Responses to Comments Received on IC2 AA Guide Draft Version 1.2

Commenter: Krishana Abrahim-Petrie
Massachusetts Executive Office of Energy and Environmental Affairs

1. Comment:

   Great! I think you should explicitly include "in the context of the AA Guide" or "for the purposes of the AA Guide". It offers clarification based on context.

   Response: It's not clear what this comment is referring to.

2. Comment:

   Another recommendation is to also explicitly spell out "environmental justice" in each instance instead of shortening to "EJ".

   Response: Agreed. Thank you for the suggestion.

3. Comment:

   Remove "Frequently, EJ communities will self-identify as a community, sometimes for the purpose of political organization and action. Assessors should not force the label of an EJ community onto any group."

   a. Avoid this statement as it may be inaccurate. Agreed that assessors should not force the label of an EJ community onto any group but there are great tools in identifying and EJ community and those tools should be used in the AA process. If we leave assessors to allow communities to "self-identify", then we run the risk of leaving behind many disadvantaged populations.

   Response: Agreed. While assessors should not impose labels unnecessarily, there are well established tools for identifying environmental justice communities that can be used under appropriate circumstances. Also, some states have specific statutory definitions of environmental justice communities or disadvantaged communities. We removed these two sentences.

4. Comment:

   Replace with "Assessors should use available mapping tools, such as EPA's EJ Screen and the Climate & Economic Justice Screening Tool (CEJST), as well as any statewide mapping tool, to identify environmental justice populations. It is recommended that the available and up-to-date mapping tools be used in conj0nction with one another, rather than separately.".

   a. You can further explain and link to EJScreen and CEJST if necessary

   Response: The language referenced above is no longer present in the Guide.

5. Comment:

   I would rephrase that "Equity is a step towards achieving environmental justice and is the act of giving fair treatment to individuals."

   Response: The proposed edit is not substantially different from the existing language. We will retain the original wording.

Commenter: Heather McKenney
ChemFORWARD

1. Comment:

   On Pages 69-70, note that ChemFORWARD also provides results of GreenScreen List Translator through our Pharos API. We also include results from regulatory/non-regulatory/RSL list screening. If you would like to highlight this, an example of how this may be included for the reader's benefit is below.

   a. The Pharos Database searches additional hazard lists, restricted substance lists, and regulatory lists and provides information on whether a chemical is found on any of those lists and whether that may be associated with a potential hazard. *Via API to the Pharos Database, ChemFORWARD presents List Translator results as well as hazard list, restricted substance list, and regulatory list screening results which can be accessed via annual subscription.*

   Response: Thank you for the suggestion. The following text has been added at the location you suggested:

ChemFORWARD presents List Translator results from the Pharos Database as well as hazard list, restricted substance list, and regulatory list screening results which can be accessed via annual subscription.

2. Comment:

   On page 74, a link to ChemFORWARD's landing page is missing as a hyperlink (https://www.chemforward.org/)

   Response: We added a hyperlink to ChemFORWARD's landing page.

3. Comment:

   On Page 74, a few suggested updates to ChemFORWARD's program language. It also might be stated that while CF assessments meet level 1, they may be used for level 2 assessments as well, similar to the other examples in this section.

   a. ChemFORWARD is a centralized chemical hazard assessment (CHA) repository created by a nonprofit of the same name. Human and environmental hazard and fate data is presented according to varied GHS-based methodologies, including the Cradle to Cradle Certified® (C2CC®) Material Health Assessment Methodology and GHS. ~~ChemFORWARD evaluates chemicals using human and environmental health and environmental fate hazard traits taken from the Material Health Assessment and GHS~~. Some groups will pay to make ChemFORWARD hazard evaluations publicly available. Those publicly available evaluations will meet the Level 1 criteria provided all the minimum hazard criteria were all included. If the assessor has the expertise to evaluate decisions, ChemFORWARD CHAs may be used for Level 2 Extended Hazard Evaluations as well. For an annual fee, users gain access to hundreds of additional CHAs as well.

   Response: Thank you for the suggestion. The following edits have been made at the location you suggested:

   ChemFORWARD is a centralized chemical hazard assessment repository created by a nonprofit of the same name. For an annual fee, users gain access to hundreds of chemical hazard assessments. Human and environmental hazard and environmental fate data is presented according to varied GHS-based methodologies, including the Cradle to Cradle Certified® (C2CC®) Material Health Assessment Methodology and GHS. ~~ChemFORWARD evaluates chemicals using human and environmental health and environmental fate hazard traits taken from the Material Health Assessment and GHS~~.

Some groups will pay to make ChemFORWARD hazard evaluations publicly available. Those publicly available evaluations will meet the Level 1 criteria provided all the minimum hazard criteria were ~~all~~ included. If the assessor has the expertise to evaluate decisions, ChemFORWARD chemical hazard assessments may be used for Level 2 Extended Hazard Evaluations as well.

4. Comment:

   On page 78, a few suggested updates to ChemFORWARD's program language.

   a. ChemFORWARD provides comprehensive ~~evaluates~~ chemical~~s~~ hazard assessments through a shared digital repository available via subscription or API. The method uses human and environmental health and environmental fate hazard traits taken from the C2CC® Material Health Assessment and GHS that will meet criteria for a Level 2 evaluation. The method also provides a clear and transparent approach to assign an overall score (called a Hazard Band) to the chemical based on the availability and quality of hazard data.

   b. The ChemFORWARD method is updated as needed to reflect changes in the underlying GHSbased methodologies and best practices ~~the Material Health Assessment methodology~~ and is publicly available. ChemFORWARD's process includes an assessment verification by third-party experts to ensure assessment quality. For further details on the method, assessors should refer to the ChemFORWARD website.

   Response: Response: Thank you for the suggestion. The following edits have been made at the location you suggested:

   a. ChemFORWARD provides comprehensive ~~evaluates~~ chemical hazard assessments through a shared digital repository. The method uses human and environmental health and environmental fate hazard traits taken from the C2CC® Material Health Assessment and GHS that will meet criteria for a Level 2 evaluation. The method also provides a clear and transparent approach to assign an overall score (called a Hazard Band) to the chemical based on the availability and quality of hazard data.

   b. The ChemFORWARD method is updated as needed to reflect changes in the underlying GHS-based methodologies and best practices, ~~the Material Health Assessment methodology~~ and is publicly available. ChemFORWARD's process includes an assessment verification by third-party experts to ensure assessment quality. For further details on the method, assessors should refer to the ChemFORWARD website.

Commenter: Alicia Lim
DTSC

1. Comment:

   "Externalized costs can include things like the cost of disposing of hazardous materials during product manufacturing but also the health costs associated with exposure to a hazardous chemical." (pg. 105)

   The cost of disposing of hazardous materials during product manufacturing is an internal cost for the manufacturer.

   Response: Thank you for the comment. This sentence has been edited as follows:

   "Externalized costs can include things like ~~the cost of disposing of hazardous materials during product manufacturing but also the~~ health costs associated with exposure to a hazardous chemical or costs for environmental remediation. These costs are often borne by government or society rather than manufacturers."

2. Comment:

   "Economic impacts are the net costs or savings to manufacturers, importers, downstream users, distributors and consumers in the supply chains for the chemical of concern and alternatives." (pg. 107)

   Yes, these are economic impacts, but economic impacts more typically refer to benefits such as increased incomes or tax revenues as the result of increases in demand for a product or service and the associated economic ripple effects. (The first level of economic impacts (direct and indirect) are to businesses, and then the next level of impacts are to society (e.g., employees, government revenues, etc.))

   Response: Thank you for the comment. It may be true that the term "economic impacts" is typically used in a slightly different way than how it is explained on pg. 107. However, the working definition on pg. 107 aligns with the way the term is used throughout the IC2 AA Guide, and it also parallels the way that terms like social impacts, health impacts, and environmental impacts are used. We will retain the original wording.

3. Comment:

   "Social impacts are the relevant impacts that may affect workers, consumers, and the public not covered under health, environmental, or economic impacts. Examples may include employment, working conditions, job satisfaction, education of workers, and social security." (pg. 107)

   Question – Does the author mean US Social Security or 'social security' generally?

   Response: The intended meaning is general, rather than the specific U.S. federal benefit program.

4. Comment:

   "The Level 2 evaluation can help the assessor identify alternatives where external pressures increase the cost-effectiveness." (pg. 107)

   I suggest changing the text to "increase or decrease the cost-effectiveness."

   Response: Thank you for the suggestion. Taken in the context of the preceding sentence, "increase" is more relevant than "decrease." The sentence has been edited as follows:

   "The Level 2 evaluation can help the assessor identify alternatives where external pressures increase (or decrease) the cost-effectiveness."

5. Comment:
   In Level 2 and higher Levels under "What resources and knowledge are required to use this level?", I suggest adding some of the basic tools and resources that can be used to perform basic economic impact modeling (e.g., RIMS II multipliers, IMPLAN economic impact modeling software).
   https://apps.bea.gov/regional/rims/rimsii/?_gl=1*15n1qzz*_ga*Njg1MDEwOTc3LjE3MDg0NTg3Nzc.*_ga_J4698JNNFT*MTcwODQ1ODc3Ni4xLjAuMTcwODQ1ODc3Ni42MC4wLjA.

   https://implan.com/

   Response: Thank you for the comment. We will consider this for future updates of the Guide.

6. Comment:

In several parts of the module, the author implies that demand will necessarily increase for the product if a safer alternative is found. Other factors, such as price, may drive down demand.

Response: It is unclear what specific sections of the text this comment refers to. Most of the discussion of demand in the Cost and Availability Module refers to the idea that while an alternative may not currently be cost-competitive, it may become cost-competitive in the future if demand for it increases. We made no changes in response to this comment.

7. Comment:

   In the "Advanced: Full Cost/Benefit Analysis Evaluation" section the author implies that every full cost/benefit analysis includes life cycle considerations. This is not the case; shorter time frames can be examined with full CBAs.

   Response: Thank you for the comment. The intent of performing a full cost/benefit analysis as part of an AA is to include life cycle considerations. We made no changes in response to this comment.

8. Comment:

   There are some typos throughout the modules.

   Response: Thank you for the comment. We reviewed the document and corrected all typos we could find.

Commenter: Rebecca Stam
Healthy Building Network

Firstly, the set of updates to the Guide are great additions. Clearly a lot of time and effort was spent on this – thank you for this work.

At a high level, the below suggestions are around 1) ensuring feedback on the updates from EJ communities, 2) some additional edits throughout to highlight the broad definition of alternatives, and 3) some additional resources/links.

Red text indicates suggested additions to quoted text. Strikethrough indicates suggested removal from quoted text.

1. Comment:

Has the update process involved getting input/specifically engaging with any EJ groups/communities? If not, it would be good to engage on the development of this document, as is recommended to engage within an AA — consider Coming Clean and EJHA.

Response: Thank you for the comment. We will keep this under consideration for future updates of the Guide.

2. Comment:

The Golden rule on page 3 could be clarified to include the expanded substitution approach, something like - "The objective of an alternatives assessment is to replace chemicals of concern in products or processes with inherently safer alternatives (including different product or process alternatives that provide the same service to society), thereby protecting and enhancing human health and the environment." or "The objective of an alternatives assessment is to replace chemicals of concern ~~in products or processes~~ with inherently safer alternative~~s~~ chemicals, products, or processes, thereby protecting and enhancing human health and the environment."

Response: Thank you for the comment. We made the second version of the proposed edit.

3. Comment:

Page 3 - include communities across the life cycle - "Life cycle thinking: All decisions made should reflect a broad perspective and include consideration of the full life cycle of the product. Impacts to workers, communities, consumers, and the environment across the life cycle and the supply chain should all be considered."

Response: Thank you for the comment. We made the suggested edit.

4. Comment:

In terms of Unintentionally added chemicals of concern (p19)

1.B. Are other chemical sources available without the by-product, impurity, or contaminant?

The process notes that if the by-product or impurity is eliminated, then no AA is necessary. One of the examples is that "Dioxane may be removed by means of vacuum stripping at the end of the polymerization process" — if the chemical of concern contaminant is removed through processing, that chemical could still exist and need to be disposed of, correct? Would that not

still have life cycle concerns that should be considered as to whether there are safer alternatives?

Response: Indeed, there may be life cycle concerns associated with vacuum stripping of 1,4-dioxane during surfactant production. But this is still a useful example for thinking about how to avoid unintentionally added chemicals of concern. Life cycle concerns are addressed extensively in the Life Cycle Module. We opted to make no change in response to this comment.

5. Comment:

   Tools for functional use data (p23): consider adding Pharos - https://pharos.habitablefuture.org/ Includes functional use data from a wide range of sources. Can search by functional use or view functional uses by chemical or compound group.

   Response: Thank you for the comment. We made the suggested edit.

6. Comment:

   P58 Example alternatives — it may be helpful here to include an example of an alternative type of product to again draw attention to that as an option. E.g. If the chemical group you want to phase out is orthophthalates used in vinyl flooring an alternative type of resilient flooring product that avoids orthophthalates is linoleum flooring.

   Response: Thank you for the comment. We added this suggestion to the list of Example Alternatives on p. 58, as below:

   "Vinyl flooring containing orthophthalates can be replaced with linoleum flooring."

7. Comment:

   P69 reference to Healthy Building Network and Pharos - HBN is changing our name on April 3, 2024. If the final version of the guide will be released after this date, could you please include this update if possible?

   a. "Habitable (formerly Healthy Building Network) incorporated GreenScreen® List Translator into its Pharos Database, which can be accessed for an annual fee."

   b. In addition, the blue text is not currently linked, here are the links

      i. https://healthybuilding.net/ (will redirect to the new Habitable site)

ii. https://pharosproject.net/

Response: Thank you for the comment. We made the suggested edits.

8. Comment:

   It may be helpful to add some guidance on how to compare things that are not just a drop in chemical replacement — i.e a different material or type of product or alternative solution. I see in the Life Cycle Module it says to compare at the product level, but there are likely other places this would be important. To use the example from above, if you are considering linoleum flooring as a functional alternative that avoids orthophthalates in vinyl flooring, guidance on how to fairly compare these two — you would not the orthophthalate hazards to the formulated linoleum product, but the overall vinyl flooring product to the linoleum product - comparing based on the level of functionality being replaced.

   Response: This is an important point but one that is beyond the scope of the updates being made to the Guide for version 1.2. We will keep this under consideration for future updates of the Guide.

9. Comment:

   Performance evaluation module, p90 - consider adjusting language in Table 5 to allow for the functional substitution of more than just the chemical. E.g "Basic Performance Evaluation: Uses a few, very basic questions about whether the alternative performs the required function in the product, process, or to society."

   Response: Thank you for the comment. We agree with this idea and decided to implement it by removing the words "in the product" instead of adding "process, or to society", as below. We made this edit in the descriptions for both Level 1 and Level 2.

   "Uses a few, very basic questions about whether the alternative performs the required function ~~in the product~~."

   "Determines whether the alternative performs the required function ~~in the product~~."

10. Comment:

    Social Impact Module Resources (p 167) - consider adding Case Studies here: https://healthybuilding.net/reports/24-chemical-and-environmental-justice-impacts-in-thelife-

cycle-of-building-insulation - for examples of quantitative measures of some environmental justice impacts.

Response: Thank you for the suggestion. We've added the suggested report to the list of Resources and described it as follows:

"Chemical and Environmental Justice Impacts in the Life Cycle of Building Insulation": A case study that includes examples of quantitative measures of some environmental justice impacts."

Commenter: Madeline Goodhart
American Chemistry Council

Introduction

The American Chemistry Council appreciates the opportunity to comment on the Interstate Chemicals Clearinghouse (IC2) draft IC2 Alternatives Assessment (AA) Guide v1.2 (the Guide). ACC represents the business of chemistry in the United States. Our industry is at the forefront of creating groundbreaking products that are improving the world all around us by making it healthier, safer, more sustainable, and more productive.

Summary

Alternatives assessments are not only a tool used by regulators to identify safer and more efficient alternatives to a chemical of concern but are also used by industry to improve product performance, circularity, cost, and more. Alternatives assessments should be holistic, risk- and science-based, and cover a product under a condition of use. An alternative identified by an assessment should not only have an improved safety and environmental profile, but also should be technologically and commercially feasible, of comparable cost, and maintain or improve product efficacy, performance, and usability. ACC agrees that the AA process should have some level of standardization in order to make requirements and expectations clearer for government-mandated AAs and improve the overall quality of alternatives assessments conducted. With that in mind, a 'one size fits all' approach cannot accommodate the complexities of all the categories of products and their use applications. Therefore, any standards or guides on alternatives assessments should be flexible.

General Comments

1. Comment:

   Development and Communication of Revisions. As is stated in The Guide, it is important to reach out to stakeholders early in the AA process. However, it appears that no industry stakeholders were involved in the development of the revised Guide. Industry stakeholders

have unique insight on many aspects of a successful alternatives assessment and often undertake assessments of their own as a result of competition and product development. Leaving out industry, who are likely to be performing these government-required alternatives assessments (such as in the CA Safer Consumer Products Program), in the formation of such a guide, leaves out an important stakeholder at the earliest point in the process.

The bulleted summary at the start of the draft revisions document is a good start to communicating what has been changed in the revisions, but a more detailed and side-by-side analysis of the changes would have been much more useful. Especially for those who are not as familiar with the previous versions of the Guide, it would be incredibly helpful to have a redline of the changes made in this version.

Response: Thank you for the comment. The intended audience of the IC2 AA Guide v1.2 is governments, rather than businesses. Thus, it is appropriate that this update to the Guide was developed largely by staff from IC2 member agencies. The Safer Consumer Products Program in California has distinct requirements for its Alternatives Analysis process and the IC2 AA Guide is not intended to provide guidance for meeting those requirements. It is well noted that detailed redlines of the proposed edits to the Guide would be useful. We will take this into consideration for future updates.

2. Comment:

Environmental Justice Considerations. Throughout the Guide, IC2 provides prompts to address Environmental Justice (EJ) issues in the alternatives assessment process, including general direction to "include environmental justice in alternatives assessment to assure that the process authentically and meaningfully consults people who have historically experienced or are currently experiencing environmental injustice; safeguards against the introduction of new or different burdens among disproportionately impacted populations; and supports identifying alternatives that benefit communities harmed by the chemical under assessment."2 ACC recognizes the importance of EJ considerations in public health policy decisions and strongly encourages all associated decisions to be made in a way that prioritizes principles of transparency, certainty, risk-based criteria, and best available science. However, we are concerned that as currently drafted, the IC2 Guide fails to provide appropriate detail and justification for the consideration of EJ issues in this context. As such, the language presents a speculative and ambiguous attempt to address EJ issues in areas where questions or concerns may not exist, or at a minimum have not been properly articulated. ACC offers the following recommendations for IC2's consideration as it moves forward with development of the Guide.

   a. Terms and Definitions. In its discussion of EJ considerations, IC2 defines "disadvantaged and/or vulnerable populations" as those that "have been overburdened or

disproportionately impacted by exposure to toxic chemicals" or otherwise may be more susceptible to various health effects from potential exposures.3 Any thoughtful consideration of EJ issues in initiatives like the AA framework must be supported by clear descriptions, well-defined terms, and detailed definitions with supporting criteria that help establish the parameters for such EJ-focused considerations. However, while IC2's aim to address EJ issues in potential EJ communities is admirable, its definitions and operative criteria lack sufficient detail and create ambiguity. The result is a speculative framework that provides little to no clear direction on where appropriate EJ considerations should be targeted. In the absence of clear criteria, IC2 risks creating an ineffective and inefficient framework for the Guide's utility and application.

Additionally, the Guide often ambiguously references various types of "health impacts" or "new or different burdens" as considerations to help identify EJ communities and potential new alternatives. For example, the Guide notes that assessors can use "negative health impacts" in combination with a communities' "health experience" to avoid potentially burdensome alternatives.4 The IC2 provides scant other details that would inform assessments of hazard beyond these considerations and references to existing screening lists. Once more, the result is a speculative and general recommendation that fails to provide sufficient detail to inform credible, science-based decisions on chemical usage and alternatives.

ACC believes that any consideration of impacts or potential stressors in an EJ context should be based upon sound science, validated, publicly available data, and recognized and validated analytical methodologies to achieve consistency in the evaluation process. Not all data is appropriate for use in terms of quality, relevance, and reliability. When considering the potential impacts as part of its EJ considerations, ACC strongly encourages IC2 to provide additional clarity, specific language, and transparency regarding the consideration process to increase certainty and overall understanding of the AA process in this context. Without appropriate considerations, the Guide could result in an AA process that is overly broad and ambiguous and fails to address relevant impact or scientifically credible risk.

Response: Thank you for the comment. We will consider this for future updates of the Guide.

b. Public Involvement. Throughout the Guide, IC2 recommends that assessors engage the public and various stakeholders through the AA process to "promote transparency" and actively address EJ issues.5 As stated above, it is unclear that a sufficient concern

around public engagement has been established to warrant such a consideration. As an example, IC2's framework fails to appropriately consider the outreach activities that may already occur in coordination with similar goals. For instance, industry often proactively engages local communities for constructive information-sharing opportunities. ACC has long held that community input is paramount to being a good corporate citizen. Many of our member companies host Community Advisory Panels (CAPs) where industry, neighbors, community members, first responders, and elected officials come together to communicate, exchange information, and promote transparency with one another. These CAPs have proven to be a successful method to address community concerns and share information about operations at nearby manufacturing facilities. IC2 should provide a fuller consideration of existing vehicles for public engagement like CAPs, where local facilities may already be engaged with their communities in a meaningful and effective way. This may help to avoid duplicative activities that would achieve the same purpose.

Response: Thank you for the comment. We support ACC member companies' efforts to engage with their local communities. However, the intended audience of the IC2 AA Guide v1.2 is governments, rather than businesses. As such, we are making no changes in response to this comment.

3. Comment:
   Many Resources but Few Sources. The Guide links many helpful resources for readers to better understand aspects of an alternatives assessment; however, there is a critical lack of cited scholarly works to support assertations throughout the Guide.

   Response: Thank you for the comment. We will take this into consideration for future updates.

4. Comment:
   Insufficient Consideration of Consumer Acceptance. In order for an alternative to have an impact on consumers, it must be sufficiently analyzed for consumer acceptance. Consumer choice is a foundational concept for conducting a cost-benefit analysis. The only explicit reference to considering consumer acceptance is in the performance evaluation model.6 Consumer acceptance helps ensure that the product will actually be used by consumers, therefore achieving substitution with a safer alternative, and that the alternative can be as economically feasible as the existing product. The Guide should highlight the importance of consumer acceptance and provide more guidance on the topic.

Response: The concept of consumer acceptance is an inherent part of performance, cost and availability. The performance module includes guidance on engaging with product users (i.e. consumers) to identify performance requirements. We made no changes in response to this comment.

5. Comment:
   Challenges with Value Chain Stakeholder Engagement and Lack of Confidential Business Information Guidance. ACC agrees that stakeholder engagement is vital and should be part of the process as early as possible. It is also important to give ample time for stakeholders to consolidate any information requested by the assessors. Comment periods or call for information deadlines should be sufficiently long for stakeholders to thoroughly gather relevant information. The Guide calls for lifecycle thinking when identifying stakeholders, which will help capture important stakeholders down the value chain. The Guide should offer suggestions on how to increase stakeholder engagement when there is no obligation for involvement by the value chain. It is difficult to get value chain input, not only because they may not know their product will be affected, but also because there may be proprietary information requested that stakeholders will be hesitant to share. This would also help promote a more comprehensive approach to overall product design, safety and performance that is essential for an effective AA process, as emphasized elsewhere in these comments.
   The Guide highlights transparency as one of its main principles, which is an important aspect of any scientific assessment. It does not, however, give any guidance on protection of confidential business information (CBI). The Guide should consider CBI protection as it will impact how stakeholders engage with the assessor and the quality and quantity of data collected for the alternatives assessment. The Guide should ensure that all CBI submitted is appropriately protected and include: 1) established process and procedures for protecting this information, 2) ensuring that any of contractors that review the information do so under a separate confidentiality agreement; and 3) notifying the submitter if any information submitted as CBI does not meet criteria for protection.

   Response: The Guide acknowledges that it may be difficult to get input from some stakeholders. For example, a bullet on p. 30 states, “If stakeholders cannot be engaged with, document the reason why. Seek out research or other literature from trusted sources that document potential concerns from these stakeholders.” The need to handle confidential business information with care is well noted; we will take this into consideration for future updates to the Guide.

Specific Comments

6. Comment:
   Identifying Potential Alternatives. The Guide states that when identifying potential alternatives, "the widest range of possible alternatives should be researched."6 It should elaborate that if an assessor chooses to pursue non- "drop-in" alternatives, they must consider the extra costs and infrastructure that could come with changing the process if necessary for such an alternative, and who would bear the burden of the increased cost.

   At the screening stage it is important to conduct a robust assessment of potential alternatives. Conducting this analysis at this stage in the identification of alternatives will save valuable time, focus the scope of any AA and help avoid regrettable substitution. Key considerations for the assessment of alternatives include:

   - The safety and efficacy of alternatives.
   - The ability of the alternative to provide equivalent functional performance. This includes whether an alternative can meet relevant product and performance standards.
   - The regulatory environment for the identified alternatives as well as broader circularity and safety considerations relevant for product design related to the available alternative.
   - The technical and economic feasibility of deploying alternative technology. "Feasibility" under the National Academy of Sciences (NAS) Alternatives Assessment Framework 7 includes an analysis of both technical feasibility and economic feasibility. Technical feasibility requires a demonstration that a substitute chemistry or formulation provides equivalent or better performance for the relevant performance criteria for a particular product. In any given class of chemistry, different individual chemistries may be used or marketed for different applications with different levels of necessary performance. For example, marine paint, outdoor paint for a bridge, outdoor paint for a building, and interior paint for a kitchen, may have performance requirements that differ significantly. The process for evaluating potential alternatives should include both technical and economic feasibility.
   - The availability of the alternative including: 1) the approximate cost and availability of other materials that may be required for use of the potential alternatives including required product design changes, 2) the approximate costs and supply chain implications for redesigning the product, including product testing and recertification, and 3) how long would it take the relevant company/industry to transition.

   Given the importance of robustly assessing alternatives to inform effective outputs and avoid regrettable substitution, the guidance should explicitly require screening related to hazard, risk

and performance. This would further help “concentrate potentially limited resources on the most viable alternatives.”

Response: The Guide includes modules addressing hazard, performance, cost and availability, and more. We agree that assessing these aspects of potential alternatives early in the process can save time, focus the scope, and help avoid regrettable substitution. To that end, the Guide’s process for Identifying Alternatives includes an optional initial screen using the lowest levels of the Hazard and Performance Evaluation modules. As stated in the Guide, “the advantage of these screens is they concentrate potentially limited resources on the most viable alternatives.”

7. Documenting Outcomes and Conclusions. There is the likely possibility that an alternative does not exist. One option the Guide suggests is to use the results to inform research into finding an alternative.8 Another option could be to evaluate exposure controls to reduce the overall risk of the existing chemical. The Guide should include a step to consider existing exposure controls. A risk-based approach for alternatives assessment would help identify these opportunities.

   Response: The Guide section on Documenting Outcomes and Conclusions does recommend consideration of exposure controls in cases when an AA does not identify any safer alternatives. The Exposure Assessment Module contains instructions for determining whether the alternative is likely to pose a greater exposure risk to human health and the environment than the chemical of concern. By design, the Exposure Assessment Module is used after the Hazard Module. As the Guide states, “by applying hazard screening first, one can narrow down the options to those that represent the lowest risk as having both the lowest hazard AND the lowest exposure potential. These are preferred alternatives.”

8. Expanding the Hazard Module to Include a More Comprehensive Assessment of Hazard and Risk. To advance effective alternatives assessments and help avoid regrettable substitution, it is imperative that the hazard module consider a broader range of factors.

   Any potential alternative should undergo a thorough safety assessment to help avoid regrettable substitution. Such analysis should be conducted on a life-cycle basis. Mere consideration of the hazard characteristics of a chemical is not sufficient so a more comprehensive environmental health and safety analysis is required. IC2 should also consider sustainability impacts in criteria, including water use, consumption of raw materials, emissions reduction, energy efficiency, reliability during use, and avoiding the use of landfill capacity. IC2 should include an evaluation for increased product or product component failure. Most

importantly, criteria developed for testing alternative products should seek to reduce potential for risk to human health and the environment.

The Guide should take hazard, exposure, and risk into account in its alternatives assessment process. The Organization for Economic Co-operation and Development (OECD) Alternatives Assessment framework9 defines "safer alternative" to mean "a chemical, product, or technology that is preferable, in terms of both hazard and potential for exposure to humans and the environment, than the existing option. Evaluating comparative hazard and exposure is an element of the process." In this framework, the OECD notes the "process of determining whether a chemical, product, or technology is 'safer' consists of three key steps: comparative hazard assessment, comparative exposure assessment, and integration of hazard and exposure information." To avoid regrettable outcomes, both the OECD and NAS alternative assessment frameworks recommend the use of comparative exposure assessment. The alternatives assessment framework also considers broader sustainability factors and evaluates performance, technical feasibility, and economic feasibility before a conclusion may be reached regarding a preferred alternative. A hazard-only approach is not a best practice for alternative assessment.

Response: We agree that evaluation of exposure is an important component of an alternatives assessment. The Guide includes a required Exposure Assessment Module for this purpose. As the Guide states, this module

> "evaluates potential exposures and determines whether the alternative is likely to pose a greater exposure risk to human health and the environment than the chemical of concern. It is used after the Hazard Module to reduce risk. By applying hazard screening first, one can narrow down the options to those that represent the lowest risk as having both the lowest hazard AND lowest exposure potential. These are preferred alternatives."

We also agree that consideration of a range of sustainability attributes, across the lifecycle of the product, is useful in alternatives analysis. Consideration of such attributes is built into the Hazard Module, the Cost and Availability Module, the Materials Management Module, and the Life Cycle Module of the Guide.

The Guide is designed to be an adaptable tool, and one of its goals is to replace chemicals of concern with safer chemicals regardless of exposure and risk.

9. Performance Module. Considering performance is critical and will advance a more effective AA. The performance module should be expanded further to include overall Product Design, Safety, and Sustainability Factors. Effective evaluation of uses should include the multiple factors that are important for overall product design and performance, including critical attributes related

to efficacy and sustainability. The absence of a robust and holistic assessment process will likely foster regrettable substitution and detract from some of the underlying objectives of the assessment. Moreover, there are a host of sustainability issues to consider in the context of electronics product design and performance, including energy efficiency, durability, light, weighting, and material selection, among other factors. Failure to consider these factors could ultimately impact product safety, performance, sustainability, and innovation. Active engagement with the actual end-users will be important, as emphasized in the Stakeholder Engagement section of these comments.

While it is referenced in the revised Guide, this module should also more explicitly require consideration of existing product codes and standards. There are numerous existing codes and standards that help inform and guide overall product design and performance. In addition, it is important to recognize that these are often viewed as minimum requirements for many Original Equipment Manufacturers (OEM) and that overall performance and safety can often go beyond these standards for specific applications. Changes in product design may affect the ability to meet certain standards and/or require product redesign, re-sourcing, re-testing and recertification.

Response: Thank you for the comment. We agree that codes and standards are important considerations. We added the following text to the Performance Module to emphasize this point.

> "It is also important to consider existing industry or product codes and standards when evaluating safer alternatives. These can include important information related to safety, product design, performance, and regulatory requirements for use within industry or the development of products. Codes and standards may also include important sustainability considerations."

10. Cost and Availability Module. This module should include an assessment of the technical and economic feasibility of deploying alternative technology. "Feasibility" under the National Academy of Sciences (NAS) Alternatives Assessment Framework, which includes an analysis of both technical feasibility and economic feasibility. Technical feasibility requires a demonstration that a substitute chemistry or formulation provides equivalent or better performance for the relevant performance criteria for a particular product. In any given class of chemistry, different individual chemistries may be used or marketed for different applications with different levels of necessary performance.

    In terms of cost, one should not assume that the adoption of an alternative will be cost neutral in terms of the manufacturing process. Critical cost considerations, including retooling

production facilities, changes in production yield, workforce training, and disposal costs should be factored into alternatives. The Guide should also consider the substantial cost associated with replacing products more frequently due to relatively less durability. There will also be broader supply chain costs and impacts to consider.

As noted in our comments, the availability/economic feasibility analysis must consider costs other than price as part of the availability analysis. A substitute chemistry may require process or equipment changes; labor force changes; raw material sourcing changes; and so forth that impact the total cost of the substitution well beyond what an equivalent or similar price is for purchase of the chemical would be.

Evaluation of cost and availability should consider whether any potential substitution will be available at scale during the time for transition. If an entire industry were to switch on a short timescale from one chemical to another, this would create significant scale-up pressures on existing manufacturers and relevant supply chains. This is even more relevant for complex products which have multiple components and require product testing to confirm they meet designated safety and performance standards. In these cases, products must be carefully redesigned, reengineered, and recertified. Such product redesign and recertification processes for complex sectors may take several years so the lead time for these changes needs to be factored into the assessment. The risk of global supply chain disruption from discontinuation of the availability of a commercially important chemical without adequate due diligence with respect to the availability of alternatives can have real and significant consequences.

Response: Thank you for your comment. We acknowledge that factors related to manufacturing can significantly affect the cost of adopting an alternative. These cost impacts are often difficult to quantify, but they should be considered when possible. We made the following edit on p. 103 to address this point.

> "An assessor may want to define cost effectiveness by including manufacturing related costs associated with adopting the alternative, including equipment purchases, retooling production facilities, and workforce training. ~~This a~~An assessor may also want to ~~define cost-effectiveness by looking~~ look beyond the price of an alternative to include society-wide costs and benefits switching."

Technical feasibility is addressed in the Performance Module.

11. Exposure: Hierarchy of Exposure Controls. The Guide states that "Elimination and substitution can best be applied when the product or process is still open to design and/or development and may be the most inexpensive and simplest to implement from the exposure perspective."10 Not every chemical in every condition of use is in the design and development phase and many

existing chemicals have been in use for many years. Substitution and elimination would be the most difficult in these circumstances. The cost and ease of implementation is heavily dependent on the chemical and process. An entire process may need to be changed and infrastructure rebuilt in order to eliminate or substitute a chemical.

Response: We agree with this comment and believe it is in keeping with the quoted text from the Guide. We made no changes in response to this comment.

12. Materials Management Module This is an important module that helps advance broader life-cycle considerations. As noted in our comments, some preliminary screening earlier in the process in the "identification of alternatives" stage would be helpful to further focus the scope of the AA.

    Response: We appreciate this comment and acknowledge the need to review the Materials Management Module Module. We will do that during the next review.

13. Social Impact Module. As noted, this module helps increase broader life-cycle considerations in the Guide. The Social Impact Module should be expanded further to include other socio-economic considerations. While some of these concepts are captured in the Materials Module, additional consideration in this module of these socio-economic factors will be important. Key additional considerations for this section include other economic, social, circularity and sustainability factors such as comparative water use, consumption of raw materials, emissions reduction, energy efficiency, reliability during use, etc.

    Response: We appreciate your feedback and acknowledge that these are very important factors. We believe we address most of these under the Materials Management Module and the Life Cycle Assessment Module. We made no changes in response to this comment.