



REPORT

SELECTING SAFER ALTERNATIVES TO TOXIC CHEMICALS AND ENSURING THE PROTECTION OF THE MOST VULNERABLE: A DISCUSSION DRAFT



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About CHANGE

CHANGE is a broad-based coalition of more than 30 environmental and environmental justice groups, health organizations, labor advocates, community based groups, parent organizations, and others working to change chemical policies for the protection of workers, children, public health, the environment, and the economy. www.changecalifornia.org.

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I. Executive Summary

Over the last decade, scientists have developed methods called alternatives assessment to create a comprehensive approach to identifying safer chemicals, materials, and processes. Practitioners use the alternatives assessment process to help to avoid “regrettable substitutions”—the replacement of a known toxic chemical with another that proves to be equally or more harmful to human health or the environment. For example, the chemical diacetyl, used in butter flavoring for microwave popcorn, caused disabling and irreversible lung disease in workers. After companies replaced diacetyl with a similar chemical that was thought to be safer, researchers discovered that the replacement chemical also caused lung disease.

As in this example, regrettable substitutions can particularly affect vulnerable populations that are sometimes harmed first by the original toxic chemical and then by its substitute. For the purposes of this project, “vulnerable populations” are defined as those that:

- have been disproportionately impacted by toxic chemicals; and/or...
- have an increased likelihood of adverse health effects from toxic chemicals due to greater susceptibility and/or exposure; and/or...
- have been, and continue to be, marginalized and excluded from processes and decisions that affect them.

These populations include those that are exposed to toxic chemicals in their workplaces; low-income communities; communities of color; fence line neighborhoods; communities that rely on subsistence for at least a portion of their diet (such as indigenous people of the Arctic); and infants, children, and pregnant women.

Recent reforms to federal and state chemicals policies focus on stronger evaluations and restrictions of toxic chemicals and may help to better protect vulnerable populations. Nevertheless, the many examples of regrettable substitutions that have disproportionately impacted vulnerable populations demonstrate that decision-making processes to date have fallen short. (Examples are provided in Section 3.)

Alternatives assessment frameworks outline a process for identifying, comparing, and selecting safer alternatives. These frameworks provide detailed guidance on data-driven parts of the process, but generally do not provide sufficient guidance for decision making that involves societal value judgments.

The purpose of this discussion paper is to generate initial guidance to address gaps related to protecting vulnerable populations in the process of alternatives assessment. Our discussion is grounded in the principle of health equity, a fundamental value and priority in public health that encompasses the protection of vulnerable populations.





To begin this dialogue, we interviewed five leaders working at the intersection of environmental justice, public health, and chemical policy to understand their viewpoints on how vulnerable populations can be protected via the alternatives assessment process.

Three major themes emerged from these interviews. These themes describe critical elements that affect decision making relevant to vulnerable populations during the alternatives assessment process:

1. **Access to information and information quality:** who has access to information, and the completeness/ accuracy of the information.
2. **Genuine stakeholder engagement:** the need for affected communities to be engaged throughout the process to maximize protection of vulnerable populations.
3. **Explicit accounting of the consequences of trade-off decisions, including:**
 - Differential exposures, including legacy exposures and disproportionate impacts, and how these are factored into decisions around alternatives
 - Who has the power to make decisions about what trade-offs are acceptable
 - The relative weighting of human health and environmental impacts in trade-off decisions.

To integrate the findings of this research with current practice, we used the framework of the Commons Principles for Alternatives Assessment (Commons Principles). Developed by scientists, advocates, funders, and policy makers, and published in 2013 with more than 100 signatories, the Commons Principles reflect a consensus on the general principles that should guide an alternatives assessment. Our interviewees observed that equity and the protection of vulnerable populations are not explicitly encompassed. In Section 6, we consider how the Commons Principles could incorporate these themes, and we suggest additional language that can serve as guidance.

We also identify some key areas of focus for practitioners who wish to integrate these findings into an alternatives assessment process. These focus areas include the following goals:

1. Ensure that persistent, bioaccumulative, and toxic chemicals are not selected as alternatives.
2. Ensure that chemicals posing serious chronic health hazards are not selected as alternatives.
3. Define a minimum data set needed to evaluate alternatives.
4. Understand the complete product life cycle in order to evaluate trade-offs.
5. Promote public communication of information regarding chemicals in products.
6. Require economic and social impact analysis to make trade-offs visible.

More work is needed to describe how to incorporate these concepts into alternatives assessment research and practice. We hope that this discussion draft will serve as the foundation for further discussion among alternatives assessment practitioners, environmental health advocates, the business community, and policymakers. We envision an alternatives assessment process that engages and empowers vulnerable populations, avoids regrettable substitutions, and ultimately improves the health and lives of those who are most impacted by toxic chemicals.

2. Introduction: Toxic Chemicals Continue to Disproportionately Impact Vulnerable Populations

In 1987 the seminal report “Toxic Wastes and Race in the United States” documented the disproportionate toxic burdens faced by communities of color.¹ A 2007 follow-up report² illustrates that little progress has been made on this issue. Research continues to document that vulnerable populations face disproportionate exposure to toxic substances via ambient outdoor pollution,³ worker exposures,⁴ drinking water,⁵ certain foods⁶ and products,⁷ and the built environment⁸ in these communities.

For the purposes of this project, “vulnerable populations” are defined as those that:

- have been disproportionately impacted by toxic chemicals; and/or...
- have an increased likelihood of adverse health effects from toxic chemicals due to greater susceptibility^{a,9} and/or exposure; and/or...
- have been, and continue to be, marginalized and excluded from processes and decisions that affect them.

These populations include those that are exposed to toxic chemicals in their workplaces; low-income communities; communities of color; fence line neighborhoods; communities that rely on subsistence for at least a portion of their diet (such as indigenous people of the Arctic); and infants, children, and pregnant women.

Weaknesses in chemical laws, including the federal Toxic Substances Control Act, have allowed this disproportionate burden to continue for many years. This law was updated in 2016, following a decade of work by numerous organizations to improve the safety of chemicals and better protect vulnerable populations through policy reform. It remains to be seen, however, how the law will be implemented and whether it will lead to increased protection of human and environmental health.

According to the Louisville Charter for Safer Chemicals, published by the Coming Clean Workgroup for Public Policy Reform in 2005, chemical policies should address six key principles to effectively “regulate chemicals and shift the economy to safer products and clean production:”

1. Require Safer Substitutes and Solutions
2. Phase Out Persistent, Bioaccumulative, or Highly Toxic Chemicals

3. Give the Public and Workers the Full Right-to-Know and Participate
4. Act on Early Warnings
5. Require Comprehensive Safety Data for All Chemicals
6. Take Immediate Action to Protect Communities and Workers.¹⁰

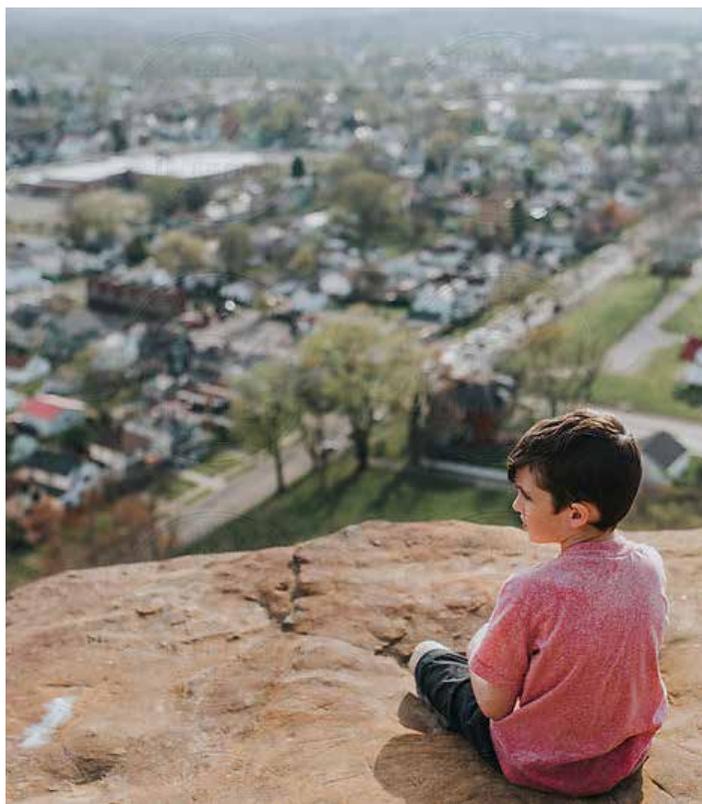
The first element of the Charter, “Require Safer Substitutes and Solutions,” is critical to solving the toxic chemical problem and avoiding regrettable substitutions. A regrettable substitution is defined as the replacement of a known toxic chemical with another that proves to be equally or more harmful to human health or the environment. Regrettable substitutions often disproportionately affect vulnerable populations that are harmed first by the original toxic chemical and then by its substitute. When a toxic chemical is phased out only to be replaced by a harmful substitute, we have not achieved the goal of improving human and environmental health. In addition to the human health and environmental costs, regrettable substitutes also impact the businesses that invest in them only to discover later that they need to find a different solution.

Alternatives assessment plays a central role in breaking the cycle of regrettable substitutions. Alternatives assessment is a process for identifying, comparing, and selecting safer alternatives to chemicals of concern (including those in materials, processes, or technologies) on the basis of their hazards, performance, and economic viability. The terms “alternatives assessment” and “alternatives analysis” are both used to refer to this process or parts of it.^{b,11} The primary goal of these methods is to reduce harm to human health and the environment by providing a comprehensive approach to identifying safer chemicals, making informed decisions, and avoiding regrettable substitutions. This discussion draft focuses on the question of how to ensure that vulnerable populations are protected in the practice of alternatives assessment.

In 2014, the National Academy of Sciences (NAS) published a report, *A Framework to Guide Selection of Chemical Alternatives*, that reviewed current approaches and provided a detailed decision framework for evaluating potentially safer chemical alternatives.¹² The NAS report noted that an alternatives assessment includes two kinds of elements: (1) those that are data-driven (using information

^a Biological traits, chemical and non-chemical stressors can contribute to increased susceptibility to health impacts from toxic exposures. An example of a biological susceptibility is the sensitivity of pregnancy and early life to developmental and reproductive toxicants, because these are periods of rapid growth and development.

^b The UCLA Sustainable Technology and Policy Program defines alternatives analysis as “an emerging scientific method for identifying and determining the viability of safer substitutes for hazardous chemicals, products, or industrial processes.” In this definition, alternatives analysis is a two-step process. In the first step, known as alternatives assessment, potential alternatives are identified and compared to the hazardous product/process with respect to a set of key criteria. The second component of alternatives analysis is alternatives evaluation, conducted after the alternatives assessment is completed.



within the principle of health equity, is a fundamental priority and value in public health.¹⁷ Health equity “is the value underlying a commitment to reduce and ultimately eliminate health disparities. Health equity means social justice with respect to health and reflects...ethical and human rights concerns... Health equity means striving to equalize opportunities to be healthy.”¹⁸ The principle of health equity is grounded in the ethics of justice, which requires the fair distribution of benefits and burdens.¹⁹ As explained in the Oxford Textbook of Global Public Health:

This account of justice has the aim of bringing about the human good of health for all members of the population. An integral part of that aim is the task of identifying and ameliorating patterns of systemic disadvantage that profoundly and pervasively undermine prospects for well-being of oppressed and subordinated groups—people whose prospects for good health are so limited that their life choices are not even remotely like those of others.²⁰

In this ethical framework, actions which may adversely affect socially disadvantaged groups are particularly unacceptable.²¹ Further, actualizing the principle of health equity in practice requires “policies of action that are consistent with the preservation of human dignity and the showing of equal respect for the interests of all members of the community.”²²

To avoid selecting a “regrettable substitute” that may negatively affect vulnerable populations, guidance on how to protect such populations during the alternatives assessment process is needed. The Natural Resources Defense Council (NRDC), in collaboration with Californians for a Healthy and Green Economy (CHANGE), initiated a research project to prepare a discussion paper addressing this issue for use by policy makers, the business community, alternatives assessment practitioners, and environmental health advocates.

With the assistance of two consultants, the research team identified and interviewed leaders working at the intersection of environmental justice, public health, and chemical policy. Interviewees were asked to speak from their own perspectives, rather than speaking as representatives of their respective organizations.

Following some examples of regrettable substitutions and a brief background discussion of alternatives assessment methods, this discussion draft summarizes key themes from the interviews, reflects on how the Commons Principles for Alternatives Assessment could encompass these themes, and suggests some ways that alternatives assessment practitioners might implement these findings.

The purpose of this draft is to provide initial guidance and a foundation for discussion. To further develop guidance, more work is needed and additional members of vulnerable populations must be consulted and engaged. Their expertise and experience provides the information needed to create an alternatives assessment process that will result in the selection of the safest possible substitutes for chemicals that impact their communities.

such as empirical data on a chemical’s toxicity) and (2) those that are based on societal value judgments (such as whether to select a chemical that lacks data on reproductive toxicity as a safer alternative). The report explains how these societal value judgments play an important role in decision making when comparing information on alternatives:

Integrating evidence, however, also includes the application of explicit or implicit value judgments. The choices of which health end points are most important, how choices are made in the presence of uncertainty, and the relative importance of health and ecosystem end points bring societal value judgments into the alternative selection process... Key considerations in choosing the means to implement trade-off decisions include the question of who is appropriately empowered to make societal value judgments, and whether these judgments are developed in advance of the implementation of alternatives assessment or are developed during the alternatives assessment. If the latter is true, the judgments may be more likely to be adjusted in a biased fashion toward a preferred or status quo alternative.¹³

While the NAS and other frameworks provide detailed guidance on the data-driven parts of an alternatives assessment, they do not help the user navigate the elements that rely on societal value judgments. This is problematic, because, as stated in the NAS report, these judgments may bias the outcome of the assessment.

In this discussion draft, we use a well-established framework of societal value judgments based on public health,¹⁴ social justice,¹⁵ and biomedical ethics principles¹⁶ to consider how to protect vulnerable populations. The protection of vulnerable populations, as encompassed

3. Regrettable Substitutions Can Impact Vulnerable Populations

A fundamental goal of alternatives assessment is to ensure selection and implementation of a safer alternative. A safer alternative “represents an option that is less hazardous to humans and the environment than the existing chemical or chemical process. A safer alternative to a chemical of concern may include a chemical substitute or a change in materials or design that eliminates the need for a chemical alternative.”²³

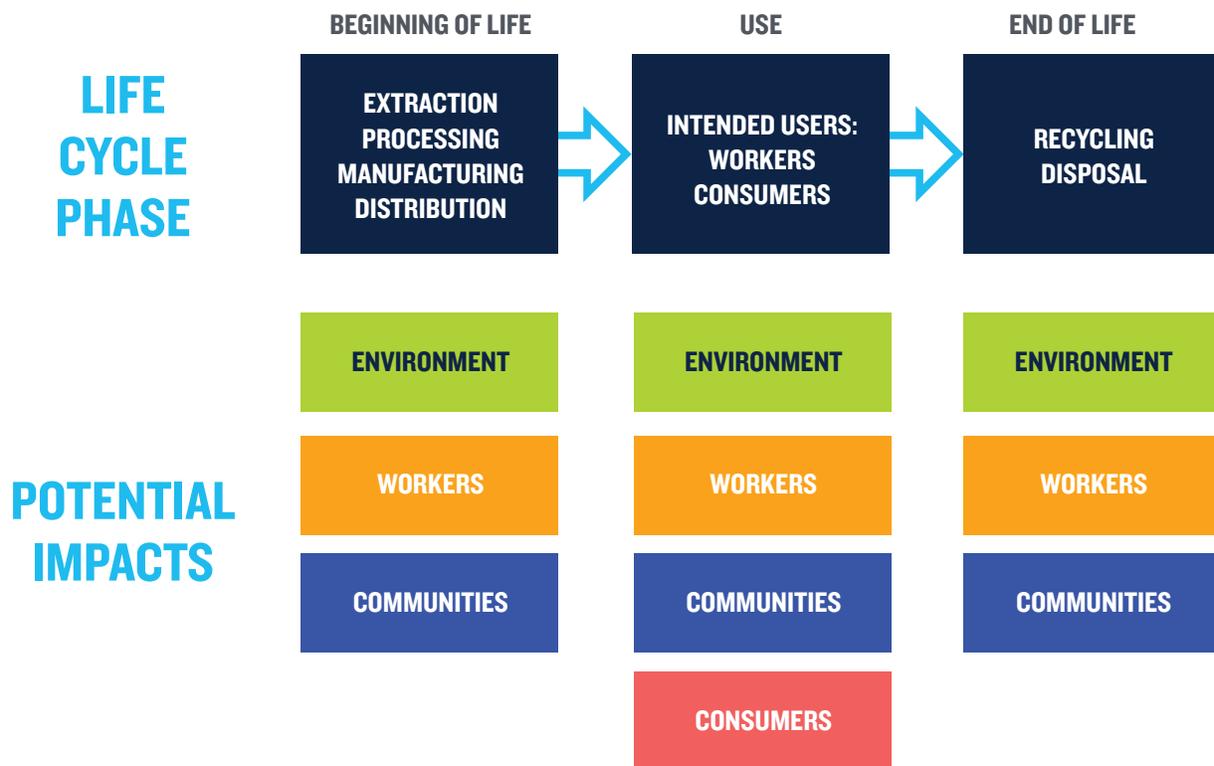
In the absence of a comprehensive alternatives assessment, a regrettable substitution can occur for a variety of reasons. Sometimes limited data are available on an alternative but it appears to be safer than the known toxic chemical. After the substitute is in place additional data may reveal toxicity that was unknown at the time of the substitution. In many cases, alternatives are selected that are very similar in chemical structure to the known hazardous chemical. Though this may ease integration of alternative chemicals into existing manufacturing processes and product formulations (known as a “drop in” substitute), the alternatives selected may be similarly toxic. In other cases, it may be that the alternative poses a different type of toxicity, is harmful to a different population, or is harmful in a different life cycle phase—but because of regulatory, political, or economic pressures the alternative is chosen and implemented.

We briefly describe some examples of regrettable substitutions below to demonstrate the unacceptable trade-offs that resulted and highlight the ways in which vulnerable populations can be harmed. It is important to note that a formal alternatives assessment was not conducted in any of these examples, to our knowledge. These examples identify the primary impetus for shifting from the problem chemical and the vulnerable population(s) that are most impacted by the substitute. Many of these chemicals have additional health and/or environmental concerns that are not discussed. Figure 1 illustrates a simplified chemical life cycle and the potential impacts at each stage to aid in understanding the examples.

SAME TOXICITY, SAME POPULATION

Diacetyl in butter flavoring for microwave popcorn: Diacetyl is linked to lung disease. Workers in microwave popcorn manufacturing facilities have developed irreversible, disabling respiratory problems. A chemical that is structurally similar to diacetyl, called 2,3 pentanedione, is used as an easy drop-in substitute but it causes similar health impacts to workers.²⁴ This is an example of a substitute that presents the same type of toxicity as the problem chemical and continues to harm the same vulnerable population of workers.

FIGURE 1: A SIMPLIFIED CHEMICAL LIFE CYCLE ILLUSTRATING POTENTIAL IMPACTS IN EACH LIFE CYCLE PHASE





DIFFERENT TOXICITY, SAME POPULATION

Methylene chloride in paint strippers: Methylene chloride, a known carcinogen and acutely toxic substance, is commonly used in commercial and consumer paint strippers.²⁵ Workers who use paint strippers on the job are the most highly exposed. As methylene chloride has come under increased scrutiny, a common substitute for methylene chloride in paint strippers is n-Methylpyrrolidone (NMP), which is toxic to the reproductive system. This is an example of a substitute that poses a different type of toxicity than the problem chemical, but continues to harm the same vulnerable population of workers.

DIFFERENT TOXICITY, DIFFERENT POPULATION

Chlorinated solvents in brake cleaners: In the 1990s, pollution control regulations targeted chlorinated solvents in brake cleaners because these volatile organic compounds contribute to smog formation. N-hexane, which does not contribute to smog, was used as an alternative to chlorinated solvents. Unfortunately, this chemical is a known neurotoxicant and many workers developed debilitating nerve damage in their arms and/or legs. This is an example of a “burden shifting” substitute: The problem chemical affected communities suffering from smog pollution. The substitute had improved performance in relation to smog, but created a significant health impact on a different vulnerable population, in this case workers.

DIFFERENT TOXICITY, DIFFERENT COMMUNITIES

Methyl bromide used as a pesticide: Methyl bromide is a pesticide that was widely used in agriculture. Because of impacts on the ozone layer, it was banned internationally in 1992. The substitute for methyl bromide, 1,3-dichloropropene, is a probable human carcinogen; farmworkers and communities living near agricultural areas are exposed. This is another example of a “burden-shifting” substitution that improved performance with regard to one characteristic (communities affected by ozone depletion) but created health hazards for two other vulnerable populations—farmworkers and agricultural communities—which are largely low-income communities of color. These communities are more susceptible to adverse health effects from chemicals because of socio-economic stressors (such as lack of health care) and exposures to many toxic chemicals.

These examples demonstrate how the right intention of moving away from use of a hazardous chemical to protect human or environmental health can result in an outcome profoundly at odds with those intentions. These regrettable substitutes did not equally improve health for all people; in fact they placed a burden on those least able to bear it. In the past decades, those promoting the use of safer chemicals have learned from these and other examples that identification and phase-out of toxic chemicals must be paired with an effective process for choosing safer alternatives.

4. Alternatives Assessment For Safer Substitutes: An Emerging Field

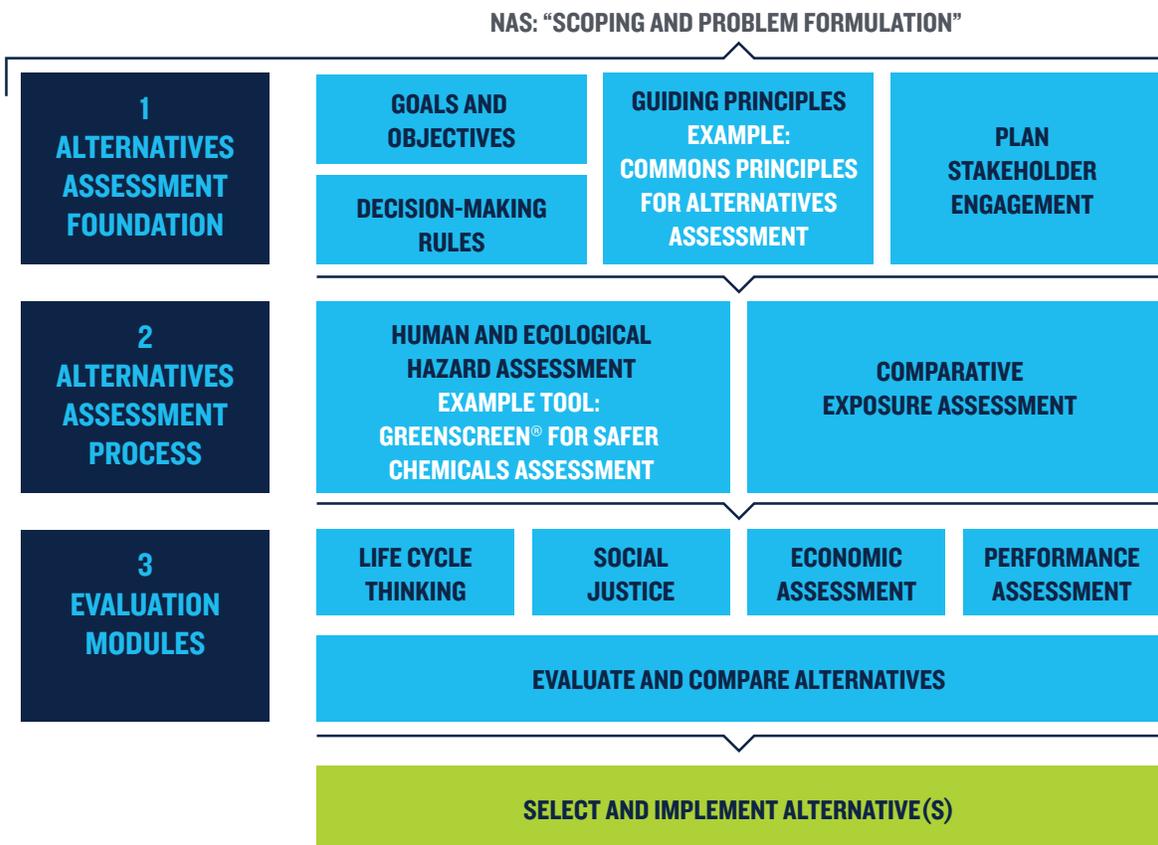
The U.S. Environmental Protection Agency (EPA) began to develop the concept of alternatives assessment in its Comparative Technologies Substitutes Assessment (CTSA) program in the 1990s.²⁶ In 2006, the Lowell Center for Sustainable Production at the University of Massachusetts at Lowell published a foundational report that described key elements of an alternatives assessment framework needed to “evaluate and identify environmentally and socially preferable alternatives” to toxic chemicals.²⁷ This framework describes three core elements, shown in Figure 2 below:

- 1. Foundation:** where values embodied in the assessment are made explicit by clearly articulating the principles, goals, and rules that guide decisions made during the process.
- 2. Assessment Processes:** are the methods, tools, and criteria used to evaluate which chemicals, materials, or products are safer in terms of human health and environmental impacts.
- 3. Evaluation Modules:** which evaluate the economic feasibility, technical performance, and social justice impacts of alternatives.

Although this foundational report identifies the need to articulate values that guide the alternatives assessment process and to develop methods that address social justice impacts, the methods created over the last decade have primarily focused on collecting and evaluating data to compare human health and environmental impacts, rather than addressing values-based decision making. Researchers at the University of California, Los Angeles have considered some of these issues in studying how the relative weighting of chemical hazards, human health and environmental impacts, and other values from diverse stakeholders affected the ranking of safer alternatives.³⁰

Building on the CTSA approach and the Lowell Center framework, the EPA’s Design for Environment (DfE) program developed an alternatives assessment framework in 2011.³¹ The DfE framework in turn informed the development of the GreenScreen® for Safer Chemicals, which is now a well-known tool for identifying the health and environmental hazards of chemicals and comparing potential alternatives.³²

FIGURE 2: SELECTED KEY ELEMENTS OF AN ALTERNATIVES ASSESSMENT FRAMEWORK



Adapted from the Lowell Center for Sustainable Production²⁸ and National Academy of Sciences.²⁹



In 2012, a group of 26 environmental health scientists, advocates, funders, and policy makers met in Boston to begin to build a “community of practice” for alternatives assessment. One outcome of this meeting was an understanding of the need for a common definition and set of guiding principles for alternatives assessment. Following this meeting, a subcommittee met over four months to refine a consensus set of principles, now known as the Commons Principles for Alternatives Assessment. The Commons Principles are “designed to guide a process for well informed decision making that supports successful phase out of hazardous products, phase in of safer substitutes and elimination of hazardous chemicals where possible.”³³ Section 6 of this discussion draft examines the Commons Principles with a focus on protecting vulnerable populations.

In 2013, the California Safer Consumer Products Program became the first in the United States to have a regulatory requirement for an alternatives assessment when targeting chemicals of concern (the program uses the term “alternatives analysis”).³⁴

The 2014 NAS Framework built on these existing frameworks and includes a “scoping and problem formulation” that describes principles, decision rules, and a plan for stakeholder engagement (see Figure 2). Although the report acknowledges the importance of societal value judgments, it does not describe a process for ensuring that the values used in the assessment are clearly articulated and that key values, such as the protection of vulnerable populations, are incorporated.

5. Key Themes From Interviews On Alternatives Assessment and Vulnerable Populations

To explore what is needed in an alternatives assessment to protect vulnerable populations, the project team interviewed five leaders working at the intersection of environmental justice, public health, and chemical policy (listed in Appendix A). Interviewees were asked to discuss:

- Their experience with alternatives assessment and safer substitution;
- Their views on what information is needed to make informed decisions on safer alternatives;
- Their views on how and when different stakeholders (e.g., workers, impacted communities, and the general public) should be engaged in an evaluation of safer alternatives; and...
- Their perspectives on scenarios in which alternatives presented various public health and environmental trade-offs or were an incremental improvement over current chemical use.

In addition, interviewees were asked about potential topics and attendees for an in-person meeting to continue this dialogue. The interview questions are included as Appendix A.

Three major themes emerged from our in-depth interviews. These themes describe critical elements of an alternatives assessment that affect decision-making relevant to vulnerable populations:

1. **Access to information/information quality:** who has access and the completeness/ accuracy of the information.
2. **Genuine stakeholder engagement:** the need for affected communities to be engaged throughout the process to maximize protection of vulnerable populations.
3. **Explicit accounting of the consequences of trade-off decisions including:**
 - Differential exposures, including legacy exposures and disproportionate impacts, and how these are factored in to decisions around alternatives
 - Who has the power to make decisions about what trade-offs are acceptable
 - The relative weighting of human health and environmental impacts in trade-off decisions.

Interviewees also outlined potential solutions, although more work is needed to describe how to incorporate these concepts into alternatives assessment practice and research. We provide some initial ideas for practitioners in Section 7.

THEME I: ACCESS TO INFORMATION/ INFORMATION QUALITY

Interviewees noted the following concerns regarding information access and quality:

Data gaps/missing information: Often the information available to make a direct link between a chemical and adverse health impacts is limited. When there is some scientific evidence, the language used is often weak; e.g., potential, probable, possible. Interviewees articulated the need for stronger language and action when there is evidence of harm, based on the Precautionary Principle.^{c,35} Most chemicals lack data on key health hazards, but it is not possible for stakeholders to make an informed decision without this information. In addition, several interviewees noted that information is rarely available on the costs of adverse human and environmental health impacts that can be traced to toxic chemicals; therefore these factors are rarely evaluated in economic analyses.

Accessing information is challenging even for well-informed users:

It is difficult to access reliable information on chemical ingredients and their hazards. Some labels, when available, are hard to read and interpret and contain misinformation and misleading use of language. Terms like “natural” are not clearly understood, and information on “greener” alternatives is similarly challenging to obtain and verify.

Lack of transparency: Because most product manufacturers do not disclose chemical ingredients, consumers are exposed without their consent. Companies may use the pretense of “proprietary secrets/confidential business information” as a way to withhold information from the public. Manufacturers need to be accountable for transparency throughout the supply chain and to consumers. Disclosure of ingredients is needed to enable informed decision-making—by consumers and by those who are seeking to improve alternatives evaluation and selection.

Information quality issues: Stakeholders need full life cycle information on the hazards and potential impacts of chemical exposures to humans and the environment. Because people are not exposed to only one chemical at a time, but to many chemicals at once, information is needed on exposure to chemical mixtures. Stakeholders need information on how a product is used, what other processes or substances are used concurrently, and how these processes impact the targeted chemical or contribute to health effects. Stakeholders also need to receive information on other environmental health risks in their

^c “When an activity raises threats of harm to human health or the environment, precautionary measures should be taken even if some cause and effect relationships are not fully established scientifically.”



communities that may interact with chemical risks. Workers need to know if they are being exposed to a chemical in their workplaces.

In addition, information provided to non-English speakers is often not accurate and may not be culturally appropriate. Material Safety Data Sheets and Safety Data Sheets are not sufficient. Infographics with concise and accurate information would be valuable to workers and consumers, especially those who are non-native English speakers.

Potential solutions

To address the concerns articulated above, interviewees suggested the following ideas for alternatives assessment research and practice:

1. In the scoping stage of an alternatives assessment, stakeholders should help to decide what information about the assessment process, the chosen alternatives, and implementation will be communicated—as well as to whom and how. Complete transparency is ideal, but at a minimum:
 - The identity of the chosen alternative and its hazard information should be available to anyone in an easy to understand format.
 - Workers who are exposed should receive sufficient information on any steps they need to take to protect themselves and ensure their safety.
2. For potential chemical alternatives, comprehensive information on a chemical's entire life cycle should be considered in the assessment, including where raw materials are sourced, processed, made into a commercial chemical, and stored. The assessment should also consider how materials and finished products are transported, where the product is sold, and how the product will be disposed of or recycled. This information can be used to inform selection of an alternative that minimizes impacts on vulnerable populations throughout its life cycle.

3. In comparing exposures between the chemical of concern and alternatives, potential impacts on vulnerable populations must be identified and considered. This includes consideration of the context in which chemical exposures will occur. Traditionally, chemical exposures are evaluated one at a time, but in reality, most people are exposed to multiple chemicals and many communities are already overburdened with toxic exposures. Development of better methods to measure cumulative impacts should be prioritized.

THEME 2: GENUINE STAKEHOLDER ENGAGEMENT

Interviewees articulated a central problem with current alternatives assessment practices: Marginalized communities with disparities in exposure and health outcomes are not meaningfully engaged as stakeholders in the alternatives assessment process.

Potential Solutions

Interviewees provided the following input on potential solutions to improve stakeholder engagement and information-sharing throughout the alternatives assessment process, from planning to implementation and follow-up.

The 2014 NAS report recommends that the scoping step include a plan for stakeholder involvement. Assessors should include impacted populations during this stage to help develop the plan, and encourage their participation in all the subsequent stages. Assessors should seek stakeholder input regarding how a product is used, other products used that might impact the targeted chemical, and any unique vulnerabilities of the people who use the product.

While all affected populations/stakeholders should be involved in the alternatives assessment process, workers have a particularly valuable role to play because they often have direct experience with the chemical of concern, and could compare that experience with alternatives that are under consideration if offered the chance to test or pilot the potential substitutes. Because workers can provide critical information on a selected alternative's performance, feasibility, and benefits, they should be directly involved in the process of comparing alternatives. The Massachusetts Toxics Use Reduction Act^d requires that workers be trained and consulted when companies are developing plans for toxic use reduction.³⁶

While all information should be available to every member of society, it is essential that directly affected populations receive information about how they may be negatively impacted or benefited. For example, workers need to know if they will have more exposure and/or more frequent exposure to an alternative as a result of a substitution. Workers and their unions can then ensure that workers get the information they need to protect themselves.

^d Enacted in 1989 and amended most recently in 2006, TURA requires Massachusetts companies that use large quantities of specific toxic chemicals to evaluate and plan for pollution prevention opportunities, implement them if practical, and annually measure and report the results.



Government agencies need full information on chemical hazards and safer alternatives, because they have an obligation to protect all citizens, especially vulnerable populations. Government agencies should provide vulnerable populations with information that is designed and targeted appropriately.

The public needs information about exposure when using the finished product and the potential impact of long term, low level exposures and exposure timing. The public should also receive information on the trade-offs of suggested alternatives, with one alternative being the option of not using the product at all.

THEME 3: EXPLICIT ACCOUNTING OF THE CONSEQUENCES OF TRADE-OFF DECISIONS

Interviewees described the following as a key problem: Decisions made by governments and the private sector about toxic chemical impacts have consistently disregarded the health and well-being of vulnerable populations and have not factored in the true health and environmental costs of chemical usage. As documented in “Toxic Wastes and Race in the United States,” these communities are often exposed while other communities are protected.³⁷

Potential solutions

To address this concern, interviewees made the following recommendations for alternatives assessment practice:

- Specifically state that a trade-off that disproportionately affects an already vulnerable community is not a viable option.
- Engage impacted populations and the advocacy community in determining how to best evaluate potential impacts and which trade-offs are acceptable.
- Base decisions on those who are impacted the most, not the least. The weakest and most vulnerable must be protected, especially those who have already been affected by legacy exposures.

Interviewees were also asked to review the Commons Principles for Alternatives Assessment and consider how these principles could encompass equity and protection of vulnerable populations. The following section describes their observations.

6. Reviewing the Commons Principles for Alternatives Assessment with an Equity Lens

As described in Section 4, the Commons Principles for Alternatives Assessment (Commons Principles) were published in 2013 with more than 100 signatories, reflecting a general consensus about the foundational principles that should guide the process of selecting safer alternatives.³⁸

The Commons Principles are intended for those who conduct alternatives assessments and implement their results (known as practitioners, assessors).

Stakeholders involved in developing the Commons Principles included environmental health advocates, scientists, funders, and policy makers, but the process did not directly engage representatives of vulnerable populations. Interviewees observed that equity and the protection of vulnerable populations are not explicitly encompassed. Using the input provided by our interviewees, we have identified additional language that could serve as guidance to incorporate equity and address the values inherent in decision making about safer alternatives.

The language additions are in many cases aspirational and lay out an ideal vision to strive for, though it may be difficult to realize. More work is needed to determine how to incorporate these concepts into alternatives assessment research and practice. We provide some initial ideas in Section 7. The interviewees agreed that both industry and government need to be held accountable for taking action to protect vulnerable populations. Specific suggestions for effective accountability mechanisms need to be further developed.

Each of the original Commons Principles is provided in a box below, followed by a note and the draft additions. The intent is not to re-write the Commons Principles, but to provide additional guidance to alternatives assessment practitioners for implementing these principles with a goal of equity for and protection of vulnerable populations.

I. REDUCE HAZARD

Reduce hazard by replacing a chemical of concern with a less hazardous alternative. This approach provides an effective means to reduce risk associated with a product or process if the potential for exposure remains the same or lower. Consider reformulation to avoid use of the chemical of concern altogether.

Note: The intent of the proposed additional language is to set an aspirational goal that all hazardous substances be replaced by benign alternatives. In the interim, any alternatives selected should not include persistent,

bioaccumulative, or toxic chemicals, nor other chemicals with potential chronic impacts to human health and the environment. See Section 7 for a further discussion of these points.

Draft additions:

- Set a goal to eliminate hazard and thereby do no harm. “Reduce hazard” is not enough – particularly because many vulnerable populations have had excessive exposure to toxic chemicals. Aim to replace hazardous chemicals with benign substances.
- Persistent, bioaccumulative, and toxic chemicals pose unmanageable global threats and are never viable alternatives.
- Protecting vulnerable populations from chemicals that may have chronic health impacts due to properties of carcinogenicity, developmental or reproductive toxicity, is a high priority.
- It is important to always ask whether a toxic chemical is needed in a product and to reformulate whenever possible to avoid its use.

2. MINIMIZE EXPOSURE

Assess use patterns and exposure pathways to limit exposure to alternatives that may also present risks.

Note: The intent of the proposed additional language is to prevent vulnerable populations from facing additional exposure to toxic chemicals and to ensure that workers are protected.

Draft additions:

- Identify vulnerable populations currently impacted by the toxic chemical and those that may be impacted by potential alternatives; understand each chemical’s use patterns and exposure pathways.
- In evaluating alternatives, ensure that any differential exposures to these vulnerable populations are minimized throughout the product life cycle.
- Ensure that workers are informed of any steps they need to take to protect themselves and guarantee their safety.
- Prioritize the development and implementation of better methods to measure cumulative impacts and account for legacy exposures.

3. USE BEST AVAILABLE INFORMATION

Obtain access to and use information that assists in distinguishing between possible choices. Before selecting preferred options, characterize the product and process sufficiently to avoid choosing alternatives that may result in unintended adverse consequences.

Note: The intent of the proposed additional language is to emphasize that those conducting alternatives assessments should seek sufficient data to fully evaluate alternatives and work to generate needed information if data are not available—for the entire product life cycle. This goes beyond the original principle, which does not explicitly address generating additional information when needed. We provide further thoughts on critical data needed in the discussion of a minimum data set in Section 7.

Draft additions:

- A headline of “**SEEK AND USE BEST AVAILABLE INFORMATION**,” would better encompass the idea of generating needed information if it is not available.
- Gather sufficient data to fully evaluate health and environmental impacts of alternatives and potential trade-offs. If critical data are not available, make every effort to generate needed information.
- Take into account the entire product life cycle when evaluating potential health and environmental impacts of alternatives.

4. REQUIRE DISCLOSURE AND TRANSPARENCY

Require disclosure across the supply chain regarding key chemical and technical information. Engage stakeholders throughout the assessment process to promote transparency in regard to alternatives assessment methodologies employed, data used to characterize alternatives, assumptions made and decision making rules applied.

Note: The first addition below reflects the strong theme of information access and identifies the need for disclosure and transparency to stakeholders outside the supply chain as well as within it. The principle states that practitioners should engage stakeholders in order to be transparent about their alternatives assessment methodologies. The intent of the other draft additions is to make broader recommendations around stakeholder engagement.

These include the issue of when to engage vulnerable populations and how information on hazardous chemicals and alternatives should be designed and provided. Such information should be appropriate to a vulnerable population’s language of origin, literacy, education level, and cultural context, and should use media and technology that are most suitable for outreach to different audiences.

Draft additions:

- A headline of “**REQUIRE AND PRACTICE DISCLOSURE AND TRANSPARENCY**” would better encompass the different kinds of disclosure and transparency needed, such as the public disclosure of ingredients as a matter of regular business practice.
- Meaningfully engage vulnerable populations by seeking their input early and often, at all stages of an alternatives assessment from scoping to follow-up.
- Ensure that the identity of a chosen alternative and its hazard information is publicly available and understandable to a typical layperson.
- Ensure that information that is specific to vulnerable populations is accurate, accessible, and culturally appropriate.
- As noted by the Strategic Approach to International Chemicals Management (SAICM),^e “information on chemicals relating to the health and safety of humans and the environment should not be regarded as confidential.”³⁹

5. RESOLVE TRADE-OFFS

Use information about the product’s life cycle to better understand potential benefits, impacts, and mitigation options associated with different alternatives. When substitution options do not provide a clearly preferable solution, consider organizational goals and values to determine appropriate weighting of decision criteria and identify acceptable trade-offs.

Note: The intent of the proposed additional language is to highlight the need to protect vulnerable populations from the negative impacts of trade-off decisions. In addition, the health of humans and the non-human environment are inextricably interconnected; therefore, trade-offs that reduce impacts to human health but negatively impact the environment are not acceptable. While robust methods for social and economic impact analysis may be limited, qualitative evaluation should be encouraged at a minimum. This issue is discussed further in Section 7.

^e SAICM is a policy framework to promote chemical safety around the world. It was developed by a multi-stakeholder committee and is administered by United Nations Environment and the World Health Organization.



Draft additions:

- A trade-off is acceptable only if it does not disproportionately impact a vulnerable population.
- A trade-off that negatively affects the health of ecosystems on which vulnerable populations depend is not acceptable.
- Engage vulnerable populations and the advocacy community in determining how to best evaluate potential impacts and which trade-offs are acceptable.
- Base decisions on those whose health and well-being are impacted the most, not the least.
- Require analyses of environmental impacts and social and economic impacts on vulnerable populations to resolve trade-offs.

6. TAKE ACTION

Take action to eliminate or substitute potentially hazardous chemicals. Choose safer alternatives that are commercially available, technically and economically feasible, and satisfy the performance requirements of the process/product. Collaborate with supply chain partners to drive innovation in the development and adoption of safer substitutes. Review new information to ensure that the option selected remains a safer choice.

Note: The intent of the proposed additional language is to highlight that the assessment of safer alternatives must be a continuous improvement process. Incremental changes should be made only if they are beneficial to vulnerable populations and will not hold back momentum that could lead to identifying and adopting an even safer alternative.

Draft additions:

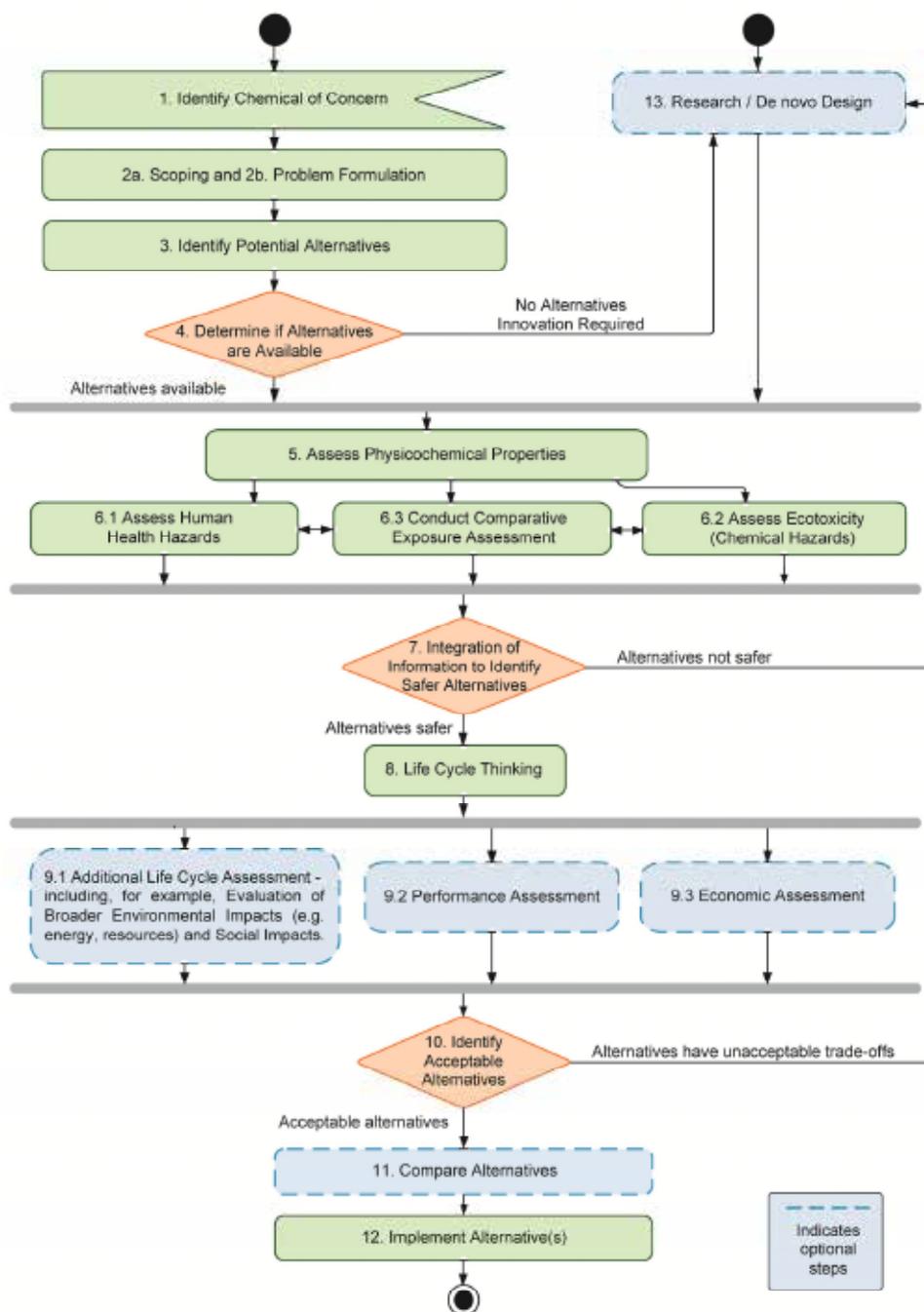
- Make an incremental change only when it benefits vulnerable populations.
- Take action with continuous improvement in mind. Regularly evaluate progress and implement additional changes as needed to ensure protection of vulnerable populations.
- Engage workers in the implementation of alternatives and incorporate their feedback.

7. Putting Principles Into Practice: Suggestions For Starting Places

The draft additions to the Commons Principles provide high-level guidance for encompassing equity and protecting vulnerable populations that is critical to address in order to move towards health equity and improve public health. How might alternatives assessment practitioners incorporate these principles into current practice? In this section, we present six initial ideas that more specifically describe how

these draft additions intersect with key technical issues in alternatives assessment and how they can be used to guide decision-making. We use the NAS framework shown in Figure 3 as a reference but these recommendations should be widely applicable as other comprehensive frameworks include similar elements.⁴⁰ Our recommendations are summarized in Figure 5 at the end of this section.

FIGURE 3: THE STEPS IN THE NAS ALTERNATIVES ASSESSMENT FRAMEWORK



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RECOMMENDATION 1: ENSURE THAT PERSISTENT, BIOACCUMULATIVE, AND TOXIC CHEMICALS ARE NOT SELECTED AS ALTERNATIVES

As stated in the Louisville Charter on Safer Chemicals:

There is now broad international agreement that chemicals that are persistent, bioaccumulative, and toxic (PBT) should be prioritized for eventual phase out...This consensus largely rests on the observation that chemicals with these characteristics cannot be effectively managed. This is not necessarily due to the failure of particular management systems, but because of the characteristics of the chemicals themselves.⁴²

Potential alternatives that are persistent, bioaccumulative, and toxic should be screened out as part of the alternatives assessment process. This can be done using two complementary approaches: (1) referring to authoritative lists of persistent and bioaccumulative chemicals and (2) using criteria for persistent and bioaccumulative chemicals. However, as noted in the Louisville Charter's background paper, authoritative lists may differ and there is ongoing debate regarding the definition of persistence, bioaccumulation, and toxicity. Criteria developed as part of the Stockholm Convention on Persistent Organic Pollutants (Annexes D and E) serve as a good starting place for defining PBT chemicals; note that these criteria require consideration of a chemical's transformation products. The Convention also advocates for a precautionary approach, with consideration for monitoring data that indicate the presence of a chemical in remote locations.

We suggest the following three actions (listed with references to the NAS framework) in an alternatives assessment process to ensure that persistent, bioaccumulative, or toxic chemicals are removed from consideration as potential alternatives:

I. Scoping (Step 2a)

In this step, the goals, principles, and decision rules that will be used in the assessment process are described. Write an explicit decision rule such as "Persistent and bioaccumulative chemicals, as defined by the following lists and criteria, are not safer alternatives: [fill in lists and criteria here]."

2. Identification of Potential Alternatives (Step 3)

In this step, initial screening of identified alternatives is used to narrow the list before proceeding. Compare potential alternatives to lists of PBT chemicals, very persistent very bioaccumulative (vPvB) chemicals, and other lists of chemicals of concern. Remove any potential alternative that is on a list from further consideration in the alternatives assessment process.

3. Integration of Information to Identify Safer Alternatives (Step 7)

In this step, data on physicochemical properties, ecotoxicity, and human health effects for each alternative are compared. Compare the data for each alternative to the criteria for persistent and bioaccumulative chemicals. Remove any potential alternative that meets the criteria from further consideration in the alternatives assessment process.

RECOMMENDATION 2: ENSURE THAT CHEMICALS POSING SERIOUS CHRONIC HEALTH HAZARDS ARE NOT SELECTED AS ALTERNATIVES

One approach to screening out alternatives that pose chronic health impacts is to use the GreenScreen® for Safer Chemicals, a chemical hazard assessment tool utilized by businesses, regulators and advocates. As shown in Figure 4, GreenScreen® includes decision-support rules that evaluate chemicals using four benchmarks.

FIGURE 4: GREENSCREEN BENCHMARK DESCRIPTIONS

BENCHMARK 1	AVOID- CHEMICAL OF HIGH CONCERN
BENCHMARK 2	USE BUT SEARCH FOR SAFER SUBSTITUTES
BENCHMARK 3	USE BUT STILL OPPORTUNITY FOR IMPROVEMENT
BENCHMARK 4	PREFER SAFER CHEMICAL

Adapted from Clean Production Action.⁴³

According to GreenScreen® Guidance, Benchmark 1 chemicals rate "high" for PBT characteristics or present a "high" hazard for any of the following human health endpoints: carcinogenicity, mutagenicity, reproductive toxicity, developmental toxicity, or endocrine activity.⁴⁴

We suggest the following actions in an alternatives assessment process to ensure that chemicals with chronic health impacts are removed from consideration as potential alternatives:

I. Scoping (Step 2a)

Write an explicit decision rule such as "Any chemical rated a GreenScreen Benchmark 1 is not a safer alternative."

2. Integration of Information to Identify Safer Alternatives (Step 7)

Compare data for each alternative to the GreenScreen Benchmark 1 criteria. Remove any potential alternative that meets the criteria from further consideration in the alternatives assessment process.

RECOMMENDATION 3: DEFINE A MINIMUM DATA SET NEEDED TO EVALUATE ALTERNATIVES

As discussed in the Louisville Charter, the idea of “sufficient data” is closely connected to the concept of the basic level of reliable health and safety information needed for the reasonable evaluation of the safety of chemicals for human health and the environment.⁴⁵

The NAS framework identifies three categories of information required to evaluate and compare alternatives: (1) physicochemical properties, (2) human health hazards, and (3) ecotoxicity. GreenScreen® identifies 18 human health and environmental endpoints for hazard assessment.⁴⁶ While not fully comprehensive, these endpoints provide a starting place for defining the minimum data that are needed on each alternative to evaluate potential impacts and trade-offs.^f There may be additional impacts of concern not encompassed within the GreenScreen endpoints, especially as related to ecotoxicity, which may be relevant to subsistence populations. These can be added on a case-by-case basis as needed.

We also suggest that, as described by the GreenScreen® Guidance, data from analogs and modeled data be used to fill data gaps.⁴⁷ When considering data gaps, grouping chemicals into classes and using information from data-rich chemicals to fill gaps on similar, but data-poor, chemicals can be a useful approach.^{48,49} For example, this approach could have avoided the substitution of hormone-disrupting ortho-phthalate chemicals for other similar ortho-phthalates by grouping ortho-phthalates that are likely to be anti-androgenic hormone disruptors together.⁵⁰

We suggest the following three actions in an alternatives assessment process to ensure that chemicals with key human health and environmental hazard data gaps are removed from consideration as potential alternatives:

I. Scoping (Step 2a)

Write an explicit decision rule such as “Any chemical with a data gap in one or more of the 18 GreenScreen endpoints is not a safer alternative.”

2. Assess human health hazards and ecotoxicity (Steps 6.1 and 6.2)

Gather data on each of the 18 GreenScreen endpoints, and any additional endpoints needed, using analogs, models, and other appropriate tools as needed.

Integration of Information to Identify Safer Alternatives (Step 7)

Remove any potential alternative with a data gap in one of the 18 GreenScreen endpoints from further consideration in the alternatives assessment process.

RECOMMENDATION 4: UNDERSTAND THE COMPLETE PRODUCT LIFE CYCLE IN ORDER TO EVALUATE TRADE-OFFS

Step 8 of the NAS framework requires the use of life cycle thinking to consider the entire product system associated with a potential alternative, from raw materials acquisition through disposal as waste or reuse/recycling. Consideration of the product life cycle is essential to evaluate “burden shifting” trade-offs (eliminating an impact at one point in the life cycle while adding an equal or greater impact at another point in the life cycle). The product life cycle and impacts diagram shown in Figure 1 is simplified; for more detailed guidance and resources on assessing life cycle impacts, the California Safer Consumer Products Alternatives Analysis Guide is a good place to start.⁵¹

Stakeholders (workers, communities, consumers) can also provide valuable information about how chemicals and products are used and handled throughout the life cycle.

RECOMMENDATION 5: PROMOTE PUBLIC COMMUNICATION OF INFORMATION ON CHEMICALS IN PRODUCTS

Public disclosure of ingredient information is an essential element of protecting vulnerable populations. Without this information, informed decision making cannot occur. In addition to requiring disclosure across the supply chain regarding key chemical and technical information, practitioners should encourage, or require if possible, that such information be publicly disclosed. Ideally companies should disclose chemical ingredients in a product-specific manner both on a product label and online. This dual notification scheme is required, as explained in the Louisville Charter background paper, to give the public and workers the full right to know and participate.⁵²

RECOMMENDATION 6: REQUIRE ECONOMIC AND SOCIAL IMPACT ANALYSIS TO MAKE TRADE-OFFS VISIBLE

While there is a need for further development of tools and methodologies for economic and social impact analysis, we encourage practitioners to consider these areas, even if only qualitatively. For more detailed guidance and resources on assessing economic impacts, see the California Safer Consumer Products Alternatives Analysis Guide.⁵³ Vulnerable populations engaged in the assessment process can also provide valuable input into potential economic and social impacts.

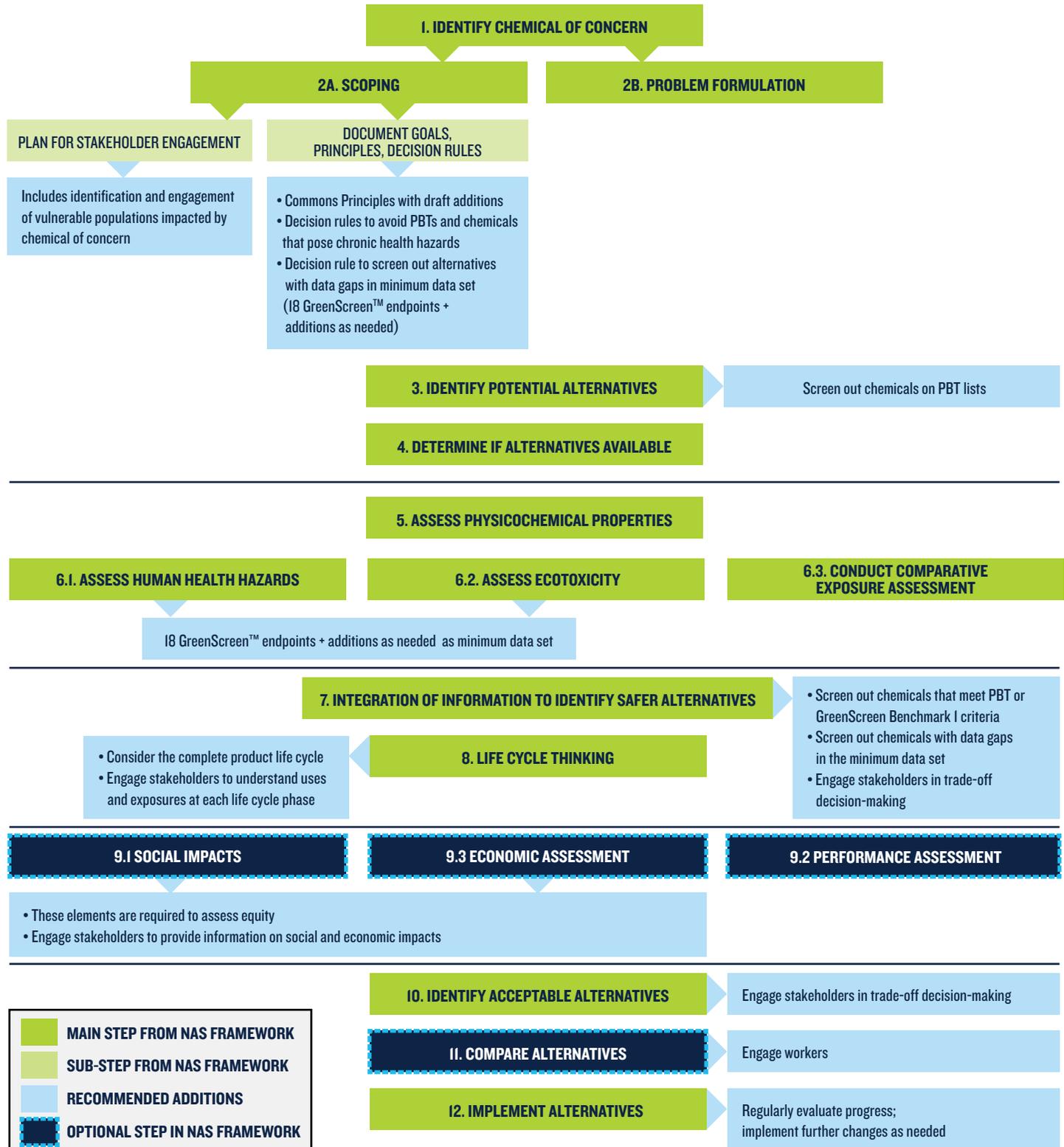
It is also important to remember that economic prosperity and quality of life depend on healthy families and communities. Therefore, while economic and social impact analyses are critical to perform as part of an alternatives assessment, these should not be used to justify continued use of a toxic chemical because of potential loss of jobs if the

^f Note that the NAS framework recommends using the Globally Harmonized System (GHS), which does not include an endocrine disruption endpoint.

toxic chemical is eliminated. As described in the Louisville Charter background paper, elimination of a toxic chemical should be viewed from a Just Transition framework, with primary emphasis placed on guaranteeing income and protecting the health of impacted workers.⁵⁴ Just Transition

is defined as a “tool the trade union movement shares with the international community, aimed at smoothing the shift towards a more sustainable society and providing hope for the capacity of a green economy to sustain decent jobs and livelihoods for all.”⁵⁵

FIGURE 5: SUMMARY OF OUR KEY RECOMMENDATIONS FOR ALTERNATIVES ASSESSMENT PRACTICE WITHIN THE STEPS OF THE NAS FRAMEWORK



8. Summary And Conclusions

The protection of vulnerable populations, as encompassed within the principle of health equity, is a fundamental priority and value in public health. In the last decade, government, academic researchers, and industry have developed frameworks and methods for alternatives assessment, but these methods have fallen short of ensuring a means to protect vulnerable populations. The research conducted for this report is intended as a first step to begin to articulate the critical elements needed to address this gap in the alternatives assessment process.

The Commons Principles for Alternatives Assessment provide a useful framework for recommendations to ensure the protection of vulnerable populations. In Section 6, we have identified additional language that can be used as guidance to incorporate equity and address the values inherent in decision making about safer alternatives.

The draft additions to the Commons Principles for Safer Alternatives are clearly aligned with the six elements of the Louisville Charter. It comes as no surprise that the themes that emerged from our interviews with environmental

justice advocates regarding alternatives assessment parallel the work of colleagues who are pursuing chemicals policy reform. In both cases, these are aspirational goals that are designed to drive long-term change toward the development of chemicals, materials, products, and processes that meet clear needs and functional performance requirements without negative consequences to human health and the environment.

We envision an alternatives assessment process that engages and empowers vulnerable populations, avoids regrettable substitutions, and ultimately improves the health and lives of those most impacted by toxic chemicals. As the Louisville Charter did for chemicals policy reform, the findings of this report are intended to inform and improve upon the developing practice of alternatives assessment. We hope that this discussion draft will encourage alternatives assessment practitioners to immediately begin to integrate these issues into their work, while also serving as the foundation for further discussion among environmental health advocates, researchers, the business community, and policymakers.



9. Glossary

Alternatives assessment or alternatives analysis: A process for identifying, comparing, and selecting safer alternatives to chemicals of concern (including those in materials, processes, or technologies) on the basis of their hazards, performance, and economic viability.

Alternatives assessment practitioner or assessor: People who conduct alternatives assessments and/or implement their results.

Commons Principles for Alternatives Assessment: Developed by scientists, advocates, funders, and policy makers and published in 2013 with more than 100 signatories. The Commons Principles are “designed to guide a process for well informed decision making that supports successful phase out of hazardous products, phase in of safer substitutes and elimination of hazardous chemicals where possible.”

Green chemistry is the design of chemical products and processes that reduce or eliminate the use or generation of hazardous substances. Green chemistry applies across the life cycle of a chemical product, including its design, manufacture, use, and ultimate disposal.⁵⁶

GreenScreen® for Safer Chemicals: A tool for identifying the health and environmental hazards of chemicals and comparing potential alternatives.

Health equity: According to the American Public Health Association, health equity means that everyone has the opportunity to attain their highest level of health.

Louisville Charter for Safer Chemicals: Developed by advocates in 2005, the charter describes six key principles necessary to regulate chemicals and shift the economy to safer products. The charter contains a detailed background paper for each principle.

NAS (National Academy of Sciences) framework/report: Published in 2014, *A Framework to Guide Selection of Chemical Alternatives* reviews current alternatives assessment approaches and provides a detailed decision framework for evaluating potentially safer chemical alternatives.

Regrettable substitution: The replacement of known toxic chemicals with others that prove to be equally or more harmful to human health or the environment.

Safer alternative: An option that is less hazardous to humans and the environment than the existing chemical or chemical process. A safer alternative to a chemical of concern may include a chemical substitute or a change in materials or design that eliminates the need for a chemical alternative.

Vulnerable populations: For the purposes of this project, “vulnerable populations” are defined as those that:

- have been disproportionately impacted by toxic chemicals; and/or...
- have an increased likelihood of adverse health effects from toxic chemicals due to greater susceptibility and/or exposure; and/or...
- have been, and continue to be, marginalized and excluded from processes and decisions that affect them.

These populations include those that are exposed to toxic chemicals in their workplaces; low-income communities; communities of color; fence line neighborhoods; communities that rely on subsistence for at least a portion of their diet (such as indigenous people of the Arctic); and infants, children, and pregnant women.

10. Appendix A: Interview Questions and Interviewee

Names/Affiliations

INTRODUCTION AND INFORMATION NEEDS

1. What is your experience with chemicals policy, safer alternatives/substitution, alternatives assessment, and/or the concept of regrettable substitution?
2. What environmental health issues do you feel have not been adequately considered by government or business in decisions about regulating harmful chemicals or choosing safer alternatives?
3. Do you feel you currently have the information you need to make informed decisions about safer chemicals and products in your home and workplace? If not, what information are you seeking to make an informed decision?
4. What information about the health and environmental impacts of potential substitutes should manufacturers know in order to make an informed decision about a safer alternative?
5. When a chemical of concern is being replaced with an alternative, do different actors need different information, for example, workers, government, or the general public? If different, what is the critical information that should be provided for each actor?
6. When should stakeholders (such as workers, potentially impacted communities, and the general public) be consulted when product manufacturers or government agencies are evaluating safer alternatives? How should stakeholder input be used?
7. How can information about chemical hazards and safer alternatives be shared most effectively?
8. What is your reaction to The Commons Principles for Alternatives Assessment? Is there anything you would add to these Principles?

CHEMICAL HAZARDS AND TRADE-OFFS

9. Alternatives assessments may evaluate a range of health and environmental problems, such as those listed below. Which of these impacts concern you the most, on a scale of 1-5 (1 least; 5 most concern)
 - Skin rash
 - Dizziness
 - Eye irritation
 - Miscarriage
 - Birth defects
 - Impacts to brain development
 - Cancer
 - Gene damage
 - Persistence in environment
 - Bioaccumulation in environment
 - Toxic to fish and aquatic life
10. Are you familiar with tools that have been created to compare chemical hazards, for example, GreenScreen®? If so, which tools? Is there anything you believe these tools should evaluate that is not currently included?
11. Here are some examples of possible trade-offs. For each question, would you make the switch to the new chemical? Why or why not?
 - a. There's a new flame retardant that reduces consumer exposure in home environments. The previous chemical posed a high risk, particularly to children exposed to it in household dust, contributing to learning disabilities. However, the new option presents a higher health risk for electronics recycling workers.
 - i. Switch? Yes No Why or why not?
 - b. A substitute is available for a plastics additive that is known to contribute to infertility and birth defects. The alternative does not pose these risks but there is no information available on its potential to cause cancer.
 - i. Switch? Yes No Why or why not?

c. A new type of food packaging eliminates a chemical that disrupts hormones in the body and may contribute to infertility. The new packaging creates greater emissions of greenhouse gases because food packaged in this new material is heavier to transport.

i. Switch? Yes No Why or why not?

d. A pesticide that is hazardous to human health is replaced by one that is hazardous to fish.

i. Switch? Yes No Why or why not?

12.

a. If data indicate that a substitute is incrementally safer, i.e., a toxic solvent in a paint stripper with hazard level “1” (worst) can be substituted with a chemical with hazard level “2” (still toxic but not as harmful)—how would you proceed?

b. Are there instances when you would not support the selection of a substitute that is incrementally safer?

c. What are your thoughts about how to motivate chemical suppliers to continuously improve and develop alternatives that are truly safer?

13. How do you define a safer alternative?

14. Once an alternative is implemented, what follow up is needed to make sure there are no unintended consequences, such as health impacts to workers or communities?

NEXT STEPS

15. If an in-person meeting was convened on the topic of developing approaches for alternatives assessment to protect human health for vulnerable populations, what issues would you want to discuss more in depth?

16. Do you have suggestions for attendees at this meeting?

INTERVIEWEE NAMES AND AFFILIATIONS

Ernesto Pacheco, *Communications Workers of America District 9*

José T. Bravo, *Just Transition Alliance*

Catherine Porter, *California Healthy Nail Salon Collaborative*

Ogonnaya Dotson-Newman, *JPB Foundation*

Vi Waghiyi, *Alaska Community Action on Toxics*

II. Appendix B: Detailed Analysis of Interviewee Responses to Trade-Off Questions

Our interviewees provided valuable input in our broad-based discussions and in our more specific discussions of hypothetical trade-off scenarios. Several of the interviewees noted the importance of “first, do no harm” and one noted that “at every stage human health should drive chemical policy decisions, not profit.” This respondent also stated that chemicals that harm health and well-being should not be on the market and noted that if the voices of those impacted by chemical harm were heard and they had decision-making power, we could, by acting collectively, prevent further harm from occurring.

One respondent stated that the goal is “a system where these unknown risks to public health and the environment are absolutely minimized by mandatory Precautionary Principle regulation and a chemical industry that operates on Green Chemistry principles.” Another interviewee suggested that the advocacy community could help industry to transition from unsustainable toxic and polluting processes towards the sustainable production of safer alternatives.

ASSESSING PRIORITIES FOR TRADE-OFF DECISIONS

We asked the interviewees detailed questions about trade-off decisions. We first listed a range of health and environmental impacts and asked interviewees to rank them on a scale of 1 to 5 with 5 indicating highest concern. We totaled the scores for each endpoint and provide both the individual and total scores below, with endpoints ranked from highest to lowest total score.

Birth defects and neurodevelopmental impacts ranked of highest concern, followed closely by miscarriage and persistence and bioaccumulation in the environment. These impacts were followed by the long-term effects of cancer and gene damage, as well as ecosystem effects, with one interviewee commenting that ecosystem endpoints were important because these impacts are indicators of further toxic potential for humans. Our interviewees noted that birth defects and neurodevelopmental impacts were of concern because they affect individuals for their entire lifetimes. Persistence and bioaccumulation were of concern because of the potential to harm both humans and ecosystems.

TRADE-OFF SCENARIOS

We asked additional questions about specific trade-off scenarios as described below. Our interviewees noted that real-world examples generally were not this straightforward and these scenarios were arbitrarily limited in context, resulting in a narrow range of potential solutions.

Human Exposure: Life Cycle Trade-offs

There’s a new flame retardant that reduces consumer exposure in home environments. The previous chemical posed a high risk, particularly to children exposed to it in household dust, contributing to learning disabilities. However, the new option presents a higher health risk for electronics recycling workers.

Switch? Yes No Why or why not?

ENDPOINT	INTERVIEWEE RESPONSES					TOTAL SCORE
Birth defects	5	5	5	5	5	25
Impacts to brain development	5	5	5	5	5	25
Miscarriage	5	5	4	5	5	24
Persistence in environment	5	5	4	5	5	24
Bioaccumulation in environment	5	5	4	5	5	24
Cancer	3.5	5	5	5	5	23.5
Gene damage	3.5	5	5	5	5	23.5
Toxic to fish and aquatic life*	5	5	4	4	4	22
Eye Irritation	5	4	1	2	2	13
Dizziness	4	3	2	1	1	11
Skin Rash	3	3	1	2	1	10

*because these serve as indicator species

Three of the interviewees responded that they would not make this switch because a) a human health risk continues to exist, b) the alternative could affect the offspring of workers, or c) the alternative does not go far enough in considering other existing exposures for recycling workers, etc. It was generally agreed that more information was needed on several fronts before a fully informed decision could be made, including whether there were options to protect workers until a better alternative was identified. One interviewee noted that the global electronic recycling workforce employs many children.

Human Exposure: Endpoint Trade-offs

A substitute is available for a plastics additive that is known to contribute to infertility and birth defects. The alternative does not pose these risks but there is no information available on its potential to cause cancer.

Switch? Yes No Why or why not?

The interviewees noted that this information gap was not acceptable to them, and that they would not make the switch to the new chemical without information on the alternative's carcinogenic potential. Respondents also expressed concern about the chemical potentially posing a health threat at some point in its life cycle to populations most susceptible to its specific carcinogenic mechanism of action (e.g., cancer risk could vary in response to this chemical among different populations).

From these first two questions we note that that interview responses indicate that potential impacts on children (e.g., birth defects and neurodevelopmental effects) should be a high priority. In addition, more complete human health impact information (for all endpoints, throughout the chemical's life cycle) is necessary to decide in favor of a substitution.

Life Cycle Trade-offs: Human Exposure vs. Climate Change Impacts

A new type of food packaging eliminates a chemical that disrupts hormones in the body and may contribute to infertility. The new packaging creates greater emissions of greenhouse gases because food packaged in this new material is heavier to transport.

Switch? Yes No Why or why not?

Two of our interviewees stated that they would not support this switch, because the trade-off of an increase in greenhouse gasses (GHG) was not an improvement. The other three interviewees said they would support the switch because GHG emissions could be reduced in other ways, such as changing transportation logistics to distribute locally, or increasing fuel efficiency standards to offset the increased emissions. One interviewee noted that "while anthropogenic climate change is the single most important issue we face as a species that also impacts all the other species on this earth, it is possible to address these issues via policy and other strategies beyond the scope of this question."

Human Exposure vs. Ecosystem Impact

A pesticide that is hazardous to human health is replaced by one that is hazardous to fish.

Switch? Yes No Why or why not?

Three interviewees responded negatively to this proposed replacement, indicating that the fish could potentially be a subsistence food in which a potential hazard could bioaccumulate up the food chain. All interviewees responded with the concern that the chemical would eventually result in human exposure, and that more information on routes of exposure would be needed to ascertain that this was not a shift to a different type of contamination burden.

One interviewee responded with a "maybe," noting that while human health, particularly workers' health, needs to be a priority, a preferred solution would be one that considered practices that removed both existing and proposed chemical hazards entirely. Another interviewee noted that we shouldn't have to make this selection at all, and that solutions should focus on trade-offs to improve our health and well-being, starting with the principle of "first, do no harm." Incremental changes as expressed by this scenario are not adequate; we need a more fundamental change in approach.

Incremental Chemical Safety Improvement

A. If data indicate that a substitute is incrementally safer—for example, a toxic solvent in a paint stripper with hazard level "1" (worst) can be substituted with a chemical with hazard level "2" (still toxic but not as harmful)—how would you proceed?

One interviewee stated that they would accept the substitution; a second stated that they would not put the chemical on the market. The remaining three interviewees stated that they would accept the substitution with a variety of follow-up responses. One interviewee elaborated that they would have extensive follow-up questions about costs, the long-term plan for reducing the overall hazard, other available options on the market, potential impacts on human health, and more detailed information on what "incrementally safer" actually means. The remaining two interviewees had slightly different responses, with one stating that they would make sure the manufacturer knows that the incremental improvement is insufficient, and the other stating that they'd applaud the manufacturer for the slight improvement, but not endorse the product until it was proven to be safe.

B. Are there instances when you would not support the selection of a substitute that is incrementally safer?

All five interviewees responded that there were times when they would not support an incremental improvement, specifically:

- If the substitute chemical still harmed human health and the environment;
- If it meant that no additional work would be done to find something safer;
- If the substitute could reasonably be suspected of subverting the actual solving of the problem through changes in practice, or green chemistry.
- The decision would rest on the specifics of the situation, e.g., where in the life cycle is the chemical substitute an incremental improvement? Is there a possibility to push for a more significant improvement?

C. What are your thoughts about how to motivate chemical suppliers to continuously improve and develop alternatives that are truly safer?

The interviewees made several suggestions about how to motivate chemical suppliers to develop truly safer alternatives and initiate continuous improvement on this front. The key issue raised by interviewees is the need to create mechanisms to internalize costs to human health and the environment to account for the systems that are not currently valued and as a result are being deteriorated or destroyed. They noted that corporations should be required to factor in the true costs of their product to reduce return on investment in use of hazardous chemicals and increase the return on investment in safer alternatives.

Respondents shared a number of ideas for policy changes and advocacy, including:

- Highlight the subsidies that certain industries receive that are a disincentive to safer alternatives.
- Provide subsidies and incentives for the green chemistry industry and its users.
- Hold regulatory agencies accountable to their responsibilities to protect public health and the environment.
- File lawsuits for injuries related to chemical exposure. (This may require new legislation or changes in current laws.)
- Increase accountability for CEOs whose actions harm vulnerable populations.^g
- Create new laws that require the development and use of safer alternatives.
- Create incentive mechanisms to promote companies making safer products and penalize companies that continue to make toxic products (e.g., lower liability insurance rates for companies making safer products).
- Educate all levels of a company about chemical hazards and safer alternatives.
- Require companies to include community members (especially those most impacted), grassroots advocates, private sector representatives, healthcare professionals, and scientists in decision processes.

In the NAS framework for Alternatives Assessment, the following steps are optional:

- Additional life cycle assessment, including social impacts
- Economic assessment

Our interviewees articulated that these steps cannot be optional. Furthermore, the economic assessment must include an evaluation of the health costs of the chemical of concern (as well as potential alternatives) when making cost comparisons. As above, such evaluations have to consider the context in which chemical exposures will be occurring, such as multiple exposures and the burdens of existing pollution and legacy contaminants.

^g A respondent noted that this could be modeled after the case of the mining executive who was sentenced to jail in 2015 for willfully violating mine safety laws that resulted in the death of 29 miners.

12. References

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