



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON D.C. 20460

OFFICE OF THE ADMINISTRATOR
SCIENCE ADVISORY BOARD

April 23, 2015

EPA-SAB-15-008

The Honorable Gina McCarthy
Administrator
U.S. Environmental Protection Agency
1200 Pennsylvania Avenue, N.W.
Washington, D.C. 20460

Subject: SAB Review of the EPA's Draft Technical Guidance for Assessing Environmental Justice in Regulatory Analysis

Dear Administrator McCarthy:

The EPA's Office of Policy (OP) and Office of Environmental Justice (OEJ) requested that the Science Advisory Board (SAB) review the draft report titled *Technical Guidance for Assessing Environmental Justice in Regulatory Analysis* ("EJTG"). The EJTG provides information to assist EPA analysts, including risk assessors, economists, and other analytic staff, in evaluating potential environmental justice (EJ) concerns in the context of rule development (i.e., regulatory actions). The EJTG presents the analytic expectations for EJ analyses to help ensure that potential EJ concerns are appropriately considered.

In response to the EPA's request, the SAB convened an expert panel to review the EJTG. The SAB was asked to comment on: the clarity and technical accuracy of the guidance; the inclusion of the most relevant peer-reviewed literature; appropriateness and sufficiency of the six analytic recommendations listed in the EJTG to ensure consistency, rigor and quality across assessments; the clarity and accuracy of the guidance on when and how to conduct an analysis of the distribution of costs; and key methodological or data gaps specific to considering EJ in regulatory analysis. The enclosed report provides the SAB's consensus advice and recommendations. This letter briefly conveys the major findings.

The SAB commends the agency for undertaking the very important and complex task of addressing environmental justice in regulatory decision-making. Overall, the EJTG is a comprehensive presentation of EJ concerns and of the complex issues, processes and methods associated with EJ analyses. The SAB would like to offer several recommendations for improving the clarity and rigor of the guidance for conducting EJ analyses.

To increase the document's clarity, the EJTG needs to include better definitions for key terms (e.g., EJ populations, susceptibility and vulnerability). The SAB recommends that the EJTG direct analysts to existing agency guidance documents and focus on providing guidance on elements that are specific for and can add value to an EJ analysis, thereby reducing redundancy and inconsistency. The EJTG should provide specific, clear options and examples of best practices for consideration by analysts. Decision trees, diagrams, checklists and other means may be helpful to summarize key guidance and to steer the

analyst to those areas where consistency is essential. The SAB recommends that the EJTG emphasize the importance of involving communities when conducting an EJ analysis. The EJTG should reference relevant reports from the EPA National Environmental Justice Advisory Council (NEJAC) and other published studies that provide recommendations on how to ensure more effective public participation.

The SAB understands the need for the EJTG to remain flexible but is concerned that the EJTG may be less effective without further specificity. Phrases such as “if feasible” or “when possible” convey a lack of commitment and may lead to inconsistency in addressing EJ concerns. To ensure consistency and transparency, the SAB recommends that the EJTG should instead ask analysts to provide an explanation for why an analysis was not conducted or specific recommendations in the guidance were not followed. Additionally, the EJTG should not favor quantitative over qualitative analyses, since both are important and useful. The best and most relevant data should be included in the analyses, not just the most recent.

The terms “differential” and “disproportionate impacts” should be described earlier in the document where the purpose of the guidance is spelled out. The discussion of these impacts should be made clearer and less detailed and complex. Conceptual maps may help to highlight the contributors and drivers of EJ and thereby make them easier to communicate. The SAB recommends that the EJTG direct the analyst to be transparent in the EJ analysis about how differences across groups are identified for the potential scenarios that may result from a regulatory action. The EJTG should also encourage the inclusion of stakeholders early in the analytical process to determine the most relevant metric(s) or analysts should conduct sensitivity analyses across alternative metrics.

The SAB notes that the use of the standard risk assessment model is emphasized in the guidance as the primary means to quantify adverse health impacts due to exposure to chemicals in the environment. The EJTG does not, however, indicate how cumulative impacts should be evaluated, quantified or otherwise considered in an EJ analysis. The SAB encourages the EPA to develop guidance on how to incorporate and evaluate cumulative impacts quantitatively and/or qualitatively. In the meanwhile, the EJTG should consider adopting a more holistic approach to assessing risk and cumulative impacts. In addition, a more expansive discussion of the limitations of the information used to complete an EJ analysis will add value by identifying the sources and potential impacts of uncertainties on the effected populations.

The SAB found that there was a lack of sufficient guidance on when and how to conduct an analysis of the distribution of costs. If EPA documents already exist that provide the needed guidance, analysts should be directed to them. The issues that are unique to EJ analyses should be highlighted in the EJTG. The SAB recommends that the EJTG should clarify when cost analyses are appropriate and analysts should be required to document the basis for any exclusion. Clearer guidance also is needed regarding the time frame that should be used in a cost analysis. Furthermore, the EJTG should provide direction on how to characterize the uncertainty inherent in cost estimates.

The SAB agrees with the research gaps and priorities identified by the EPA and the public commenters, including the need for better distribution of air monitoring locations, use of cumulative impact assessments, use of appropriate data sources and maintenance of privacy, more complete demographic information, identification of non-chemical stressors, and the appropriate use of qualitative data. The SAB recommends that the EPA address these issues systematically by undertaking a strategic planning exercise to better focus short-term needs versus long-term priorities. To address staffing needs, the SAB suggests recruitment of appropriately trained postdoctoral researchers, temporary inter-agency transfers, community-based participatory researchers, and creative use of the agency’s STAR research program.

The SAB appreciates this opportunity to review this important EJ guidance and looks forward to the EPA's response to these recommendations.

Sincerely,

/s/

Dr. Peter S. Thorne, Chair
Science Advisory Board

/s/

Dr. H. Keith Moo-Young, Chair
SAB Environmental Justice Technical Guidance
Review Panel

Enclosure

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1. EXECUTIVE SUMMARY

The Science Advisory Board was asked by the EPA to review the agency's *Draft Technical Guidance for Assessing Environmental Justice in Regulatory Analysis (May 1, 2013 Draft)* (also referred to as the EJTG). The purpose of the EJTG is to provide technical direction to EPA staff and managers to aid them in incorporating environmental justice into the development of risk assessment, economic analysis and other scientific input and policy choices as an integral part of the agency rulemaking process. The EJTG contains guidance on how to assess disproportionate environmental and public health impacts of proposed rules and actions on minority, low income and indigenous populations in a variety of regulatory contexts. The charge to the SAB included questions on the following topics: overall impressions, key questions for analysts, key recommendations, differences and disproportionate impacts, contributors and drivers, human health risk assessment, suite of methods, distribution of costs analysis and research gaps. The SAB's response to the questions under each topic are summarized below, with further discussion of the issues and recommendations contained in the body of the report. In addition, a major concept in the context of environmental justice – that of public involvement – is highlighted here and emphasized within the body of the report.

Overall Impressions

The SAB commends the agency for developing the *Draft Technical Guidance for Assessing Environmental Justice in Regulatory Analysis (May 1, 2013 Draft)* (also referred to as the EJTG) for incorporating environmental justice principles into regulatory analyses. In general, the EJTG is a comprehensive compilation and presentation of environmental justice (EJ) concerns and the complex issues, factors, parameters, processes and methods. It also presents examples of the necessary elements to conduct a rigorous, credible and meaningful assessment of environmental justice during the development of a regulatory action. The EJTG will be useful for understanding EJ issues and will improve the process for including EJ concerns in rulemaking. It will also be an important resource for use by other agencies. The SAB offers recommendations and advice on how to improve the clarity, transparency and utility of the guidance.

The SAB recommends that further guidance be included in the EJTG to assist analysts with understanding how to conduct an EJ analysis. By doing so, the SAB does not mean to make the EJTG an all-encompassing document; rather by limiting its scope and not repeating existing guidance, the EJTG can reduce redundancy and the risk of providing conflicting instructions. To increase the guidance document's clarity, the EJTG needs to include better definitions for the terms that are used (e.g., cumulative risk, co-factors, susceptibility, vulnerability, EJ populations and communities). In addition, the SAB strongly recommends the use of detailed examples to guide the analyst through conducting the EJ analysis for regulatory action. The EJTG should provide specific, clear options and examples of best practices for consideration by analysts. The EJTG should emphasize the role of the analyst while devoting only a minimum amount of text to explaining the role of the decision/policy-makers in the same context. The SAB also notes that guidance for EJ methodologies should encourage the use of state, local, and community level data and assistance that are essential for an accurate national EJ analysis.

Key Questions and Recommendations for Analysts

Flexibility and Feasibility

By attempting to provide flexibility for analysts through ensuring that guidance is not “overly prescriptive,” the recommendations in the EJTG are too broad; hence, the SAB recommends that the EJTG provide more specificity. One solution is to be more prescriptive regarding when the use of

different types of data is appropriate, while leaving flexibility for the application of qualitative information where applicable and available. Analysts should be provided with guidance on how to account for uncertainties due to limitations of available data and gaps in knowledge. Analysts may be directed to existing agency guidance while the EJTG recommendations focus on EJ-specific issues that should be considered in the analysis. It would be helpful to include a table in the EJTG that presents alternative analytical methods along with examples (citations) of where they have been applied effectively, key assumptions embedded in the approaches, and evaluations of their strengths and weaknesses. Decision trees, diagrams, checklists, and other means to summarize key guidance may be helpful to steer the analyst to the most important elements of the guidance and those areas where consistency is essential. To further ensure consistency and transparency, the recommendations presented in the EJTG should instruct analysts to declare under which conditions specific recommendations were not followed. There should also be a clear statement or process for determining “feasibility,” as instructed in the guidance, and documenting it as part of the EJ analysis so that these decisions can be readily understood. This could take the form of a protocol or checklist that outlines how specific recommendations in this guidance are addressed, or the reasons why they are not addressed. Such a checklist should also include a statement that addresses the issue of qualitative information in the EJ analysis or analytical design.

Qualitative Versus Quantitative Data

The EJTG should reinforce the concept that the use of good data, either quantitative or qualitative, is important. The quality of the data can be measured by the metrics that are used in the sciences, such as rigor of the study design, sample size, corroboration, universality, proximity, relevance and cohesion. The “highest quality and most relevant” data should be explicitly favored rather than “newest” data. Moreover, the EPA should provide more guidance about incorporating qualitative data in EJ analyses, including how the information should be integrated and what weight it should be given in decision-making.

Differential and Disproportionate Impacts

Regarding differential and disproportionate impacts, the SAB finds the text in the EJTG to be overly complex and too detailed to be of practical use to an analyst. In addition, the terms differential and disproportionate impacts should be described earlier in the document where the purpose of the guidance is spelled out. While these terms have been defined, what constitutes disproportionality in an EJ context is not. More discussion is needed on how to analyze and present the data, along with the uncertainties, that may lead to a determination of a disproportionate impact.

Contributors and Drivers of EJ

The SAB recommends that the concepts of “contributors” and “drivers” be clarified. The section describing the contributors and drivers of EJ should include a critique of the EPA’s traditional risk assessment and its potential role in contributing to environmental injustice as documented in reports by the National Research Council (NRC) and the published literature. The EPA should make clear distinctions between the uses of contributors in analyzing place-based versus health assessment rulemakings. In rulemakings where there are disproportionate impacts on vulnerable populations (not limited to specific locations), the contributors described in this section will be important features in recognizing and addressing the concerns for these populations. Additionally, the SAB notes the omission of any simplified framework or graphical representation of contributors and drivers to environmental injustice commonly found in the social determinants of health literature. Conceptual maps would be a particularly effective heuristic for this section.

Human Health Risk Assessment

Cumulative Risk Assessment

The lack of EPA guidance on cumulative risk assessment, dose-response assessment for chemicals in a mixture and exposure assessment are the primary technical challenges for the EJTG. The SAB encourages the EPA to update its guidance on cumulative risk assessment so that analysts will have the tools they need to estimate the toxicity of individual chemicals and chemical mixtures and the impacts from non-chemical stressors. Currently, the EJTG does not indicate how cumulative impacts should be evaluated, quantified or otherwise considered in an EJ analysis. More guidance is needed on how to incorporate and evaluate cumulative impacts for chemical and non-chemical stressors, quantitatively and/or qualitatively. The SAB recommends that the EJTG consider adopting a Health Impact Assessment (HIA) approach – a more holistic approach to assessing risk and cumulative impacts. Given the lack of data or information that might be available when doing such an EJ analysis (for instance, information on the toxicity of specific compounds and on the cumulative effects of mixtures or multiple exposures), the assessment should serve as a way to highlight data gaps or lack of available information. For example, if a more expansive discussion is included of the limitations of the information used to complete the EJ analysis, the value of the assessment may increase.

Risk Assessment Model

The SAB notes that the current, standard risk assessment model is emphasized in the guidance as the primary means to quantify adverse health impact from chemicals in the environment. However, the current risk assessment approach has limitations (both from the technical standpoint and in terms of communicating with impacted communities) and may not be suitable for assessing complex environmental justice concerns. If risk assessment continues to be the model of choice for the EPA, then there should be a subsection in the EJTG to present the difficulties associated with risk assessment and chemical regulation; the technical limitations and gaps; the lack of mechanisms to incorporate most qualitative data, in particular social welfare considerations; an inability to incorporate cumulative impacts of multiple, dissimilar stressors; the lack of effective public involvement inherent in the model and its application; and complexity that leads to a lack of transparency and accountability. The SAB also cautions that the use of uncertainty factors in developing dose-response assessments for an individual chemical might address the general population as a whole, but does not specifically address differential or disproportionate vulnerability of an environmental justice community. This is especially true when multiple stressors, factors, and conditions exist to increase the vulnerability of a subpopulation to a far greater extent than what would be expected in the general population when exposed to a single stressor, which is how risk assessment is used. Additional uncertainty factors may not be appropriate as they may become the focus of the assessment and lead to inaction. Instead, it may be more beneficial to transparently discuss the sources and potential impacts of uncertainties on the affected populations rather than simply presenting the uncertainties.

Suite of Methods

Literature review

The SAB found this section on the literature review to be an admirable attempt at summarizing an immense body of research; however, it could be improved. Since this section presented background information, it warrants an earlier location in the EJTG. While additional references will better reflect the state of the literature to the benefit of EPA analysts, this section should provide pathways to the literature instead of a comprehensive literature review. In addition, the social science literature review should be improved. The EJTG should include narratives and references to health disparities as drivers

and contributors, as well as relevant reports from the EPA’s National Environmental Justice Advisory Council (NEJAC). Further, the EJTG should be updated to direct analysts to the most recent guidance on conducting risk assessment so that these are readily available.

Analytical Considerations

Best practices

The EJTG (Section 5.4 in particular) could benefit from a table or matrix of “best practices.” This should also include and identify some advantages and disadvantages of each concept/method/practice along with providing information about prior use or noting where their application is most appropriate. Likewise, Section 5 would be more useful if the key research design elements in EJ analyses were clarified.

Although the scoping questions in the EJTG are a good starting point, the SAB recommends that the scoping questions for each EJ analysis should be guided by the circumstance of the assessment and developed in consultation with the affected populations and stakeholder workgroups. Conducting an empirical, prospective EJ analysis of EPA rules inevitably entails several major components: (1) defining the “metric of interest” or dependent variable, (2) defining the comparison group, (3) identifying the counterfactual distributions, (4) defining the scope of the analysis, and (5) spatially identifying and aggregating effects. Section 5.4 discusses only (2), (4), and (5), and its discussion of the scope (Section 5.4.2) is limited. Section 5.4.2 should also be expanded to explicitly address *temporal* scope.

The EJTG does not provide clear guidance to analysts with regard to resolving differences in spatial resolution between two or more geospatial datasets. A list of best practices for geospatial data should be added to the EJTG to provide guidance on these issues or refer analysts to other EPA documents that discuss them, if they exist. To enhance the consistency and rigor of EJ data analyses, the SAB envisions a set of training videos for analysts on topics like exposure, epidemiology, resilience, Geographic Information Systems (GIS), sample size, and many others. Moreover, the EJTG needs to enforce the concept that analyses and decisions must be transparent and readily understandable by the public.

The SAB recommends that the EJTG provide better guidance on the selection of a baseline. The EJTG should provide guidance on identifying and characterizing “hot spots” in the most meaningful context, as well as resources and examples (in an appendix) to illustrate approaches and best practices. The SAB also recommends that the EPA examine whether there are any lessons learned or valuable information that can be gleaned from previous assessments to serve as a guide for future assessments. For instance, the EPA’s Office of Environmental Justice (OEJ) may have data or information on EJ populations that can be used to assist in the evaluation of potential EJ concerns. A “data repository” may be created for this purpose.

Transparency and consistency

The EJTG should promote more transparency and consistency in all aspects of an EJ analysis. Clearer instructions to analysts should be provided when faced with choices over which control variables to employ, implicitly defining the comparison population. The SAB recommends that working models should be included in the EJTG until there are better methods developed in the future. These working models should include clear guidance on what variables to control for when selecting comparison populations; how to incorporate quantitative and qualitative differences when selecting comparison populations; demographic versus geographical considerations; national versus state versus local data; and the level of refinement needed. The EJTG should be clear and consistent in its use of the terms

susceptibility and vulnerability when referring to population and individual differences. It is important to understand that the characteristics defining the population as having an EJ concern are not necessarily the characteristics that make individuals more susceptible to the hazard. Rather, an EJ population is regarded as more vulnerable due to its potential increased exposure to hazards and ensuing health effects.

Distribution of Costs

It is not clear whether the EPA is considering the costs of implementing a regulatory option from the perspective of individual well-being where costs such as changes in prices and workers' wages are relevant. Executive Order (E.O.) 12898 refers to costs in terms of disproportionate impacts to health or exposure. It is plausible that a rule could provide a net reduction in population risk, but an exacerbation of differential risk to a particular populations. The SAB therefore recommends that the EJTG should *either* (a) guide against inclusion of costs in the scope of EJ analyses, *or* (b) provide much more guidance on the key issues for addressing costs. Here again, analysts may be directed to use existing agency guidance but additional information on the issues that are specific to EJ concerns should be highlighted, such as those discussed below.

The EJTG states that in order to assess the “differences in the baseline incidence [of environmental harms or risks] and determine if the distribution increases or decreases differences” some information is required. That information should include the pre-regulation environmental conditions, the projected environmental conditions without regulation, and the projected post-regulation environmental conditions for the EJ group and for a comparison group. In practice, even if other regulatory analyses for the rule define these scenarios, the EJTG should direct the analyst to be transparent about how the *differences across groups* are identified for each scenario in the EJ analysis. If the EJTG is not meant to implicitly define what “justice” looks like through its prescriptions for analysts, then the technical guidance should encourage sensitivity analyses across alternative metrics or inclusion of stakeholders early in the analytical process to determine the most relevant metric(s). If there is not clear guidance from the rule as to scope, then sensitivity analysis would be appropriate to identify the impact on the results of any environmental outcome or effect.

Public Involvement

Although the EJTG describes public involvement as an essential element of achieving environmental justice, there is no mechanism specified for ensuring that the public is involved in an environmental justice analysis. Instead, words like “*if feasible*” or “*if possible*” are used to guide the analyst on considering public involvement; such phrases may suggest to impacted communities that the EPA lacks a commitment for incorporating public involvement and EJ concerns into the risk assessment process.

The EJTG has not adequately addressed or emphasized the need for a more effective means of ensuring public involvement in risk assessment. This is a major concern and will not address one of the principles of environmental justice, that is, public involvement should be integrated into the process of risk assessment from start to finish (including decision-making). Public involvement must be more inclusive than reaching out to general stakeholders who will not be experiencing first-hand the potential impacts of a rule or regulation in a community. The SAB recommends that the EJTG reference relevant reports from the EPA National Environmental Justice Advisory Council (NEJAC) and other published studies that provide recommendations for analysts on how to ensure public participation when conducting an EJ analysis.

Key methodological and conceptual omissions

Additionally, there are some key methodological and conceptual omissions and ambiguity in the EJTG, as follows. The EJTG should:

- Define and describe methods to identify a comparative control population for evaluating differential impacts.
- Define the distinction between differential impacts and disproportionate impacts.
- Define what is “normal” for the sake of establishing a baseline of acceptable risk.
- Clarify the concepts of sustainability and prevention.
- Explain how disproportionate environmental (ecological) impacts of a rule or regulation should be factored into an overall, multi-stressor analysis.
- Provide guidance for including transparency and accountability to the public.
- Define the range of endpoints needed for a holistic or integrated equity analysis (dose, physiological health, ecological and environmental health, socio-cultural and economic health, and so on).

2. INTRODUCTION

2.1. Background

In July 2010, the Environmental Protection Agency (EPA) released the *Interim Guidance on Considering Environmental Justice During the Development of an Action*. This guidance provided agency analysts and decision-makers with information on when to consider environmental justice in rule making. As a complement to this document, the Office of Policy, Office of Enforcement and Compliance Assurance, and the Office of Research and Development led an effort to develop the *Draft Technical Guidance for Assessing Environmental Justice in Regulatory Analysis (May 1, 2013 Draft)* (also referred to as the EJTG). The purpose of the EJTG is to provide technical direction to EPA staff and managers on incorporating environmental justice into the development of risk assessment, economic analysis and other scientific input and policy choices as an integral part of the agency rulemaking process. The EJTG contains guidance on how to assess disproportionate environmental and public health impacts of proposed rules and actions on minority, low income and indigenous populations in a variety of regulatory contexts.

2.2. Charge to the SAB

The EPA asked the SAB to conduct a review of the EJTG to assess the appropriateness and scientific soundness of the technical guidance. The EPA charge (see Appendix A) included questions on: the clarity and technical accuracy of the guidance; the inclusion of the most relevant peer reviewed literature; appropriateness and sufficiency of the six analytic recommendations listed in the EJTG to ensure consistency, rigor and quality across assessments; the clarity and accuracy of the guidance on when and how to conduct an analysis of the distribution of costs; and key methodological or data gaps specific to considering EJ in regulatory analysis. In response to EPA's request, the SAB convened an expert panel to conduct the review. The panel held two public face-to-face meetings (June 19-20, 2013 and January 30-31, 2014) to deliberate on the charge questions and consider public comments and held a public teleconference (July 22, 2014) to discuss its draft report. The SAB panel's draft report was considered by the chartered SAB on January 23, 2015 and approved pending some edits. Oral and written public comments were considered throughout the advisory process.

3. RESPONSE TO CHARGE QUESTIONS

3.1. Overall Impressions

Charge Question 1. Please provide your overall impressions of the clarity and technical accuracy of the EJTG for analyzing and presenting quantitative or qualitative information on potential environmental justice concerns in the development of EPA regulations.

3.1.1. Clarity

The SAB commends the EPA for developing the *Technical Guidance for Assessing Environmental Justice in Regulatory Analysis* (hereafter referred to as the EJTG). The document is thoughtful in providing guidance for analysts. Moreover, the EJTG represents major philosophical and communication steps for the agency and EJ communities with a major goal of the guidance being to incorporate EJ analysis into the framework of regulatory analysis.

In general, the EJTG is a comprehensive presentation of EJ concerns and the complex issues, processes and methods associated with EJ analyses. It also presents examples of the necessary elements to conduct a rigorous, credible, and meaningful assessment of environmental justice during the development of a regulatory action. Appendices can enhance the organization of the EJTG and provide case studies with greater detail; this organization of the material will allow the main document to focus on the key technical elements with reference to more detailed information in the appendices.

The EJTG can be improved by reducing redundancy. To strengthen the EJTG, the SAB recommends that the document leverage the information in existing guidance documents on risk assessment for regulatory analysis. Indeed, the EJTG will be easier to use if it does not try to repeat general risk analysis guidance. Limiting the scope of this guidance also reduces the risk of providing conflicting instructions. Whenever possible, analysts should be directed to relevant agency guidance documents and the EJTG should focus on additional guidance for EJ specific considerations.

More specific guidance on what to do and how to do it – for example, by identifying decision points and key methods to use (including what data to consider) – also will assist the analyst. To increase the document’s clarity, the EJTG needs to include better definitions of key terms (e.g., of cumulative risk, co-factors, susceptibility, EJ populations and communities). Furthermore, a more complete glossary of terms would improve the EJTG and provide analysts with a consistent definition of the terms used throughout the document. The SAB also suggests that the terms quantitative, qualitative, analyst, decision maker, and policy decision be defined in the EJTG narrative or glossary to increase the clarity, technical accuracy and meaningful community involvement.

Recommendation:

The SAB strongly recommends the use of detailed examples to guide the analyst through conducting an EJ analysis for regulatory action.

3.1.2. Use of Qualitative Data

The SAB notes that the lack of definitions for *quantitative* and *qualitative* data leads to confusion in the examples provided in Section 5 of the EJTG to illustrate for the use of the proposed methods. The EJTG appears to erroneously equate qualitative data with anecdotal evidence. The EJTG does not clearly describe how to analyze and present quantitative or qualitative information about potential environmental justice concerns during EPA rulemaking. Throughout the EJTG, there are references to quantitative and qualitative methods, often including comparisons that suggest a hierarchy of methods,

with quantitative methods being universally preferred. The text should make clear that both approaches can be used with success and that in some cases qualitative methods can be the best analytical tool (see Berg and Lee, 2012). The method selected should be based on context, scope and scale of analysis, and appropriateness of a given method for the questions posed by the analyst. In some cases, a combination of qualitative and quantitative methods may be the best approach.

The draft EJTG makes clear that qualitative information should be considered but it does not sufficiently describe how qualitative information should be integrated and considered in decision-making. This guidance is especially critical in instances where qualitative data are the only information available. Clear guidance should be provided on how to account for uncertainties due to limitations of available data and gaps in knowledge. Data used in risk analyses may include interval, ordinal, and nominal data, including single words and/or lengthy descriptions. Analysts are able to convert interval data into ordinal or nominal, and nominal data can now be scanned with computerized tools to convert the data into quantitative forms. The real issue is not the form of the data, but rather the quality of the data. Quality is measured by number of samples, reproducibility, and rigorous practices in gathering the data. The bottom line is how certain can the analyst be in the quality of the data.

Recommendation:

The SAB strongly recommends that EPA provide clear guidance about how qualitative data can be used in EJ analyses.

3.1.3. Examples, Case Studies and Best Practices

Overall, the guidance should be more specific. It makes sense for the EJTG to be brief in providing a roadmap for the analyst, without being overly (and unhelpfully) prescriptive. However, the EJTG would benefit from the inclusion of brief text on additional case studies, best practices, guiding principles, and definitions for key terms and concepts. In many places, the EJTG advises the analyst to do what is appropriate and relevant but the guidance should do more to help the analyst determine what factors are appropriate and relevant, and what factors should be considered when making judgments about this. In addition, the EJTG needs to provide guidance on how to select key elements of an EJ analysis that must be part of the analysis and provide specific instructions or choices for an analyst or manager on how to proceed. The EPA may consider integrating the principles and practices of the health impact assessment model, including going beyond single chemical exposure risk assessments and considering a more holistic approach that incorporates stressors other than chemicals and economic burden (Hicken et al., 2011; Schwartz et al., 2011).

Providing the analyst with a range of best practices will facilitate making appropriate choices, which in turn can promote consistency among evaluations conducted by different analysts. The document also could include a section for frequently asked questions or an overview.

Recommendation:

The SAB recommends that the EJTG be improved by providing specific and clear options and examples of best practices.

3.1.4. Limitations of the Risk Assessment Model

The EJTG emphasizes the risk assessment model as the primary means to quantify adverse health impacts from chemicals in the environment. This focus is understandable, given that the agency has invested decades and countless resources to develop regulations based on risk assessment. However, some SAB panel members suggest that EPA's current approach to risk assessment may be incompatible

with assessments for environmental justice. The EPA may want to consider the availability and feasibility of alternative approaches that may provide a richer basis for decision-making.

If risk assessment will continue to be the model of choice for the EPA, then there should be a subsection in the EJTG devoted to the weaknesses and disadvantages associated with risk assessment and chemical regulation. This discussion should summarize the technical limitations and gaps; the lack of mechanisms to incorporate most qualitative data (e.g., in particular social welfare considerations); the lack of methods for incorporating cumulative impacts of multiple dissimilar stressors; the lack of effective public involvement inherent in the model and its application; and the lack of transparency and accountability.

The SAB has concerns about the use of the health risk assessment model as the basis for assessing multiple stressors and impacts unrelated to an individual exposure to a single chemical. The EJTG presents the environmental justice analyses as being integrated alongside risk assessment and cost-benefit assessment. Risk assessment requires a highly quantitative relationship between the “cause” and the “effect” variables and generally uses dose-response models; whereas, the EJTG does not contend that the parameters important for EJ analyses (e.g. socioeconomic factors, nutritional status and other susceptibilities) can be modeled that way. The effects of cumulative exposures and cumulative impacts are mentioned as important considerations when assessing the presence of disproportionate impacts in a subpopulation. However, there is no further elaboration in the EJTG as to how cumulative impacts should be evaluated, quantified, or otherwise considered in the EJ analysis. The lack of guidance on cumulative risk assessment, dose-response assessment, and exposure assessment are the primary technical challenges for the EJTG. These concerns could be addressed by adopting a Health Impact Assessment (HIA) approach or another more holistic approach to assessing risk (NRC, 2011a). An example of this type of assessment is the *Duwamish Valley Cumulative Health Impacts Analysis: Seattle, Washington* (Gould et al., 2013). Another opportunity to be more responsive to this concern is in the EPA’s call for planning, scoping and other activities that are consistent with EJ evaluation described in the agency’s “Framework for Human Health Risk Assessment to Inform Decision-Making” (U.S. EPA, 2014a).

Recommendation:

The SAB recommends that the agency consider adopting a Health Impact Assessment (HIA) approach or another more holistic approach to conducting an EJ analysis.

3.1.5. Tools for Describing Cumulative Impacts

The EJTG needs to speak in a single voice and incorporate tools – such as a graphic roadmap, flow charts, decision trees, or checklists – to facilitate use of the material by the reader. Additionally, the guidance is not clear on when the EJTG is to be used. The problem formulation step should articulate the reason for conducting an EJ analysis and explain if the human health standard in question is not health protective from an EJ perspective. The guidance should include a flow chart that can help the EPA analysts with decision making responsibility to consider EJ issues. A flow chart or roadmap with “Yes” and “No” paths will help document the various reasons for either conducting or not conducting an EJ assessment. Also, making use of decision trees, diagrams, checklists, and other means to summarize key guidance might be helpful to steer the analyst to the most important elements of the guidance and those areas where consistency is essential. Clear criteria should be included for any inclusion or exclusion of data for EJ analyses.

When multiple chemical exposures are of concern, the EJ analysis should consider the modes of action of the individual chemicals, if known, to help determine possible interactions of the chemicals at the

cellular and subcellular level and to better describe cumulative impacts. The EJTG should recommend that analysts include a discussion on the mode of action of the chemical and systematically evaluate all the information using an Evidence Integration process (Rooney, 2014; NRC, 2014).

The EJTG should acknowledge that some regulatory actions might experience differential compliance related to some of the same drivers that shape EJ concerns. In these situations, it is plausible that a rule could provide a net reduction in population risk, but an exacerbation of differential risk. As a simple example scenario, it is plausible that compliance with the Lead Renovation, Remodeling, and Painting Final Rule (U.S. EPA, 2008) could vary by housing type, neighborhood, household attributes and other factors strongly tied to race/ethnicity. The differential exposure of families living in multi-unit properties owned by non-compliant landlords could potentially increase, relative to renters in a higher socioeconomic status. To be clear, in most cases, these effects would not be dominant, but it is worthwhile acknowledging that these dynamics are relevant when thinking about the net impacts of EPA rules. Further, there is value in acknowledging these effects to highlight the importance of considering compliance issues in rulemaking and subsequent enforcement.

Recommendation:

The SAB recommends that the EJTG make use of decision trees, diagrams, checklists, and other means to summarize key guidance to steer the analyst to the most important elements and areas where consistency is essential.

3.1.6. Inclusion of Updated References

The EJTG refers to some EPA documents but omits many other relevant EPA documents and key references (e.g. EPA 2014a). The EJTG should be updated to include many new references for conducting risk assessment (e.g., EPA 2014b). Since these references have not been provided in the EJTG, it is not clear if the EPA analyst will refer to the latest references. EPA's guidance on cumulative risk assessment needs to be updated so that analysts would be able to estimate not just the toxicity of an individual chemical but chemical mixtures and non-chemical stressors. In addition, the social science literature review should be improved. The EJTG should also include narratives and references to health disparities as drivers and contributors as well as relevant reports to the Administrator from the EPA's National Environmental Justice Advisory Council (NEJAC) (e.g., NEJAC 2004).

Recommendation:

The SAB recommends that the references be updated to include additional relevant documents.

3.1.7. Revisions for Key Methodological or Conceptual Issues

There are some additional key methodological or conceptual omissions or ambiguity in the EJTG. These include:

- Defining and identifying a comparative control population for evaluating differential impacts;
- Making a clearer distinction between differential impacts and disproportionate impacts;
- Characterizing what is “normal” for the sake of establishing a baseline of acceptable risk;
- Clarifying the concepts of sustainability and prevention;
- Determining how disproportionate environmental (ecological) impacts of a rule or regulation should be factored into an overall, multi-stressor analysis;
- Providing guidance for incorporating transparency and accountability to the public; and
- Identifying unique considerations for subsistence populations.

3.1.8. Improving Data Quality

To improve the data quality of EJ analyses, the SAB suggests that the EJTG provide guidance on how to identify an appropriate control population for comparison to a potential environmental justice community. This extremely important element of an impact assessment is likely to be inconsistent from one analysis to another and may contribute to extremely flawed analyses of disproportionate risk. There are several factors that need to be considered, for example, what variables to control for when selecting comparison populations, how to incorporate quantitative and qualitative differences when selecting a control population, demographic versus geographical considerations, national versus state versus local data and level of refinement, and so forth. This might be a consideration for future research but it is such a critical element to the EJ analysis that at least a working model with clear guidance needs to be included in the EJTG until better methods are developed in the future.

Recommendation:

The SAB suggests that the EJTG provide guidance on how to identify an appropriate control population for comparison to a potential environmental justice population.

3.1.9. Accountability and Public Involvement

Moreover, the EJTG needs to reinforce the concept that analyses and decisions must be transparent and readily understandable by the public. Transparency will be enhanced by discussion of the data with its limitations and the assumptions. To achieve this, the analyst and manager should provide a detailed account of decisions on which data to include in the analysis, including a systematic review of the data considered, with clear inclusion and exclusion criteria. Often, accountability and transparency are linked; therefore, requiring this level of documentation would go a long way to achieving consistency and defensible decisions. Better data collection may be possible with new technologies that track human behavior. However, this is a future research need which can improve and enhance EJ analysis in the future.

Although the EJTG describes public involvement as an essential element to achieve environmental justice, there is no mechanism specified in the guidance for ensuring that the public is involved in an environmental justice analysis.¹ Public involvement in the agency's EJ analyses could be enhanced in two ways. First, the EPA should consider preparing a public version of the EJTG that provides an accessible summary for the public. Second, analysts should be required to seek input from impacted communities or citizens (at a minimum public comment) for unique exposure pathways, end points of concern, and data sources to consider in the analysis (see Berg and Lee, 2012). Additionally, since the EJTG follows the "2010 Interim Guidance on Considering Environmental Justice During the Development of an Action", it should be made clear in the EJTG that it is an extension- a further development and expansion of the 2010 Interim EJ Guidance via the EJ Plan 2014. The utilization and integration of the 2010 Interim Guidance may facilitate meaningful public involvement along with the very relevant, thorough and important considerations, questions, and recommendations provided in the EJTG public comments.

¹ The following are three reports from EPA's National Environmental Justice Advisory Committee (NEJAC) regarding public participation. This is NEJAC's 2013 update to its earlier Model Guidelines for Public Participation. It is current and represents the consensus of a broad base of stakeholders. <http://www.epa.gov/compliance/ej/resources/publications/nejac/recommendations-model-guide-pp-2013.pdf>

This is an older report that takes a broad perspective on ways to solicit stakeholder involvement that might be useful as a secondary reference. <http://www.epa.gov/compliance/ej/resources/publications/nejac/stakeholder-involv-9-27-06.pdf>

This URL provides information on a number of initiatives that EPA is undertaking to expand public involvement in the rulemaking process. <http://www2.epa.gov/open/expanding-public-awareness-and-involvement-development-rules-and-regulations>

Recommendation:

The SAB suggests that the development of EJTG within the framework of the 2010 Interim Guidance be used as a starting point, essentially modifying and expanding the approach in the 2010 document to articulate and demonstrate the critical analytical methods and tools necessary to engage stakeholders and conduct a meaningful assessment of EJ during the Action Development Process (ADP).

3.2. Quantitative risk and benefit analysis

Charge Question 2. The EJTG suggests that if quantitative risk and benefit analysis is done in support of the rule, analysts should rely on these data to do a quantitative EJ assessment when feasible. The level of quantitative analysis is expected to vary by regulation and be affected by data, analytic, or other constraints. If quantified benefit or risk information is not available then a qualitative EJ analysis is still expected.

(a) Are these directions appropriate? Do they strike the right balance between developing information that is useful to the decision making process and the cost (time, resources, data constraints) of doing quantitative EJ assessments.

(b) Please provide advice on methods and best practices for conducting rigorous, high-quality EJ analyses, both quantitative and qualitative, that may be conducted in support of a national rule (including data needs or other issues associated with such assessments).

The SAB found the EJTG to be too long for a general public audience but too limited for an analyst without substantial experience. Those with experience in conducting risk assessments and risk management projects understand that without much firmer guidance than is currently provided in the EJTG, the task of doing EJ assessments remains daunting. For example, an economist without extensive experience would have great difficulty understanding risk assessment, epidemiology, exposure, and human health data. In contrast, someone from the biological sciences, chemistry and other lab sciences without experience would find it difficult to address the risk management issues.

There are several options available to address these concerns. One is to have a group of interdisciplinary analysts work on each assessment and divide their responsibilities according to their experience and academic background. This method is used when developing environmental impact assessments (EIA) under the National Environmental Policy Act (NEPA). Second, case studies could be added to the EJTG as appendices. The small text boxes currently in the document do not suffice, unless there is a direct link to an example. Third, it would be advisable to hold continuing education seminars from experts in the elements of the EJ analysis process. Fourth, time and resources have increasingly prohibited the use of long training sessions. Agencies have responded by developing shorter 15-25 minute training modules. The SAB envisions a set of training videos aimed at topics like exposure, epidemiology, resilience, GIS, sample size, and many others. Absent this kind of information, the analysts are expected to make important recommendations with highly inconsistent backgrounds and without proper support. A final option would be for the EJTG to provide very detailed instructions on how to do the analysis. Ideally, that could be done, but it would take a great deal of time to compile and test such instructions.

As noted in the previous section, the SAB is concerned about the stated bias in the EJTG toward quantitative data and analysis. The key consideration should be the quality of the data, rather than whether the data are quantitative or qualitative. Moreover, the quality can be measured by the metrics that are used in the sciences, such as rigor of the study design, sample size, corroboration, universality, proximity, relevance and cohesion. In some situations, high quality qualitative data are more certain and

available, and hence, more reliable than a less rigorous quantitative database. Ideally, the analysts will gather all the data, assess the quality of all data and then use the best decision-relevant data rather than focus exclusively on quantitative/numerical data.

Since Question 2b was a later addition to the charge, the SAB panel had already addressed the issues regarding methods and best practices that may be used in conducting a high-quality EJ analysis in the response to Questions 9 and 10 as they pertain to Section 5 of the EJTG. The SAB recommendations have not been repeated here to avoid redundancy and to provide a clearer and better organized narrative.

Recommendations:

The SAB recommends that the EJTG provide more guidance/training to assist analysts so that they can develop information that is useful to the decision-making process. This training can be in several forms: utilize the expertise of senior risk assessors to assist new analysts, provide more case studies, and/or develop training modules.

The SAB suggests that the emphasis on quantitative assessments be decreased and the use of all relevant, high-quality data be utilized.

3.3. Key questions for analysts

Charge Question 3. Section 1.1 presents 5 key questions analysts should address when analyzing the environmental justice considerations during the development of a regulation. Are these questions clear and appropriate for considering EJ during the development of a regulation?

Section 1.1 of the EJTG poses the following three questions and describes five steps that the analyst should take.

Questions:

- 1) How did your public participation process provide transparency and meaningful participation for minority, low-income and indigenous populations, and Tribes?;
- 2) How did you identify and address existing and new disproportionate environmental and public health impacts on minority, low-income and indigenous populations during the rulemaking process? ; and
- 3) How did actions taken under #1 and #2 impact the outcome or final decision?

Steps:

- 1) Assess exposures, relevant health and environmental outcomes, and other relevant effects by population group in the baseline;
- 2) Assess differences in these exposures, relevant health and environmental outcomes, and other relevant effects across population groups in the baseline;
- 3) Assess exposures, relevant health and environmental outcomes, and other relevant effects by population group for each option;
- 4) Assess differences in these exposures, relevant health and environmental outcomes, and other relevant effects across population groups for each option; and
- 5) Assess how estimated differences in these exposures, relevant health and environmental outcomes, and other relevant effects across population groups increase or decrease as a result of each option compared to the baseline.

From the risk analysis perspective, the five steps make sense. The first four steps are part of risk assessment. The fifth step asks the analyst to integrate across risk assessment to assist in risk management decisions. In the first question, analysts are asked how the public participation process provided transparency and meaningful participation for the EJ population at risk. The extent of public participation is not clearly delineated for analysts in the EJTG. Convening a single public meeting may not be sufficient and many times 3-4 public meetings are needed during which people's assessment of the decision evolves. A great deal of literature addresses public participation practices and lessons from this literature could be incorporated into the EJTG (e.g., McComas et al., 2003).

The second question asks the analyst to make a judgment about "disproportionate environmental and public health impacts." Disproportionality, however, is not defined in terms of magnitude of the impact. In other words, it is not clear whether an impact requires a 5%, 50%, or one or two standard deviations of difference to be considered disproportionate. An analyst may be able to estimate differential impacts and should indicate, as best he or she can, the uncertainty associated with the findings; however, in order to answer question 2, the analyst would have to make *a priori* decisions about the level of disproportionality that requires action. It is more useful that the analyst report the data and the uncertainty associated with it and leave the determination of disproportionality to the policy and decision-maker.

The third question relates to and is tied to the answers to the first two questions. Finally, the first question requires reconsideration in light of the outcomes or final decision. The SAB considers the third question to be appropriate and consistent with the analysis.

The EJTG describes five steps (listed above) to ascertain the extent to which a potential EJ concern is associated with the affected environmental stressors prior to the rulemaking; the analyst is instructed to follow the steps "when feasible." The SAB recommends that this statement be revised to state that the analysts should follow these steps or document why they could not.

Recommendations:

The SAB recommends that the EJTG include lessons from the literature on public participation practices.

The SAB recommends that rather than providing a singular assessment, the analyst should instead focus on the relevant data and other information and seek to offer a variety of options clearly presenting the uncertainty associated with the analysis.

3.4. EJTG Key Recommendations (Section 1.2)

3.4.1. Comprehensiveness and flexibility of key recommendations

Charge Question 4. The EJTG makes six recommendations to ensure consistency, rigor and quality across assessments. Are the six analytic recommendations listed in Section 1.2 appropriate and comprehensive? Are they consistent with the state of the literature while providing flexibility to EPA program offices in the analytic consideration of EJ in the development of a regulation?

The six recommendations in the EJTG are as follows:

- 1) For regulatory actions where impacts or benefits will be quantified, some level of quantitative analysis for EJ is recommended.

- When feasible, analysts should present information on estimated health and environmental risks, exposures, outcomes, benefits and other relevant effects disaggregated by race/ethnicity and income.
 - When such data are not available, it may still be possible to evaluate risk or exposure using other metrics (e.g., prevalence of affected facilities as a function of race/ethnicity or income, evidence of unique or unusual (i.e., atypical) consumption patterns or contact rates).
- 2) When impacts or benefits will not be quantified or disaggregated by race/ethnicity or income, analysts should present information that is insightful with regard to potential EJ concerns (e.g., basic demographic information, and evidence of differential exposure).
 - Analysts should use their best professional judgment to determine what combination of quantitative and qualitative analysis is possible.
 - 3) Analysts should integrate applicable scoping questions during the planning stages of a risk assessment when one is being conducted for the regulatory action.
 - 4) Analyses should use the same baseline and regulatory option scenarios as other types of regulatory analyses (e.g., benefit-cost and economic impact analyses) conducted in support of the rulemaking.
 - 5) Analysts should follow identified best practices when feasible and applicable. Text Box 1.1 outlines current best practices that may be helpful for evaluating potential EJ concerns.
 - 6) Analysts should consider the distribution of costs associated with implementing a regulatory option from an EJ perspective when appropriate and relevant.

The SAB considers the six recommendations to be generally appropriate and reasonable, but the guidance on when to implement the recommendations is too broad. More specific guidance should be provided in terms of both analytical approach and information sources, as described below.

While understanding the EPA's reasons for wanting the technical guidance not to be "overly prescriptive," the SAB recommends that it should be more so. There are instances in the EJTG key recommendations, and elsewhere in the EJTG, where the analyst is advised to conduct some analysis "when feasible and applicable" (e.g., Recommendation 5) or when "appropriate and relevant" (e.g., Recommendation 6). The document lacks guidance to assist the analyst in determining the conditions under which an analysis is applicable, appropriate, or relevant. This overly flexible approach may lead to a lack of consistency and rigor in the agency's EJ analyses. Therefore, a more specific and prescriptive guidance would likely be welcomed by analysts and could save time and resources during analytical design.

A clear statement or process for determining "feasibility," and documenting it, should be part of the EJ analysis so that these decisions can be readily understood. Allowing analysts too much latitude to define what is "feasible," "applicable" or "relevant" may not always address EJ concerns adequately, and in some cases may introduce error or bias to the analysis itself. The stated goals and key priorities for the EJTG include having a more consistent analytical approach and standardization of metrics. For these reasons, and also for appropriate transparency, the SAB recommends that the EJTG provide clear, specific guidance on analytical approaches and standards.

To ensure consistency and transparency, the EJTG recommendations should also include a description of the conditions under which the six EJTG specific recommendations are not followed. This could take the form of a protocol or checklist that outlines how specific recommendations in this guidance are addressed, or the reasons why they are not addressed. Such a checklist should also include a statement that addresses the issue of qualitative information in the EJ analysis or analytical design. For example, the guidance could state that "Qualitative data may be considered in addressing potential EJ concerns

provided that the information is determined to be valid and reliable” with some explanation of how the qualities of validity and reliability were evaluated. Other approaches to ensure consistency and transparency could include a list of “best practices” for specific types of analyses (e.g., selecting and aggregating geospatial data, proximity analysis, when to use sensitivity analysis, selecting acceptable statistical techniques appropriate to the data characteristics). The best practices could be illustrated by carefully selected examples from peer-reviewed research literature. Such examples might better serve analysts than some of the summaries in boxes now in the draft. Other approaches may include a separate section on research design with examples, and a matrix of methods that summarizes the strengths and weaknesses of each method, as well as its implicit assumptions.

The SAB recommends replacing references about using the “most recent data” with the reference “highest quality data” since, in some cases, the most recent may not be the highest quality. For example, using the most recent single-year U.S. Census Bureau American Community Survey (ACS) estimates will introduce greater error into an analysis than using the most recent 5-year rollup simply because of sample size. This emphasis on data quality is consistent with the language under Section 1.2 of the EJTG, which states “Rather, they encourage analysts to conduct the highest quality analysis feasible, recognizing that data limitations, time and resource constraints, and analytic challenges will vary across media and with the specific regulatory context.” One solution is to provide more prescriptive guidance regarding the use of some types of data, where it is appropriate to do so, while leaving flexibility for the use of non-quantitative information in cases where it is the highest quality available.

As an example, the SAB recommends the following edits (italicized and strikethrough text) be made to the EJTG’s Recommendation 1:

For regulatory actions where impacts or benefits will be quantified, some level of quantitative analysis for EJ is recommended (see Section 5.1).

- ~~When feasible~~ Analysts should present *the highest quality, most current and complete* information *available* on estimated health and environmental risks, exposures, outcomes, benefits and other relevant effects, disaggregated by race/ethnicity and income *if possible*.
- When such data are not available, it may still be possible to evaluate risk or exposure using other metrics (e.g., prevalence of affected facilities as a function of race/ethnicity or income, evidence of unique or unusual (i.e., atypical) consumption patterns or contact rates).
- *In all cases, analysts should include a discussion of the quality and limits of these data (e.g., completeness, accuracy, and validation). It is also advisable to discuss data gaps and suggest analyses that could provide more definitive answers to key EJ questions if that data were available.*

Regarding the guidance for comparison of scenarios, the SAB generally agrees that the present wording is strong and clear, and that it is important to guide analysts to design these comparisons with specific relevance to regulatory actions. EJ analyses need not include or repeat specific approaches for quantitative analysis of risk that are already conducted by the agency and described elsewhere. Rather, the guidance should refer to standard analytical practice for estimating risk currently used by the EPA, thereby eliminating any confusion regarding analytical procedures, and avoiding any tendency for non-technical readers to conclude that risk analysis included as part of an EJ analysis is done differently. Some panel members and public comments raised issues regarding the need to define control populations and establish a baseline for statistical power used in data comparisons. These elements are referenced in Text Box 1.1 of the EJTG, but could be further refined to add more guidance.

Recommendations:

The SAB recommends that analysts be provided with clearer, more prescriptive guidance.

The SAB recommends that analysts be instructed to document why an EJ analysis is not feasible or appropriate or relevant.

The SAB recommends that analysts be instructed to use the highest quality data which may not necessarily be the most recent.

3.4.2. Additional analytical recommendations

Charge Question 5. Are there any analytic recommendations that should be added? Any that should be removed?

An additional recommendation on geographic assessment could be included to the EJTG, either as a separate recommendation or by providing better guidance on the selection of a baseline. Many communities, such as those that are located around ports, for instance, have similar environmental exposures as well as potential EJ concerns. It would be worthwhile to examine whether there are any lessons learned from previous assessments that could serve as a guide for future assessments. To facilitate this effort, it would be helpful to maintain a list of sources that might be accessed in completing an assessment. For example, the EPA's Office of Environmental Justice (OEJ) may have data or information on EJ populations that could be used to assist in identifying a baseline and in evaluating the potential EJ concerns. A data repository could also serve as an authoritative and easy-to-access source of publicly available data used in EJ analyses.

Additionally, given the acknowledgment of the lack of data or information that might be available when doing an assessment, the assessment should serve to highlight data gaps. For example, if a more expansive discussion of the limitations of the information used to complete the EJ analysis was included, the value of the analysis may increase. Another example of how such an assessment might be valuable is by investigating what can be learned using information that is available from other regulatory bodies. For example, the California EPA's Office of Environmental Human Health Assessment (California OEHHA, 2002) used a state-approved Inventory Update Reporting (IUR) estimate for diesel particulates to calculate an estimated lifetime cancer risk for diesel exposure. Although the U.S. EPA does not have an IUR for diesel, OEHHA has derived a potency estimate for this mixture of compounds and has classified it as a carcinogen under California law (Proposition 65). Ultimately, this type of information may advise the agency in future work and highlight data gaps.

Some reviewers expressed concerns that Recommendation 6 in the EJTG was not sufficiently clear and unambiguous on the subject of costs, as they can be defined differently, depending on context. It is not clear whether EPA is considering the costs of implementing a regulatory option from the perspective of individual well-being, where costs such as changes in prices and workers' wages are relevant, or are limited to the wording of Executive Order (E.O.) 12898, which refers to disproportionate impacts to health or exposure. If the goal of considering EJ in rulemaking is to ensure that everyone experiences some minimum level of health or clean environment, then economic costs should, perhaps, not be included in the analysis. If such costs are included, it will be difficult to describe their distributional effects in many cases, because the distribution may depend on general-equilibrium effects in the economy (i.e., national, open to foreign trade) that arise as consumers, industries, and others react to changes in prices. In the interest of transparency and appropriate guidance to analysts, EPA should provide clearer guidance on this question. It was also suggested that Recommendation 6 be omitted entirely, or the role of costs be amplified throughout the guidance.

Recommendations:

The SAB recommends better guidance on the selection of a baseline be added.

The SAB recommends that analysts be instructed to provide a discussion of the limitations of the information used in the EJ analysis.

The SAB recommends that Recommendation 6 in the EJTG be clarified or omitted.

3.5. Differential versus Disproportionate Impacts (Section 2)

Charge Question 6. The EJTG distinguishes between analytically defined differences in impacts and making a determination of disproportionate impacts. It also suggests six types of information that may be useful to the decision maker for determining whether differences are disproportionate and may warrant Agency action (Section 2.4). Is the description of differences in impacts and disproportionate impacts clear and do reviewers agree with this distinction? Are the types of data listed to aid the decision maker helpful? Are there other categories of data or information that should be added to this list?

3.5.1. Description of impacts

The SAB agrees that there is a clear distinction between differential impacts and disproportionate impacts as EPA defines them but the text on this topic in the EJTG is overly complex and too detailed to be of practical use to an analyst. While the distinction between these impacts is evident, the current definitions, including the use of the word “substantial,” could be reworked to be clearer and more effective.

Providing a brief definition or description of the terms “differential” and “disproportionate” impact, including how they are evaluated and by whom, is appropriate to retain because analysts will be required to provide relevant information to decision-makers. However, further detailed discussion and reference to disproportionate impact should be removed from the EJTG to avoid confusion. In addition, these terms should be described earlier in the document where the purpose of the guidance is spelled out.

As stated earlier in the response to Charge Question #3, the extent of disproportionality is not defined in the EJTG. The text should clearly explain that determining whether there is a disproportionate impact- “that may warrant Agency action” -is a policy judgment made by the decision-makers and informed by the analysis. Further, the finding of a disproportionate impact is neither necessary nor sufficient for the EPA to address adverse “differential” impacts; the two issues are separate and distinct.

Recommendations:

The SAB recommends that the terms “differential impacts” and “disproportionate impacts” should be introduced earlier in the document where the purpose of the guidance is presented.

The SAB recommends that the process for making a determination of disproportionality be clarified.

3.5.2. Types of data and other information to aid the decision

The SAB recommends that the emphasis of Section 2.4 of the EJTG should be to provide clear and complete guidance to the analyst on what to consider when assessing differential impacts. The section should be revised to provide more detail and examples of how to present information to decision makers. The EJTG, on page 11, presents examples (six bullets) of the kinds of information that may be useful to provide to decision makers. They are:

- The severity and nature (i.e., biological significance) of the health consequences for which differences between population groups have been estimated.
- The magnitude of the estimated differences in impacts between population groups of concern and the appropriately defined comparison group (e.g., a measure of statistical significance when relevant and appropriate).
- Mean or median exposures or risks to relevant population groups (or acceptable surrogates when such data are not available).
- Distributions of exposure or risk to relevant population groups – while average exposure or risk estimates are helpful, it may be the case that differences between population groups only occur in the tail of the distribution.
- Characterization of the uncertainty surrounding various aspects of the analysis.
- A discussion of factors that may make population groups of concern more vulnerable to exposure (e.g., unique pathways, cumulative exposure, behavioral or biological factors).

As currently written, these six bullets are superficial and mostly subjective and thus would provide only limited guidance to an analyst. In addition, the SAB recommends that any examples provided be drawn from actual instances or case study examples where an authoritative entity (e.g., federal or state government, a significant municipality, court case) found impact(s) that were deemed disproportionate to the degree that corrective actions were taken or penalties imposed.

Recommendations:

The SAB has the following specific comments, concerns, or recommendations related to types of data or terms used in describing EJ analyses for decision-makers:

- a) Make elements of EJ assessments as straightforward and easy for the public to understand as possible. It is equally important to disclose clearly any elements of uncertainty in the analysis (e.g., sample size, potentially incorrect assumptions like using proximity as a surrogate for exposure).
- b) With the exception of the last two bullets, the list of information useful to decision-makers requires or involves quantification. EPA should consider adding an additional statement reinforcing the concept that the use of good data, either quantitative or qualitative, is important.
- c) The fifth bullet recommends the inclusion of an uncertainty analysis. However, this guidance is too vague to effectively assist analysts in incorporating an uncertainty analysis in their assessment and presenting useful information to decision-makers. This is an example of a topic where more detail and clear examples need to be provided in the EJTG.
- d) The SAB recommends the EJTG should be clear and consistent in its use of the terms susceptibility and vulnerability when referring to population and individual differences. These are not interchangeable terms. Although the terms are defined in the glossary it would be helpful to also include an example (real or hypothetical) on how the terms should be used in an environmental justice analysis. For example, according to the EPA Framework on Cumulative Risk Assessment (U.S. EPA 2003; NEJAC 2004), a subpopulation is vulnerable if it is more likely to be adversely affected by a stressor than the general population. There are four basic ways in which a population can be vulnerable: susceptibility/sensitivity, differential exposure, differential preparedness, and differential ability to recover.
- e) Defining “biological significance” has recently been the subject of a National Academy of Sciences publication (NRC, 2007). While some subtle biochemical change(s) may not be or result in an adverse effect(s) that is/are biologically significant, many upstream and seemingly benign

changes in certain biological responses may result in a significant adverse health outcome downstream; therefore, it would be helpful to cite this publication in the EJTG and to provide examples for analysts.

- f) As noted in the EJTG, a critical piece of information for decision-makers is the inclusion of information about cumulative impacts in the assessment. However no definition, method, or approach is provided in the EJTG to guide analysts about how to include cumulative impact analysis in their assessments. The SAB emphasizes the importance of including cumulative impacts from multiple stressors (chemical and non-chemical) and conditions and urges the agency to provide clearer guidance, both in Section 2.4 and elsewhere in the document, on this topic for analysts. This concern was echoed in public comments to the SAB for this review.

3.5.3. Other categories of data or information

In addition to the types of data and information discussed in the EJTG, the following clarifications may also be helpful for analysts conducting EJ analyses:

- a) It is difficult to ascertain when a qualitative vs. quantitative analysis is recommended or needed. The SAB recommends presenting quantitative data and qualitative data separately, with examples and more detailed guidance.
- b) It is not clear if the last bullet in the list from p. 11 of the EJTG (see above) includes exposures from using consumer products and from occupational exposure. Decision-makers should know the extent to which both sources influence the overall analysis of impact.
- c) In some situations, a hot spot analysis could be useful. While the term “hot spot” can be used in several different ways in spatial analysis, the hot spots of most concern for EJ will be those specific locations with multiple risks. Rather than analyzing large geographic areas for specific risks, an analyst might analyze a few specific locations for multiple risks. The bullets listed on page 11 would hold but it does imply a broad spatial analysis instead of a hot spot analysis. Perhaps it would be helpful to indicate that both could be useful, depending on the situation.
- d) Census block demographics could be helpful to the analysis (and decision-maker), as well as information on locations, numbers and types of facilities and their distances from the center of the census block group within 1 and 3 kilometer radii. This information is part of the needed spatiotemporal baseline for environmental stressors, i.e., what is happening on the ground.
- e) Subsistence populations and unique exposure pathways should be more fully discussed. While these are mentioned in the EJTG, additional guidance on how to recognize potentially differential degrees of exposure, even in populated areas, would be useful to the analysts.

3.5.4. Use of exposure assessment statistics

The SAB also noted that there is some inconsistency with regard to the use of exposure assessment statistics in section 2.4 compared to other sections in the EJTG. Whereas median and geometric mean can tell part of the story, a distribution of exposures around the mean tells a more complete story. To maintain both rigor and consistency, the EJTG should provide specific guidance or cite EPA guidance documents where this information on what values to select when evaluating exposures can be found.

The issue of “disproportionate” exposures is related to how to disaggregate the analytical data and how fine a scale is intended. There is always a high-end tail of exposure and sensitivity, and with enough disaggregation it is possible to determine who is in that tail. Sometimes the highly exposed populations might be clustered in an ethnic or low-income group. In other cases this group might include children,

the elderly, disabled or the sick regardless of ethnicity or income. The uneven distribution of stressors does not always sort along the lines of race or income.

Recommendation:

The SAB recommends that the analyst should describe the characteristics of the population in the higher percentiles.

3.6. Contributors and Drivers of Environmental Justice (Section 3)

Charge Question 7. Section 3 provides a brief overview of the contributors and drivers of Environmental Justice. This overview is intended to provide analysts with some considerations that might drive the analytical decisions used when examining environmental justice for a regulatory decision.

Does the discussion of contributors and drivers adequately reflect the state of the literature? Is it clear and technically accurate? Are there any additional factors that should be included in the discussion?

3.6.1. Reflecting the state of the literature

While the SAB found this section to be an admirable attempt at providing a literature review of an immense body of research, it could be improved in the following ways.

- Since this section presented background information, it warrants an earlier location in the EJTG.
- A paragraph on the “Contributors and Drivers” topic should be added early in Section One.
- Section Three should become Section Two with an additional paragraph on Environmental Injustice Contributors and Drivers added early in Section One.

The SAB notes the omission of any simplified framework or graphical illustration of contributors and drivers to environmental injustice commonly found in the social determinants of health literature. Concept maps would be a particularly effective heuristic for this section. For example, in a 2002 *Environmental Health Perspectives* article, Morello-Frosch et al. (2002) proposed a political economy and social inequality framework for future research. Likewise, Krieger (2001) described the “social production of disease” or a “political economy of health” perspective. The SAB suggests that while such additions will better reflect the state of the literature to the benefit of EPA analysts, this section could provide pathways to the literature, describing a variety of perspectives instead of a comprehensive literature review. The SAB also recommends that the agency consider the conceptual map discussed in a 2004 NEJAC report (2004, p. 28).

Recommendation:

The SAB recommends the inclusion of a graphical illustration or conceptual map of the contributors and drivers of environmental injustice.

3.6.2. Clear and technically accurate

The SAB recommends that the EJTG should clarify the concepts of “contributors” and “drivers” of health disparities in the context of environmental justice. This section should address the concept of “hotspots,” exposure to them, and the drivers of differential susceptibility to hotspots (like residential sorting behaviors and housing discrimination). Section 3 is repetitive in some places, and redundant elsewhere which weakens this section’s attempt to reflect the literature. A clearer discussion of contributors and drivers existed in the 2010 *Action Development Process- Interim Guidance on*

Considering Environmental Justice During the Development of an Action (U.S. EPA, 2010). In addition, the synthesis of studies' findings should be restated. Instead of: "For example, many studies have established that sources of environmental hazards tend to be located and concentrated in areas that are dominated by minority, low-income, or indigenous populations", it would more completely reflect the literature if it were replaced by: "For example, many studies have established that due to both disproportionate siting and economic and discriminatory factors that push minority, low-income, or indigenous populations into polluted communities, these groups tend to be located and concentrated in areas that are dominated by sources of environmental hazards". This should lead into a description of "the links between the residential and environmental hazard stratifications for these populations." Additionally, given extant evidence that over the long-run low-income and/or minority households tend to sort into lower-priced/environmentally degraded neighborhoods (Banzhaf and Walsh, 2008; Depro et al., 2012), it is important to note that any rule that increases the prevalence of environmental hotspots raises the potential for long-run EJ concerns.

The EJTG omits key aspects of the historical role that EPA's implementation and enforcement of regulations may have played in socioeconomic disparities. The agency's use of risk assessment rather than applying more holistic approaches in regulatory decisions may also fail to provide comparable protection of environmental justice communities. There is an extensive academic literature on this perspective and reflects the consensus among a number of risk assessment critics. For instance, a 2002 *Environmental Management* article noted the following:

While risk assessment continues to drive most environmental management decision-making, its methods and assumptions have been criticized for, among other things, perpetuating environmental injustice. The justice challenges to risk assessment claim that the process ignores the unique and multiple hazards facing low-income and people of color communities and simultaneously excludes the local, non-expert knowledge which could help capture these unique hazards from the assessment discourse. . . traditional models of risk characterization will continue to ignore the environmental justice challenges until cumulative hazards and local knowledge are meaningfully brought into the assessment process. (Corburn, 2002)

Similar concerns were raised in: (1) a National Research Council document entitled *Understanding Risk: Informing Decisions in a Democratic Society* (Stern and Fineberg, 1996); (2) an SAB report entitled *Integrated Environmental Decision-Making in the Twenty-First Century* (U.S.EPA SAB 1999); and (3) a National Research Council document entitled *Sustainability and the U.S. EPA* (NRC, 2011b). None of these major reports are cited in the EJTG, which reinforces the SAB recommendation that the Contributors and Drivers section of the EJTG should include a discussion of traditional risk assessment and its potential role in contributing to environmental injustice.

The EJTG should make clear distinctions between the uses of contributors in analyzing place-based versus health assessment rulemakings. In rulemakings where there are disproportionate impacts on vulnerable populations (not limited to specific locations), the contributors described in this section will be important features in recognizing and addressing the concerns for these populations. In setting a new contaminant health standard, for example, genetic factors, nutrition and access to healthcare among subpopulations may lead to the conclusion that a health standard is safe for some categories of individuals, but not for others. In these cases, the analyst would be greatly helped by cumulative risk protocols under development at the EPA that would identify reliable data sets and give guidance on how to characterize the confounding effects of multiple stressors and conditions. Until the EPA's anticipated cumulative risk guidance becomes available to assure methodical and consistent approaches, the EPA's analysts will have a particular burden to be transparent about what data they relied upon, its quality and

scope, and how they computed cumulative risk. These explanations will need to be sufficient to provide the public with the assurance that rulemakings are approached with roughly equivalent rigor, and therefore each rulemaking has thoroughly examined environmental justice impacts.

With regard to place-based rulemakings (e.g., new standards for particular kinds of facilities), there is a history in the early years of environmental justice advocacy where factors like nutrition or quality of neighborhood were used to minimize the link between environmental releases and the impacts on minority communities. In years past, when the issue of disproportionate impacts on communities of color and low-income communities was raised, poor nutrition or crime were blamed as the source of a community's health problems. These non-chemical and income-related contributors were used as a justification to inquire no further into impacts from exposure to local environmental hazards. It was because of this history that EPA's NEJAC emphasized that additional contributors should not obscure the need for regulatory action to reduce environmental burdens in communities of color and low income communities.² This concern is particularly acute when the scope of potential contributors is expanded to factors where the EPA will not have uniform sets of data. Data that are insufficiently representative or factors that distract from identifying disproportionate impacts may obscure the circumstances where communities of color and low income communities will be disadvantaged by a rule.

Recommendations:

The SAB recommends that the EJTG instruct analysts to transparently present the data and assumptions used in deriving risk estimates.

The SAB recommends that the EJTG should provide guidance to address the concern that non-chemical and income-related contributors may inappropriately be used as justification to obscure the need for regulatory action in place-based rulemakings.

3.6.3. Additional factors

Section 2 and 3 should be revised to address different social contexts that are relevant for EJ analyses, such as, occupational and tribal considerations and their differing contributors and drivers to environmental injustice. The new Section 2 should also include a graphical figure that represents a prominent conceptual framework from the literature on the contributors and drivers (social and biological) of health disparities (e.g., see NEJAC, 2004).

Recommendation:

The SAB recommends a number of edits to Section 2 of the EJTG (see Appendix C).

3.7. Human Health Risk Assessments (Section 4)

Charge Question 8. The Guidance directs analysts to use a series of scoping questions at the planning stages of a human health risk assessment to integrate EJ into analyses conducted for the rulemaking. Is section 4 clear and technically accurate? Are the scoping questions outlined in Section 4.3.2.1 appropriate? Do the scoping questions adequately identify opportunities for incorporating environmental justice into a human health risk assessment?

² See, e.g., NEJAC (2010), Nationally Consistent Environmental Justice Screening Approaches ("Moreover, we believe that race is an appropriate factor in EJSEAT, and currently its relevance may be unintentionally diluted in the EJSEAT methodology by including the compliance and health variables."), p.13. Note that the NEJAC report was specifically addressing place-based impacts.

3.7.1. General concerns about risk assessment methodologies

Overall, the SAB agrees that EJ concerns can be considered within the framework of human health risk assessment (HHRA) with respect to sensitive and vulnerable populations, the subsistence exposure pathways, and any group of people that is identified as potentially having disproportionate exposure and/or disproportionate vulnerability. However, acknowledging that the EJTG emphasizes use of the risk assessment model as the primary means to quantify adverse health impact from chemicals in the environment, there are some limitations of the HHRA for EJ analyses and these limitations could be discussed in the EJTG. Some SAB panel members suggested that a framework based on the risk assessment model may be difficult for both its technical limitations as well as its reputation for being difficult to understand, and potentially unfair to impacted communities with multiple sources of stressors (Coburn, 2002). Section 3 of the EJTG could provide a brief summary of the difficulties historically associated with risk assessment and chemical regulation, including: technical limitations and gaps; the lack of mechanisms to incorporate most qualitative data, in particular social welfare considerations; an inability to incorporate cumulative impacts of multiple, dissimilar stressors; the lack of effective public involvement inherent in the model and its application; and the lack of transparency and accountability.

The California Comparative Risk Project (1994) and other comparative risk projects are recommended as references to provide a historical perspective and critique of the risk assessment model. In addition, the SAB recommends that the EPA consider integrating the principles and practices of the health impact assessment model, including deviating from single chemical exposure risk assessment and considering a more holistic approach that incorporates stressors other than chemicals and economic burden (Hicken et al., 2012). Risk assessment could be more broadly defined as opposed to focusing solely on conventional human health concerns. EPA's Comparative Risk method was mentioned as an example to address everything that is "at risk" including quality of life and well-being. The EJTG should direct analysts to broaden risk assessment beyond health and economics, if this is a goal.

The SAB raises some general concerns regarding the use of a status quo risk assessment as a model rather than tailoring it to address specific environmental justice concerns. Four key elements identified as missing or not adequately incorporated into the risk assessment guidance are:

- **Public Involvement.** The EJTG should emphasize the importance of including more effective means of public involvement in risk assessment. Words like "if feasible" or "if possible" were used to guide the analyst on considering public involvement. This is a major concern and will not address one of the principles of environmental justice, that is, public involvement is inviolate and should be integrated into the process of risk assessment from start to finish (including decision-making). In this case, public involvement must be more inclusive than reaching out to general stakeholders and instead to include those who are experiencing first-hand the impact of a rule or regulation in a community.
- **Cumulative Impacts.** Some advances have been made for evaluating cumulative impacts quantitatively when numerical data are available and qualitatively when not. The EPA needs to develop guidance on how to incorporate qualitative data, with sufficient specificity to address how the information should be integrated in EJ analyses and what weight it should be given in decision making. Guidance is also needed on how to account for uncertainties due to limitations of available data and gaps in knowledge if qualitative data is the only information available. This guidance will advance the agency's ability to conduct cumulative assessments and is especially needed for EJ analyses.
- **Hot Spots.** Identification and characterization of "hot spots" should be included in the analysis. The SAB recommends that the EJTG should define the term "hot spots" in its most meaningful context

and provide resources and examples (in an appendix) illustrating approaches and best practices. The agency also could examine whether there are any lessons learned from previous assessments to serve as a guide for future assessments; for instance, EPA's Office of Environmental Justice (OEJ) may have data or information on EJ populations that could be used to assist in the evaluation of potential EJ concerns. This idea was captured in the concept of a "data repository".

- **Uncertainty Factors.** The use of uncertainty factors in developing dose-response assessments for an individual chemical might address risks to the general population as a whole, but does not specifically address disproportionate vulnerability of an environmental justice community. This is especially true when multiple stressors, factors, and conditions exist to increase the vulnerability and sensitivity of that subpopulation to a far greater extent than would be expected in the general population exposed to a single stressor, which is how risk assessment is most commonly used.

Recommendations:

The SAB suggests that the EJTG consider integrating the principles and practices of the health impact assessment model, including deviating from single chemical exposure risk assessment and using a more holistic approach that incorporates stressors other than chemicals and economic burden.

The SAB recommends that the EJTG be revised to address the four elements presented above.

3.7.2. Clarity and technical accuracy

As noted previously, the SAB recommends that statements such as "*when feasible*" and "*if possible*" with respect to public involvement be changed or deleted. Use of such language may suggest to impacted communities that EPA lacks a commitment to incorporating public involvement into the risk assessment process. A specific example of language that may be considered by some groups to be inflammatory and was recommended for revision includes the statement on page 23, the last sentence in section 4.3.1, "*The scope of the HHRA also will be affected by ... limitations in time and resources.*" An EJ community is not likely to find comfort in statements that EPA does not have the time or resources to help them.

In order to clarify section 4, the agency should revise the first paragraph of Section 4.3. The text seems misleading, since racially/culturally diverse (minority), low-income or indigenous populations are of EJ concern by definition. For example, the text could be changed from "*it is important that HHRA's conducted in support of regulatory actions explicitly consider health risks that may disproportionately accrue within minority, low-income or indigenous populations since these demographic attributes may reflect underlying vulnerability and susceptibility to environmental stressors*" to "*...define subpopulations of concern for environmental justice.*"

The 3rd paragraph of Section 4.3.2.1 also needs clarification. The language in the guidance, "*Similarly, communities with potential EJ concerns may experience differential risks due to higher susceptibility (e.g., due to lifestage or pre-existing health conditions) to the stressor being regulated*" raises a conceptual issue that should be clarified. If everyone at some life stage (e.g., prenatal) is more susceptible to a particular stressor that may be regulated, then if one income/racial/ethnic group has more children than the majority, does that fact by itself make the stressor an issue for EJ? A suggested clarification for that language is that the stressor is a concern for people at the relevant life stage. It is important to understand that the characteristics defining the population as an EJ concern are not necessarily the characteristics that make individuals more susceptible to the hazard. Rather, an EJ population is regarded as more vulnerable due to their potential increased exposure to hazards and ensuing health effects.

The effects of cumulative exposures should be highlighted when assessing the presence of disproportionate impacts in a subpopulation. The EJTG does not indicate how cumulative exposures should be evaluated, quantified, or otherwise considered in an EJ analysis. For example, Sections 4.3.2 (Planning and Scoping) and 4.3.3 (Problem Formulation) are sections where a discussion of cumulative exposures could be included. The SAB recommends that the guidance include a consideration of the cumulative environmental health risks faced by low-income and minority populations or, at the very least, provide a detailed explanation for its decision to exclude consideration of cumulative risks. Moreover, the EJTG should explicitly refer users to any EPA cumulative risk assessment (CRA) guidance it develops. Cumulative HHRA should not be limited to the mode of action and target organ interactions; assessments should evaluate multiple chemicals of concern and multiple exposure pathways and media.

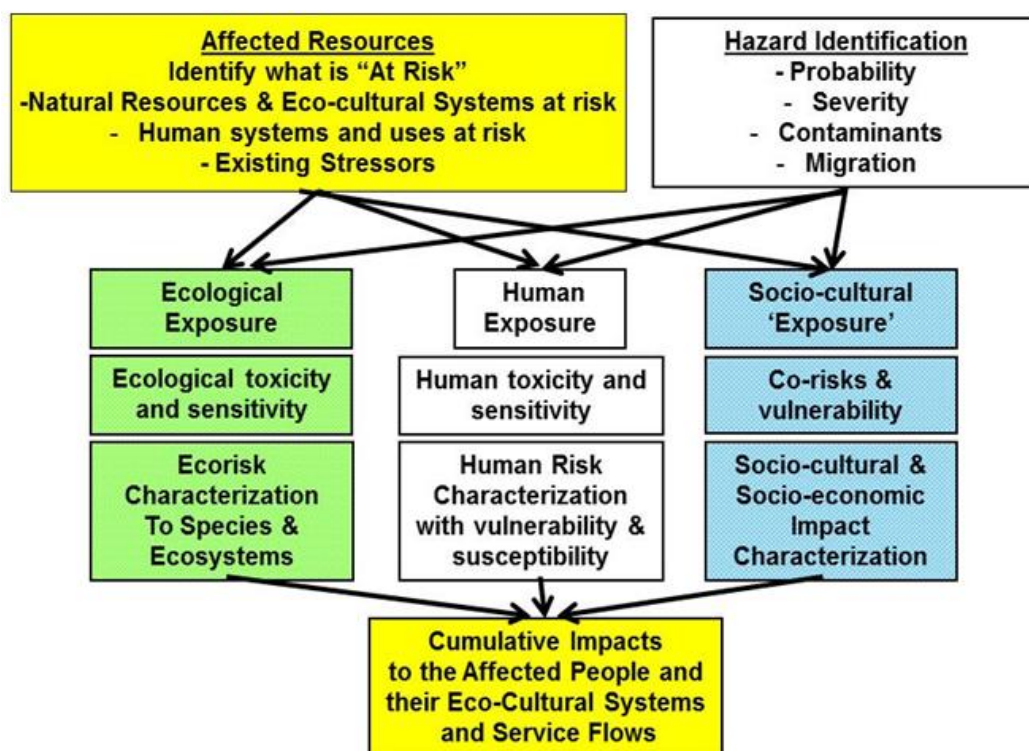


Figure 1. A broader view of risk assessment including elements of the overall eco-cultural system: human health, ecological health, and socio-cultural/socioeconomic health (Adapted from Harper et al., 2007)

The willingness to include quality of life or well-being, as well as the use of a term like HIA in order to force some thinking outside the conventional box is encouraged. In addition, incorporating co-stressors and the broader identification of what is “at risk” in a community should be considered. To further illustrate this idea, the SAB suggests that a figure be added (see Figure 1 above) to introduce a step to identify “affected resources” prior to the “hazard identification” and “exposure assessment” steps, and a “cumulative impacts” step after human and ecological risks are evaluated. This new figure could be blended with Figure 4.2 in the EJTG in order to demonstrate how HHRA can include co-stressors or co-risk factors.

3.7.3. Appropriateness of questions

Getting EJ issues recognized can be difficult, even when minority/ethnic groups are vocal and well-recognized. Specifically, flaws in the community participation process impact participation from Tribes and other rural EJ populations. Initial demographic and income screens are not adequate in determining whether an EJ concern exists; for instance, these screens are not appropriate for Tribes and other groups who may experience increased risk due to exposures from subsistence pathways. Assessors should be required to find out who uses natural resources within the impact area, thus giving more emphasis on pathways of exposure earlier in the screening assessment, independent of a formal delineation of the EJ community. This is especially needed when the EJ community is dispersed or represents only a stratum of the overall population. Also, a mention of the *proportion* of an affected population, and not just the absolute numbers of affected people, should be part of the analyst's report. For example, 20 percent of a rural population (or tribe) might be fewer people than 2 percent of an urban population, but the risk manager might need to know this. If an important tribal resource-gathering area is affected, 100 percent of the tribe is affected even if it is a small area, or somewhat remote from a population center.

3.7.4. Prioritizing scoping questions

The SAB recommends that the scoping questions be guided by the circumstance of the assessment and determined in consultation with the affected populations and stakeholder workgroups. Each HHRA is unique based on the situation being assessed, the regulatory action being considered, the resources and EPA office conducting it and therefore may call for different priorities in assessing risk.

The SAB finds that the EJTG does not adequately address the exposure assessment, which is a critical (and difficult) step in the risk assessment process. Exposure assessment is the one part of the risk assessment model that may identify (or miss) disproportionate impacts of a stressor depending on the available data, the experience of the analyst, and/or the proper use of tools and methods available to assess exposure. The EJTG should provide additional guidance to the analyst on methods and sources of information.

The EJTG also lacks guidance for identifying an appropriate control population for comparison to a potential environmental justice community. This will likely lead to inconsistent analyses and result in flawed assessments of disproportionate risk. The identification of an appropriate control population is a critical element to the EJ analysis.

Recommendation:

The SAB recommends that the EJTG include at least a working model with clear guidance (e.g., including what variables to control for when selecting comparison populations, how to incorporate quantitative and qualitative differences when selecting control populations, demographic versus geographical considerations, national versus state versus local data and the level of refinement needed) until there are better methods developed in the future.

3.8. Methods for Considering Environmental Justice (Section 5)

Charge Question 9. Does Section 5 provide a clear overview of the methods that could be used for considering environmental justice? Are there other methods that should be added to the discussion?

3.8.1. Clarity and other methods

For the most part, Section 5 provides a clear *overview* of some methods for use in analyzing EJ, but lacks sufficient detail about the full suite of methods that can and, more importantly, should be used. Other methods that could be used but are not mentioned, include HIA and other social science methods

(e.g., mixed methods, approaches using qualitative data). Ideally, the research design could incorporate both qualitative and quantitative approaches, possibly giving analysts feedback on their investigations from the people who are potentially impacted by the rule. A mixed methods approach can promote a critical aspect of EJ, that of ensuring meaningful involvement.

Additional methods to be added are the use of EJ or “cumulative impacts” screening tools or methods. One such tool, EJScreen, under development by EPA, is mentioned once in the EJTG but there are many other efforts that represent the varying approaches, data types, analytical methods, and scoring/weighting systems and rationale that could be useful to analysts. The public comments also mentioned other screening approaches that should be included in the EJTG (e.g., Cal-EPA’s EnviroScreen).

It also would be helpful to include a table that presents alternative analytical methods along with examples (citations) of where they have been applied effectively, key assumptions embedded in the approaches, and evaluations of their strengths and weaknesses. Appendix B provides a summary table and a list of peer-reviewed, empirical EJ studies of agency actions. Some of these studies might be useful examples of approaches to be included in the EJTG. There is a very limited literature that accomplishes what EJTG directs analysts to do which can be expanded by including examples from state and local rules.

Recommendation:

The SAB recommends that the EJTG expand its presentation of the available methods to include EnviroScreen and reference the list of state and local rules to provide further examples of other approaches.

3.8.2. Data considerations

The SAB notes that the narrative and glossary in the EJTG lack definitions for *quantitative* and *qualitative* data, which leads to confusion in the examples in Section 5 for the use of the proposed methods. The EJTG appears to erroneously equate qualitative data with anecdotal evidence. Examples of when an analyst would use qualitative data to answer the research question should be given. Qualitative data likely will be used when EJ analyses seek to describe processes or to understand people’s values, behaviors, motivations, or cultures—although social science and ethnographic methods can yield numerical data about people’s values etc. An outline of the diversity of qualitative data analytic methods would also be useful (e.g., see Tesch, 2013, pp.72-73).

Where restrictions outside the scope of the EJTG constrain the selection of data or methods, these limitations should be made explicit and the rationale for selecting a particular type of data should be included. Otherwise, “highest quality and most relevant” data ought to be explicitly favored in all instances rather than the “latest” data (pp.4, 44). In principle, qualitative methods should not be favored differently than quantitative methods. The EPA should not assume that numerical or statistical data are always the highest quality and preferred data – they can be precise but inaccurate. At the other end, qualitative data can be imprecise but correct or accurate. Analysts should be instructed to justify their choice of data and analytical methods. Unless other rules or feasibility (time, resource constraints within EPA) dictate, the EJTG should not pre-judge the intrinsic superiority of either quantitative or qualitative approaches.³

³ Whether it is OMB stipulations or other concerns about validity, reliability, and generalizability, qualitative data analysis *can* meet high quality standards. If done correctly, qualitative approaches can be generalized to a national level or at least *transferred* to other contexts. As is true across all inferential methods, purposeful sampling for cases would be key to the findings being useful in other

It is generally recognized that it is important to evaluate data quality and risk of bias (ROB) in risk assessments. However, it has been difficult to define a single set of rules for evaluating data quality because risk assessments often include diverse data streams (i.e., animal studies, human chamber studies, and epidemiological studies). There are several publications that provided best practices and frameworks to assess data quality and ROB. For example, Klimisch et al. (1997) proposed a systematic approach for evaluating the quality of experimental toxicological and ecotoxicology data. In their approach, Klimisch et al. (1997) provided three categories (Reliability, Relevance, and Adequacy) for evaluating data quality in animal studies. The three categories are described as follows:

- **Reliability** — evaluating the inherent quality of a test report or publication relating to preferably standardized methodology and the way that the experimental procedure and results are described to give evidence of the clarity and plausibility of findings.
- **Relevance** — covering the extent to which data and/or tests are appropriate for a particular hazard identification or risk characterization.
- **Adequacy** — defining the usefulness of data for risk assessment purposes. When there is more than one set of data for each effect, the greatest weight is attached to the most reliable and relevant.

The National Research Council provided a table that discusses the strengths and weaknesses of human studies and animal studies and can be a good reference for the EPA analyst (NRC 2014). Human studies are generally preferred over animal studies because they do not require animal-to-human extrapolation. Human studies are mainly of two types: human chamber studies and epidemiological studies. Human chamber studies are very useful but are limited in that they often have very limited sample sizes. Epidemiological studies are also useful but often are limited because of poor exposure data. Rooney et al. (2014) provided a very good summary on ROB as well as a comprehensive set of questions to discuss ROB. Lavelle et al. (2012) and Money et al. (2013) provide frameworks for systematically integrating human and animal evidence and evaluating and scoring human data, respectively. Rhomberg et al. (2013) not only provide best practices for conducting weight of evidence analysis but also a critical review of the available frameworks.

More broadly in Section 5, there are important gaps and confusion about evaluating feasibility and presenting information. For example, the introduction (p.36 in the EJTG) identifies what the analyst should do “when feasible,” which suggests that the EPA is using a screening process to determine feasibility of conducting an EJ analysis. The process and the criteria for feasibility are absent in Section 5 of the EJTG. Footnote 51 (p.42 in the EJTG) references a “screening analysis” without a full discussion. In addition, Section 5.1 does not discuss how to evaluate the feasibility of doing an analysis. For a section titled “Evaluating the Feasibility...,” the text should avoid the use of “when feasible” and instead focus on explaining the criteria and process for determining feasibility. Alternatively, the section could be retitled to accurately reflect its contents (e.g., “Data and Methodological Considerations in Assessing Potential EJ Concerns”). The SAB urges the former because this section of the guidance is an appropriate place to better address several related concerns expressed by the SAB, such as: evaluating feasibility, articulating the research design, and selecting among alternative data sources and analytic methods.

or broader contexts. Three strategies are employed to assist with transferability: thick description, purposeful sampling and triangulation. Thick description paints a highly detailed picture of the context and boundaries so that the key issues can be discerned for other contexts. Purposeful sampling refers to the many ways of designing a research study with qualitative data, depending on the purpose of the study and the guiding questions. Triangulation is the use of multiple data points to draw conclusions (Popay et al., 1998; Fossey et al., 2002).

Section 5.2 stresses the need for detailed information about the baseline distribution *and* the projected distribution of outcomes (or at least the distribution of regulatory impacts). Most of the bulleted list in Section 5.3 (p.41) refers to information about the baseline. Parallel bullet points about information reporting expectations related to the projected distribution of outcomes should be added. (Additional discussion of this issue appears in response to charge Question 10.)

Recommendation:

The SAB recommends that, in Section 5, the EJTG clarify elements of EJ analysis such as, evaluating feasibility, articulating the research design, and selecting among alternative data sources and analytic methods.

3.9. Analytical considerations

Charge Question 10. Section 5.4 discusses analytical considerations that may have a significant impact on results. Are these considerations appropriate for assessing EJ in the context of a regulation? Are there considerations that should be added/removed from the discussion?

The SAB agrees that the analytical considerations in Section 5.4 of the EJTG are relevant for conducting an EJ analysis, but recommends that additional important considerations be added. Section 5.4 in particular could benefit from a table or matrix of “best practices,” to include information about prior use and identify some advantages and disadvantages of each or note where their application is most appropriate. Likewise, the whole of Section 5 would be more useful if the key research design elements in EJ analyses were clarified. Conducting an empirical, prospective EJ analysis of EPA rules inevitably entails several major components, including: (1) defining the “metric of interest” or dependent variable, (2) defining the comparison group, (3) identifying the counterfactual distributions, (4) defining the scope of the analysis, and (5) spatially identifying and aggregating effects. Section 5.4 discusses only (2), (4), and (5), and its discussion of the scope (Section 5.4.2) is limited, as noted below. In addition, the EJTG could benefit from a richer, more detailed and more prescriptive discussion of these crucial points in order to better guide analysts. Each of these important topics is discussed further below.

3.9.1. Defining metrics of interest

Selecting the metrics to assess EJ concerns is a critical component of any EJ analysis. Section 5.2 makes two bold and restrictive statements in this regard. These statements are hidden in an overall confusing explanation in Section 5.2. First, it notes that analysts need to characterize both the pre- and the post-regulation distribution of environmental quality (or, equivalently, a baseline distribution and a distribution of changes in environmental quality). The argument is that knowing just the distribution of the change in environmental quality (ΔE) owing to the rule is insufficient for an EJ analysis. The EJTG can be improved by stating that a useful EJ analysis could still be done if only the distribution of ΔE is known. It might not be ideal, but reasonable quantitative and qualitative EJ analyses have been based on just ΔE before, and it would be unfortunate if the absence of baseline distributional information is used to prevent an analysis of the distribution of ΔE .

The reality is that the EJ discourse has not settled on a single metric (e.g., distribution of ΔE or change in distribution of E). While an EJTG that prescribes a single conceptual measure takes away discretion from future analysts, it also implies potentially objectionable policy priorities by any such measure.⁴

⁴ For instance, the example on p.40 seems to imply that a policy that had only a 5% reduction in asthma cases for minorities and a 10% reduction for others might not appear unjust if the baseline incidence rate for minorities was more than double that of others. Regardless, a metric consistent with dispersing new pollution sources would not be seen as “just” by some.

The choice of the metric might implicitly target policy to equalize pollution levels or environmental risks across groups or to equalize gross or relative environmental improvements across groups. Noonan (2008) argues for less ambiguity in defining the metric of interest. The EJTG's assertion that EJ analyses should assess convergence in the distribution of environmental quality or stressors rather than equity in the distribution of ΔE goes a long (and controversial) way to taking a policy stand. More prescription about measuring environmental impacts, in particular whether analysts should be measuring in relative (as rates or per capita) or gross terms, would help.⁵ The results of an EJ analysis can differ significantly depending on the use of a maximum individual risk (MIR) or a population risk measure (Turaga et al., 2011).

Recommendation:

The SAB recommends that the EJTG should encourage sensitivity analyses across alternative metrics or inclusion of stakeholders early in the analytical process to determine the most relevant metric(s).

3.9.2. Defining comparison groups

The description of comparison groups (Section 5.4.2) should be clarified. If the objective of EJ analysis is to compare environmental conditions (exposure, risk, etc.) for EJ groups identified on the basis of income, race/ethnicity or other factors, then the relevant comparison group for each EJ group would be the population that is as similar as possible, but lacking the characteristic defining the group as of EJ concern.

An important question is on what variables this similarity is based. Clearer and better guidance in Section 5.4.2 is needed. Race/ethnicity, family income, and other (permanent) characteristics can affect individuals over their entire lifetime, contributing in various ways to their current situation. One possibility is to select a population 'as similar as possible' before the birth lottery is resolved (i.e., the uncertainty about who one's parents will be), in which case the comparator would be the general population excluding those that are of EJ interest. Other approaches – especially when the defining EJ characteristic is something that individuals have some discretion over (e.g., region of residence, religion, education, etc.)⁶ – might imply many other controls or alternative research (e.g., quasi-experimental) designs in order to identify the proper comparison group.

Recognizing alternative explanations for unequal baseline (and potentially future) distributions, the use of multivariate statistical analysis to control for these factors offers the analyst considerable latitude to implicitly define a comparison group (insofar as the findings are then conditional on the covariates). This is particularly important in many EJ analyses, where common EJ group characteristics like race and income or subsistence lifestyles are highly correlated. EJ studies in the literature employ an inconsistent variety of conditioning variables, sometimes including both race and income. These various controls not only affect the findings, they often implicitly define the comparison groups. The EJTG should promote more transparency and consistency by providing clearer instruction to analysts faced with choices over which control variables to employ that implicitly define the control group.

⁵ The language on p.40 should be revisited to ensure consistency with evaluating the rate of incidence rather than number of cases.

⁶ Tribes will argue that their birth into a tribe determines location and religion – tribal members cannot move from their homeland, and dislocation causes immense harm (e.g., Trail of Tears). Religion is also often seen as immutable. Education might seem to be a matter of choice, but not so much in poor communities. For example, the Creator gave tribes particular natural resources in their home regions, and partaking of those foods is a requirement of natural law (religion). So, tribal members may knowingly eat contaminated fish because that is the food the Creator gave them. They do not see that they have a choice, although they might reduce the amount of fish they feed their children. Someone has to continue the First Foods consumption, and adults may accept the burden of eating contaminated foods on behalf of the tribe.

Section 5.4.2 also presents two perspectives by Bowen (2001) and Ringuist (2005) on the selection of an appropriate comparison group. Bowen suggesting to restrict the comparison group to a sub-national level and Ringquist contending that placing restrictions on comparison groups may bias the results against finding disproportionate impacts. These perspectives have been discussed elsewhere in the EJ research literature. The EJTG recommends that the analyst conduct a sensitivity analysis regarding how the comparison group is defined, as if marginal differences in geographic extent are a principal determinant in error or bias for the results. In work subsequent to the articles cited in the EJTG, this argument has been resolved using a better analytical approach and should be cited instead of those detailing the competing points of view, and would serve as a much better source of information for analysts seeking appropriate methodological direction on defining a comparison group. The two papers that best detail this approach are Mohai and Saha (2006; 2007).

The SAB also recommends that the EPA consider both urban and rural examples in the application of a proposed rule. This might be a research question, or the EPA may already have examples it can give. In rural or western United States/Alaska areas, population densities are lower, so census tracts are larger, and the proximity rule might need to be larger. The EJ population identification might differ as well, especially if income and race are the primary filters. The definition of hotspot might differ in urban and rural settings, which is important because the intent of EJ is not to simply shift new source permits to low-population rural areas.

Recommendations:

The SAB suggests that the definition of a comparison group be clarified.

The SAB recommends that the EJTG instruct analysts to be transparent about the choices they make when deciding which control variables to employ that implicitly define the control group.

The SAB recommends that the discussion on the selection of a comparison group in Section 5.4.2 of the EJTG be updated to include the approaches described in papers by Mohai and Saha.

The SAB recommends that both rural and urban examples be considered in the application of proposed rules.

3.9.3. Identifying counterfactual distributions

As presented on page 40 of the EJTG, in order to assess the “differences in the baseline incidence [of environmental harms or risks] and determine if the distribution increases or decreases the differences” some information is required about:

- the *baseline* (pre-regulation) environmental conditions for the EJ group and for a comparison group;
- the *counterfactual* (projected-yet-absent regulation) environmental conditions for the EJ group and for a comparison group; and
- the *projected* (post-regulation) environmental conditions for the EJ group and for a comparison group.

In principle, this presents no less than six different distributions. The counterfactual and the projected distributions need to be known or assumed in order to identify the rule’s impact. The baseline distribution (per p.40 of the EJTG) needs to be known to fully assess the justice of that impact. EJ assessments will typically require comparing distributions between at least two groups for each of those scenarios (baseline, counterfactual, projected). In practice, the analysis may be much simpler, perhaps

because the baseline and counterfactual distributions are assumed to be the same. In addition, the “baseline” definition in the Glossary (p.54) confuses matters by defining the baseline as both the *status quo* and as the counterfactual.

Recommendation:

The SAB recommends that the EJTG direct the analyst to be transparent about how the *differences across groups* are identified for each scenario in the EJ analysis.

3.9.4. Defining the scope of analysis

This section simply mentions the possibility that rules may require EJ analyses at a sub-national level. Because the result of an analysis of difference in impact is significantly affected by the selection of geographic extent (e.g., Baden et al., 2007), the analyst should make certain that the specific scope selected for analysis is policy-relevant or rule-relevant. If there is no clear guidance as to scope from the rule, sensitivity analysis would be appropriate to identify the impact on the results of any “boundary effect” – the SAB recommends that this be also discussed in 5.4.2 and added as a recommendation.

Further, the SAB recommends that Section 5.4.2 be also expanded to explicitly address *temporal* scope. This is partly wrapped up in decisions about identifying counterfactuals (how things would be in the absence of the rule) and how far into the future to project post-rule. Regardless, analysts should have clear guidance on where to place temporal bounds in the analysis. Such bounding implicitly defines what sort of behavioral responses to regulations are included in the analysis (e.g., reducing emissions, switching technologies, averting behavior and defensive investments, relocation of polluting activities or receptors/residences), which are likely consequential for results of EJ analyses. EJ analysts should be given more guidance and less discretion here. Insofar as a rule’s Regulatory Impact Analysis (RIA) prescribes the temporal boundaries for analysis (per Section 5.2, p.40), EJ analysts should be invited to report on the likely implications of using these boundaries.

Recommendation:

The SAB recommends that analysts be instructed to transparently present results of sensitivity analyses to identify the impact of geographic and temporal boundary choices.

3.9.5. Spatially identifying and aggregating effects

The wording of this section does not provide clear guidance to analysts with regard to resolving differences in spatial resolution between two or more geospatial datasets, in particular on how to avoid two classic “bad geospatial practices” in this regard: ecological fallacy (the impact of spatial resolution on conclusions one can accurately draw) and the modifiable areal unit problem (the source of bias that can impact statistical tests if data are aggregated incorrectly). The SAB suggests that a list of best geospatial practices be added to the EJTG to provide guidance on these issues.

The SAB also recommends that the EJTG provide useful guidance on data sources by expressing a preference for certain types of data – notably individual-level data (rather than spatial aggregates) and exposure data (rather than crude proxies and buffers-around-sources). Some of these issues appear in Text Box 5.3, where a presumption of aggregated data remains even in the “data rich” context, but guidance on ecological fallacy and aggregating effects belongs in Section 5.4.3.⁷

⁷ The preference for finer-scale data (p.43) should be tempered and guided by context. Finer resolution allows detection of more and smaller hotspots, but does not imply better measures of exposure. Highly resolved environmental quality data puts more pressure on data describing where and when receptors (people) are. Eventually groupings can get small enough that inequities in risk become inevitable.

This section of the EJTG also suggests that analysts use buffer circles in a GIS to select and aggregate census-related data, often called a “cross-walking” procedure, but does not include the various ways that this can be done. These include: selecting tracts that intersect the buffer circle, selecting tracts with centroids (or geographic center, depending on which is used by the analyst) captured by the buffer circle, or using the geo-processing capability of the GIS to actually intersect the buffer circle with the tract polygon, and transferring attributes from tracts to the buffer area using area-weighting or population-weighting. All of these methods have been used in the EJ research literature, and all carry assumptions that need to be acknowledged by the analyst and the specific method selected that is most appropriate to the analysis that is being conducted.⁸

Recommendations:

The SAB recommends that the EJTG provide a list of “best geospatial practices” as guidance for analysts.

The SAB recommends that the EJTG provide a list of GIS data sources for analysts to use.

The SAB recommends that the EJTG provide clearer guidance on the methods used to select and aggregate census data in EJ analyses.

3.9.6. Interpreting geographic patterns

Section 5.4.4 describes instances where interpreting a geographic pattern can be difficult because many metrics are correlated, and the relative role or strength of various determinants is not known. The EJTG notes “regression techniques are able to partially control for these factors,” but offers the analyst no specific direction. The EJTG could usefully cite research here, which the analyst could use to examine how other researchers have approached this problem using various multivariate techniques; for example, Boer et al. (1997); Sadd et al. (1999); Pastor et al. (2001, 2004a, 2004b, 2005, 2006); and references therein.

Recommendation:

The SAB recommends that the EJTG provide additional citations that can assist analysts in interpreting geographical patterns using various multivariate techniques.

3.10. Analysis of the Distribution of Costs

Charge Question 11. Is there sufficient guidance on when and how to conduct an analysis of the distribution of costs? Is the guidance associated with distribution of costs appropriate?

The SAB does not agree that there is sufficient or appropriate guidance on when and how to conduct an analysis of the distribution of costs. The solution to the problem of inadequate guidance on costs is to be clearer about the conscribed nature of the EJTG and point to other sources/parts of the rule-making process for a discussion on costs.

⁸ As the GIS of choice for federal agencies is the ESRI, Inc. software suite, a good summary review can be found in the ArcGIS help files: http://resources.esri.com/help/9.3/arcgisengine/java/gp_toolref/geoprocessing/proximity_analysis.htm

If EJ is about disproportionate impacts to health (or exposure to environmental stressors), and not about total well-being,⁹ then this interpretation can be justified by the view that health (or a clean environment) is a merited outcome and everyone should experience at least some minimum benefit. Under this definition, it may be inappropriate to consider costs. SAB panel members raised concerns that consideration of costs could be used as an argument against protecting the health of particular EJ communities. One dimension of this concern is the potential that in traditional cost-benefit approaches, measures of benefits utilizing a willingness-to-pay metric will lead to low benefit measures due to the lower ability to pay in EJ communities. The discussions regarding how to fix the guidance on costs highlighted the complexities involved in providing guidance on costs. Some of these issues are addressed below.

3.10.1. Sufficiency

One potential response to these concerns would be a determination that it is beyond the scope of the EJTG to adequately address these concerns. The second approach, and one proposed by the SAB, is to expand the treatment of costs in the EJTG to provide sufficient guidance on when and how to conduct an analysis of the distribution of costs. Section 5.5.1 states that the need to undertake an exploration of the distribution of costs should be assessed on a “case by case” basis, and then proceeds to give examples of when such an analysis is warranted based on characteristics of the case or assumptions about the effect of a rule. This section also states that “Data or methods may not exist to fully examine the distributional implications of costs across population groups of concern.” In this second case, the reader gets the impression that the notion of “difficult to perform an analysis” is the sufficient condition for “unnecessary to perform an analysis.”

While it is entirely possible that data constraints may prevent a serious analysis of cost distributions in many instances, feasibility is a different rationale than relevance or appropriateness. The sentence in the middle of page 51 of the EJTG that states cost analyses are not always necessary, combined with its footnote (58), misleads the analyst because it confuses necessity with difficulty in measurement and infeasibility. Adding further confusion, the following sentence implies that considering cost distributions might not be necessary because they are evenly distributed. An analyst would get better guidance if the entire paragraph up to the word “Whether” were deleted. Better still, the EJTG should more clearly identify when cost analyses are appropriate.

Recommendations:

The SAB recommends that the EJTG be revised to include the following specific suggestions regarding the question of when to conduct a cost analysis:

- Where analyses are omitted, the analyst should be required to document the basis for the exclusion. Specifically, was the exclusion the result of a qualitative or quantitative determination based on attributes of the rule or its assumed effects, or was it based on the lack of relevant data or methods?
- The EJTG lists examples of cases where consideration of the distribution of costs is warranted, including: “...costs to consumers may be concentrated among particular types of households such that they impose a noticeable burden...; identifiable plant closures or relocation of facilities; or behavioral changes in response to a rule or regulation.” This list is helpful, but it

⁹ In indigenous communities, personal and community health are inseparable from environmental quality, culture, and many other factors (Donatuto et al., 2011)

exemplifies the need to have more examples and case studies available for analysts. The list does not provide enough context/rationale to guide (potentially) similar analyses.

- Under Section 5.5.2 (Other Impacts), in providing guidance on estimating non-health endpoints the analyst is instructed: “When data are available, analysts should use them in the evaluation.” This is another example where if the analyst can propose scenarios where non-health endpoints may be important but data availability prevents or limits analysis, the analyst should be instructed to note this limitation.

3.10.2. Clarity

With regard to whether the guidance associated with distribution of costs is appropriate, the SAB identified several areas that need further clarification. One key set of concerns relates to issues of scope and the types of responses and/or adjustments that will be accounted for in the analysis. The SAB recommends that these issues which can be categorized into two main areas, short run versus long run analysis and general versus partial equilibrium analysis, be further clarified as follows.

Short Run versus Long Run Analysis

What time frame should be used in cost analyses? This is important because the distributional effects can change over time. As an example, consider the distribution of costs associated with the requirement for additional pollution controls on automobiles. Such regulatory changes cause the cost of cars to go up. This burden initially falls on higher income individuals (who buy cars more rapidly) over time, lower income people will possibly buy new cars, or experience a cost, in the long-run, as the price impacts in the new car market spill over into the used car market. Thus, these controls may become more regressive over time.

Conversely, what about regulations that impose upfront costs on consumers that are "paid back" over time? An example is the requirement to purchase Low Carbon/High Efficiency appliances. There would potentially be large upfront costs, but likely long-run savings. The time component and personal behavior/choice are important here.

General versus Partial Equilibrium Analysis

In general, an accurate accounting of the distributional cost impacts will require a general equilibrium analysis. The EJTG should provide guidance on if and when a partial versus general equilibrium analysis will be required. Another way to look at this issue is in terms of what set of costs should be considered. Should only first order costs be considered? Should second order costs also be considered, and the costs to whom? If there are guidance documents that currently exist which answer these questions, analysts should be instructed to use them.

The SAB recommends that this section of the EJTG should highlight what other considerations are important and specific to EJ analyses (e.g., those particularly likely to arise in assessing cost) and to define the scope or put some bounds on what the cost analyses should consider. One possible suggestion is that direct consumer costs would be appropriate for EJ analyses but the general equilibrium or second-order cost effects would not be expected to be covered by an EJ analysis. Factors such as compliance, averting behavior and precision/range of estimates also need to be addressed. For example, should analysts assume complete compliance? If not, how should this be reflected in the analysis? How should analysts address the potential role of averting behavior? If a policy induces a change in behavior, where and how does that get taken into account? A related issue is the treatment of adjustment costs. How

should they be accounted? Furthermore, the EJTG should provide guidance on how to characterize the uncertainty inherent in cost estimates. While guidance on how to address these considerations may be available in other agency documents; issues that are specific to and may differ for EJ analyses should be highlighted and examples provided in the EJTG.

Recommendations:

The SAB recommends that the EJTG should provide guidance on the time frame that should be used in cost analyses as well as guidance on if and when a partial versus general equilibrium analysis will be required.

The SAB recommends that the EJTG should provide guidance on how to characterize the uncertainty inherent in cost estimates.

3.11. Key Methodological or Research Gaps

Charge Question 12. What are the key methodological or data gaps specific to considering EJ in regulatory analysis? Which factors should be prioritized in the near-term to improve how EPA considers potential EJ concerns in regulatory analyses?

The EJTG core writing team led by the Office of Environmental Justice, Office of Policy, and Office of Research and Development has done an excellent job surveying and querying EPA personnel and the interested public on methodological and research gaps and needs in the EJ area. The team identified long and short-term research priorities among various EPA offices and regions that they presented in Tables 1 and 2, respectively (shown below). The SAB has identified additional research planning, staffing needs, data gaps, and methodological needs which can strengthen the EJTG.

3.11.1. Research Planning

To a significant degree, gaps noted in public comments reflect the research gaps and priorities expressed by agency personnel. These include better distribution of air monitoring locations, use of cumulative impact assessments, use of appropriate data sources and maintenance of privacy, more complete demographic information, identification of non-chemical stressors, and the use of qualitative data in an appropriate manner.

In examining these gaps, the SAB noted that the short-term and long-term needs expressed are quite similar, suggesting the need for a greater degree of strategic thinking on longer-term priorities. There is a danger that without careful alignment of immediate needs and longer-term aims, there may be considerable misdirection in research that may require frequent readjustment of objectives and scope. One approach, common in the EPA's Office of Research and Development (ORD), is to differentiate between short-term "outputs" and longer-term "outcomes," the latter providing guidance as the results of short-term projects become available. Only the "framework for using available data" in Table 12-2 appears to address this need (without further explanation), while other long-term priorities mimic those presented as short-term. Longer-term priorities that could emerge might come about through work with other agencies that are concerned with demographic and behavioral trends (e.g., the Departments of Labor, Commerce, and Homeland Security), and agencies that address long-term human and ecological health needs, for example, the Department of Health and Human Services' National Institutes of Health (NIH), Food and Drug Administration (FDA), and Centers for Disease Control and Prevention (CDC). For example, the FDA's Office of New Drugs has a wealth of experience with drawing conclusions from limited sample size and quantifying differing reactions to an agent according to race or ethnicity. A "brainstorming" session with appropriate staff members in these agencies might reveal protocols,

practices and reference materials valuable to the ORD/risk assessment staff developing cumulative risk and impact guidance. Similarly, CDC expertise in biomonitoring might be used to better assess community exposures.

Recommendation:

The SAB recommends a greater degree of strategic thinking on longer-term priorities since the short-term and long-term needs expressed are quite similar.

Table 1. Short-term Research Priorities for EJ Identified by the EPA

GENERAL RESEARCH PRIORITIES—TOP 5 SHORT TERM PRIORITIES (DRAFT)	Offices identifying priority
Analysis: chemical and non-chemical stressors, Cumulative effects, behavioral effects, costs, health impacts	OAR; OCHP; OCSPP; OP; OW; Regions
Data gaps: chemical and non-chemical stressors, cultural, product use, workplace characteristics, finer resolution air quality data	OAR; OCHP; OCSPP; OEJ; OP; OW; REGIONS
Review of criteria used to characterize EJ communities	OAR; OCSPP; OW
Methodology: distribution of risk, receptor approach, different types of rules, and validity of assumptions in BCA	OAR; OCSPP; OEJ; OSWER; OW
Improve tools: behavioral responses, combined risk including non-chemical stressors, IRIS for system specific endpoints.	ORD; OSWER

Table 2. Long-term Research Priorities for EJ Identified by the EPA

GENERAL RESEARCH PRIORITIES – TOP 5 LONG TERM PRIORITIES (DRAFT)	Offices identifying priority
Data gaps: chemical, non-chemical, cultural, product use, demographic characteristics, health outcomes, group dose response, workplace characteristics, finer resolution air quality data, new environmental burdens	OAR; OCHP; OCSPP; OEJ; OW
Analysis: consistent analytical approach, other routes of exposure, health indicators	OAR; OCSPP; OW; REGIONS
Framework, guidelines for using available data	OCSPP
Methodology: standardization of metrics, differential burdens, disaggregating BCA for EJ analysis	OAR; OCHP; OEJ; OP; ORD; OW; REGIONS
Improve tools: for policy makers, vulnerability by life stage, characterizing vulnerable communities.	OAR; ORD

3.11.2. Staffing Needs

The SAB is concerned that the EPA may not have the full complement of expertise among its research scientists to fully address EJ needs and priorities. To a significant extent the agency relies on its cadre of economists (behavioral economists) to discern complex human behaviors. While this is certainly a valid approach, insights from the learning, sociological, anthropological and psychological science communities might also provide complimentary expertise that could result in new methods of data management and interpretation, and more robust ways of treating uncertainty. This is especially the case as long-term trends are considered. Recruitment of appropriately trained postdoctoral researchers, temporary inter-agency transfers, community-based participatory researchers, and creative use of the STAR research program would assist in meeting short-term personnel needs. Regarding the latter, the SAB suggests a well-structured set of EJ-focused research areas that might bring new thinking into the agency, and result in a greater array of information with which to work.

3.11.3. Data Needs

During the SAB panel meetings, there were frequent concerns expressed by agency personnel that data extent, quality, and availability were often insufficient to carry out the EJ mission; i.e., that the agency is “data poor.” While this may be the case in some instances, for example, with respect to the locations and numbers of air quality monitoring stations or low dose exposures and their impact as contributors and drivers of risk—the SAB is concerned that other data sources and methods of analysis are being overlooked or not fully integrated into analyses. Quantitative structure-activity relationships (QSAR), Relative Potency Factor, and EPA’s NexGen methods can all be used to fill data gaps. In addition, the investigation of EJ issues requires examining the problem both from the behavioral and social equity perspectives and the environmental risk perspective. Making use of surrogate and metadata, and the application of advanced methods of cyber-analysis (data mining, ontological matching, and disambiguation) to build more robust and useful data sets are ways of transforming a “data poor” problem into one which is “data rich.”

The SAB agrees that ensuring data sufficiency, accuracy, and appropriateness is essential for EJ analyses, particularly for the detection of EJ-relevant “hotspots.” An important aspect of this involves using more, optimized monitoring locations, models that better incorporate the implications of monitoring locations, and techniques for better integrating dispersion models for areas not directly monitored. Better (and more accessible) techniques for including model errors into EJ analyses (which typically use questionable proxies for environmental quality or risks at a particular location without formally accounting for error in that measurement) would help. Even basic data indicating the spatial extent of regulated hazards could bring substantial improvements.

Beyond better characterizations of pollutant levels in space and time, a concomitant concern is better characterization of pollutant receptors in space and time. The convenience of census data, and the new limitations brought on by the shift to American Community Survey (ACS) data with less granular geographic range, bring with it important limitations in assessing actual exposure. The SAB notes that improving the spatial precision in measuring risks should not come at the expense of improved temporal precision and a better understanding of how this contributes to the overall goal of improving the characterization of exposure. Accordingly, the EPA should invest in research to better understand actual exposure, i.e. reflective of how receptors actually behave, rather than reliance on standard models of fixed behavior. Shifting empirical analyses to aggregate units (e.g., census tracts) and relying on location of residence (rather than time spent outdoors or using indoor and workplace risks) departs from unbiased estimates of actual exposure and adds to the uncertainty associated with the analysis. Technologies, such as the incorporation of cell phone tracer data (anonymously), could add an element of mobility to risk

analyses that is currently lacking. Similarly, the Longitudinal Employer-Household Dynamics¹⁰ program holds great promise for improving spatial and temporal precision in measuring receptors' location and travel habits. Efforts to make use of this information – and to promote more researchers' access to the data for these purposes should be encouraged. Additionally, while better use of geospatial and spatial econometric models is needed, the EPA might facilitate their use by analysts by making spatio-temporal models easier to access, especially those with limited dependent variables.

The SAB also recommends that group-specific estimates of dose-response relationships, as well as estimates of workplace and indoor exposures, be improved. The rigor and quality of EJ analyses will be enhanced by standardization of the use of the block group level census for demographics and as the spatial unit of analysis, as well as the comparison of environmental stressors and their impacts at 1 and 3 kilometer radii for proximity analyses. TRI data, commonly used in EJ analyses, could be released in ways that include more information about the data itself (e.g., when releases are estimated or measured) and in ways to allow more “accurate” use of the data. The ubiquity and ease-of-use of TRI data also leads to misuse, and the EPA can do more to improve how these data are used. Efforts to better model “hotspots of pollutant receptors” should parallel better models of pollutant hotspots (i.e., Does more precise identification of pollutant hotspots increase or decrease the bias in estimated exposure?).

Because the field of EJ is fairly dynamic, it would be useful to develop a repository of relevant empirical methods and analytical toolkits as well as geospatial/temporal data, including environmental and psychosocial stressors, facilities, and demographics relative to impacts. Such a repository should include those which have been created and maintained by other agencies or stakeholders. The repository would be expected to grow with the field and facilitate more and better analyses, including external review of the EPA's actions. Each EJ analysis can also be used to identify data needs for this repository, if analysts are required to document the data gaps and uncertainties which shaped their analysis.

3.11.4. Methodological Needs

The SAB strongly encourages the EPA to work toward the incorporation of cumulative impacts and multiple facility proximity in its analyses of its proposed rules and regulations as they pertain to environmental justice and identification of disproportionate impact. The SAB understands the challenges posed by cumulative assessments, and acknowledges that, practically speaking, a complete and robust assessment might not be feasible until further methods and tools are developed and data become available. However, examples of cumulative health impact assessments, an alternative to traditional risk assessments that take into account both quantitative and qualitative data, continue to be documented (Dannenberg et al., 2008). Further, with current knowledge and methods available, a trained practitioner should be able to identify limitations in their analysis and consider characterizing (both quantitatively and qualitatively) the degree of uncertainty introduced short of a complete impact assessment.

While understanding the need for national guidance for EJ methodologies, the SAB notes that state, local, and community level data and assistance are essential for an accurate EJ analysis. In addition, it often will be necessary to engage community leaders, EPA regional offices, and others in dialogue to fully understand what information they can contribute to the analysis and what exposure or other concerns a community might have. For example, it is not clear that proposed methodologies are adequate for evaluating subsistence communities (whether tribal or other rural populations) where dietary needs are met largely through hunting and fishing. To this end, the SAB recommends adopting one of the suggestions made in the public comments regarding funding pilot projects with states, local governments, and communities to develop and test mechanisms for sharing data and information and

¹⁰ See <http://lehd.ces.census.gov/>

engaging communities in order to inform an EJ analysis. Section 4.3.2.3 of the EJTG should include a specific recommendation of early, thorough, and culturally and linguistically competent community involvement in order to identify and address relevant data gaps.

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APPENDIX A. Charge to the SAB

Revised¹¹ Charge Questions for the SAB review of EPA's *Technical Guidance for Assessing Environmental Justice in Regulatory Analysis*

Overall Impressions

The *Technical Guidance for Assessing Environmental Justice in Regulatory Analysis (EJTG)* provides EPA economists, risk assessors and other analysts with information on how to assess potential environmental justice (EJ) concerns during the development of a regulatory action. It is intended to introduce consistency and rigor to the analytic consideration of EJ, while maintaining flexibility in how analysts implement the guidance.

1. *Please provide your overall impressions of the clarity and technical accuracy of the EJTG for analyzing and presenting quantitative or qualitative information on potential environmental justice concerns in the development of EPA regulations.*

Key Questions for Analysts

The EJTG suggests that if quantitative risk and benefit analysis is done in support of the rule, analysts should rely on these data to do a quantitative EJ assessment when feasible. The level of quantitative analysis is expected to vary by regulation and be affected by data, analytic, or other constraints. If quantified benefit or risk information is not available then a qualitative EJ analysis is still expected.

2. a- *Are these directions appropriate? Do they strike the right balance between developing information that is useful to the decision making process and the cost (time, resources, data constraints) of doing quantitative EJ assessments?*

b- *Please provide advice on methods and best practices for conducting rigorous, high-quality EJ analyses, both quantitative and qualitative, that may be conducted in support of a national rule (including data needs or other issues associated with such assessments).*
3. *Section 1.1 presents 5 key questions analysts should address when analyzing the environmental justice considerations during the development of a regulation. Are these questions clear and appropriate for considering EJ during the development of a regulation?*

Key Recommendations (Section 1.2)

The EJTG makes six recommendations to ensure consistency, rigor and quality across assessments.

4. *Are the six analytic recommendations listed in Section 1.2 appropriate and comprehensive? Are they consistent with the state of the literature while providing flexibility to EPA program offices in the analytic consideration of EJ in the development of a regulation?*
5. *Are there any analytic recommendations that should be added? Any that should be removed?*

¹¹ The EPA released for public comment its *Draft Technical Guidance for Assessing Environmental Justice in Regulatory Analysis* on May 9, 2013 (see <https://www.federalregister.gov/articles/2013/05/09/2013-11165/technicalguidance-for-assessing-environmentaljustice-in-regulatory-analysis>). As a result, EPA received a number of comments (see docket # EPA-HQ-OA-2013-0320 at <http://www.regulations.gov>). After considering these comments, the EPA Office of Policy has revised the charge questions posed to the SAB panel to include an additional question (#2b).

Differences and Disproportionate (Section 2)

The EJTG distinguishes between analytically defined differences in impacts and making a determination of disproportionate impacts. It also suggests 6 types of information that may be useful to the decision maker for determining whether differences are disproportionate and may warrant Agency action (Section 2.4).

6. *Is the description of differences in impacts and disproportionate impacts clear and do reviewers agree with this distinction? Are the types of data listed to aid the decision maker helpful? Are there other categories of data or information that should be added to this list?*

Section 3

Section 3 provides a brief overview of the contributors and drivers of Environmental Justice. This overview is intended to provide analysts with some considerations that might drive the analytical decisions used when examining environmental justice for a regulatory decision.

7. *Does the discussion of contributors and drivers adequately reflect the state of the literature? Is it clear and technically accurate? Are there any additional factors that should be included in the discussion?*

Section 4

The Guidance directs analysts to use a series of scoping questions at the planning stages of a human health risk assessment to integrate EJ into analyses conducted for the rulemaking.

8. *Is section 4 clear and technically accurate? Are the scoping questions outlined in Section 4.3.2.1 appropriate? Do the scoping questions adequately identify opportunities for incorporating environmental justice into a human health risk assessment? Should certain scoping questions be prioritized at various stages of the risk assessment (e.g. exposure, dose-response)?*

Section 5

This section provides a suite of methods that can be used to assess EJ in the context of a regulation.

9. *Does Section 5 provide a clear overview of the methods that could be used for considering environmental justice? Are there other methods that should be added to the discussion?*
10. *Section 5.4 discusses analytical considerations that may have a significant impact on results. Are these considerations appropriate for assessing EJ in the context of a regulation? Are there considerations that should be added/removed from the discussion?*

Program Offices are advised to consider the distribution of costs associated with implementing a regulatory option from an EJ perspective when appropriate.

11. *Is there sufficient guidance on when and how to conduct an analysis of the distribution of costs? Is the guidance associated with distribution of costs appropriate?*

Research Gaps

The EJTG acknowledges that analysis of potential EJ concerns in regulatory analysis is an ongoing and evolving area and that EPA needs additional research to develop better EJ assessment tools and methodologies. In answering this question, we ask that you think less about general data or methodology gaps for conducting quantitative risk or benefits analysis, and instead focus on research gaps that are specific to evaluating potential EJ concerns.

12. *What are the key methodological or data gaps specific to considering EJ in regulatory analysis? Which factors should be prioritized in the near-term to improve how EPA considers potential EJ concerns in regulatory analyses?*

APPENDIX B. Select Evidence of Federal Actions' Unequal Impacts

Authors	Regulatory/ issue context	Research question	Finding
Gianessi et al. (1979)	Clean Air Act	Do uniform CAA standards yield uniform results?	No. The poor appear to gain the most.
Hird (1990)	CERCLA	Is the cleanup pace or spending at NPL sites correlated with neighborhood income?	Neither.
Hamilton (1993)	hazardous waste processing facilities	Did the post-CERCLA regulatory regime change siting of hazardous waste facilities	No longer drawn to counties with more minorities; collective action explained more
Gupta et al. (1996)	CERCLA cleanup decisions	Do demographics affect EPA remedial decisions?	No. Permanent remedies were not favored different in minority or poor areas.
Sigman (2001)	CERCLA	Do demographics affect listing, cleanup pace?	Somewhat. Community income affects pace; progress is faster with more Hispanics.
O'Neil (2007)	CERCLA (listing on NPL)	Do neighborhood demographics predict the likelihood of a proposed site getting listed to the NPL? Did EO 12898 increase equitability of Superfund program?	Proposed sites in poor and minority tracts are less likely to be listed. Post-EO, sites in minority tracts are even less likely to be listed.
Daley (2007)	CERCLA cleanup decisions	Does EPA supporting local citizen groups affect remedial decisions?	Yes. Forming CAGs and TAGs leads to more health-protective clean-up approaches.
Noonan (2008)	CERCLA cleanup progress	Does neighborhood race or income predict NPL deletions?	Deletions uncorrelated with race, less likely in wealthier areas.
Shimshack and Ward (2010)	mercury advisories in fish	Did advisories alter consumption? Differently for different groups?	Fish consumption fell, even for groups not at risk
Baryshnikova (2010)	air emissions at pulp & paper mills	Does regulatory pressure yield inequitable impacts on plant abatement	Children and high-school dropouts enjoy less abatement; no difference for minorities and poor
Ringquist (2011)	Clean Air Act	Does the SO ₂ trading regime transfer pollution to minority communities?	No. Minority communities received fewer imports.

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APPENDIX C. Additional Recommended Edits

The SAB panel suggests the following edits of the five steps in section 1 (suggested changes are italicized):

- “Assess exposure, relevant health and environmental outcomes, and other relevant effects *separately by population group and within each population group in the baseline, including the extent of uncertainty in the data and how that uncertainty impacts the results.*
- Assess differences in these exposures, relevant health and environmental outcomes, and other relevant effects *separately by population group and within each population group in the baseline for the most recent decade and in the local community (e.g., 1, 3 and 5 mile radius) at highest risk. Include an assessment of the quality of the data, and uncertainties that impact the results.*
- Assess exposure, relevant health and environmental outcomes, and other relevant effects *separately by population group for each option, including the extent of uncertainty in the data and how that uncertainty impacts the results.*
- Assess differences in these exposures, relevant health and environmental outcomes, and other relevant effects across population groups for each option, *for the next decade and in the local community (e.g., 1, 3 and 5 mile radius) at highest risk. Include an assessment of the quality of the data, and uncertainties that impact the results.*
- Assess how estimated differences in these exposures, relevant health and environmental outcome and other relevant effects across population groups increase or decrease as a result of each option compared to the baseline. *Include an assessment of the key variables that account for these differences and an assessment of the quality of the data for these key drivers. If these drivers are pronounced in particular types of places, indicate the kinds of locations, and if they appear at varying times, indicate how soon we might expect to see evidence of their effects.”*

The SAB panel suggests the following edits to improve section 2:

- Change the title to “Defining Differential Impacts.”
- Para 1, Cut after ...policies, programs and activities.”
- Cut Text Box 2.2
- Para 2, Cut after ...implement the Executive Order and also the three bullet points.
- Para 3, Cut first sentence.
- Para 3, Change sentence 2 to ...whether there are differential impacts.
- Para 3, before “Examples of the kinds...” insert “The decision makers will use this to determine if the differences are disproportionate and require agency action.
- Cut the last two paragraphs.

Points of clarification for section 5

- Text box 5.1 is not a good example of qualitative analysis. It is essentially an example of using secondary data. It is unclear to the reader of what this is an example.
- Change the word “statistics” to “data” on p.42.
- A new passage in Section 5.3.1 on presenting qualitative data summaries should be added.
- The emphasis on statistical significance (p.48 and Section 5.4.4) directs attention to analytical precision without sufficient attention to accuracy and bias. This should be emphasized more. The third and fourth concerns in Section 5.4.4 (i.e., non-socioeconomic factors that may have

influenced stressor source location and using distance as a proxy for exposure), is simply too limited in appreciating sources of bias and in understanding the complexity using control variables in multivariate analyses in implicitly defining counterfactuals. Incorporation of co-stressor information should be encouraged.

- The italicized recommendation (p.44 and p.4) should instead say that ‘Analysts should follow best practices appropriate to the question at hand. If infeasible, explain.’
- As Section 5.3 indicates baseline health data, the EJTG should also incorporate other triggers (e.g., for asthma) and co-stressors. This includes incorporating background pollutant concentrations and other potential confounders like indoor pollution concentrations (especially insofar as they co-vary with expected regulatory impacts).
- The EJTG should instruct analysts to provide qualitative and quantitative characterizations of the data used in the analysis, including how pollutants effects arise and margins of safety. Analysts should be advised to provide qualitative or quantitative characterizations of the (differential) effect sizes identified in their analysis.
- The title for Section 5.3 refers to methods to assess EJ concerns, yet frequently refers to *presenting* information (which is not the same as *assessing*). Semantic clarity here would help. Further, Section 5.3.2.1 poses Visual Displays as an analytic method, yet it is not. This important subsection should be relocated.
- The issue of spatial autocorrelation in inferential statistics is common and important to EJ analyses, and it should be elaborated upon in Section 5.4.4 (rather than relegated to footnote 56). The EJTG should include more complete explanations and guidance on how to test for spatial autocorrelation, as well as guidance on how to properly work with spatially auto-correlated data to accomplish reliable statistical measures.
- Sensitivity analyses should be emphasized more. They should be done for all key assumptions. (The “when feasible” qualification is not needed on p.4 and p.44.) This is true generally, and not just a matter of Summary Statistics (p.44) and should not be limited to demographic data resolution (p.44) or comparison group definitions (p.49). For instance, distances and buffers for proximity-based analyses typically merit sensitivity analyses consistent with underlying uncertainty in the model. Analysts should document why sensitivity analyses were not performed.
- Analysts should be guided to characterize uncertainties, especially sampling and modeling uncertainties that might affect findings. EJ analyses should not portray exposures or population data as known with certainty when substantial uncertainty exists.
- An analytical consideration worth mentioning in Section 5.4 is non-environmental and non-health related impacts of EPA rules. This could include accounting for impacts on cultural practices or resources with particularly high value.
- More examples would help, as well as mentioning how the examples described in the EJTG could have been improved by adhering to the guidelines.
- Time-activity information, especially as it differs across comparison groups, should be incorporated into the analysis. The same is true of differential consumption of local natural resources, whether wild or domesticated. Both types of information are required for exposure analysis.
- The EJTG should include the latest references to conducting risk assessment (e.g., EPA 2013, National Research Council 2007).
- The sentence on page 50 that reads: “Analysts will need to examine what the coefficient [sic] estimate implies (e.g., how different is poverty across these geographic areas).” This could be improved to read “Analysts will need to examine what the coefficient estimate implies (e.g., how

different is poverty across these geographic areas), and summarize and report those differences in a manner appropriate for policy relevance.”

- The word “probably” should be struck from Section 5.4.