AEI Project Form: 2010 - 2011

AEI Organization: **Bay of Fundy Ecosystem Partnership**

Project Title: **Protecting the Bay of Fundy from Pollution from Land-Based Activities: a) Assessing Ecological Risks of Chemical Contamination; b) Working with Municipal Planners to Reduce Chemical Risks from the Urban Environment.**

Proposed Start Date: July 1st, 2010 **End Date: March 31st, 2011.**

Project Criteria - 2010-2011 projects *must* fit under at least one of Environment Canada's environmental priority areas. They are as follows:

1. **Habitat and biodiversity loss:** these projects work towards preventing biodiversity loss while enabling sustainable use of the local resources by protecting and recovering species at risk, conserving, restoring and/or rehabilitating significant habitats, and/or conserving and managing migratory birds.

2. **Water Quality:** these projects can include the development and promotion of cooperative and integrated sustainable water management concepts, principles, best management practices and activities, and approaches. The projects must provide stakeholders with the knowledge and understanding of the impacts and risks of human activities to water quality and the health of aquatic ecosystems.

3. **Impacts of Climate Change:** these projects aim to protect the health of communities and coastal ecosystems. They employ adaptation and risk mitigation approaches to the adverse effects of climate change on coastal communities and ecosystems. Such approaches could include increased awareness of coastal vulnerabilities, adoption of relevant and effective adaptation approaches to harmful effects of sea level rise and storm surge and best practices of risk mitigation by reducing greenhouse gas emissions.

Project Criteria continued: The 2010-2011 proposed projects must include one or more of the following elements of Environment Canada's Ecosystem Approach:

a. **Knowledge Generation and Assessment**: projects that involve data collection and monitoring and the analysis of that data. For example, in order to update a CEMP or to address an area of concern identified by stakeholders in the community, a group may set up a volunteer monitoring program for a brook or river. The data will be collected over a period of time and the group will analyze the results and/or publish them online or in a paper report.

b. **Decision-Making:** projects where analysis/knowledge from data is shared with decision makers either through a formal presentation or report and/or making the information accessible to community stakeholders. For example, groups might collect data on an issue, analyze the results and present them to the local and/or provincial government with recommendations to improve environmental conditions. Another example could be work to update a CEMP or develop a watershed management plan.

c. **Action:** projects must demonstrate the ability of the proponent to both inspire and lead a multistakeholder approach, including governments, industry and communities, to take action which yields quantifiable and qualitative outcomes or behavioural change towards sustainable development.

**** Please see the 'Proposal details and guidance information' document for more details on these guidelines. You may contact the AEI Coordinator for additional assistance.***

Project Description: Please answer the following questions in a concise manner:

1. Outline specifically how this project contributes to the goals, objectives and outcomes outlined in your CEMP or annual work plan.

BoFEP, formed in 1996, is a partnership of many diverse groups (governmental, community, academic, First Nations, industry etc.) and individuals with an interest in conserving and wisely using the Bay of Fundy and its renewable and non-renewable resources. The fundamental currency of BoFEP is "knowledge", specifically scientific and traditional knowledge about the Bay of Fundy, its watersheds and biological communities. BoFEP is dedicated to creating, sharing and using knowledge to promote the ecological integrity, vitality, biodiversity and productivity of the Bay of Fundy ecosystem in support of the social and economic well-being of its coastal communities. The organization has long served as an effective two-way conduit between the Fundy scientific community and the resource users and decision makers whose activities impact the Bay. This project represents a further step in that direction in that 1) it seeks to collect and synthesize scientific information pertaining to land-based pollution in the Bay and make it available to those responsible for land-use planning and 2) confer with these same planners as to the most effective means of packaging scientific and other information that they require. Most BoFEP projects are normally undertaken by one or more of its Working Groups. This project will involve participation by members from the Stress and Cumulative Effects WG, the Minas Basin WG and possibly the Sublittoral Ecology and Conservation WG. The project is partly a response to concerns about the presence of chemical contaminants in nearshore waters raised by coastal fishermen at a pollution workshop organized by the Stress and Cumulative Effects Working Group in May 2010 in St. Andrews. It also builds upon a preliminary consultation forum with municipal planners from around the Minas Basin organized by the Minas Basin Working Group.

2. Project Goal: How will your project goals address the following?
What is the desired outcome of this project? Please use action words, such as increase, reduce, improve, enhance, alleviate, prevent, rather than provide, develop, create, etc. which are passive. Please be as quantitative as possible.

The overall project goal is twofold: (a) To increase understanding of the ecological risks to the marine ecosystem of the Bay of Fundy associated with chemical pollution from land-based sources and (b) To increase awareness and equip municipal planner's with the knowledge required to make more informed planning decisions when addressing the priority chemical problems and reduce risks from the chemicals through various mechanisms, such as, in the case of sewage and urban run-off, choosing appropriate levels of treatment to utilizing decision support and information management tools.

(a) Improving our knowledge of chemical risks: A comprehensive ERA (ecological risk assessment) framework and assessment for a number of key trace toxic chemicals, such as heavy metals, pesticides, nutrients and endocrine disrupters, in the watersheds and near-shore waters of the Bay of Fundy will improve the ability of marine scientists, environmental managers and other coastal stakeholders to understand and evaluate the most critical chemical contamination/pollution issues – the key persistent chemicals that may combine and cause enhanced toxic effects or cumulative effects. ERA has three components – problem formulation, risk analysis (characterization of exposure, characterization of toxicity and ecological effects), and risk characterization. It is augmented by risk communication, where the risk assessment results are communicated to the risk manager. For this ERA, the problem formulation stage would consist of a detailed literature review of the primary sources of chemical pollution into the Bay of Fundy (including primary journals, grey literature, EC and other technical reports, and appropriate contaminant and toxicology databases), and their potential effects, and a hazard evaluation of key substances of special concern selected from the contaminant groups mentioned earlier. The risk analysis would be a desk-top, modeling analysis of the exposures and effects, to key valued ecosystem components (VECs); commercial ERA software new on the market would be used. The risk characterization would be the final step, conducting both single source and combined source (cumulative effects) analyses of the risks, and developing risk quotients for both. Hence, a comprehensive assessment of the ecological risks of what is primarily combined, cumulative, low level chemical contamination of the watersheds and coastal waters would be achieved. In summary, this project addresses three primary areas of interest of Environment Canada – water quality, habitat quality and biodiversity, especially water quality – but in an integrative manner, under the working/operational framework of an ecological risk assessment (ERA) of key persistent chemicals entering the Bay of Fundy.

(b) Enhancing the capacity of municipal planners: This project is designed to increase municipal planners' awareness of the many complex linkages between land-based activities within their municipalities and the health and well-being of coastal habitats and communities of the Bay of Fundy. It will also enhance BoFEP's awareness

of the information requirements of these planners and enable BoFEP to better assist them in making more informed recommendations to decision makers regarding sustainable municipal development around the Bay. Furthermore, it will provide BoFEP with the feedback needed to increase the utility of specific information modules and decision support tools suitable for municipal and regional planners, especially improving the utility of the Fundy Information Collaboratory developed by the Fundy Informatics Working Group. *(This collaboratory project, currently underway in Phase Two and funded in this past FY, aggregated the documents created and/or compiled by BoFEP to date, and created a web-based and accessible, full-text, digital repository of those documents. Limited resources dictated that the initial working prototype be based on a small literature collection, but it is now being developed into a broader, more sophisticated system compatible with existing Gulf of Maine/Bay of Fundy systems. The prototype can be accessed at: http://docs.informatics.management.dal.ca/bofep).*

3a. Project Description: Each project idea must clearly and concisely explain the following:

- Describe the main project idea, its location, and the need for the project.
- What problem/issue are you addressing?
- What is prompting the need for this project?
- Which activities will you use to address the problem/issue?
- What resources (human, financial, material) will you need to carry out your activities?
- How will these activities address the problem/issue?
- Who are the partners in this project? What role will they be playing?

The project has two sub-projects: the ERA and the work with municipal planners. These are presented separately below.

a) The ERA of priority persistent chemicals entering the Bay of Fundy

The Bay of Fundy and its watersheds have been, and are being, exposed to a myriad of synthetic chemicals and chemical mixtures such as nutrients, heavy metals, domestic and agricultural pesticides, hydrocarbons etc. Important sources have included forestry spray programs; various industries - heavy (refineries) and light (food processing); the salmon aquaculture industry; municipal waste water plants, and raw sewage discharges; urban stormwater runoff; domestic and agricultural pesticide use, air pollution, including long-range transport of acid rain and contaminants such as mercury; ground vehicle and aircraft emissions; transformers and cables; operational shipping discharges and spills; etc. Some of the chemicals are synthetic, persistent and still have a signature on the watersheds and bay (e.g. DDT and its residues, PCBs, organotins), while others are natural but entering the system in above natural concentrations (e.g. mercury, lead, cadmium). There are many concerns (raised by the Gulf of Maine Council on the Marine Environment in their 5 year Action Plan, for example) about the fate and effects of these chemicals on human health, fish populations and natural ecosystems of the bay and its watersheds, stimulating research programs such as those from the Rivers Institute at University of New Brunswick, Saint John, Environment

Canada, Moncton, and St. Andrews Biological Station, St Andrews. For example, the Rivers Institute is intensively studying nutrient and pesticides in the St. John River watershed.

Recently a BoFEP sponsored workshop held in St Andrews explored pollution concerns in the Bay *(BoFEP Pollution Workshop proceedings, in prep, May 2010, Burt and Wells, eds.*). The principal focus was on pesticides used against the sea lice on salmon, but many other contaminant issues were discussed. The participants, including fishermen working the adjacent waters, made it clear that there is a need for comprehensive research on the problem(s), as well as a need for risk assessment and enhanced communication about chemical issues. They also voiced concern about the slowness of regulatory response to issues such as lobster kills.

This proposal is for the development of a comprehensive ERA framework and assessment for a number of key trace toxic chemicals in the watersheds and near-shore waters of the Bay of Fundy. An ERA, typically done on individual contaminants (unless there is reason to suspect combined effects), has three components – problem formulation, risk analysis (characterization of exposure, characterization of toxicity and ecological effects), and risk characterization. It is augmented by risk communication, where the risk assessment results are communicated to the risk manager. The problem formulation stage would consist of a detailed literature review of the primary sources of chemical pollution into the Bay of Fundy (such as sewage outfalls, industrial plants, agriculture etc.) and their effects, and a hazard evaluation of the key substances of concern mentioned earlier. The risk analysis would be a desk-top, modeling analysis of the exposures and effects to key valued ecosystem components (VECs) such as major fishery species and key marine wildlife species; commercial software new on the market (acquired through www.setac.org) would be used. The risk analysis would be the final step, attempting to do both single source and combined source (cumulative effects) analyses of the risks, developing risk quotients *(the Risk Quotient [RQ] is the predicted concentration of contaminant in the marine environment divided by the predicted toxicity threshold for a particular species; an RQ less than one suggests little or no risk, while an RQ greater than one indicates a risk, with the degree of risk increasing with the magnitude of the quotient)* for both. Hence, a comprehensive assessment of the ecological risks of what is primarily combined, cumulative, low level chemical contamination of the watersheds and coastal waters would be achieved. Substantive effort would be put into the important step of risk communication, including addressing the area of risk perception through written materials and forums for municipal planners and the general public.

- Resources needed to carry out the activities of the project include two part time contractors (ideally graduate students or post docs): risk assessors (one for problem formulation, one for the risk analysis and characterization) acquired on sub-contracts and working under the guidance of a BoFEP project management team consisting of 3-4 members. They would be assisted as required by relevant BoFEP Working Groups, which would allow for input from various interested agencies and other organizations.

The activities of the risk assessment team will address the problem /issue directly, providing quantitative estimates of the risks of a number of key chemicals of concern, and the risk communications approach associated with each chemical.

Partners in the project would include: the University of New Brunswick (Fredericton); Natural Sciences and Engineering Research Council; New Brunswick Department of the Environment; New Brunswick Fisheries and Aquaculture; Nova Scotia Department of the Environment; Nova Scotia Fisheries and Aquaculture; Fisheries and Oceans (Bedford Institute of Oceanography and Moncton); Environment Canada (Dartmouth and Moncton); Dalhousie University; and likely others. Partner agencies and institutions will be playing a support and/or advisory role, by providing data, assisting with analyses, participating in working group meetings or serving on the project management committee.

Products of this project would be:

- A comprehensive literature review on the sources, fates and effects of chemicals in the watersheds and coastal waters of the Bay, as part of the problem formulation stage of the ERA.
- An integrative ERA of key persistent toxic chemicals in the watersheds and coastal waters of the Bay.
- A risk communications package for this issue.
- Papers and reports on all of the above.

b) Working with municipal planners

The United Nations Environmental Program has concluded that, worldwide, about 80% of all marine pollution results from the activities of humans on land. It has long been recognized that the bulk of the chemical contaminants present in the coastal water of the Gulf of Maine and Bay of Fundy are also derived from land-based sources. Throughout the Maritimes, municipalities play a critical role in the planning and management of land-use activities in the coastal zone and adjacent watersheds. Cities, towns and villages located on the coast, or in watershed areas ultimately draining into the Bay of Fundy, can have a major influence on the health and well-being of coastal marine ecosystems, including coastal wetlands. How a municipal unit manages such issues as domestic sewage treatment, urban runoff, pesticide usage, land use planning, application of biosolids, municipal infrastructure development and industrial development can have significant direct and indirect effects on the marine environment. However, municipal planners often do not have ready access to the information resources that would help them to make recommendations regarding land-based activities that would reduce their impacts on the marine environment. It is important that municipal decision makers) be aware of the many complex links between the land-based activities about which they provide planning advice and the Bay of Fundy coastal environment as a whole. In particular they must recognize that, while the impacts of individual planning decisions may seem minor, cumulatively, collectively and

synergistically they can directly or indirectly contribute to deterioration of marine habitats, marine biological communities and coastal fisheries of considerable economic importance.

In 2005, BoFEP's Minas Basin Working Group convened a preliminary meeting between municipal planners in the Minas Basin region and representatives of BoFEP and some of its partners. This followed a series of public forums on issues around the Minas Basin region (2001-2003). The goal was to explore the concept of developing a working partnership devoted to maintaining and improving the health of the Minas Basin through better informed land-use planning in the coastal zone and watershed of the Minas Basin. The planners' meeting was very successful with 11 municipal and regional planners participating. There was a general agreement that further developing such a partnership would be worthwhile. The planners felt that it would be useful for them to be made more aware of priority impacts in specific coastal areas and how particular land-uses and municipal activities might increase or decrease those impacts. The production of fact sheets focused on specific coastal issues (similar to the Fundy Issues series already produced by BoFEP) were thought to be particularly useful resource (BoFEP has produced several recently with this in mind, on sewage, organics and metals pollution). It was also suggested that there was a great need for improved clarity regarding jurisdictional issues within provincial and federal governments (e.g. management of wetlands). Local planning activities would be greatly strengthened if there was heightened awareness of, and improved access to, planning resources within provincial and federal government departments (e.g. GIS data, planning information and knowledgeable sources of advice). It was felt that BoFEP and its various working groups could serve as a valuable resource to planners in terms of enhancing access to relevant scientific expertise, assisting in identifying appropriate government contacts and other resources, as well as in various other ways. It was suggested that it would be particularly helpful to planners if pilot projects focused on specific priority issues, such as wetland conservation, nutrient loading through sewage and agricultural runoff, etc., could be developed.

It is proposed that BoFEP build on this initial work done by the Minas Basin Working Group, as well as on work by the BoFEP Stress and Cumulative WG (subproject 1 above), by expanding the consultation/partnering process to involve municipal and regional planners in other areas of the Bay of Fundy. It is proposed that three or four regional workshops be held to bring together 8-10 municipal and regional planners from each of three or four regions around the Bay such as:
1.Outer Bay- Nova Scotia (Digby/Yarmouth)
2. Inner Bay - Nova Scotia (Truro/Wolfville)
3. Inner Bay - New Brunswick (Sackville/Moncton)
4. Outer Bay - New Brunswick (St. Andrews/Saint John)

The meetings will consider the accessibility; content and scope of available web-based decision support tools for use by municipal planners and make recommendations for improvements if required. This project will work to strengthen municipal planning of land-based activities that affect the coastal and marine environment by providing timely

and pertinent information to Nova Scotia's and New Brunswick's municipal planners and decision makers on:

- Priority issues (e.g. nutrification from sewage, agricultural run-off and urban storm water run-off etc.).
- Contacts for expert advice.
- Relevant federal and provincial laws and regulations.
- Best management practices (BMPs) (e.g. set-backs, on-site sewage design, etc.).
- planning tools (e.g. nutrification modeling, GIS, etc.).

Items to be considered at regional meetings: *[Detailed agenda to be developed in consultation with project coordinator]*

- Overview: Linking watersheds and coastal waters.
- Highlight major issues impacting the Bay related to land-use activities in general.
- Pollution from land-based sources, particularly ones within the purview of municipalities (urban runoff, sewage, cosmetic pesticides, biosolids etc.), including pollutants selected for the ERA portion of the project.
- Discussion about the roles /responsibilities of landowners and municipalities in watershed and coastal management.
- Information resources currently available to planners and identification of additional needs. How can BoFEP help out in that regard? What support tools might be useful to planners?
- What would be the desirable elements comprising a web-based decision support tool for municipal planners?
- Others considerations.

List of project activities:

- Create BoFEP advisory committee (3-4 members) to oversee this sub-project. This committee would be assisted as required by relevant BoFEP Working Groups, which would allow for input from various interested agencies and other organizations.
- Recruit part time coordinator for the planners sub-project .
- Develop format, agenda, resource people, venues, facilitators, rapporteurs and schedule for three or four regional meetings.
- Identify Planners to be invited to each of the mini workshops.
- Create and circulate a preliminary information package about BoFEP, the meeting plans and other relevant background information to planners.
- Hold three or four regional meetings.
- Prepare reports on discussions and recommendations from regional meetings.
- In the following fiscal year convene a special municipal and regional planning session at BoFEP 2011 Biennial Bay of Fundy Science Workshop to review report and recommendations from regional planning workshops and consider how to move ahead with any specific projects.

- Resources needed to carry out the activities of the project include a part time contractor to coordinate the regional workshops and synthesize a final report. The coordinator would work under the guidance of a BoFEP project

management team consisting of 3-4 members. They would be assisted as required by members of relevant BoFEP Working Groups, which would allow for input from various interested agencies and other organizations. Hired facilitators would also be required to guide each of the regional workshops. Members of BoFEP working groups or Steering Committee would serve as rapporteurs at the meetings. Where possible meeting facilities would be obtained as in-kind contributions from partner organizations, although it may be necessary to rent suitable space for some meetings.

3b. Project Alignment with Environment Canada's Priority Areas and Ecosystem Approach:

- Describe how this project will align with at least one of Environment Canada's priority areas: habitat and biodiversity loss, water quality and/or impacts of climate change

Both these subprojects directly align with Environment Canada's priority area focusing on water quality. They will identify key chemicals of concern in the watersheds and coastal waters of the Bay of Fundy i.e. land-based activity-related pollution; assess and communicate risks associated with them; and work with municipal officials to increase knowledge and understanding and promote best management practices, resulting in better informed decisions. The overall project will provide municipal stakeholders with the knowledge and understanding of the impacts and risks of human activities to water quality and the health of aquatic ecosystems.

- Describe how this project will align with one or more of the elements of Environment Canada's Ecosystem Approach: Knowledge Generation and Assessment, Decision Making and Action.

Together these two subprojects align with both knowledge generation and assessment, and decision making and action. The ERA will produce extensive information on the priority chemicals of concern; produces a risk assessment of key chemicals; and through the workshops with municipal planners, will share the information as well as collectively and cooperatively seeking and identifying solutions to improve environmental conditions. The project is unique in that it links ERA with planning and decision making at the municipal planning level.

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3c. Evaluation Plan: Each project idea must clearly and concisely address the following questions:

- What will happen as a result of the project?
- How will you track your outcomes during the life of the project?
- At what time during your project will you be using these evaluation tools?
- What tools will you use to measure your results: log books, questionnaires, surveys, focus groups, database, etc?
- How will you quantify and qualify your results?

- What method will you use to gather information for your evaluation?
- How will you gather your sources of information: e.g. volunteers, staff, research, data, etc.?

Subproject a) ERA of persistent priority chemicals

As a result of this project there will be more information about and greater awareness of the ecological risks associated with a number of key chemical contaminants (nutrients, currently used pesticides, legacy pesticides, PCBs, PAHs, dioxins and furans, etc) entering Bay of Fundy watersheds and coastal waters. This information is important to a wide range of users and citizens of coastal communities, where there is concern about trace chemicals e.g. pesticides from the salmon aquaculture industry. The project will put the various key chemicals into perspective in terms of risks that they pose. These risks will then be communicated to municipal planners, fishermen and other concerned coastal residents.

There will be monthly reports from the contract employees to the project management team on the progress of work pertaining to the ERAs, including data acquisition, analysis and synthesis. The management team will provide feedback and further guidance to contractors after carefully reviewing these reports.

Reports on progress of the project will be submitted to the management team monthly.

Tools used to measure results will include data bases in email reports and periodic written reports.

The ERA for each chemical considered is a quantitative ERA, in that a risk quotient is generated for each chemical. The quality of each ERA will depend on the quality of the data available on a selected chemical's concentration in the environment and its toxicity threshold for selected species.

Evaluation information will be gathered by monthly reports from the contractors.

The work of contract staff will be supplemented by assistance from volunteer members of Working Groups as required

Subproject b) Working with Municipal Planners

This project will serve to inform municipal and regional planners around the Bay of Fundy about the many linkages between the land-based activities with which they are involved and the health and well-being of the marine environment of the Bay. It will make them more cognizant of such issues as they plan municipal developments and other relevant activities in their respective watersheds. It will also help BoFEP to ascertain the information needs of planners, tabulate the resources presently available to them, determine additional information and resource needs and consider what types of decision-making and other tools might be most useful to them. The results of the regional planners meetings will be synthesized into a comprehensive report that will be used as background material at a special planning session at the 9th Bay of Fundy

Science Workshop that will consider how best to implement the recommendations and forge a more lasting and mutually beneficial partnership between BoFEP and municipal and regional planners from around the Bay.

A three member BoFEP advisory committee will oversee the implementation of the project and work closely with the project coordinator at all times. All discussions and recommendations at the each of the regional meetings will be recorded by a rapporteur. After each regional meeting, the planners in attendance will be asked to complete an evaluation questionnaire to assess their satisfaction with the scope and content of the meeting. The rapporteur's summaries will also be circulated to meeting participants to ensure accuracy and comprehensiveness. After each Regional meeting a debriefing session will be held with the coordinator, facilitator and the advisory committee to ascertain the effectiveness of the event and make any needed adjustments in strategy for subsequent meetings.

3d. For Science Linkages projects include all of the following information:

* *Multi-year projects* require a summary of previous years' project activities and accomplishments against stated objectives and outputs.
* *Multi-site project(s)* should be identified as such. Please include information on the collaboration process.

A. Name and role of EC science participant(s) - must clearly identify active role(s) in this project. Scientist must send a confirmation note to the Science Linkages Coordinator.
B. Project Design/Methodology - include both quantitative and qualitative information
C. List anticipated permit/license requirements and the organizations involved
D. List potential activities (i.e. use of heavy machinery, work in stream beds, etc.), even if minor, that can potentially trigger an Environmental Assessment
E. Describe the involvement of Environment Canada's Lab facilities in your project (specify whether this is an in-kind contribution)

N/A to this project

4. **Project Outputs (Indicators):** Use the attached **Indicators Table** to identify how many and/or what type of products/services will be generated from the project activities (e.g. # of participants, # of sessions/events, and kms of remediated property). These indicators need target measures which are reported on in the final report and must also reflect EC's priority environmental areas and Ecosystem Approach.

   Please see attached Table.

5. **Projected Project Outcomes:**

What environmental outcomes will be realized as a result of this project within the specified timeframe?
A minimum of 6 ERAs will be conducted; a minimum of 3 meetings and forums with municipal planners around the Bay of Fundy will be held. As a result of these projects municipal planners will be more aware of the potential impacts that land-based activities within their watershed can have on the Bay of Fundy marine environment. In addition, BoFEP will gain a better understanding of the information needs of, and most suitable formats for delivering such information to, municipal planners and decision makers. This will help guide BoFEP's ongoing informatics and publications initiatives in the future.

What is the long term environmental outcome of this project?
Greater awareness of the ecological risks associated with trace toxic chemicals from land-based sources and industrial sources in coastal waters, and greater awareness of actions needed to reduce chemical levels, if risks exist.
Are you confident the above steps will result in the stated outcome?
Yes, the project will produce useful information about the environmental risks of selected toxic chemicals from land-based sources and provide municipal planners with the information they need to reduce the release of such materials in their region.