

**U.S. Environmental Protection Agency
Science Advisory Board
Public Meeting
Meeting Minutes**

Date and Time: August 29, 2017, 10:30 a.m. to 5:00 p.m.
August 30, 2017, 9:00 a.m. to 12:00 p.m.

Location: Residence Inn Arlington Capital View, 2850 South Potomac Ave,
Arlington, VA 22202

Purpose: To conduct quality reviews of SAB reports on: EPA's Draft Assessment of Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX); Economy-wide Modeling of the Benefits and Costs of Environmental Regulation and EPA's Framework for Assessing Biogenic CO₂ Emissions from Stationary Sources (2014); and receive briefings on SAB and EPA projects

Meeting Participants:
SAB Members

Dr. Peter S. Thorne, Chair	Dr. Catherine J. Karr	Dr. Tara L. Sabo-Atwood
Dr. Deborah Bennett	Dr. Madhu Khanna	Dr. William Schlesinger
Dr. Sylvie M. Brouder	Dr. Francine Laden	Dr. Gina Solomon,
Dr. Joel Burken	Dr. Robert E. Mace	Dr. Daniel O. Stram
Dr. Deborah Bennett	Dr. Mary Sue Marty	Dr. Jay Turner
Dr. Janice Chambers	Dr. Denise Mauzerall*	Dr. Jeanne M. VanBriesen
Dr. Alison Cullen	Dr. Kristina D. Mena *	Dr. Edwin Van
Dr. Otto Doering	Dr. Surabi Menon	Wijngarrden
Dr. Joel J. Ducoste	Dr. James Opaluch	Dr. Charles Werth
Dr. Susan P. Felter	Dr. Thomas F. Parkerton	Dr. Peter J. Wilcoxon
Dr. William Field	Dr. Kenneth Portier*	Dr. Robyn S. Wilson*
Dr. H. Christopher Frey	Mr. Richard L. Poirot	
Dr. Steven Hamburg	Dr. Kenneth Ramos	
Dr. Robert J. Johnston*		
Dr. Kimberly L. Jones		

*Members on telephone
(For the full SAB see Roster¹)

SAB Staff:

Mr. Thomas Carpenter, Designated Federal Officer (DFO), for the Chartered SAB
Mr. Christopher Zarba, SAB Staff Office Director
Dr. Holly Stallworth, DFO, Biogenic Carbon Emissions Panel and Economy-Wide Modeling Panel;
Dr. Diana Wong, DFO, Chemical Assessment Advisory Committee (CAAC) Augmented for the RDX Review

Other Attendees: Names of those in attendance and those who requested the teleconference call-in number are provided in Attachment A and Attachment B, respectively.

Meeting Summary:
Convene the meeting

Mr. Thomas Carpenter, Designated Federal Officer (DFO) for the chartered SAB, formally opened the meeting and noted that this federal advisory committee teleconference was announced in the Federal Register². The SAB is an independent, expert federal advisory committee chartered under the authority of the Federal Advisory Committee Act (FACA). The SAB is authorized by the Environmental Research, Development, and Demonstration Authorization Act (ERDDAA), to provide advice to the EPA Administrator on scientific and technical issues that support the EPA's decisions. The DFO noted that the Federal Register notice announcing the meeting had provided the public with an opportunity to provide written and oral comment.

The DFO stated that the SAB consists entirely of special government employees (SGEs) appointed by EPA to their positions. As SGEs, chartered SAB members are subject to all applicable ethics laws and implementing regulations. EPA has determined that advisors participating in this meeting have no financial conflicts of interest or appearance of a loss of impartiality under ethic regulations specified in 5 CFR §2635 relating to the topic of this meeting. The DFO noted that Dr. Michael Dourson recused himself and will not attend the meeting.

Mr. Zarba welcomed and thanked the members of the SAB for their work in preparing for the meeting and looked forward to productive discussions in finalizing the three reports.

Purpose of the teleconference and review of the agenda

The SAB Chair, Dr. Peter Thorne, stated the purposes for the SAB meeting was to conduct three quality reviews of SAB reports: 1) Economy-wide Modeling of the Benefits and Costs of Environmental Regulation; 2) EPA's Framework for Assessing Biogenic CO₂ Emissions from Stationary Sources (2014); and 3) EPA's Draft Assessment of Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX). The SAB received briefings on Integrated Risk Information System and discuss current SAB projects. He stated that speakers registered to provide a statement regarding the biogenic carbon emissions report and no other speakers registered for the meeting.

Dr. Thorne reminded members that the purpose of the quality review is to determine if the report is ready to transmit to the Administrator as a SAB report and under what conditions. In reaching that determination he asked members to focus on the SAB's four quality review questions:

- Were the charge questions adequately addressed?
- Are there any technical errors or omissions in the report or issues that are not adequately dealt with in the draft report?
- Is the draft report clear and logical?
- Are the conclusions drawn or recommendations provided supported by the body of the draft report?

Hearing no questions from Board members, Dr. Thorne proceeded to the agenda³.

Quality review of the Draft SAB Report on Economy-wide Modeling of the Benefits and Costs of Environmental Regulation

Dr. Thorne reviewed the agenda item and stated the SAB would proceed with an introduction by Dr. Peter Wilcoxon, Chair of the Economy-Wide Modeling Panel, comments from the lead reviewers and then additional comments from SAB members before the Board discusses the disposition of the report. He noted that there were no requests to provide oral comment.

Dr. Wilcoxon gave brief opening remarks regarding the Panel's peer review of the draft report on Economy-wide Modeling of the Benefits and Costs of Environmental Regulations (hereafter, EWM review). The panel received seven different white papers in two batches in 2015 and 2016 and met seven times over a two-year period. He said this peer review of the EWM white papers would address two major themes: 1) the use of EWM for assessing the benefits and costs of air quality regulations and 2) EWM's use as an adjunct to existing analytical tools.

The EWM review suggests there is a path forward with respect to:

- What can EWM do in principle?
- What can EWM do now?
- How to get from here to there?

He mentioned the panel focused on and discussed four topics in each of the seven white papers prepared EPA's Office of Policy and the 29 charge questions given to the SAB.

- Science
- Benefit cost analysis (BCA)
- Economic impact
- Consistency

Dr. Wilcoxon noted that EWM is a "useful supplement" to benefit cost procedures, because EWM can capture spillover effects between environmental regulations and tax policy. These features of EWM are important for estimating social costs. He also noted that EWM is not the same as using a computable general equilibrium (CGE) model, and that there are other ways to assess benefits and costs.

Dr. Wilcoxon acknowledged the SAB members comments⁴ and noted that many of the suggestions could be incorporated. For example, the Executive Summary is too long and the EWM Review can better describe how EWM is used in the assessment of air quality models (e.g., Wharton econometric models), use tables to compare advantages and disadvantages of methods, and describe how GE models are driven off the elasticities of supply and demand and how the elasticities are derived.

Lead Reviewers

Dr. Thorne thanked Dr. Wilcoxon for the overview of the report and turned to the Lead Reviewers for their comments.

Dr. Otto Doering, the first reviewer provided the following comments:

- The report needs to be transparent in its presentation, otherwise it will be difficult to explain the report's findings to policymakers.
- Add a simple summary table to the Executive Summary, in order to make the full document more readable.
- The requirements for elasticities and data are the "death knell" to development of CGE models. He will provide specific edits to the text on this.
- It is not possible to estimate the impacts of emissions on air quality and unemployment unless there is good data available on engineering costs at all scales: state, regional, and national.
- The report should begin with an analysis of all methods, their advantages and disadvantages, and, importantly, the consequences that stem from model selection.

Dr. Johnston (participating by phone) then provided the following comments:

- The report is good, however it reads as if written by modelers who are comfortable with CGE models; i.e., the "warts" associated with CGE modeling could have been better highlighted.
- The text should highlight that CGE models are best regarded as a supplement and these CGE models must be based on engineering data.
- He notes that the estimates from the two modeling approaches vary quite a bit; this means that both approaches must be used together.
- The inconsistencies within the text of the report are due in part to the numerous charge questions (there were 29 charge questions).
- The report emphasizes that CGE models are not forecasting models, yet policy issues related to benefit cost analyses relies on forecasting. This inconsistency must be addressed; i.e., how the models are being used and for what purpose?
- CGE models cannot be verified in ways that other models can be. Thus, the text must be clear about the assumptions underlying the models and about the need for long-term data sets (e.g., in order to derive the mean and standard deviation of the model parameters).
- The report refers to climate models. Similarly, the report should highlight the sensitivity of model results to maintained assumptions.
- The report says that CGE models "bound the analyses" of willingness-to-pay and willingness-to-accept. Note, however that a person's willingness-to-accept is not bounded by income.
- The report waffles in its discussion of "non-market values." CGE models struggle with non-market values and non-use values. The text seems to want it both ways with respect to addressing separable benefits and non-separable benefits; in fact, CGE models can be used only for non-separable benefits.
- The report suggests use of contingent valuation – this method is likely to be invalid.
- The report is very long and could be shortened.

Dr. Opaluch, the third reviewer, agreed with the previous reviewers and commented that it is difficult to provide a summary due to large number of charge questions. Dr. Opaluch noted the report may be too encouraging with respect to use of CGE models. Caution should be included within the Executive Summary; i.e., use of CGE models as a complement to other methods, not as a replacement. He provided written comments for detail and his general points are:

- The report did not point out instances where CGE should not be used.
- Emphasize need for data to support models.

- Also need better advice on specific data needs, e.g., more detail on public utilities and their linkages to other sectors and to air pollution. Suggests using a hybrid approach (e.g., Phoenix model includes utility data)
- Charge questions are repetitive.
- Suggests using “vintage capital” models for old coal plants.
- Note, should not put non-use values in CGE – at least, not soon.
- On the subject of morbidity and mortality as time endowments – see his detailed notes.

Dr. Wilcoxon responded to the lead reviewers noting that:

- The Executive Summary can be shortened.
- He agrees with the suggestions regarding alternatives to use of CGE models.
- He notes that the subject of using CGE models arose due the interest in looking at social costs, which are best described by CGE models.
- The Board will remind EPA to use confidence intervals when reporting elasticities.
- The text does not discuss the use of hybrid models that use CGE and linear programming models based on data from electric utilities.
- The issue of making the report clear and transparent to the public is difficult and will require further work.
- Will add more on backcasting and validation of models and will encourage EPA to do comparisons.
- Will suggest existing datasets and will refine data for electric utilities.
- Will tone down use of non-market benefits in the short-term. And, will also note that that, if non-market benefits exist, they will likely have behavioral consequences.
- Also agrees that morbidity should be emphasized.
- EPA’s IPM model for electric plants is proprietary – EPA may move to using open-source models.

Discussion and Disposition of the Report

Dr. Thorne asked the Board if they have additional issues to discuss.

Dr. VanBriesen encouraged use of open-source models in order to build trust in model results. The reviewers of the applied modeling approach, including the public, will need access to data, data structure and assumptions used in the model(s). Drs. Bennett and Khanna agreed with Dr. VanBriesen noting the agency must provide the data and underlying assumptions and non-market issues should be expressed as a bias, not merely an uncertainty in the modeling. Dr. Bennett added that the responses to questions were inconsistent with respect to describing the time frame needed for making improvements, especially for estimating non-market values.

Dr. Doering noted he provided explicit instructions in his written comments on the discussion of technological change and how this is incorporated into models.

Dr. Thorne thanked the members for the discussion and reminded members of the Quality Review options noting that there will be revisions based on the discussion. It seems that revision by the chairs or revision by a select group of members are appropriate given the members comments.

Dr. Opaluch suggested that the Chairs and the lead reviewers revise the document and Dr. Thorne review the revision to finalize the report. Dr. Bennett seconded the motion. The lead reviewers agreed to assist in the revisions to the report. Dr. Wilcoxon and the DFO, Dr. Stallworth would revise the report incorporating comments agreed in the discussion for subsequent review by members and Chair. Dr. VanBreisen noted that the discussion has focused mostly on clarifying the report and asked Dr. Wilcoxon if he thought the revision would be in line with the panel. Hearing that Dr. Wilcoxon thought the revision were manageable suggested having lead reviewers participate in the revision may not be necessary. A motion was made to call the question. The motion passed by voice vote with two members voting against. Dr. Thorne asked if the no votes were regarding the option or finalizing the report itself. Members confirmed they found that the revisions could be completed by the Chairs and the report should be finalized based on the Board's discussion

Dr. Thorne thanked members for their work on the Economy Wide Review and introduced the next agenda item.

Quality review of the draft SAB review report on the Framework for Assessing Biogenic CO₂ Emissions from Stationary Sources

Dr. Thorne stated that the draft SAB review report on the Framework for Assessing Biogenic CO₂ Emissions from Stationary Sources was previously reviewed and wanted to make sure all members were familiar with the chronology. The Board's quality review would begin with public comments, a review of the chronology, a summary of the report from Dr. Madhu Khanna the Chair of the panel, statements from the lead reviewers and the Board's discussion and disposition of the report. He identified four speakers that registered to address the Board regarding this report and called upon the speakers.

Public commenters

Mr. David Williamson spoke on behalf of the Biogenic CO₂ Coalition⁵. He was concerned that biogenic CO₂ emissions from processing short-rotation herbaceous crops are not being addressed as carbon neutral -- or at least negligible -- in terms of atmospheric radiative forcing. They find that EPA has put regulation before science by rushing to regulate crop-based biogenic emissions, without a scientific foundation. The Biogenic CO₂ Coalition requests the SAB acknowledge a separate track for short-term herbaceous crops, which don't have any of the temporal issues implicated by woody biomass. A separate track is needed so that EPA can finally recognize that agricultural biomass is carbon neutral or de minimis on a life cycle basis and should not be regulated as a fossil fuel.

Ms. Carrie Annand, Executive Director of the Biomass Power Association⁶, commented that there are benefits to facilities that generate electricity using low value organic materials like forestry residues and agricultural byproducts. These fuels do not conflict with non-energy uses and avoid land use changes and have been characterized as "biofuels done right." She noted the issue is challenging and requested the SAB to consider how best to account for carbon from so many varied fuel sources being used in so many different ways.

Mr. Jonathan Lewis of the Clean Air Task Force⁷, stated that the public should have had more than one week to review the draft. The report correctly notes that biogenic accounting requires

direct comparison between baseline and scenario. He noted the draft report attempts a fuller discussion of how net biogenic emissions differ within different timeframes. However, the timeframe discussion—as it is conveyed in the new draft report—remains problematic, in that it is still disconnected from the relevant legal, regulatory, and physical realities. He further explained that there is a significant risk that regulators will interpret the report’s support for determining cumulative BAF at the end of the “emissions horizon” as a recommendation that the 95%-equilibrium value should be used in short- and medium-term policy contexts. Such a recommendation is functionally incompatible with the legal and practical realities of implementing the Clean Air Act and other policies designed to reduce air pollution.

Mr. Max Broad of the National Wildlife Federation⁸ found that the BAF framework should take into context our climate systems and pressing need for reducing emissions in the short term. While the SAB draft report does recognize that time frames make a difference, stating that biogenic material sequesters CO₂ “over time frames of years or decades,” the difference of years and decades can be pivotal in our ability to mitigate tipping points and the worse impacts of climate change. NWF’s comments set a priority on carbon benefits realized in the short-term over those that occur over the long-term. Short-term time frames are fundamental to the success of the framework in meeting climate goals. This is within the scope of the EPA’s charge for the SAB, which asks “What criteria could be used when considering different temporal scales”. Climate impacts, now and in the future, should certainly be valid criteria, if not the main one. The decision to provide information on a broad spectrum of impacts using different timeframes—without sending a clear message on the importance of near-term reductions—leaves the BAF to be interpreted by policy makers, whether on a state-by-state level or by federal entities will most likely result in different BAF timeframes. He urged the SAB’s proposed BAF methodology emphasizes temporal trade-offs and near-term benefits.

Dr. Thorne thanked the public commenters and noted that the Board members did not have any questions for the commenters. Dr. Thorne stated that this report was previously reviewed and subsequent work on the Panel’s report was assigned to SAB members. He provided a chronology⁹ of the Board’s efforts to develop the review report on the Framework for Assessing Biogenic CO₂ Emissions from Stationary Sources. The SAB conducted a quality review at its March 31, 2016^a meeting and sent the draft report back to the Biogenic Carbon Emissions Panel with instructions for revision^b. The Biogenic Carbon Emissions Panel met on October 12, 2017^c with SAB members to discuss the requested revisions. A revised draft report was provided to the SAB on June 2, 2017¹⁰ and Dr. Khanna provided a memorandum summarizing the revisions to the report¹¹.

Dr. Thorne noted that the revised report did not address all the requested revisions from the SAB¹². The Chair and the lead reviewers from the March 2016 quality review worked with the Chair of the panel to address all of the SAB’s requested revisions. The negotiations continued to revise the draft document until August 22 when he forwarded an email with specific instructions

^a [Chartered SAB Meeting 03/31/2016 to 04/01/2016](#)

^b Biogenic Carbon Emissions: [Summary of Chartered SAB Requested Revisions](#) to the Draft (2-8-16) SAB Review of Framework for Assessing Biogenic CO₂ Emissions from Stationary Sources (2014)

^c [Public Teleconference of the Biogenic Carbon Emissions Panel](#)

for the quality review¹³ to all Board members. He noted that all versions of the report are posted on the SAB website.

Dr. Thorne invited Dr. Madhu Khanna, Chair of the Biogenic Carbon Emissions Panel to provide an overview of the revision developed by the Panel. She explained that the Charge for SAB review of the Biogenic Carbon Dioxide Emissions from Stationary Sources - Assessment Framework (2014) was narrow: “to quantify the adjustment to make to smokestacks using biogenic feedstocks.” The 2014 report presented a method to quantify a biogenic assessment factor (BAF) that recognizes that a portion of the feedstocks will regrow. The BAF created a baseline for comparing effects. The panel continues to recommend estimating the “net biogenic effect by using an economic model and a physical model to consider effects on the land. Thus, the Panel recommends accounting for the cumulative effects, as defined at a systems level once the system reaches and equilibrium (i.e., using the aggregated demand for all biogenic feedstocks). She notes the panel found the main charge was to provide guidance regarding time scale and spatial scale, in a policy neutral framework. In response to last year’s review, the Panel added a discussion on policy context to define boundaries. The revised draft report (6/2/2017) notes that absence of policy context affects issues outside the scope of charge. She expressed the panel’s response to the SAB concern about different timelines. She finds that the revision is now addressing that the timeline is system-wide across all feedstocks and factors that affect the time horizon, sources of feedstocks. The panel finds that there may be multiple horizons that may be determined by the modeling to assess a given policy with a specific time horizon. Dr Khanna summarized the recommendations to EPA: EPA should:

- Consider changes in Carbon stocks, not changes in emissions
- Use a measure based on cumulative net biogenic effects
- Time horizon should be selected so that it accounts for almost all effects.
- The draft panel report presents two modeling versions: sigma T for near-term, T for long-term effects.

Lead reviewers:

Dr. Thorne thanked Dr. Khanna and introduced the lead reviewers

Dr. Steve Hamburg expressed concern that the Panel has worked for 17 months to revise report yet provided only one week for review. The draft report still has inconsistencies and issues that need to be addressed and a careful comparison across sections of the report to ensure consistent advice and recommendations. He finds that the Panel’s recommendation is inconsistent with climate science. He noted that the draft report argues that biogenic CO₂ should be treated differently than all other carbon emissions; for example, current deforestation science accounts for carbon emissions when it occurs.

It seems that the report recommends evaluating a horizon using “sigma little t” in order to assess the net effect over whatever time horizon is needed for the policy being evaluated. However, the report decides - *a priori*- that the only way to develop the BAF is when all factor have been considered and an equilibrium is reached over the long timeframe “T” (previously estimated to be approximately 100 years). These two recommendations are inconsistent.

In the past review of the 2016 report the SAB requested revisions that the carbon accounting system should be time-neutral, because there are multiple time horizons. Time should be plugged in when using the factor, not as a way to construct the factor.

The second reviewer Dr. Johnston respectfully disagreed with Dr. Hamburg because the BAF can be calculated at any point in time. The issue is whether the report should be agnostic as to time horizon or should the report recommend some time horizon. He noted there are strong opinions on both sides. Currently, the revised letter to the Administrator tries to acknowledge this fundamental disagreement by noting that the BAF can be calculated at any point in time. He went back to the original charge questions and it was clear that Panel was asked to create an accounting framework, thus the Panel chose to pick a timeline that accounts for all effects. The Letter also says, it's fine to calculate at any time one wants – i.e., to be agnostic about time frame. The draft report also notes there are other issues raised in report, e.g., effects on biodiversity.

Dr Johnston found it very unlikely that the Panel will agree to be agnostic and the SAB members are equally unlikely to accept the panel's time horizon. As a reviewer, he finds the 8/22 draft of the letter to the administrator addresses arguments on both sides. He expressed concern that if the report is again remanded to the panel the report will not be completed given the Panel's stance.

Dr. Schlesinger, the third reviewer commented that is it unfortunate that report came in so late. This is a lightning-rod issue for those who work with conservation and forests. He did not find this report transparent – the text is so dense, that it's unlikely to be clearly understood. He noted he has fundamental concerns regarding the characterization of feed stocks. Agricultural residues grow quickly. But with trees, it is a long timeframe and the nature of the forest – hence the BAF would be dramatically different for agricultural and forest feed stocks. He also expressed concern in the generic modeling approach with limited knowledge about the location of stationary source. The approach fails to keep track of what has a 1-year payback vs. 100-yr. payback, as is done in other economic sectors – e.g., oil production.

The report is missing key discussion of differences in feed stocks. He did not find a clear graph over time for different materials within the report. Also, the role of forests that are not cut is not discussed, as was requested in last discussion and requested revisions. He finds Dr. Hamburg's statement to be clear, e.g., if forest is cut down, it should be accounted in the budget for the year it was cut down. This should be the same for woody biomass.

He appreciated that the method included conservation of mass and the statement acknowledging there will be disagreement. He sees no need to rush to judgment and force the finalization of the report. Dr. Schlesinger doesn't think the report in its current form will be useful for practitioners. He found the report to be very dense and would benefit greatly from a copy edit. He believes the topic will come up again so there may not be an urgency to finish the report.

Dr. VanBriesen noted the new report remains quite dense. She was a member of the team working on the report over the summer with Dr. Thorne and still it is difficult to get through the report. While the draft report purports to be policy neutral, the formulation of BAF with capital T

is not policy neutral. She finds that the letter to the Administrator needs to be explicit that the short-time frame is not wrong. As written, the report says many times that short time-frames are the wrong approach. This begs the question: if a short time frame for policy is evaluated using the long timeframe recommended what is the probability that the modeling will predict accurately? She expressed concern that this was a key request from the initial quality review and the panel failed to address the issue.

The temporally specific BAF (σ little t) is available – yet there is always a caveat in the report that this approach is in error. Dr. VanBriesen expressed concern and stated the report should not present an approach with a caveat that it could be wrong as is done for a policy specific issues with a short-time frame. The report conflates the calculation of T with the policy model, a model that includes economic and biophysical model. This is not what is usually done. The policy comparison model is more like a CGE – it does not attempt to predict the future. In this case, we revert to the long- time frame. The FASOM model was not run backwards and thus should not be used to set a time frame. To focus on accounting methods for carbon, we need to move away from the policy frame. The report is not clear that these two models are used this way – and especially, if the models are not used in the same way.

With respect to climate discussion – temperature is but one way. The introduction of climate as a carbon accounting framework is misleading. If the long-time frame is appropriate (and we don't know that is is) then this answer does not need to refer to a specific time.

Our goal as reviewers is clarity in the writing, it should be clear enough to make the recommendation and the supporting science impossible to be misinterpreted.

Dr. Thorne asked Dr. Khanna if she would respond to the lead reviewers, he will then turn to remaining SAB members for any comments they may have.

Dr. Khanna summarized that biogenic and fossil feedstocks are different and thus need a different framework for analysis for looking at carbon effects. The BAF varies at every point in time – this could be used to assign a value at every point, but this would be impractical. The alternative is to cumulate it. Thus, should it be instantaneous or cumulative. If cumulative, then what time period should be used? The Panel is not saying that the time period will be 100 years; it could be three decades. Also, the report says that policy makers can choose any time horizon.

Dr. Schlesinger asked if facility feedstock level could be estimated? Dr. Khanna noted that the Panel discussed this at length, but it is difficult to define the “fuel-shed” for a facility. Thus, the Panel went with representative BAF (for a region). Dr Khanna noted there is not a discussion of payback periods in the report – because this topic was not in the charge questions.

Regarding Dr. VanBriesen' s comments, the text says the time frame should account for most of the positive and negative effects, otherwise, it would under- or over-estimate the effects.

Regarding the choice of the FASOM model causing the confusion, Dr. Khanna disagrees. She found one must use the same model in order to be able to compare the delta, based on the initial shock (e.g., demand for 10 M tons of feedstock). The panel wanted to use an integrated model

because it will be used in a policy context and is needed to determine what stocks will be demanded (i.e., the mix of feedstocks and related C effects). The issue at hand is when to truncate the calculation.

Dr Khanna disagrees that the discussion of climate effects is conflated with the time horizon. Charge question 1 asked “what should be the time frame?” The Panel defined the time horizon needed to reach equilibria but the effects of carbon on climate were not part of the question or the response.

Discussion and Disposition of the Report

Dr. Schram asked if the Panel is looking only at one long T, rather than shorter times and different carbon forms. Dr Khanna responded that the 1st Panel report did not even mention time scale. She noted that one may get very odd results thinking about short time scales. Dr. Schram agreed with Dr. Hamburg that short time scales are important and that it is possible to have a framework that addresses both long and short time scales. Dr. Schram asked what distinguishes the σT and T: do they really differ from each other? Also, part of the argument is about the harm due to the added carbon and part is about how / when we replace the feedstock regrowth of the forest. Dr. Khanna responded the using σt (shorter time frames), biogenic feedstocks have early emissions that last in the atmosphere but will reduce over time. Estimates made with σT tend to be higher.

Dr. Werth asked what would the BAF be in the absence of replacement? Dr. Khanna responded the same thing as coal; it's the same as feedstock without replacement. Both equal 1. With biogenic carbon sources, there is a possibility of some emissions offset in the future.

Ken Portier: Regarding uncertainty in long-term projections, over long time-frames may not be distinguishable from zero in pretty short time, less than 100 yrs., i.e., a functional T may be much shorter. The US Forest Service only projects out to 50 years in their forest projections.

Dr. Bennett asked why can't we plot values over time, up to the 95% percentile as done with many types of risk assessment (transportation, etc.)? Dr. Khanna responded the T is to represent “steady-state” because this provides all the appropriate information.

Dr. VanBriesen noted the timeline is drawn by models – when they reach stability in difference between the scenarios. These are not assumptions about the feedstocks, because the further the time projection, the greater the uncertainty in the estimates. Dr. Mauzerall asked if the report could address that issue by adding all factors and adding uncertainty for decision-makers within shorter time frames. Can the report present both sides and not recommend T as being more correct? Dr. Hamburg agrees with this neutral approach and notes this what the Board previously requested. The current text is pejorative, says other options are wrong. He cited anthropogenic methane as an example. The BAF would be near 0 by yr. 50, and yet methane accounts for more radiative forcing. We're losing track of the point and the reason for carbon accounting.

Dr. Thorne called on Dr. Steve Rose, Biogenic Carbon Emissions Panel member, he reminded the SAB members how the Panel derived their recommendation. The Agency presented a policy neutral approach, that is, the framework should be science based and independent of climate policy position. It is based on correlation between carbon and temperature. Carbon stocks can be estimated over long-term and that allows us to look at incremental effects. This discussion has raised important issues related to uncertainty in deltas and T.

Dr. Thorne commented that Dr. Khanna's 4th point had the most controversy. The point was "The draft panel report presents two modeling versions: sigma T for near-term, T for long-term effects. (use T? use or sigma t?). Dr. Thorne recommends that these topics be included in the revised report and the SAB should not close the door on either approach but outline the needs for each. Dr. Hamburg does not believe the report should present this statement as on the one hand, then on the other hand style. The report is opaque. Should say the report does not have consensus.

Dr. Thorne noted for members that that the Panel's report becomes the SAB's report, so it's critical that SAB members agree fully. Where there are differences, the report must reflect the Board's findings, not the Panel findings, and should identify areas of disagreement.

Dr. Stram noted the differences between two ways of calculating T / sigma t. He found both are over-simplifications of the realities of the timing with respect to harm to atmosphere. i.e., the harm continues forever, but the BAF function stabilizes over time.

Dr. Johnston restated Dr. Thorne's suggestion boils down to removing the pejorative tone of using less than full long-term to determine capital T. Instead one could draw the graph and calculate the point at the desired time. Would this middle road approach be acceptable to the Panel and to the SAB? Dr. Thorne confirmed this is the approach he prefers.

Dr. Schlesinger asked what use this does to move forward with the report, because changing this tone is not likely to create a report the SAB would support or would help the environment. He prefers not to issue a report exercising a pocket veto. There are many issues in the report that require clarification. Dr. Schlesinger presents a motion to pocket veto the report – that is the SAB take no steps to finalize the report. Dr. Hamburg seconded the motion.

Dr. Thorne recognizes the motion and its second and asks SAB members if there is any discussion on the motion. Drs. VanBriesen and Martin asked what are the implications of adopting this motion and was there any precedent?

Mr. Zarba suggested the Board could describe the discussion and present the status to the Administrator in a letter: We would simply describe this discussion in a letter to Administrator. Mr. Carpenter reviewed the Quality review protocols and options to reconstitute a panel to complete a report. He noted he was not aware of a "pocket veto" or reconstituting a panel to complete a review. He is also not aware of any draft SAB report not being finalized.

Dr. Thorne noted that a dissenting opinion could be included in an option to finalize the report. Dr. Solomon asked if the SAB could take the Panel's work and create a document that reflects the Board's perspective, rather than a "sorry, we couldn't agree." Dr. Thorne suggested it would be appropriate to acknowledge the Panel's view and also the Board's opinion.

Dr. Mauzerall clarified that the report still comes from the SAB, so it should be possible to include full scope of discussion of valid opinions that are not settled. Dr. Menon asked if the final report could omit the discussion of capital T and the longtime frame horizon. Dr. Thorne commented that the SAB should create a report that notes the Panel's position and the Board's position.

Dr. Hamburg described a friendly amendment to the motion. If there were a way to have unified language that gets rid of pejorative language on the description of using the two approaches (which permeates report), and that reflects what we said 17 months ago, and then review during another in-person meeting (i.e., "we can deal with time in multiple ways").

Dr. Thorne noted that some member's terms are limited, key members involved – including himself – have terms that expire on Sept. 30, 2017.

Dr. Mauzerall noted she had previously suggested amending the Panel with new expertise – thus changing the panel may not be a bad thing.

Thorne summarized the discussion and called for a vote on the motion for a "pocket veto", seconded. Taking a voice vote on motion to pocket veto the report: 3 for veto. 1 abstention. Remaining members voting no. The motion doesn't carry.

Dr. Thorne opened the floor for members for further discussion and other options.

Dr. Portier asked if the Board could add an Appendix to the report stating Board's opinion and concerns, and then going forward with letter to Administrator. Dr. Thorne noted that it is Board's report, so better to put in Letter and in the Executive Summary.

Dr. Bennett motioned for a vote to send it back to the Panel and suggested getting a science editor to work on the document. Dr. Hamburg seconded the motion. The motion was restated, the Report is amended / edited by Board and Panel and then returned to Board, for quality review during in-person meeting.

Dr. Thorne asked for comments and questions from the Board.

Dr. Werth commented that we are not likely to get anything different from the Panel. Perhaps the work could be done through combination of work by Panel and Board. Dr. Ducoste reminded the SAB of the recent work on a question regarding the finalized Ballast Water report and urges the Board to exercise caution, clarity and any report needs to meet that level of scrutiny before it is finalized.

Dr. Thorne asked Dr. Bennett to summarize the motion: The Board make specific suggestions for content and clarity requesting revision and provides the charge to the panel. Board members work with the Panel to revise the report and submit for a third quality review.

Multiple members note the level of effort to get the report to this point and the panel demurred having SAB members participate in the revision delivered to the Chair (June 2). The Chair and members involved in the revisions that were attempted between June and August also commented on the difficulty in addressing concerns between the SAB and the Panel. These members express strong doubt that the Panel will be able to address the Board's concerns and direction for revision. They also note that this is the same approach used in the first quality review. Drs. Bennett and Hamburg agree to withdraw the motion.

Dr. Solomon then moved that Board Chair and lead reviewers work together to revise the Letter, the Executive Summary and the body of the report, insofar as possible. Then return the report to the full Board for approval. Dr. Hamburg seconded the motion.

Dr. Thorne asked if doing this could be done via teleconference. and asked members if they had any comments or questions.

Dr. Solomon responded she has no objection, if lead reviewers and Chair agree, could be done by teleconference run in accordance with FACA.

Dr Thorne noted no other members wished to speak and called for the vote. The motion passed on voice vote with one nay.

Dr. Thorne suggested the Drs. Hamburg, VanBriesen, and Schlesinger be the core group of SAB members revising the report and reach out to other SAB members as needed. He invited other members to volunteer if they wish to participate letting the DFO know via email.

Quality Review of the draft SAB Review of EPA's Draft Assessment entitled Toxicological Review of Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)

Dr. Thorne reviewed the agenda item and stated the SAB would proceed with an introduction by Dr. Kenneth Ramos, Chair of the Chemical Assessment Advisory Committee Augmented for the RDX Review, comments from the lead reviewers and then additional comments from SAB members before the Board discusses the disposition of the report. He noted that there were no requests to provide oral comment.

Presentations from the Committee Chair

Dr. Ramos provided an overview of the augmented committee's work to develop the draft peer review presented to the Board. The augmented committee met in three teleconferences and one face to-face meeting since November 2016.

The National Center for Environmental Assessment (NCEA) is developing a draft IRIS assessment for Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX) to update an oral reference dose

(RfD) and a cancer descriptor and oral cancer slope factor. Epidemiological data, experimental animal data, and other relevant data from studies of the noncancer and cancer effects of RDX are evaluated in this reassessment.

The committee found the draft assessment to be comprehensive and generally well-written. The revised rat and human PBPK models were an improvement over the original approach, and these changes adequately represent RDX toxicokinetics.

The committee found that NCEA correctly applied uncertainty factors (UF) to the points of departure in developing the RfD. The committee supported the application of an interspecies UF of 3 to account for the toxicodynamic and residual toxicokinetic uncertainty in extrapolation from animals to humans that is not accounted for by the toxicokinetic modeling. In addition

The committee supported the derivation of a RfD for nervous system effects but found the scientific rationale for the proposed RfD to be incomplete due to concerns regarding the choice of the BMR and the choice of value for uncertainty factors. While the committee supported the use of the dose-response data from the Crouse et al. (2006) study in the assessment as the primary basis for the derivation of an RfD for neurotoxicity, they found that EPA should more fully account for database uncertainty.

Dr. Ramos noted that he reviewed the preliminary comments¹⁴ and believes the report can be revised to address the majority of the comments and looks forward to discussing those with the lead reviewers

Comments from Lead Reviewers

Dr. Alison Cullen commented that the SAB Review Draft Report on RDX responded in detail to the charge questions with careful and high-quality responses. She stated that the draft was well written, and the scope was appropriate and comprehensive.

The draft SAB Review Draft expresses agreement with EPA that neurotoxicity including seizures or convulsions is a human hazard of RDX exposure but goes on to note that convulsions in rodents constitute a limited spectrum of the potential human hazard given the range of possible effects (pg. 1 lines 35-42 and following pg. 15 and beyond). The Review then asks EPA to add further evaluation or explanation for these potential endpoints. It would be very helpful to detail further the desired content for these additions in order to highlight the key components.

In the comments on Crouse et al 2006, the committee questioned using the 1% for the BMR and suggested the EPA provide more justification and identified that the Benchmark Dose Technical Guidance lacks clarity in developing BMDs. It might be appropriate to carry this recommendation to other assessment not just RDX

The draft made excellent points about data limitations that potentially compromise the application of the multistage model, e.g., high dose mortality. Although it has no specific recommendation on how EPA should address the limitations other than to include/exclude the highest dose in the sensitivity analysis, it goes on to suggest that other standard BMD model forms be fit to the available data, and that these fits be included when discussing model adequacy. Which models among the others facilitated by BMDS software is SAB specifically suggesting? Is there a specific set, or should EPA include all that constrain slopes to be positive,

or is there something other? Should this recommendation also appear in the “Key Recommendations” section?

Finally, should SAB consider whether to make a more general comment (beyond this single Toxicological Review for RDX) about EPA’s Cancer Guidelines policy of “discretion” regarding whether or not to use data from doses that exceed the maximum tolerated dose.

Dr. Susan Felter found, overall, the Draft SAB report was well-written, followed a logical flow, and responded clearly to most of the charge questions posed by the EPA. It is a long report, and many of the points are made multiple times such that the report could be significantly shortened while still providing the same information and recommendations. This is in part a reflection of the SAB responding to each individual charge question when some could be combined in a more effective way.

Dr. Felter found the response to part of charge question 3a(ii) to be lacking. This charge question actually had 3 separate questions; this is the middle one: “Considering the difference in toxicokinetics between gavage and dietary administration (described in Appendix C, Section C.1, and in the context of specific hazards in the toxicological review), is it appropriate to consider the Crouse et al. (2006) study, which used gavage administration.” The SAB’s response (p. 33) states: “The differences in toxicokinetics of RDX exposure by gavage versus dietary administration are clear, and must be accounted for when predicting risk,” but there is no further discussion of this and it is not clear if the SAB agrees that the differences have, in fact, been accounted for. Especially given that gavage administration is less relevant to human exposures to RDX and effects seen following gavage administration were not seen in most dietary studies (pointed out by the SAB), this response should be more thorough.

One topic that would be helpful to expand on is the discussion around what is known about other neurogenic compounds, specifically with regard to the potential for neurological effects at doses lower than those associated with seizures.

Dr. Felter agreed with Dr. Cullen regarding the discussion on the BMR and developing the BMDL

Dr. Marty, the third lead reviewer agreed with comments provided Drs. Cullen and Felter. She noted that overall, the draft report was very well done. Below are a few observations for consideration by the committee.

The different exposure scenarios for RDX (oral gavage and dietary) and their support for using oral gavage studies, need clarification to address some issues with dose homogeneity and achieving nominal doses. While the SAB justified its choice, this section should include some discussion on relevant exposure scenarios in humans to clarify which of these scenarios most closely mimics human exposures (only mention of human exposures is one phrase on p. 43, l. 23-24). While this may not determine the studies selected for BMR analyses, it is a critical element of the discussion.

Can the SAB confirm that the two-generation study of Cholakis et al. (1980) only looked at histopathology of the F2 pups at weaning? Is this referring to histopathology of the brain of F2 pups at weaning? If so, consider adding this clarification. A two-generation study generally

includes histopathology (minimally of reproductive organs) in the F1 offspring that were exposed throughout gestation, lactation and into adulthood.

Dr. Marty agreed that neurotoxicity is the critical non-cancer endpoint. Furthermore, the request to include information on the role of GABA(A) in neurodevelopment and the effects of interference with GABA(A) receptor during development will strengthen the report.

Dr. Gina Solomon noted the original charge questions were adequately addressed. In a few places the report has almost too much technical detail in its response to some of the charge questions. This is particularly the case in the extensive discussion of the suppurative prostatitis endpoint on page 46-49. This discussion could be shortened without sacrificing the responses to the charge questions.

She identified three issues in the response to charge, however, that seem like more significant issues:

- 1) The divided and confusing discussion of the Cholakis vs. Crouse studies;
- 2) A conflict between the committee's expressions of concerns that the RfD based on the neurotoxicity endpoint may not reflect lower level neurotoxicity in sensitive populations and the overall committee recommendation to derive an RfD that is essentially the same or a bit higher than the one derived by EPA; and
- 3) Language in the report that makes it appear that the committee is seriously questioning the science in the EPA draft, when the discussion suggests instead that there are mostly minor issues that could be resolved fairly easily.

She noted the previous reviewers also discussed these issues

The report, and especially the letter to the Administrator over-emphasizes areas of disagreement and in some places uses negative language when in fact the committee's report is overall fairly positive. Some of the conclusory sentences could be misunderstood. For example, on p. 2, lines 40-41, the conclusion that there "remains significant uncertainty about the developmental neurotoxicity of RDX" could be read in various ways, as could the introductory sentence to this paragraph on lines 27-28 of the same page saying that the RfD for nervous system effects is "not scientifically supported." There are a couple of examples in the written comments.

Dr. Edwin Van Wijngaarden the fifth and final, lead reviewer agreed in general with the previous reviewers. Many suggestions for improvements on the draft assessment were made, including clarification of language, identification of inconsistencies, suggestions for different analytic approaches, and highlighting the need for additional evidence. His written comments address specific considerations that include but are not limited to further clarification about how to address developmental neurotoxicity in EPA's draft assessment, better distinguishing key vs. suggested recommendations, providing more details on the cross-sectional epidemiologic study of nervous system effects, providing more discussion of the relevance of gavage studies to the human exposure, and clarifying earlier in the document (including the executive summary) the impact SAB recommendations would have on the RfD estimate.

Dr. Van Wijngarrden noted that many of his comments have already been presented and he yielded back to Drs Thorne and Ramos for a discussion on addressing the quality review comments.

Dr. Thorne thanked the lead reviewers and asked Dr Ramos if he would like to respond. He noted that most of the comments asked for clarification of the committee's discussion and the reviewers agreed with the recommendations and conclusions. Dr. Ramos acknowledged the discussion regarding the BMR BMDL discussion in the report. He also noted members of the committee looked into the difference between study design and results. Dr. Ken Portier reviewed the point of departure discussion. Dr. Steve Roberts reviewed the cancer guidelines and how they were applied to the assessment. He has spoken with both members and they can work on the members comments regarding the dose response work the committee found the study design as very strong and that led the committees to support the agency in moving forward with the assessment. He agreed the report could be clearer and add some justification.

He agreed with Dr. Marty regarding adding some clarifying language to the GABBA and F1 generation discussion. Dr. Ramos also thought he could address Dr. Solomon's concerns regarding the Cholakis and Crouse studies. Dr. Ramos also noted that, where possible, he and the DFO will edit the report to provide more succinct discussions.

Discussion and Disposition of the Report

Dr. Thorne thanked Dr. Ramos and asked if other members had any comments. Hearing no requests Dr. Thorne called for a motion. It was proposed that Drs Ramos and Wong revise the report for Dr. Thorne's review and distribution to the Administrator. The motion was seconded.

Dr. Thorne opened the floor to members for discussion of the motion. Having no request, the Board voted unanimously for Dr. Ramos to revise the report and submit the revised report to Dr. Thorne 's review and submission to the Administrator.

Recess

The DFO placed the meeting in Recess until 9:00 am August 30, 2017

Reconvene the Meeting

The DFO reconvened the meeting and asked Dr. Thorne to preside over the agenda.

Dr. Thorne welcomed members back and noted the morning discussions were updates on issues the SAB has been involved. We would begin with and update on the Integrated Risk Information System and then turn to SAB projects

Approaches to Operationalize Systematic Review to Increase Transparency, Efficiency, and Access to Assessment Products.

Dr. Thorne introduced Dr. Kris Thayer, Director, Integrated Risk Information System, and Dr. Tina Bahadori, Director, National Center for Environmental Assessment, EPA Office of Research and Development.

Dr. Bahadori provided an overview of the IRIS program and recent improvements. She discussed IRIS roles in ORD and across program offices the NCEA Human Health Risk Assessment products. NCEA 's new leadership structure, and more specifically the IRIA program¹⁵.

Dr. Thayer continued the presentation¹⁶ with a discussion of systematic review and how the program is incorporating this approach in their assessment working with other EPA program offices and reaching out to stakeholders to develop a common understanding of systematic review among the risk information and risk assessment community. They also provided an overview of the Population Exposure Comparator Outcome they will be using to streamline the IRIS assessments that are in queue.

Discussion with SAB Members

Dr. Thorne thanked Drs. Bahadori and Thayer and asked the first question. Regrading systematic reviews how can the SAB assist in the comparison of studies in our peer reviews? Can we objectively demonstrate how the review was conducted?

Dr Ramos is trying to visualize, in a comparative way, how reviewers engage in systematic review? Dr. Thayer responded that the biggest challenge is to identify the critical study. They are building the process to minimize missed critical studies; they do that through the search process, transparency in developing the list of studies found and bringing problem formulation in earlier in the process to better understand what one is looking for.

Dr. Ramos followed up noting the program is rapidly moving to develop the systematic reviews. Dr. Thayer responded that they are harmonizing across NCEA and program offices. Staff are very engaged and willing to build the skill set needed for systematic review. Dr. Bahadori noted their teams cross-pollinate ideas. NCEA is working with stakeholders and sister agencies to build a Systematic Review Community of Practice, making investments in staff and creating space to accomplish this important goal.

Dr. Felter asked about the systematic review software HAWC and its open access status. Dr. Thayer confirmed the software is open source. She elaborated on how NCEA is working toward a grass root collaboration and bringing in additional sources into the workflow. They are using data extraction from the National Toxicology Program and REACH, however they are not using the same platform.

Dr. Frey asked about the synergy across IRIS the Integrated Scientific Assessment used in the Clean Air Act and National Ambient Air Quality Standards. Dr. Bahadori noted they are working with the different divisions that manage those programs and across “pollutant products.” For example, the HERO data system is working with the Toxic Substance Control Act, IRIS and NAAQS product lines.

Dr. Thayer responded to a question regarding training that there are hands-on workshops at the Society of Toxicology and the Society for Risk Analysis. In response to a question regarding holes in the literature and how EPA is reporting the deficiency, NCEA is encouraging publishing findings at the journal level, working with the community of practice and stakeholders in general.

Dr. Solomon noted that from a state perspective there is not another organization that provides services like NCEA and the IRIS program in particular. They provide a tremendous function and the IRIS staff have been very responsive to the National Academy of Sciences, SAB’s comments and advice, and those of stakeholders and the risk community at large. She presented a motion for the SAB to write the Administrator to document the observed significant enhancements in the IRIS program over the past few years, with impactful changes over the past year, and marked

progress over the past six months. She noted the changes are so extensive and positive that they constitute a virtual reinvention of IRIS. The letter should also emphasize the unique support the IRIS program provides to the protection of public health. Dr. Ramos seconded her motion. Several Board members spoke in support. Dr. Thorne proposed that he and Drs. Solomon and Ramos draft a letter for his signature. He asked for further comments and discussion, hearing none he suggested a vote on the motion. The motion passed by voice vote unanimously.

Update on current SAB Projects

Dr. Turner noted the Scientific Achievement Awards panel was completing a report for quality review in the early fall. He is also chairing the review of the Risk and Technology Review under the National Emission Standards for Hazardous Air Pollutants. The Office of Air and Radiation periodically bring the framework to the Board as the Agency updates and improves the RTR process.

Dr. Chamber provided an update on the SAB review of SAB Draft Report: 08-30-2018 Draft Review of EPA's Draft Toxicological Review of Ethyl Tertiary Butyl Ether and Draft Toxicological Review of tert-Butyl Alcohol. The Chemical Assessment Advisory was augmented to conduct the reviews. The augmented committee will produce a single report. they have conducted a teleconference to discuss the charge questions and held the initial meeting to develop the review document.

Dr. Hamburg asked to conduct new business not on the agenda. Without members' objection he noted that Administrator Pruitt has not communicated with the Board and suggested the SAB send a formal invitation. Dr. Thorne suggested Dr. Hamburg and any other members draft a letter and forward it for his consideration and transmittal to Administrator Pruitt. Board members agreed unanimously.

Having completed the agenda and no further new business, Dr. Thorne thanked members, recapped the orders of business as voted by the SAB and then turned to the DFO to adjourn the meeting. The DFO adjourned the meeting at 11:55 a.m.

Respectfully Submitted and Certified as Accurate,

/signed/

Mr. Thomas Carpenter
SAB DFO

/signed/

Dr. Peter S. Thorne
SAB Chair

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.

Materials Cited

The following meeting materials are available on the SAB website,
<http://www.epa.gov/sab>, at the page for the August 29-30, 2017 meeting:

<https://yosemite.epa.gov/sab/sabproduct.nsf/a84bfee16cc358ad85256ccd006b0b4b/128c37947b204e77852581540079160e!OpenDocument&Date=2017-08-29>

¹ Roster of SAB members

² Federal Register published Vol. 82 No.142. Wednesday, July 26, 2017 (34663-34664)

³ Agenda

⁴Economy Wide Modeling: Comments from Members of the Chartered SAB on the SAB Draft Report: SAB Advice on the Use of Economy-Wide Models in the Evaluating the Social Costs, Benefits, and Economic Impacts of Air Regulations. As of August 28, 2017, and Economy Wide Modeling: Deborah Hall Bennett quality review comments for the SAB Review of EPA's Draft Assessment entitled Use of Economy-Wide Models in Evaluating the Social Costs, Benefits, and Economic Impacts of Air Regulations:

⁵ Biogenic CO2 Coalition statement presented by Max Williamson

⁶ Oral statement from Carrie Annand, Executive Director, Biomass Power Association.

⁷ Oral statement presented by Jonathan Lewis, Senior Counsel, Clean Air Task Force

⁸ Oral Statement by Max Broad, Sustainable Bioenergy Specialist
National Wildlife Federation.

⁹ Biogenic Carbon Emissions: Summary of Chartered SAB Requested Revisions to the Draft (2-8-16) SAB Review of Framework for Assessing Biogenic CO2 Emissions from Stationary Sources (2014).

¹⁰ Draft (06-02-2017) SAB review of Framework for Assessing Biogenic CO2 Emissions from Stationary Sources (2014)

¹¹ Biogenic Carbon Emissions: Memorandum from Dr. Madhu Khanna summarizing revisions to the draft SAB report in response to the Board's quality review comments.

¹² Biogenic Carbon Emissions: Summary of Chartered SAB Requested Revisions to the Draft (2-8-16) SAB Review of Framework for Assessing Biogenic CO2 Emissions from Stationary Sources (2014).

¹³ Biogenic Carbon Emissions: Instruction for the SAB Quality Review on the Biogenic Carbon Emissions Report Discussion.

¹⁴ RDX: Comments from Members of the Chartered SAB on the SAB Draft Report:Review of EPA's Draft Assessment entitled Toxicological Review of Hexahydro-1,3,5-12 trinitro-1,3,5-triazine (RDX) (September 2016). As of August 28, 2017 .

¹⁵ IRIS Briefing: Updates from ORD National Center for Environmental Assessment (NCEA) & Integrated Risk Information System (IRIS) Slides 1-10

¹⁶. IRIS Briefing: Updates from ORD National Center for Environmental Assessment (NCEA) & Integrated Risk Information System (IRIS) Slides 11-26

Attachment A: In Person Meeting Attendees

29-Aug-17

NAME	ORG
Khanna Johnston	EPA SAB
Holly Stallworth	USEPA
David Evans	USEPA
Allen Fawcett	USEPA
Bryan Bloomer	USEPA
Iris Goodman	USEPA
Richard Garbaccio	USEPA
Brittany Patterson	E&E Publishing
Vicki Soto	USEPA
Dahnish Shams	USEPA
Genna Reed	Union of Concerned Scientists
James Avery	USEPA
Alex Marten	USEPA
Justin Baker	RTL International
John Steller	USEPA
Jeff Cole	USEPA
Jonathan Lewis	CATF
Carrie Annand	Biomass Power Association
Kyla Cheynet	Drax Biomass
Kyle Harris	Corn Refiners Association
Max Broad	National Wildlife Federation
Ryan Andre	Biogenic CO2 Coalition
Tina Bahadori	USEPA
Samantha Jones	USEPA
Maria Hegstad	IWP
Sylvia Carignan	Bloomberg BNA
Ann Wolverton	USEPA
Nina Heikkinen	E&E Publishing
Steve Crookshank	API
Sara Banaszak	ExxonMobil
Shaunta Hill-Hammond	USEPA
Jason Fritz	USEPA
Vincent Cogliano	USEPA
Richard Yamanda	USEPA
Diana Wong	USEPA
Kelly Garcia	USEPA
Rachel Lehman	USEPA
Sue Shallal	USEPA

30-Aug-17

NAME	ORG
Khanna Johnston	EPA SAB
Shaunta Hill-Hammond	USEPA
Diana Wong	USEPA
Sue Shallal	USEPA
Bryan Bloomer	USEPA
Bruce Rodan	USEPA
Dahnish Shams	USEPA
Tina Bahadori	USEPA
Kevin Bromberg	SBA Advocacy
Ted Berner	USEPA
Sylvia Carignan	Bloomberg BNA
Beth Moore	DOE
Jason Fritz	USEPA
Vicki Soto	USEPA
Susan Rieth	USEPA
Samantha Jones	USEPA
James Avery	USEPA
Vincent Cogliano	USEPA
Xabier Arzuaga	USEPA
Maria Hegstad	IWP
Mary Ross	USEPA
Rachel Lehman	USEPA
Genna Reed	Union of Concerned Scientists
Roman Merercev	USEPA
Emma Lavoie	USEPA

Attachment B: Names and Affiliation of those who requested the teleconference call-in number

Janice Lee, US Environmental Protection Agency
Leif Hockstad, EPA
Amy Benson, EPA
Annette Gatchett,
John Bucher, NIEHS
Iris Camacho, EPA
Jennifer Nichols, EPA
Steven Dutton, US EPA
Pamela Noyes, U.S. EPA
Chip Murray, National Alliance of Forest Owners
Mary Ross, EPA,
Kirkley Cain, EPA-ORD-NCEA
Gunda Reddy, US Army PHC
Resha M Putzrath, Navy and Marine Corps Public Health Center
Robert Cleaves, Biomass Power Association
Sara Ohrel, EPA
Vincent Camobreco, US EPA
Bill Irving, USEPA,
David Beaudreau, DCLRS
Laura A Haight, Partnership for Policy Integrity
Jenny Li, EPA,
Michelle Mabson, Earthjustice
Mary Grace Schley, National Alliance of Forest Owners
[Brandi Buchman](#) Courthouse News Service
John Shoaff, EPA
Dana Jackman, EPA
Margaret Pratt, US EPA
Audrey Galizia, EPA
Mary Booth, PFPI
Desmond Bannon, US Army
Carl Pasurka, U.S. EPA,
Maria Hegstad, Inside EPA
Peter Nagelhout, US EPA
[Pat Rizzuto, Bloomberg BNA, Inc.](#)
Amanda Persad, U.S. EPA
Elizabeth Miller, EPA
Kevin Bromberg, SBA Office of Advocacy
Darryl Weatherhead, US EPA
Thomas Armitage, , EPA
Hsing-Hsiang Huang, EPA
Christine Ross, EPA
Karen Thorne, City of Louisville KY,
Lily Wang, EPA
Jim Kim, Office of Management and Budget
Ravi Subramaniam, Subramaniam.Ravi@epa.gov, US EPA
Gloria Helfand, US EPA
Vicki Soto, EPA/ORD/NCEA

Lou D'Amico, U.S. EPA
Brian Heninger, US EPA
Elvy Barton, SRP
Anita Meyer, US Army Corps of Engineers,
Stan Lancey, American Forest & Paper Association
Kyla Cheynet, Drax Biomass
Jessica Marcus, US Industrial Pellet Association
Clint Woods, Association of Air Pollution Control Agencies,
Sarah Mesrobian, EPA
Kate Shenk, , BIO
Summer Lingard-Smith, US GAO,
Michelle Mabson, Earthjustice
Genna Reed, Union of Concerned Scientists
Kevin P. Bundy, Center for Biological Diversity
Meredith Linch, Southern Company,
Anthony Oliver, South Coast Air Quality Management District
Joe Fontaine, NH DES
Joanne English,
Jessica Montanez, EPA,
Allen Fawcett, U.S. EPA,
Ann Wolverton, US EPA
Cheryl Itkin, US EPA
Jessica Montañez, EPA
Elizabeth Hill, USDA,
Steve Woock, Weyerhaeuser Company