December 1, 2017

To: Bryan Bloomer, Designated Federal Officer
U.S. Environmental Protection Agency, Science Advisory Board

From: Stan Hayes, Panel Member

RE: **Comments on Draft Report from**
SAB Risk and Technology Review (RTR) Methods Review Panel

Please accept these comments on the draft SAB report from the Risk and Technology (RTR) Methods Review Panel. The draft is well done, recognizes EPA's substantial efforts to improve its RTR methodology, effectively blends the results of writing teams, and accurately captures panel discussions at the June 29-30, 2017 meeting.

I offer here several selected comments chosen to emphasize certain points that I consider important or to provide additional information that I hope will be helpful.

Overarching Issues

Comment 1: Suggestions for Reducing RTR Input Data Errors

> *"Overarching data quality considerations are important in the assessment. The SAB recognizes the fundamental importance of accurate input data as a bedrock foundation on which all RTR risk analyses build. The SAB recognizes EPA's past efforts to ensure RTR input data accuracy, and strongly supports and encourages such efforts." (Executive Summary, page 9, lines 28-31)*
>
> *"The SAB recognizes the fundamental importance of accurate input data as a bedrock foundation on which all RTR risk analyses build. The Agency should continue to make meaningful efforts to ensure the validity of the data used. The possibility of errors should be considered in doing the analysis and in interpreting the results." (Section 3.1. The three-tiered multipathway screening approach, page 18, lines 17-20)*

Over the past decade or more, my staff and I have conducted risk modeling of several hundred industrial facilities using EPA's evolving RTR risk modeling methodology and have reviewed RTR data collected in a number of EPA Section 114 Information Collection Requests (ICRs). Based on those experiences, I strongly agree with the above statements in the draft SAB report.

Further to those statements, I would ask the panel to consider the following suggestions for reducing RTR input data errors. The panel could simply leave this memorandum as my statement on the record, without inclusion in the SAB report. Or, should the panel concur, the suggestions could be incorporated in some form in the report (e.g., an appendix), acknowledged by referencing this comment memorandum in the report, or separately endorsed, either in total or portions (e.g., by motion):

> *It is evident from past RTR experiences that significant and material policy-relevant errors can occur in RTR input data, skewing risk results, possibly by large and misleading margins. Building on the substantial efforts that EPA staff has already made, EPA could further develop and expand its affirmative efforts to ensure RTR input data accuracy. The possibility and policy implications of such errors should continue to be considered when doing RTR risk analyses and interpreting results.*

At times, RTR input data errors have been caused by reporting errors by individual facilities, including:

- *Unrealistically wide-margin emission outliers,*
- *Sources mislocated offsite,*
- *Incorrect measurement units,*
- *Mismatched data conventions, and*
- *Typographical mistakes.*

At other times, errors have been made due to undetected incorrect information in publicly-available national, regional, and local emission inventories, including:

- *Outdated or inaccurate data,*
- *Non-existent "phantom" sources no longer operating, and*
- *Embedded errors carried over from predecessor legacy inventories.*

Possible approaches to reducing such errors could include the following:

- *Guidance could be developed to assist facilities in*
    - *Prioritizing quality assurance efforts to focus on those data likely to matter most for risk assessments, such as source emissions and locations.*
    - *Assessing the representativeness of EPA "defaults" for less critical facility data (temperature, stack diameter, etc.) when such defaults are used.*
    - *Assessing the representativeness of EPA "gap filled" facility data when such data are used.*

- *Development, online distribution, training, and certification in the use of a suite of input data screening tools to detect and flag common errors could be undertaken, including emission outliers, offsite sources, incorrect units, and data convention mismatches.*
    - *Such tools could include data visualization techniques similar to the Google Earth imagery provided in EPA's RTR inhalation risk model HEM-3.*
    - *While such imagery is currently available in HEM-3 only after the model is run, data visualization tools could be employed earlier in the RTR risk assessment process, when data quality assurance feedback (e.g., source locations) would be most helpful.*

- *Submittal of additional information to support data quality screening could be required where needed.*
    - *For example, facility fenceline information in electronic format could be submitted.*

- *RTR risk models could be modified to:*
    - *Add an optional data quality assurance step, including the flagging of suspect offsite sources (e.g., outside of the fenceline and nonrepresentative census blocks) and other risk-driver information.*
    - *Expand the risk attribution breakdown in Google Earth map visualization imagery to include risks both by HAP and by source at each modeled receptor, similar to that currently provided in HEM-3 by HAP for the maximum individual risk (MIR) receptor.*

- *Improved methods for verification and certification of data accuracy could be implemented for both facility-reported information and public emission inventories, e.g., EPA's NEI, state/local emission inventories.*
- *An EPA in-house RTR data verification team could be formed (or its role expanded) with affirmative responsibility for certifying data accuracy.*
- *An independent in-house EPA team could be formed (or its role expanded) to "stress-test" risk results to verify their accuracy prior to public release.*
- *Further efforts could be made to compare and, where appropriate, to reconcile similar data submitted in different EPA programs (e.g., TRI).*
- *EPA's multi-cycle iterative approach to RTR risk modeling could be further refined and formalized, including the following steps:*
    1. *Conduct individual facility risk assessments.*
    2. *Rank order facilities by risk.*
    3. *Determine risk-driver emission sources and hazardous air pollutants (HAPs) for the highest-risk facilities (e.g., top 10%).*
    4. *For highest-risk facilities, seek verification of risk-driver data (e.g., contact affected facilities), especially if risks exceed maximum acceptable levels.*
    5. *For lower-risk facilities, conduct screening to guard against risk under-estimation (e.g., sources mislocated far offsite).*
    6. *Incorporate and document facility corrections as appropriate.*
    7. *Repeat until risk results are stable.*

Chapter Comments

<u>Comment 2: Need to Clarify Summary Paragraph in Executive Summary</u>

The division among the multiple topics in the Executive Summary's paragraph (page 2, lines 18-26) summarizing "additional observations and recommendations" is not clear. I would modify that paragraph to clarify that division as follows:

> *"The SAB makes several additional observations and recommendations. Among these are the following: (a) inclusion of the gardener scenario is appropriate, though evaluation of how many people this applies to should be conducted to determine the efficacy of the addition; (b) the accuracy of dispersion and deposition results from the TRIM.FaTE model should be evaluated by comparing them to results from a more technically robust dispersion model, such as AERMOD; (c) while incorporation of turbulence in determining urban/rural selection in dispersion modeling is appropriate, a different approach was suggested; and (d) although EPA's reliance on census block centroid locations as surrogates for where people live often can be reliable, because such an approach might not always be sufficient to ensure that receptors are representative of residential areas near facilities, additional methods should be identified and evaluated."*

Note that I have also included as (b) above EPA's evaluation of the accuracy of TRIM.FaTE's dispersion and deposition calculations.

Comment 3: Need to Evaluate TRIM.FaTE Dispersion and Deposition Accuracy

Estimation of the dose received by a fisher under the refined fisher scenario depends closely on the estimation of PB-HAP deposition. EPA calculates such deposition using the TRIM.FaTE model.

Unlike EPA-recommended, state-of-the-practice dispersion models such as AERMOD, TRIM.FaTE substantially simplifies the complex atmospheric processes that govern the transport, dispersion, and deposition of airborne material. As stated in the TRIM.FaTE technical support document (EPA 2002)[1]: "horizontal dispersion between air compartments is not currently modeled" and "vertical dispersion is not modeled either." Instead, TRIM.FaTE makes the highly simplifying assumption that airborne material emitted into or transported in the air within TRIM.FaTE is "instantaneously distributed evenly throughout a compartment."

Deposition onto lakes directly and onto land surfaces that then affects run-off into lakes is driven by the air concentrations calculated by TRIM.FaTE. It is unclear how accurately PB-HAP deposition is calculated by such a simplified model. Additional information is needed to demonstrate the accuracy (or for a screening methodology, the conservatism) of such deposition estimates and to evaluate the implications of that accuracy for the reliability of fish consumption exposure estimates. Absent this demonstration of TRIM.FaTE deposition accuracy, it is difficult to assess the validity of refined fisher scenario results.

Dispersion models recommended by EPA, such as AERMOD, have been continuously improved and updated many times over the years (as recently as December 2016). Such models have been employed by many users in a variety of regulatory proceedings, and have been subject to rigorous performance evaluation by EPA and the scientific community to test and demonstrate model accuracy.

It is not clear to me the extent to which TRIM.FaTE has been updated since 2002, when its technical support document was released and the most recent scientific paper cited by EPA on the TRIM.FaTE website was published.

EPA should test and demonstrate across a relevant range of representative scenarios the reliability of TRIM.FaTE air concentration and deposition estimates by comparing TRIM.FaTE results to those calculated by more physically realistic models, such as AERMOD. In addition, a probabilistic approach to the design and specification of parameters used to define fisher exposure scenarios could be helpful and provide important insights.

I would add the following paragraph to the Executive Summary, page 10, after line 44:

> *"EPA should consider evaluating the accuracy of dispersion and deposition modeling results from its TRIM.FaTE model by comparing them to those calculated by a more physically realistic dispersion model, one that is more fully documented, regularly updated, and whose performance has been more rigorously evaluated and demonstrated, such as AERMOD. If the results of such a performance evaluation warrant it, the SAB suggests using a different approach."*

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[1] EPA. 2002. "Total Risk Integrated Methodology, TRIM.FaTE Technical Support Document, Volume I: Description of Module." EPA-453/R-02-011a. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, North Carolina. September.

Note also that the draft SAB report has a more complete discussion of this topic in Section 3.3, Fishing, Lake and Pond Assumptions, page 23, lines 8-33. The Transmittal Letter and Executive Summary should match the sense of that discussion.

Comment 4: Importance of Professional Judgment in Selecting Urban or Rural Dispersion

Because the choice between urban and rural dispersion in AERMOD can make a materially significant difference in the risks calculated using the HEM-3 risk model, it is helpful to EPA to automate that choice to supplement the professional judgment of the HEM-3 user.

A number of complexities can be present, though, that bear on urban/rural dispersion selection, including the presence of land-water boundaries, facility heat-island effects, and unique population distribution patterns. As a result, individual physical circumstances should be inspected to confirm tool selection results.

It would be helpful if HEM-3 produced a summary of the model's rationale/calculations for its urban/rural recommendation (perhaps as an option). While it is sensible to seek greater consistency in the choice of urban/rural dispersion through use of an automated tool such as that proposed by EPA, ultimately the final choice of urban/rural dispersion should be a matter of risk assessor professional judgment based on "facts on the ground."

I would add the following new paragraph on page 31, after line 45:

> *"In any event, because this procedure is automated, with calculations internal to the selection tool, the final choice of urban/rural dispersion should be a matter of professional judgment based on 'facts on the ground.' Where a material difference in risk results exists between urban and rural dispersion, EPA could seek an explanation and justification, should professional judgment differ from that of the selection tool."*

Comment 5: Need to Clarify the Representativeness of Census Block Centroids

> *"Overall, the SAB finds that the tool's reliance on census block centroid locations is not sufficient to ensure that receptors are representative of residential areas near the facilities." (Section 3.8. The census block receptor check tool, page 33, lines 42-43).*

High risks calculated at mislocated or nonrepresentative census blocks can be misleading, sometimes by a wide margin. Census block issues can arise in circumstances such as the following:

- Onsite, within a facility's fenceline
- Offsite, but where the extended exposure required for development of cancer or non-cancer chronic health effects is not physically plausible (e.g., roadway, river/lake, parking lot)
- Offsite, but not representative of the actual population (e.g., the census block centroid does not match the physical locations where the people represented by that census block actually live).

EPA's proposed census block tool can be helpful in flagging locations that are not representative of actual human exposures. However, it is not always possible to anticipate every circumstance. Based on my experience with HEM-3 and RTR risk analyses, manual inspection of each facility should be conducted to verify and supplement if necessary any receptor adjustments recommended by the census block tool.

The draft report's statement that reliance on census block centroid locations was not sufficient does not seem to be adequately supported, since the panel did not review and evaluate evidence sufficient to justify such a sweeping statement.

Moreover, the statement is contrary to my experience, having done risk modeling of several hundred facilities using EPA's RTR facility-specific inhalation risk model HEM-3. Google Earth imagery provided by HEM-3 shows clearly residential patterns around modeled facilities, their orientation with respect to modeled emission sources and census block centroids, and the magnitude and geographical pattern of risks in surrounding areas.

Using such imagery and initial risk results, it is straightforward to identify circumstances where census blocks are not adequately representative of nearby residential areas. In such cases, the locations of additional modelled receptors can be clearly identified (e.g., nearest residence) and added to the risk analysis. Should uncertainty exist in identifying such receptors, multiple new receptors spanning the range of such uncertainty can be added and risks re-calculated (with the new highest-risk receptor then used).

Where such adjustment causes a material difference in risk results, EPA could seek an explanation and justification, should professional judgment differ from that of the census block tool.

I would modify the draft SAB report text as follows:

> *"Overall, the SAB finds that, while the method's reliance on census block centroid locations often can be reliable, care must be taken that they are sufficiently well-placed to ensure that receptors are representative of residential areas near the facilities. The SAB suggests additional methods be identified and evaluated (e.g., using Google Earth imagery and preliminary risk calculations)."*

I would also replace the last sentence to the Executive Summary paragraph on page 11, line 27 (at the end of the paragraph) with the following:

> *"Overall, the SAB found that, while the method's reliance on census block centroid locations often can be reliable, care must be taken that they are sufficiently well-placed to ensure that receptors are representative of residential areas near the facilities. To facilitate tool transparency and results reproducibility, EPA could develop tools to enable risk assessors to exercise their professional judgment in verifying tool risk receptor placement (e.g., using Google Earth imagery and preliminary risk calculations)."*

Editorial Comments

Acronyms and Abbreviations, page 7, line 3: AERMOD should be identified as AMS/EPA Regulatory Model (dispersion model)

Executive Summary, page 9, lines 31-32: Recommend moving last sentence in paragraph to first sentence of next paragraph

Executive Summary, page 10, line 38: Correct “suggest’s” to “suggests”

3.1. The three-tiered multipathway screening approach, page 17, line 24: Correct “Program” to “Programs”

3.2. Risk equivalency factor methodology, page 20, lines 11 and 32, elsewhere?: Should “read across” be “read-across” throughout for consistency?

3.6. Environmental risk screening methodology, page 29, line 32: Correct “famer” to “farmer”

3.7. Inhalation risk assessment enhancements, page 30, line 35: Correct “90percent” to “90 percent”