

**COMPANION USER'S GUIDE:
A MODULAR APPROACH TO ANALYZING INNOVATIVE
ENVIRONMENTAL PROJECTS AND PROGRAMS**

INTRODUCTION

Environmental innovation comes in many shapes and sizes. It may be process or substance-oriented, innovation or program-based, on a facility or geographic scale, community-based or nation-wide, or it may produce systemic organizational change. In all cases, it will be important to determine whether the innovation is achieving its intended outcomes, whether it provides greater process efficiencies or superior environmental performance compared to standard practice, and to identify ways in which to improve the innovation. Program managers must be able to measure and describe the impacts of their programs.

The process of evaluation will help innovation practitioners to answer these questions by identifying clear goals, developing performance indicators to track progress, establishing baseline data, setting targets for future performance, and measuring progress toward such targets. A well planned and thoughtfully conducted evaluation can help determine if program activities are providing the outcomes needed to achieve the stated goals. With evaluation, innovation practitioners can understand barriers to innovation and modify the program as needed to accomplish objectives, or modify program goals to set more appropriate or realistic expectations. Knowledge and insights obtained from an evaluation can serve as performance feedback. Evaluation can also play a pivotal role in mainstreaming innovative practices and policies into everyday work.

The National Center for Environmental Innovation (NCEI) has developed a series of innovation analysis “modules” to assist staff and program managers to answer these questions and others throughout the life cycle of an innovation—from pilot testing to broad-scale application of a successful innovation. The purpose of this document is to assist innovation practitioners with the application of the modules. Each chapter corresponds to the actual module, each of which may be used independently or in combination with other modules, and is intended to serve three purposes:

- (1) Inform the evaluative process
- (2) Help an innovator plan for evaluation at the beginning or intermediate stages of an innovation
- (3) Help serve as a innovation management/development tool

The modules can be tailored to meet each of the purposes mentioned above and the needs of the innovation practitioner. Each module presents an assessment framework, which can be answered with varying degrees of rigor in order to answer the questions for his/her purposes. The main goal of these tools is to allow the practitioner to collect data in an organized manner, conduct an ongoing assessment of the innovation, and provide the information necessary to conduct a full evaluation.

WHAT ARE THE INNOVATION ANALYSIS MODULES?

The innovation analysis modules are a suite of evaluative questions that provide a framework to evaluate, understand, and share information on environmental innovations. Each module represents a compilation of research questions that EPA staff have used when evaluating innovations. The modules partially reflect the pioneering work of Everett Rogers, who analyzed and systematized the life cycle of innovations and wrote *Diffusion of Innovations*.

Because of the diversity of environmental innovations, NCEI designed the innovation analysis modules to provide guidance, direction, and flexibility. The questions are designed to encourage critical thinking and assessment of environmental data, successes, obstacles, and lessons learned in order to help the practitioner improve the innovation. Innovation practitioners are encouraged to consider the core questions contained in each module, determine their applicability to the innovation, make appropriate modifications to the questions, and gather the available data—quantitative, qualitative, or anecdotal—to assess progress. **The quantity and quality of data that the practitioner has and the rigor with which the modules are applied will determine the quality of the analysis.** Although all of the modules do not have to be completed, the information collected from all of the modules could offer a more complete picture of whether an innovation is working well or highlight areas that need improvement. Each module is described briefly below.

- **Mapping the Innovation** – Provides a systematic way to map the logic behind the innovation by asking the practitioner to list the goals, resources, activities, partners/customers, outputs, and intended outcomes of the innovation. This module also gathers background information to describe the innovation, its scope, goals, purpose, regulatory and programmatic issues, participants, and stakeholders.
- **Assessing the Environmental Results of the Innovation** – Assists innovation practitioners in measuring the environmental results of the innovation. Questions regarding the establishment of baseline data, environmental indicators, and performance measures are included.
- **Assessing the Costs and Cost Savings of the Innovation** – Outlines the economic impact of the innovation and gathers information necessary to conduct a cost-effectiveness assessment.
- **Enforcement and Compliance Assurance** – Assesses the practical enforceability of the innovation. This module may require the active participation of Federal and State enforcement and compliance staff.
- **Public Involvement and Stakeholder Feedback** – Gathers information regarding stakeholder/public participation in the innovative process.
- **Assessing the Potential Transferability of the Innovation** – Presents questions that rank innovations on a five-part transferability scale, with the objective of determining whether the innovation is ready for broad-scale application.

WHO SHOULD USE THE MODULES?

Program managers, designers, and staff participating in innovation should use the innovation analysis modules to focus their thinking about the innovative process, assess how well the innovation is working, and assist in innovation management and development. Different members of the innovation team may be responsible for different modules or different components of the modules. For example, one member of the innovation team may be in charge of data collection and management, whereas another member may be the coordinator of public participation. The modules have been designed so that EPA or other Federal government agencies, State agencies, local and Tribal governments, regulated entities and the public at large, can use them for analytical purposes. The questions in each module may be more or less relevant depending on who the innovation practitioner is and how the modules are applied. Another example may be a project manager who is designing an innovation and decides to use the modules to help build evaluation into the design of the innovation. For the purpose of clarity, we discuss the “innovation practitioner, innovator, or practitioner” as the main reader and user of the modules. However, an “evaluator” can use the modules as well.

WHO IS THE AUDIENCE FOR THE RESULTS OF THE EVALUATION MODULES?

Information gathered by using the innovation analysis modules will be a valuable resource for innovation team members, decision makers within an environmental agency, participants in the innovation, the public, and others interested in the progress of the innovation. The *quality and results* of the information obtained will likely influence decisions on the need for modifications to the innovation, or whether the innovation is ready for broad-scale application.

HOW CAN THE MODULES HELP YOU?

The modules are flexible tools intended to guide and shape decisions and discussions around important innovative environmental evaluative questions. The innovation analysis modules provide a systematic way to collect and analyze data, make adjustments to improve performance, and organize, track, and monitor the progress of the innovation. The innovation analysis modules can help determine whether an innovation is working as intended and whether it has the potential for broad-scale application. As a project management tool, they can be used to raise important questions and make methodological decisions explicit. Finally, they can (and should) be modified to adapt to the innovation and the needs of the innovation team.

The modules can also help the innovation practitioner conduct a formal evaluation study. The modules can help identify the evaluation questions about the innovation. Based on the data collected for each module, the innovation practitioner should have a clear picture of where the innovation is working well and where it is falling short of expectations. In addition, the modules will indicate areas of uncertainty or weakness in the innovation design. The evaluation can then be crafted to hone in on both the successful and problem areas through more data collection to understand why the innovation is performing a certain way. The modules will provide the quantitative data needed for the evaluation and some qualitative data. The evaluation should look for a more rigorous approach to collecting additional quantitative data if needed, and the qualitative data that is often needed to understand an innovation. The user's guide provides examples of how the evaluation can be crafted from the modules.

AT WHAT PHASE OF THE INNOVATION SHOULD THE EVALUATION MODULES BE USED?

The modules are intended for use throughout the innovative process: 1) at the design and planning phase to help design the innovation for evaluation; 2) during implementation; 3) when the pilot experimentation is complete; and 4) when informing a formal evaluation. Exhibit 1 provides examples of how each module can be used during the three primary phases of an innovation – design and planning, implementation, and maturity of the innovative concept (or completion of a phase of the innovation).

Designing an Innovation—In order to design an innovation, it is necessary to clearly define the problem that the innovation is addressing and then outline how the innovation will address the stated goals. The modules provide a series of questions that will identify the following: 1) innovation goals and desired environmental and behavioral outcomes; 2) baseline data; 3) performance measures; 4) enforcement and compliance aspects; 5) public involvement requirements; and 6) how to plan for the transferability of the innovation. **It is often difficult to assess how well the innovation is working without planning for data collection early on in the innovation design.**

Implementation of an Innovation—An innovation can be assessed at different levels. As a basic step, every innovation should have a project tracking and monitoring component. The modules provide questions to help set up an adequate data collection system. Project tracking and monitoring means

collecting information on how the innovation is working according to schedule or protocol and meeting stated objectives. Using the modules at this phase pinpoints and addresses successful elements of the innovation and any barriers to success. If the innovation is not meeting expectations in any one area of importance, the modules can be used to conduct a deeper level of analysis.

Assessing the Innovation at the Termination Point—The modules can be used to conduct more of an in-depth assessment to see how the innovation performed. Robust qualitative and quantitative information gained from each module can provide a complete picture of how well the innovation performed in meeting its stated goals. Each module asks the innovation practitioner to assess how well the innovation performed relative to the traditional approach. Determining the relative advantage of the innovation over the traditional approach is vital to innovation transferability and overall success.

Designing a Formal Evaluation—The modules can be used to help the practitioner design a formal evaluation study of the innovation. Evaluation looks at how well an innovation is working to achieve its stated outcomes and why it is working the way it is. The modules ask the practitioner to construct a logic model (Module 1), which is an integral first step to doing an evaluation and to formulating the right evaluation questions. In order to construct the rest of the evaluation study, the practitioner uses the completed modules to help address the following questions: 1) to what extent have the stated outcomes been achieved and why; 2) what aspects of the innovation lead to those outcomes; and 3) what is the context in which the outcomes were achieved.

WHAT KIND OF DATA IS NEEDED TO COMPLETE THE MODULES?

Depending on the innovator's needs, the module questions may be answered with anecdotal, qualitative, and/or quantitative data. Generally, more robust data results in greater certainty in the analysis, or the ability to characterize the uncertainties or successes of an innovation in greater detail. For example, in some cases, an anecdotal reporting of the costs required to pursue an innovation may be sufficient, whereas a financial accounting of capital costs may be necessary for another type of innovation. Data collection will, however, depend largely on the needs of the innovation team and available resources. The modules together can be powerful evaluative tools if the innovation practitioner ensures that it is supported by thorough analyses and quality data.

HOW TO USE THE SIX EVALUATION MODULES

In the sections that follow, each module is described in greater detail, with guidance provided on its application, the organizational structure of the questions, useful sources of information, and a methodology for addressing each module's content. Each module is attached in Appendix A. It is recommended that innovation practitioners answer the questions in each of the corresponding modules rather than within the companion user's guide. In addition, the practitioner should collect information from a variety of sources and in an iterative fashion throughout the innovative process. By returning to the key questions contained in the modules at different phases of the innovative process to assess progress, the practitioner will be better informed and can make adjustments to the innovation, if necessary.

Exhibit 1—Uses of the Modules

Phases of the Innovation	Module 1: Mapping the Innovation	Module 2: Assessing the Environmental Results of the Innovation	Module 3: Assessing the Costs and Cost Savings of the Innovation	Module 4: Enforcement and Compliance Assurance	Module 5: Public Involvement and Stakeholder Feedback	Module 6: Assessing the Potential Transferability of the Innovation
Design and Planning	<ul style="list-style-type: none"> • Identify goals • Identify partners and customers • Identify tools to assist project • Identify preliminary drivers and barriers • Create a logic model for the innovation, innovative project or program • Develop project fact sheets and communication tools 	<ul style="list-style-type: none"> • Identify environmental goals • Identify feasible measurement approach • Characterize baseline • Identify anticipated medium and long-term behavioral and environmental outcomes • Identify data sources and collection/monitoring protocols to obtain outcome data • Set-up schedule to update information 	<ul style="list-style-type: none"> • Identify types of savings and costs goals associated with project • Identify who is incurring the savings and costs (i.e., facility, government) • Characterize baseline • Identify data sources for savings and cost information 	<ul style="list-style-type: none"> • Identify the monitoring, reporting, and recordkeeping requirements • Identify the method of determining compliance (i.e., record review, inspection) • Identify responsible parties for verifying data and information 	<ul style="list-style-type: none"> • Identify key participants • Identify approach for engaging stakeholders • Determine resources available for addressing stakeholder issues • Identify potential stakeholder issues (e.g., Environmental Justice) up-front 	<ul style="list-style-type: none"> • Identify data necessary to determine relative advantage • Identify a path to disseminate information • Define and focus targets of diffusion efforts

<p>Implementation</p>	<ul style="list-style-type: none"> • Modify to accommodate changes in project conception, tools, etc. • Review goals, partners, customers, drivers, barriers etc. identified in the planning stage • Review logic model for completeness and accuracy 	<ul style="list-style-type: none"> • Review data collection and monitoring results to verify adherence to protocols • Normalize and compare mid-course data to baseline to determine need for mid-course corrections • Review data collection to ensure data will provide information on environmental and behavioral outcomes • Review monitoring and measuring approach, baseline data, and anticipated outcomes identified in the planning stage 	<ul style="list-style-type: none"> • Review cost information for completeness and accuracy • Normalize and compare mid-course data to baseline to determine need for mid-course corrections • Review projections identified in the planning stage for comparison between perceived and actual results 	<ul style="list-style-type: none"> • Review and track information to monitor compliance and identify problems or trends that require mid-course corrections • Review requirements established during implementation 	<ul style="list-style-type: none"> • Check in with stakeholders to assess whether there are stakeholder concerns and the level of participation • Assess availability of information to the public • Assess stakeholder participation and participation plans 	<ul style="list-style-type: none"> • Provide opportunities for potential early adopters of the innovation to participate in implementation • Communicate early positive results of innovation • Analyze innovation for its relative advantage
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<p>End of the Innovation</p>	<ul style="list-style-type: none"> • Verify accuracy of original information • Adjust for unanticipated outcomes or changes in approach • Compare goals and items identified in the planning stage with what happened during implementation • Verify accuracy of logic model 	<ul style="list-style-type: none"> • Normalize data to account for changes • Compare pre-innovation baseline to post-innovation results to determine net change • Identify areas of success and shortcomings. • Assess environmental/public health relative advantage of the innovation • Determine if more in-depth evaluation is necessary 	<ul style="list-style-type: none"> • Normalize cost/savings data to account for changes • Compare pre-innovation baseline to post-innovation costs/savings to determine net change • Identify areas of success and shortcomings • Is there a cost/cost savings relative advantage? • Determine if more in-depth evaluation or cost-benefit analysis is necessary 	<ul style="list-style-type: none"> • Verify and evaluate final record reviews, inspections, or other means of compliance assurance • Determine if innovation is practicably enforceable • Identify areas of success and shortcomings • Is there a relative advantage in compliance and enforcement to the innovation? • Determine if more in-depth evaluation is necessary 	<ul style="list-style-type: none"> • Request that stakeholders provide feedback regarding the quality of their experience in the innovative project • Identify areas of success and shortcomings • Determine if more in-depth evaluation is necessary 	<ul style="list-style-type: none"> • Develop and facilitate workshops and networking opportunities to promote learning • Develop users' guides and web-based tools to facilitate scale-up • Identify areas of success and shortcomings • Determine if more in-depth evaluation is necessary
<p>Formal Evaluation</p>	<ul style="list-style-type: none"> • Compare goals and items identified in the planning stage with what happened during implementation • Verify accuracy of logic model • Use logic model to look for gaps and unanswered questions • Use logic model to help identify key evaluation questions 	<ul style="list-style-type: none"> • Determine why there is a difference between pre-innovation baseline and post-innovation results • Determine why there is or is not an environmental/public health relative advantage of the innovation • Describe environmental/public health results in terms of customer, partner and stakeholder satisfaction and discuss why the results have meaning 	<ul style="list-style-type: none"> • Determine why there is a difference between pre-innovation baseline to post-innovation costs/savings • Why or why not is there a cost/cost savings relative advantage? • Determine if more cost-benefit analysis is necessary—why or why not? • Describe costs/cost savings in terms of customer, partner and stakeholder satisfaction and discuss why the results have meaning 	<ul style="list-style-type: none"> • Determine if innovation is practicably enforceable and what it means • Determine why there is a relative advantage in compliance and enforcement to the innovation? • Describe enforcement and compliance assurance in terms of customer, partner and stakeholder satisfaction and discuss why the results have meaning 	<ul style="list-style-type: none"> • Determine why there are areas of success and shortcomings • Why is or isn't there a relative advantage to the innovation in terms of public involvement—i.e., did the public have greater access to information or greater means to participate—why or why not? • Analyze public involvement in terms of satisfaction and ask the question of why are they satisfied or dissatisfied? 	<ul style="list-style-type: none"> • Determine how the innovation would fare if applied more broadly • Determine what aspects of the innovation are working well and those key aspects that need to be modified in order for the innovation to be more broadly applied

MODULE 1: MAPPING THE INNOVATION

Answering the questions in this module provides basic background information on the innovation that includes the problem or opportunity that the innovation addresses, the innovative nature of the project, and the purpose of the innovation. The proposed solution(s) or intervention(s) afforded by the innovation and the specific measures used to measure the effect of such intervention(s) should be described in as much detail as the status of the innovation allows. This module can also help provide the basic information needed for a project fact sheet on the innovation. This module is applicable at any phase of the innovation.

I. Background and Purpose of the Innovation

This section describes basic background on the innovation, including a brief description of how the innovation is different from the traditional way of doing business. The innovation practitioner should also include the impetus for the innovation and its purpose, so that anyone reading about the project will quickly understand its innovative nature. The following questions will help to frame this background information:

1. Why was the innovation developed or proposed?
2. What problem or opportunity does the innovation address?
3. To what extent and does the innovation focus on the following:
 - a. Individual facilities
 - b. Economic sectors or groups of sectors
 - c. Other regulated entities
 - d. Communities
 - e. Tribes
 - f. Other
4. To what extent is the innovation intended to:
 - a. Improve technology
 - b. Streamline Federal/State regulations
 - c. Improve facility operations
 - a. Make more efficient use of Federal/State/local resources
 - b. Improve stakeholder involvement
 - c. Foster organizational change, especially with respect to organizational culture
 - d. Improve environmental management practices (e.g., pollution prevention, environmental stewardship, environmental data, etc.)
 - e. Consider cross-media impacts or multi-media strategies
 - f. Other
5. In what way(s) does the innovation involve new ideas and approaches when compared to the current/existing approach?
6. What programs or policies are impacted by the innovation, and how?

II. Identifying Customers, Partners, and Stakeholders of the Innovation

Answering this set of questions to identify the major participants in the development and implementation of the innovation, and their respective roles and responsibilities. Key individuals or organizations working on the innovation should be identified as partners, i.e., necessary participants in order for the innovation to be implemented. For example, in the case of a facility-specific innovation, a state permit writer may be identified as a key partner. In the case of a community-based innovation, the community leaders and organizers who are actively participating in the innovation should be identified. The roles and responsibilities of Federal and State regulators should be described, key contact personnel identified, and the process for coordination and collaboration documented.

The innovator should also make an attempt to describe the customers of the innovation. For example, is the innovation going to benefit the government and regulated entities? If the answer to both questions is “yes”, then the innovator should further specify parties in the government that may benefit (e.g., inspectors, permit writers), the level of government at which the innovation is aimed (e.g., the innovation is intended to benefit state permit writers and inspectors), and the types of facilities that may benefit (e.g., is the innovation intended to help a sector or an individual facility?). Specificity in identifying customers of the innovation will allow the innovator to target resources, collect data and communicate results, and craft public involvement strategies. Key stakeholders in the innovation are the individuals who may care about the innovation and its results, but may not be active in the everyday implementation and activities of the innovation. For example, for an EPA innovation, key stakeholders may be a nearby community, EPA senior managers, and Congress. For a facility innovation, senior corporate managers and shareholders may be key stakeholders to engage. These stakeholders are important to keep in mind when communicating the results of the innovation or in designing the innovation.

7. Who are the key regulated entities?
8. Who are the key partners?
9. Who are the key customers?
10. Who are the key stakeholders?
11. Who has primary responsibility for designing, overseeing, and implementing or using the innovative approach or tool?
12. Does the innovation involve delegation of regulatory responsibilities from EPA to a Tribe or State or from the State to local government? (Y/N). If yes, how?

III. Tools that Assist Innovation

The tools that assist innovation may have significant influence on the progress and advancement of the innovation. This section identifies and describes tools that have been or will be used during development and implementation of the innovation. These tools may include but are not limited to: environmental management systems, economic incentives, regulatory reform, smart permitting, pollution prevention, performance-based compliance assistance, information management and access, and risk-based standards.

13. What innovative tools are employed (e.g., economic incentives, EMSs, regulatory reform, smart permitting, pollution prevention, performance-based compliance assistance, information management and access, risk-based cleanup standards)? Please describe.

IV. Drivers for Innovation

This question is asking the innovator to identify the primary motivating factors that are driving the innovation forward. There may be many drivers for innovation – including the need for regulatory flexibility to reduce uncertainty within the permitting process, rapid economic growth, technological/scientific development, increased environmental awareness, population growth, urbanization, and international commerce. Drivers that promote innovation should be identified, and if possible, ranked according to their significance. For example, the potential opportunity costs of delays from air permitting can be high, creating a demand among companies for permit flexibility to stay competitive within a global market. By identifying the primary drivers for innovation, the practitioner may be better equipped to identify potential adopters of the innovation in the event of broad-scale application.

14. Describe all drivers for innovation that pertain to your innovation and explain how such drivers promote innovation (e.g., law or policy that promotes the use of the innovation).

V. Barriers to Innovation

From the point of view of an innovator, barriers to innovation may include: technical challenges consisting of inadequate tools or limited economic alternatives; scientific challenges consisting of the absence of key data or inadequate scientific understanding; institutional challenges such as a resistance to change, a jurisdictional challenge, or lack of an authorizing environment; or legal challenges arising from laws, regulations, or policies that impede innovation. Different barriers require different strategies to create a pathway for the innovation. Barriers, and the strategies for overcoming these challenges, should be identified within this module. Innovation practitioners should identify and address barriers, or perceived barriers, early in the innovation to enhance the innovation's chances of success.

15. Describe all challenges to your innovation and explain how such challenges present barriers.

VI. Describing the Logic of the Innovation

Many innovative programs and projects often run into trouble because they lack a well-articulated road map describing the logic of the program or project. Having gathered information on the purpose of the innovation, the problem or opportunity the innovation addresses, as well as the customers, drivers for and barriers to the innovation, as a next step in the process, innovation practitioners may want to develop a logic model that synthesizes the key activities intended to achieve the goals of the innovation into a picture, which links inputs to activities and to expected outputs and outcomes. A logic model is a diagram and text that describes the logical (causal) relationships among program elements and the problem to be solved, thus defining measurements of success. This section of the user's guide leads the innovator through an exercise to map out the logic behind the innovation. The innovator is provided with a template in Module 1 to enter in a completed logic module.

Using a logic model helps determine the degree to which an innovation's activities affect the expected outcomes and can help plan appropriate measures to achieve the outcomes. Logic models can be created in many different ways. For an ongoing innovation, the starting point can be the elements of the innovation, which are then organized into their logical flow. For a new innovation that is in the planning phase, the starting point can be the mission and long-term goals of the effort. The intermediate objectives that lead to those long-term goals are then added to the model, followed by the short-term outcomes that will result from those intermediate objectives. The key to the logic model is that it tells the story of why the innovation is important, how it will make a difference, and the expected outcomes as a result of the innovation. An example of a logic model is provided in Exhibit 1a on Page 13.

VII. Benefits of Developing a Logic Model

Design Phase

The logic model can help communicate the performance story of the innovation and can help build a common understanding of the purpose, goal, and anticipated outcomes among staff and stakeholders. By answering questions relating to what the innovation is trying to achieve, with what resources, through what customers, the program niche, and the expected results within a given context, the logic model can help identify potential pitfalls in the design of the innovation. The logic model identifies potential outcomes that may be difficult to achieve based on the design of the innovation or innovative program. For example, if the innovation is supposed to result in a behavior change due to adoption of the innovation and there is no way of knowing if the intended practitioner of the innovation does or does not adopt the innovation, then it will be difficult to measure the success of the innovation.

Implementation Phase

The logic model can also be used to further design and develop innovation by helping to identify gaps in the suite of activities and prioritize programs and resources toward achieving desired end outcomes and goals. By being explicit about the program theory and assumptions behind an innovation, various stakeholders and policy-makers can better understand the innovation.

Once completed, the logic model can help the practitioner “manage for results”. By arraying information in a logical sequence the innovation practitioner can identify and choose appropriate performance measures. Specifically, the identification of anticipated outcomes will also be useful in identifying and developing performance measures and indicators that can be used to determine if the innovation is achieving the stated goals, objectives, and results. The development of performance measures and the collection of data can facilitate *program improvement* and allow the practitioner to communicate the value of the innovation and influence new program development. As a planning and evaluation tool, the logic model can help identify which areas of a program to focus an evaluation.

End of the Innovation Phase

If a logic model of the program was not completed during the design or implementation phases, producing one at the conclusion of an innovation and at the outset of an evaluation can be an extremely valuable process. A logic model at this stage will help describe the operation of the program to stakeholders and evaluators, identify potential questions to be asked through an evaluation, and highlight the key areas of program design and theory for further analysis. If a logic model was created during an earlier phase, returning to it at this point and comparing how the innovation actually functioned to the earlier logic model can provide a starting point for areas to focus on during an evaluation.

Formal Evaluation

The logic model can help identify the right evaluation questions to ask based on the major components of the innovation. The evaluation focuses on the connection points between the elements of the program. This means that the practitioner should focus on the “how and why” between the phases of the program. For example, if the innovation is supposed to change the behavior of a target group of individuals in order to get improved compliance—some evaluation questions to ask are: 1) to what extent has compliance improved, 2) what is the innovation doing to change people’s behaviors, and 3) what else could be causing the change in behavior?

VII. Steps in the Logic Model Process

The logic model provides a basis for identifying the major facets or components of the innovation being evaluated. This is less difficult if the practitioner determines the major functions of the innovation and then aggregates similar functions into program components. After each major function area or component is identified, it should be described in terms of the resources (inputs) needed to conduct the activities, (e.g., staff, time, finances, information, equipment, facilities, etc.) and activities (processes) that will be accomplished to achieve the objectives, outputs, and outcomes. The following five steps can help in the development of a logic model of the innovation. Please note that not all of the steps mentioned below have to be formalized. Time and resources may limit the extent to which the innovator implements the logic model process, but at a minimum, people involved with the innovation should work on a logic model.

STEP 1: Establish a Stakeholder Workgroup and Collect Documents

An important first step in developing the logic model is to establish a workgroup comprised of individuals/stakeholders that are knowledgeable about the innovation. A stakeholder workgroup can


provide a wide breadth of information and different perspectives and knowledge about the innovation that might otherwise be missed if developed by a single individual. Once convened, the workgroup should review any available documentation about the innovation that will provide information on goals and objectives, costs, anticipated outcomes, etc. Sources of program documentation may include, strategic and operational plans, budget requests, current metrics, past evaluations, evaluations of similar innovations or programs, extant theories (e.g., economic, behavioral sciences), and interviews. This stage does not have to be overly formal nor does it have to be a large workgroup. The main goal is to make sure that major components of the innovation are accounted for and that the logic model will provide a close to accurate roadmap of the innovation and its intended outcomes.

STEP 2: Define the Problem and Context for the Innovation

Clearly defining the problem the innovation is designed to address and understanding the context in which the innovation is designed to operate will help the practitioner understand the conditions that may influence the success or failure of the innovation. Using the answers to the questions in Module 1, begin to develop a problem or issue statement that describes the problem(s) the innovation is attempting to solve or the issue(s) the innovation will address. As part of this step, specify the needs and/or assets that led to the design of the innovation which addresses the problem. If desired, state and/or identify expected results or vision of the future (including those results out of the control or not in the direct influence of the innovation) by describing the expected near and long-term outcomes. Next, list the possible factors that will influence change in the affected community and list general successful strategies or “best practices” that have helped achieve the kinds of results intended by the innovation. Lastly, state the assumptions behind how and why the change strategies will work.

STEP 3: Define Elements of the Logic in a Table

Using the answers developed to the questions in Module 1, use the blank table included in Module 1 to: 1) describe the resources or influential factors available to support the innovation activities; 2) describe each of the activities conducted to support the innovation; 3) identify (for each activity) what outputs (service delivery/implementation targets) aimed to produce/provide; 4) describe the customer(s) the innovation is intended to reach through the activities and the partner(s) needed to implement the innovation; and 5) identify the short-term, intermediate and long-term outcomes the innovation is expected to achieve for each. Exhibit 1a below provides an example of a completed logic model table. Just as a reminder: **Short-term outcomes** are described as changes to attitudes, knowledge and/or skills of the target customers. **Intermediate outcomes** are described as changes in behaviors that result from the acquisition of knowledge or shift in attitude that flows from the short-term outcomes. **Long-term outcomes** are outcomes that result in a change in condition—e.g., the air is cleaner.



Tip:
Understand the **ABC's** of your innovation's outcomes

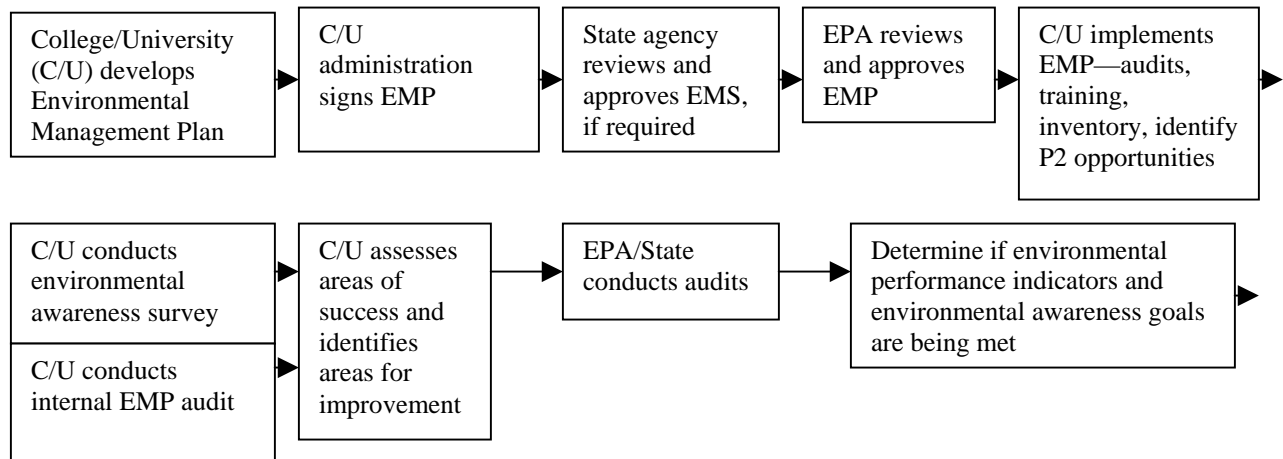
Exhibit 1a—Abridged Logic Model of the New England Labs Project XL

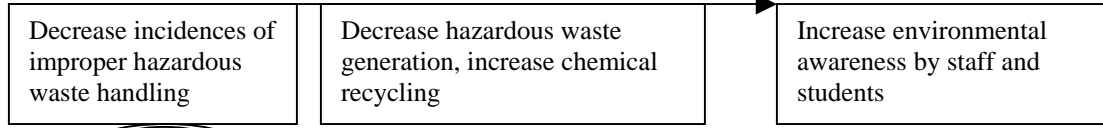
Resources <i>(what you invest)</i>	Activities/ Programs <i>(what you do in the program)</i>	Outputs <i>(what you produce)</i>	Customers <i>(who you reach and who you work with)</i>	Short-term outcomes <i>(what are the short term results you are looking for?— changes in Attitude, knowledge, skills)</i>	Intermediate outcomes <i>(what are the intermediate results you are looking for?— changes in Behavior)</i>	Long-term environmental outcomes <i>(what is the ultimate impact of the innovation on behavior, human health, environment— changes in Condition?)</i>
Examples: <i>Staff Budget Technology</i>	Examples: <i>Develop Environmental Management Plan Auditing Training Surveys Reporting</i>	Examples: <i>Inspection Audits Trainees</i>	Examples: <i>Customers— staff and students; Partners— Administration and department chairs</i>	Example: <i>Increase in knowledge of regulations Change in attitude to recycling</i>	Example: <i>Decrease in improper waste handling and management Increase in recycling Decrease in waste generation</i>	Example: <i>High environmental awareness among staff and students and implementation of pollution prevention activities</i>

STEP 4: Develop a Diagram of Logical Relationships and a Narrative

As the model is developed, remember that innovation components are often related. The logic model should help graphically depict and explain the logical relationships that exist between inputs, outputs, and outcomes. It graphically illustrates what must occur in order for the innovation to accomplish its goals. While the boxes represent an activity, the arrows indicate the connection between the activities. As the model is developed, limit the words in the diagram, but attach more detail in separate charts or a narrative that describes the information underlying the assumptions. Keep in mind there are many different forms of logic model diagrams. The innovation practitioner may want to have more than one model that depicts different levels of detail, different groups of activities, different levels at which performance is measured, different stakeholder views, or different theories.

Exhibit 1b—Abridged Logic Model Part 2





Outcomes

STEP 5: Verify the Logic with Stakeholders

As a final step, be sure to verify the logic model to ensure that all aspects of the innovation have been captured and depicted. The original stakeholder group can review the logic model or an even broader group of stakeholders can be employed for this. As the model is reviewed, consider asking “How-Why” questions. For example, start with a specific outcome and ask, “How is the outcome expected to be achieved?” Start at Activities and ask, “Why is this activity important?” Also consider asking “If-Then” questions. For example, start at Activities and move along to Outcomes and ask, “If this activity happens, then what outcome is expected?”

MODULE 2: ASSESSING THE ENVIRONMENTAL RESULTS OF THE INNOVATION

Module 1 asks the innovation practitioner to describe the logic of the innovation, and the logic model process describes the relationship between the goals, activities, outputs, and outcomes of the innovation. This module is intended to help the practitioner identify the environmental goals of an innovation, link environmental outcomes to those goals, identify appropriate performance measures, determine methods for measuring results, and measure the results of the innovation. The term *environmental results* is intended to include output measures (e.g., number of facilities committing to a reduction in greenhouse gases in a voluntary program or number of permits issued), outcome measures (e.g., percent reduction of greenhouse gases over the baseline), and environmental indicator measures (e.g., air monitoring data that indicates improvements in air quality).

Innovation analysis often falls short on identifying environmental performance measures, tracking environmental indicators, and measuring environmental outcomes. **Performance measures** are usually designed at the start of the innovation and track with the goals of the innovation. For example, if the innovation is an environmental technology, an example of a performance measure for the innovation is 50 percent adoption of the innovation within two years. **Environmental indicators** help measure the state of our air, water, and land resources, the pressures on them, and the resulting effects on ecological and human health. An example of an indicator measure is the number of people living in areas with ozone (8-hour) and particulate matter levels above the National Ambient Air Quality Standards. **Outcome measures** look at the extent to which the innovation is achieving its intended results. For example, EPA's programs should have long-term environmental outcomes of improving public health and the environment and quantifiable health and environmental measures to show if EPA is reaching its goals. The logic module in Module 1 asks the innovator to think of outcomes in short-term horizons (i.e., a change in attitude or acquisition of knowledge), intermediate outcomes (i.e., a change in behavior), and long-term outcomes (i.e., a change in condition).

Environmental results may also include the benefits of having a cleaner environment, which can be classified into three types of benefits: 1) human health, 2) ecological, amenities (i.e., taste, odor, visibility), and 3) reduced environmental damages (e.g., reduced runoff). Such environmental results should be identified and, to the extent feasible, described quantitatively. In situations where quantification is not possible, the innovation practitioner should qualitatively describe the benefits.¹ Results also may include or be dependent on behavioral changes that the innovation may be trying to address. Behavioral changes can also be described in this section, however they may be described at different qualitative levels (e.g., anecdotal evidence versus a survey) depending on the analytical rigor necessary for the innovation.

Design Phase

For innovations in the planning phase of the innovation life cycle, evaluators should be able to identify goals, develop appropriate measures to assess whether the innovation is meeting its goals, and *anticipate* environmental outcomes. Often, the hardest part of designing an innovation is choosing appropriate measures to describe the intended outcomes of the innovation. Many innovations stop at the measurement of outputs of the innovation (e.g., number of permits issued or number of inspections completed), especially in the design phase. The innovation practitioner should have an eye to linking the output measure to the outcome measures for intended or expected outcomes (e.g., 10 percent reduction in emissions from permitted sources).



Tip: A logic model can help!

¹ This module is not intended to result in a valuation of benefits that would occur in the context of a formal benefit-cost analysis. Instead, the analyst will assemble available information and use it to guide the development of the innovation.

Implementation Phase

For innovations in implementation (depending on how long the innovation has been implemented), innovators should be able to measure and report results as to whether environmental outcomes are meeting or exceeding expectations when compared to the baseline measures. In addition, innovators should look at collecting and reporting qualitative and quantitative information needed to explain if and how well the innovation is working. During implementation, this module may be used to re-check the data measurement and collection approach depending on the results. A mid-course analysis may reveal a data gap or incomplete data collection. The innovator may have to decide what the impact of a data gap is on the long-term course of the innovation and whether the data should be collected mid-stream.

End of the Innovation Phase

For mature innovations, the innovator should demonstrate if and how the innovation poses a relative advantage over the traditional approach in terms of environmental results. This module explores possible differences between anticipated results and actual results in order to ascertain if and why, the innovation may or may not be working as intended. For an innovation to succeed and possibly be replicated, qualitative information as well as quantitative data on environmental outcomes is needed.

Formal Evaluation

The practitioner should focus on how the results were achieved and if a causal link can be made between the innovation and the results. The evaluation should address how the innovation caused the intended outcomes to be realized. If the outcomes were not realized, the evaluation should focus on why they were not realized and how the innovation should be modified or improved to realize outcomes in the future.

This module concentrates on environmental results in contrast to process efficiencies such as permit streamlining that make more efficient use of Federal, State, or local resources. Such efficiencies could be addressed in Module 3: Assessing Costs and Cost Savings of Innovation. Process efficiencies may result in greater environmental protection because scarce resources are able to focus on other environmental problems, but it may be difficult to track these connections and to determine a cause and effect relationship.

I. Identifying Environmental Goals of the Innovation

In Module 1, the practitioner identified the problem(s) that the innovation was designed to target and asks the user to identify outcomes for the innovation in a logic model. Module 2 asks the practitioner to identify the environment goal or goals that innovation intends to achieve relative to the problem that the innovation is trying to solve. The innovation practitioner should ensure that the stated goals appropriately match in size and scope, the nature of the environmental problem that the innovation is trying to solve.

1. What are the specific **environmental goals** that the innovation is intended to achieve? Please describe.
2. Do the goals of the innovation match the problem(s) that the innovation is trying to solve? (Related to Module 1)
3. Do the goals of the innovation match the expected/intended outcomes of the innovation? (Related to Module 1)
4. Do the goals of the innovation include **cross-media transfers**? If yes, how many and what types of cross media transfers are being considered?

II. Measuring the Environmental Results

In order to make sound judgments about the potential benefits of the innovation, the practitioner needs to measure the results of the innovation when compared to the current practice. That is, compare the current state of the world (or world without the innovation) to the one in which the innovation is in effect—this determines whether the innovation is achieving its intended outcomes. If the user is in the Federal

Government, measurement is also central to reporting obligations under the Government Performance and Results Act (GPRA). The practitioner can adapt the questions in the module to address the GPRA reporting requirements as well as any other reporting requirements specific to the innovation. The next section includes the overview questions, a discussion of the issues to consider in answering each question, how to design performance measures, and examples of how data might be organized to measure environmental impacts.

Measurement Approach. A measurement approach is the method(s) that will be used to collect data and information on the innovation. For example, the innovation practitioner may decide to use focus group interviews to collect qualitative data on the efficiency of the innovation and can use air-sampling data to collect data on the efficacy of the innovation. The practitioner must determine what measurement approaches are feasible based on the available data – quantitative, qualitative, or anecdotal – and the needs and resources of the innovation team. They are more likely to have greater flexibility at the design phase to choose the appropriate measurement approaches than if the innovation is already being implemented.

The availability of quantifiable environmental results depends on the type of intervention of the innovation. For example, where an innovation results in a change in the level of emissions or discharges that are already being monitored and tracked for regulatory purposes, it will be easier to access data (e.g., permitted source will already be monitoring and tracking emissions through stack tests). If an innovation is aimed at an environmental problem for which there exists little or no data (e.g., non-point source pollution for certain pollutants), it will be more difficult to quantify the level of improvement directly related to the innovation, through environmental indicators.

Qualitative and anecdotal data can support an innovation and may be necessary to make the case for transferability of the innovation. For example, in the case of a health benefit, it may be possible to qualitatively assert that the innovation is expected to be a contributing factor to a reduced incidence of asthma in children without establishing a direct correlation between the innovation and the reduced incidence. Anecdotal data also provides information on how people perceive the innovation to be working. An example of an anecdotal use of information might be where a regulatory agency is testing the merits of an Internet-based public participation process and stakeholders are asked informally to provide feedback because it is not feasible to conduct a statistically valid survey.

NOTE: If the user is in the Federal government, there are restrictions under the Paperwork Reduction Act on surveys and questions that the Federal government can ask of non-Federal entities or persons. For more information on survey/interview limits of Federal entities, please see <http://www.epa.gov/icr/icr.html> for more details.

Baseline Data. Establishing a credible baseline is critical for measuring the impacts of environmental innovations. Developing a baseline involves more than taking stock of current conditions; it lays the foundation for which all future environmental progress will be measured. Baseline data provide a frame of reference for the change that the innovation is initiating. Characterizing an appropriate baseline involves describing the conditions that prevail in the absence of the innovation by looking at measures, time frame, assumptions, and comparability. It is important to collect baseline data before the innovation is applied.

Measures: The innovation goals should be translated into measurable parameters, and appropriate metrics should express both baseline conditions and expectations of future changes. Appropriate measures to consider are environmental measures (e.g., particulate matter emitted), economic measures (e.g., tons of cement produced), and the inter-relation of environmental and economic measures (e.g., particulate matter emitted per ton of cement produced) when developing a baseline and planning for future reporting.

Baseline assessments are most helpful if innovation goals are addressed and well-defined at the beginning of the innovation. For example, if a facility's goal is to reduce Hazardous Air Pollutants (HAPs), it should clarify whether it is committing to reduce all HAPs, or it is focusing its efforts on reducing a subset of HAPs. Units of measurement and numeric expressions should be standardized early on. For example, mass units (tons, pounds) and actual number are appropriate measures to use. Similarly, measures for assessing economic activity should be standardized early on. The established environmental and economic baseline measures should be transparent and as simple as possible.

Normalizing measures: Normalizing environmental and economic data helps to organize data so that it remains relevant and meaningful in describing the innovation despite changes to processes or practices associated with the innovation. A common way to normalize data is on a per unit basis, or using a normalizing factor to adjust performance to the baseline year.

To normalize data on a per unit basis, simply divide the environmental quantity by the production measure for the same time period, which is typically one year (e.g., tons of emissions per tons of product annually). For example, if a facility produces 2000 tons of cement a year and 30 tons of air pollution, its per unit pollution is $30/2000 = 0.02$ tons of air pollution per ton of cement.

When using a normalizing factor, the factor assigned to the baseline year is always one (e.g., Year 01). For example, in the first year of reporting and then in subsequent years, a facility divides its current year production by its baseline year production to derive the normalizing factor for that year. The facility then divides its actual environmental performance by the normalized factor to derive the normalized quantity. In Year 1, the facility produces 2000 tons of cement and 30 tons of air pollution. In Year 2, the facility produces 2300 tons of cement and 28 tons of air pollution. Its normalizing factor for the baseline Year 1 is 1.15 (2300/2000). To calculate Year 2 tons of air pollution normalized to the baseline Year 1, divide the tons of air pollution produced in Year 2 by the normalizing factor to get 24.35 (28/1.15) normalized tons of air pollution. The normalized quantity is less than the actual quantity in Year 1, reflecting that the facility performed proportionally better than its actual environmental statement given the increase in production in Year 2.

NOTE: If the innovation practitioner is trying to aggregate normalized data or compare normalized data across facilities—ensure that the basis for normalization is similar in order to be able to compare relative environmental performance.

Time frame: Another key decision to make when establishing a baseline is the appropriate period of time that characterized “current” or “normal” environmental and economic conditions. Using one year of recent data or an average of two years data is appropriate when:

- Economic activity is relatively steady over time;
- Recent and significant environmental technology upgrades mean that older environmental data are no longer applicable to future activity;
- Reporting on past performance related to the same innovation and is providing applicable economic data, essentially providing a longer time horizon for baselining; or
- Other facilities are involved in the innovation and may have one of the above circumstances.

It is important that environmental and economic data are reporting in the same time frame when establishing a baseline, as well as throughout the life of the innovation. Matching multi-year environmental data with single year economic data has the potential to skew the measurement of results.

Assumptions: The innovation practitioner should consider key assumptions behind the data collection. For example, if the innovation will be affected by impending regulations, the innovation baseline should account or include the effects of the new requirements in the baseline or explicitly identify the innovation impacts of the regulations. Criteria for making this determination could include the time frame of the

pending regulatory change compared with the time frame for the innovation, the level of certainty regarding the change in regulations, and the level of certainty regarding the effect of the change on the threshold for compliance.

Comparability: If the innovation practitioner is interested in comparing a series of like-innovations for transferability potential, then it is important to standardize the baseline as much as possible to allow for comparison of data. Specifically, individual projects that are part of a larger innovation initiative should ideally use the same measures, timeframes, and regulatory assumptions. Failing to standardize baseline conventions often sets individual projects down different paths in terms of data reporting and can lead to great difficulty in comparing the results of multiple innovations, and in analyzing factors that affect innovation success or failure. The innovation practitioner should consider the following baseline comparability factors whenever possible:

- Identify a reasonable compromise format that suits all innovations within a program.
- Data is provided in multiple formats—to better reflect individual innovation needs and one that is suitable for comparison and aggregation with other projects.
- Try to identify at the start of the innovation the components that may not be comparable to others due to existing baseline conditions.

A determination of what entities will be subject to the innovation allows the innovation practitioner to define the extent to which segments of the community will be affected by the innovation and to identify reliable databases from which to draw information regarding the number and size of such entities. Alternatively, the innovation practitioner may need to confer with councils, trade associations, or community groups to determine methods for gathering data regarding existing conditions. Despite efforts to use the best available data sources to establish a baseline analysis, the innovation practitioner should nonetheless identify areas of concern such as the consistency of variables over space and time, adherence to sampling protocols, sensitive populations, whether non-compliant or exempt entities are included, or any other limiting factors. In addition, there may be cases where the innovation is providing the data in an area where little existing data exists. If such is the case, if appropriate, surrogate data from research or data from similar experiments may be used. Depending on the innovation, the baseline may in fact be the absence of information, activities, or data.

Environmental Indicators

5. For each environmental goal, what qualitative and quantitative **environmental indicators** (e.g., beaches closed, waters impaired, brownfields redeveloped) are being used to measure progress/impacts?
6. What is the **measurement approach** (e.g., modeling data, in-situ experiment, data extrapolation, real-time, one-time observations) that will be used to measure progress for each environmental goal?
7. For each environmental indicator, what is the **pre-innovation “baseline”** against which progress is measured (e.g., baseline is that 10 percent of beaches currently impaired—the innovation is to have zero impaired beaches in five years)?
8. How will pre-innovation “baseline” conditions for the **environmental impacts of third parties** (customers, suppliers, environmental quality trading partners, etc.) be established? How will changes be measure and non-innovation related changes controlled for?
9. For each of the environmental indicators listed above, what is the **schedule for data collection** (daily, weekly, yearly, etc.)?
10. According to the indicators listed above, what have been the **environmental impacts** of the innovation (e.g., 100 tons of volatile organic compounds emissions have been eliminated)? *Provide both qualitative and quantitative outcomes. The innovation may be of too recent origin for environmental impacts to be observable. Provide qualitative outcomes if possible—e.g., increase in senior management review, etc.*

Environmental Results of the Innovation. By comparing the pre-innovation baseline environmental results to the results during implementation or post-innovation, the practitioner can determine the net

change as a result of the innovation. This will allow for mid-course corrections, if necessary, or a determination as to whether the innovation had the desired outcomes.

An organizing table is provided in Exhibit 2. This model is neither intended to be comprehensive, nor anticipate every kind of innovation for which practitioners will want to assess environmental results. It should be modified to suit the innovation as the elements provided in the table are for illustration only.

Data Sources, Collection, and Verifiability. It is recommended that the innovation team identify early in the process the data sources, collection and monitoring protocols, frequency of collection, persons responsible for data collection, and methods for data verification and quality control. By establishing procedures up front, it will be easier during implementation and at the evaluation phase of an innovation to assemble the proper data to determine credible environmental results.

Environmental Results

11. To what extent are the **environmental impacts** of the innovation consistent with what was expected at the time of design and implementation?
12. Are **sufficient data available** to determine if the innovation has met its environmental goals (e.g., are the data qualitative or quantitative or both)?
13. To what extent **has the innovation been an improvement** over the prior/traditional approach with regard to:
 - i. Human health
 - ii. Organizational management
 - iii. Community based protection
 - iv. Quality of life
 - v. Ecosystem health
 - vi. Tribal management
 - vii. Environmental Justice communities
 - viii. Others
14. How are **environmental results verified**? Who is responsible for verifying results?
15. How often are environmental results verified?

Exhibit 2—Environmental Results Table

Innovation: Pallet Waste-to-Flooring Demonstration Project

Problem the innovation is trying to solve: Demonstrate the technical and financial feasibility of recycling waste pallet wood into a value added flooring product

Project Objectives with Goals	Pre-innovation Base Statistics	Output Metrics	Sources of info and Calculations	Impact/ Outcome
Produce recycle pallet flooring Goals sq. ft	Pallet Hardwoods used in U.S: 4.5 billion board feet/yr (1998)	# square feet of flooring produced (from recycled pallets)	Production records	Natural resource conservation - Estimated percentage (increase compared to baseline) of hardwood tree conserve (trees/yr)*
		# trees not cut for flooring*	Calculation based on production records*	Percentage of trees saved from harvesting when compared to baseline.
Divert Pallet wood waste from landfilling/waste management methods	Over 305,000 tons per year of wood pallets are disposed in landfills in NC (1998)	# square feet of pallet boards diverted	Production records	Conservation of landfill/waste management capacity (tons/yr) compared to the baseline
		Tons of Pallet wood diverted from landfilling	Calculations based on production records	
Reduce greenhouse gases through carbon sequestration and landfill methane reduction.	No statistics.	MTCE	Model tools**	% GHG methane reduction MTCE

*100 board ft/ 1 tree – USFS estimates based on trees 12” in diameter (DBH) with 2.5 16 foot long logs. Conversion factors: 0.625 board ft/ft² of finished flooring (for a 3/8” thick flooring product)

**Metric tons of Carbon Equivalent (MTCE). Emission factors for wood: (Methane generation in landfill: 0.170 MTCE/wet ton) + (Carbon storage of wood: 0.21 MTCE wet ton) = 0.39 MTCE per wet ton. Source: SOLID WASTE MANAGEMENT AND GREENHOUSE GASES, A Life-Cycle Assessment of Emissions and Sinks, 2nd EDITION, EPA530-R-02-006, May 2002

SOURCE: Taken with Permission from EPA Region 4 and Office of Solid Waste and Emergency Response Innovation Pilots

MODULE 3: ASSESSING THE COSTS AND COST SAVINGS OF THE INNOVATION

This module assists practitioners in determining the costs and cost savings associated with an innovation. Many innovations are aimed at improving resource efficiency for the regulator or regulated community so that scarce resources may be re-allocated to other environmental priorities. For example, if a permit streamlining innovation results in less permit review time by personnel within the regulatory agency, these full-time employees (FTEs) may now address other important problems. In addition to calculating resource efficiencies, it may be possible with some innovations to conduct a cost-effectiveness analysis with the goal of minimizing the costs of achieving particular policy goals. For example, if an innovation results in reducing the compliance costs per ton of pollutant, the innovation is more cost effective than the traditional way of doing business. In most cases, the innovation team will not have the resources to conduct formal cost-benefit or economic analyses, nor are such analyses appropriate in all cases.² This module helps assess if the innovation is more cost-effective than standard practice and assists in identifying ways in which the innovation can be more efficient. This module does not address assessing the costs and benefits of ecological or environmental attributes (e.g., economic value of a wetlands or health benefits).

Costs and cost-savings should be addressed in all three phases of the innovation.

Design Phase

The innovation practitioner should design the innovation to ensure that information is collected on the expected cost-savings and costs of the innovation. It is important at this phase to collect and assess the baseline costs before the innovation is applied. For example, attempt to quantify FTEs, budget, time, etc. instead of the traditional way of doing business of a traditional permitting system. If the innovation is a streamlined facility-wide permit, the design of the innovation should include an estimation of the expected cost-savings (time, money, FTE, etc.) and methods to collect this data so that the cost-savings can be compared to the traditional costs to demonstrate a relative cost advantage of the innovation.

Implementation Phase

The innovation practitioner should be tracking information on the cost-savings and costs of the innovation. Often, there are higher transaction costs associated with the initial implementation of innovations. The practitioner should anticipate these costs, but also track costs to see if those costs decrease with time over the life of the innovation, and that expected cost-savings projected in the design phase are being realized. Most importantly, cost and cost savings information is needed in order to help determine if there needs to be a mid-course correction of the innovation and if the innovation can eventually be transferable.

End of the Innovation Phase

Depending on the type of innovation, the innovation practitioner may want to consider if a full cost-benefit analysis is needed or warranted. For more information on economic analyses, please see EPA's *Guidelines for Preparing Economic Analyses* (<http://yosemite.epa.gov/ee/epa/eed.nsf/Webpages/Guidelines.html>). For this module, focus on whether or not the innovation poses a relative cost-savings advantage over the traditional way of environmental protection. Costs and cost-savings do not have to be limited to transaction costs and cost savings, but can also include the amount of job creation, cost savings incurred by faster time to market, property redevelopment benefits, etc.

² For more information on complete cost-benefit assessments and on preparing economic analyses, please see EPA's National Center for Environmental Economics website. <http://yosemite.epa.gov/ee/epa/eed.nsf/Webpages/Guidelines.html>

Formal Evaluation

A cost and cost-savings evaluation addresses how much the innovation or innovation components cost, preferably in relation to alternative uses of the same resources and to the benefits being produced by the innovation. The cost evaluation will include a description of the costs and savings associated with the innovation as well as an analysis of the efficiency, productivity and cost-effectiveness of the evaluation. The evaluation will focus on the “how and why” resources invested achieved the intended outcomes. The practitioner may decide that a formal cost-benefit analysis is needed outside of a cost-evaluation.

I. Measuring the Costs and Cost Savings of the Innovation

Quantifying the costs and cost savings associated with the innovation may require the innovation practitioner to use data sources from different organizations (i.e., regulated entity, governmental body, or other stakeholder group). Cost estimates will likely involve assumptions or uncertainties that will need to be identified and acknowledged, particularly at the time when transferability of the innovation is being considered.

Measurement Approach. In most instances, the innovator can use a simple direct compliance cost method to analyze costs and cost savings. This approach involves quantifying the compliance costs/cost savings realized or incurred by organization(s) implementing the innovation. The costs may include the capital costs associated with new technologies; the costs of operating and maintaining that new equipment; the costs of modifying operations to comply with the innovation; and the costs of complying with the innovation’s monitoring, record keeping, and reporting requirements. In addition, the analysis can quantify the costs that state regulatory authorities and EPA will incur in administering the innovation. Analysis of these costs is often likely to provide a reasonable approximation of the total social costs of the innovation. A similar analysis can be performed for the cost savings of the innovation.



Tip: The innovator should distinguish between start-up costs and ongoing implementation costs of the innovation.

Baseline Analysis. Similar to the analysis undertaken to determine environmental results in Module 2, the innovation practitioner must also characterize baseline cost conditions to determine the net change in costs. Without a baseline, there is no frame of reference for the change that the innovation proposes and it is difficult to say if the innovation poses a relative advantage to the traditional system.

Data Sources. Sources of cost and cost savings information should be identified if possible at the outset of the innovation. By recording the staff time incurred by the innovating organization, governmental entities, and stakeholders during innovation development and implementation, there will be a better estimate of the real costs of innovation.

Costs or Cost Savings of the Innovation. By comparing the pre-innovation baseline costs to the costs during implementation or post-innovation, the practitioner can determine the net change as a result of the innovation. This will allow for mid-course corrections, if necessary, or a determination as to whether the innovation had the desired outcomes.

1. What is the measurement approach that will be used to estimate the costs and cost savings of the innovation? What indicators will be used (*e.g., compliance measures, materials use, numbers of spills, etc.*)?
2. What is the pre-innovation baseline against which costs are measured?
 - a. Costs of compliance
 - b. Cost savings of streamlined permitting systems
 - c. Cost savings of reallocation of personnel
 - d. Other (*e.g., new investments, time to market, competitiveness*)

3. What data sources will be used to measure costs and cost savings?
4. To what extent has the innovation resulted in costs or cost savings?

II. Savings of the Innovation

The innovator will need to estimate cost savings resulting from the innovation in comparison to the cost-savings that would be incurred or generated in the absence of the innovation. For the purposes of innovation cost savings analyses, cost savings are represented as savings in time, personnel, capital, operation and maintenance, transactional costs, and economic activity.

5. What significant **time savings/savings** has your organization derived as a result of the innovation? (*Please describe the key types of time savings you incurred including staff time and contractor savings involved in activities including project development, implementation, monitoring, reporting and record keeping, rule revisions, permit administration, and inspections.*)
6. What **significant cost savings in capital, operation and maintenance of new equipment, operation and maintenance of existing equipment, materials, or energy** has your organization derived as a result of the innovation?
7. What **other savings** (e.g., insurance, worker compensation, creation of jobs etc.) has your organization derived as a result of the innovation?
8. What **significant savings** (including major equipment and operation and maintenance costs) has the **regulated community** derived as a result of the innovation?
9. What **significant savings** have **local communities or other stakeholder groups** derived as a result of the innovation?
10. What **economic activity**, if any, has been generated by implementation of the innovation (e.g., jobs may be created if a brownfields site is redeveloped)?

III. Costs of the Innovation

Costs that are frequently feasible to quantify include compliance costs, government regulatory costs, and transaction costs.³ One type of cost of doing an innovation is that you forego investing time and resources into a more traditional approach. The five basic categories of cost include:

- Real-resource compliance costs: the costs associated with changing production processes or with purchasing, installing, operating, and maintaining new equipment to comply with the innovation or traditional regulations. The costs can be fixed that require an investment over a period of time or they can be variable as a per unit cost.
- Government or stakeholder costs: any public sector administrative, training, permitting, monitoring, reporting, or enforcement costs associated with the innovation or traditional approach.
- Social costs: costs associated with a rise in price of goods or the decrease in the production of goods and services as a result of the innovation or traditional approach.
- Transitional cost: the costs associated with changes in processes or production due to the innovation or traditional approach—these costs could be a disruption in production or the costs of retiring old equipment and changing to a new technology.

³ Economists assign other kinds of costs such as social welfare losses (i.e., rise in price or a decrease in the output of goods and services as a result of the innovation that raises prices for consumers and may decrease a producer's revenues), transitional costs (i.e., the value of resources that are displaced because of innovation-induced reductions in production), and indirect costs (i.e. the adverse effects the innovation may have on product quality and productivity, or on markets for other goods and services). These types of costs or cost savings are difficult to quantify and generally will not be available to the innovation practitioner.

- Indirect costs: the unintended costs the innovation or traditional approach may have on product quality and productivity, or on markets for other goods and services.

The innovation practitioner should consider each potential cost, however, it is not always necessary or feasible to quantify costs in each category. If real-resource compliance costs are likely to be small, social costs and transitional costs may be insignificant. Similarly, if the resources available for an analysis are limited, it may not be feasible to model indirect costs. The practitioner will want to indicate which costs can be quantified, and which will be addressed qualitatively. An example of a qualitative cost may be changes in organizational management to account for an Environmental Management System. The following questions should be described as the costs in terms of the real-resource compliance costs, social welfare costs, transitional costs, and/or indirect costs.

11. What significant **time costs/investments** has your organization incurred as a result of the innovation? (*Please describe the key types of costs you incurred including staff time and contractor costs involved in activities including project development, implementation, monitoring, reporting and record keeping, rule revisions, permit administration, and inspections.*)
 - a. Costs to the regulator
 - b. Costs to the regulated
 - c. Costs to the local community or other stakeholders
12. What significant **costs/investments in capital, operation and maintenance of new equipment, operation and maintenance of existing equipment, materials, or energy** has your organization incurred as a result of the innovation?
13. What **other significant costs** (e.g., insurance, worker compensation, creation of jobs etc.) has your organization incurred as a result of the innovation?

IV. Relative Cost Advantage

The innovator should look at costs and cost savings of the innovation relative to the system prior to implementing the innovation.

14. If the innovation were more used more widely in the future, how would the **marginal (i.e., per innovation) savings and costs** of the innovation change for **your organization**?
 - a. Regulator
 - b. Regulated
 - c. Local community and other stakeholders
15. What is the **difference** between the innovation costs and baseline costs (i.e., costs associated with current regulatory framework)?

Exhibit 3 is an organizing table that is intended as a model for consideration by the innovation practitioner. It is neither intended to be comprehensive, nor to anticipate every kind of cost associated with an innovation.

Exhibit 3—Costs/Cost Savings Model Table			
Category of Costs	Baseline Costs	Costs of Innovation	Net Change: Costs or Cost Savings
Real-Resource Compliance Costs			
Project Development Costs			
Capital Costs			
Operation and Maintenance Costs			
Government Regulatory Costs			
Permit Review Costs			
Inspection Costs			
Social Costs			
Cost of goods with recycled materials			
Transitional Costs			
Indirect Costs			

MODULE 4: ENFORCEMENT AND COMPLIANCE ASSURANCE

This module evaluates the innovation's reporting requirements, accountability, enforceability, and effectiveness compared to the traditional reporting requirements. Completion of this module may require input from EPA, State, and local enforcement and compliance assurance personnel at the design, implementation, and evaluation phases of the innovation.

Design Phase

To ensure that all substantive and procedural requirements of the innovation are met, the appropriate scope, timing, and availability of all monitoring, reporting, and record-keeping (MRR) requirements should be included in the innovation at the design phase.

Implementation Phase

During the implementation phase, regulatory authorities should review and track information submitted by the facility to monitor compliance and identify problems or trends that may require mid-course adjustments.

End of the Innovation Phase

To verify the results of the innovation, compliance assurance and enforcement staff may need to complete final record reviews and conduct a facility inspection or use alternative methods to verify results. Federal, State, and local regulatory authorities should decide in advance how to allocate these responsibilities to conserve scarce resources.

Formal Evaluation

To evaluate the enforcement and compliance assurance it is essential that the practitioner keep contextual factors in mind when asking how and why certain results were achieved. For example, the innovation results clearly show a rapid rise in the rate of compliance from a target sector. The evaluation needs to ask why compliance changed—was it a direct result of new compliance assistance, was it the result of the innovation that focused on targeted enforcement, or was it the result of economic factors or forces outside of the scope of the innovation? Enforcement and compliance can have important short-term outcomes that should be captured and fully explained in order to make the causal link between the innovation and the outcome.

I. Monitoring, Record-Keeping, and Reporting to State Agencies, EPA, and Stakeholders

The innovator may choose to standardize the collection and tracking of monitoring, record-keeping, and reporting information at the outset of an innovation to assess compliance with MRR requirements at the design of the innovation, throughout implementation and during evaluation of the innovation. Exhibit 4 below is intended to assist EPA, State, and local regulatory authorities to develop a conceptual framework for verifying compliance with MRR requirements and to note any deviations. The table can be modified to meet the needs of the innovation. For each applicable requirement, the innovator will want to identify the monitoring approach and/or materials use and operating parameter requirements for the environmental media, specify the frequency of data collection, and identify the reporting and record-keeping requirements. Depending on the method of determining compliance (i.e., record review, facility inspection, etc.), enforcement personnel will determine whether the innovation is in compliance with applicable requirements. The innovation practitioner will want to tailor the table to meet the specific needs of each innovation, and may choose to create separate tables for monitoring, reporting, and record-keeping purposes.

Design Questions

1. What is the **legal implementing mechanism** for the innovation?
2. What standard permit conditions or regulatory requirements, if any, will require/have been modified?
3. What are the specific **requirements for environmental monitoring** of this innovation?
4. What are the specific **requirements for keeping records** of this innovation?
5. What are the specific **requirements for reporting to regulatory organizations** regarding this innovation?
6. What are the specific **requirements for reporting to stakeholders** regarding this innovation?
7. Do the reports have a **required audience(s)**? (Y/N) If yes, please identify the audience(s).

Implementation Questions

8. To what extent have the specific **requirements for environmental monitoring** of this innovation been met?
9. To what extent have the specific **requirements for keeping records** been met?
10. To what extent have the specific **requirements for reporting to regulatory organizations** been met?
11. To what extent have the specific **requirements for reporting to stakeholders** been met?
12. Have reports been delivered to the required audiences identified in question 7? (Yes/No) If yes, please list dates and method of communication (e.g., website, email public notice). If no, please provide explanation.

II. Compliance Assurance with a “Innovation Agreement”

For this module, the term “innovation agreement” is being used to cover innovation that may also fall under grant programs. The innovator will want to structure the innovation agreement carefully to ensure that all applicable requirements are met and function within the current regulatory framework, unless rule revisions are contemplated by the innovation. The innovator should address all substantive requirements (e.g., technology, emissions or effluent performance, work practice requirements etc.) and procedural requirements (e.g., public notification, review, comment processes; potential termination of the innovation; and reporting and informational availability requirements).

13. How do you ensure that the parties to the innovation comply with the provision(s) of the innovation?
 - a. How will the organization’s performance under the innovation be compared to the performance that could have been obtained under the normally applicable regulatory structure?
 - b. Who is responsible for verifying compliance and environmental performance results and how will it be done?

III. Practical Enforceability of Innovation

Innovation practitioners will want to ensure the practical enforceability of the innovation. This is accomplished by developing monitoring, record-keeping, and reporting requirements that enable regulatory authorities to detect source compliance with all applicable requirements. Compliance personnel will find innovations to be practically enforceable if sufficient data regarding the innovation is available and well organized to perform compliance verification calculations according to established procedures. Further evidence of the practical enforceability of an innovation occurs in the context of inspections. For example, if inspectors find that inspecting innovations is straightforward and comparable to conducting inspections for sources with conventional approaches, the innovation will prove to be practically enforceable.

14. What is the **pre-innovation “baseline”** for enforcement and compliance assurance against which progress will be (is) measured?
15. Can an inspector visiting the innovation site **determine historic and current compliance** from the records maintained on site?
16. Does the innovative permit, if applicable, **contain a legal obligation** for the source to adhere to the terms and conditions of the limitation?

17. Does the permit **rely on the efficiency of a control technology** for compliance with a permit limit? If so, how is that efficiency determined and shown to be accurate?
18. Does the innovation agreement **require the correct type and amount of information** (in logs, notices, monitoring data, etc.) to determine the number and duration of any deviations?
19. How will regulators determine—prior to and throughout the innovation—that the facility is **continuing to implement the innovation**?
20. Do the terms of the innovation agreement obligate a regulator to exercise its **enforcement discretion** in specific ways (if so, explain)?
21. Does the regulator preserve the requisite statutory **inspection and enforcement authority** to satisfy EPA-State delegations of authority?
22. How, and for what reasons, will the **organization return to standard permit terms** should it become necessary to terminate the organization’s participation in the innovation?

IV. Redirecting Regulatory Oversight

Potential objectives of an innovation may include redirecting regulatory oversight from lower to higher priority areas and increasing the proportion of time spent addressing “high risk” activities relative to time spent addressing “low risk” activities. The next series of questions are designed to help the innovator design and collect data to determine if redirecting regulatory oversight is achieving the desired outcome for the innovation.

23. What **screening criteria** (e.g., compliance history or participation in leadership programs) are used to ensure that good partners (e.g., facilities or other organizations) participate in the innovation?
24. If applicable, what **combination of conditions and organizational characteristics** are being used to establish the confidence or the analytical basis for redirecting resources (e.g., compliance history, transparency of decision-making, quality and degree of public involvement, third-party auditing, reporting, etc.)?
25. What is the analytical basis being used for determining the **relative priority or risk** of agency activities (i.e., for the purpose of targeting staff time and resources)?

V. Results and Relative Advantage

The innovator should determine what results and relative advantage mean in the context of enforcement and compliance assurance for his/her innovation. For example, is the innovation attempting to redirect regulatory oversight? Is the innovation attempting to achieve greater performance with the same level of resources and no change in oversight? Is the innovation attempting to improve enforcement and compliance assurance activities? The answers will impact the way in which the innovator plans for performance measurement and collects data for the innovation. The innovation may not have to result in a relative advantage in the area of enforcement and compliance, however the innovation should show that there was no change in the current level of enforcement and compliance requirements.

26. To what extent is inspection of a source with the innovation comparable to inspection of a similar source operating under conventional approaches?
27. To what extent **can the source** with the innovation **be more/less easily inspected** to determine compliance than a similar source operating under conventional approaches?
28. Does the innovation **improve on enforcement or enforcement practices** over the current system?

Exhibit 4—Model Table for Monitoring, Reporting, and Record-Keeping (MRR)

Environmental Media and Pollutants of Concern	Monitoring Approach (continuous, parametric, analytical testing, composite sample, grab sample)	Materials Use and Operating Parameter Requirements (e.g., application rate, percentage by weight)	Data Collection Frequency	Reporting Requirements for Regulatory Authorities and Stakeholders	Record-Keeping Requirements	Compliance Notes (specify date of report and note any deviations)
Air Emissions by Pollutant (tons/year)						
Average Effluent Concentrations by Constituent (mg/L)						
Hazardous Waste Generated (pounds)						

MODULE 5: PUBLIC INVOLVEMENT AND STAKEHOLDER FEEDBACK

EPA defines public involvement as the full range of activities that are used to engage the American people in decision-making processes. Public involvement is a progression that starts with outreach to build awareness and interest. It evolves to information exchange, through collaboration and recommendation, and finally to agreement and decision-making. The public may include private individuals, environmental or other advocacy groups, environmental justice groups, indigenous peoples, minority and ethnic groups, business and industrial interests (including small businesses), elected and appointed public officials, trade associations, and research and governmental associations.

Public involvement in the development and implementation of innovations is fundamental to ensure a transparent process that fosters trust and works to enhance the relationships between the public, the regulated community and the regulators. Public participation can benefit the innovation, the regulated entity, the regulator and the public by increasing awareness about innovation and their environmental benefits and impacts, developing measurable and verifiable environmental results, preventing shifts in risk burdens to disadvantaged populations, ensuring worker safety and protections are maintained, and enhancing the level of information available to the public. By involving the public early in an innovation, practitioners will have the benefit of the public's guidance, experience and input. Not everyone may choose to be an active participant in the innovation, however, the goal should be to provide opportunities for people to engage at every point along the progression. Individuals and groups should decide for themselves whether, when, and how to participate. EPA issued a new Public Involvement Policy in May 2003, which contains useful tips on implementing effective public involvement strategies and helps define different stakeholder groups. The policy also provides useful tools to assist practitioners with the public involvement process at the public involvement website, <http://www.epa.gov/publicinvolvement/intro.htm>.

I. Stakeholder Participation

The first step in stakeholder involvement is to identify key participants who may be interested in, or affected by, the innovation. Depending on the nature of the innovation and who is implementing the innovation, stakeholders may include members of the regulated community, community groups, environmental or other advocacy groups, governmental entities, trade associations, and others. Innovation practitioners will also want to consult with EPA, State, Tribal, and local government partners. To alert the public in low-income and minority communities of the opportunity to become involved in an innovation, practitioners should consider using various media such as advertising in local newspapers, making announcements on radio stations, and communicating through local institutions such as religious establishments. Please see EPA's Public Involvement Policy for more specific information and tools on how to involve different stakeholder groups and stakeholder needs. The key questions to ask are:

1. Who are the key stakeholders?
2. Have State, Tribal, and local government partners been consulted?
3. If applicable, what specific strategies are being considered to ensure the participation of low-income and minority communities?
4. What is the pre-innovation "baseline" for public involvement and accountability against which progress will be measured?
5. How does the innovation address regulatory requirements (Federal/State/local/Tribal) for public involvement?
6. What changes to the transparency in decision-making (for the regulator and/or the regulatee) and the degree of stakeholder/public leverage result from the innovation?

II. Collaborative Dialogue Approaches

The best means of involving stakeholders in the development and implementation of an innovation depends on the number and diversity of the parties to be consulted, the geographic impacts of the innovation, the resources available to engage in consultative processes, and the type of communication networks generally used by particular stakeholders. Constructive dialogue approaches may include outreach activities, information exchange, the solicitation of stakeholder advice or recommendations, technical workgroups, web-based dialogues, Citizen Advisory Committees, and stakeholder negotiations. Collaborative processes encourage an interactive and dynamic discussion that may lead to greater clarification of the issues and consensus among the parties.

7. What are the best means of involving stakeholders in the development of the innovation?
8. What types of collaborative processes or other participatory practices will be used to solicit input?

III. Availability of Information

For information to be readily available to stakeholders, it must be both understandable and accessible. Innovation practitioners must prepare “plain English” (or other appropriate language) summaries and fact sheets to facilitate comprehension of otherwise complex environmental concepts. Communication materials must engage participants at all levels – from members of the general public to experts in the field – and make available materials such as innovative permits, progress reports, annual reports, emissions and/or effluent data, etc. Materials must be translated when appropriate so that diverse populations have access to the information. In addition, innovation practitioners must seek ways to ensure the broadest participation feasible and should work with all identified partners to enhance information distribution to all potentially interested parties. Public information meetings can provide a valuable and interactive means for communication with interested stakeholders.

9. Is information regarding the innovation readily available to stakeholders?
10. What changes to the type, scope, amount, quality (accuracy, relevance), and timing of information available to the public result from the innovation?

IV. Stakeholder Feedback

Stakeholder involvement needs to be carefully planned to allow sufficient time for discussion of the relevant issues with the stakeholders and to incorporate their feedback in the innovation. How stakeholder feedback is used in the innovation should be communicated and explained to participants from the start of the innovation, if possible. The innovation practitioner should anticipate both positive and negative feedback from stakeholders. The feedback may be content-based or about the innovative process; and the feedback from one stakeholder group may be at odds with another group. In order to understand the feedback, work to resolve conflicts, and strive for consensus, the innovation practitioner may use the collaborative processes described above.

11. At what stage in the innovation process will stakeholders be involved to ensure participation and an opportunity to incorporate feedback?
12. To what extent has the practitioner been successful in obtaining feedback from the public about the innovation’s design and/or implementation?

V. Responsiveness to Stakeholder Priorities and Concerns

Innovation demands a high level of responsiveness to the priorities and concerns of stakeholders. To address the greater level of scrutiny experienced by innovation, practitioners need to develop a process that addresses the major concerns of stakeholders. If resources are available, academic experts may

provide objective technical assistance to stakeholder groups or a facilitator can be used to make sure that all concerns are heard and addressed. It is important at the outset of an innovation to determine what resources will be available to address stakeholder issues.

13. Has the practitioner developed a process to address the major concerns of stakeholders?
14. Is technical or financial assistance available to facilitate the participation of particular groups of stakeholders?
15. In your opinion, how do stakeholders view their involvement in the innovation?

MODULE 6: ASSESSING THE POTENTIAL TRANSFERABILITY OF THE INNOVATION

The purpose of this module is to provide information on an innovation to help reduce the uncertainty about its expected consequences and determine its rate of adoption. In 1962, Everett Rogers wrote the pioneering work, *Diffusion of Innovations*¹, which presents a workable framework for diffusing innovations or innovative thoughts over time. Rogers' work provides a systematic approach to understanding the nature of innovations and the existing conditions and culture necessary for accepting, adopting and implementing innovations.

In assessing the potential transferability of an innovation, practitioners should consider a set of overview questions, followed by a ranking methodology based on Roger's innovation-diffusion model and a sample application of the transferability module. It is recommended that practitioners first read through the questions and ranking methodology to understand the approach and how these two steps work together. Some of the overview questions will also be addressed in the ranking process and the ranking will inform responses to the overview questions. This transferability module is based on Rogers' innovation-diffusion model, which has five components: 1) relative advantage; 2) compatibility; 3) complexity; 4) trialability; and 5) observability. This module provides a definition of each component as it relates to environmental innovation and key questions related to each component.

I. *Relative Advantage* is the degree to which an innovation is perceived as being better than the idea it supersedes. The degree of relative advantage is often expressed as enhanced environmental protection, reduced risk to public health, costs savings in meeting regulatory requirements, recognition for being an environmental leader, administrative streamlining, increased public involvement, or other benefits over the traditional approach.

Within this component, it is also important to identify who benefits from the innovation(s). If all parties to the innovation including the regulated community, the public, and Federal and State environmental regulators benefit from the innovation, the relative advantage is easier to ascertain. If, however, regulated entities perceive a relative advantage while the public perceives a disadvantage, the innovation may need to be better communicated to the public and stakeholders or it may need modification prior to scale-up.

A final question regarding the relative advantage component is whether additional data is needed to inform this determination. If additional information is required prior to making this assessment, it may be necessary to go back and re-check the module on *Assessing the Environmental Results of the Innovation* to see where there are data gaps in data collection or methodology. It is often the case that more complete information is necessary to make a determination of the potential for broad-scale application of the innovation.

1. Compared to the traditional way of doing business, what has been the measurable impact (positive and/or negative) of the innovation with regard to:
 - a. Environmental protection
 - b. Organizational management
 - c. Economic impacts
 - d. Expedited action
 - e. Public involvement
 - f. Accountability
 - g. Environmental justice

¹Rogers, E. *Diffusion of Innovations*. 4th Edition. The Free Press, New York: 1995.

- h. Administrative burden
- i. Other areas
- 2. Who benefits from the innovation(s)?
 - a. What do they gain?
- 3. Who incurs costs as a result of the innovation?
 - a. What costs do they incur?
- 4. What additional data are necessary to inform determination of the relative advantage of the innovation?

II. *Compatibility* is the degree to which an innovation is perceived as consistent with the existing values, past experiences, and needs of potential adopters. The innovation practitioner should assess how well the innovation is consistent with organizational needs and goals. This module asks the practitioner to look at the feasibility to adopt an innovation given the “culture” of those who are affected by the innovation, the users of the innovation, or the perceivers of the innovation.

As in the relative advantage component, it is important to assess the innovation’s compatibility with the multiple organizations that participate, or may be interested in participating, in the innovation. For example, compatibility with the culture of the regulated entity is as important as compatibility with the culture of the environmental regulators. If the innovation is embraced by the regulated community, and rejected by the regulators, the innovation is unlikely to be adopted. It is also possible that an innovation may be embraced at the Federal level and not at the State or local levels for a variety of reasons that may, or may not, have to do with the innovation itself, but with the availability of resources.

- 5. To what extent is the innovation consistent with existing organizational beliefs, values, and/or management approaches?
- 6. What is the level of support for the innovation from:
 - a. Within EPA
 - b. The affected entity or entities
 - c. Other regulated entities
 - d. State agencies
 - e. Federal agencies
 - f. Local community
 - g. Environmental NGOs
 - h. Environmental Justice groups
 - i. Local government
- 7. To what extent has a similar innovation been tested before?
 - a. Different sector or industry
 - b. Different media
 - c. Different state, EPA Region, local government, Tribe
 - d. Different community
- 8. Among existing practitioners, to what extent does the innovation support organizational goals, (i.e., department, office or divisional goals, community goals)?
- 9. Among existing practitioners, to what extent are organizational changes necessary to enable widespread use of the innovation (what specific changes are necessary)?
- 10. Among potential practitioners, to what extent does a broader user market or audience exist for the innovation?
- 11. Among potential practitioners, to what extent does the innovation need modifications to be used more broadly (what specific changes are necessary)?
- 12. Who else might use or be interested in the innovation (e.g., regulated entities not originally contemplated as practitioners of the innovation, or regulators who might be able to transform the innovation in a creative way for other purposes)?
 - a. Other regulated entities
 - b. Other regulators (Tribes, local, State, EPA Regions, EPA Headquarters)
 - c. Communities

III. *Ease of Adoption* is the degree to which an innovation is perceived as relatively easy to understand and use. If the innovation is complex, the development of assistance materials to assist adoption may be considered. Or, if the innovation has been tested before in a different sector, media, governmental entity, or community, are there existing users that would be willing to provide testimonials, or existing materials that might prove helpful?

13. How readily understood is the innovation?
14. To what extent is assistance necessary, and available, to understand and use the innovation?
15. If the innovation needs to be brokered, what assistance products are available?
 - a. Are in development
 - b. Need to be created

IV. *Trialability* is the degree to which an innovation may be experimented with on a limited basis. New ideas that can be tried in a phased approach are generally adopted more rapidly than innovations that are not easily implemented in stages. The innovation practitioner should identify, to the extent feasible, how the innovation might be divisible, and in what sequence, to solicit feedback for this component.

16. To what extent can the innovation be tried on a temporary basis (i.e., one month, one year, etc.)?
17. To what extent can the innovation be tried on a limited scale (i.e., fewer facilities initially or with fewer regulatory authorities)?

V. *Observability* is the degree to which the results of an innovation are visible to potential practitioners of the innovation. If the innovation is targeted at a small group of technical experts, dissemination of the idea in a trade journal may be adequate, whereas an innovation that affects a watershed will need a different strategy to assure optimal visibility and broad-scale adoption.

18. To what extent are innovation results apparent to others?

VI. Personal Experience and Observations

These overview questions are for the lead innovator and other key players. They ask fundamental questions that must be addressed in any assessment of transferability potential, including whether the innovation represents an improvement, whether it is ready for diffusion, what the primary drivers and barriers are to scale-up, how to best implement the innovation, and at what organizational level?

19. To what extent do you consider the innovation to be an improvement over the traditional way of doing business? In what way(s) was the innovation an improvement?
20. Is the innovation old enough to have a full understanding of its advantages and disadvantages?
 - a. If not, when will it be possible to gain a full understanding of the advantages and disadvantages of the innovation?
21. What are the primary lessons learned from testing and analyzing the innovation that pertain to its broad-scale application?
22. What is the potential for broader application of the innovation?
 - a. Could the innovation be used to address another problem?
23. What are the primary barriers to broader application of the innovation?
24. What are the critical implementation elements needed to overcome the barriers to broader application of the innovation?
25. In your judgment, how would the innovation best be applied?
 - a. What steps could be taken to facilitate more widespread application of the innovation?
 - b. What steps could reduce the transaction costs of the diffusion?
 - c. What elements should be scaled-up?
 - d. What elements should be changed?
 - e. How might other practitioners be identified?

Are there unique circumstances that could impact broader application of the innovation (e.g., window of opportunity)?

26. Are there resource limitation, if any, which would constrain broad-scale application?
27. At what level – national, State, or local – should the innovation be applied?
 - a. What are the appropriate mechanisms for such application?

VII. Innovation-Diffusion Model: Using a Transferability Scale

By assessing the potential transferability of an innovation by the five diffusion components, the innovation practitioner will be able to better identify candidates for broad-scale application. Those innovations with high scores on all or more diffusion components are likely to be better candidates for broad-scale application than those innovations with low scores. This ranking methodology should provide the innovation team with insights into the potential transferability of an innovation, but it will not substitute for the judgment of experienced practitioners and it does not guarantee the predicted results. Innovations can take a life of their own despite best predictions. For example, an innovation that ranks as a “low” on the transferability scale may be able to be scaled-up due to unanticipated events. The converse is true for those innovations that may seem to be highly transferable, and may end up sidelined in the end. The ranking table should be used to emphasize the strengths of the innovation and to continue to improve on the weaknesses in order to help transfer the innovation. The table can also be used to help identify priority innovations for scale-up. If the practitioner has multiple innovations, but limited resources, the ranking table can help assist decisions to scale-up those innovations which are highly transferable first.

Relative Advantage: If an innovation is perceived, when compared to the traditional way of doing business, as resulting in significant environmental benefits and cost savings, it would be ranked as high on the transferability scale for this component. Conversely, if the innovation yields environmental results that are no better than the traditional approach and the costs are increased, it would be ranked as low for the relative advantage component.

A more difficult case is when environmental results are superior, but costs are significantly increased. In this case, the innovation practitioner may want to identify the benefits that are being ranked (i.e., rank the relative advantage for environmental results as high and the relative advantage for costs as low). Or, the practitioner may choose the “moderate” rank to reflect the competing considerations. In either case, the practitioner is advised to explain the rankings so that the rationale is transparent to other members of the innovation team.

Compatibility: An initial ranking regarding compatibility should begin with the existing practitioners of the innovation, and then address compatibility of the innovation with potential adopters. Existing practitioners and, to the extent feasible, potential adopters should be consulted to ascertain whether the innovation is, or is likely to be, consistent with organizational beliefs and management approaches. If not, are there specific changes that would make the innovation more compatible? Again, if there are differences in the compatibility rankings among the cultures of participants in the innovation, or between existing users and potential users, the innovation practitioner should note these differences and provide explanations, if possible. The practitioner should use these differences to honestly assess how feasible adoption of the innovation will be, and how to communicate differently with parties to address cultural differences.

Ease of Adoption: An innovation will be ranked high on the ease of adoption component if potential adopters readily understand it and little assistance is needed to use the innovation. If the innovation is complex, difficult to understand, and requires considerable assistance to inform adoption of the innovation, the innovation will be ranked low on the ease of adoption component.

Trialability: For this diffusion component, a high ranking means that the innovation may be tested on a temporary basis, or on a limited scale, before being fully adopted. A low ranking would indicate that the innovation must be tried with a large number of facilities or over a significant period of time in order to see results, implying that significant and sustained resources (e.g., capital, personnel) are required to diffuse the innovation.

Observability: A high ranking means that the innovation is very visible to the targeted practitioners and a low ranking means that greater efforts will need to be made to increase the innovation’s visibility.

Exhibit 5—Transferability Scale			
Innovation-Diffusion Components	High	Moderate	Low
Relative Advantage			
Compatibility			
Ease of Adoption¹			
Trialability			
Observability			

¹ For ease of adoption, “high” responses are positively related to an innovation’s rate of adoption, whereas “low” responses are negatively related. For trialability, “high” responses are positively related.