

**U.S. Environmental Protection Agency  
EPA Science Advisory Board (SAB)  
SAB *Ad Hoc* All-Ages Lead Model (AALM) Review Panel**

**Summary Meeting Minutes of the SAB Panel’s Public Advisory Meeting**

**Thursday, October 27, 2005 – 9:00 a.m. to 5:30 p.m. Eastern Time, and  
Friday, October 28, 2005 – 8:30 a.m. to 2:00 p.m. Eastern Time**

**SAB Conference Center, 1025 F Street, N.W., Suite 3700, Washington, DC 20004**

**Advisory Meeting to Conduct a Peer Review of EPA’s  
“All-Ages Lead Model (AALM), Version 1.05 (External Review Draft)”**

Panel Members: See SAB *Ad Hoc* AALM Review Panel Roster – Appendix A

Agenda: See Meeting Agenda – Appendix B

Purpose: The purpose of this public meeting was for the SAB *ad hoc* All-Ages Lead Model (AALM) Review Panel to provide the Agency with advice and recommendations on the recently-developed All-Ages Lead Model (AALM).

Attendees:

Chair:	Dr. Meryl Karol
Panel members:	Dr. Mary Jean Brown Dr. Deborah Cory-Slechta Dr. Philip Goodrum Dr. Roberto Gwiazda Mr. Sean Hays Dr. Paul Mushak Dr. Joel Pounds Dr. Michael Rabinowitz Dr. Joel Schwartz Dr. Alan Stern Dr. Ian von Lindern
EPA SAB Staff:	Mr. Fred Butterfield, Designated Federal Officer (DFO) Dr. Vanessa Vu, Director, SAB Staff Office
Other EPA Staff:	Dr. James Brown, ORD, NCEA-RTP Dr. Robert Elias, ORD, NCEA-RTP Dr. Lester Grant, ORD, NCEA-RTP Dr. Onyemaechi Nweke, OA, OPEI Dr. Zachary Pekar, OAR, OAQPS Dr. Dennis Utterback, ORD, OSP Mr. Aaron Yeow, OSWER, OSRTI

## Meeting Summary

The discussion followed the issues and general timing as presented in the meeting agenda (Appendix B).

### **THURSDAY, OCTOBER 27, 2005**

#### Convene Meeting, Call Attendance, Introduction and Administration

Mr. Fred Butterfield, Designated Federal Officer (DFO) for this *ad hoc* Science Advisory Board (SAB) panel, opened this meeting, called attendance, and welcomed all attendees. He noted that the SAB is a Federal Advisory Committee chartered under the Federal Advisory Committee Act (FACA) to provide advice and recommendations to the EPA Administrator, and that the SAB *ad hoc* All-Ages Lead Model (AALM) Review Panel provides its formal advice and recommendations to the Administrator via the statutory Science Advisory Board. Consistent with FACA regulations, the deliberations of this SAB Panel are held as public meetings and teleconferences for which advance notice is given in the *Federal Register*. The DFO is present at all such meetings to ensure compliance with FACA requirements. He mentioned that there three (3) individuals who had registered with him in advance to provide oral public comments during this meeting (although in the course of the meeting another individual requested time to present his public comments, which was granted by the DFO). Mr. Butterfield noted a transcript of this meeting is not being taken. However, summary minutes were taken (by the DFO) for this meeting. These minutes will be certified by the AAMM Subcommittee Chairs and posted on the SAB Web Site (<http://www.epa.gov/sab>) after this meeting. Mr. Butterfield noted this was a newly-formed panel, and that all SAB Panel members had submitted documentation with respect to possible financial conflicts-of-interest or appearances of a lack of impartiality, which was reviewed by the SAB staff prior to the meeting and found to be satisfactory.

Dr. Vanessa Vu, Director, SAB Staff Office, thanked the members of the SAB All-Ages Lead Model Review Panel for taking part in this review and consultation. She also thanked the managers and staff from the EPA's National Center for Environmental Assessment in Research Triangle Park, NC (NCEA-RTP), within the Agency's Office of Research and Development (ORD).

#### Welcome and Purpose of Meeting by SAB Panel Chair

Dr. Meryl Karol, Chair of the SAB AALM Review Panel, welcomed the members of the SAB Panel and briefly restated the purpose of the meeting, which was to provide the Agency with advice and recommendations by means of a "peer review" of the recently-developed "Version 1.05 (External Review Draft)" of the AALM.

#### Overview Presentation on EPA's All-Ages Lead Model by NCEA-RTP

Dr. Robert Elias of NCEA-RTP gave an overview presentation on the All-Ages Lead Model, focusing on its: purpose, background and history, and description, which also included an interactive computer demonstration of the features of the model. SAB Panel members en-

gaged Dr. Elias and other NCEA-RTP staff with questions and answers during this summary presentation. (A hard-copy of NCEA-RTP presentation — entitled, “All-Ages Lead Model Review” — is located in the FACA file for this meeting.)

### Public Comment Period

Mr. Butterfield, DFO for this SAB Panel, facilitated the formal public comment period. There were three (3) individuals who presented oral public comments: Ms. Rosemary Mat-tuck of Gradient Corporation, speaking on behalf of the International Lead Zinc Research Organization (ILZRO); Dr. Laura Plunkett of Integrative Biostrategies, LLC (whose work is funded by the American Chemistry Council [ACC]); and Dr. Susan Youngren of Integrative Biostrategies, LLC (whose work is similarly funded by the ACC). (See Appendix C for a summary listing of all public speakers; copies of public commenters’ oral statements are lo-cated in the FACA file for this meeting.) SAB Panel members were permitted to ask follow-up questions after each public speaker had finished delivering his or her oral public state-ment.

### SAB AALM Review Panel Discussions in Response to Agency Charge Questions

Immediately after lunch, there was an additional, extensive (90-minute) question-and-answer session between SAB Panel members and NCEA-RTP staff — particularly Dr. Elias and Dr. Les Grant, Director, NCEA-RTP — concerning the AALM presentation and the associated model demonstration.

SAB AALM Review Panel Chair Dr. Karol then led the Panel through a wide-ranging dis-cussion of the charge questions from Agency staff for this peer review of the AALM Version 1.05 (External Review Draft). (The background for this review and the associated charge questions are found in the October 20, 2005 memo from Dr. Grant, NCEA-RTP Director, attached as Appendix D.) A qualitative summary of these and the meeting’s subsequent dis-cussions is found below, in the section of these minutes entitled, “Summary of SAB AALM Review Panel’s Interim Recommendations Concerning the AALM Version 1.05 (External Review Draft.”

Mr. Butterfield, DFO, adjourned the meeting for the day at approximately 5:30 p.m. on Oc-tober 27, 2005.

## **FRIDAY, OCTOBER 28, 2005**

### Reconvene Meeting, Call Attendance

Mr. Butterfield reopened the meeting at 9:00 a.m., called attendance, and welcomed all at-tendees back to the second day of the meeting.

### Re-cap of Previous Day's Meeting

SAB AALM Review Panel Chair Dr. Karol welcomed members back to the meeting. She gave a brief re-cap of the previous day's events, and discussed the revised plan for the day, which included concurrent breakout sessions in response to eight of EPA's charge questions.

### Additional Public Comment Period

There was one additional request to present public comments on the second day of the SAB Panel meeting, from Mr. Steve Via of the American Water Works Association (AWWA). As before, SAB Panel members were permitted to ask follow-up questions to the speaker after he had finished delivering his oral public statement. (A copy of Mr. Via's public statement is found in the FACA file for this meeting.)

### Summary of SAB AALM Review Panel's Interim Recommendations Concerning the AALM Version 1.05 (External Review Draft)

SAB AALM Review Panel members then broke into breakout groups to concurrently discuss EPA's charge questions in-depth. The SAB Panel reconvened in late morning to report-out on the first three charge questions. Then, during a "working lunch," Panel members again broke into groups to consider the last five Agency charge questions. In the course of their concurrent breakout sessions, members of the SAB Panel identified the following eleven broad, interim recommendations for Version 1.05 of the AALM that will be further developed in the Panel's draft report:

1. Increase transparency within the model.
2. Provide good documentation (*e.g.*, include the qualifications of the data sets that were used).
3. Improve the model's terminology.
4. Include instructions and caution regarding changing parameters (*i.e.*, how does this affect the model?)
5. Validation and testing of model — how, and against what?
6. Build uncertainty into the model (*i.e.*, for a probabilistic outcome).
7. Update information within the Leggett model (*e.g.*, biokinetic equations, parameters).
8. Make the model more "user-friendly."
9. Address coding errors in the model.
10. Consider batch inputs, and increase this number of output choices.
11. Enhance the AALM Guidance Manual, including interpretation of results.

In general, the members of the SAB AALM Review Panel were supportive of the Agency's progress in developing this model. However, in Panel members' judgment, the current version of the AALM is not ready for deployment due to a number of deficiencies that will be

detailed in the SAB Panel’s forthcoming draft report. Nevertheless, members of the Panel encouraged the Agency to continue its development of this model. Detailed suggestions for improving the draft AALM will be presented therein, to be organized by the following four sub-group areas: (1) conceptual construct of the model; (2) predictive accuracy and reliability of the model; (3) computer coding and quality assurance; and (4) AALM documentation (for example, the guidance manual, a parameters dictionary, *etc.*)

Specifically — and in amplification of the above list — with regard to features and operation of the model, Panel members recommended that the AALM be made more transparent and easier to understand by diverse users. Members of the Panel also noted that the predictive accuracy of the model could be improved by incorporating new biokinetic data that has been available in three key areas since 1993 (*e.g.*, with respect to absorption, skeletal turnover, and blood/plasma components). It was noted that the existing Leggett and O’Flaherty models are both incomplete and do not include current understanding in these areas, and that the AALM parameterization in these three areas should be improved.

Panel members also suggested a more rigorous examination of all lead models, including a summary of each model’s advantages and limitations, as well as differences in their conceptual structures, and use these as a basis for justifying the structure of the AALM. In particular, the Agency needs to address the following three model components: dust exposure, gastrointestinal absorption of lead, and soil exposure. Furthermore, bioavailability, especially with respect to soil, is not addressed in the AALM and should be one of its key parameters, noting that differences in bioavailability among lead in soils of different origins and character is likely to be a major factor in model predictions.

Additionally, SAB Panel members recommended that “real-world” data should be used to evaluate — and improve — the predictive accuracy and reliability of the model (*e.g.*, environmental lead values compared with blood urine and bone lead for children and adults), and should be modified to predict a distribution rather than a single value. Moreover, it was noted that, since a high degree of uncertainty is introduced in the modeling effort by specifying so many parameters, the AALM needs to be modified to incorporate uncertainty more directly. Panelists also thought that the user interface of the model was, in general, quite good although they would be suggesting additional features. The guidance manual and the parameters dictionary, in particular, were singled-out as needing substantial improvement. Panel members also identified problems in quality control, pointing-out that Version 1.05 of the AALM often did not perform correctly — at times yielding strange results — with coding errors suspected. Finally, SAB Panel members recommended that: the model be run with the same datasets as the Leggett model; plausibility checks also be conducted, and other human lead pharmacokinetic data sets be examined.

#### Summary, Wrap-up, Next Steps and Closing Remarks

The Chair thanked all members of the SAB Panel for their participation in this two-day meeting to review EPA’s “All-Ages Lead Model, Version 1.05 (External Review Draft).” She asked that all Panel members provide their charge question inputs to the Panel’s group leaders, with copy to her (as the Chair) and to Mr. Butterfield (as DFO). Group leaders are requested to draft their consolidated responses to Agency charge questions and send these to

the Chair and the DFO (with copy to their respective group members) by December 2, 2005. The Chair and the DFO will compile the group leaders' inputs and assemble a draft report from the SAB AALM Review Panel, with a goal of sending this to the entire AALM Panel by the first week in January 2006.

The SAB AALM Review Panel will hold a public teleconference (currently being planned for February 2006) to review and approve the Panel's draft report. Once all SAB Panel members have concurred on this draft report, it will be sent to the Science Advisory Board (SAB) (as the "parent" committee" under FACA) in mid- to late-March 2006 for quality review and public approval. After this, any necessary changes will be incorporated and the final report will then be transmitted to the EPA Administrator.

Mr. Butterfield, DFO, also thanked all SAB Panel members and Agency staff for their participation in this two-day meeting, following which he adjourned the meeting at approximately 2:00 p.m. on October 28, 2005.

Respectfully Submitted:

Certified as True:

/s/

/s/

*Fred A. Butterfield, III*

*Meryl Karol, Ph.D.*

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Fred A. Butterfield, III  
DFO, SAB AALM Review Panel

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Meryl Karol, Ph.D.  
Chair, SAB *Ad Hoc* AALM Review Panel

**NOTE AND DISCLAIMER:** The minutes of this public advisory meeting reflect diverse ideas and suggestions offered by SAB All-Ages Lead Model Review Panel members during the course of deliberations within the meeting. Such ideas, suggestions, and deliberations do not necessarily reflect definitive consensus advice from the members of this panel. The reader is cautioned to not rely on the minutes 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.

## **Appendix A – SAB *Ad Hoc* All-Ages Lead Model Review Panel**

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### **U.S. Environmental Protection Agency Science Advisory Board (SAB) Staff Office SAB *Ad Hoc* All-Ages Lead Model Review Panel**

#### **CHAIR**

**Dr. Meryl Karol\***, Associate Dean for Academic Affairs, University of Pittsburgh, Pittsburgh, PA

#### **PANEL MEMBERS**

**Dr. Mary Jean Brown**, Chief, Lead Poisoning Prevention Branch, U.S. Centers for Disease Control and Prevention (CDC), Atlanta, GA

**Dr. Deborah Cory-Slechta\***, Director, University of Medicine and Dentistry of New Jersey and Rutgers State University, Piscataway, NJ

**Dr. Bruce Fowler**, Assistant Director for Science, Division of Toxicology and Environmental Medicine, Office of the Director, Agency for Toxic Substances and Disease Registry, U.S. Centers for Disease Control and Prevention (ATSDR/CDC), Chamblee, GA

**Dr. Philip Goodrum**, Senior Scientist/Manager, Blasland, Bouck & Lee, Inc., Syracuse, NY

**Dr. Roberto Gwiazda**, Assistant Researcher, Environmental Toxicology, University of California – Santa Cruz, Santa Cruz, CA

**Mr. Sean Hays**, President, Summit Toxicology, Allenspark, CO

**Dr. Marlin Mickle**, Professor, Electrical and Computer Engineering, University of Pittsburgh, Pittsburgh, PA

**Dr. Paul Mushak**, Principal, PB Associates, and Visiting Professor, Albert Einstein College of Medicine (New York, NY), Durham, NC

**Dr. Joel Pounds**, Scientist, Cell Biology & Biochemistry, Biological Sciences Division, Battelle – Pacific Northwest National Laboratory (PNNL), Richland, WA

**Dr. Michael Rabinowitz**, Geochemist, Marine Biological Laboratory, Woods Hole, MA

**Dr. Joel Schwartz**, Professor, Environmental Health, Harvard University School of Public Health, Boston, MA

**Dr. Alan Stern**, Section Chief-Risk Assessment/Adjunct Associate Professor, Division of Science, Research & Technology/Dept. of Environmental & Occupational Health, New Jersey Dept. of Environmental Protection (NJDEP)/University of Medicine & Dentistry of NJ-School of Public Health, Trenton, NJ

**Dr. Ian von Lindern**, Senior Scientist, TerraGraphics Environmental Engineering, Inc., Moscow, ID

**SCIENCE ADVISORY BOARD STAFF**

**Mr. Fred Butterfield**, Designated Federal Officer, 1200 Pennsylvania Avenue, N.W., Washington, DC, 20460, Phone: 202-343-9994, Fax: 202-233-0643 ([butterfield.fred@epa.gov](mailto:butterfield.fred@epa.gov)) (Physical/Courier/FedEx Address: Fred A. Butterfield, III, EPA Science Advisory Board Staff Office (Mail Code 1400F), Woodies Building, 1025 F Street, N.W., Room 3604, Washington, DC 20004, Telephone: 202-343-9994)

\* Members of the statutory EPA Science Advisory Board (SAB) appointed by the EPA Administrator

## Appendix B – Meeting Agenda

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**U.S. Environmental Protection Agency  
EPA Science Advisory Board (SAB)  
SAB *Ad Hoc* All-Ages Lead Model (AALM) Review Panel**

### **Public Meeting**

**Thursday, October 27, 2005 – 9:00 a.m. to 5:30 p.m. Eastern Time, and  
Friday, October 28, 2005 – 8:30 a.m. to 2:00 p.m. Eastern Time**

**SAB Conference Center, 1025 F Street, N.W., Suite 3700, Washington, DC 20004**

### **Advisory Meeting to Conduct Peer Review of EPA’s “All-Ages Lead Model (AALM), Version 1.05 (External Review Draft)”**

#### **Final Meeting Agenda**

#### **Thursday, October 27, 2005**

9:00 a.m.	<b>Convene Meeting; Call Attendance; Introductions and Administration</b>	Mr. Fred Butterfield, SAB Designated Federal Officer
9:10 a.m.	<b>Welcome &amp; Opening Remarks</b>	Dr. Vanessa Vu, SAB Staff Office Director
9:15 a.m.	<b>Welcome; Purpose of Meeting</b>	Dr. Meryl Karol, Chair
9:20 a.m.	<b>Overview/Presentation on EPA’s All-Ages Lead Model, Version 1.05 (External Review Draft)</b>	Dr. Robert Elias, National Center for Environmental Assessment (NCEA-RTP)
10:30 a.m.	<b>Break*</b>	
10:45 a.m.	<b>Continue Overview/Presentation on AALM (Interactive Demonstration and Operation of Model)</b>	Dr. Elias
11:30 a.m.	<b>Public Comment Period</b>	Mr. Butterfield (Moderator)
12:00 p.m.	<b>Lunch</b>	
1:00 p.m.	<b>SAB AALM Review Panel Question-&amp;-Answer Session and Discussions with Agency Staff re: All-Ages Lead Model Overview/Presentation</b>	Chairs, SAB AALM Review Panel Members; Dr. Elias, Dr. Les Grant, NCEA-RTP
2:30 p.m.	<b>Break</b>	

\*Note: Periodic breaks will be taken as necessary and at the call of the Chair.

**Thursday, October 27, 2005 (continued)**

2:45 p.m.	<b>SAB AALM Review Panel Discussion in Response to Charge Questions</b>	Chairs, SAB AALM Review Panel Members
5:30 p.m.	<b>Adjourn meeting for the day</b>	Dr. Karol, Mr. Butterfield

**Friday, October 28, 2005**

8:30 a.m.	<b>Reconvene Meeting; Call Attendance</b>	Mr. Butterfield
8:40 a.m.	<b>Re-cap of Previous Day's Meeting</b>	Dr. Karol
8:45 a.m.	<b>Public Comment Period*</b>	Mr. Butterfield (Moderator)
9:00 a.m.	<b>Additional NCEA-RTP Comments re: All-Ages Lead Model</b>	Dr. Elias, Dr. Grant, NCEA-RTP
9:15 a.m.	<b>Continue SAB AALM Review Panel Discussion in Response to Charge Questions</b>	Chairs, SAB AALM Review Panel Members
10:30 a.m.	<b>Break**</b>	
10:45 a.m.	<b>Continue SAB AALM Review Panel Discussion in Response to Charge Questions; Begin Drafting Panel's Report (tentative)</b>	Chairs, SAB AALM Review Panel Members
11:30 a.m.	<b>Working Lunch</b>	
12:00 p.m.	<b>SAB AALM Review Panel Continue Drafting Panel's Report</b>	Chairs, SAB AALM Review Panel Members
1:45 p.m.	<b>Summary, Wrap-Up and Next Steps</b>	Dr. Karol
2:00 p.m.	<b>Adjourn Meeting</b>	Mr. Butterfield

Notes:

\*The purpose of the public comment period on the second day of the meeting is to permit any members of the public who were unable to provide their oral comments on the first day with an opportunity to do so.

\*\*Periodic breaks will be taken as necessary and at the call of the Chair.

## Appendix C – List of Public Speakers

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### List of Public Speakers

U.S. Environmental Protection Agency

EPA Science Advisory Board (SAB)

SAB *Ad Hoc* All-Ages Lead Model (AALM) Review Panel

Meeting to Conduct Peer Review of EPA’s “All-Ages Lead Model (AALM), Version 1.05 (External Review Draft)”

Public Meeting ❖ October 27-28, 2005

SAB Conference Center, 1025 F Street, N.W., Suite 3700, Washington, DC 20004

#	Speaker’s Name	Organizational Affiliation	Organization(s) Represented [or Funding Organization(s)]
1	Ms. Rosemary Mattuck	Gradient Corporation	International Lead Zinc Research Organization (ILZRO)
2	Dr. Laura Plunkett	Integrative Biostrategies, LLC	same; funded by the American Chemistry Council (ACC)
3	Dr. Susan Youngren	Integrative Biostrategies, LLC	same; funded by the American Chemistry Council (ACC)
4	Mr. Steve Via	American Water Works Association (AWWA)	same

## Appendix D – Charge to the SAB *Ad Hoc* All-Ages Lead Model Review Panel

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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY  
RESEARCH TRIANGLE PARK, NC 27711

October 20, 2005

### MEMORANDUM

**SUBJECT:** SAB Review of “All-Ages Lead Model, Version 1.05 (External Review Draft)”

**FROM:** Les Grant, Ph.D. /s/ Les Grant  
Director  
National Center for Environmental Assessment, Research Triangle Park, NC  
Office of Research and Development

**TO:** Fred Butterfield  
Designated Federal Officer  
SAB *Ad Hoc* AALM Review Panel  
EPA Science Advisory Board Staff Office (1400F)

This memorandum provides background information and transmits charge questions for the upcoming meeting of the **EPA Science Advisory Board (SAB) *Ad Hoc* All-Ages Lead Model (AALM) Review Panel**. The Panel is scheduled to meet on **October 27-28, 2005** in Washington, DC, to conduct a *peer review* of the “**All-Ages Lead Model, Version 1.05 (External Review Draft)**” and, subsequently, to provide the EPA Administrator with its advice and recommendations on the AALM. Please forward this memo to the members of the SAB *Ad Hoc* AALM Review Panel in preparation for this review.

A few weeks ago, my staff here at EPA’s National Center for Environmental Assessment, Research Triangle Park, NC (NCEA-RTP), within the Office of Research and Development (ORD), sent hard-copies of the following review materials to all prospective members of the SAB *Ad Hoc* AALM Review Panel via an overnight mailing:

- (1) A CD-ROM containing the “AALM, Version 1.05 (External Review Draft)” (EPA/600/C-05/013);
- (2) The “AALM Guidance Manual” (EPA/600/R-05/102) — *i.e.*, the user’s guide which provides instructions and sample displays for the AALM; and

- (3) The “Parameters and Equations Dictionary,” which furnishes brief definitions for various elements of the AALM.

These review materials are also posted on the EPA-NCEA Web site at the following URL: <http://cfpub.epa.gov/ncea/cfm/recordisplay.cfm?deid=139314>. In addition, we enclosed a paper published in *Environmental Health Perspective* by Dr. Richard W. Leggett (1993), which described the derivation of the “Leggett Model,” upon which the earlier EPA IEUBK Model was based, and from which the biokinetic portion of the present AALM is largely derived. In addition, copies of computer code for selected key equations included in the AALM were also provided to you upon your request, which you subsequently forwarded to all Panel members.

### **Background:**

The multimedia nature of lead exposure must be considered in decision-making on setting standards to lessen risks for adverse health effects associated with projected lead exposures of susceptible populations or in planning remedial actions for existing lead contamination situations. Scientific rationales underlying most EPA lead-related regulatory or remedial action decisions typically include estimation of the impact of exposures to lead in air, water, food, soil/dust or other media on internal lead body burden indices, *e.g.*, blood or bone lead levels. Modeling activities related to the development of EPA’s 1978 National Ambient Air Quality Standards (NAAQS) for Lead led to the generation of EPA’s “Integrated Exposure, Uptake, Biokinetic Model (IEUBK) for Lead” in the late 1980s. The IEUBK Model provides a tool for estimating distributions of blood lead levels among pediatric populations < seven (7) years old likely to result from exposures to varying concentrations of lead from one or more media. The IEUBK Model has become widely used to support development of standards or guidance for control of lead in drinking water, remediation of lead-based paint and lead-contaminated house dust and soil, and remediation of soil contaminated by lead from smelter operations.

During recent years, NCEA/RTP has led efforts to further refine and expand the Lead IEUBK Model and its software to create an “All-Ages Lead Model.” The AALM not only estimates the impact of lead exposures from various media (air, water, food, dust, soil, *etc.*) on blood lead levels in young infants and children < 7 years old (as per its progenitor, the IEUBK Model), but it also aims to project impacts on blood lead and bone lead concentrations of lead exposures for older children and adults through age 90 years (as well as, potentially, for the unborn fetus exposed *in utero* via transplacental transfer of lead in pregnant women, as a future intended feature). Thus, the AALM is intended to broaden the array of potentially susceptible population groups (*e.g.*, postmenopausal women and geriatric individuals) that can be more readily evaluated with regard to the extent to which various lead exposure scenarios may pose risks of undue elevations of internal lead body burdens and associated health impacts. Such information is expected to be used, most immediately, as inputs to the current ongoing periodic review of the Lead NAAQS and, additionally, for other future EPA regulatory and remedial action decisions.

In order to facilitate a clear understanding of key features of the AALM and the rationale for inclusion of such features, important background information on the evolution of advances in mechanistic modeling of lead exposure-biokinetics (which have contributed to creation of the

AALM) is provided in an accompanying attachment. That background information (not included here for review by the SAB AALM Review Panel) has largely been drawn from a draft chapter on lead biokinetic modeling to be included in the First External Review Draft of the revised Lead Air Quality Criteria Document (AQCD) now under preparation by NCEA-RTP. That 1<sup>st</sup> draft Lead AQCD will soon be released for public comment and review by EPA's Clean Air Scientific Advisory Committee (CASAC).

Overall, the AALM is structured so as to mathematically characterize the following four (4) aspects related to evaluation of human lead exposure impacts on internal concentrations of lead in various body tissues:

1. Multimedia exposure parameters, *i.e.*, concentrations of lead in various media (*e.g.*, air, water, diet, soil, dust) for which varying values can be inputted as appropriate for various hypothetical or actual exposure scenarios;
2. Uptake/absorption parameters for amounts of lead absorbed into blood from portals of entry (*e.g.*, lung, GI tract) that are generally fixed for given age groups, but can be adjusted by the user;
3. Biokinetic algorithms for distribution of lead via blood to several types of body tissues (*e.g.*, bone, brain, kidney, liver, and other soft tissues), algorithms that represent transfer of lead between these body compartments via interchanges with blood plasma and are generally fixed for different age groups but can be adjusted by the user; and
4. Elimination parameters that reflect the main routes of removal of lead from the body (*e.g.*, feces, urine, perspiration) — values for which are generally fixed for different age groups but can be adjusted by the user.

### **Charge to the SAB *Ad Hoc* AALM Review Panel**

The Agency seeks the review and advice from the SAB regarding the scientific soundness of the All-Ages Lead Model, and requests that the Panel focus on the following charge questions during its review of the AALM:

(1) In general, to what extent are the parameters and relationships represented by various AALM features adequately supported by available research findings in published peer-reviewed literature or by reasonable extrapolations from such findings? That is, are the specifications of key components of the AALM model scientifically supportable in characterizing particular parameters or relationships of the types noted above. More specifically, what are the AALM Review Panel's views with regard to:

- (a) The adequacy of the values specified for the exposure parameters for different media and how well the model interprets exposure throughout the various age groups;
- (b) The adequacy of the uptake/absorption parameters or any need for modification of the methodology for determining absorption for various routes of exposure;

- (c) Whether there are any errors in AALM methods for determining biokinetic distribution or errors in assigning values to biokinetic parameters; and
- (d) Does the AALM model correctly account for elimination of lead via various pathways?

(2) Based on EPA’s demonstration of the model, what can be stated with regard to the predictive accuracy and reliability of the AALM regarding comparisons of: (a) model-generated outputs of projected blood lead distributions derived from real-world lead exposure data inputs with (b) actual distributions of blood lead (or bone lead) concentrations for individuals experiencing such lead exposures? In addition, have SAB *Ad Hoc* AALM Review Panel members made any “test runs” to apply the current draft version (1.05) of the AALM to “real-world” datasets that may be available to them; and, if so, what were the outcomes of such efforts?

(3) What advice can the Panel offer with regard to identification of specific features of the AALM that should be further refined in order to improve its predictive accuracy or to make it more user friendly? For example, what comments can be offered with respect to default values assigned for various parameters in the current version of the AALM software? Which, if any, of those default values may need to be changed — and why?

(4) Based on any trial-run experiences of Panel members, what can be said about the “learning curve” needed to become sufficiently-familiar with the AALM software in order to effectively apply it? Furthermore, assuming that one had a need to apply the AALM to a hypothetical or real-world risk assessment problem, what additional information (if any) about the AALM might be useful for a user to have in order to correctly and efficiently apply the model and enhance effective communication of modeling outcomes? What comments can the SAB *Ad Hoc* AALM Review Panel offer concerning output features (*e.g.*, tabular presentation of modeling results, graphic display options, *etc.*)?

(5) In the judgment of the SAB *Ad Hoc* AALM Review Panel, to what extent has the computer code comprising the AALM software been adequately verified and appropriate quality assurance checks carried out and/or planned? What additional quality control/quality assurance checks, if any, would the Panel recommend?

(6) To what extent is the “AALM Guidance Manual” 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 to help facilitate use of the model?

(7) To what extent are the entries in the “Parameters Dictionary” for the AALM sufficiently clear and accurate in explaining important elements of the AALM? How might the Parameters Dictionary be improved?

(8) Are there any other comments or advice that the SAB AALM Review Panel wishes to provide with regard to ways that the AALM, its software, and other associated materials can be improved to help to facilitate its application and enhance the usefulness of its results?

SAB AALM Review Panel Meeting, October 27–28, 2005

(9) Does the AALM follow the Agency’s Regulatory Environmental Model Guidance found at URL: <http://cfpub.epa.gov/crem/>?

We appreciate the efforts of the SAB *Ad Hoc* AALM Review Panel in preparing for this upcoming meeting, and we look forward to discussing the All-Ages Lead Model with the Panel in detail on October 27-28. Should you have any questions regarding the “AALM, Version 1.05 (External Review Draft),” please contact Dr. Robert Elias, NCEA-RTP, at phone: 919-541-4167 or e-mail: [elias.robert@epa.gov](mailto:elias.robert@epa.gov); or feel free to contact me at phone: 919-541-4173, or e-mail: [grant.lester@epa.gov](mailto:grant.lester@epa.gov).