and if you go out and do this dust testing, for example, you find that there's large amount of charge on the particles. You can take a filter back to the lab and if you try to weight it without de-charging it, you can take a forceps and go towards the filter, particles will jump off of the filter. And you actually have to pass a radiation strip over the filter to de-charge the particulate matter before you can weigh it.

Well, we found some effects that the electrostatic conglomeration, because depending upon the composition and size of the particles, you can actually have a polarity shift and so you can have particles in the dense plume that are attracted to each other and actually are agglomerate at a much higher rate. And we found these effects in some recent field tests that we did for the Department of Defense.

So, these kind of things need to be dealt with in looking at plume losses that occur in reality and they need to be represented in the models for dispersion of these emissions.

Now, another issue is source configuration. Haul Road haul trucks, you know, if you go out to one of these mines or steel plants, they come along every few minutes. There's not a continuous stream of haul trucks lined up. So, if you model this as a continuous line source, area source, or volume source, you're assuming the entire source is emitting constantly and that's not a good representation because you don't allow for any dilution in the direction of the road. The entire road is emitting. So, you remove one dimension for dilution and that leads to overestimation of the impacts.

And so, we've talked about pit trapping and I already mentioned that and so, someone else previously addressed the issue of low wind conditions and we know that if you have a dense plume cloud -- cloud of dust -- that this electrostatic conglomeration is going to be more prevalent in that kind of a situation and so, that's going to cause a depletion to occur when that is developed.

I actually submitted a summary of all this to EPA in August of 2009, but I also want to point out a couple of things before my time is up and that is that in looking at regional models performed by EPA to look at the impacts of dust sources, they found that, on average, CMAQ over-predicted by a factor of four the observed dust impact. So, the way that was done was to actually go out and collect samples off of the filters. Do a chemical analysis of those samples and then do fingerprinting against the dust sources and then associate how much dust is actually -- fugitive dust is actually on the filters.

And so for a while, there was just a factor of four reduction of the transport effect to account for what was actually observed at the modeling sites, or the monitoring sites.

And so I developed a table showing a lot of these effects and it's in the report I just mentioned. I'm not going to have time to go through all of this, but these are the kinds of problems you can run into if you represent Haul Roads as continuously emitting area or line sources or volume sources. The factor of four correction which is a cumulative effect of a number of different conditions near source agglomeration enhanced deposition. There's a factor, a large factor of over-prediction if you don't account for that. Exclusion of trapping by vertical obstacles during horizontal transport. These are all developed by different investigators. A lack of treatment of pit trapping and then instant vertical mixing and grid models. There are all of these different effects that you can take a look at.

And so, what we recommend is that there be some adjustment for these over-predictions if we're going to be modeling these sources with AERMOD and I will say that after EPA used the factor of four adjustment, they refined that and they developed a map of the whole U.S. county-by-county and they used transport fractions. In other words, it was based on the ground cover in each county. The prevalent ground cover. So, counties with a lot of trees would have a low transport fraction of dust. Counties that are bare -- bare lands -- would have a higher transport fraction. That was developed.

So, you could use an emissions pre-processing step, similar to what was used in CMAQ, to take a better look at how do we adjust the emissions slash transport estimate to correct for what we actually observed in the field.

And so, in summary, we feel that the air dispersion models need some further work in order to accurately be used for regulatory compliance analysis, especially the fugitive area, volume, and low stack sources that are present in these industries and that, for example, this could be handled by using an emission deposition pre-processing step as part of the standard modeling protocol. Adjusting the models to address wind speed dependent emissions and avoid positive biases for fugitive and volume slash area sources during low wind speed events and to re-examine the applicability of the AP-42 emission factors and the particle size distributions and make adjustments as necessary.

The number of modeling improvements, as we said before, all of this takes time. This is a big effort. It's not going to be accomplished overnight and so, AISI is offering our services to work with the EPA and try go through this in more detail and see what can actually be done reasonably at this time until a better accommodations can be made within AERMOD and other models that might be used for this purpose.

So, I thank you for your attention.

MR. BRIDGERS: Hopefully, this afternoon's session feels like it's moving along after we had pretty long presentations this morning.

If it will load, up next we have a Federal partner agency, a fellow EPA discussion and this is, sort of, the predecessor of some stuff we'll talk about tomorrow morning with the PM 2.5 modeling guidance, Meg Patulski.

MS. PATULSKI: Thanks, George.

I guess before I get started in the presentation, by a show of hands, how many people know what transportation conformity is?

Well, that's nice. I know we've been covering a lot of other types of sources in this workshop and it makes perfect sense, but now that we're having more overlap in my world at the Office of Transportation Air Quality with Appendix W, it seemed like a good time to have a presentation on our program in this conference.

So, thanks, Tyler and your shop for inviting us and telling you a little bit about transportation conformity.

I want to let you know that transportation conformity applies in PM-10 and PM-2.5 non-attainment maintenance areas. And what I plan to do today is to give you a sense of the program, a few more details, tell you about the overview of our hot spot guidance, highlight some places where we rely on Appendix W, and then I guess that's all the time I'll have.

So, let's go.

Transportation conformity has been around since 1977. But in 1993, because of the Clean Air Act, we -- revisions in 1990, we revised the conformity rule and it applies to any new transit or highway project that receives Federal funding or approval by the Federal Highway Administration or the Federal Transit Administration. And conformity at its core is intended to make sure that Federal taxpayer investments in those kinds of projects or in larger transportation plans and programs should not cause or contribute to new NAAQS violations, worsen existing violations, or delay timely attainment of the NAAQS or interim milestones.

It is -- a lot of conformity is done at the regional non-attainment maintenance area level through emissions, budgets, those on road mobile source portions of SIPS sub-attainment demonstrations RFP maintenance plans.

But there is also a portion of our conformity rule, where hot spot analyses are done in carbon monoxide, PM-2.5, and PM-10 areas so that those individual projects also do not cause or contribute to new violations, worsen existing violations, and so on.

I'll be focusing on the PM today. Since 1993, there's been a CO hot spot requirement that's been implemented primarily for intersection projects, but we have, of course, a new focus on PM now.

How do you meet conformity? At its core, conformity at the project level is a build, no-build test. In my world, the build is -- are the concentrations from the new project as well as your background, compared to the no-build, what life would have been without the project. And you pass if you're below the NAAQS in your build scenario or if your build scenario is less than your no-build scenario even though you're above the NAAQS.

So, you know, this is something that I'm sure, you know, that folks in this room know what this is. Just to focus the conversation, we have, you know, obviously we have -- well, basically it just shows the background level here, we're looking at the part immediately around the highway transit project. You know, looking at the background plus your local component. The emissions from your highway project or from a transit project which I'll go into. That's where the hot spot analysis is done. You know, 100 meters, 500 meters from a road. We don't look out any farther than that because, of course, it goes to background.

In December of 2010, we released the PM hot spot guidance and this is written to be a transportation conformity guidance document, but it has technical information as applicable to modeling any type of mobile source like a highway or transit project. Many aspects of it rely on the same things that are relied on for other EPA programs.

Right now, qualitative analyses are being done, but quantitative -- because of introduction of the moves emissions model, new quantitative requirements will go into place in December of this year.

The technical guidance includes emissions modeling, air quality modeling, background, design values, calculations, and for the parts of it that are relevant, we rely on Appendix W. That is EPA's guidelines for all programs and we follow those guidelines in implementation of our requirement.

This just gives you a sense of various parts of completing a hot spot analysis. We have found in our world most of our users are transportation agencies, state DOTs, some state air agencies are involved, but people who, you know, doing a PM localized air quality analysis, we have found, is really a brand new world for lots of programs, not just ours. And so, we try to organize our document to go to various steps in a user-friendly way and to be clear in every step. And basically, you know, you're looking at once you know you need to do an analysis, and for PM hot spot analysis, we're looking at new highway projects or new transit projects with a significant new amount of diesel traffic. So, this is like five percent of all the projects that are done through Federal approval funding in the country.

Large highway expansions, new highway

expansions involving lots of trucks. Lots of volume is 125,000 annual average daily traffic or higher. Large new intersection expansions that service primarily by diesel trucks. Say you're adding an off ramp or new freight terminal expansion or a port. Large projects. Lots of diesel trucks. Or large new regional or expanded transit terminals with lots of diesel buses.

So, those are the kinds of projects. Step three, you look at your motor vehicle emissions, your other sources, and so on. I'm going to go through some of these, but if you want to know what all the steps are, I just wanted to put this up. Our guidance follows all these and goes over a tremendous amount of detail in every single step.

But let's -- this is kind of a nice visualization of the kind of work that we do and the scope of what we do and, in this graph, the yellow dotted line is -- outlines a new highway or expanded highway involving, you know, you have some, you know, say you're adding a couple lanes here, you've got maybe a new interchange right here, some ramps. Let's just assume these are all, you know, there's a large amount of diesel traffic.

Emissions modeling would first be done for the local roads which are in green and the new facility. Get the emissions there. Then, the air quality modeling would be done, of course, from the source. You know, and in this example it goes out to about 500 meters. And the emissions, of course, from this area after the air quality concentrations are predicted would then be confined to your background concentrations and then you'd go through your design value calculations.

But I'm just trying to give you a sense of the area that people need to show that there is no new NAAQS problem. The public health is protected in those areas immediately adjacent to these facilities.

So, latest emissions models need to be as -- for vehicle, tailpipe, tire wear, and brake wear that's MOVES 2010a, soon MOVES 2010b which will be released very soon. EMFAC is used in California and you've got to use the latest models.

For construction dust, I'll go over the MOVES project links in a little bit, but in a visual -- I have a couple of pictures there.

But, we also look at, especially in PM-10 areas, we look at road dust from paved and unpaved roads and for PM-10 areas, all of them that have these kinds of projects need to include those types of emissions.

For PM-2.5, you only include paved and unpaved road dust. If your air quality monitoring data for your area that using your SIP development and so on shows that road dust is a significant contributor to air quality problems. Because we all know that you're going to get a lot of emissions calculated from those facilities for that road dust, but not all of it in PM-2.5 areas get to the monitor. So, we have that and in some areas they look at construction dust as well, from transportation related construction.

So, one of the things I want to mention about MOVES since it does carry over to using AERMOD, is with the MOVES model, we have an added layer of sophistication quantifying the emissions from these -- from highways, intersections, and so on, to pick up different levels of activity, volumes, types of fleets on doing the individual parts of facilities.

So, let's just look at this. We have an intersection here. We have a highway here. Let's say that this new road here -- that this existing facility is a new road. In MOVES, if you look, there's several speed options which you can characterize emissions rates, but if you looked at the average speed option, you could be trapping this road into various calculating different emissions factors for these, you know, Q activity here in the red. You've got acceleration links where most of -- you're seeing most of the activity there is accelerating. Green as in crews and so on. And what's nice about this is to realize that this information that you're using to quantify your emissions factors will be carried over when you use the air quality models and you characterize your sources. I just wanted to give you a sense of that, of the level of detail.

So, air quality modeling. You know, the same steps that are involved in air quality modeling for stationary sources, point sources, are the same steps we use, just the details are different.

First you have to select your air quality model, characterize your emissions sources, obtain your MET data, specify your receptors, and run the model. And I can't emphasize enough that we work with Tyler's shop very closely to make sure that what we do is consistent with other air quality modeling, because Appendix W covers our world as well.

Now, for what air quality models are used for analyses? Well, AERMOD, it really depends on the kind of project you have. AERMOD can be used for all of the different kinds of projects that could get Federal funding or approval. That could be highway and intersections projects that don't involve nearby sources or terminals of any kind. We also rely on the CAL3QHCR model. That's the refined version of the CAL3QHC model. That can be used for those kinds of projects. Transit, freight, and other types of terminals, again, these are ports, expanded rail stations, parking lots, things like that. Of course, you can use AERMOD and any project in the transportation world that involves a mix of those different kinds of sources can also rely on AERMOD.

This kind of just lets you emphasize, again, the types of sources that we described in our guidance. We, you know, have line sources which we think AERMOD can simulate and CAL3QHCR can certainly cover. Those are for those highway and intersection only projects.

Then you have the bus and garage terminals and all those, as well as, for point sources you might have a stack on a maintenance facility. That you can use AERMOD in.

Of course, area and volume source, we don't have a preference in our guidance. We offer that as an option for any of the projects that could have a transportation conformity determination.

Okay, now selecting MET data and placing receptors, again, we follow Appendix W. You need to, when you do your air quality modeling, have at least five years of representative off-site data, which for our users will be the most common case. Nobody in the transportation world usually has a site specific monitoring station. They don't do new -- they don't monitor for these sources.

But if you do happen to have site specific data, you need to have, like Roger said, at least one year of site specific data and we follow the AERMOD implementation guide for representativeness and so on.

Receptor spacing is the same. The same guidelines. You look for the highest model concentrations. You put receptors where the people are going to be and not in places that people cannot access like right-of-ways, private property, and so on. And we also have additional guidance for the annex.

Background concentrations, for these kinds of analyses, you know, people can use a representative air quality monitoring station to -- if you don't have any nearby sources, you can certainly use that to represent your background concentrations, but if you do have a nearby source, you have to follow the various parts of Appendix W that apply and quantify those emissions and include them in your air quality modeling.

I do want to point out that we don't envision stationary sources being modeled in these kinds of analyses. We expect, for the most part, those are not going to be affected by our transportation projects and if you have representative background concentrations from an air quality monitor, that could be included there or relevant. Most of these projects are going to be in urban areas.

Design value calculations, we follow very closely what people use for other types of sources. We're consistent. We combine the air quality modeling that's done for five years with the air quality representative background concentrations which, again, is usually typically three years of background data from a monitor. And we have a tremendous amount of detail in our guidance and our training for calculating these values and we also have created a MYSQL tool to calculate the 24 hour PM-2.5 NAAQS because that's a very difficult NAAQS to quantify and we have found that tool has been well-received in our training. So, all of this is on our website.

The hot spot training, if you want to know more about the details, you can always check out our guidance, of course. We have a three day training where we walk through not only the conformity aspects of this document, but also you learn MOVES one day. If you're in California, you'll learn EMFAC. Applying that at the project level for PM-10 and PM-2.5. There's a day on AERMOD and then there's a day on CAL3QHCR and design value calculations and so on.

We've had in seven places so far and we're going to be offering three more in the near future in Madison, Wisconsin; Frankfurt, Kentucky; and Denver, Colorado. So, if you're interested in learning more, check those out on our website.

And again, we have tools and tips and we also have a mini-exercise, as well as more extensive example analysis that goes over all of these models.

And then, I guess, if you want more information, you can talk to me or check out our website.

Thanks.

MR. BRIDGERS: Thanks, Meg. And to that end, we also crosslink off the SCRAM website to the Transportation Conformity Hot Spot Analysis.

Well, we've reached the part of the afternoon where we actually have a little time. We had budgeted a half hour for questions related to the

AERMOD applications. I don't know that they need to absolutely have to be.

With respect to the speakers, it might be a good policy to do like we did this morning and just have everybody come up and sit so they're at a mic. Is that kosher? Is that cool?

Sorry, Meg. You just sat down.

I'll turn the mics on here.

MS. PATULSKI: Hi, I just wanted to add one more thing. We work very closely with the Department of Transportation. They, per the Clean Air Act, need to concur on all of our rules and requirements and we're working jointly with them, with the Federal Highway Administration with our training, and I would be remiss to not mention their -- the partnership that we have with them.

AUDIENCE MEMBER: I'm not sure this is a question for this panel.

I'm Gale Hoffnagle from TRC.

I did an AERMOD modeling study last summer and the people at EPA, U.S. EPA, that I'm working with have only criticized the fact that I wasn't using the most current version.

Well, now I've had to re-run AERMOD twice, because you've changed the versions twice, since the original study.

What do I do?

MR. BRODE: Well, I don't think the solution is for us to just stop updating the model and we certainly regret any inconvenience that that might cause anybody in the community. I would say that you should work it out with the appropriate reviewing authority.

If there are changes that have been made to the model that impact your application, then certainly that would be a valid reason to require someone to remodel it.

If it's clear that there aren't changes, then maybe that's something that could be worked out, but--

AUDIENCE MEMBER: I've asked them to talk to you, but that hasn't happened.

MR. BRODE: Okay. And whose call should I look for?

MR. BRIDGERS: Thank you, Gale, I'll follow-up--

MR. BRODE: Well, there's a new update coming up soon and you're going to have to remodel again. So, just tell them to wait.

AUDIENCE MEMBER: Quguo Jing, from

Breeze Trinity Consultants.

I have a question for Bob.

So, under the low wind conditions, the USTAR is always measured by the AERMET so, the sigma V is also on AERMET so you set some minimum value for sigma V.

How about sigma W? Do you have a sigma recommendation or do you have any other concerns?

MR. PAINE: Sigma W was not, apparently, not as critical a parameter, especially for low level releases and in flat terrain as sigma V.

We noticed that the Tracer observations indicated a wide plume spread and predictions without the increased sigma V indicated too small of a plume footprint.

By the way, this study has been published in the 2010 Air Waste Management Association Annual Meeting Proceedings. So, that's one access point for this low wind speed study.

AUDIENCE MEMBER: Hi. Mike Lebeis from DTE Energy. I just had a couple of questions actually related to AERMOD.

First, the intermittent source clarification. I mean, basically, you have the emergency sources. You have, like, a routine source that operates, you know, typically a certain hour or two a day. Then your third category are sources like peeking units that, in reality, don't operate very often, but they could under an emergency like the Northeast U.S. when we had a blackout back in 2003. Under those circumstance, they're going to operate unit the grid comes back.

The question I have is like for those types of sources, would you have to model them in an impact assessment for a specific plant or could you model at an annual average emission rate if you took like a federally enforceable limit, say 100 hours or 500 hours? Would you be able to model them at average annual emission rate instead of the maximum hourly emission rate?

MR. BRIDGERS: First, I want to see if Roger has any comments. He's looking at the schedule.

MR. BRODE: I just want to say that that question would fit more appropriately at some sessions tomorrow, but -- or I would defer to Tyler.

MR. BRIDGERS: Let's go ahead and address it now. We've got plenty of time.

MR. BRODE: Well, I don't know that I can say much beyond what's in the March clarification memo. We certainly have to be very careful about offering responses to comments or questions on specific applications outside of the formal Model Clearinghouse process. So, that's -- I mean, our group within OAQPS gets involved in specific permit application issues. Generally, it should be through that formal Model Clearinghouse process, an issue that needs to be resolved.

We do interact with the state regional offices, in particular if there are questions that come up that need clarifications. So, I don't think that this is a proper venue to give you an answer that may not have adequately considered all of the facts.

I'm sorry about that. I mean, again, we identified in the memo what was intermittent emissions which are not expected to contribute significantly to the annual distribution of daily -- maximum daily one hour values. You know, that's not necessarily a precise definition, but that's sort of the criterion that you need to look at.

And we do mention using the annual average emission as an option to consider, but we have not indicated that as a alternative that can be used routinely in every situations.

So, it depends on the circumstances and the detail. The devil is in the details as it is with many things.

MR. BRIDGERS: And Roger, I think it's worth pointing out that the annualized emissions, that's not the only solution. There are other options that are there. That's just one potential way of addressing these intermittent emissions.

MR. BRODE: Right. It may depend on how well you can actually character the distribution. It may be a situation where you really don't know, like you said. That makes it harder.

If it's something where you actually do have some idea what the annual distribution of potential impacts would be, it would be easier, but again it gets into a lot of details that are very application specific.

AUDIENCE MEMBER: I'm Mark Bennett with CH2M Hill and I have a question for Randy Robinson and the Haul Roads Work Group.

You've heard a number of other issues that have been brought up that are obviously directly applicable to Haul Roads. Bob Paine's presentation and the whole discussion about ASOS and the increased level of low wind speeds. All of those obviously directly applicable. I don't think those were considered in your report that you just posted.

Is that something that you will be considering in your further work?

MR. ROBINSON: That's not something that we envision looking at further necessarily. Our charge and our purpose was examining the best way to sort of characterize the dispersion and the initial set-up of these kinds of sources.

I think a lot of the things we've heard today speak to, sort of, get at the emissions and maybe more appropriately an emissions factor applied somewhere in the pre-processing area might be a better way of getting at that, but the light wind speed and that kind of thing isn't something that we envision looking at further.

AUDIENCE MEMBER: Okay. Thank you.

AUDIENCE MEMBER: Hi. This is Ahammad from RWDI and we -- my company works in Canada mostly and some of our work related to roadway jobs, kind of a highway expansion, that sort of stuff. So, my question goes to Meg.

The first question is do you have any guideline for -- about the representative background concentration of the monitoring station? Because sometime those background monitoring stations are biased by, you know, the nearby sources like, say for example, if that monitoring station is near a highway or any industrial location or something like that. So, do you have any guideline for that or do you have any plan to cover that?

MS. PATULSKI: We have section eight of our hot spot guidance covers background concentrations and it does include -- it looks at four different options for characterizing background.

Looking at one monitor, interpolating between several monitors, or also looking at possibly chemical transport modeling results in some areas and a third, limited option for PM-10 areas.

I would say check that out. There are some factors that you should consider so you find a representative site and you have to consider those kinds of things. Is it upwind from your project area? Is it downwind? Is the development similar?

You have to consider all of those kinds of things and find, you know, hopefully you have something nearby the project location that is representative, but there possibly could be other monitors in your non-attainment area that might be more representative. You need to just look at what you have and make the best decision and I cannot emphasize enough talking with your state air quality agencies is really important for this part of our analysis.

So, I would say check out section eight of our document and it has a lot more details on making those decisions.

AUDIENCE MEMBER: Okay, my next question is about the new version of MOVES.

So, you said that the 2010b is coming pretty soon, so what kind of changes we can expect from that.

MS. PATULSKI: Well, none of the changes are going to affect anything related to air quality modeling guidelines. I'd just like to say that first.

In general, there are some performance enhancements in MOVES 2010b that will help emissions modelers in some aspects, but the emissions results are not really going to be different from MOVES 2010a, but there are some things that have been added. I guess if we have time, I guess I would like to defer to my colleague, Chris Dresser.

Can I have Chris? It looks like we have a little bit of time.

MR. BRIDGERS: Absolutely.

MS. PATULSKI: Yes, why don't you use the mic there.

Chris is the MOVES Team. He can give

you a better answer.

MR. DRESSER: This is Chris Dresser and I work with Meg at EPA Office of Transportation and Air Quality and I work on the MOVES model and I guess I can announce that we're planning an update, like Meg said, to the MOVES model. It's called MOVES 2010b. It will likely come out at the end of this month or early next month.

All of the changes will be mainly usability and performance. There will be no changes to emission rates at all, so it's not considered a new model.

MS. PATULSKI: All right.

MR. BRIDGERS: Thanks, Chris.

AUDIENCE MEMBER: I'm Ryan Gesser from Georgia Pacific and I'll direct my question to Randy, but invite anyone else to comment up there.

With regard to your best practices, it might be premature, but I wondered if you could comment on the level of receptiveness or if any of the methods you described are going to be considered presumptively acceptable among your peers and the state agencies and, depending upon your answer, will that be communicated through a memo or AERMOD implementation guide or a stand-alone report or how do you expect that process to work?

MR. ROBINSON: Well, I can answer the beginning and maybe the end Tyler could speak to.

From my perspective, I guess I would say if someone in Region 5 came in and was applying the approach that we recommended, I wouldn't have necessarily any objections to it. I mean, it was what we came up with as a reasonable recommendation that we thought was, sort of, technically supportable and so we have it out there now for comments and, as we gather those, and if we end up making modifications, I guess ultimately that would result in EPA coming out with a memo, sort of a final position on it.

Tyler?

MR. FOX: Yeah, and we -- the great work that Randy and Meg led with the state and local agencies and other local regional modelers. It has been a long time, hadn't it, Randy? 2009 seems like yesterday.

What we expect to do as we put it out for comment as part of this conference is to get comments from you all in the community, submit that to the docket, we would consider those comments and need to determine what the appropriate next steps are.

I would agree with Randy that it's out

there now so, if someone were to come to a regional office and propose to address the issue in a particular situation following that guidance, again, it would up to that regional office to approve that and I would imagine that, if appropriate, they would do so.

So, the fact that there is not final guidance doesn't preclude people. I think the issue was, as Randy presented, we saw a wide ranging type of assessment or account for these types of sources ranging from not at all, to being the controlling scenario for the permit and I think there was a lot of need to figure out what the there there was and the issues. There are issues that Randy and company didn't address that Chat did in terms of the emissions factors and other factors that go in there.

So, from the standpoint of getting to a point of having final EPA guidance, there would have to be quite a bit of work done to address the issue fully and we look, again, for your input as part of the comments on this conference and then, as was suggested in another venue, having some type of maybe collaborative work group to get more information and work towards that final EPA guidance.

But this is an important aspect. I congratulate Randy and Meg and company for getting it done and, you know, making it available to you all to review and comment and we would urge you to do so.

AUDIENCE MEMBER: Hi. Pete Manuso from First Energy. Quick question.

I think the study that API conducted and found potential work around or fix for the low wind speed issue with AERMOD, along the same line as the last question, how does something like that get adopted? Apparently, it's been sitting on the shelf for about two years. Can you comment on that at all?

MR. FOX: Sure. Given the prioritization that I and others in the group have to attend to, we have limited resources to get to those things.

I think, as a follow-up to this conference and, again, having it there for others to comment on, that study and the like, would be useful for us in consideration of that and along the lines of the other issues that we'll be discussing and have discussed this afternoon and will tomorrow in terms of the one hour NAAQS, those things will be taken into consideration.

That's -- we're dealing the best we can in providing guidance to deal with current permit issues and the like under these one hour standards.

We're trying to put out things that are flexible and valuable to the community and resources are constrained.

AUDIENCE MEMBER: It just seems like it doesn't get the attention it deserves, respectfully speaking.

MR. FOX: Well, that's why it was presented--

AUDIENCE MEMBER: I know resources are minimal, but, you know, we're all under that same issue.

MR. FOX: That's why it was part of the invited speaker, for Bob to come here and present it to the community, for us to consider it, and so it's not something we are ignoring or discounting, it's just when, you know, we face the realities of what we have to do, we have to hit the priorities that are dictated to us by case-by-case examples and other situations and we're doing the best we can with that.

I think as evidence of having Bob present that here, we're looking for input from the community and we'll take it under advisement in terms of follow-up as part of this conference and into our workshop with regional, state, and local modelers in April and we will continue, hopefully, to work with the technical work group that's established to keep the lines of communication open and any collaborations that could assist us in addressing any questions we may have once we review that study and then do further work maybe to inform either in interim guidance or changes to the model as far as updates to Appendix W go.

AUDIENCE MEMBER: Hi. This is Steve Hanna from Hanna Consultants. I have a question for Ms. Patulski.

I've done a little bit of analysis in urban areas of the PM hot spots and I heard you say that there's a 500 meter limit and I've heard that mentioned other places before, but you said once you get 500 meters from the highway, then the concentration of course goes down to background and I wouldn't think that would be such an absolute number that it might be a larger distance if it's a large highway and so on.

MS. PATULSKI: Yes, I guess I'll just say that it does depend on every situation. When I said 500 meters, I was just talking about the hypothetical project area that I had just to illustrate the concept that we're not looking kilometers away. In most cases, it's going to be very close and when you have a nearby source or topography or other things, it, you know, could be a lot farther out.

So, yes, it really -- what the conformity rule and the Clean Air Act requires is that you need to demonstrate the NAAQS achieved in the project area that is affected by a given situation. So, throughout that project area, you need to demonstrate that the NAAQS is not harmed by building the project. And if that is farther out than 500 meters, then you need to look at that. Sometimes, it's going to be less than that. It's really something the consultation process because, yes, I've seen studies where you see differences up to 1,000 meters.

So, you're absolutely right.

AUDIENCE MEMBER: Larry Simmons with E squared M.

I'm glad to see us looking back at Haul Roads again after all these years. Chat mentioned that Southern Research Institute Study at Gary works, that was 28 years ago, I think, that we did that and I was one of the guys on the team eating dust as those big trucks went by. So, it is good to see that as time moves on, we are looking at Haul Roads again.

Hang in there guys.

MR. FOX: It'll define your career, Randy.

AUDIENCE MEMBER: Actually, I have a

question, if I may. Bob Paine. I have a question of maybe Chat and Randy.

If it is determined that an adjustment to the emission rate for Haul Road emissions would be the best way to do it, how does that happen? With AP-42 or whatever? How do we go about improving that characterization because that's an important input to the model. It might be a wind speed dependent input, in fact.

MR. COWHERD: Well, it's -- as far as the roadway emission factors, they're the most reliable that we have in AP-42. We don't feel that there -- we feel it's a problem once the emissions are generated and then there's effects occurring in the plume that's formed immediately adjacent to the source and those effects have to be dealt with.

So, we feel it's more into the initial dispersion process than it is in the emission factors. However, as, you know, I pointed out, a lot of the emissions data that were developed, you know, decades ago, as much as I hate to say it, and just to revisit all of the data, to look it over, to try to assess it, I mean, we'd be willing to -- obviously, willing an interested to help out with that, but to see if there is something to be done to improve the emission factors? If you start talking about the way to represent the source as a volume source and what height to use and so forth and use meandering and all of these other effects, then it's sensitive to those decisions that you make. I mean, the impact of those sources is sensitive to those decisions.

So, it's a sensitivity analysis. One of the uncertainties in the original emission factors, how the source is represented, and then the dispersion process that occurs immediately adjacent to the source. If there was some way of sort of evaluating and ranking the importance of these different factors to figure out where the work should be done first, I would think the EPA would want to do this as well, considering all of the different issues that have been raised and will be raised at the conference.

How do you decide which one to go after first? I mean, is there something about the impact of that particular phenomenon that deserves more attention than something else? I'd be interested in hearing from Tyler or somebody else on that as well.

I mean, is it just a matter of what happens to come up at this time and what you have time to consider or is it looking at the big picture and trying to figure out, long term, how can this area be improved most effectively?

MR. FOX: Well on this topic or area is even more problematic, I guess, than one that is self-contained within the modeling community because, you know, you get a lot of this. So, if you talk to some of the emissions people, it's a modeling issue and if you talk to the modelers, it's an emissions issue. And so, it's an emissions issue.

You know, we've had some long-standing discussions with the Emissions Factors Group. You know, they have their own sense of priorities. There have been some collaborative things to improve the emissions factors for paved and unpaved roads. I think other factors that relate there are the type of vegetation or other types of things that may be near the roadway that may mitigate some of these effects. I think it's a reality and it's safe to say that I doubt we're going to get to the point where we're modeling, you know, impacts near the tire while of a truck or something. I mean, we've got a number of other issues to deal with and so, what I would imagine would be the most productive way is to have some discussions. Bring, for maybe the umpteenth time, people within the agency together to talk about how we could come up with some adjustment factors along the lines of what Tom

Pace and others did. Have some studies to validate those in a way that we feel comfortable with and address that on a case-by-case basis if there's other nuances in terms of the particulars of a permit action.

We've -- the Corn Refiners Association and others have approached the agency and have done some work to try and address some of these issues, you know, but I think if people feel as if it's going to be resolved by the models and the modeling community in terms of those micro scale types of effects, we're fooling ourselves.

I think there needs to be some discussion along what type of situations and what types of factors to consider to potentially adjust those emissions as they come in to get a more realistic and appropriate characterization of those contributions.

MS. PATULSKI: I work with emissions and air quality modelers and I think there's a lot to go around.

And then there are policy people like me, so there you go. I guess I will just say that it's my understanding that the last version of AP-42 that was approved included the information from that, from that ethanol plant study and, I guess, I just wanted to add in for transportation conformity, we have several areas and states that have approved local specific alternatives to AP-42 to take in account their silt loading and other types of information.

I mean, a lot of this is used on a regional level, not a project specific level. I totally agree with that, but there are some states where EPA has approved customized emissions factors for road dust.

MR. FOX: That's an excellent point, Meg. What we were hearing is that people had to use the AP-42 factors, but we've said over and over again that a local -- local data or specific data to the area or the sources of concern is always preferred as with defaults that we set in other types of guidance.

AUDIENCE MEMBER: I'm Pete Catizone. I'm with TRC and I think if I stand here long enough, all of my questions will get answered.

I appreciate the conversation, but a lot of the comments that have been made cover questions that I have, but I think with the fact that we're dealing with a totally different pollutant, PM-2.5 and Chat, I remember the days in the 70s and 80s when we were worried about the dust fall and TSP. A lot of the factors we're using weren't exactly collected -- the data wasn't collected to answer the questions that we have today.

I truly believe that to do justice -- to both be able to meet the new standards, we need to go back in the field and get some new data and the sooner we do that, the better off we'll be because re-massaging the data as we do every decade doesn't make the data any better. It just makes us feel better a little bit, I think.

So, as much as I hate to say, there's a lot of work to be done to generate the right data, both from emissions standpoint and also to get the information we need for the modeling to be done properly. We need to get back out in the field.

Thank you.

MR. FOX: And we would agree with that wholeheartedly.

AUDIENCE MEMBER: Good afternoon. Hi, Meg.

My name is George Schewe. I'm with Trinity.

First of all, I really miss the ISC model. I guess you can't bring it back, huh?

Chat and Randy, I wanted to maybe make a comment to you, especially maybe Randy. Maybe Chat knows about it.

There was some obscuration modeling done at Fort Leonard Wood years ago that might help you in some of your Haul Roads dust evaluations and I don't know who did that, Chat, but somebody was doing obscuration on purpose because they were trying to shut down the bad guys radio communications. So, they were out there trying to generate dust with trucks and tanks and so there might be some good data out there that you can take a look at.

MR. COWHERD: What was the location?

AUDIENCE MEMBER: Fort Leonard Wood, I believe, Missouri? Isn't that right?

Maybe you don't about it, Chat.

MR. COWHERD: I do know that they had smoke releases when we were down there and they were filling up valleys with smoke and whatever, but I'm not aware of any dust obscuration tests.

AUDIENCE MEMBER: A couple guys that I had worked with back in the Pedco days in Cincinnati were actually riding. Bob Zimmer, he's out in Denver, he was actually riding in the tanks so, they had stuff all set up there.

I do have a question for you, Meg. I'll get to you in a second.

I want to tell Bob and Ron to keep

beating the drum, you guys, thank you.

Meg, and maybe this is a question for Tyler or Roger, too. What kind of evaluation studies that AERMOD works with these complex situations where we're going to have all these different roads?

I haven't really seen too many evaluation studies of even one road and now you're going to be chunking them in there. I mean, I've run CAL3QHCR with Mr. Claggett and so I was wondering, how confident are you that these are going to work on these kind of conformity analyses for hot spots? AERMOD, that is.

Thanks.

MS. PATULSKI: Well, I would throw into that CAL3QHCR, MOVES, EMFAC, AP-42, all those models are important.

I mean, my job is to mean the Clean Air Act requirements and when I -- so, I guess first let me state what my job is and then I'll answer your question. My job is to look at what's latest available information that's in EPA's requirements and that's how I write my guidance. That's what I'm required to do so, I mean, you can look at section seven of our hot spot guidance. We have a lot of information there that we relied upon for relying on AERMOD and CAL3QHCR which are in Appendix W for these kind of situations.

We didn't think screening tools were sufficient for looking at, you know, daily PM-2.5 concentrations or annual PM-2.5 concentrations through the complexity of sources. This isn't a CO world anymore. It's not just mobile sources.

So, I feel very confident that AERMOD is the best tool based on the latest science to model these projects.

In terms of validation, I mean, we do have a couple of things mentioned in our--

AUDIENCE MEMBER: Don't say validation. Say evaluation.

MS. PATULSKI: Evaluation. Okay, validation, evaluation -- I know there is another one there that modelers use.

Whatever the case, I mean, I would say check out our hot spot rule that we promulgate our requirement. We have over 70 studies there about why hot spots are important.

We've mentioned several studies in our -- including one that OTAC did for selecting models -- for doing the modeling work itself.

And then I would just turn to all of you and say that, as you supply new information, you know, or other Transportation Research Board or whatever -- as new information becomes available and if Appendix W is changed, I mean, we will just follow that. I mean, my job isn't necessarily to do what you asked, but I think it has to be based on the latest information and we believe it is by relying on AERMOD. I'll say that just from a conformance perspective.

Roger and Tyler, jump in if you want to say more since we worked with you on that recommendation.

MR. FOX: As Randy indicated and as we've experienced and Roger presented at the last modeling conference in the context of the NO2 REA, there devil is in the details in terms of both the inputs to the model as well as how you configure and parameterize that model.

I think, as Meg said, this community has a responsibility and obligation to help us all get up that learning curve. Right now, we're using the best science available and, you know, using that science then allows us the opportunity with field study data or other types of information that may become available to improve those and then provide more case specific types of examples to ultimately come up with broader guidance, but we've been working successfully with OTAC and to the extent that we have a process in place and a consultation process in place to address those issues on a case-by-case basis. We think that's sufficient for now.

AUDIENCE MEMBER: Hi. I'm Leslie Fifita from URS.

I have kind of a general comment and question.

It seems like, over time, we've been going from a very prescriptive modeling process using defaults, using standard procedure to going to a very case-by-case situation. You keep saying the devil is in the details and everything depends on your particular situation which is great that we're looking at it in that level of detail, but it's very hard to plan for.

So, if we knew that someone submitted an application that, say, included some kind of source and said that we didn't have to put it in our one hour NO2 analysis because it's intermittent and you guys agreed, it would be great for the rest of us to know what kind of source that was and why it was approved.

Or, if another kind of source was disapproved, for us to know why that was disapproved and not just in this particular context in one hour

NO2, but any of these variables that very widely, on a case-by-case basis, I'm just wondering if those cases are published anywhere in the clearinghouse or somewhere where we could take a look at it?

MR. FOX: Well, we only deal with situations that rise to the level of us having to deal with them, otherwise the states' sources and regional offices are dealing with those. There's not a clearinghouse or inventory of these things. I'm maybe naive in my belief that, as a community, you all are exchanging information and providing information to each other about successes and failures and the like.

We will talk about some information tomorrow. We engage with AERMOD Implementation Workgroup to try and deal with, you know, model plans for real situations to try and understand what the nature of the problem was and what critical aspects are.

We provide defaults because folks can use those without any further justification, but we do prefer and look to people providing case specific information and that would always be preferred, but you can't just use anything. You have to provide some justification for that information and so, as that information, for example, in stack ratios, you know, are used either through ongoing efforts that the regions have had or folks in California have had to compile those types of data for particular sources that could be particularly useful and so, that's one thing that we hope to talk about tomorrow.

But if there are other types of examples of those situations, then we can have those.

I guess from the standpoint of, you know, dealing on a case-by-case basis with the permits, we don't see all of these things. In fact, we only see a very few of the permits that are reviewed. Those things are part of the public record so, protocols and other types of information and results are made available and so, I guess I would look to you and the community to be, you know, looking at those things and evaluating those to provide a template or example for where there's successes or where there's issues.

We're dealing with issues at the higher level and dealing with guidance and the like that hopefully helps facilitate more flexibility or maybe breaks a barrier or two in dealing with the state or regional office who may be interpreting it in a particular way and we are providing maybe a broader interpretation or more flexibility in that regard and that's what you saw in the March 1st guidance.

MR. BRIDGERS: I guess I would add that that's a topic that I'll take to heart with respect to the regional, state, and local modelers workshop that's coming up. We've got state and local in addition to regional office presentations so, maybe when we are in that venue that we can discuss other ways that the states and locals and the regional offices and the program office here can better exchange that information.

So, that's something I'll table for that workshop.

MR. BRODE: Well, I will just comment that I think that the relative stringency of the new standards is really -- creates issues on things that weren't issues before. So, you know, if the default values might have worked before, it may not work now and so forth.

MR. FOX: And hopefully tomorrow, you'll hear a number of presentations that address some of those things and kind of inform us both in the near term and maybe long term in terms of updating Appendix W.

MR. BRIDGERS: Well, to help keep us on schedule, if everybody would, again, give the speakers a round of applause.

I'm not going to ask you to go to the bathroom in six minutes, but if you could get back in here by 3:05, that would be great, so we're shortening the break by about four or five minutes.

MR. BRIDGERS: As everybody is taking their seat, I actually am starting to get announcements now.

Here's one announcement. I have a young lady in the audience that is staying at the Fairfield Inn. Again, the Fairfield Inn near the airport. If anybody is staying there, she would love to talk with you. So, Hui Chen, are you in the room? She's waving her hand at the back of the room so, if you're staying at the Fairfield Inn, please see her and see if she can catch a ride back over to the hotel this evening. Thank you.

MR FOX: All right. So, we're entering the home stretch of the first day.

So, we're going to have several presentations on CALPUFF and end the day with discussions about the new beta release of the Mesoscale Model Interface Program and use of those prognostic data.

So, I'm going to begin with the current status of CALPUFF and walk you through some things since the last modeling conference so we're all working off of the same information.

As you all know, the agency last updated the regulatory approved version of CALPUFF back in June of 2007 after going through and extended process facilitated by VISTAS and working with the model developer to both understand the nature of the some of the changes that were made and to get a sense of comfort level with this version.

In May of 2009, George indicated this morning that we had a Model Clearinghouse memo to Region 8 in terms of the CALPUFF modeling protocol for BART and that addressed a number of issues and then resulted in a draft reassessment of the WAQM Phase 2 recommendations that's on SCRAM.

We noticed and acknowledged that the CALPUFF modeling system continued to evolve and so that IWAQM guidance that had been previously been put together to support the promulgation of CALPUFF had been static and really no longer reflected the state of the world.

And then in August of 2009, we worked very closely with the federal land managers to issue a clarification memo with recommended settings for CALMET to freeze the model options for most regulatory applications.

Of late, there's been a lot of discussion about the most recent version of CALPUFF, version 6.4. In fact, we were aware of this version in the work by AER as contracted, funded by API. Christian Signiore talked to folks in my group back in a CMAS Conference a number of years back and then at the 9th Modeling Conference, Prakash Karamchandani, I always mess up that name. I'm sorry, Prakash. Presented on that work in 2008.

TRC updated the version six of CALPUFF with these API sponsored updates, resulting in that new version of 6.4 and that included a number of corrections to the gas phase chemistry as well as new PM and aqueous phase chemistry modules.

And on February 15th of last year, we met, along with the federal land managers, with West Associates and API and the model developer to discuss this version and what had been done.

As part of that discussion, it became clear that we needed to clarify the regulatory status and so, in working both internally and with the federal land managers, we wanted to be clear that the April 15th, 2003 promulgation of the model for NAAQS and PSD increment under Appendix W, it was there for approve for distances of 58 to 200 kilometers with a 300 kilometer maximum and on a case-by-case basis as approved under as an alternative model in situations with complex winds and the near-field.

We wanted to be clear that everybody understood that it was not approved for chemistry. Appendix W does identify a preferred model for use in attainment demonstrations for ozone or PM or the uniform rate of progress assessment for regional haze. Models for these purposes should meet requirements of alternative models as defined in section 3-2 and that's consistent with the statement in our SIP modeling guidance which refers back and Appendix W actually does refer to that guidance in terms of the criteria and it follows that criteria. It may be used for reasonable attribution of visibility impairment RAVI analyses per section 6.2.1(e).

And so, there was some, I guess, confusion in terms of the regulatory status as a result to the BART guideline, Appendix Y, which states that you may use CALPUFF or other appropriate model to predict the visibility impacts from a single source in class one areas. However, I just want to be clear that Appendix Y does not confer status to any model as an EPA preferred model and certainly doesn't do so here for either secondary PM or visibility. That can only be done through Appendix W and notice and comment rulemaking.

In terms of air quality related values, it's also important to make sure that we're all understanding the guidance pertaining to application of those models for that purpose is under the justification of the federal land managers and, if fact, Appendix W refers to that. The second bullet explicitly states that the FLM has affirmative responsibility to protect HRVs that may be affected and provide the appropriate procedures and analyses techniques.

I don't have the reference to the flag 2010 guidance that actually went through OMB review and the like, but that is available and provides those specific procedures and analysis techniques and there's a number of folks from the federal land manager community here that could speak to that, if necessary.

So, in terms of the status of this version, both the EPA and the FLMs have outstanding technical concerns about the adequacy of the evaluation. Regardless of that, 6.4 does update chemistry and therefore, does not allow the agency to go through the previous update process that we instituted for CALPUFF because it's outside the approved regulatory use of the model.

And during that discussion in February, we informed API, the West Associates representative and the model developer and pointed to the fact that we would be working with the federal land managers through a phase three of the inter-agency workgroup on air quality models to discuss the need for chemistry and improvement in our long range transport models and the process of in forming the rulemaking.

So, as I said, this would necessitate a regulatory change in Appendix W through notice and comment rulemaking that would also include the required public review and comment and recently we worked with -- OAQPS worked with Region 6 to reaffirm this decision regarding 6.4 in response to comments on the New Mexico regional haze fail. Each of those aspects that relate to approving a model as an alternative model, we found there to be a lack of support or deficiency in being able to do that.

So, I do want to address or at least introduce the fact that we, as an agency, do need to address chemistry under Appendix W. We're going to get into that more tomorrow with respect to the emerging models and techniques session and go through a number of evaluations and assessments of existing models in terms of addressing that and starting that process and this being the appropriate venue to engage the community on that.

As some of you may know, the Sierra Club filed a lawsuit back in August of 2011. They had actually filed previous petition and notice of intent to sue in 2010 and they alleged that we were unreasonably delayed. Imagine that. Responding to an administrative petition for rulemaking which they have provided, requested that we identify and designate models for ozone and PM-2.5 to use in evaluating PSD under the Clean Air Act and do so by updated Appendix W and taking the action required under the Clean Air Act to designate those models.

So, we, after a lot of discussion both internally with our division director, Chet Wayland, the policy division, Anna Wood, and Raj Rao in the New Source Review Group, as well as of our Office of General Counsel and the Department of Justice determined the best way to deal with this was to grant the Sierra Club petition and on January 4th, 2012, not 2121. That may be the date on which we deliver the models, but -- a little subliminal messaging there. So, not our grandkids, our grandkids' grandkids, but I don't know. Maybe Planet of the Apes. Maybe they can make it work.

I blame Bret for that.

But, we will engage in rulemaking to evaluate the updates of Appendix W, as appropriate, and incorporate new analytical techniques or models for ozone and secondary PM.

I think it's important to notice that we did not say thou shalt be a model. We said that we would evaluate updates and, as appropriate, incorporate new techniques or models. And, as we'll discuss tomorrow, we're both looking at the existing models that have capabilities to address these issues and evaluating them and looking for various techniques that may provide a suitable technical basis for providing those inputs recognizing the types of resource constraints that are in existence in terms of working on permits.

And we will use the existing process and procedures under section 320 of the Clean Air Act to complete that and when, in fact, we refer to this conference as one of the first stepping stones in terms of introducing the work and thoughts of the agency in this regard to the community, getting input from the community, and then engaging in a process to move forward.

In that grant, I believe it specifically states that we would expect that the next modeling conference, the 11th Modeling Conference in 2014, that we would hopefully either be talking about a proposed rule or an upcoming proposed rule in terms of updating Appendix W.

So, I'm giving you little highlights of what we'll talk about tomorrow morning as setting the stage for things that we'll be taking on and considering.

Key to that effort is the effort -- the collaborative effort that we have ongoing with the federal land managers. As most of you know, IWAQM was formed in 1991 and led us through the process, through phase one and phase two, ultimately with the promulgation of CALPUFF phase one reviewing guidance and recommending interim modeling approaches that would meet and immediate need and are evaluating current models that have those capabilities similar to, right now, us issuing draft permit guidance for PM-2.5 and then evaluating the existing models as we are doing and then in phase two, coming up with specific recommendations concerning the application of a model or techniques in that context to inform promulgation of the model. Just as in phase two that was done to support the promulgation of CALPUFF.

In phase three in particular, we know that we need to meet the single source needs in characterizing ozone and secondary PM-2.5 and also the AQRVs, both visibility and deposition.

And, as I've mentioned, the latest efforts both by the agency and in collaboration with the FLMs will be reported tomorrow and so we look forward to both presenting that information to the community and engaging in conversation, recognizing that that's not necessarily sufficient information or sufficient time to engage in the type of discussion that we're going to truly need. We do have a comment period here. I'm not sure if George announced, but we will be extending that so that people have more time to comment on reports and guidance that still has yet to be put out there and we would look forward to comments in terms of the types of analyses that we've done so far and will be presented tomorrow.

Now, the latest information as you all recall in April of 2006 Earth Tech sold the rights to CALPUFF to TRC and we have been working with TRC since that time in terms of regulatory updates to the modeling system. I believe we've gone through two updates, at least.

But then, this past spring, Joe Scire and ASG left TRC for Exponent and we could hear the ripple effects in terms of people calling us and asking us what was going on and, to be clear, and Gale reiterated this both in email and on the phone to me last year that TRC retains the rights of CALPUFF and will continue working with us in order to meet those regulatory needs.

And to that end, we do recognize that there is a need to update the current regulatory version of CALPUFF to address known bugs. We haven't updated the model since 2007. Again, from the standpoint of priorities and the like, it's been very difficult to get to that process and the past experience in that process have shown that it is not a very simple one to engage in. But it is clear that we need to do that and to that end, we will be meeting with the federal land managers by the end of the month to take into account all of the known bugs and, in terms of things that have already been addressed in current versions of CALPUFF or other bugs that the FLMs know from their experience and then, based on that, we would make a formal request of TRC to provide an updated version, 5.8 version, of that system with the bug fixes, provided the results of the update tool and post also the updated CALPOST to address the new, improved equation. We had previously requested that in the fall and looked to Gale to address maybe when we can expect that.

So, that's the status of where we are right now and so I will turn this over to Gale and then I think Roger follows with a validation study and we have some open time to discuss.

MR. HOFFNAGLE: Okay, as described, he took my whole talk, but that's all right. That's fine. It'll get us back on schedule.

The guideline on air quality models is codified and there's a location. It requires a modeling conference every three years. The guideline is intended for PSD permitting and attainment demonstrations for single sources. Single sources in an important concept here.

Multiple source, state demonstrations, other guidances used. For class one demonstrations, the federal land managers rely on the air quality related values workgroup guidance flag and additionally is it used for the BART process.

So, since adoption of AERMOD to replace ISC, EPA has taken a stronger and stronger position that AERMOD is preferred within 50 kilometers of the source. We don't happen to agree with that. This EPA position reduces the potential use of CALPUFF in obvious complex wind situations and there are many complex wind situations.

We believe that CALPUFF should be used in complex wind situations less than 50 kilometers and argued for those options when they are necessitated by the complex winds.

We still disagree with the use of arbitrary use of 50 kilometers. You had a 500 meters issue. Well, we have the 50 kilometers issue. So, CALPUFF is the preferred model for class one area impacts.

We need a 3D lagrangian model. Eularian model will not work well for individual sources. We still believe that point and grid and sub-grid scale models in eularian models are too simplistic and are inaccurate. So, if you're evaluating a single source, you still need a CALPUFF type model to handle what happens and how it happens.

Better handling of low wind speed cases, stagnation, coastal, complex terrain, and flow reversals we know, for instance, in coastal situations, CALPUFF gives us larger concentrations than AERMOD will, but that is appropriate because those larger concentrations actually occur.

Better handling of deposition than is available in AERMOD and CALPUFF is a model with substantial user community experience and should be implemented.

TRC maintains the EPA approved code for free use by the public, version 5.8. TRC answers questions about the code and teaches courses on its use. TRC provides multiple graphic user interfaces for user presentation of the results. TRC will provide CALPUFF's version 6.221 which is what Tyler was talking about, that supports the federal land managers, although I should say that the current version of CALPOST on our website does do the same job if you give it the right switches. So, it's just for the lack of having a CALPOST that has the right number on it which is what I was complaining about about AERMOD before.

And so you can get the model from the SCRAM website or directly from our website.

EPA has not yet approved the bug fixes for 5.8 which Tyler agreed to and we are willing to sit down with Tyler at any time to get that fixed and resolved and we'd be glad to do it.

Model change bulletins E and F, we

believe, meet the requirements that you talked about, but we'll be glad to sit down and meet with you on that issue and move forward.

EPA's only work to date on CALPUFF are meant to confine its use and to sponsor one study which uses CALPUFF as a long range transport model which we will be having separate comments on. That study needs to be peer reviewed.

I believe that's my presentation so far. CALPUFF -- that's the status so far. CALPUFF 6.4, several studies have demonstrated that 5.8 is significantly over-estimates sulfate and nitrate production and thus visibility impact. 6.4 incorporates more sophisticated handling of the atmospheric chemistry as nitrate -- as sulfate and nitrate formation leads to more accurate reproduction of the particulate formation and visibility impact calculations.

So, we have the rapid ozone chemical mechanism. Isoporeum. Inorganic gas particle equilibrium. RADM for aqueous phase transformation and secondary organic aerosol formation from CALTECH and those things substantially increase the chemistry for visibility analysis and for BART analysis. TRC urges EPA to consider version 6.4 for application to these assessments. 6.4 is backward compatible with 5.8, so we don't need to worry about that part of it. 6.4 will provide much more accurate determinations of sulfate and nitrate and repeat the same answer.

Thank you.

MR. BRIDGERS: Thanks, Gale.

So, I want to introduce somebody that we haven't heard form yet today. Mr. Roger Brode.

MR. BRODE: Do I have to change my voice?

So, I'm going to talk about CALPUFF near-field validation a little bit and first, sort of review the regulatory status of CALPUFF for near-field applications which is defined in Appendix W as nominally within 50 kilometers.

Some of these issues were addressed in an August 2008 clarification memo and there was a technical issues memo that came out around that same time.

Give a brief history of the CALPUFF near-field validations which -- and then share some results from a CALPUFF validation study that was done more recently by the New Jersey DEP in support of their 126 petition against the source in Pennsylvania.

So, I'm not going to read all of these

words, but again, we issued a clarification memo back in 2008 to address this point. At that time, we sort of came to the conclusion that some members of the modeling community maybe didn't quite understand what Appendix W said about CALPUFF and the near-field.

It mentioned in section -- I mean, basically, EPA is a preferred, the AERMOD is the EPA preferred model for near-field regulatory applications. That's what we promulgated in 2005. CALPUFF is not the preferred model for near-field applications, but may be considered as an alternative model on a case-by-case for near-field applications involving complex winds subject to approval by the reviewing authority.

The preamble to the CALPUFF promulgation rule actually talked about this in more detail. It says we will require approval to be obtained prior to accepting CALPUFF for complex wind situations. As this will ensure that a protocol is agreed to between the parties involved and so on.

So, that hadn't been happening. People -- some people seemed to have it in their mind that if I say complex winds then I can use CALPUFF because it's got to be better. I kind of wish it was better, but so far, that's the issue. We haven't seen a lot of evidence of that yet, so how you apply the model under those complex winds situations in accordance with section 7, 2, 8 of Appendix W should be determined through the consultation with the reviewing authority and consistent with limitations of paragraph 3, 2, 2, (e) and, a key point is to paragraph 3, 2, 2, (e) is the reference that basically places CALPUFF in the status of an alternative model for near-field applications subject to certain requirements.

So, here are the requirements spelled out as paragraph 3, 2, 2, (e) that would apply to CALPUFF for near-field applications. The model has received a peer review. It can be demonstrated to be applicable to the problem. Databases are necessary to perform the analysis are available. That appropriate performance evaluations of the model have shown that the model is not biased toward under-estimates. And a protocol on methods and procedures to be followed has been established.

So, item four is really the key issue that emerged as we looked more closely at this. So, we summarized in the clarification memo what steps to go through. First, you have to make a determination as to whether complex wind is critical to estimating design concentration. I appreciate the comment you made in your presentation and if you look at the types of complex winds that are talked about there, I think in almost every case the expectation would be that, due to those complex winds, I should get higher impacts than I would with a steady state plume model.

And maybe one solution would be, okay, run AERMOD, run CALPUFF take the higher result and we'll be happy to accept that. I don't think that's probably an approach that most people would want to take, but I think that was a valid point that you made and felt we'll go on from here.

So, each of those has very case specific issues that need to be addressed. So, this is section 2, 2, 8 which describes the types of complex winds that, you know, for which CALPUFF may be considered on a case-by-case basis. There are local wind circulations, stagnation, very light winds, valley -- mountain valley winds and so on, but I think the real issue has been, for us, is that the CALPUFF model for near-field app complex wind situations is not that well documented.

The IWAQM phase two report which was available before CALPUFF was promulgated includes some CALPUFF evaluation results for Kincaid. A field study that's a flat terrain database. And Lovett which is a power plant near a hill. So, a complex terrain field study and the results for Lovett actually show pretty good performance. This is from the IWAQM phase two report and so, one to one line is there perfect agreement. The higher line is from CTDM Plus that was the preferred model for complex terrain impacts in near-field before AERMOD was promulgation. It's still in Appendix W, but AERMOD is still so much more in widespread use. And then CALPUFF results are there and is actually pretty good. It is within the two to one sort of benchmark for being unbiased. It performs better than CTDM Plus and that's all well and good. The problem is that that evaluation was based on applying CALPUFF with CTDM Plus MET inputs and bypassing CALMET. So, basically it showed that CALPUFF could emulate CTDM Plus pretty well, even better than CTDM Plus in a way, but that approach to applying the model is not consistent with CALPUFF near-field applications under paragraph 7, 2, 8 which actually states that the purpose is to fully treat the time and space variations of meteorological effects on transport and dispersion. That's why it's called complex winds.

So, therefore the evaluation results that were available at the time actually are not relevant to application of the model under section 7, 2, 8.

So, more recently, a New Jersey DEP had submitted a CALPUFF near-field validation study using the Martin's Creek field study in support of Clean Air Act section 126 petition against a source across the border in Pennsylvania under the new one hour SO2 NAAQS.

Section 126 of the Clean Air Act addresses interstate transport that may significantly contribute to non-attainment or interfere with maintenance of a NAAQS in a downwind state and New Jersey claimed that the validation study they provided demonstrates that CALPUFF performed better and produced predictions of greater accuracy than AERMOD and therefore should be acceptable as a basis for the modeling submitted for that petition.

Now, Portland, actually the facility that the petition was filed against was actually one of the background sources included in the Martin's Creek field study. It wasn't he main focus of the study, it was, you know, the largest I think of the other background sources.

New Jersey also had claimed that CALPUFF was more appropriate than AERMOD due to the influence of complex winds. There's a lot of details there that we're not going to get into. You know, we responded in a fair amount of detail to some of these issues and the technical support documents that were issued in support of the proposed rule and more recent final rule, but the question of whether the validation study submitted adequately demonstrated CALPUFF performing better than AERMOD was important because CALPUFF model results that were submitted by New Jersey DEP were much higher than the AERMOD results that they submitted. They submitted model results based on both models. CALPUFF results tend to be about two to three times higher than AERMOD results and if we had based our response to the petition on CALPUFF results that would have required a much lower emission threshold to eliminate their significant contribution to non-attainment or interference with maintenance of the one hour NAAQS in New Jersey. So, it was a very important issue.

This is the layout of the Martin's Creek field study, I don't know if you can see, but Martin's Creek, the main focus of that study is down here. The monitor -- the ambient monitors of SO2 that were deployed as part of the study were mostly focused on this terrain feature to the southeast of Martin's Creek. These identify the location of a SODAR and ten meter tower there that was a source of MET data and these were the sources of the background data, Portland being up here. So, it's the furthest, but it's also the largest emitter of these other background sources. There was another ten meters MET station up on higher terrain northwest of Portland -- of Martin's Creek.

So, we identified some issues that we had with this evaluation protocol including the fact that they varied the number of values in determining the robust highest concentrations and we had some concerns about how that was done and whether it really improved the validity of the evaluation.

Ambient data were also collected from this monitor. There was MET data and SO2 ambient data. And the original field study was done before it was applied to AERMOD as well as in the AERMOD study the MS8 monitor was used only to determine background concentrations in comparing model results over here. It was never intended to be -- validate the model at that receptor.

So, there's a lot of issues there we won't go into, but that was one concern that we raised.

The residual analyses that were done to compare model bias were based on rank distributions and we expressed some concerns there and, again, these are addressed in detail in the TSDs for the proposed and final rule as well as the final response to comments document.

So, these Q-Q plots that were submitted by New Jersey DEP as part of their CALPUFF validation study. So, a one hour Q-Q plot, three hours, and 24 hour and the red curve is CALPUFF. The blue which you can't see as well is AERMOD, but overall they actually look quite similar. They both looking pretty good. Very similar. So, that's one bit of information.

These are the results using the boot analysis program on the data and this -- these are results for CALPUFF. These are results for AERMOD. So, these are time series -- one hour time series results and the boot analysis does the boot resampling procedure to assign confidence limits on the model evaluation results and those confidence limits are reflected by the range there. So, zero fractional bias is the ideal result and the CALPUFF model results are actually better than, you know, closer to zero than AERMOD. They overlap zero which is good, but if you look at the range of those two confidence intervals, they overlap which is an indication that the difference in the performance between the two models is not statistically significant at the confidence interval.

So, that's a key point and that's addressed in our responses. What is better mean when in Appendix W, section 3-2 that you show that another model is better -- performs better than the preferred model.

Well, we also independently applied the Cox-Tikvart Protocol for determining the best performing model to the -- based on the data that was provided by New Jersey, including the results from the MS8 monitor and, again, one of the issues we raised was that New Jersey varied the value of N, number of top ranked values used to determine the robust highest concentration and the general default recommendation is 26, but there's some wording that suggest that, well, maybe it should be different in some circumstances. I won't go into the details there here, but we actually applied it for different values of N and 26 is sort of the standard that's used, especially for a large field study like this. A long term, full year of data.

Usually, the question of whether you change it is if your sample size is very small. If you only have 24 samples, the 26 highest values isn't going to be very meaningful. We varied with N equals 26, N equals 15, and N equals eight. These are model comparison measures based on the Cox-Tikvart Protocol so, if the middle of the air bars is at zero, then there's no difference between the models overall. If there air bars cross zero, then if there is a difference, it's not statistically significant. So, basically, these results are very consistent with what you see in the Q-Q plots, just kind of a visual sense of how the models performed. Applying the Cox-Tikvart Protocol which is mentioned explicitly of section 3-2 of Appendix W confirms that.

If anything, AERMOD is a little better here. AERMOD would be better if it's on the left. CALPUFF better on the right. CALPUFF does, you know, a little better, but not significantly better for the smaller value for N.

So, the initial assessment was that, you know, the performance of CALPUFF and AERMOD for this field study is very similar. I mean, we're not saying CALPUFF did badly. It did pretty good. So did AERMOD.

So, where does that leave us? Again, since the confidence intervals overlap zero, the differences aren't statistically significant. So, we felt that based on those results, it didn't support the claim that CALPUFF performs better in the sense of statistically significant and we laid out some of the logic and rationale behind that finding and technical support document, but a further review of the CALPUFF input files indicated something we hadn't noticed earlier which was the PRIME downwash algorithm was not used when CALPUFF was applied for the Martin's Creek validation study. There are some downwash influences from nearby cooling towers on the stacks. AERMOD valuation or validation results are based on the conclusion of PRIME downwash, so we decided that we would look at that and when you incorporate PRIME downwash in CALPUFF for this field study, the CALPUFF performance degrades somewhat.

So, here's a one hour Q-Q plot so, again, AERMOD and CALPUFF -- the green is the original CALPUFF with the ISC type downwash. Blue is AERMOD. The red is CALPUFF with a PRIME downwash. And you see a tendency now in CALPUFF to over-estimate the peak concentrations. So, it's still not horrible, but it's not quite as good as it was before.

When we go to the statistical evaluation metrics with inclusion of the MS8 monitor, you know, again, the difference in results is not statistically significant even when PRIME is included in CALPUFF. The difference is a little bit larger, so you're getting closer. So, again, value to the left of one means AERMOD's better, to the right CALPUFF is better, but it is wider confidence interval.

If we remove a MS8, then suddenly -- you go to N equals eight, suddenly you will -- actually, for N equals 15 and N equals eight, that's where AERMOD actually does perform better in a statistically significant sense.

So, based on this, we just didn't feel that they had made an adequate demonstration that CALPUFF is better for this application and when our final rule, we based our proposed remedy on the AERMOD modeling results.

There were some other issues that we won't get into here, but also, but there's some additional information that may shed some further light. New Jersey had also installed an ambient SO2 monitor at Columbia Lake. I think it was two kilometers northeast downwind of the Portland plant back in September 2010 and the monitor shows numerous exceedances at the one hour NAAQS. I think the 99th percentile daily max one hour value for the first year was 136 ppb, so it was about twice the standard. Not quite. So, we're not saying there isn't problems there. Here's where the monitor was located. Here's the Portland plant. So, again, it's about two kilometers and it's kind of a very broad valley, so there's a lot of southwesterly winds. This shows the time series. This wasn't the full year, I just -- Sept

23rd was when it started through February 27th, you can see again a number of exceedances. That's the NAAQS level there. But when it's not spiking up like that, it's pretty much near zero which suggests that there is not a lot of other background sources contributing to impacts at that monitor and we kind of figured that in our action as well.

But New Jersey had actually done some monitor to monitor comparisons with the Columbia monitoring data. Comparing the top ten monitored values with the top ten modeled. It wasn't clear if they were the top ten daily max one hour or overall top ten and I made some conclusions there. So, I thought that was a reasonable thing to look at, so we did that ourselves and the next table is going to show observed data, top ten maximum daily or daily maximum one hour values observed and modeled. Observed are from that period, a full year. Now, September 2010 to 2011.

AERMOD results are based on the best data we have which is the site specific data collected back in July 93 to June 94. It had 100 meter tower plus a SODAR. With what we think are representative emissions there at maximum load with about 77 percent of allowables based on the fuel contents, we think those emissions are sort of representative of, you know, the high impact from the plant during this period.

CALPUFF was modeled based on the same emissions, but using the three sets of MET data that were included in the 126 petition and, you know, despite the significant difference in the data periods, the periods for CALPUFF varied as well. Overall, the distribution of the maximum one hour daily max one hour values is very similar for AERMOD. Average predicted to observed ration is about 1.14. CALPUFF results show some significant over-predictions with ratios over three. So, here are those results. There's there top ten daily one hour observed values. AERMOD peak one hour is a little bit, you know, about 30, 50 or 60 percent higher, but the average of the ratio of modeled to observed across the top ten is, like I said, 1.15 for AERMOD and about 3.3 for CALPUFF with 1992-1993 data. That was the data period for the Martin's Creek study. The study had some site specific data back then and SODAR as well. And then with 2002 MET it was about 3.9 higher.

So, those relative comparisons kind of match more closely with the differences in model concentrations submitted with the petition itself, but again, don't really jive with what we just saw as far as performance at that Martin's Creek study.

So, the validation study show generally good performance for CALPUFF, similar to AERMOD, but not clearly superior in our opinion. In fact, when we addresses some of the issues that we raised, it actually started to skew the other way, but at least, you know, it's not bad.

More recent model to model comparisons based on the new monitor actually show much better agreement based on AERMOD and CALPUFF and those relative differences, again, I said are similar.

So, that's sort of -- we are encouraged to see that kind of study done because that's what we think needs to be done to support the use of CALPUFF in near-field applications under Appendix W. One of the things that we'd maybe like to look at is, you know, what kind of drove CALPUFF performance. I know that there was a SODAR available for the Martin's Creek study. I know that the proffed up tool was used to try to get that SODAR profile information into the modeling system maybe more effectively could be done easily before the proffed up tools, so maybe that's helping. I would be interested to see how much effect that had on its performance, but that's where we are.

Any questions?

AUDIENCE MEMBER: Hi. I'm Alan Dresser, New Jersey DEP and one of the infamous authors of the CALPUFF validation study Roger just talked about there.

Yeah--

MR. BRODE: You should be commended for having conducted such a study.

AUDIENCE MEMBER: I'm a little surprised you're talking about it. I didn't know about this, so I feel a little sucker-punched, but Roger and I did have a spirited back and forth on this over a number of months.

If you want to read a detailed description of the validation we did, go to the June 2011 Air and Waste Management Association Magazine and you'll see our write up of the validation.

I'm not going to go into all of the details of some of the things that Roger brought up, but, you know, things like the robust high concentration. We talked to Bill Cox who came up with that concept and how to better develop it and not to use an N of 26 all the time that you can vary that. The AMS8 monitor -- all the monitors were used as background, not just AMS8. So, why eliminate it? It just didn't make sense.

And the PRIME downwash, we felt we had

to use a EPA approved version of CALPUFF. The EPA approved version of CALPUFF, you can't run PRIME downwash with more than one source and that's one of the fixes that Mr. Hoffnagle was telling you about that had to get in there.

So, we were stuck between a rock and a hard place. We either use the approved version without -- that can't handle PRIME downwash or we used a non-approved version that can handle it. So, that's kind of the problems we were running into.

But yeah, please do read the article.

MR. BRODE: Thank you for your comments.

AUDIENCE MEMBER: Bob Paine, AECOM.

I noticed that Gale mentioned that version, CALPUFF version 6.4 can be made backward compatible to version 5.8 with the bug fixes. So, I would strongly recommend that EPA simply replace version 5.8 with version 6.4 and prescribe how it should be used and that would be very -- I think that would help to bring in the advancements in -- that are in the CALPUFF version six series and still make it backward compatible and why not go to a version six rather than a version five?

So, that's what I would recommend.

MR. FOX: I appreciate that

recommendation based on experience. That's fine. Based on our experience and the review -- this is Tyler Fox OAQPS. Based on our past experience in terms of the update process, it's not as simple or never as simple as that and so we have some concerns in terms of those things that are in the 6.0 series and so we would prefer to stick with the current version that we have an understanding of and have bug fixes, vis-that version.

We don't have the time and resources to spend to evaluate it like we did before given all the other issues that we have. So, that's just kind of where we're at.

AUDIENCE MEMBER: This is just a follow-up question.

If TRC were to provide an equivalency demonstration between the two version, would that help?

MR. FOX: That was provided previously and the devil is in the details in terms of those aspects and as we found out, you know again, that there are a lot of issues and those are well documented and we just can't afford or can't use that time to, you know, go down that road again.

AUDIENCE MEMBER: But if the model is equivalent to an approved model, it could be proposed for any given application, correct?

MR. FOX: It was said to be equivalent previously and we found some issues in terms. That's what I referred to in terms of federal land managers and EPA, but again, I don't want to belabor or debate the point. I think that we will and acknowledge that we need to address the bug fixes. We're going to engage with FLM to do that and that's the process that we're going to go through.

I would urge everybody to pay attention tomorrow to the emerging models and techniques to the extent that version 6.4 is a model that's considered viable in terms of moving forward and addressing the transport needs and the chemistry needs of the agency. Then, it will continue to be evaluated in that context for that suite and it has been and will be in that suite of models that are being evaluated.

AUDIENCE MEMBER: Okay. This is Joe Scire.

Just a couple of points I wanted to make.

One is about the model change bulletins themselves. ENF were changes to CALPUFF that were submitted to EPA back in the year 2007 and that did include the code that went with that and it did include the entire matrix of applying the EPA model evaluation software. So, you mentioned about receiving those -- waiting for those, but those have been delivered oh, maybe five years ago.

The other thing that wasn't mentioned was that there was a model change bulletin G and that really needs to be implemented as well. They're important changes to CALMET that was missing from the presentations that has been prepared and provided and that's important to introduce into the model as well.

MR. FOX: Well, we appreciate that, Joe, and that was my point in terms again, yes, we have the ENF, but are there other issues and that's why we're meeting with the FLMs to make sure that we have full account of the issues and the bug fixes that need to be part of the update in terms of addressing known bug fixes.

AUDIENCE MEMBER: E, F, and G include all of the known bug fixes.

MR. FOX: Right. No, I referred to E and F in terms of delivery and I was unaware of the G, so we'll -- that's why we're going to talk to FLM and then engage with TRC to make sure that we have account for everything that we need to.

AUDIENCE MEMBER: Okay. The other issue

I want to comment on is related to the equivalence of the different version of CALPUFF.

You made reference to problems of last time it was difficult to get equivalents. And that's the case. It was difficult. We had done many tests and found that the version 5.8 and the previous version were equivalent. At that time, we did not have access to the EPA model evaluation software. That's a matrix of about ten different test cases that the model was designed to run with.

And so we did tests. In every test, we found the model to be equivalent. Later, EPA ran against this extra set of ten and found some differences that we did not find because we knew the test cases and we did go through and make the models equivalent in those cases where we found that there were differences.

So, I mean, it's a process. We do work. We submit it to EPA. We describe what it's finding -- what the findings are. The fact that there were other cases that you discovered we then addressed and had to revise the code to make it equivalent doesn't mean that version 6.4 is not equivalent. It would have to be tested and I think that's something that is not outside of the responsibility of EPA to perform in order to do its evaluation of the model. It's been five years since the last update.

MR. FOX: Thank you.

AUDIENCE MEMBER: One other comment. This is about Roger's tweaking of CALPUFF and the evaluation statistics. I think that AERMOD is a model that EPA developed. I think people do independent evaluations and then there's the model evaluations that are done by the developers.

I think changing the model options to obtain worse performance like the downwash option is questionable in that why would you choose to run the model in the mode that performs less well?

The model has both sets of downwash algorithm in there for a reason and what we've found, and we've had discussions with the EPA on individual projects about this, is sometimes the ISC downwash performs better and we recommend its use in those cases and this seems to be a case where things were changed until finally AERMOD performed better and that's when you stopped doing the evaluation tests.

So, I don't think that's really appropriate.

MR. BRODE: I didn't choose to run CALPUFF with the PRIME downwash option because I thought it would make the model perform worse. I actually didn't expect that to happen. I just realized that it hadn't used PRIME downwash and, as explained in some of our documentation related to that, you know, the regulatory status of PRIME in CALPUFF may not be that clear, but it's not unreasonable to suggest that if we were to accept the use of the CALPUFF in a near-field situation where downwash was considered to be important, then -- and the PRIME algorithm is incorporated into the model since PRIME is the preferred downwash algorithm at this point in terms of near-field applications it's reasonable to assume that we would expect that PRIME downwash option to be used. The fact that it changed the model results that much was just what happened. It certainly wasn't -- I just thought it would be appropriate to see how that affected the results and I did not expect to see that level of difference.

AUDIENCE MEMBER: In the large structures, we tend to find there's a big difference which is why we recommend the ISA downwash for certain kinds of buildings.

MR. BRODE: Well, so, I mean, AERMOD was run with both the old downwash and PRIME and that degree of difference didn't occur. I don't know why one was more sensitive than the other.

AUDIENCE MEMBER: Marsha Kinley with Duke Energy.

In light of the discussion of performance into the models and the need for field data, I did want to make EPA and the modeling community aware that there is a project that is just getting started between EPRI and RTI here at RTP to take a database that was preliminarily developed for GE during the Fukushima accident. It's called JMARTIS and they are going to get that data qualified as much as possible and they're going to use, first, as a focal point for comparison of models on the nuclear side of the industry. The nuclear utility models, but this data could be used potentially down the road for these type of models and in the near-field that you're talking about around sources.

So, we would strongly support that to be looked at in the future.

MR. BRODE: Thank you. And we agree that, again, one of the critical aspects of model evaluation is getting the right field study data or getting information.

One aspect is do we have access to the available field studies and that's something to pose to the community. I think we've gone through great lengths to acquire some of this information. It would be great to have that information compiled in a way that would make it more accessible so that we could reduce the barriers to conducting those types of evaluations.

Then, to the point of near-field evaluation, identify those areas where we do need those data and then work, either through collaborative or coordination manner to acquire information that is being acquired for other purposes or perhaps focus on field studies.

The unfortunate aspect is that given the funding of the agency, I don't envision the agency being able to fully support and fund the types of field studies that we need so, we're going to have to do it in a collaborative way to get where we need to be.

AUDIENCE MEMBER: Hi. This is Steve Hanna of Hanna Consultants.

As a developer of the BOOT model evaluation software, I was very pleased to see Roger looking at the significance tests and coming to conclusions about whether there was a difference between CALPUFF or AERMOD.

However, I think maybe you need to take

it one step further and look at the difference between the performance measures between instead of the performance measures themselves. It appears to me is what you did is you took the, like, fractional bias and then you calculated the uncertainty about that for each model and then you looked at whether those overlapped and then concluded that there wasn't a significant difference because they overlapped.

But there is another output of the BOOT software that looks at the significant difference between the two -- the individual fractional bias, say. And then it -- an example of how what you did can arrive at erroneous conclusion is supposing model A is the same as model B, but just the concentration for model A equals twice model B so they're perfectly correlated with a -- you would end up with those two different FBs and distribution and you might conclude that they're not significantly different, but if you go on and use the -- look at the other output which accounts for the correlation between the models and I would assume there is a fairly good correlation between CALPUFF and AERMOD on individual values because it's the same meteorology, then there may be a significant difference in reality that would come out of look at that additional output.

So, the bottom line is there -- you concluded that there was not a significant difference, but in fact there may be a significant difference between the performance of the two models.

MR. BRODE: I appreciate those comments. In fact, I think that might have been that I actually had run the BOOT program. That was actually the what -- the way it was used by New Jersey and later I looked at it more closely and realized that, I can't remember, but I think it actually may have been statistically significant at that next level, but I can check that.

AUDIENCE MEMBER: Yes, it's kind of confusion and most people don't even use that output. So, I'm pleased to see that.

MR. BRODE: I appreciate your pointing that out and I recognize that difference since then and I'll check it.

MR. HOFFNAGLE: Maybe the developer can make it less confusing.

MR. BRODE: Well, a lot of confusion is on the side of the users, so.

MR. BRIDGERS: Do we have other questions?

Well, if not, then I guess we can give our speakers another round of applause and we can move on to the last set of presentations for the day.

So, if you look at your schedule, we have 4:15 to 5:15 we've got some talks on MMIF. It says Bret Anderson and Kirk Baker, but all that's been pulled into one presentation if I understand correctly, so I'm going to yield the floor to Bret Anderson for the next hour.

MR. ANDERSON: I'm not going to torture anybody with an hour long presentation. Honest.

Many of you have seen me in years past, you know, working for EPA Region 7, for the Office of Air Quality Planning and Standards, and now I'm doing my final tour of duty with the Federal Land Management community before I go into imposed retirement -- self-imposed retirement.

Anyway, you had seen presentation given by Herman Wong of EPA Region 10 at the 9th Modeling Conference on a project that was then called the, I think he referred to it as the BARF project which was the Bret Anderson Reformatting Tool. For political correctness, we've changed it to the Mesoscale Model Interface Program and you've, you know, you've -- there's a beta copy of that up on the website and there's reports, you know, on some of the testing of it and I just wanted to kind of give you an overview of, you know, what it is and, you know, and some of the ancillary software that, you know, accompanies this.

And, so basically, what I wanted to do is I wanted to take a step back and talk about -- to discuss the state of the practice, you know, with respect to the use of old prognostic and diagnostic models as it relates to long range transport modeling and since the publication of the phase two recommendations. This is important because a set of recommendations, as Tyler had mentioned, was a set of recommendations had been laid out in 1998 and Joe, you know, has done a lot to advance the use of prognostic models in long range transport modeling, but the state of the universe has continued to evolve as we've seen, you know, both on the dispersion modeling side and on the SIP modeling side.

So, what we wanted to do is we wanted to, you know, in concert with EPAs second essential element which was promoting the use of the prognostic or the grid and meteorological data in a more, you know, in a more complete manner. We looked at the development of this software.

And so, basically, what I wanted to do was introduce design feature elements that, you know, make up the MMIF software and to discuss the testing procedures, introduce the supporting software that goes along with it and then discuss any next steps.

So, stepping back to 1998 and the publication of the IWAQM phase two guidance here, we had a new model, you know, called CALPUFF and its diagnostic wind field model called CALMET which, you know, produced three dimensional meteorology which is, you know, for most of the people in this room is, you know, it's a new concept that's been introduced into the dispersion modeling realm. Fully evolved three dimensional meteorology.

And so, these are quotes directly from the IWAQM phase two recommendations and it, rightfully, discusses the complexity that's involved with the construction of three dimensional wind fields and, basically, it talks about the, you know, the recommendations as far as the expertise required for the use of CALMET it says that expert understanding of mesoscale and micro scale meteorological effects such as terrain and slope flows on meteorological conditions and the finesse to adjust the available processing controls within CALMET to, you know, induce these desired effects.

And then it goes on to say that the IWAQM does not anticipate a lessening in this required expertise in the future. It says developing three dimensional time varying fields of meteorological conditions is a demanding task which cannot be left to unskilled and inexperienced staff. Written by John Irwin, obviously.

It goes on to say that developing CALMET meteorological fields is considered a difficult task just managing the sheer volume of input and output data from CALMET and excellent computer skills are needed to manage the operation of the various processors to CALMET.

And it also says that the software was not written, at that time, was not writing to accept a variety of input data formats. The software was developed that the assumption that the user is capable of screening the data for anomalous values. It was also assumed that if the data are not in the required format, that the user has the programming skills to write special programs to translate the data format into the format required.

So, taking that into consideration, you know, we've had a number of state of -- advances in the state of practice with respect to the development of three dimensional wind field models and key to this has been the development of graphical user interface.

And as Gale had mentioned in his talk, you know, there have been considerable resources developed by many organizations, in particular we credit Earth Tech and TRC for introducing the original graphical user interface for both the CALMET and CALPUFF system and then you'll see the commercial software that's available from Lake, Trinity, or us and they've made the process of getting data into the CALMET modeling system much less of a burden.

And then you couple that with the fact that we now have routinely available MM5 data that was primarily developed by the regional planning organizations for the BART demonstrations across most of the lower 48 United States.

These two advances have made the application of CALMET much more user friendly and has expanded the application base of the modeling system tremendously just as Gale had indicated, but there's been a cost associated with this.

So, if we roll back to May 2009 and look at what the draft IWAQM revisions talked about in terms of what the state of the practice was at this particular time, it goes on to say as a result of the practice of what we were describing, the end user, that is the dispersion modeler, typically has little knowledge of the choices made in the numerical weather prediction model physics, options, or the suitability of either the numerical model or the CALMET data sets used in the long range transport model applications. This has also created the unenviable position for reviewing authorities of having to make the judgments on the suitability of those data sets for specific LRT applications with little or no experience in the application of mesoscale meteorological models and an incomplete understanding in the practical limitations of diagnostic meteorological models in relationship to their usage for air dispersion modeling.

And so, in the long-winded way of saying it is the state of the practice had deteriorated to a point where the graphical user interfaces had made it so easy to get data into the model and that there was MM5 data that was routinely available, people stopped looking at the meteorology that they were generating and as the IWAQM phase two guidance said, and if you go to any of the TRC or Joe's classes, they will teach you that CALMET requires significant amount of finesse in order to get to induce the correct features. But the state of the practice had degenerated to a point where there was very little evaluation of that going on.

You see this in comments that were made

by AB3 -- the AB3 Committee back in 2005 where they talked about inconsistent acceptability, you know, both in terms of both observations and no observations. Which MM5s do I use and which resolutions do I use?

So, they recommend that EPA provide oversight for consistency and adequacy and that EPA should collect and distribute at cost.

The list of higher priority items that came from AD3 in 2005 was in, you know, highlight and italicized here where mesoscale model data sets and also a methodology to evaluation CALMET wind fields.

Rolling forward to 2008 for the 9th Modeling Conference, a presentation was given by Doug Blewitt on behalf of the American Petroleum Institute talks about the widespread use of the meteorological model output and air quality modeling requires the accuracy of MM5 CALMET model output must be tested for each dispersion model application and that EPA needs to coordinate a stakeholder group to develop guidelines to use meteorological models in air quality analyses. Meteorological accuracy is more important than the number of years of model results used in an air quality analysis.

So then, roll forward to the IWAQM phase two, we talked about the current state of the practice here where we said that the ease of use and the date availability can breed complacency in the modeling community. What we found on the Federal Land Management side was the fact that we were seeing no statistical evaluations of either the prognostic or diagnostic meteorological fields as required under the regulations under section 8-three dimensional under Appendix W.

And then also a key component of what was recommended in the phase two recommendations was the fact that visualization capabilities became critical because you're relaying upon, you know, as I believe the term is used -- tweaking, I guess, to describe how you go through a process of inducing the correct features into a particular, you know, to induce the correct complex terrain features into a wind fields which is through visualization process.

The current regulations are very prohibitive where that's concerned because we have three years where, you know, the regulations require three years' worth of prognostic data be used for long range transport models and for those that are fluent with the modeling system and its utilities for visualization, trying to do three years' worth of print MET and, you know, on individual static fields in

SURFER can be a very painful process.

And so that sort of environment has led to where we're at now in terms of the lack of robustness in certain aspects of that and the state of the practice had deteriorated as a result of that.

So, the EPA in May of 2009 responds to this by saying the required expertise and collective body of the knowledge in mesoscale meteorological models has never fully emerged from within the dispersion modeling community because, again, it's the dispersion modeling community that is responsible for the review of CALPUFF applications. It is not the SIP modeling community where there meteorological modeling was done. It's the dispersion modelers that are responsible for the CALMET and CALPUFF system and that expertise has never fully emerged from that community.

That the lack of a sufficient body of knowledge with respect to the mesoscale meteorological models, model evaluation procedures and related issues has resulted in a process whereby the dispersion modeling community typically obtains the most readily available numerical weather prediction, you know, their NWP or MM5 data set for applications for the CALMET and CALPUFF modeling system, without regard to its suitability, creates a three year CALMET data set and then performs no additional analysis on the assessment or no additional assessments of the resulting CALMET meteorological fields.

And we in the Federal Land Management community are equally guilty of that.

And so we get to a state where a lock-down is enforced. Basically, so as EPA continued, it said the situation described above and public comments have compelled the EPA to reassess the existing guidance and standard practices for the application of CALMET. Whereas in the past it was deemed to be both, quote, premature and counter-productive according to the phase two recommendations to recommend specific CALMET model control options, the EPA now believes it's timely and necessary to specify such options to promote scientific integrity and to restore balance to this public decision-making process.

Interim recommendations were made in 2009 that were intended to configure CALMET in such a way as to preserve as much of the integrity of prognostic data as, you know, of the meteorological fields as they were and we'll get into a little bit of discussion on that a little bit later.

And then finally, in August of 2009, EPA issued a clarification memorandum discussing identifying preferred, what we refer to as preferred model control options. The final control model options are based upon statistical performance evaluations and Ralph Morris will talk more about that tomorrow about some of the data that actually went into formulating those recommendations.

And so that kind of gets us to where we are now which is, given that we know what the state of practice was in the modeling community as a whole and recognizing the fact that, you know, the state of the science had evolved to a point where the prognostic -- the use of direct prognostic models or, you know, the direct use of prognostic model output became a much more viable concept compared to what it was back in 1998 with the phase two publications where we were limited to, you know, to one year or one to two years of 80 kilometers of MM4 data, we now have multiple years of continental 12 kilometers data and in some areas of the United States, one or more years of four kilometers data over multiple states.

So, we look at, you know, taking into consideration EPA's second essential element about promoting the use of prognostic meteorological or gridded meteorological data to advance the state of the science, that we look to the possibility of direct coupling of prognostic meteorological models directly to long range transport models which is a process which is very similar in the emergency response modeling community.

It was also in response to comments that were received from AD3 was the attempt to develop methods for evaluating both prognostic and CALMET meteorological fields and then recognizing the practical limitations that, you know, one of the key elements of doing any sort of evaluation is not only a statistical evaluation, but also visual analysis is to enhance the methods for meteorological field visualization.

So, this brings us to the first element here which is the mesoscale model interface program and, as I had mentioned before, Herman Wong had already given this presentation back in 2009 and, basically, the MMIF beta program converts either MM5 or WRF meteorological outputs into the appropriate formats for three separate models now; CALPUFF, SCICHEM, and AERMOD.

The prototype was developed by U.S. EPA and the continued development is through contract with Environ. MMIF 2.1, the user's guide, is dated January 1st, 2012 and this has been released up on the 10th

Conference website.

MMIF 2.1 beta features include ability to run on both Linux and Windows environments. The options to re-diagnose are passed through the PBL depths which, you know, which is a -- even with CALMET in a No Obs mode, your convective boundary layers are still being re-diagnosed and so this is one feature of that is, you know, it passes through the prognostic PBL heights.

It's designed to work either on the entire MM5 or WRF domain or process a subset of it. There is options in there to perform layer aggregation consistent with the, you know, the IWAQM or the revisions to the phase two recommendations which, you know, basically recommended an 11 model or an 11 layer model or you could specify going, you know, doing one layer matching here.

Another key feature here is the fact that it was designed to retain the original MM5 WRF map projection in the horizontal grid resolution and so it's not an interpolator. So, the idea that this is -- you'll understand the philosophy behind this in a minute here. That was a key feature that was left out in the design of it and it was done for a reason.

And then finally, it, you know, most

applications in the continental United States for prognostic models are in Lambert-conformal, but we've added polar stereographic and Mercator projections based upon work that, you know, EPA Region 10 was having up in the Chukchi Sea and Beaufort area where they were contracting with the University of Alaska Fairbanks in order to produce, you know, three years' worth of WRF high resolution. So, to provide this capability for other areas that require, you know, additional map projections.

So, basically, for CALPUFF it has been made forward -- MMIF has been made forward compatible for both 5.8 and 6.4 and basically it was two basic, you know, it has a number of basic features and one of them is that it has two options for defining PG stability class. One is based upon the SRDT method which was in supplement C to the guideline on air quality models in 1995 and the other relies upon the Golder method which is, you know, relates Monin Obukhov length and surface roughness to PG stability class.

It will generate a CALMET dot dat file format that can be directly input to CALPUFF and it works with both, and again, it's forward compatible to version 6.4.

It's also designed to generate the

auxiliary files that contain the 3D cloud and water mixing ratio for CALPUFF version 6.4, you know, or 6X, the 6-series.

It has the option for extracting the MM5 and WRF data based upon latitude and longitude window rather than the way it was originally designed which was just to base it on the IJ coordinates of the system.

And then it also has the option to pass through the WRF or MM5 leaf area index, Monin Obukhov length and surface roughness values rather than using the look-up table which was in the prototype.

And then the final part was, as I had mentioned before, it's designed to retain the projection and the grid resolution of the original prognostic meteorological data in order to preserve the integrity of it as much as possible and you'll understand that that has some pretty severe implications associated with it that I'll get to here at the end of the talk.

For AERMOD, there are three options for output of the data that the user can select.

They are the -- you can select from a particular grid cell. You can output surface and upper air meteorological data to run through AERMET so it basically it would be creating pseudo observations that could be used to be reprocessed through AERMET.

You can output meteorological data in the AERCOR format to go through, you know, to run through AERCOR consistent with the presentation that was given earlier here in the discussion on the Model Clearinghouse option or memorandum on that.

And then also to create AERMET like surface and upper profile data files so that they can be directly input into AERMOD.

And for SCICHEM or SCIPUFF it generates the meteorological inputs in the MEDOC format and the MEDOC format can be specified either by ASCII or binary and then MMIF also generates a sample location file with the XYZ and location of all the points that our output in the subdomain that are extracted.

And so, you know, MMIF has been, you know, MMIF has been a multi-year effort to do this and so there's been a lot of -- there's been a lot of evaluations that have taken place in terms of -- both in terms of quantitative and qualitative evaluations and these consist of, you know, qualitative diagnostic evaluations of the original prototype and, you know, the MMIF 1.0. Looking at comparing MMIF to CALMET No Obs at the same resolution just to look at -- is there, just to do a sanity check. Do they look similar to one another?

And then, quantitative performance evaluations for both the meteorological and the air quality models and, as I mentioned before, these will be discussed tomorrow in greater length by Ralph Morris in his presentation.

And then quantitative and qualitative consequence analyses for use in AQRV assessments and I'll discuss today a little bit about the -- a little bit of the qualitative assessment that the Fish and Wildlife Service did and then the more quantitative assessment that Environ did under contract to EPA.

So, for the testing and evaluation, this is just basically -- this is, you know, the qualitative sanity check that we, you know, that I talked about was, basically, a comparison of MMIF and CALMET with the No Obs option for a ten meter winds and so you can see that the two of them look almost identical to one another. It's like in, you know, since both of them are superimposed on one another, you can only see one.

The testing and, you know, as far as the temperature, you know, what you see is that the -- what you'll see is that they have very similar patterns although you see more, you know, it appears you see slightly more definition in the MMIF pattern, but they show a very similar spatial patterns and, you know, magnitude and you would expect to see that given that, you know, CALMET is, you know, if used properly is just using the prognostic temperatures that way anyway. So, the temperature patterns should look very similar to one another.

And then this is where the differences start to occur. As I had mentioned before which is because even in the No Obs mode, CALMET re-diagnoses the convective boundary layer. This will generate a pass through or you can, you know, alternatively you can specify the -- you can specify a re-diagnosis of it based upon Bulk Richardson formulation.

And so, you can see here this is just two different snapshots between, you know, then. As you can see, there's less agreement between the two models in that construct.

So, now we move on to the FLM testing of the MMIF software and this was conducted by the U.S. Fish and Wildlife Service on the MMIF 1.0 and so, as you can see, we're up to 2.1 now. So, the consequence analysis is basically, it's a CALPUFF results examining the differences between deposition fields generated with, you know, meteorology from CALMET versus meteorology generated from MMIF.

The key area of concern was to examine the effect of the prognostic fields on the AQRVs, in particular, you know, what you'll see here is deposition and, in particular, the concern over what impact purely prognostic precip will have on what deposition patterns.

And three domains were looked at. They were the Four Corners area and North Dakota and the VISTAS Area Domain 5 and I'm only going to show, you know, just limited results from the two. The North Dakota and the Four Corners Domain. And the analysis, again, was the effect of wet deposition. Turning it on. Dry off. And then dry deposition. So, basically, you know, two hypothetical scenarios were used for this. One was a two stack EGU and the other was a cement plant.

And so, this is an example of what the Four Corners MMIF Domain looked like and what the CALMET Domain looked like and, you know, Bob Paine correct me if I'm wrong, I think Tim got those data sets from you, did he not? Yes. So, I think so, you know, so thank you, Bob, for providing those data sets. Well, you know, it did help with the evaluation of this a little bit.

So, and this is the comparison of, you know, the -- which essentially would be the 12 kilometers domain that MMIF represents and then the four kilometers -- I believe this is a four kilometers domain nested over the, you know, the Four Corners area.

So, and then this is what the -- I think this is probably another Bob Paine one here. This is North Dakota and so, anyway, so again, thank you to Bob for, you know, helping us out with the testing on this.

So anyway, this is what the -- this is a purely qualitative analysis here and there's two key elements here.

One is, you're looking at two different spatial resolutions here. The one you're looking at a 12 kilometers field on the left and you're look at a four kilometers field on the right. So, you know, the spatial pattern, obviously, is going to look different, but, you know, there are some obvious differences that you can see here, you know, and we haven't went back to -- the Fish and Wildlife Service hasn't went back to do a head to head numerical evaluation of just looking at the absolute magnitude. They were just, you know, they were just eyeballing these to see, you know, to look at, you know, what does, you know, what is the impact in terms of the spatial extent of the change in the deposition fields and such. And as you can, they do, you know, they do have, you know, the CALMET on the right shows a significantly more -- it's less coherent than compared to the, you know, the MMIF, you know, the MMIF one here, but you can see they have -- they show similar flow features, you know, and such, but you'll see that the aerial extent of the deposition, if you take a look at, I believe it's the class one area that you see that extends to the south of this area here. So, if you're looking at this one here as you can see as the marker, you can see that CALMET pushes the precip further to the north so the wet deposition occurs more up in this area here and the prognostic data has it pushed further to the south and so, again, it's just a difference in the spatial pattern.

So, that's part of the sanity testing that the EPA -- the FLMs have to go through is that for 14 years now, since, you know, 14 or 15 years since CALPUFF has been used and, you know, in a routine sense with the land management community, we're very used to interpolated precipitation values and so, switching over to purely prognostic precip is going to be completely new aspect to the Federal Land Management community.

And so, here you can a, you know, here you can see a similar pattern here in terms of, you know, a larger difference between the deposition fields between MMIF and CALMET. And again, they show a similar transport pattern since, you know, if you look at it, but the precipitation is probably accounting for the spottiness, you know, the prognostic precip is probably accounting for the spottiness in the MMIF whereas you see a more uniform field just like you did in the last one. You see a, you know, you see a more uniform field here with the CALMET one.

So, some initial observations from the FLM testing is that there are some significant differences noted in the deposition levels and patterns between MMIF and CALMET results. And these are just common sense, you know, it's like because you're, you know, anything that would be different between a purely prognostic data set versus what would be in CALMET would include; how it calculates stability classes, how it calculates the mixing heights, the convective boundary layers, what the precipitation was, if the prognostic precipitation was correct or not, and then transport directionality.

Additional examination of the results is necessary in order to take a more definitive conclusions or a more quantitative assessment of what the magnitude of the, you know, the extent -- the magnitude and the extent of the differences are.

And so it's important to reiterate that this is not a model validation exercise. This is just -- rather these are tests designed to affect the different methods. This is supplying the meteorological data to the dispersion model and the subsequent effects on the air quality related values.

So, you know, stepping forward again, some of the additional testing that went on with respect to MMIF includes; comprehensive testing of the MMIF tool done against the Tracer releases that, you know, that Gale had mentioned that they want to provide comment on and this was done with the U.S. EPA's Forest Service and Environ looking at, you know, which is the documentation that you'll see, you know, that Ralph will talk about tomorrow.

Basically, what it was was CALPUFF was applied with CALMET and MMIF for various Tracer releases which you've seen many times before and then, basically, the generic conclusion from that is, is that the plume placement is generally comparable or better using MMIF and I think that's, you know, that's probably an overstatement of MMIF's capability there.

On the whole, I think you would see that MMIF, probably for one Tracer experiment it does better. For another one it does worse. And so, you know, the results are somewhat mixed in terms of that.

The final report, you know, is up on the EPA website that you see below here regarding that portion of the testing and evaluation phase of MMIF. MMIF testing and evaluation continued. This is work that is being done internal to OAQPS which is where the MMIF tool is being used to prepare meteorological inputs for SCICHEM for the 1999 TBA plume measurement study.

Based upon their initial results, they find that the plume placement using MMIF generated meteorology consistent with using SCICHEM with meteorological observations as inputs and the plume placement with MMIF and SCICHEM was also consistent with CMAQ using MSIP and CAMX using WRFed CAMX.

So, in terms of MMIF support, the U.S. EPA and Environ have already made several code updates since the MMIF was released in beta form in its original posting on SCRAM in mid-February to address reported bugs and that's kind of the idea is to, you know, getting this out to the community is to, you know, find those things because obviously, when you're looking at Trace -- whether you're looking at Tracer evaluations or you're looking at, you know, one specific element of it -- if you're looking at, if you're just looking at, you know, with the Tracer evaluations you're only looking at, you know, two to three day up to four day simulations and so, you're not putting it through its full paces of what it would be like under an annual simulation, you know, doing an annual simulation or running it for the other two models, you know, AERMOD or SCICHEM.

And, so anyway, so there have already been a flurry of bug activity, bug reports coming in which is, you know, really what this is all about -- getting this out to the community and getting feedback from the community on its use and, you know, how it can be improved.

And then the updated beta code is already available on SCRAM. I believe the EPA updated the -- right around the 1st of March when the -- with one major bug that was found in the AERMOD component of it and so then an update was released then.

And so, there will continue -- the EPA, you know, under, you know, under contract with Environ will continue to compile the bugs and then issue the program with documentation at routine intervals, you know, much in the same way, you know, you collect it. I hope it's not on that, you know, year 20 thousand whatever schedule, but the next periodic release, you know, unless there's found to be major, major, you know, major flaws with it, there will be periodic releases and the next one is schedule to be for, you know, autumn of 2012.

So, now I wanted to get into talking a little bit about the related software. You know, stepping back again to what I had talked about before, the comments that we have received from the, you know, from industry at the 8th and 9th Conference talked about the ability, you know, enhancing the ability to evaluate the, you know, the model. The meteorological data going into the model.

And so we looked at it, you know, again going back to the phase two recommendations, the two key components are statistical evaluation and visualization.

And so for the first component, the Federal Land Managers and EPA Region 10 sponsored, through Alpine Geophysics, sponsored the development of a program that's called MMIFSTAT. And basically, it's like for those that are familiar with, you know, the running of prognostic models, Environ has developed a tool that's called METSTAT which is used quite a bit in the SIP modeling community for doing, you know, surface, you know, for doing surface analysis or doing performance evaluation of surface meteorological data against observations.

And so it was based off of that, the METSTAT platform, you know, and modified to, you know, to read CALMET data and it was designed to provide statistical evaluation of CALMET or MMIF related fields, MMIF process fields, you know, using, you know, using surface analysis.

And we understand that there's going to be issues with this sort of performance evaluation because whenever you're using a diagnostic model, for example, you're evaluating observations against observations. So, you either have to have a data set which is -- you have to have a data set, you know, your evaluation data set which has more observations in it than what was used in the diagnostic model or you have to hold back observations in order to have that, but that's the same issue that you see when you're evaluating prognostic models in the SIP community because when you're doing four dimensions simulation, you're pounding those same observations into the analysis and so, it's not a true one to one comparison.

So, the same issue applies whether you're using a diagnostic model or a prognostic model in this particular case.

And then the other one here is, you know, recognizing what we had said before is that, you know, the Earth Tech and TRC have done a lot in order to, you know, promote the visualization tools, but they still have their, you know, they still have the -- they rely upon the functionality of the Golden Software Surfer Platform and that can be very -- that can be very painful and I know that, you know, I know that there's been the animation tool and things like that that have brought that forward and so, you know, it is much better, but we're still limited by -- we're still constrained by that somewhat.

So, what we tried to do -- what we tried to, you know, tried to provide a seamless bridge to other visualization platforms. And so what we decided to was to take the CALMET output or the MMIF output and convert it to a Models 3 I/O API format and this was developed -- this approach was developed originally by the U.S. Forest Services Air Fire Team as part of their BlueSky System. And basically what it does is that it reads in the CALMET data and outputs it in a Models 3 I/O API format and you can process it -- you can bring it into PAVE, you can bring it into VERDI and all these other ones.

And so what we did is we grabbed that and, you know, basically modified it to work as a stand-alone. So, rather than being part of the BlueSky PERL framework, it's now a stand-alone tool that can be used to convert the data to this separate format, then it can be bridged. Then you can bring it in since it's in essentially NetCDF format, now you can bring it into any myriad of visualization platforms.

So, going over what MMIFSTAT is, is again, MIFFSTAT is a statistical performance evaluation package for CALMET format and meteorological files so it will work with either CALMET or MMIF files. And it provides basic statistical measures for winds, temperature, and relative humidity at, you know, mixing ratios at the surface. Again, that's a key component here because it's only a surface evaluation.

It's designed after Environ's MEDSTAT program and was designed by Alpine Geophysics under contract to the FLMs and EPA Region 10.

So, again, it's basic feature is that it provides basic statistical analysis of primary meteorological variables. It runs on both the Windows and Linux operating systems. That's another key constraint is taking into consideration that most of these -- well, all of these prognostic models are run on Linux or the Unix environment and most of the dispersion modeling community is a Windows based environment that most of these tools had to be functional on a Windows based system in order to provide, you know, to provide for greater penetration into the user community.

Also, it provides an Excel macro. This is another important feature is that it just provides an Excel macro which allows you to visualize either the hourly time series or the daily summaries of the statistics. And so you can see that this is just an example of what it looks like here for, you know, this is just the wind component of the analysis here and it just shows you what the basic measures look like and this is the time series.

So, now this is the -- this is getting into the visualization component of it. Because you've -- because you now have it in NetCDF format, you now have access to a wide variety of tools that are used by the prognostic modeling community. And this one here is a particularly powerful tool and this one is called the integrated data viewer. It was developed by Unidata or UCAR out in Boulder, Colorado and it's a

Java based software framework for analyzing and visualizing, you know, geosciences data.

So, basically, if you can get it into NetCDF format or grid format, you can get it into this visualization package. And it's all GUI driven and it works on both Linux and Windows and it gives you the ability to, you know, to visualize, you know, in a very powerful way as you can see. These are some, you know, it allows you to look at your meteorological data in any combination of ways.

The next one is NCAR Command Language. This is a, developed again by the National Center for Atmospheric Research and I said it is a free interpreted language. In other words it's a scripting language, basically. It's designed by NCAR for scientific visualization and data analysis of atmospheric data sets.

It has pretty decent file handling capability if you, like I said, if you can get it in the NetCDF format, you can get it into -- you can get it into NCL. And so, basically, it has file handling capabilities for NetCDF, HDF, GRIB, and ASCII files. So, you can actually, you know, since it's a scripting language, you have the ability to pull in observations and lay them over if you want to. So, you know, you're basically limited by your own imagination and your own programming skills in terms of being able to do that, but, you know, these are just two basic plots that could be used for, you know, for visualization of the CALMET meteorological data.

And again, because of the fact that, you know, we're trying to provide -- we're trying to provide penetration to the community, we're again providing examples of where it could be used for software that is freely available and is available -- that is able to run both under the Linux and the Windows operating systems which are key components here of all of this.

And then finally, the one that, you know, the CALMET to NetCDF was actually designed for which was for VERDI which is the visualization environment for data rich interpretation and again, it's a Java, you know, it's a Java based program for visualizing and it's what EPA and what UNC Environmental Programs has developed and it's basically designed to, you know, visualize meteorological emissions and air quality data. And it provides extreme flexibility as well in terms of how you look at your data sets.

Now, it doesn't provide three

dimensional visualization in the way that you saw IDV, but it allows you to do time series statistics, you know, visualization here like you see at the bottom plot is -- I think that's the time series of temperature here and so you can select any point on the grid that you have and you can generate time series -- time series values of it and things like that.

So, these are just examples of, you know, by creating and putting in a different format, you now have a whole universe of visualization tools at your disposal whereas before we were limited by, you know, by those physical constraints that we have.

So, in summary for the for testing, I said -- we basically said that it's important to note that the testing to date does not, you know, and I need to stress this. It doesn't indicate superior performance advantage for MMIF over CALMET. That's not -- I'm not here to tell you that. MMIF is not a silver bullet. You know, as I had said, you'll find, you know, the statistical performance evaluations show better performance for some Tracer evaluations and worse for others.

But it does have certain advantage that the community should take into consideration and those are for regulatory agencies and going back to the state of practice discussion that I had discussed earlier in terms of the, you know, the regulatory agencies that are charged with the responsibility for reviewing and accepting both prognostic and diagnostic meteorological data sets. This offers a very nice advantage for them because it can provide them the confidence and consistency in the meteorological data sets that are produced because not everybody that applies CALMET knows how to apply it appropriately. It's not a condemnation of CALMET. CALMET is a perfectly good tool, but it requires expertise and sometimes some people that do it don't have that expertise. And so this provides that -- a potential confidence in the data sets that are produced that could be used in LRT modeling assessments.

And then for the other parts of the community, it can provide lower costs and reduce project timelines for LRT model assessments. A significant component of the time that goes into doing long range transport modeling assessment is the development of the meteorological inputs. And since you're no longer having to run and -- one interpreting program to put, you know, the prognostic data into an ASCII format and then re-ingest it back into a diagnostic model, you know, it can shave time off your project timelines that way. And so you know, there is a potential cost savings, you know, and both in terms of time and resources that go along with this.

So, where does the community go from here?

So, going back to EPA's second essential element here, where we talked about promote and facilitate the use of the gridded meteorological data, including the state of the practice, National Weather Service Meteorological Analyses, to improve modeling science and performance for near-field modeling applications.

And going back to what we talked about in the draft phase two recommendations, the released, you know, going back again, you remember those draft recommendations. They were released to support the discussion of the May 2009 EPA Clearinghouse memorandum that George had talked about earlier in response to EPA Region 8, but it had much more in there than just dealing with that. It talked about a vision, you know, of where we could go from here. And unfortunately, it was released prematurely because a lot of these tools, you know, the many elements of these tools were in their infancy at that point. But it talked about what, you know, what a philosophical paradigm might look like for the use of prognostic data sets.

However, revisions reflected the vision that, you know, to address EPA's second element as well as to address many of the longstanding concerns that had been identified by the community here. And so, this is how we were trying to, you know, respond to some of those concerns to provide, you know, to provide analysis tools. To provide, you know, bridges to visualization programs. To allow you to do a better job in the evaluation of those data sets.

So, going back to what I had said before, you know, a key design element of MMIF is the fact that there's no horizontal interpolation that occurs. So, basically what this implies is the fact that it's going to -- if you use MMIF, it shifts the burden of the responsibility back to the user. And unfortunately, that's just the way it is. And so what that means is that these recommendations strictly imply that whatever numerical weather model data set you use should be appropriately analyzed to make sure that it appropriately characterizes the features that govern source receptor relations in terms of a specific application.

So, In other words, basically what that says is if I've got a 36 kilometers data set and I'm modeling over a river valley in Colorado, that's not appropriate. And probably even with a 12 kilometers data set. That would be questionable, you know, again it shifts the burden of analysis back to both the applicant and the reviewing authority, in that sense, to bring some sanity back to this process of rather than just grabbing whatever meteorological data set I can find available, to doing this.

So, it places a higher emphasis on insuring that the candidate numerical weather model data set is appropriate horizontal grid resolution and that the data set captures the meteorological features that are responsible for either design concentrations or responsible for in the long range transport community that the source receptor relationships to class one areas and things along that line.

Therefore, the recommendation, you know, we can't underscore this enough. This, if the community moves forward in this direction, the recommendation for establishing the suitability of these data sets which is required -- I repeat -- required under section A3D of the guideline. It's a very critical component for planning of a successful long range transport modeling application.

In light of these concerns and the

appropriateness and the adequacy of these grid resolutions that we've talked about before, that all of these features should be adequately justified based upon the specific needs of the particular modeling demonstration that is current here.

So, again, I can't stress enough because of the way MMIF was designed, if it is ultimately accepted into the community, it's going to shift the analysis burden back onto the applicants to make sure that the prognostic data sets that are used are appropriate.

So, you know, continuing here. In accordance with A3D, you know, EPA must, you know, re-emphasize the fact that, you know, the prognostic data set is, you know, acceptance of a prognostic data set is contingent upon the concurrence from the appropriate reviewing authority. Therefore, at a minimum, any protocol should include an evaluation of the, you know, of the performance of the candidate numerical weather model data set prior to acceptance by the reviewing authority.

Again, this is -- we're getting back to the basics here, which is, you know, you heard talking about the need for, you know, in the section 7, 2, 8 discussion where we talked about the need for a modeling protocol, you know, in a complex wind situation, you know. The same thing applies in the long range transport application.

We've gotten pretty confident that we're doing the right thing here and so our protocols have become pretty stale in the sense of they've become fairly vanilla and things along that line and as, you know, you don't see the analysis that goes into that, you know, which is required by regulation.

So, for next steps. Basically what, you know, as we release it here, we release it as a beta to get feedback from the community based on that. And again, we don't market this as the silver bullet, but it is a viable alternative. And so, you know, we put it out to get feedback and input from the user community on the beta release. And as I had mentioned before, you know, we've already -- the community has already picked it up and started playing with it and we've gotten feedback from them already in terms of some of the features that were wrong with some of the, you know, the newer features in the system.

We will begin the process of developing guidance on the use of MMIF as appropriate.

We will begin meteorological model evaluation procedures which is the other aspect, you know, in relationship to the AD3 discussion and I think API discussion in 2008 which is to develop the model evaluation procedures.

Unfortunately, even in the prognostic community, the, you know, with METSTAT as an example, the focus is very heavily upon surface analysis and we don't focus enough on look at that whole system which is both looking at upper air and because AQRV analyses in particular are dependent upon precipitation and, you know, for what deposition that's overlooked. And so we will have to develop recommendations and procedures for evaluation both precip and upper air as part of this.

Additional updates to MMIFSTAT will have to include, since it was originally designed as a CALMET prototype, was to add features that will allow it to interface with the SCICHEM Medoc format and to also provide which should, you know, be fairly easy. It's just, you know, fairly minor code changes to the header to make it come forward compatible with version 6.x of the CALMET system. And then to parallel the development of MIFF to add polar stereographic and Mercator projection.

Well, Dennis, it already has polar stereographic, doesn't it?

Yes. So, I guess it would just be, I

guess for MMIFSTAT it would just be to add the Mercator to make it, you know, to make it seamless with the MMIF capabilities. So, that's a correction there because it's just -- just to update it for Mercator projections.

And then on the Federal Land Management side which is independent from, you know, EPA's use of, you know, of the tool for its purposes is, you know, again, you know, we share this vision that we want to try to provide to the user community consistent, you know, that confidence and consistency in the data sets that you use.

And so what we are going to do is we will provide -- we're in the process of developing MMIF coverages for the entire United States based upon WRF, you know, annual WRF simulations and we have a number of those available. EPA has produced a number of 12 kilometers CONUS WRF applications for areas of the country, like I'd mentioned before, shifting back to the burden that you have if you're going to use this and you want to use this in a highly complex trained environment. We're not telling you that you should use 36 or 12 kilometers data in highly resolved areas. And so, we're saying that if you're going to use this, you're going to have to have the appropriate meteorological data sets and so going to places like the WRAP West Jumps project which has a very large, you know, four kilometers domain over the western part of the United States as an example of where those data sets could be accessed for that. And to also, you know, if necessary, to develop those four kilometers data sets in the areas where they're necessary.

And then as part of this FLM effort, we will also once, you know, once the meteorological evaluation guidance is finalize, we'll provide performance evaluations on each of the domains to provide the data and the performance statistics for those that wish to use these data sets. And then, going back, if you want to use your own prog, you know, we're going to offer you, you know, similar to the was VISTAS has done their work where they have, you know, five or, you know, I think it's five domains to provide, you know, a CALMET data set that is essentially pre-approved by the regulatory agencies for use and so you're not going to get any argument from them about how it was run. That's more or less the intention is to follow the VISTAS model to provide for the FLMs to provide, you know, seamless coverage for those that we would, you know, that we would feel very comfortable with.

And so, if an applicant would like to use their own, independent prognostic data set, then we remind you that, you know, the section, you know, the requirements under section A3D are still in force and that, you know, that will require an independent meteorological performance evaluation in accordance with the final performance guidance.

Just acknowledgements and I think, 15 minutes ahead of schedule. Well, I guess I'm on schedule, I'm sorry here.

But anyway, acknowledgements, you know, I'd like to acknowledge all the people. This has been a pretty torturous process and it's been a long process, too. It's been, you know, and like I said, it's still in its infancy, but there's been a lot of people that have been involved in this and I'd like to, in particular, I'd like to recognize Kirk Baker from EPA OAQPS. He's been the MMIF project work assignment manager and he's had to deal with a lot of whining from FLMs for a couple of years on this thing.

And then also, you know, the Environ Development Team. Bart Brashers and Chris Emory, you know, they've done -- they've been very good about, you know, about, you know, cleaning up my coding mistakes and, you know, putting in very good FORTRAN 90 coding standards and documentation. They've done an excellent job with that.

And to recognize Dennis McNally on the MMIFSTAT development.

All of the people who have provided testing and funding and then also, you know, from my group back in, you know, back in the Forest Service, you know, the Air Fire Team and Carolina Environmental Programs for their work on, you know, CALMET to NetCDF development.

And, I'm done.

MR. BRIDGERS: Bret, don't walk away. We have a Q and A session here and since Bret was the only speaker in that session, the chair is yours.

AUDIENCE MEMBER: Hi, Bret.

MR. ANDERSON: Hey, Patrick.

AUDIENCE MEMBER: Patrick McKean with AECOM.

I have a general question.

The MMIFSTAT program. If you inherit or you generate your own prognostic MET data that's going through a model performance evaluation, it's deemed acceptable, you then have to run through another performance evaluation if you use MMIF just to convert it to CALMET format?

MR. ANDERSON: It would depend.

Because again, for example, if you have a continental scale application, you know, you inherit an entire 12 kilometers CONUS application and it was evaluated and, you know, you do a sub-regional evaluation and you find that in certain areas of the country it performs miserably, then answer is probably not. You know, we may have to think twice about that.

You know, again, you know, it's not a one size, you know, again, it goes back to it's not a one size fits all approach to that because, you know, when the EPA does its evaluation for its rulemaking, it looks at the macro. And, you know, there may be sub-regions of the country that do better than others and, as a result of that, you know, and since you're, you know, since long range transport applications are typically on order of maybe several hundred to maybe 500 to 600 kilometers, you know, on the domain on a site, you know, you're talking about a sub-regional analysis.

So, at a minimum, what I would say is, you know, if your -- if the performance evaluation that had been done and has already been documented and if your modeling domain falls within a sub-regional analysis because that's typically what's done is they, you know, the way that they used to do it for the RPOs was to break the country up into performance zones based upon, you know, the entire RPO or like, you know, in the case of Sunwrap because it went from Canada to Mexico was we had Sunwrap North, Sunwrap South and so, if your modeling domain falls within one of those existing performance zones and you have documented statistics showing that it does okay, then, by all means.

But you know, again, the devil is in the detail on those sort of things.

AUDIENCE MEMBER: Thanks.

MR. ANDERSON: Oh, this is good.

AUDIENCE MEMBER: Bob Paine, AECOM.

I was wondering what is the limitation to the grid spacing or -- how fine can you go before you cannot trust these numerical weather prediction models and therefore you cannot hope to get the terrain influences?

MR. ANDERSON: That's a fair question. I mean, I think, you know, I think, you know, and I'm certainly not an expert on, you know, fine scale applications of numerical weather models, but, you know, you're limited by the resolution of the terrain data sets or, you know, essentially the geophysical data sets that are going into the model.

There have been only a handful of sub-grid scale or sub-kilometer grid scale applications of these models that I've been aware of and so you'll see there was like work that was done by Nelson Seaman and Dave Stalfor up at Penn State University where they were looking at gravity wave formation where they were running W RF at a 440 meters resolution and so, you know, when you get into that environment, you're really talking more about an LES application of it rather than that.

You know, I would argue that the, you know, you're going to start running into issues with stability in the model because of the vertical velocity, you know, the vertical velocities that are going to be generated and stuff like that.

So, I would think that practically speaking, kilometer would probably be, you know, 1.33 kilometers about the farthest that I've seen most people go. You know, that's not a limitation of the model. That's just the limitation of the data set and the time that it takes to run it.

AUDIENCE MEMBER: Because one thing that would be for AERMOD applications, we have this problem with the airport or the ASAR station is 50 kilometers away from the source and therefore you have to figure out, well, could I bypass that limitation by magically taking one of this MMIF profiles? And then I would get away from the fact that I don't have the right surface characteristics at the airport and all that stuff. It would nice, but the limitation is well, if it's in torturous terrain, maybe you cannot trust it.

Also, the nice thing about MMIF would be well, I have maybe daily updates to the moisture and other features whereas AERMET only has monthly resolution of those features. So, there's some possible benefits of MMIF if we can trust its, you know, application to AERMOD.

MR. ANDERSON: Yeah. And I think that goes back to is the, you know, again, because MMIF really is, you know, just a reformat or whether you call it a BARF program or whatever else. It's, you know, it really is a reformatter of it for whatever modeling system.

Obviously, you have to diagnose certain variables, but I think your point is that, you know, it goes back to is the numerical data set sufficient for the application and that, you know, that's really where you get into, you know, you have to do that critical analysis.

I think it's even more important when you're talking about AERMOD because you're talking about, you know, the representative and site specific representativeness in that particular case.

AUDIENCE MEMBER: Joe Scire. I have just a couple questions.

One is about the statement about not doing horizontal interpolation. I've been reviewing an earlier version of MMIF. Version 1.0. And it seems the way it's construction is that you always do horizontal interpolation of the four MM5 dot points to the crest point.

MR. ANDERSON: Correct.

AUDIENCE MEMBER: And so, what I'll talk about on Thursday is what the effect is of that interpolation relative to the original MM5 winds.

So, it's not exactly a pass through.

On the W RF model, the winds are defined the U and V components on opposite sides of the cell, so again, you always have to do some interpolation.

So, just to clarify that, it's not really using the exactly the MM5 winds.

MR. ANDERSON: I think, and you're absolutely right, Joe, you know, and I think again, it's getting, you know, it's getting from one grid model, you know, the structure of one grid model whether using Arakawa B or Arakawa C configuration to get it into the appropriate models format.

The issue is that the platform was originally designed off of, you know, when I started working on this back in 2007, I started using the MM5 CAMX platform and it has the ability to take a 36 kilometers data set and output it at a 12 or a four, whatever you specify. That was what I was referring to specifically. Is that design feature has been shut down or shut off in terms of that because, you know, because we just felt that it would be too easy for somebody to try to say hey, I've got a four kilometers data set when I just started with 36 kilometers MM5 so, all I have is a 36 kilometers MM5 interpolated at 4 kilometers, which is not appropriate.

And so that -- it was a conscious design decision in order to force the discussion onto the suitability of the prognostic data set is basically what it amounted to.

AUDIENCE MEMBER: Okay. And I agree about the need for the model evaluation elements of the study. We've been saying that for a long time, many years in fact.

But one thing is, on prognostic models,

it's not that MM5 gives you the same mixing height or the same precipitation patterns in each run. It very much depends on the configuration of MM5. And if you think that CALMET has a lot of options, MM5 and WRF have even more options which have an even greater influence on some of those parameters.

Every boundary layer scheme in WRF will produce a different boundary layer height -- mixing height.

Also, the WRF model, in particular, is very sensitive to the cumulus parameterization scheme. We found, in some cases, WRF over-prediction precipitation by large amounts over the Gulf of Mexico. Four, five, six times the observed.

The opposite is true in complex train where the precipitation patterns are often under-predicted. The train enhancement is off and under-predicted by the diagnostic models.

So, I think precipitation is a very important parameter to evaluate because even if the winds look okay, when you're looking at air quality related values like sulfur and nitrogen deposition, the precipitation patterns may or may not be adequate.

MR. ANDERSON: I don't even have a comment. I would just say that I agree completely with everything that you've said.

You know, those are very good points, you know, it's again, you know, and that underscored the point which is the fact that we need to go back in order for -- this is not ready for PRIME time, yet. We think that it's in a relatively mature stage to get out to the community to start playing with, but I agree completely with you. We need to, you know, if there is a shift, you know, a programmatic shift towards the use of more, you know, more direct use of prognostic data, then we have to be able to evaluate those in a credible manner.

So, there are tools out there that, you know, the SIP modeling community use for the evaluation of prognostic, you know, precip and things along that line to compare to the Climate Data Center gridded values and things like that.

So, there are those tools out there and we just need to bring those forward into, you know, this suite of packages that could be used, but I completely agree with everything you said, Joe.

Oh. We really are done this time. Good.

MR. BRIDGERS: I guess that's a good thing and if you want to applause, let's go ahead and give a round of applause to everybody today. I think that's warranted.

Real quick, we're going to start again tomorrow at 8:30. All the people that have the V visitor badges, please remember to return those at the guard station when you leave and I hope everybody has a very nice evening and also, all of the presentations minus two are already available for today on the web. I'll put the other two up here in the next 30 minutes.

Thank you.

(WHEREUPON, the conference concluded at 5:15 p.m.)

CAPTION

The Conference in the matter, on the date, and at the time and place set out on the title page hereof.

It was requested that the Conference be taken by the reporter and that same be reduced to typewritten form.

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