

**U.S. Environmental Protection Agency
Science Advisory Board
All Ages Lead Model Panel
Public Meeting
Meeting Minutes**

Date and Time: October 17, 2019, 9:00 am to 5:00 pm and October 18, 2019, 8:30 am to 3:30 pm

Location: Crystal Gateway Marriott, 1700 Jefferson Davis Highway, Arlington, VA 20002

Purpose: The Panel met to conduct a peer review of the EPA’s All Ages Lead Model External Review Draft Version 2.0, comprising the model’s software, technical documentation, and user manual (hereafter referred to collectively as AALM 2.0). The AALM 2.0 was developed by EPA’s Office of Research and Development.

Meeting Participants:

AALM Panel Members

Dr. Hugh A. Barton, Chair	Dr. Steven Marcus
Dr. Harvey Clewell	Dr. Clyde Martin
Dr. Joel M. Cohen	Dr. Isaac Pessah
Dr. Deborah Cory-Slechta	Dr. Robert Phalen
Dr. Philip Goodrum	Dr. Ian von Lindern
Dr. Michael Kosnett	Dr. Kathleen Vork
Dr. Anne Loccisano	Dr. Michael Weitzman

(*For the full AALM Panel membership see ^[1] [Roster](#))

SAB Staff Office

Ms. Iris Goodman, Designated Federal Officer (DFO) for the SAB/ Panel
Mr. Thomas Brennan, SAB Staff Office Director
Ms. Khanna Johnston, SAB Staff Office Deputy Director

Other Attendees

See Attachment A.

Meeting Summary:

Convene the meeting

Ms. Iris Goodman, DFO for the SAB All Ages Lead Model Peer Review Panel, opened the meeting at 9:00 am. She noted that the Science Advisory Board (SAB) is an independent, expert federal advisory committee chartered under the authority of the Federal Advisory Committee Act (FACA). The SAB is empowered by the Environmental Research, Development, and Demonstration Authorization Act (ERDDAA) to provide advice to the EPA Administrator on

scientific and technical underpinnings of the EPA's decisions. The AALM panel and all panels of the SAB provide advice through the chartered Board.

She also stated that FACA and EPA policy require that SAB meetings be announced to the public in the Federal Register and that substantive deliberations and interactions, with EPA and the public, be conducted in open sessions where a DFO is present to ensure that the requirements of FACA are met. She further explained that FACA also requires that public meetings provide an opportunity for oral and written public comment. There is a public comment period noted on the agenda, where members of the public who have registered in advance with the SAB Staff Office to make oral comments may give their comments. She said that currently there were not any registered speakers. She noted that an additional public comment period is scheduled for tomorrow for members of the public and for EPA to make brief clarifying comments. She asked that anyone wanting to give comments to please let her know before 9 AM Eastern Time tomorrow morning, October 18th either in person or via email (Goodman.Iris@epa.gov) .in order to register to speak. She said these clarifying comments are limited to 3 minutes.

Ms. Goodman noted that Minutes will be prepared to summarize discussions and action items in accordance with requirements of FACA and will be posted on the SAB website. She also explained that SAB panel members are special government employees appointed by EPA to their positions. As government employees, they are subject to all applicable ethics laws and implementing regulations. The SAB Staff Office has determined that advisors participating in this meeting have no financial conflicts of interest or appearance of a loss of impartiality under ethics regulations specified in 5 CFR 2635 relating to the topic of this meeting. She concluded by noting that all materials pertaining to this meeting can be accessed on the SAB website.

Mr. Thomas Brennan, the Director of the SAB Staff Office, provided remarks to the AALM Panel. He thanked Panel for their expertise and service on the Panel and he thanked the public for their interest. He closed by emphasizing the role of the review panel and the process for delivering the final report to the Agency via the protocol for quality review by Chartered SAB of the report prepared by the AALM Panel.

Ms. Goodman turned the meeting over to the panel chair, Dr. Hugh Barton, who reviewed the agenda; no changes were made.

Dr. James Brown, US EPA Office of Research and Development provided introductory remarks to the panel regarding the All Ages Lead Model Version 2.0 and the history of its development.

There were no Public comments

Panel Discussion

Thursday, October 17, 2019

The panel began their discussion of the AALM charge questions at 10:45 a.m. The issues that the Panel identified and agreed upon as a basis for developing their response to the charge questions are summarized below, for each charge question.

1. Are the features of the AALM adequately described in the “Technical Support Document for the All Ages Lead Model (AALM) – Parameters, Equations, and Evaluations?”

Dr. Loccisano led the discussion. She commended EPA for creating an extensive and generally well written documentation for the AALM. The panel noted that the documentation is very technical. In order to make the AALM easier to understand and to use, the following observations and recommendations were made:

- It is not clear who the Agency intended as the users of the Technical Support Document. The review document is quite technical. They noted that a less technical document would be valuable for reaching a broader audience beyond skilled modelers
- The addition of hyperlinks to Figures and Tables in document would make it easier to use the model and to move around its various components.
- The diagram of the model structure should be modified to be clearer and more accurate (e.g., double headed arrows should be shown as two arrows in opposite directions, and all four compartments of GI tract and lung need to be shown)
- The AALM growth curves should be better explained, e.g., to explain what they are, how they were used, and how they were implemented. In addition, the terminology should be revised to make it easier for public health officials and medical practitioners to understand and use the model.
- The current strengths and limitations of the AALM of the model should be clarified (e.g., no pregnancy model; also, the recommended default inhalation scenario may be appropriate for environmental exposures but not for occupational exposures).

2. Are the model features supported by available research findings in published peer-reviewed literature or by reasonable extrapolations from such findings? [Dr. Cory-Schlecta, Lead discussant]

In general, the model features are supported by research findings. The following identifies model features that should be updated.

- Description of brain lead distribution and absorption pathways from very small particles in the nose could be updated.
- The default parameters for inhalation, following Leggett’s work, are for smaller environmental particles, but occupational exposure might involve larger particles. Thus, model would likely need other parameter values for respiration rates and for respiratory tract deposition associated with more mucociliary clearance (fraction to oral).
- Recommends adding articles by Leggett on data quality and uses in modeling.
- The current parameter values and growth curves are based upon values from years ago. These should be checked to determine if they are still relevant to current populations.

Break for lunch 12:15 to 1:30

Reconvene: 1:30 PM.

3. In general, is the theoretical basis for the model adequately described in Chapter 2 (Theoretical Framework, Parameters, and Equations)? Are the following specifics regarding AALM, also adequately described?

The Panel found that, in general, the description of the theoretical basis for model is adequately described. They noted that the ventilation rates described in the model are for healthy individuals and don't necessarily apply to conditions such as asthma, COPD, or other disease conditions.

The Panel suggested the following:

a. Values specified for the intake rates as a function of age for different media. The Panel recommended that the default respiratory parameters be reconsidered in order to reflect occupational settings. They noted the following issues”

-Dust lead concentration of 175 ug/g likely will skew results for blood lead with this being a major driver for blood lead. Need appropriate values for a range of settings, e.g., urban today, urban years ago

-Fraction soil (0.45) source of number is unclear, see IEUBK.

-Dust concentrations assumed to be same as soil, which may be appropriate in some conditions and not others.

-Infant milk intake (whether from breast feeding or bottle feeding) needs to be included in the modeling. Recommendations for addressing this would be a valuable addition.

b. Uptake/absorption parameters and parameters requiring modification for specific routes of exposure.

-The terminology for bioavailability, absorption, etc., needs to be made consistent with previous work by the Agency, especially with respect to lead, but also more broadly, if feasible.

-The relative bioavailability factor is applied to the weighted average concentration, so the three sources must have similar characteristics for bioavailability factor to be appropriate.

c. Biokinetic parameters describing lead distribution and elimination.

-Tissue lead concentrations appear high compared to data from Leggett; this raises concerns regarding the description of red blood cell saturation description and adjustment of values.

Additionally, please comment on any strengths or weaknesses in the justification provided for model assumptions (data inputs, methodology, etc.) and the quantitative impact of those assumptions on the model and its results.

- Issues were raised with sensitivity analysis (e.g., normalized coefficients greater than 1 and unclear definition of the output measure used)
- Assumptions of fraction going through mucociliary clearance depend upon particle size, so this needs consideration.

The Chair turned the discussion to Charge Question 4, and noted that they would continue this discussion after ORD's demonstration of the AALM model. A summary of the initial discussion of Question 4 follows below.

4. What are the Panel's views of Chapter 3 (Evaluation and Development of AALM.FOR) regarding:

a. the predictive accuracy and reliability of the AALM based on comparisons to available data sets.

The panelists found that, overall, the model well simulated several data sets having a range of characteristics. They also noted the following.

- In Figure 3-15, formula-fed infants were identified as a concern due to under-estimation at low intakes and over estimation at higher intakes. They recommended double-checking to verify that there are no errors in the simulations. They advised that ORD should identify the issues leading to the poor prediction.
- There was not a lot of data for females, and this could affect the model's predictive accuracy and uncertainties in the results, e.g., would changes in bone density in post-menopausal women be captured by the model?
- The Leggett table of tissue lead should be compared to model outputs, e.g., there are a couple instances where adult tissue concentrations were greatly overestimated.
- The results of simulations for long duration exposures (e.g., 30-40 years) should be evaluated, perhaps using NHANES data (though cross-sectional rather than longitudinal), in a manner similar to recent efforts by Dr. Lisa Sweeney for the DOD-O'Flaherty modeling, available in the NASEM review committee report.

b. Extent to which the computer code implementing the model has been adequately verified and is operating as expected, based on the results comparing model predictions between applications of the AALM implemented in distinctly differing platforms.

The panelists concluded that the nearly identical results from comparison of AALM coded in ACSL and in Fortran strongly supports the finding that the models have been coded correctly and are operating appropriately. They also said that potential uses should be informed of the platform that can be used to run the AALM, e.g., Windows and others.

c. Availability of other datasets that may be useful for further model evaluation. Dr. Martin-writing lead

Dr. Vork and Dr. Kosnett suggested several data sets useful to further evaluate the AALM, and that they would send that information to the DFO.

The Panel took a break from approximately 4:00 – 4:20 PM

The Panel reconvened for the afternoon demonstration and interactive session with All Ages Lead Model Version 2, presented by Dr. James Brown, EPA, ORD.

Iris Goodman, DFO, adjourned the Panel at the conclusion of the demonstration at approximately 5:45 PM.

Friday, October 18, 2019

Ms. Goodman opened the meeting at 8:00 a.m. She noted that there were no public comments submitted to the Panel as of today.

Dr. Hugh Barton, Chair, welcomed the panelists and reminded them about the role of lead writers for preparing their assigned charge questions. The panel then turned to their discussion of Question 4b.

8:30 a.m. - 10:30 a.m. Discussion of the Panel's Responses to Charge Questions (continued)

4. What are the Panel's views of Chapter 3: Evaluation and Development of AALM.FOR) regarding:

b. The extent to which the computer code implementing the model has been adequately verified and is operating as expected, based on the results comparing model predictions between applications of the AALM implemented in distinctly differing platforms.

-Overall, the panelists thought the code was good. They asked about the model's operating system, and they discussed the macros used in the AALM with Dr. Brown.
-They also asked about the extent to which the model code was peer reviewed. Dr. James Brown said the model code was reviewed as the model underwent renovation and repair. Panelists said this should be clarified in the document. They also noted that the current documentation is about running the AALM rather than explanation of the code and that the code also needs to be clarified in the document.

c. The availability of other datasets that may be useful for further model evaluation.

Panel members recommended additional data sets that should be included in the report and will send citations for:

- several papers published in Canada that provide information about lead exposure patterns over time for retired workers.
- a report that provides data about the kinetics of lead exposure for individuals exposed to long-term high-dose levels of lead.
- a citation for a publication by Carol Angle (2000) that has a dataset for children's blood levels after being removed from exposure.
- Panel members discussed the issue of "high-dose" lead exposure to "low-dose" lead exposure as contrasted with duration of exposure to occupational exposures to lead.

Dr. Barton asked panel members to send to Ms. Goodman published papers, published cases, and /or peer review publications relevant to their review -- not abstracts or posters. A panelist cautioned that care needs to be taken when recommending datasets, e.g., the Panel should caveat that some datasets could be "muddled" with other types of exposures.

5. Is the AALM Fortran Users Guide sufficiently clear and useful in providing "user friendly" instructions for carrying out model runs for AALM applications? How might the AALM user's manual be improved?

The Panel discussion led to the following recommendations for EPA:

- EPA should review how the IEUBK model was documented for public use.
- Consider creating a YouTube video by Dr. James Brown to assist users in learning how to use the AALM.
- Provide some baseline scenarios (or cases) for users to explore and modify.
- Adjust the model so that, after a run, the model should go back to default value, i.e., the user should be able to push a button to go back to baseline inputs. This is also an opportunity for EPA to establish norms about how the model should be used. Also, the user should be required to

provide justification when changing input values, in a manner similar to the IUEBK requirements for changing inputs.

- Provide a summary of model inputs for a given model result.
- Make the “bioavailability tab/feature” consistent with the AALM definition and concepts; and with other EPA Programs.
- Users guide should include examples with corresponding screen-shots.
- Include an acronym / nomenclature page.
- Documentation should be consistent throughout (e.g., across names and scenarios).
- Modify the model to include the developing fetus and other feedback as previously discussed by the panel members.
- Consider creating a “dummy” guide for non-modeler users. This goes back to the question about the intended users of the AALM; e.g., if it is for public use, documentation needs to be “back to the basics” and should include the addition of webinars, training, etc.
- Add list identifying the report authors.

6. How could specific features of the AALM be further refined to improve its predictive accuracy?

- Consider adding a pregnancy module to AALM; e.g., to be able to include or exclude pregnancy in the model.
- EPA should see publications from ICRP's dose coefficients for members of the public i.e., “Reliability of the ICRP's dose coefficients for members of the public. 1. Sources of uncertainty in the biokinetic models”
- EPA should investigate initial values for infants from mothers exposed to lead, e.g., background exposures in each organ tissue.
- Recommend that the model not start from “0” exposure when user begins a model run. Instead, background levels need to be brought in from other sources; doing so is complex because a user cannot input a value directly. EPA should include hypothetical examples in the document that shows how to do this.
- The document should describe what happens to blood lead levels when the user manipulates a single output at a time.
- Improve flexibility in the AALM’s input data (e.g., particle size for homeowners and workers). -
- Also, body weight, age and height variables should be available to “create individuals.”The current version of the model is not as well characterized for the brain as it is for blood. There should be a clear discussion for users regarding uncertainties in the model output.
- The quality of the studies used should be included in the documentation. The “gold standard” is to provide a systematic approach to consider the data used. This could be very useful for model validation.
- Documentation should include a section on the model’s limitations.
- There should be a Table that summarizes which parameters could be changed and which ones should not be changed
- There should be a Table that presents the data EPA used for each model input and its associated level of confidence. This is helpful for understanding model uncertainties; e.g., in a manner similar to the “Reliability of the ICRP's dose coefficients for members of the public: Sources of uncertainty in the biokinetic models,” 2010.

7. How could specific features of the AALM be further refined to make it more user-friendly?

Refinements to the AALM to make it more user-friendly include the following:

- Include a read-me file for the model about the content of all the sheets/tabs in Excel.
- Include a library for different scenarios, already set-up for use.
- Allow the user to have some limited control of the output (via a scroll bar). For example, the user should be able to determine “the variable that I want to see.” EPA should add a post-processor and/or manual options for users that are less comfortable with Excel.
- Include a different user interphase for public use; specifically, it needs a good graphic interphase, such as BMDS.
- For use in risk assessment, the model could present a distribution to provide a way to consider changes in response to different inputs. The model should be able to answer this question - what is the probability of exceeding a certain level or threshold?
- Add simple scenarios as included in IUEBK model and add more common inputs should be in a menu, in a manner similar to what people are used to see when running IEUBK model.
- A public user should not be involved in the “stepwise” decisions and be able to modify the algorithm. Yet, the user should have the “text file” available for use by the more experienced modelers.
- Model should give the user a little control of the output (via scroll bar). For example, user should be able to determine “the variables that I want to see”. EPA should add a post-processor and/or manual options for users that are less comfortable with Excel.

8. Is the AALM consistent with the Agency’s Regulatory Environmental Model Guidance (as found at [URL:http://cfpub.epa.gov/crem/](http://cfpub.epa.gov/crem/)) ?

The Panel’s overall impression is that EPA has generally applied and followed the basics of their own guidance in this document. The Panel noted that EPA needs to conduct a sensitivity and uncertainty analysis of the model. The model documentation also needs to more clearly describe the uncertainty of the parameters in order to understand the uncertainty of the model, which is key. There are various methods for conducting the uncertainty analysis and the panel will provide cases and examples of good methods, including a variety of Monte Carlo methods useful for analysis of blood lead levels.

The documentation of the model needs to clearly note that the model is still in the development phase and needs more cases. The documentation needs to address the model strengths and what it is that the model is trying to address; this is needed to comply with the CREM guidance. The model documentation also needs to better describe the estimates/ranges in the parameters in order to assess how much confidence can be placed in its predictions; e.g., by using Bayesian methods to assess uncertainties in the model parameters.

The Panel discussed whether the model is intended for occupational exposures. They said EPA needs to clarify this, as is required by EPA’s guidance.

9. What additional information (if any) about AALM might be useful to users who want to assess a hypothetical or real-world risk assessment problem, in order to facilitate the correct application of the model and to communicate its modeling outcomes correctly and efficiently?

The AALM should be modified to:

- Include real-world examples, e.g., a worker with only infrequent lead exposures. One of the values of this model is that it could give cumulative information about short-term, high-dose exposures.
- Provide guidance and recommendations on how to create scenarios would be helpful, e.g., real-world examples such as “children and ingestion of paint chips.”
- Provide modifications that could compare multiple exposure scenarios.
- Be explicit in the document about the current utility of the model. Yet, the model will need to be revisited from time to time for updates based on new information. For example, fetal exposure based on mothers and BLL – that type of effort could facilitate research efforts and could be listed in the limitation section of the documentation
- Short-term, high-dose exposures which provide cumulative information helpful to decision makers.
- EPA should clarify whether AALM is intended for model predictions for populations vs. for individual. Model users might also want to compare multiple exposure scenarios. This needs to be clear to the users early in the document. EPA should describe this in the document and define what is the best approach to using the model.

Dr. James Brown provided a brief presentation on HERO

Dr. Brown provided a brief presentation on the HERO database and clarified how to access and use the augmented version of HERO for the AALM, which has only been made available to panel members due to copyright issues. He reminded panelists that they will need to request login credentials to be able to download the papers; Dr. Brown will help Ms. Goodman with obtaining logins and facilitating access.

Timeline Discussion

Ms. Goodman reviewed timeline for completing the AALM, i.e., the panelists should send their initial responses to her by November 13, 2019 as material for her to prepare the draft report, to be posted for public comment in January 2020, followed by a Teleconference of the AALM Panelists to discuss the draft report. The timeline goal is to send the final draft to the full Science Advisory Board for Quality Review in mid-to late February 2020.

Mr. Brennan described the context and importance of public comment and the Quality and their inclusion into the project timeline. Dr. Barton also gave remarks to clarify the process.

The Panel members discussed where specific recommendations should appear in the draft report, based on discussions at this meeting.

Ms. Goodman said the Panel would break for lunch and asked everyone to return at 1:00 pm.

12:00 - 1:00 p.m.

Lunch

Ms. Goodman reconvened the meeting at 1:09 pm. She noted that there weren't any public comments submitted nor commenters today. She also described a new report format that would be used for the AALM report and summarized the tiering process the Panel would use for their recommendation, i.e., Tiers 1, 2, and 3.

1:15 p.m. – 2:30 p.m.

Summary of Major Findings and Question Recommendations

Dr. Barton began the panel discussion of assigning Tiers to each per charge question; the results are noted below.

Question 1: Overall, the documentation is strong.

Tier 1 recommendations:

- The model documentation is presented from a technical point of view – it needs revisions in order to communicate range of users
- GI tract has some 4 compartments and the compartments that are in model are in the graph

Tier 2: recommendations:

- User Guide needs revision for use by non-technical individuals.
- Occupational parameters recommendations.

Question 2: Documentation makes good use of the public review literature.

Tier 1: recommendations:

- Need to look at indoor dust parameters.

Question 3

Theoretical model was well described.

There are questions about intended audience and various parameters (assumptions, dust exposure too high, ventilation rates – occupational settings, fetal exposure, breastfeeding)

Question 3a

Tier 1 recommendations:

Soil and dust ingestion rates are drivers and need to be revisited

Water needs to be included in the document

Three types of inhalation – this comment re: if the model is going to be used for occupational

Food intake

Breastmilk intake

Tier 2 recommendations:

Activity levels and inhalation rate

Tier 3: recommendations:

Nano particles and inhalation and their deposition

Question 3b

Tier 1 recommendations:

- Technical Support Document needs to be clear about GI tract; needs more deliberation and discussion (p.23)

Tier 2 recommendations:

- Technical Support Document needs to be clear about relative bioavailability and limitations of the model
- Feces elimination needs discussion
- Mass balance issue
- Bioavailability of lead in water (Montreal study)

Question 3c

Tier 1 recommendations:

- EPA needs to provide justification about red blood cells threshold – why was the change made? Rapid drop of lead level when removed from exposure (i.e., evaluation and calibration of the model is needed); need to compare to different data sets showing slower clearance
- Mass distribution in age 40-50 years old
- Lead in Bone
- Clarify in the document options for alternative parametrization of the model
- Consider age-differences and kinetics

Question 3d

Tier 1 recommendations:

- Sensitivity analysis: EPA should look at the parameters and identify their effect on the output; including plus and minus in the sensitivity coefficient.

Question 4a

Tier 1 recommendations:

- Simulation – need to verify that the model is behaving correctly, i.e., Figure 315 was the exception.

- Address lack of data in females

- Old studies may not reflect current occupational practices – EPA should look into this issue

Tier 2 recommendations:

- Recognize/acknowledge that the model is for an average size individual – a larger individual needs more oxygen, body sizes matter; need to recognize diverse characteristics (also related to Question 7)

- Pre-existing conditions should be acknowledged– and perhaps also in future work

- Needs discussion of age-dependence and sex

- Presentation of the materials in Chapter 3 could be improved.

- Note that model comparison to model is not a calibration exercise –calibration requires separate lines of evidence; need to clarify this in document

Question 4b

Tier 1 recommendations:

Need to acknowledge and make public aware that EPA has not tested the model in other systems – address issues related to whether the model work on a Mac computer?

-It would be valuable to compare the AALM as applied in other computer systems

Question 4c

Tier 1 recommendations:

-All data sets should be referenced here and linked to other sections

Question 5

Tier 1 recommendations:

None discussed

Tier 2:

-Current programmers guide vs user's guide – EPA needs to create a users guide similar to that for the IEUBK, or an intermediate guide

-Appendices need to be added to the current manual

- Case studies are needed to enhance the user's manual

Question 6

Tier 1 recommendations:

None discussed

Tier 2 recommendations

-Add discussion of model uncertainty

-A high quality study guide is needed

-An explanation of values under the curve is needed

- the quality requirements for input data should be described

Tier 3 recommendations:

-Gestational model

-Investigate how to include the brain in the model

- Assess rapid vs. long-term clearance after decrease in lead exposure

- Initial blood levels – add background exposure levels for each organ tissue

Question 7

Tier 1 recommendations:

- The Technical Support Document lacks a risk characterization module – the Panel will propose text needed to feel comfortable with using BLL as a processor – e.g., a probability distribution of exceedance for users, and a non-technical version for the public.

Tier 2 recommendations:

- Features to improve – Panel will provide a list

- Consider a profession “gui” in the front end of AALM for non-modelers

- Modify the Excel input to make it more user friendly

- Discuss how to change parameters

- Include a method to hide the stepwise function for users that are not modelers

Tier 3 recommendations:

- Be clear about the challenges need to apply this model in the future to regulatory decisions.
- Panel is not endorsing model to be used to make regulatory decisions
- It is OK to include the GSD – but not to substitute other models that haven’t been review for longer times; the AALM has not currently had sufficient scientific review at present to be used for regulatory decisions

Question 8

The model does follow, for the most part, EPA’s modeling guidelines.

Tier 1 recommendations:

- Need to run sensitive analyses, e.g., with Monte Carlo simulations.
- Add an uncertainty diagrams.
- Do not lump the kinetics and the exposure modules together.
- The section on uncertainty should be expanded to include more aspects.
- The narrative should include a description of limitations of the model.

Question 9

-Discussion among panelists about estimates for “average individual” vs “population estimates.”

-Panelists asked about options work further on the model. Ms. Goodman explained they may do so, provided they work in groups of six people or less.

3:15 – 3:30 pm. Summary and Next Steps

Dr. Barton explained that the panelists should submit their comments to Ms. Goodman and reiterated that panelists could work with the model individually and in groups of six or less. He thanked the panel for their careful review of the model and its documentation.

Meeting adjourned

Ms. Goodman adjourned the meeting at 3:20 pm.

Respectfully Submitted and Certified as Accurate,

/s/

Iris Goodman
DFO

/s /

Dr. Hugh A. Barton
Chair, AALM Panel

NOTE AND DISCLAIMER: The minutes of this public meeting reflect diverse ideas and suggestions offered by committee members during the course of deliberations within the meeting. Such ideas, suggestions, and deliberations do not necessarily reflect definitive consensus advice from the panel members. The reader is cautioned to not rely on the minutes to represent final, approved, consensus advice and recommendations offered to the Agency. Such advice and recommendations may be found in the final advisories, commentaries, letters, or reports prepared and transmitted to the EPA Administrator following the public meetings.

Attachment A – Attendees

October 18, 2019	
Attendees	Affiliation
James Brown	EPA
Margaret Clark	Public
Aaron Ferster	EPA
Zaida Figueroa	EPA
Andrew Geller	EPA
Maria Hegstad	Inside EPA
Brandall Ingle	ICF
October 17, 2019	
Attendees	Affiliation
Michele Burgess	EPA
James Casey	EPA
Zaida Figueroa	EPA
Andrew Geller	EPA
Brandall Ingle	ICF
Cheryl Itkin	EPA

Materials Cited:

The following meeting materials are available on the SAB website (<http://www.epa.gov/sab>) at the page for the October 17, 2019 Meeting:

- 1) Technical Support Document for the All Ages Lead Model (AALM)
- 2) Users Guide for the FORTRAN Version of the All-Ages Lead Model (April 2019)
- 3) The AALM Version 2.0 Software

Roster of SAB members

<https://yosemite.epa.gov/sab/sabpeople.nsf/WebExternalCommitteeRosters?OpenView&committee=BOARD&secondname=Science%20Advisory%20Board>