

DEPARTMENT OF
ECOLOGY
State of Washington

Washington State
Alternatives Assessment Guide

Discussion Draft

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Purpose

In January 2012, the Interstate Chemicals Clearinghouse (IC2) published its Alternatives Assessment Guide ([Guide](#)). The IC2 is an association of state, local and tribal governments and supporting members from non-government organizations, businesses, labor unions and academia. The IC2 was created with the intention of:

- Avoiding duplication and enhance efficiency and effectiveness of government initiatives on chemicals through collaboration and coordination.
- Build government capacity to identify and promote safer chemicals and products.
- Ensure that agencies, businesses, and the public have easy access to high quality and authoritative chemicals data, information, and assessment methods.

The Guide is the results of coordination among member states to identify a common perspective for conducting alternatives assessments, a process created to identify safer alternatives to toxic chemicals in products and to reduce the impacts from and cost of toxic use upon human health and the environment.

The Guide identifies no single process that is appropriate for all consumer products but provides numerous frameworks for conducting an alternatives assessment. In addition, the Guide identified individual states may have different perspectives, legislative requirements and priorities that would affect the contents of an acceptable alternatives assessment. However, by working together on the Guide, the states identified a common foundation upon which to conduct alternatives assessments with the intent of sharing resources and expertise among the member states.

The purpose of this document is to create guidance recommended by Washington State Department of Ecology (Ecology) based upon the Guide. This guidance establishes minimum requirements for an alternatives assessment and a desired methodology for implementation. Individual companies or organizations conducting an alternatives assessment may build upon these requirements and add modules and complexity in agreement with the Guide. Any alternatives assessment conducted within Washington State by Ecology, however, will follow these requirements as a minimum.

Background

It is appropriate to summarize some basic principles inherent both to the alternatives assessment (AA) process and the contents of the Guide. These principles include:

Replacement of toxic chemicals with safer alternatives: The primary objective of an AA is to replace toxic chemicals in products with safer alternatives. This is in agreement with a recent National Academy of Sciences report ¹that indicates ‘*Better methods.... are needed to support consideration of health and environmental effects for the green chemistry goal of safer products....*’ Elimination of toxic chemicals is also in direct agreement with Ecology’s [Reducing Toxic Threats](#) (RTT) initiative. Ecology’s RTT initiative is based upon the principle that removal of toxic chemicals from the manufacturing process not only better protects human health and the environment but saves the general public substantial amounts of money through the prevention of cleanup sites and regulatory oversight.

Hazard based: Reducing risk by reducing hazard is fundamental to the AA process. Therefore a chemical hazard assessment process is the first process to be conducted in an AA.

Risk based: The AA process is based upon reducing risk by selecting alternatives that have both the lowest hazard and lowest exposure potential. See the box on risk for more information.

Scientifically based: The AA process uses the best available science when evaluating the different components selected for an AA.

Transparency: The AA process requires identification and publication of information used, where possible, within the AA. All though some information may be confidential (see following bullet), some information such as the hazard assessment, for example, must be made accessible to all reviewers.

Risk:

The Guide defines risk as:
‘Identification of the probability of harm a chemical may have upon human health and the environment. Risk is defined as a function of hazard and exposure and is approximated by the equation: Risk = f (Hazard, Exposure).’

Unlike the Risk Assessment process which attempts to quantify risk based primarily upon assumptions related to exposure, the Alternatives Assessment process reduces risk by optimizing BOTH components of the risk equation, i.e. hazard and exposure. The safest alternative and, by definition, the alternative with the lowest risk has both the lowest hazard and exposure potential.

¹ [Sustainability and the U. S. EPA](#), 2011, 286 pages.

Continuous Improvement: This guidance recognizes that safer alternatives may not exist for all toxic chemicals used in products. The AA process, however, conducts a review of the current conditions and when safer alternatives are not found provides a focus for product innovation and green chemistry to create new chemicals to replace the toxic chemical.

Confidential Business Information (CBI): The Guide does not consider CBI. Members creating the Guide identified that CBI was outside their mandate to address. It is necessary for other entities such as State Legislators to determine between the conflict of a industry's need to keep information confidential and a consumer's right to know the impacts chemicals in products have upon human health and the environment. It is important to note, however, that the US EPA's Design for the Environment Program has conducted AAs and was able to protect CBI while still releasing information on the impacts the unidentified chemical has upon human health and the environment.

The following guidance is based upon these principles.

Alternatives Assessment Structure

The Guide creates a five step process for conducting an AA:

1. Identify Chemicals of Concern
2. Initial Evaluation
3. Scoping Alternatives Assessment
4. Identification of Alternatives
5. Evaluate Alternatives

This guidance will address each of the five steps and, based upon the contents to the Guide, identify what is recommended as a minimum for an AA conducted in Washington State.

1. Identify Chemicals of Concern

As identified in the Guide, the identification of a chemical of concern is outside the scope of this guidance. There are numerous methods that can lead to the identification of a chemical of concern including legislation, consumer concern, industry concern, etc. To attempt to include this process within this guidance would make implementation of this guidance difficult if not impossible. Therefore both the Guide and this document assume that the identification process occurs prior to initiating an AA.

2. Initial Evaluation

Ecology believes that it is important to conduct an initial evaluation as recommended within the Guide. If it is possible to eliminate the use of the toxic chemical without the need to consider alternatives, there is no need for manufacturers to conduct an alternatives assessment process.

Therefore, this guidance incorporates the complete Initial Evaluation Module identified in the Guide. The Initial Evaluation Module from the Guide can be found in Appendix A or the assessor may refer directly to the Guide.

3. Scoping Alternatives Assessment

This step within the AA process identifies both the level of stakeholder involvement and which of the three frameworks identified with the Guide will be used. This guidance identifies which levels of stakeholder involvement are appropriate for an AA and which framework is recommended.

Stakeholder

The Initial Screen and two levels identified in the Stakeholder Module of the Guide and recommended for use in this guidance are:

Initial Screen	<i>Identification of pertinent stakeholders:</i> Identifies pertinent stakeholders and those likely to be interested in and important to the proposed AA.
Level 1	<i>Internal exercise:</i> Identifies potential stakeholders, their concerns and how their concerns may be addressed in the AA. There is little external stakeholder involvement unless specific questions are posed where external input is required or recommended.
Level 2	<i>Formal stakeholder process:</i> Identifies potential stakeholders and seeks their input in a formal and structured process. Pertinent AA information is provided for stakeholder review and comment. All comments are collected and responded to.

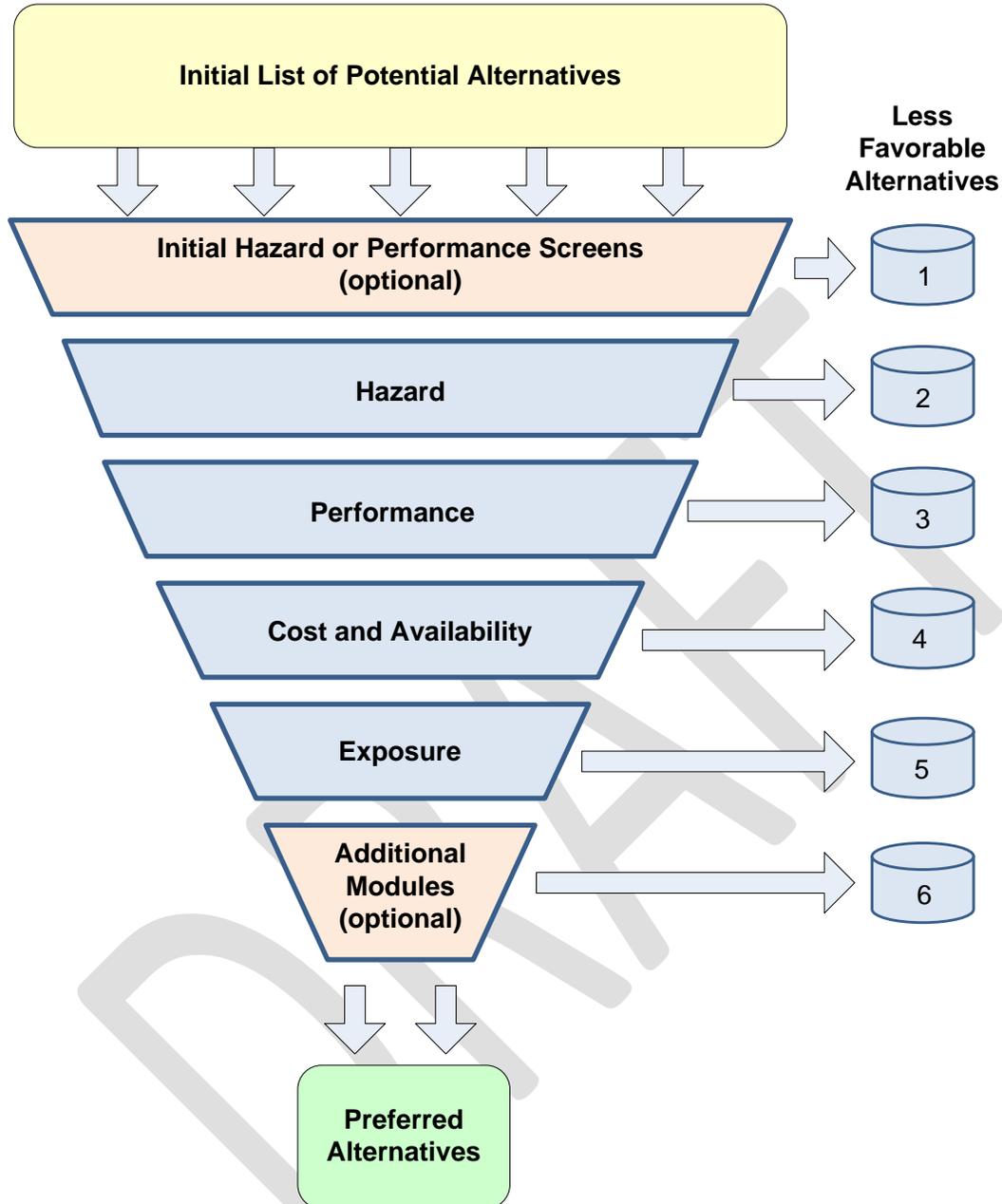
For the purpose of this guidance, Ecology recommends as a minimum Level 1 for most assessors and Level 2 for AAs conducted by public agencies such as Ecology. Assessors may use higher levels of stakeholder involvement if interested and appropriate. Pertinent portions of the Stakeholder Module can be found in Appendix B or the assessor may refer directly to the Guide.

Decision Framework

The Guide identifies in three different frameworks that can be used to conduct an AA. Those three frameworks are:

1. Sequential
2. Simultaneous
3. Hybrid

For the purposes of this guidance, Ecology recommends using the Sequential Framework. The Guide approximates the Sequential Framework as follows:



The Sequential Framework utilizes the decision methodologies inherent in each module and does not require an additional decision methodology. Therefore, it is not necessary to include the Decision Methodology Module in this guidance. The Sequential Framework can be found in Appendix C or the assessor may refer directly to the Guide.

4. Identification of Alternatives

For the purpose of this guidance, Ecology recommends implementation of the complete Identification of Alternatives Module in the Guide. This includes conducting an initial screen of alternatives using the lowest levels of the Hazard and Performance Modules. By implementing this procedure, the widest range of alternatives is identified. This includes consideration of alternatives such as product redesign that removes the need for chemical addition. For the purposes of this guidance, the Identification of Alternatives Module can be found in Appendix D or the assessor may refer directly to the Guide.

5. Evaluation of Alternatives

For the purpose of this guidance and for small and medium sized companies (annual sales of less than \$250,000,000), Ecology recommends the lowest levels of the minimum recommended Modules identified in the Guide. The four modules to be used and the order established are 1) Hazard Module, 2) Performance Module, 3) Cost and Availability Module and 4) Hazard Module.

The alternatives identified in the previous step are subjected to a Level 1 Hazard Assessment. Those alternatives identified to have the lowest toxicity are evaluated using Level 1 of the Performance Module. The alternatives that are found to have the lowest toxicity and perform in the application are subjected to Level 1 of the Cost and Availability Module and so forth. As indicated in the Guide, if no safer alternatives are identified, it may be necessary to review the second best alternatives identified in the Hazard Module and evaluate these alternatives using the other modules.

For larger companies (annual sales exceeding \$250,000,000) and for government organizations, Ecology recommends that the Level 1 in the Hazard Module be replaced with a Level 2 assessment. This more detailed assessment improves the quality of alternatives subjected to further evaluation as a more thorough toxicity review is involved.

As stated previously, the expectations identified in this section establish minimum expectations. If the situation warrants it, assessors may use higher levels and different frameworks identified in the Guide. Applicable portions of each module will be provided in the Appendices.

Hazard Module

The two levels and Initial Screen of the Hazard Module recommended in this guidance are:

Initial Screen	<i>Initial Screen:</i> Uses several readily available sources to evaluate whether a chemical, product or process appears on authoritative lists of hazard criteria.
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Level 1	<i>Basic Evaluation:</i> Utilizes the Quick Chemical Assessment Tool to determine if hazards exist for specific hazard criteria using well-defined, readily available data sources.
Level 2	<i>GreenScreen Evaluation:</i> Uses the GreenScreen for Hazard Assessment tool (GreenScreen™) to conduct a thorough hazard evaluation. The GreenScreen™ is a free, publicly available hazard assessment tool.

Smaller companies with limited resources and expertise in the AA process would use Level 1 while larger companies would use Level 2. Higher levels may be used if appropriate. For the purposes of this guidance, pertinent portions of the Hazard Module are provided in Appendix E or the assessor may refer directly to the Guide.

Performance Module

This guidance recommends Level 1 of the Performance Module as minimum. The Guide describes Level 1 as:

Level 1	<i>Basic Performance Evaluation:</i> Identifies a few, very basic questions about whether the alternative performs the required function in the product. This level uses qualitative information readily available from manufacturers and other sources to evaluate alternatives.
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Higher levels may be used if appropriate. For the purposes of this guidance, pertinent portions of the Performance Module are provided in Appendix F or the assessor may refer directly to the Guide.

Cost and Availability Module

This guidance recommends Level 1 of the Cost and Availability Module as a minimum. The Guide describes Level 1 as:

Level 1	<i>Basic Cost and Availability Evaluation:</i> This evaluation asks a few, very basic questions about whether the alternative is being used in cost competitive products. If yes, the alternative is considered feasible.
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Higher levels may be used if appropriate. For the purposes of this guidance, pertinent portions of the Cost and Availability Module are provided in Appendix G or the assessor may refer directly to the Guide.

Exposure Module

This guidance recommends using both the Initial Screen and Level 1 of the Exposure Module as a minimum. The Guide describes Level 1 as:

Initial Screen	<i>Initial Exposure Assessment Evaluation:</i> Identifies whether sufficient similarities exist between the chemical of concern and potential alternative(s), such that an exposure assessment is not necessary. If so, differences in exposure concerns between the chemical of concern and potential alternatives are inconsequential to the AA.
Level 1	<i>Basic Exposure Evaluation:</i> Identifies potential exposures concerns along with how the concerns may be addressed. Decisions in this level are based upon a qualitative assessment using readily available data.

The Initial Screen is important as it provides a mechanism for focusing attention only on those alternatives that have a substantially different potential route of exposure. If the routes of exposure are the same for the alternatives as for the toxic chemical, exposure can be assumed to be identical and therefore not pertinent to the AA. Higher levels may be used if appropriate. For the purposes of this guidance, pertinent portions of Exposure Module are provided in Appendix H or the assessor may refer directly to the Guide.

Final Report

As indicated previously, transparency is an important factor in any AA. Therefore, the assessor should document the results of each step in a final report and have the report available for review if requested. Ecology recommends disclosure of as much of the report as possible to provide consumers with greater confidence in the overall impacts products have upon human health and the environment. If confidential business concerns prevent publication of some of the steps, the report must include the results of the hazard assessment for each alternative along with the source of the data used in the assessment.

Appendices

Appendix A: Initial Evaluation

The Initial Evaluation Module determines whether or not an AA is needed for a product or process containing a chemical of concern. If a product may be phased out or if a chemical of concern can be eliminated from a product, an AA may not be needed.

Before investing resources to conduct an AA, businesses should consider the reasons a chemical of concern is used in a product or process.

- Can the product or process containing a chemical of concern be phased out?
- Does the chemical of concern perform a necessary function?
- Is the presence of a chemical of concern required for regulatory purposes?

Some products or processes containing chemicals of concern may meet regulatory requirements while in other cases, the chemicals are redundant in a business' portfolio or are ready to be phased out or redesigned. Likewise, for a variety of reasons, some chemicals of concern are present in products for historical reasons and without serving a useful purpose. For example, recycled materials may contain residual chemicals of concern required by local, state, federal or international regulatory requirements. If a chemical of concern can be simply eliminated without affecting product performance, an AA can be avoided and resources saved.

Initial Evaluation Process

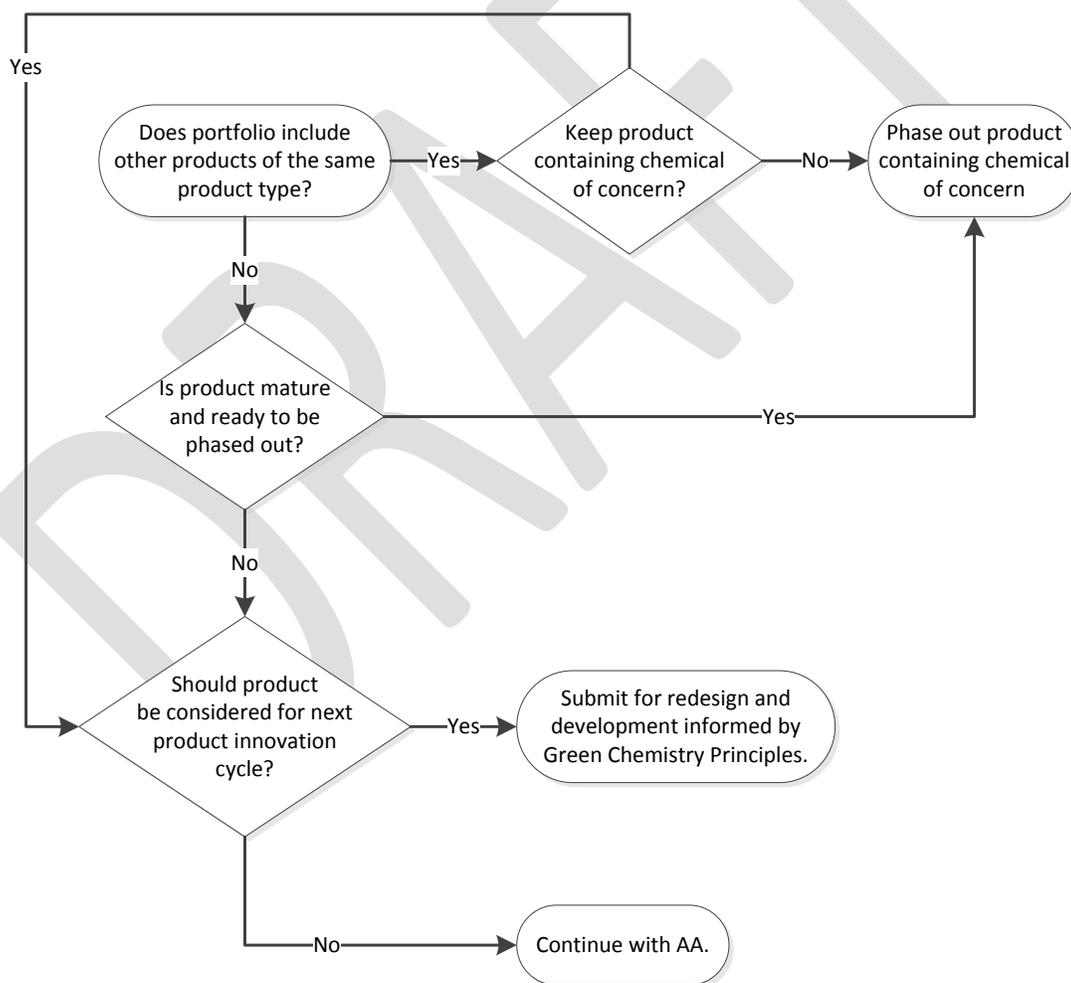
Consider phasing out a product containing a chemical of concern

It may be desirable to phase-out a product containing a chemical of concern and in the process, eliminate the need for an AA. Questions to consider include:

1. Does your business portfolio include other products that cover the same product type?
 - A. If yes, do you still want to keep the product containing a chemical of concern?
 - If yes, continue AA.
 - If no, document decision and phase-out the product containing the chemical of concern.
 - B. If no, continue AA.

2. Has the product containing the chemical of concern reached maturity and should it be considered for sunset?
 - A. If yes, sunset the product. Document the decision. No AA is necessary.
 - B. If no, continue AA.
3. Should the product be considered for the next product innovation cycle?
 - A. If yes, submit the product for redesign and development informed by [Green Chemistry Principles](#). Redesign goes beyond an AA. Rather than eliminating a chemical of concern with a safer alternative, redesign considers all aspects of a product.
 - B. If no, continue AA

Figure 5: Decision Logic for Deciding to Phase-out a Product Containing a Chemical of Concern



Consider Why a Product Contains a Chemical of Concern

Chemicals of concern may be present for a variety of reasons. In some cases, they may be present to meet regulatory requirements. In other cases, they may no longer serve a useful purpose in a product or process. For example, they may be a by-product or impurity of another ingredient, or they may be historical artifacts. It is important to understand why a chemical of concern is present in a product. If the chemical can be eliminated without affecting the product's performance, a business can avoid the AA and its associated costs.

To begin this assessment, ask the question: *Why was the chemical of concern added to the product?*

- If chemical was unintentionally added, continue to “Unintentionally added chemicals of concern.”
- If chemical was intentionally added, continue to “Intentionally added chemicals of concern.”
- If the reason for the chemical's presence is unknown, investigate the product supply chain to identify possibilities. What benefit or benefits does the chemical provide either to the manufacturing process or to the end product?

Unintentionally added chemicals of concern

If unintentionally added, the chemical of concern may be present for several reasons. It may be a by-product of a manufacturing process. For example, polychlorinated biphenyls (PCBs) can be created in the process of manufacturing pigments and dyes. It may be a naturally occurring impurity. For example, lead is often found in zinc. Finally, it may be a contaminant. Lead can contaminate water traveling through lead pipes.

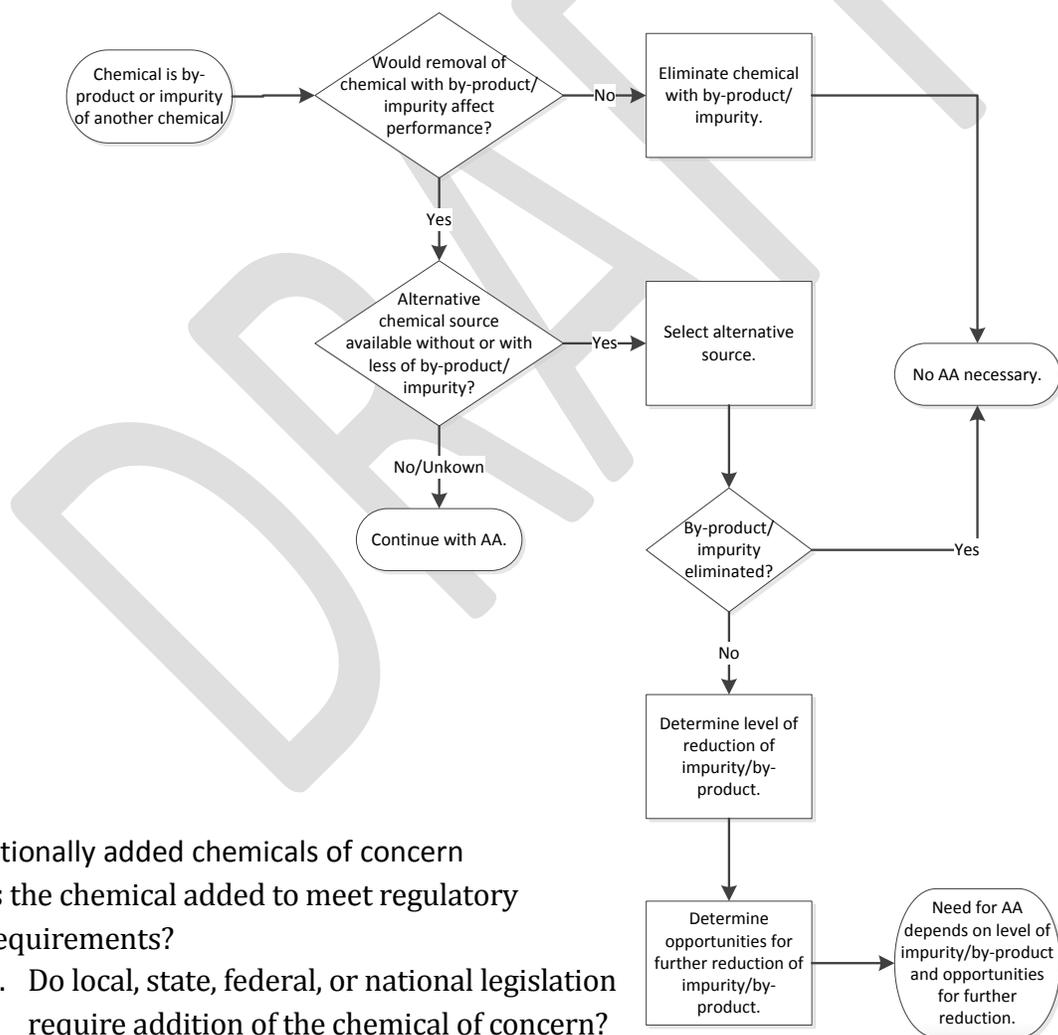
1. Is the chemical of concern an impurity or the by-product of a manufacturing process?
 - A. If yes, would removing the chemical with the impurity or generating the by-product affect product performance?
 - If no, document the decision and eliminate the chemical. No AA is necessary.
 - If yes, continue AA.
 - B. Are other chemical sources available without the by-product, impurity, or contaminant?

Example 1: Caustic soda produced in a mercury cell process may contain traces of mercury. Caustic soda produced with an alternative process will not contain mercury.

Example 2: Reactions used in the production of detergent surfactants can form 1,4-dioxane as a by-product. Dioxane may be removed by means of vacuum stripping at the end of the polymerization process.

- If yes, select alternate sources. Was the by-product or impurity eliminated?
 - If yes, document the results and no AA is necessary.
 - If no, determine the level of reduction of the by-product or impurity. Do opportunities exist for further reduction? The need for an AA depends on level of reduction.
- If no, continue AA.

Figure 6: Unintentionally Added Chemicals



Intentionally added chemicals of concern

1. Is the chemical added to meet regulatory requirements?
 - A. Do local, state, federal, or national legislation require addition of the chemical of concern?
 - Is the chemical of concern specifically required by a regulation?

- Is this use of chemical of concern the ONLY method that meets regulatory requirement?
- Does the regulation specifically prohibit the use of an alternative chemical?
 - If yes to all of the questions above, document information used to reach the conclusion and identify an AA cannot be performed.
 - If no to ANY of the above questions, conduct an AA on the chemical of concern.

Example: A manufacturer of medical radiation screening equipment may have regulatory requirements to provide radiation protection. Lead may be the only substance that can be used and other alternatives or methods may not meet this regulatory requirement. An AA may still be done in this specific application to determine if a better alternative exists. The information used to reach this decision is documented and provided as justification.

Example: Decabromodiphenyl ether (Deca-BDE) is one of the alternatives used to meet regulatory flame retardant requirements in furniture. However, several other chemical and non-chemical methods also meet this requirement. An AA is necessary to determine which of the regulatorily required alternatives has the lowest impact upon human health and the environment.

- B. Determine the function of the chemical in the product or manufacturing process.
- Is the function performed necessary for the success of the product?
 - If no, eliminate the chemical. No AA is necessary.

Example: A major sportswear manufacturer found that several intentionally added toxic chemicals in its rubber formulations were historical artifacts and did not enhance performance of the product. Rather than conduct an AA, the chemicals were eliminated from the product.

- If yes, continue AA process.
- Could the toxic chemical be eliminated from the product formula without adding any new chemicals?
 - If yes, reformulate the product and document the decision. No AA is necessary.
 - If no, continue AA.
- Are there opportunities to reduce the amount of the chemical used?

Example: A major sportswear company was able to reduce total zinc content in rubber formulations by 80 percent and leachable zinc content by more than 90 percent.

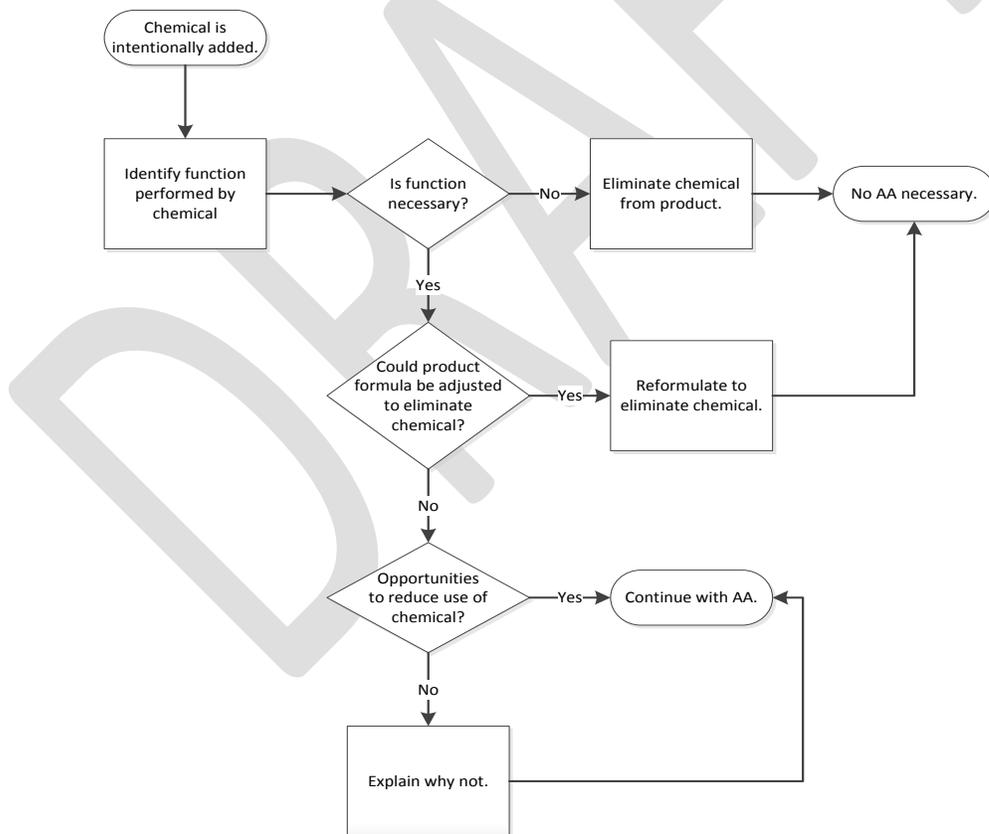
- If yes, continue AA to see if the chemical can be eliminated completely.
- If no, continue AA.
- Is it likely that an alternative might be used in place of the toxic chemical?
 - If no, explain why no alternative is thought to exist. Document information used to reach the conclusion and identify that the AA is complete.

Example: There may be no viable alternative to lead in radioactive shielding.

- If yes, continue the AA.

Many of these decisions are internal to an organization. There are a few tools available to help with these decisions, some of which are sector-specific.

Figure 7: Intentionally Added Chemicals



Tools

- Material declarations may be requested from suppliers by manufacturers.
- Material Safety Data Sheets.
- [CleanGredients](#)
- [European Union Substitution Portal](#)
- [Innovadex](#), the Search Engine for Product Innovators

Appendix B Stakeholder Levels 1 and 2

Initial Screening Process

The initial screening process identifies potential stakeholders pertinent to the chemical, product or process being evaluated. Identification of stakeholders can be a difficult process, and the list of stakeholders should remain open to additions, deletions, and other relevant changes.

If you consider the full life cycle of a chemical of concern, a list of potential stakeholders could include those associated with manufacturing, transport, storage, and product use and disposal.

Using this framework, potential stakeholders include:

Potential Stakeholders	
1. Company representatives	Company owner
	Board of Directors
	Stockholders
	Other Management
	Employees/workers
2. Technical Experts	Testing
	Performance
	Process
	Materials
	Product
	Consumer marketing
3. Supply Chain	Tier 1
	Tier 2
4. Customers	Suppliers
	Retailers
	End user
	Recyclers
5. Interest Groups/Concerned Non Government Organizations (NGOs)	Environmental groups
	Environmental Justice representatives
	Stakeholders affected by life cycle impacts

	(e.g., conflict minerals); (this starts to get to environmental justice issues)
6. Local Community	Local politicians
	Community leaders
	Native Nation representatives (if applicable)
7. Other Governmental Representatives	Federal
	State
	International
8. Other stakeholders unique to your assessment that should be considered?	

During the initial screening, questions that can help identify appropriate stakeholders include:

- Who are the most influential stakeholders within your organization?
- Who are the most influential stakeholders external to your organization?
- Which stakeholders are not typically considered and are they relevant to your business operations and to the products or process with chemicals of concern?
- At what point in the AA process is specific stakeholder input particularly relevant?
For example, technical experts are needed during performance evaluation.

Using this process, potentially interested or concerned stakeholders are identified. The list should be maintained and revisited periodically to determine if new stakeholders have been identified or if input from specific stakeholders is crucial during a specific phase of the AA process.

Stakeholder Involvement Levels

Level 1: Potential Stakeholder Identification and Limited Data Collection

This level conducts an internal evaluation of how stakeholders might be affected by the chemical of concern and potential alternatives. Potential stakeholder concerns should be identified and factored into the AA. Using the list of potential stakeholders developed in the initial screen, potential stakeholder concerns should be evaluated to determine if they might have an impact on the final decision. Seeking input from specific stakeholders is not necessary although some limited discussions between the assessors and potential stakeholders may be desirable. The approach used will depend upon the level of knowledge and expertise of the individuals assessing the chemical, product, or process.

The important point is that stakeholders would typically have minimal involvement in this process although their potential concerns would be considered.

During this assessment process, the follow questions/steps should be addressed/taken:

1. Identify potential stakeholders who might be interested and concerned with the chemical, product or process being considered.
2. Identify potential stakeholder concerns.
 - Are limited discussions with potential stakeholders warranted to clarify concerns?
 - If yes, contact stakeholders, obtain input and continue evaluation.
 - If no, continue evaluation.
3. Can the concerns identified be addressed or mitigated?
 - If yes, list actions that can be taken to address these concerns. Document how these actions will eliminate or mitigate the concern. Continue evaluation.
 - If no, document the conclusions reached and the information used to reach the conclusion. Continue evaluation.
4. Incorporate stakeholder concerns into the decision-making process. Document how this has been done. Continue evaluation.
5. Are any identified concerns serious enough to identify the alternative as unfavorable?
 - Document the information has been used to reach the conclusion. Evaluation complete.

Level 2: Solicit Information from Stakeholders

This level seeks limited input on how stakeholders are affected by the chemical of concern and potential alternatives. Approaches for soliciting input could include interviews, questionnaires, scoping discussions, or similar means. The approach chosen will depend on the stakeholder and his or her level of knowledge relative to the product or process under evaluation. Pertinent stakeholders should be approached to understand their perspectives and to consider those perspectives in the evaluation of alternatives.

Some stakeholders may be useful sources of information and data for the evaluation of alternatives. For example, customers may be important stakeholders as their needs and preferences may be important in the quality of the final product.

Using potential stakeholders developed in the initial screen, identify the approach to solicit input from different groups of stakeholders. Focus groups may be useful when dealing with customers, technical meetings with suppliers, strategy sessions with company management and employees, etc.

1. Identify potential stakeholders who might be interested and concerned with the chemical, product, or process being considered.
 - Contact potential stakeholders to confirm their interest. Continue evaluation.
2. Identify potential concerns of stakeholders.
 - Have those concerns been validated for the chemical, product, or process under evaluation?
 - If yes, continue the evaluation.
 - If no, document the decision reached and the information used to reach the conclusion. Continue evaluation.
3. Can the concerns identified be addressed or mitigated?
 - If yes, list actions taken to address these concerns and document how these actions will eliminate or mitigate concerns. Present actions to stakeholders for review and comment.
 - If no, document the decision reached and the information used to reach the conclusion. Continue evaluation.
4. Incorporate stakeholder concerns into the decision-making process. Document how this has been done. Continue evaluation.
5. Are the concerns identified serious enough to identify the alternative as unfavorable?
 - If yes, have these conclusions been offered for stakeholder review and comment and do the stakeholders concur?
 - If yes, document information used to reach the conclusion and the results of the stakeholder review and comment. Evaluation complete.
 - If no, document the reasons for failure to accept stakeholder input and make it available to stakeholders. Evaluation complete.
 - If no, continue evaluation.

Case Example

AA Guide: During the development of this Guide, stakeholders were not involved in the development of the Guide, but their input was actively sought and when possible, incorporated into the final Guide. As the Team completed portions of the Guide, the results were posted for stakeholder review and comment. Team members reviewed the input and made changes to the document as warranted. All input was retained and, at the end of the development of the final Guide, all stakeholder input was incorporated in a response-to-comment document.

Appendix C Sequential Framework

If the Sequential Framework is selected, the AA should meet minimum recommendations. An initial screen may be conducted to bin those alternatives that have clearly been identified as having serious concerns and therefore, should be eliminated from further consideration. By removing alternatives that have clearly identified concerns, limited resources are conserved and potential favorable alternatives are prioritized for further evaluation. Several modules have an initial screen built in that may be used before initiating the AA. For example, the Hazard Module includes a screening method that compares alternatives against lists of toxic chemicals. More information on screening opportunities is found in each individual module.

None of the initial screens is adequate to meet minimum AA requirements; however, incremental improvement is fundamental to the AA process and these screening methods could also be used by small and medium businesses with limited resources and expertise to conduct some basic review. If used in this manner, businesses should understand that the decisions reached using these screening methods contain considerable risk of making a regrettable substitution. Hence, initial screens are not recommended in stand-alone AAs since they do not meet minimum AA requirements.

Minimum Recommendations

Minimum recommendations include using the lowest level of 4 modules including:

1. Hazard
2. Performance Evaluation
3. Cost and Availability
4. Exposure Assessment

Module order is important. The Hazard Module is implemented first. Alternatives with the lowest hazard assessment are identified and continue on through the assessment process.

Those alternatives identified as unfavorable are binned and removed from further consideration unless subsequent modules eliminate all of the most favorable alternatives. If that occurs, it may be necessary to cycle back and review alternatives in less favorable bins. [More details are available in the Hazard Module.](#)

The most favorable alternatives are evaluated using the Performance Evaluation Module. A broad definition of performance is used to evaluate alternatives. This includes not only a simple evaluation of a one-to-one substitution but also of whether or not changes can be made to the product or process that allows the alternative to be used. [More information on this assessment is available in the Performance Evaluation Module.](#)

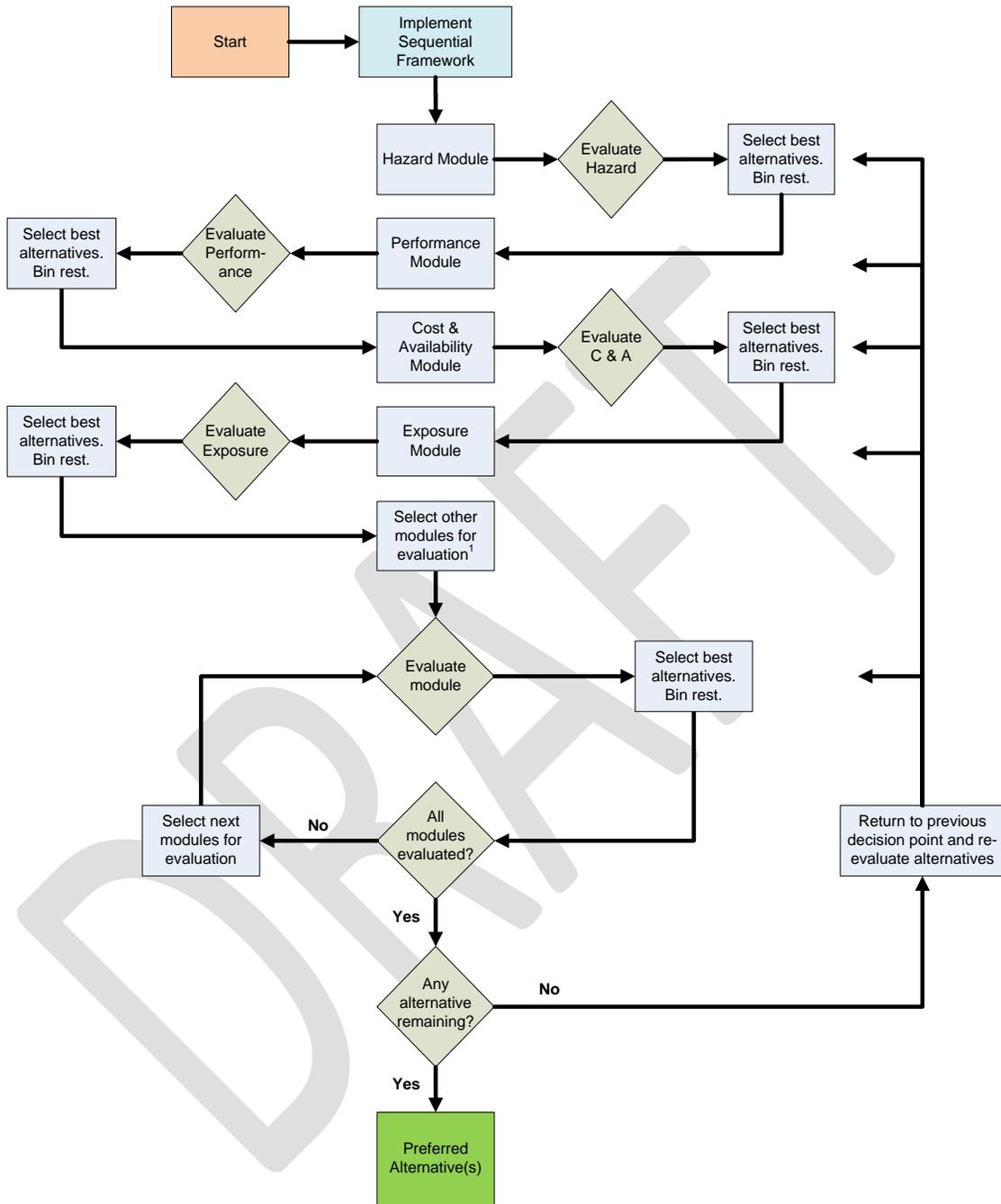
Those alternatives remaining after evaluation in the Hazard and Performance Evaluation modules are evaluated in the Cost and Availability (C&A) Module. The C&A module removes alternatives that are neither cost effective nor available in sufficient quantities to meet manufacturing needs. Alternatives are evaluated using broad definitions in the C&A module. This requires an evaluation of not only current cost and availability but also whether use of the alternative would either drive down cost or increase availability. [More details are available in the Cost and Availability Module.](#)

Remaining alternatives are evaluated in the Exposure Assessment Module where alternatives are identified that present the lowest risk potential. Those that have serious exposure concerns are binned and removed from further consideration. [More details are available in the Exposure Assessment Module.](#)

Once the minimum recommended evaluation is complete, additional modules may be selected and implemented. The assessor decides which additional modules to use, their order, and the level of evaluation within each module. The process used to reach these decisions must be documented and explained.

If successful, the alternative or alternatives identified at the end of the process are the preferred alternatives based upon the combined assessment as shown in [Figure 12.](#)

Figure 12: Minimum Recommendations for the Sequential Framework



¹ The modules that remain are Stakeholder, Materials Management, Social Impact and Life-cycle. The user may select the modules, their order and the level of complexity for a specific alternatives assessment. This decision process should be documented.

In some instances, no alternatives will remain after all alternatives have been evaluated using the selected modules. In those instances, the assessor returns to

previous, less favorable bins. The assessor would step back to a prior module assessed and look more closely at the alternatives binned as less favorable. As all of the alternatives had been found to be favorable at this point, the assessor should evaluate whether the concerns identified in the previous review were sufficient to remove a favorable alternative completely from review. If so, the decision is documented included the reasoning and/or data used to reach this decision and the assessor steps back to the previous module assessment. The process continues until a favorable alternative is identified or all alternatives have been eliminated from consideration.

Lastly, the Sequential Framework has no need for an additional decision method, which simplifies its implementation. Decision methods are contained within each individual module and applied as the alternatives are binned during the specific module evaluation. Only the most favorable alternatives proceed to the next module for evaluation. This winnowing approach reduces the need for an additional decision-making method found in the Simultaneous and Hybrid Frameworks.

Appendix D Identification of Alternatives

This module clarifies the process used to identify the universe of potential alternatives considered during the AA. Alternatives may include chemical substitutions, alternative materials, and changes to the product process or product redesign to eliminate a particular chemical. The widest range of possible alternatives should be researched, including emerging technologies. In subsequent modules, the range of alternatives to evaluate is narrowed on the basis of technical, economic, and health and safety considerations.

This module assumes that a chemical of concern in a product or process:

- Performs a useful function, either in the manufacture of the product or as part of the product itself.
- Is not restricted due to local, state, federal, or international legislation.
- Is not required by local, state, federal, or international legislation.

Chemicals restricted by legislative requirements are not favorable alternatives to the chemical of concern and should be removed from consideration. If a chemical is required, an alternatives assessment process might still be appropriate to determine if any viable alternatives exist.

Specific chemicals may be considered chemical of concern either because of their inherent toxicity or the inherent toxicity of unavoidable contaminants. Chemical

function is part of the [Initial Evaluation Module](#). Initial identification of potential alternatives should begin as a brainstorm of the widest range of solutions possible. Alternatives may include chemical substitutions, the use of alternative materials, emerging technologies or product redesign to eliminate the need for a particular chemical in the first place.

Identification of Alternatives Process

There are two key considerations in exploring potential alternatives for a chemical of concern: the availability of 1) functionally equivalent alternatives and 2) alternatives in the marketplace.

1. Availability of functionally equivalent alternatives

A functionally equivalent alternative is an alternate way of achieving the function performed by a chemical of concern. Functionally equivalent alternatives may include direct chemical replacements or potential chemical replacements dependent on changes to production processes, for example, changing plastics, temperature, flow rate, etc. A functionally equivalent alternative may also include a product design change that precludes the need for a replacement chemical.

Use the following questions to generate the broadest list of potential alternatives possible.

- A. Is the alternative restricted in use by local, state, federal or international legislation, which makes its use infeasible? If so, document this information and eliminate this alternative from consideration. If not, continue evaluation.
- B. Is the chemical of concern required by local, state, federal, or international legislation and no viable alternatives exist? The legislation must identify that no other alternative exists and specifically dictate the use of the chemical of concern in a specific application. If a chemical of concern is only one of a range of possible alternatives, the chemical of concern should be subjected to an AA. If the chemical of concern is required and no viable alternative exists, the AA process is not appropriate. Document information used to reach the conclusion and exit the AA process. If not, continue evaluation.
- C. Does an existing alternative meet a similar or equivalent functional requirement? If not, explain.

- *Example 1:* Lead wheel weights can be replaced with less toxic materials, including safer metals and other non-metallic alternatives.

- *Example 2:* Barrier fabrics between upholstery fabric and foam in upholstered furniture are an alternative to flame retardants in the foam.
- *Example 3:* Aminocarboxylate chelating agents, which persist in the environment, can be replaced with easily biodegradable chemicals.
- *Example 4:* Detergents were reformulated to eliminate phosphates.

- D. Are there technical resources available that identify chemicals, materials, or design changes with similar or equivalent required functionality? A list of potential resources is included in the separate [Resources](#) section for this module. If not, explain and continue evaluation.
- E. Can changes potentially be made to the manufacturing process or product design to allow the use of the alternative?
- If yes, document potential changes your process engineer can make to the product/manufacturing process to allow the use of an alternative.
 - If no, continue evaluation.
- F. Can the functional equivalency be achieved in reasonable time through design of new chemicals or materials applying green chemistry principles or product redesign?
- If yes, is the chemical necessary after re-design of the product?
 - If no, then an AA is not necessary.
 - If yes, continue evaluation.
 - If no, continue evaluation.

2. Alternatives available in the marketplace

A second consideration when identifying alternatives is their availability in the marketplace. Use the following questions to guide the brainstorm process:

- Are there similar products offered for sale that use an alternative? If so, is it possible to identify what alternative was used?
- Do other manufacturers advertise their product as free of the chemical of concern? If so, is it possible to identify what alternative was used?
- Do chemical manufacturer(s) offer alternatives? Is an alternative listed on manufacturer's website?
- Are there publications from trade journals or input from trade associations, technical articles, or other sources of information that identify potential alternatives?
- Does your supplier offer an alternative?

- Does your supplier's competition offer an alternative?
- Have you searched the internet for alternatives?
- Have other AAs identified possible chemicals?
- Have state, local, federal, or international organizations identified alternatives?

Based on the above questions, list all possible alternatives for review by subsequent modules.

Identification of Alternatives Initial Screen

An assessor can focus the list of potential alternatives by conducting an initial screen using the lowest levels of the [Hazard](#) and [Performance Evaluation](#) modules. For example, chemicals identified as equal or potentially greater hazard as the chemical of concern can be eliminated from further consideration. Chemicals that do not perform as identified in Level 1 of the Performance Evaluation Module may also be identified as unfavorable and removed from further consideration. The advantage of these screens is they concentrate potentially limited resources on the most viable alternatives. Any removals from consideration must be transparent and the data used to reach these conclusions documented in the final AA report.

This module requires assessors to consider as many as alternatives as possible to foster innovation and to spur the development of new products that don't depend on the continued use of toxic chemicals. For more information on potential screening mechanisms, see Level 1 of the [Hazard](#) and [Performance Evaluation](#) modules.

Appendix E: Hazard Module

Initial Screen: List Translator

Several government bodies and expert groups have performed comprehensive hazard assessments of chemicals and published lists of chemicals of concern for various hazard traits. Performing an initial screen using these lists can eliminate chemicals of concern and help identify those best suited for a more comprehensive assessment. List Translators enable assessors to identify less favorable alternatives and remove them from further consideration. Clean Production Action has created a list translator, called the [GreenScreen® List Translator](#) for use with chemical hazard assessments.

Automated versions of the List Translator are currently available for a fee. [Healthy Building Network](#) included a List Translator in its [Pharos Database](#). [The Wercs](#), a hazard communication authoring software platform and regulatory content provider, has developed a List Translator tool as part of the services it provides. Both List Translators compare alternatives against authoritative lists for the 18 hazard traits and identify any chemicals, products, or processes for which concerns have been identified.

Level 1: Quick Chemical Assessment Tool

Level 1 uses the [Quick Chemical Assessment \(QCAT\) Tool](#) developed by Ecology. Ecology has developed a guidance document for the QCAT, which provides extensive detail on its use and limitations.

Level 2: GreenScreen® for Safer Chemicals

Level 2 uses the GreenScreen® methodology. The GreenScreen® evaluates chemicals and their potential degradation products against a wide range of human health and environmental toxicity and environmental fate endpoints and physical/chemical properties to determine safer alternatives to chemicals of concern. Chemicals receive a benchmark score based on the combination of the hazard assessments of 19 endpoints (18 required and 1 optional).

Clean Production Action has written [GreenScreen® guidance](#). For further details, assessors should refer to the [GreenScreen® website](#).

Appendix F: Performance Module

The Performance Evaluation module ensures that alternatives are technically favorable for the desired application and meet performance requirements. Without this assurance, companies are unlikely to adopt the safer alternatives for their products or processes. Companies are encouraged to create performance-based specifications that allow for innovation using safer alternatives.

Level 1: Basic Performance Evaluation

This level identifies favorable alternatives based on knowledge of their existing use, marketing information, and/or public reports. It focuses on readily available qualitative information. By considering the following questions, the assessor can make a reasonable evaluation of the alternative's technical feasibility.

1. What are the performance needs for the application, process, or product that contains the chemical of concern (COC)? Why is the COC being used in this specific application?
 - What are the performance requirements at the chemical level?
 - Does the chemical perform a specific function important for its performance? For example, if in a detergent one surfactant highly toxic to aquatic life is replaced with another that is non-toxic, changes are made at the chemical level.
 - What are the performance requirements at the material level?
 - Does the chemical perform a specific function important for its performance? For example, if a plasticizer is added to a hard plastic, the plastic becomes more flexible as may be needed for certain applications.
 - What are the performance requirements at the product level?
 - Does the chemical perform a specific function important for its performance? For example, fire resistance is very important for many. Adding chemical flame retardants is one way to improve performance in case of a fire.
 - What are the performance requirements at the process level?
 - Does the chemical perform a specific function important for its performance? An example would be use of a catalyst to improve the efficiency of a process.
2. Has the alternative(s) already been identified as a favorable alternative with respect to performance?
 - Is the alternative being used (i.e., by others) for the same or similar function? For example, is a chemical being used as a flame retardant in other applications?
 - Is the alternative used in similar products available on the commercial market?
 - Is the alternative marketed in promotional materials as an option for providing the desired function for the specific application of interest?
 - Based upon answers to the above questions, does the alternative appear applicable to the product or process under evaluation?
 - If yes, identify the alternative as favorable. Evaluation complete.
 - If no, identify that the alternative is not technically favorable and document the information used to reach the conclusion. Continue evaluation.

3. Has an authoritative body² demonstrated that the alternative functions adequately for both the process and product? Are there reports from an authoritative body that evaluates the alternative(s) for use in the specific or similar applications?
 - If yes, the alternative is identified as a potential alternative. Either exit the performance module or proceed to the next level of the assessment.
 - If no, continue evaluation.

4. Is the proposed alternative(s) considered favorable but there are indications that it does not perform as well as the current chemical? For example, has the alternative been tested and found to fulfill the necessary function less satisfactorily?
 - If yes, can the process or product be modified to accommodate the alternative and improve its performance?
 - If yes, continue evaluation.
 - If no, is the difference in performance critical to the product?
 - If yes, eliminate the alternative as a favorable alternative and document the information used to reach the conclusion.
 - If no, continue evaluation.
 - If no, continue evaluation.

5. Has the proposed alternative(s) been identified by expert sources as unfavorable, i.e., NOT a viable alternative based on performance?
 - If yes, how do the performance results compare to the desired function in the specific product or process?
 - Is the application of the alternative identical to the chemical of concern?
 - If yes the application is identical, the alternative is NOT technically feasible and document the information used to reach the conclusion.
 - If no, the application is not identical, can the product or process be modified to accommodate the alternative?
 - If yes, identify the alternative as favorable. Evaluation complete.
 - If no, identify that the alternative is not technically favorable and document the information used to reach the conclusion. Evaluation complete.

² An authoritative body is an organization independent of the manufacturer and not tied to industry funding in a way that could affect its independence. Authoritative bodies include state, federal and international government research organizations, independent research organizations conducting scientific studies, etc.

- If no, identify that the alternative is technically favorable and document the information used to reach the conclusion. Evaluation complete.

Appendix G: Cost and Availability Module

This module evaluates the cost and availability of potential alternatives in the AA process. Many alternatives that appear feasible may either be cost prohibitive or not available in sufficient quantities to remain a favorable alternative. Any alternative that can't be found both in sufficient amounts and adequate quantities should be identified and potentially eliminated from consideration as a favorable alternative.

Not only should the immediate cost of a chemical or material be considered but also the cost of chemicals in the product (e.g., if the alternative allows for or results in a product redesign, which causes the cost to be at least comparable at the product level) and over the product's life cycle, including those "externalities" that may become "internalized." Economies of scale should be evaluated and used to determine whether or not a chemical that is not currently manufactured in sufficient amounts or is too costly to be favorable *could* be produced in sufficient amounts or at a lower cost if demand increased. An alternative should not be eliminated solely because it is currently unavailable at sufficient quantities or at too high of a cost when, if demand increased, it could be produced at both an amount and cost to compete with the chemical of concern.

A frequently used example of where cost and availability can prove prohibitive is when an alternative is prohibitively expensive or rare and there are no opportunities to mitigate the cost and availability concerns through recycling, restricting use, etc. In these instances when looking solely at hazard and exposure, the alternative could appear to be favorable from the risk perspective; however, when cost and availability are included in the evaluation process, the prohibitively high cost or limited availability and inability to address these concerns remove the alternative from consideration.

In other cases, a more expensive chemical or material alternative may result in a product redesign that is cost competitive at the product level. Some chemicals, materials, or product redesigns may result in net cost decreases or benefits over the life cycle of the product. Costs and benefits initially external to the decision may become privatized by regulations or by societal demand. Examples include take-back of electronic products, bottle recycling bills, or fees associated with disposal costs to consumers or communities.

The first level of this module considers only cost and availability of the actual alternative.

Level 1: Basic Cost and Availability Evaluation

This level conducts a limited cost and availability evaluation of the available alternatives and factors these results into the AA. It requires only limited knowledge and expertise by the AA assessor. The assessor determines if the alternative is currently being used in cost-effective products. If an alternative meets the requirements of this review, it is a favorable alternative. No further evaluation is required.

The viability of the alternative is determined through responses to two simple questions:

1. Is the alternative currently used in the application of interest? Identify information sources used to reach the conclusion.
2. Is the alternative currently offered for sale for the application of interest? Is the price of the alternative close to the current? Identify information sources used to reach the conclusion.

If the answer to either question is positive, the alternative is considered favorable for both cost and availability and the AA process continues.

Case Example

Deca-BDE in Televisions and Computers and Residential Upholstered Furniture, Washington Department of Ecology and Washington Department of Health

In 2008, the Washington Departments of Ecology and Health conducted an [AA for Deca-BDE](#) in electronic housings and residential upholstered furniture. For both types of applications, the assessment found that alternatives to Deca-BDE were already widely used. The AA found that the alternatives must be cost-effective, or manufacturers would not voluntarily be using them.³

³ *pers. comm.*, Alex Stone, Washington Department of Ecology, January 14, 2013.

Appendix H: Exposure Module

The Exposure Assessment Module is used after the Hazard Assessment Module in order to reduce risk. The selection of alternatives having the lowest hazard prior to the assessment of exposure allows the assessor to be confident the risk is reduced even if the exposure level increases at a later date. Additionally, an alternative with a low hazard but a higher exposure could have a means to reduce the exposure found for it. In this case, if the exposure was reviewed first, that alternative would have been deemed unfavorable prior to the realization of the reduced hazard level for it. Therefore, by applying hazard screening first, options are identified that are more likely to be favorable.

Exposure assessment can support selection of alternatives *when the inherent hazards are equivalent, for example when the functional use of one alternative would result in increased risk due to the quality and quantity of the resulting exposure (exposure profile)*. Not all alternatives will result in the same exposure scenarios. Both near field (direct consumer) and far field (environmental) exposures are considered. The exposure module may also be used independently of the other modules and applied to all options depending upon which framework is selected for data evaluation. This is particularly true if the Sequential Framework is selected but may not be applicable if the other two are chosen.

Initial Screen

The initial screen determines if the exposure pathways and potentials are similar enough between the chemical of concern and potential alternatives that no further exposure evaluation is necessary. If the screen determines no exposure assessment is necessary, the assessor should evaluate this decision throughout the AA process to guarantee that no other subsequent decisions affect this assumption.

1. Compare exposure pathways between the chemical of concern and alternative.
 - Are the exposure pathways similar? For example, are the chemical properties for the chemical of concern and alternative similar for any of the following characteristics? Only evaluate pertinent criteria for the alternatives.
 - Volatility/vapor pressure
 - Molecular weight
 - Molecular size
 - Solubility

- Log K_{ow} ⁴
 - Boiling point
 - Melting point
 - Density/specific gravity
 - pH
 - Corrosivity
 - Dissociation constant
 - Use characteristics (binding properties) or synergistic effects
 - Other
2. Compare the manufacturing criteria for the chemical of concern and alternative.
 - Are the manufacturing criteria similar?⁵ For example, are the manufacturing criteria for the chemical of concern and alternative(s) similar for any of the following characteristics? Only evaluate pertinent criteria.
 - Do they perform the same function in the product?
 - Are they used in the same relative amounts or is the alternative used in lesser amounts?
 - Are they used in the same manner? For example, are they both blended into the product matrix as opposed to being chemically attached?
 3. Compare the fate, transport, and partitioning in environmental media for the chemical of concern and alternative.
 - Are the fate, transport, and partitioning in environmental media similar? For example, are the manufacturing criteria for the chemical of concern and alternative similar for any of the following media with regards to fate, transport, and partitioning characteristics? Only evaluate pertinent criteria for alternatives.
 - Air
 - Water
 - Sediment/soil
 4. Compare the release mechanisms for the chemical of concern and the potential alternative.
 - Are the release mechanisms similar during the different life cycle phases? For example, are the release mechanisms for the chemical of concern and the alternative likely to be similar for any of the following life cycle characteristics? Only evaluate pertinent criteria for alternatives.

⁴ Log of the octanol water partition coefficient which evaluates a chemicals tendency to dissolve either in water or organic solvents.

⁵ More information on manufacturing criteria is available in the Performance Evaluation Module.

- Product
- Manufacturing
- Transport
- End-of-life

Many examples exist that demonstrate the importance of asking these questions. One recent example is the replacement of one plasticizer with another, safer plasticizer. The new plasticizer is from the same chemical family, used in the same amounts and functions and is released in the same manner. Are there any reasons why any of the above issues would be substantially different for the new plasticizer compared with the previous?

Another example is the replacement of a halogenated flame retardant with another, safer flame retardant. The new flame retardant is used in the same amounts, in the same manner (additive), the product experiences the same life cycle (i.e., manufacture, use, end-of-life, etc.) and is released in the same manner. Are there any reasons why any of the above issues would be substantially different for the new flame retardant compared with the previous?

5. Based upon the above evaluation, are there any substantive differences between the use and physical characteristics that could affect exposure?
 - If no, exposure assessment complete. Identify that uses, fate and transport, and potential exposure pathways are similar and exposure concerns become irrelevant.
 - If yes, continue with the exposure assessment.
6. Have you assessed the chemical options for hazard?
 - If no, start with Level 1.
 - If yes, has the alternative been fully assessed and been defined as inherently benign for all hazard criteria (i.e., GS Benchmark 4)?
 - If yes, a full exposure assessment is not necessary. Document the information used to reach the conclusion. Exposure assessment complete.
 - Engineering controls and proper risk management should always be applied (the dose makes the poison, even water can kill you!).
 - If no, continue evaluation.
7. Could the alternative pose a risk based on its physical and biological hazard characteristics? To what extent is the product designed to avoid such risks?

- Inhalation (dust, oxygen displacement)
- Temperature
- Electrocution
- Mold
- Entrapment

Level 1: Basic Exposure Evaluation

Level 1 evaluates specific exposure concerns using readily available qualitative data to the general assessor. Specifically, alternatives found in monitoring studies, that are persistent, bioaccumulative and/or toxic or that pose a substantial exposure concern are eliminated from consideration. However, alternatives that have potential mitigation efforts may still be considered.

Level 1 Process:

1. Consider the presence of the alternative in monitoring studies:
 - Has the alternative been found in bio- or environmental monitoring studies?⁶
 - If yes, classify it as a non-favorable alternative unless a higher degree of evaluation is performed. An alternative found in monitoring studies does not necessarily pose a risk without additional evaluation. This could include hazard or exposure assessments. For this simplified initial evaluation, presence in monitoring studies is assumed to be a concern.
 - If no, has it been looked for in bio- and environmental monitoring studies and not found?
 - If yes, identify the alternative as favorable and proceed with evaluation.
 - If no, identify exposure as a serious data gap that may affect the alternative's viability as a safer alternative. Eliminate the alternative from consideration.
2. Consider the alternative's presence in the product. *Qualitatively*, what are the pathways of exposure during manufacture, transportation, and/or storage, use, end-of-life, etc.?
 - Are any a substantial exposure pathway?
 - If yes, identify the exposure pathway of concern and proceed with evaluation.
 - If no, are there adequate data to support that the alternative does not pose an exposure concern for any of the identified pathways?

⁶ See Exposure Module Resources

- If yes, document information used to reach the conclusion and identify exposure is not a concern for the alternative(s) being evaluated. Continue evaluation.
 - If no, identify exposure as a serious data gap that may affect the alternative's viability as a safer alternative. Proceed to question #5.
3. Consider the persistence, bioaccumulative, and toxic properties of the alternative.
- Have you screened the alternative for persistence, bioaccumulative, and toxic properties based on risk and hazard phrases ([Level 1 of Hazard Module](#))?
 - If yes, highly persistent and/or highly bioaccumulative and/or toxic alternatives (vPvB, vPT, vBT, PBT) should be removed from consideration.
 - If no, screen the alternative using hazard lists and risk or hazard phrases as defined in Level 1 of the Hazard Module. Based upon this review, does the alternative have persistence, bioaccumulative, and/or toxic properties of concern?
 - If yes, note the information used to reach the conclusion and proceed to question #5. Highly persistent and/or highly bioaccumulative and/or toxic chemicals (vPvB, vPT, vBT, PBT) are removed from consideration.
 - If no, document information used to reach the conclusion. Continue evaluation.
4. Consider other inherent chemical properties of the alternative relevant to exposure.
- Does the alternative have properties that contribute to exposure? For example, is it very water soluble, does it volatilize readily into the air, is it easily inhaled or ingested, is it likely to escape into the indoor or outdoor environment (refer to [Appendix⁷](#)), etc.?
 - If yes, are these properties likely to increase exposure beyond acceptable levels?
 - If yes, document information used to reach the conclusion and proceed to question #5.
 - If no, document information used to reach the conclusion. Continue evaluation.
 - If no, document information used to reach the conclusion. Continue evaluation.

⁷ See Appendix: Examples of Exposure Pathways and Chemical Properties that May Enhance Exposure

5. Consider mitigation of potential problems.
- Have steps been taken during the design and manufacture of the product to eliminate the need for the alternative, allow for the substitution of a less hazardous alternative, reduce the possibility of exposure, etc.? For example, is the alternative bound in the product in such a way that prevents dissociation, leaching and volatilization?
 - If yes, document mitigation activities and identify the alternative as favorable.
 - If no, document information used to reach the conclusion and bin alternative as unfavorable.