Quality Review Comments from SAB Members on the SAB Draft Reports:

(1) SAB Peer Review of the EPA's Revised Guidelines for Preparing Economic Analysis
(2) Review of EPA's Reduced Form Tools Evaluation

List of comments received
November 11, 2020

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Comments on the Draft SAB Report: SAB Peer Review of the EPA's Revised Guidelines for Preparing Economic Analysis

Comments from Lead Reviewers

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EPA's Revised Guidelines for Preparing Economic Analysis
Quality Review Questions – Cullen Responses

I have reviewed the SAB Peer Review report draft dated September 17, 2020 of EPA's Revised Guidelines for Preparing Economic Analysis. I would like to commend the agency for its considerable effort in preparing the Guidelines document, as well as the peer review panel for its dedicated effort in carrying out its review. Both the peer review report draft and the agency guidelines are extremely lengthy and detailed and represent a tremendous amount of content. Below I have entered responses to the quality review questions. I will also transmit a markup copy of the peer review document in which a number of smaller items and editorial comments are noted directly in the document.

1. **Were the charge questions to the Panel adequately addressed?**

Yes, in general the charge questions to the Panel were adequately addressed. I have included a number of suggestions below to assist with clarity and completeness.

2. **Are there any technical errors or omissions or issues that are not adequately dealt with in the draft report?**

The panel peer review report draft makes many excellent points and contains a great deal of valuable content. The agency is receiving valuable information and suggestions. As the draft is edited one focus should be sharpening up the advice the report gives vis a vis addressing issues that are identified as needing further attention in the Guidelines. For example, the report states *"The distinction between benefits and negative costs (or costs and negative benefits) is at times arbitrary. "* What more could be offered specifically in terms of a preferred approach to making the distinction consistent?

Further, the report suggests that EPA create consistent definitions, perhaps including standardized names. More clarity is needed regarding what consistent definitions are being suggested or are preferred.

The tiered recommendations that the peer review lays out are well organized and helpful. But it was not clear which tier uncertainty analysis and distributional or variability analysis were meant to fall under.

Other specific comments:

- In Chapter 2, the report suggests that EPA generate prioritization rules for retrospective review where there are high costs or benefits with large uncertainties, but does not define how high is "high" or how large is "large". Similarly, in Section 2.1.7, the agency is encouraged to identify rules for retrospective review situations where the costs "vastly" exceed benefits; however vastly is not defined. Does this refer to cases where the costs represent twice the benefits? Factor of 10 higher? What about instances where a regulatory statute is strictly health based, such as for criteria pollutants? The context and relevance for the Guidelines needs to be communicated clearly in this situation.
- Page 6 line 33 Is SAB suggesting that analyses distinguish costs to elderly, the very young, or other subpopulations too, assuming costs here include health costs?
- Page 9 line 38 Regarding Chapter 3, SAB suggest to the agency that *"Section 3.2 contain emphasis that RIAs may, but are not required to, contain options that are not currently legal. This may be particularly true when economic theory points to clearly superior options than those allowed by law. "* This segment requires editing for clarity. For example does "clearly superior" here mean "clearly economically superior" or superior in other senses? Further, SAB should recommend that when including options that are not currently legal – these options should be clearly identified as such. Given the level of resource commitment that is required for sound analysis, if SAB makes this suggestion, then it should also lay out what would constitute sufficient justification for including illegal options.
- Page 51 line 43 In the discussion of retrospective analysis v. prospective analysis the report notes the value of each and also that each is hampered by lack of data. SAB should encourage recognition of the fact that the opportunity to gather additional data may also differ between the two types of analysis.
- In Chapter 8, point 5 under charge question 3, there is a suggestion to continually update analytic approaches as various "frontier topics" become standard practice in the literature. The draft report further suggests that EPA should not wait for Guidelines to be updated. It would be helpful if the draft report could specify how an analyst should gauge that something has become standard practice in the literature? How should an analyst identify the line or threshold for this?
- On page 53 related to Text box 8.4 – the draft report states this *"text box contains a nice discussion about separability of benefits and costs, although it could be helpful to provide the example of climate change. In particular, a policy that reduces GHG emissions causes global temperature to drop, which can reduce demand for electricity used for air*

conditioning. Lower electricity demand would affect factor prices and compliance costs." This example is a source of concern because the current state of the climate is such that only over the very long term will GHG reduction be expected to lead to lower global temperatures. In fact, even if GHG were to drop to zero today, it is anticipated that many decades would pass before temperatures would start drop.

- Page 55 The draft report notes that Chapter 8 appears to be silent on ancillary costs and suggests that a separate Guidelines section *"should call for a qualitative identification of possible "ancillary costs" associated with the rule-making action, since these are costs. For each possible ancillary cost that is identified, the RIA should explain whether the risk has been quantified, and why or why not."* If SAB makes this suggestion it should also suggest how to discern when this is worth doing and when it simply adds analytic complexity without analytic value. As the draft report notes on page 55 line 33, an economic analysis is not positioned to address how much policy or legal weight to give to this issue, but one could argue that economic guidelines should say something about how much analytic weight and time and effort the incorporation of ancillary costs might be worth, and how the tradeoffs about the decision to pursue this approach could be viewed and considered.
- Page 59 regarding Ch 9, states *"some read this chapter to examine potential differential impacts, and, if the analysts found large differentials – and if such differentials were measurable – to incorporate them into the regulatory analysis. If this is the objective, then the chapter should be more precise in terms of guidance to the analyst that this is indeed the purpose and provide more guidance as to when the differential impacts should be included into the analysis."* SAB should say something to indicate how large is a "large" differential?
- Page 61 the draft report notes that the *"Guidelines do not provide any help to analysts attempting to deal with the heterogeneity. "* In general, economic tools are not necessarily well suited for this. If SAB would like to argue that they are, then SAB should include references and suggestions for EPA here for how to tackle this in the Guidelines.
- Page 67 line 44, perhaps the terminology environmental justice "lens" would fit well here, to indicate that we are looking through a lens that brings environmental justice into focus.

3. Is the draft report clear and logical?

Yes, the draft report is well-written, clear and logical in general. In terms of style, the pens and voices of multiple authors are evident – which is not a surprise since this report was written by a team and is still a draft.

There are specific locations where additional clarity would be helpful. Some are noted in the markup that I provide and others are called out below.

- In the discussion of Textbox 1.1 In addition to quantifying and monetizing the anticipated benefits and costs to the "extent feasible", the analysis should include a treatment of the uncertainty and variability in benefits and costs as well. Also, the question *"Does the RIA use appropriate discount rates for benefits and costs that are expected to occur in the future?"* is noted. It is important to note in the Guidelines the question of whether an appropriate discount rate is used in an RIA, but it is also important to provide suggestions regarding how the agency should discern appropriateness.
- Regarding Chapter 4, on page 14 line 41 the report includes a sentence that appears inconsistent (also the point from Chapter 3 noted previously) *"Statutory constraints might limit the available set of options that the agency is authorized to ultimately implement and, given scare resources, may limit the set that the agency will choose to analyze. "* How does this comment in Ch 4 interact with the comment in Ch 3 that EPA could also include options that may not be legal? What balance does SAB wish to suggest relative to the obvious and inherent tradeoff? The peer review report draft goes on to say on page 15 *"In general, the SAB believes that there is value to describing the effects of stringency levels and approaches that are not currently allowed under a statute, especially when those other stringency levels or approaches are efficient. But in some cases, especially when the overall stakes of the regulation are low, deploying scarce resources to evaluating legally unavailable alternatives may be unreasonable. "* This whole sequence needs a bit more clarity bottom of page 14 through page 15.
- For Chapter 5 the peer review report draft suggests that a *"sensitivity analysis might investigate 100% compliance."* The report draft should add more information and detail about how to shape such a sensitivity analysis.
- Further in Chapter 5 charge question 2, points 2 and 3 need further clarification. The language is very tentative in places, with the word "may" appearing repeatedly, leading to a loss of clarity about the points made and their robustness.
- Regarding the section about technological change (page 25, line 22), the report draft suggests *"other factors that may importantly and specifically influence technological change related to the proposal such as changes in health prevention or mitigation or expanded virtual capability."* Is this a call to simply note factors that importantly and specifically influence technological change or is a call to also reflect on how likely such changes might be and what would be drivers to their introduction? The likelihood of these changes seems very important in directing an analyst to decide how much effort to devote.
- Chapter 5, charge question 3, the report draft states *"Where rules are linked by law, regulation or guidance; the RIA should include significant effects from the normal operation of linked existing local, state, federal and international regulatory programs."*

Not sure if there is an issue with the Guidelines document or with the peer review draft – still, it is difficult for a reader to discern the full range of what *linked rules* implies in this context. Regarding page 26 line 5 *"Discussing how to handle non-market linkages in a way consistent with taking all significant benefits and costs into account"* the peer review report draft would be strengthened by specific suggestions for how EPA should improve their approach to this.

- Page 26 line 37 Given the Ch 5 statement implying that Ketchum, Kuminoff and Powers, 2016 show that *"presumed violations of self-interest are often just violations of a utility function that an analyst had picked"* and the further implication that the analyst's choice of utility function may drive the appearance of violations, EPA could be encouraged to insert guidance directing analysts to report the sensitivity of the results to the choice of utility function. The peer review report could provide advice to EPA about how this is best approached.
- Page 27 line 8 The report draft encourages *"While the discussion of empirical sensitivity analysis in the existing draft appears quite useful, the analyst may benefit from additional guidance of standard practices or examples."* Some examples are provided however the EPA might benefit from the review report providing more specificity.
- Related to Textbox 6.2, the peer review report draft protests the use of a hypothetical rate of return, but this seems fine for an illustrative example, and even better would be to also include the sensitivity or robustness of analytic results to that rate of return.
- For Chapter 7, charge question 5, where "draft alternative" is noted, is this referring to a suggestion that EPA draft an alternative or is this suggesting that SAB take this on?
- Point 17 on page 54 says *"the cost of public funds should be discussed, since it is in chapter 4—maybe just to say it's complicated."* If an issue, such as the cost of public funds in this case, is raised and the guidelines say " it is complicated", the draft report appears to be suggesting that EPA can identify a threshold of impact or magnitude that would be necessary in order for the cost of public funds to be helpfully mentioned or included in an analysis. If that is the intention, the draft report should give advice and suggestion about this.
- Point 20 on page 54 *"Costs incurred by regulated entities are included but also costs to consumers, workers and the public. Here is a partial list of cost items that might be included in the illustrative box."* As was raised earlier, how is SAB suggesting that the Guidelines should handle the identification or categorization of costs incurred by regulated entities that are passed on to consumers or others? In this partial list of cost items there are some that appear to reflect tradeoffs. It would be possible to go very far into detail about both additional costs and benefits, and also give advice about how the Guidelines should indicate to analysts when it is worth going to this level of detail and when it is not. This gets back to the value of information raised earlier.

4. **Are the conclusions drawn or recommendations provided supported by the body of the draft report?**

Generally, yes, the conclusions drawn and recommendations given are supported by the body of the draft report. There are some spots where citations are not yet included or where the argument needs sharpening.

- The top level of recommendations in the draft report are identified as "Tier 1: Key Revisions (i.e., Actions that are necessary in order to improve the critical scientific concepts, issues and/or narrative within the guidelines)". It would be helpful if SAB could communicate to EPA specific advice related to carrying out recommended revisions, especially where related to improving clarity. Without specific advice about how to tackle some of the recommendations they are not always straightforward to implement.
- Page 30 line 7 and onward - Chapter 6 contains quite a few specific recommendations and draws on the relevant literature in many places. Still, some of the issues that are addressed here are subject to tremendous debate in the literature. Examples include the upper end discount rate for intergenerational benefits and costs – does SAB wish to recommend a high end number of 7% based on the 2003 OMB A-4 circular rather than the 5% upper value that the Interagency Working Group on the Social Cost of Carbon carried in 2010? There is quite a bit of disagreement about the right choice, however there is agreement that there are substantial implications associated with the choice. Thus, it is important to show the sensitivity or robustness of the analytic results to discount rate.
- Page 32 line 12 The discussion of the five-year latency with which EPA models fine PM premature mortality is cloudy, and the conclusion drawn here is not compelling.
- Page 33 line 12 Another spot where additional citations and clarity are needed is related to the discussion about rules which are slated to be periodically reviewed or updated (e.g., a NAAQS, or tailpipe standard, or NSPS under the Clean Air Act), and the suggestion that it may not be appropriate to use a long-time horizon in these cases. This is not convincing. Why should the time horizon of the analysis in one particular year have to account for the fact that another analysis is likely to be (or may be) carried out? Do we know ahead of time "how likely" that subsequent analysis is? Some future analyses that seem likely, may not occur on time or at all. There can be delays and changes in what is thought of as legally mandated or even simply a norm. It does not seem wise to rely on assumptions about future analyses.
- Page 59, regarding Ch 9, the draft report's discussion of overall welfare, and equity in welfare, seem to extend far outside of the scientific and technical underpinnings that are SAB's concern. There are many factors that contribute to welfare that are neither related

to health and safety, nor other factors that are part of the analyses that these Guidelines pertain to. Also, what is included in social welfare for this purpose?

- On page 63 the discussion of WTP is puzzling. Groups may have, on average, different economic situations, income distributions, levels of baseline health status. The reasons for these differences are complex and often rooted in structural and systemic inequity in the US. "Willingness" to pay, which relies on a person's available funds, thus seems an inadequate structure for the purpose laid out here. And the example about the $25K car comes across as naïve.
- Continuing on page 63, *"Accounting for such heterogeneity is absolute essential for understanding distributional effects. Indeed, assuming homogeneity in WTP when it does not exist only masks important social transfers, sweeping the problem under the rug."* It is not clear why this point is raised at all. Other analytic factors that the Guidelines refer to are also non-homogeneous, including a range of costs and benefits are routinely treated as homogeneous in this report. The draft report states further, "The current literature supports such distributional analyses." Actually, this does not seem to be a consensus view and in any case no literature is cited to support this statement. Thus the sentence should be removed.
- Page 65, "*Our Tier-1 suggestion was for the EPA to document net benefits across groups using heterogenous WTP for environmental improvements."* What groups is this referring to? For VSL it appears that only age is being treated as a distinguishing feature for grouping. What groups is the report now seeking to distinguish, please clarify?
- Page 65 line 28 *"While statistical estimation of effects on specific groups may require a control group, documentation of how a group is affected by a policy does not require comparison."* The draft report goes on to say in the EJ discussion, *"The effect is just the effect; it is not a relative comparison."* This is puzzling – isn't the concern for justice at its heart all about relative differences in what different groups are experiencing and facing?
- On page 66 lines 16-22, the discussion of charge question 4 is murky and the logic is not flowing clearly.
- Page 67 lines 12-26, It is unclear how the suggestion that generations or "age group" discussions be moved out of Chapter 10 into Chapter 9, still leaves children as a group to be treated in Chapter 10? Need to clarify this language or the logic behind this.

Comments from Dr. Otto Doering

This review clearly took a tremendous amount of time and effort on the part of the panel. The guide is an extremely important guidance document for EPA analysts. It is also very extensive - approaching 350 pages. The review panel did an excellent job completing a difficult task. I commend the members of the panel.

1. The charge questions were adequately addressed.
2. I did not identify technical errors, but will raise some potential issues or omissions that may not have been dealt with adequately in the report.
3. The draft report is clear and logical.
4. The conclusions and recommendations were well supported by the body of the draft report.

Comments:

Several of the recommendations in the transmittal letter I find particularly helpful or important. Number 6 arguing for the presentation of ALL identifiable benefits and costs, number 8 which emphasizes the importance of distributional benefits and costs, and number 10 that the target audience be better identified and focused on in terms of content and language. All the recommendations are pertinent and potentially make critical substantive contributions to the Guide. These recommendations are well made and supported in the text.

The review is well organized, and the use of tiered recommendations adds clarity and should help EPA in the revision of the document.

In the first part of the introduction, an argument is made for a line in the sand between analysts and policy makers. Is that line blurred by the last question in the Textbox 1.1 asking the analyst's RIA for an explanation of why the planned regulatory action is preferable to the identified potential alternatives? I find this dividing line is difficult to achieve and that the critical factor for policy is that there be transparency in the analytical process and the judgments made in executing the analysis - that complete separation is impossible and arbitrary. This may represent a philosophical difference on my part.

In Textbox 1.1 on page 3, it is not clear how much this is a checklist or a requirement? My concern is with the multiple alternatives to be considered. Should all RIAs have as many alternatives required? I would hope that there would not be so many alternatives as to discourage sensitivity analysis within the alternatives.

I strongly support a discussion of different tools like cost effectiveness, etc. P. 5, lines 1-3.

P.7 lines 8-10, Might low probability high cost (or benefit) events be important for particular consideration beyond retrospective review? (This might already be in the Guide.)

P.8 Lines 34-34 and lines 38-39 on P. 10 Tier 1 recommendation, for practical purposes, I find a difficult dividing line between potential and existing risk. Maybe there should be some more explanation here?

P. 9 lines 38-41 and P. 10 lines 45, it might be helpful to say a bit more about the recommendation to include options that are currently not legal. Are we encouraging illegal actions?

P.16 lines 16-25, I strongly support the suggestion to use pilot projects to better determine costs and benefits and some existing EPA programs in effect do this.

Timelines are covered in Chapter 5 and Chapter 6. I did not see much of anything about technical change over the timeline of an analysis. Is this adequately covered in the existing Guide text? I have found this a very important consideration in such analysis. This is everything from compliance enhancing technology to learning curves.

P. 42, lines 12-18, the review brings up risk assessment in RIAs. In our review of economic analysis for the Clean Air Act we spent some time on the importance of risk analysis. Is there sufficient coverage in the Guide?

The suggestions for better organizing and focusing Chapters 7 and 8 so they work better together are especially important.

P. 49, lines 20-32, I would further emphasize the importance of considering imperfect competition in RIA's. More than we wish to admit falls in this arena. This is mentioned also in lines 23-34 on page 51 with respect to CGE models.

P.52, lines30-41, The role of uncertainty in compliance decisions needs to be further emphasized for inclusion in RIA's if it is not already prominent in the Guide.

P. 59, the discussion of differential impacts and distributional impacts does not get resolved here. Can one emphasize that both need to be adequately covered wherever that is done? (Assuming the Guide does not cover them adequately now.)

P. 68, lines 41-46, The suggestion to flex bounds (margins) of a regulation for sensitivity analysis is an extremely valuable one. This includes standards as well as coverage. It might be done as a matter of course.

I did not see in the review(and it may be in the Guide) anything about the role and capacity of institutions to respond to a regulation being part of the RIA. There are instances where the RIA assumes technical assistance or enforcement capacity from institutions where that capacity does not exist. This has to be accounted for in the RIA. I also do not know how much is in the guide in terms of a framework for incremental cost analysis of a rule change. An example of the former

and a good framework for the latter are to be found in the NRC publication; Review of the EPA's Economic Analysis of Final Water Quality Standards for Nutrients for Lakes and Flowing Waters in Florida, National Research Council, 2012.

Especially given the role of the EPA Guidelines, we need to stress to EPA the importance of this review

Overall, a great job by the review panel.

Otto Doering
Purdue University (retired)

Comments from other Chartered SAB Members

Comments from Dr. Hugh Barton

Hugh A Barton

Nov 5, 2020

Guidelines for Economic Analysis Report

Were the charge questions to the Panel adequately addressed? Yes.

Are there any technical errors or omissions or issues that are not adequately dealt with in the draft report? None identified.

Is the draft report clear and logical? Yes, very well written overall. Specific edits noted below.

Are the conclusions drawn or recommendations provided supported by the body of the draft report? Yes

Specific Comments
P 6 lines 36-38: Clarify. A good place to indicate that analysts could determine information that will be needed for further analyses?
P 8-9: Generally, italic is used for the charge question text, so it is confusing that text on these pages is in regular font and italic. Consider changing format.
P 9 lines 38-9: awkward wording (e.g., contains emphasis)
P 10 line 32: fix grammar (e.g., only on)

P14 line 41: change “scare” to “scarce”
P 40 line 9: change “estimation of estimates” to “development of estimates” or other wording
P 44 line 31 and following: “draft alternative?” is unclear
P 49 line 28: IO is undefined
P 50 line 7: delete “it”
P 50 line 13: GHG is defined here, but had been used earlier.
P 52 line 41: “causes global temperature to drop” Is this correct or does decreasing GHG now just slow the rate of increase?
P 67 line 14: delete “This would be”

Comments from Dr. Samuel Cohen

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

I believe the answers to the questions for both reports is yes.
I do not have any changes to suggest.

Comments from Dr. Kenneth Portier

Kenneth Portier

Quality Review Questions

1. Were the charge questions to the Panel adequately addressed?

Yes. The panel reviewing this guideline document is to be commended for its extensive and detailed review, for the large number of recommendation that if implemented will significantly improve the guideline document, and for organizing the review report in a clear and logical document.

2. Are there any technical errors or omissions or issues that are not adequately dealt with in the draft report?

None that I could identify.

3. Is the draft report clear and logical?

Overall, the report is clear and logical in its review and recommendations.

The recommendation that "The main text of the Guidelines should be shortened substantially, either by deleting unnecessary material or moving material to an appendix" is stated multiple times. This, and possibly other oft-repeated recommendations might be discussed and recommended in Section 1. Introduction of this QR report.

In many cases, the recommendation statements are not constructed clearly as recommendations. Phrases such as "The EPA could consider …" or "The EPA should consider …" seem to be used quite often in Tier 3 recommendations but occasionally in other tiers. These statements should be revised to "Consider …".

For several recommendations on Chapter 5 and Chapter 7 specifically it is difficult to determine the corrective action being recommended without having to refer back to the detailed discussion. These statements should be revised.

Specific Issues with the draft report:

Page 29: The first bullet under Tier 2 is the recommendation to "Clarify the definition of the "adding up" condition on page 5-11." This seems more appropriate as a Tier 1 (key) recommendation rather than a Tier 2 suggestion.

Page 45: Bullet 7 is a long statement that should be divided into three recommendations: one regarding investing with other federal agencies on WTP estimation studies, one recommending that the discussion of VSL in 7.2.1.1 and Appendix B incorporate recent economic literature, and one recommendation to update the literature on how VSL varies over the lifecycle and may vary with other characteristics of risks and affected populations.

Page 45: Item 8 contains a recommendation related to the definition of VSLY that does not appear in the recommendations list. Shouldn't this be a Tier 1 recommendation?

Page 46: The last bullet has a recommendation statement related to Page 7-12 of the Guidelines that contains material that should be in the body of the discussion rather than in the recommendation statement.

Page 47: The recommendation labeled "Page 7-29, line 7" is not clearly stated. Are we recommending that this approach be discussed and recommended in the guidelines?

Page 56: Line 43-44. Is the recommendation to eliminate the discussion of employee effects or to mention but refer readers to Chapter 9?

Page 57: First bullet. Is the recommendation to eliminate the discussion of "effect of regulation on market structure and entry and exit" or to mention but refer readers to Chapter 9?

Page 57: Bullet starting line 10. Shouldn't the bulk of this text be in the discussion that precedes the recommendations?

Page 63: The Tier 1 recommendation is two paragraphs long and does not follow the format of all previous formatting of discussion/recommendations in this review. Most of this text belongs in the preceding discussion with a more concise recommendation statement.

Page 65: The text in lines 26-30 raise the issue of whether the text of Subsection 10.2.6 is consistent with economic literature. The recommended remedy for this concern is not clear from the text.

Page 67: The second Tier 1 recommendation is two paragraphs long and does not follow the format of discussion/recommendations in this review. Most of this text belongs in the preceding discussion with a more concise recommendation statement.

Page 67: Lines 30 to 35 and line 43. This text belongs in the preceding discussion, replaced with clear (actionable) recommendation statements. Looks like the recommendation is "Revise Section 10.2.6 to include in the comparison of environmental harm from alternative policy approaches input and feedback from disadvantaged groups identified under EPA's definition of environmental justice."

Page 67: Lines 37-41. Revise text to clearly state the recommended revisions/additions needed to Section 10.2.6.

A final formatting review is needed. There are a number of places where a sentence ends with two periods and where lines are not consistently included between numbered or bulleted items (see for example page 52).

4. Are the conclusions drawn or recommendations provided supported by the body of the draft report?

Yes.

Comments from Dr. Kimberly White

SAB Panel draft report titled "SAB Peer Review of the EPA's Revised Guidelines for Preparing Economic Analysis"

1. Question: Were the charge questions to the Panel adequately addressed?

Answer: Generally, most charge questions appear to be adequately addressed. However, there was one instance in where the SAB Panel should expand its answer. In Chapter 3, charge question #2 (see page 8, lines 1-7) this question should ensure that it states explicitly if the chapter contained an objective, balanced, and reasonable presentation and interpretation of the peer-reviewed theoretical and empirical economics literature. The current answer does not sufficiently address this question.

2. Question: Are there any technical errors or omissions or issues that are not adequately dealt with in the draft report?

Answer: In the introductory letter on page i, line 22-23, the sentence "Oral and written public comments were considered throughout the advisory process." should be deleted as this sentence already appears, in line 21.

3. Question: Is the draft report clear and logical?

Answer: Overall, the draft report appears clear and logical.

4. Question: Are the conclusions drawn or recommendations provided supported by the body of the draft report?

Answer: Generally, the conclusions and recommendations are supported in the body of the draft report. Of note, in drawing a conclusion to Chapter 1 charge question # 2 (see page 3, lines 1-6), which specifically asked "Does the chapter contain an objective, balanced, and reasonable presentation and interpretation of the peer-reviewed theoretical and empirical economics literature, as well as any analytic methods described?" the Panel report noted that "Peer reviewed economics literature or analytic methods are not included in this chapter." However, the SAB Panel report does not appear to make a recommendations to EPA regarding providing a thorough review of the peer reviewed literature or provide references to consider in order to address this deficiency in Chapter 1. Suggest the SAB Panel's report include a specific recommendation.

<u>Comments on the Draft SAB Report: Review of EPA's Reduced Form Tools Evaluation</u>

Comments from Lead Reviewers

Comments from Dr. John Guckenheimer

Brief answers from John Guckenheimer to the Quality Review Questions for the Panel draft report on *Evaluating Reduced-Form Tools for Estimating Air Quality Benefits (October 2019)*:

1. Were the charge questions to the Panel adequately addressed?

Yes

2. Are there any technical errors or omissions or issues that are not adequately dealt with in the draft report?

No, but …

3. Is the draft report clear and logical?

Yes

4. Are the conclusions drawn or recommendations provided supported by the body of the draft report?

Yes

Amplification of the "but":

The report the SAB is reviewing was written by Industrial Economics, Inc., a consulting firm based in Cambridge, MA. It is unclear whether the EPA has adopted the report as expressing its views about the use of Reduced Form Tools (RFT) or whether it maintains different opinions about aspects of RFT. In any case, the Review Panel rightly points out many shortcomings in the IEc report and emphatically states that the report does not make a strong case for the use of RFT as the basis of rules for regulating air quality. The Review Panel then made suggestions for how EPA could further develop RFT that would be adequate for reliably modeling the effects on air quality of proposed regulations. With this in mind, I think the Review panel could have taken a broader perspective about RFT. Here are two additional suggestions about what the EPA might do to make RFT tools more useful.

The starting point for this report is CMAQ, the Community Multiscale Air Quality model, an open source Fortran program that is a surrogate for empirical measurements of pollutants in the IEc study. CMAQ estimates air quality by projecting pollutant concentrations in space and time from inputs for weather (atmospheric flow) and pollutant emissions. Another program, BenMap, performs a benefit analysis of output from CMAQ. These forecasts and estimates are used by EPA in evaluating proposed regulations for emissions. CMAQ and the similar CAMx models are very large, limiting the number of simulations that can be run. They produce enormous amounts of output data that estimate the effects of individual policies without identifying how to optimize choices among policies. The RFT evaluated by IEc take different approaches to reducing the amount of computation required by CMAQ and CAMx. A key issue in the models is how they account for spatial dispersion of pollutants. CMAQ models the fate of pollutants due to advection, diffusion and chemical reactions, taking account of weather.

Only one of the RFT (InMap) maintains a dependence on weather, doing so by using multi-level spatial grids that are coarser except in regions of particular interest such as large cities and pollution sources. It is more expensive to run than the other RFT IEc studied. However, the estimates of pollutant concentrations produced by InMap were found to be farther from CMAQ estimates than most of the other RFT used in the study. This suggests that further study of how weather inputs affect CMAQ predictions would give substantial insight into the usefulness of RFT. A simple (but time consuming) test would be to run CMAQ on an ensemble of weather inputs – perhaps using historical data over the past 50 years. The variance of pollutant estimates and resulting health effects in such a test would set a lower threshold for the uncertainty expected from RFT that do not take weather as an input. If the variance is large, one can expect that the benefits realized by any proposed policy will fluctuate from year to year along with variations in the weather. A related issue is that the effects of extreme weather events such as large fires, hurricanes or sustained periods of stagnant air on air quality and human health may dominate the effects of emissions during other periods. If the negative impacts of emissions on health are highly concentrated in space and time, it may be difficult to account for these in models that use only averaged quantities for weather. (We are all familiar with warnings to avoid outdoor activity when air quality is very poor.)

The simplifications made by current RFT in the physics and chemistry modeled in CMAQ appear to be based upon intuition about the sensitivity of model results to different variables and combinations of variables. Computational methods for testing these sensitivities fall within the scope of data science and machine learning. I suggest that EPA initiate research projects using such approaches to develop a better understanding of the differences between reduced and full form estimates of the effects of emissions on air quality. This would be a more measured approach to the use of RFT for air quality modeling than the direct comparison of benefit estimates produced by different models described in the IEc report. It could identify systematically key variables to include in RFT models.

Here is one final comment: Global climate is changing on a decadal time scale, and these changes may be large enough to significantly impact the effects of pollutant emissions. When EPA forecasts the effects of proposed regulations, it should take into account that the benefits of the regulations will be realized in tomorrow's climate rather than today's or yesterday's.

Comments from Dr. Clyde Martin

Evaluation of SAB draft report
Review of EPA's Reduced Form Tools Evaluation

Prepared by Clyde Martin, (SAB), as the lead reviewer.

As usual I was asked to answer the following questions.

Quality Review Questions

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

Overall the report was more than adequate. It pointed out numerous shortcomings of the report and made suggestions as to how the report could be strengthened.

Question 1: The charge questions were for the most part adequately addressed. It was disappointing that the panel never really described any positive aspects of the report.

Question 2: Reading the SAB report one has to wonder what the goal of the reduced order models had been. There are many reasons one might want to produce a reduced order model when there exists a large scale simulation. One reason is that the large models may produce information that is not needed for the task at hand. Another reason is that the large simulation may take a relatively long time to produce output. This is a problem, for example, with models that attempt to predict future climatic events. It is not to be expected that small models will produce results identical to full scale models, but this is not to say that the output of small models will be less accurate than the outputs of full scale models. I felt that the SAB report would have been strengthened by a description of the intended goals of the reduced order models and whether or not those goals were reached.

Question 3: The report is clear and logical. It is very well written.

Question 4: The recommendations made were, for the most part, to provide a much larger set of scenarios in order to compare the outputs of the reduced order models to the output of the full scale models. These recommendations were supported by the body of the report.

In summary I felt that the reported would have been stronger if it had acknowledged the positive aspects of the EPA report and if it had been clearer on what the goals of the reduced order models had been.

Comments from Dr. Mara Seeley

1. *Were the charge questions to the Panel adequately addressed?*

Yes, I think the Panel adequately addressed EPA's charge questions

2. *Are there any technical errors or omissions or issues that are not adequately dealt with in the draft report?*

Air quality and economic models are far outside my wheelhouse, so in general I'm not qualified to judge the report on its technical merits. The only comment I have regards the discussion of the nitrate component for AP3 Direct vs. AP3 BenMAP RFTs – the report could note that the discrepancy for the nitrate component is larger than that for other pollutants for all the scenarios evaluated, but most notable for the Pulp & Paper policy.

3. *Is the draft report clear and logical?*

For the most part, the report was clear, logical, and, importantly, comprehendible to someone without technical expertise in the subject matter. There were places where the report might benefit with additional explanation.

- **p. 6, line 2:** Explain what is meant by "fusing" air quality concentration surfaces with monitored values.
- **p. 9, lines 9 -11:** Provide brief explanation why use of a fixed CRR/VSL places significant limitations on proper interpretation of the study's comparisons. I presume this relates to CRR/VSL nonlinearities. Perhaps include an illustrative example?
- **p. 12, lines 2-4:** Explain why assigning health impacts to county in which emissions changes occur rather than where health impacts occur is a limitation, e.g., is this due to potential for long-range transport of pollutants?

- **p. 16, lines 30-32:** How would comparison of air quality surfaces inform use of models for various scenarios?
- **p. 16, lines 32-33:** Specify which model evaluation methods/summary statistics would help, and why.
- **p. 17, line 11:** Explain, for a non-economist, why income is considered a margin, or what is meant by income when referred to as a margin.
- **p. 18, line 34:** Explain what Info-Gap is (for the uninitiated)
- **p. 18, lines 38-39:** Say why MSE would be useful.
- **p. 20, lines 17-20:** Is there a recommendation with respect to running CAMx for the Tier 3 scenario?

4. *Are the conclusions drawn or recommendations provided supported by the body of the draft report?*

Overall, the recommendations for each charge question logically follow from the corresponding discussion. But there are instances both where the report includes recommendations with no prior discussion, and where the report discusses issues with the EPA's report that aren't included as recommendations.

- **Charge Question 1a:** Several of the recommendations (e.g., which RFTs can produce air quality concentration surfaces, $PM_{2.5}$ scaling, accounting of NH_3/VOCs, RSMs/RFMs, errors identified in the EPA's report) seem to be distinct and not clearly connected with the preceding discussion. It would help if all of the recommendations could follow more directly from the discussion, to understand the panel's rationale for these recommendations. At the same time, there are points in the discussion that could be considered recommendations or could translate into recommendations (e.g., that the EPA's report should explain discrepancy in the nitrate component for AP3 Direct vs. AP3 BenMAP).
- **Charge Question 1b:** In their recommendations, the panel notes that a "stratified random sample of five scenarios would be too small." Is the panel saying that EPA's selection of the five scenarios is a stratified random sample? If yes, it would help to state this more affirmatively; if no, it would help to explain why the panel refers to the scenarios as such.
- **Charge Question 2b:** Are there any recommendations related to the panel's discussion of extrapolation of results?
- **Charge Question 3a:** There are several points discussed in response to Charge Question 3a that weren't translated into specific recommendations. For example, is there a recommendation with respect to running CAMx for the Tier 3 scenario, or considering atmospheric chemistry as an explanation for discrepancies between CMAQ and the RFTs?
- **Charge Question 3b:** No specific recommendations are highlighted for this response.

Comments from other Chartered SAB Members

Comments from Dr. Samuel Cohen

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

I believe the answers to the questions for both reports is yes.
I do not have any changes to suggest.

Comments from Dr. Otto Doering

As a disclosure, my use of RFTs has been in scoping prior to more detailed analysis which may involve determining a rough magnitude of impact - i.e. are we dealing with an elephant or a bread-basket. (p. 31 lines 20 & 21) This may be used to answer the question whether more detailed analysis is worthwhile.

1. I believe that the charge questions were adequately addressed.
2. I did not find errors or omissions that were not adequately dealt with.
3. The report was sufficiently logical.
4. I have some suggestions with respect to the recommendations visa-vi the body of the report.

I felt that the letter of transmittal should make clear (as the introduction did) that this is a consultant's report the SAB was asked to review to help EPA judge its usefulness, indicate weaknesses and how these might be overcome in the future. This should be front and center in the letter, as it is in the introduction, that this is not a 'peer' review of an EPA product that might be modified as a result of the review.

Also, in the letter, if there are important instances of poor experimental design that limit the usefulness of the report, this might also be mentioned in the letter. See concentration response relationships, lines 6-22, p. 7 and benefits assessment lines 23-28 p.9.

Finally, one might add to the bullets on page two of the letter that if these comparisons of models are to be useful, it is important to explain why the models differ (not just demonstrate that they do differ) lines 6-9 p.20.

Otto Doering

Comments from Dr. Thomas Parkerton

Quality Review of "SAB review of Review of EPA's Reduced Form Tools Evaluation" – Dr. TF Parkerton

Were the charge questions adequately addressed?

Although outside my subject matter expertise, the charge questions appear to be systematically addressed by the SAB RFT Review Panel.

Are there are any technical errors or omissions in the report or issues that are not adequately dealt with in the draft report?

I feel the last two bullets that are included in the cover letter to the administrator could be strengthened to better clarify several of the key SAB recommendations regarding future work concerning RFTs.

With regard to the next to last bullet:

"Increase the number and diversity of policy scenarios and provide more granular results to clarify the performance of the RFTs on regional scales. "

It may be clearer to revise this bullet into two recommendations that are more specific.
First, it may be helpful to highlight specific examples of the type of additional policy scenarios recommended (e.g. additional industrial point sources, area and mobile sources, in addition to examining PM2.5 components). Second, I recommend better explaining what is meant by "more granular results" such as presenting concentrations fields (where possible) separate from estimated monetized benefits and if air quality projections generated by an RFT are used directly or altered/normalized before use in benefits assessment. These points were made in several places in the full report and therefore seem appropriate to highlight in the cover letter.
With regard to the next to last bullet:

"Provide a discussion on the usefulness of RFTs in different parts of the regulatory decision process."

It may be helpful to expand this recommendation as follows:
"Clarify how EPA envisions using RFTs in lieu of full form approaches including a discussion on the usefulness of such tools in different parts of the regulatory decision process."

The full report highlights concerns regarding assumptions regarding both CRR and VSL as critical parameters to the overall benefit estimates. Should this VSL assumptions also be highlighted in the cover letter in addition to assumptions about CRR?

Pg 18 Line 33-36
The Panel suggests that it would be useful for EPA to use sensitivity analysis techniques to understand the types of scenarios that lead to different magnitude of prediction errors for some of all of the RFTs investigated. In earlier sections of this paragraph, the Panel provided citations that might assist EPA in model evaluation. It would be helpful if the Panel can also provide specific citations here regarding the sensitivity analysis techniques that are envisioned.

Pg. 29 line 1-2
The Panel states "The EPA should assess performance for a more recent mobile source scenario encompassing more contemporary aspects." For clarity, suggest better describing what more contemporary aspects need to be considered.

Is the draft report clear and logical?

The report is logical and generally well written. A few minor editorial concerns / clarification are identified below.

Pg. 10 line 13
Revise "this may lead to a misleading impression that…" To: "it may be misleading that …"

Pg 10 Line 19
Revise "strong assumption" To: "implicit assumption"

Pg 10 Lines 35-37
To avoid redundancy suggest deleting this sentence as this point is clearly stated as a recommendation on pg 11 lines 1-3

Pg 13 line 31
Replace "them according to their .." With: "each model according to …"

Pg 14 Lines 35-36

This sentence provides a vague assertion about additional inconsistencies that is not particularly helpful. I think the Panel's point is clearly articulated in the previous sentence. Suggest deleting.

Pg 15 line 6
the text "However, that is not what is presented in the document as being the basis, …" is awkward .. suggest revising sentence as: "However, this basis for the evaluation was not presented in the report, …"

Pg 16 line 21
for consistency replace "C-R" with "CRR"

Pg 32 line 9
the text "Even doing that leaves many important sources of uncertainty in the RFTs uncharacterized." is awkward .. suggest revising sentence as: "Nevertheless, even this approach would leave important sources of uncertainty in the RFTs uncharacterized."

Are the conclusions drawn or recommendations provided supported by the body of the draft report?

Pg 29 line 24

The Panel states that "While RFT estimates can play a useful role in screening analyses …" However, the remainder of that sentence states the EPA's report does not provide insight concerning how well RFT-based benefit estimates can meet the appropriate degrees of accuracy and precision needed for various types of purposes. Thus, it seems premature for SAB to include on the useful role RFTs can serve in screening analyses. This is further supported by statements made later in the report on pg 31 line 21 that RFTs "might be useful" for some pre-decisional applications. To be logically consistent, suggest above text in quotes is deleted or at least qualified that RFT estimates "might" serve a useful role for screening purposes.

Comments from Dr. Kenneth Portier

Comments on the SAB Report titled "Review of EPA's Reduced Form Tools Evaluation."

Kenneth Portier

Quality Review Questions

1. Were the charge questions to the Panel adequately addressed?

Yes. It was noted that the SAB Panel focused its efforts on developing recommendations to help guide future Agency efforts at improving the transparency, reproducibility, and quality of RFTs, rather than improving this specific RFT Evaluation document. As a result of this focus, recommendations are not tiered, and all recommendation are considered as "Future Work" recommendations. Despite this focus, some recommendations do address actions that would help improve the specific evaluation document (see, for example page 6, line 31-35, pages 13-14, recommendations for charge question 2a). It is unclear if tiering recommendations would improve the final Panel report but might be considered if the report requires extensive revisions due to other QR comments.

2. Are there any technical errors or omissions or issues that are not adequately dealt with in the draft report?

The EPA report argues that RFTs are "less resource intensive approaches than full-scale air quality modeling." The report does not provide an indication of how much of a reduction in time and resources is gained through use of RFTs. It would seem reasonable for the report to compare the benefits in time and resource reductions against the loss in precision through use of these RFTs. I was surprised that the Panel report does not comment on this.

3. Is the draft report clear and logical?

Overall, the report is clear and logical in its review. A final formatting review is needed to address issues such as:

- The change in line spacing that occurs in the cover letter (page 1, line 30).
- Sentences ended with double periods (e.g. page 4, line 35).
- Inconsistent labeling of text blocks. The text discussion for CQ 1a uses bullets, for CQ 3b uses numbering, and for CQ 4a uses dashes.
- Lack of clarity on why some comments occur in the body of the report and others are allocated to footnotes. Some footnotes are long paragraphs that seem to continue the more limited discussion in the text. In most of these cases, the footnote material seems (to me) more appropriately placed in context in the body of the document (see for example page 8 where footnotes 14 and 17 are a third of the page).
- The references are not exactly listed alphabetically by first author (page 33, Fullerton after Huang).
- There are three US EPA (2020) documents. Shouldn't these be listed as US EPA (2020a), US EPA (2020b), and US EPA (2020c).
- Some US EPA references use quotes around the report name, others do not.

- Page 29, lines 20-35: This paragraph needs splitting into two. The discussion starting with "BPT-based approaches face challenges with handling ..." is a new topic that requires a new paragraph.
- Page B-1, line 4, page B-2, line 36 and page 16, line 10: In a previous EPA report the phrase "benefit-cost analysis (BCA)" is used instead of "cost-benefit analysis (CBA)". Do we need to be consistent with these other reports?
- Tables C-1 to C-5 and C-7 in Appendix C use red fonts to highlight substantial differences. This may produce issues with colorblind individuals or cause problems if the report is photocopied. Recommend using bold or italic fonts instead.

4. Are the conclusions drawn or recommendations provided supported by the body of the draft report?

Yes. The text in the discussion of charge question 3b contains recommendations (for document improvement and future research) in the numbered text but these are not further highlighted in a RECOMMENDATIONS section. A recommendations section should be added.

Comments from Dr. Kimberly White

SAB Panel draft report titled "Review of EPA's Reduced Form Tools Evaluation"

General Comment: In the introductory letter found on pages i-iii, suggest that the SAB Panel's statement on page i, lines 24 – 25 be stronger. The SAB panel should consider updating the statement to request that EPA fully address the SAB Panels comments and incorporate their advice and recommendations prior to finalizing the EPA's report titled: Evaluating Reduced-Form Tools for Estimating Air Quality Benefits (October 2019). Highlighting the importance of addressing the SAB Panels comments seems particularly key to stress, given that on page 1, lines 35-39, the SAB Panel indicated that it was its understanding that EPA did not intend to revise their report based on comments received by the Panel because other efforts were already underway to improve the transparency, reproducibility and quality of the RFTs.

1. Question: Were the charge questions to the Panel adequately addressed?

Answer: All the charge questions appear to be included and addressed in the body of the report. Each charge question is identified, a review of the SAB Panel's findings is provided and then some specific recommendations are included.

2. Question: Are there any technical errors or omissions or issues that are not adequately dealt with in the draft report?

Answer: The report did not appear to include technical errors, omissions or issues.

3. Question: Is the draft report clear and logical?

Answer: Yes, the draft report is clear and logical. One potential recommendation is for the SAB Panel report to include some additional discussion on Page 4, lines 27-31 regarding why the SAB Panel felt it important to devote an Appendix B to the uncertainties in the concentration-response relationship and note in the body of the SAB report that EPA should incorporate these uncertainties in future review.

4. Question: Are the conclusions drawn or recommendations provided supported by the body of the draft report?

Answer: Yes, the conclusion and recommendations appear to be supported in the body of the draft report.