



Practitioner's Guide

Incorporating Climate Change into the Environmental Impact Assessment Process



ClimAdapt

Nova Scotia's Climate Change Adaptation Initiative

**Practitioner's Guide to
Incorporating Climate Change into
the Environmental Impact Assessment Process**

Final Draft

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PREFACE

ClimAdapt was initially launched in 2001 as the Nova Scotia Climate Change Adaptation Initiative, a collaborative venture between the Nova Scotia Department of Environment and Labour (NSDEL), the Halifax Regional Municipality (HRM), the Nova Scotia Environmental Industries Association (NSEIA), the Nova Scotia Branch of the Canadian Climate Change Impacts and Adaptation Research Network (C-CIARN), the Atlantic Canada Opportunities Agency (ACOA), and six private sector consulting organizations. A group drawn from the members of ClimAdapt developed a methodology for integrating climate change into an environmental impact assessment (EIA) process that forms the basis for this Practitioner's Guide.

For more information on ClimAdapt, please have a look at www.climadapt.com.

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1. INTRODUCTION

ClimAdapt is a collective venture between the Nova Scotia Environmental Industries Association, six Nova Scotia private companies, the Nova Scotia Department of Environment and Labour, the Halifax Regional Municipality, the Atlantic Canada Opportunities Agency, and C-CIARN. ClimAdapt has developed this guide to assist practitioners to incorporate climate change considerations into the environmental impact assessment (EIA) process. The guide does not address the related issue of greenhouse gas (GHG) control.

An essential purpose of the EIA process is:

“to improve decision making and to ensure that project options under consideration are environmentally sound and sustainable” (World Bank, 1999)

While current EIA processes vary in their detail and in the manner in which they are administered from jurisdiction to jurisdiction, the great majority now meet the abovementioned objective. Only few, however, include predicted climate change as an environmental consideration either as a factor in assessing the impact of the project on the environment, or with respect to the impact of the environment on the project.

1.1 Purpose of this Guide

The purpose of the guide is to provide EIA practitioners with:

- an understanding of the implications of climate change in relation to the preparation of an EIA;
- direction on determining on a project-specific basis whether climate change needs to be considered;
- sources of information for use in assessing climate change implications, and
- guidance in incorporating climate change considerations into the EIA process.

The guide assumes the user has a basic knowledge of the elements of the EIA process. As a result, the individual guidelines provided do not provide detail on how to conduct an EIA, but elaborate on those EIA elements related to, or affected by, climate change considerations.

The guide is intended to be generic, recognizing the jurisdictional differences in EIA processes in both Canada and elsewhere. The EIA practitioner should adapt the guidelines presented here to reflect local circumstances and requirements.

1.2 Inter-relationship of the Draft Federal/Provincial Document

The Federal/Provincial/Territorial Climate Change and Environmental Assessment Working Group is currently refining a working document entitled “*Incorporating Climate Change Considerations in Environmental Assessment: Guidance for Practitioners*” (CEAA, 2002). That document (referred herein as the federal document) is being developed to provide EIA practitioners with guidance for incorporating climate change in project EIAs. It includes:

- methods that can be used to obtain and evaluate climate change information in project EIAs;
- key sources of information that practitioners and proponents can use to address climate change in project EIAs, and
- guidance for establishing consistency across federal/provincial/territorial jurisdictions in how climate change is considered in the EIA process.

Collectively these objectives appear to be very similar to those of the ClimAdapt guide. However, the emphasis of the two documents differs in that the federal document focuses on:

- greenhouse gas (GHG) component – where the proposed project may contribute to greenhouse gas emissions, and
- impacts component – where future effects of climate change may adversely affect the proposed project, or influence some aspects of it.

In comparison, the ClimAdapt guide does not deal with greenhouse gas mitigation issues and emphasizes the incorporation of climate change considerations into the EIA process, with its inherent emphasis on the effects of the project on the environment.

This fundamental difference is a positive attribute and there is considerable synergism between the two documents. For example, the federal document provides a valuable input to project planning and greenhouse gas (GHG) emission control considerations with respect to climate change. It is important that EIA practitioners be aware of the federal document and use it, not only on federally designated projects but also as valuable resource for other projects.

2. OVERVIEW OF THE CANADIAN EIA PROCESS

“Environmental impact assessment (EIA) is a comprehensive and systematic process designed to identify, analyze and evaluate the environmental effects of proposed projects. It:

- involves the public in an open and participatory manner
- allows for the effective integration of environmental considerations and public concerns into decision-making
- is a powerful tool to help decision-makers achieve the goal of sustainable development” (CEAA, 2001a).

This guide is based on a generic EIA process as described in Figure 2-1, rather than on specific legislated requirements from a particular jurisdiction. EIA preparation is an iterative process, where feedback loops continually provide for input and refinements as new information enters the process. The EIA implementation process described in Figure 2-1 is compatible with a number of jurisdictions, including that of Nova Scotia, as well as the *Canadian Environmental Assessment Act* and the regulations and guidance documents that apply federally in Canada.

The need to address the cumulative effects of the project is the primary difference between EIA requirements under the Canadian federal legislation and most provincial requirements, such as Nova Scotia. In jurisdictions where cumulative effects are not currently considered, the user may make the appropriate adjustments to the guide and note the reason for not including this step.

It should be noted that the inclusion of climate change into the EIA process requires no change to the essential steps or sequence of the process, although it will inevitably influence specific steps as described within the guide in section 4.

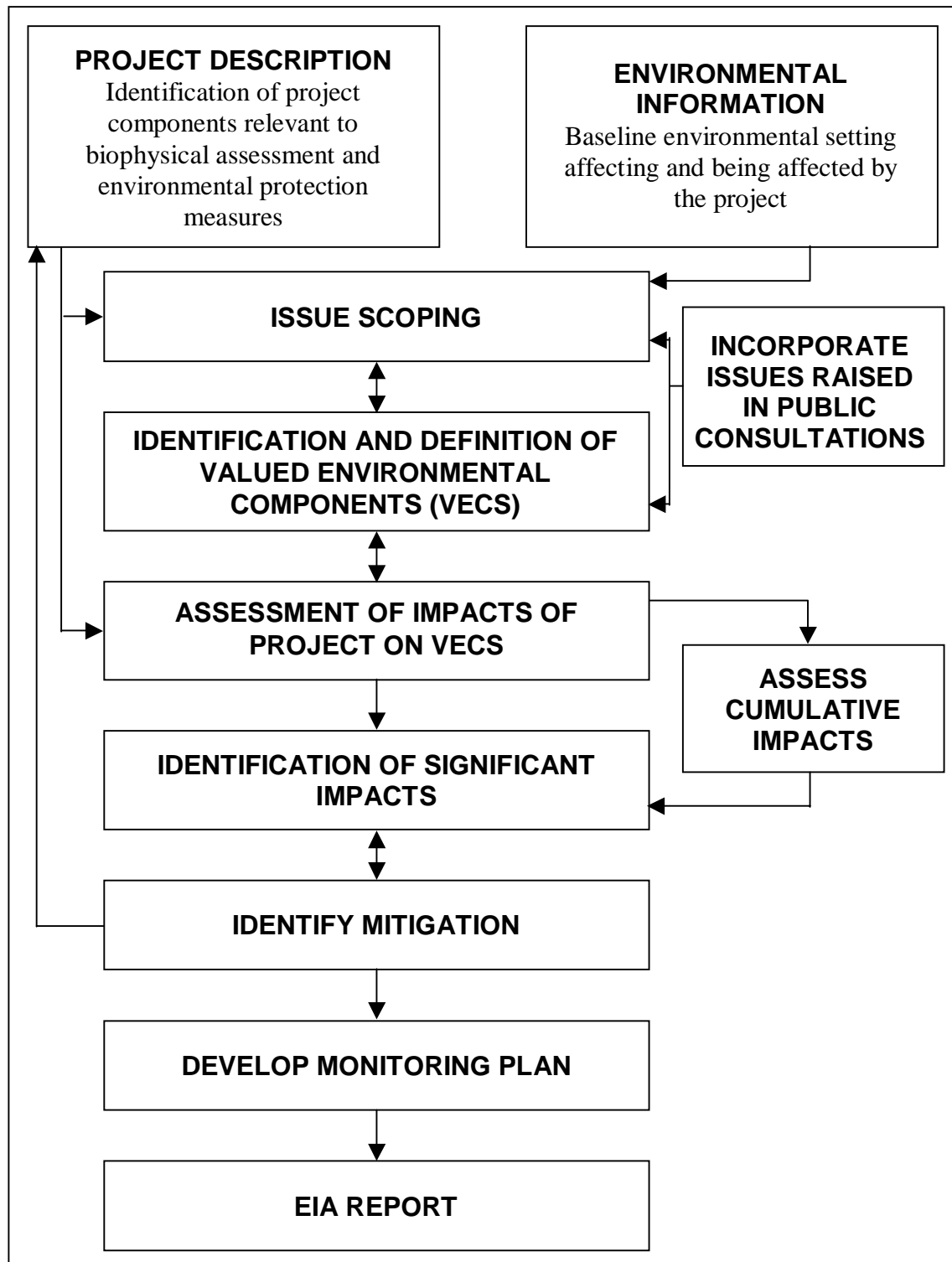


Figure 2-1: Typical Environmental Impact Assessment Process

3. INITIAL CONSIDERATIONS OF CLIMATE CHANGE

3.1. Parameters of Climate Change

Global climate change has emerged as a long-term environmental challenge of global significance. The Inter-governmental Panel on Climate Change (IPCC), established under the auspices of the United Nations, notes a high probability of continuing global climatic change if greenhouse gas (GHG) emissions continue to increase (IPCC, 2001a). Based on current levels of GHG in the atmosphere, even immediate reductions in emissions will not be rapid enough to reverse the observed changes in climate in the short term (Burton and van Aalst 1999).

The currently observed and potential future changes in climate are documented in *Working Group I of the IPCC, Climate Change 2001: The Scientific Basis* (Houghton *et al.*, 2001). This working group concluded that average global surface temperatures increased $0.6^{\circ} \pm 0.2^{\circ}\text{C}$ in the 20th century. It predicted, based on various emission scenarios, that global average air temperature will increase relative to 1990 between 1.4° and 5.8°C by 2100. As a result, global sea level rise should average 0.09 m to 0.88 m. Furthermore, the scenarios indicate that:

- changes to warming and to precipitation will vary by region;
- climate will increase in variability, and
- extreme climate phenomena will change in frequency and intensity.

The IPCC also concludes in the report of *Working Group II* (McCarthy *et al.*, 2001) that there are documented associations between changes in temperature and observations of changes in physical and biological systems in the aquatic, terrestrial and marine environments. Effects relevant to EIAs are already being observed throughout the world. Examples such as thawing of permafrost, poleward and altitudinal shifts of plant and animal ranges, and localized declines of some plant and animal populations have been reported.

For the purposes of EIA, the general parameters of climate change as perceived on a global scale can be expressed in a hierarchy of primary, secondary, and tertiary parameters (see Figure 3-1):

- temperature change as the primary response to increasing GHG levels;
- changes to sea states and wind and precipitation patterns, with increasing frequency and intensity of climate events, and
- resulting changes to physical, biological and social patterns.

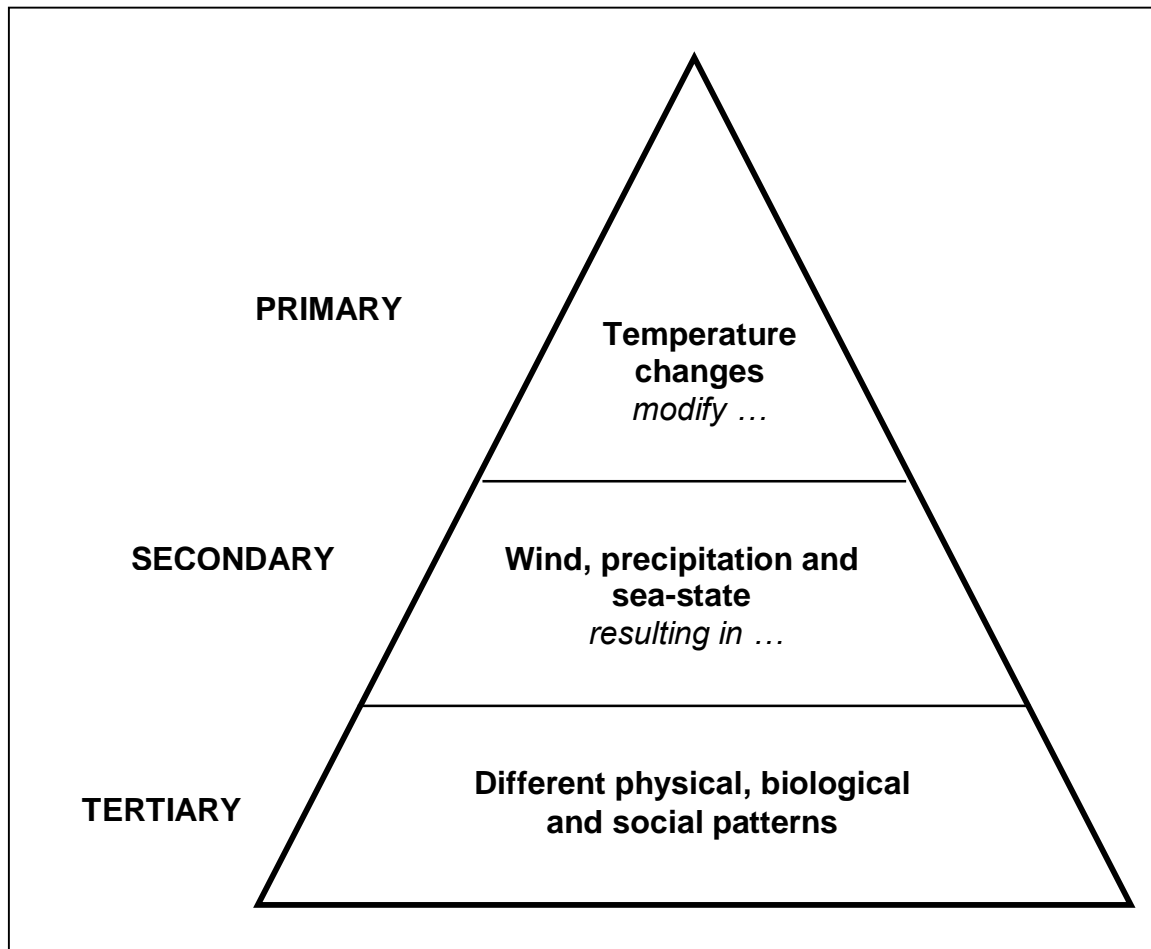


Figure 3-1: Hierarchy of Change

3.2 Overarching Considerations for Undertaking EIAs

The addition of climate change to the EIA process will not change its fundamental structure. However, it will necessitate systematic consideration of:

- changes that may occur to primary and secondary climate parameters (temperature, wind characteristics, precipitation and sea states) and also to relevant tertiary parameters over the life span of the project and its impacts (such as ecological conditions, growing season, groundwater elevation, etc.);
- impacts of those changes on the Valued Environmental Components (VECs) within the boundaries defined for the EIA, and
- changes to the project itself because of climate change over its life, which may significantly alter key characteristics of the project.

For example, in a coastal wetland area the effects of climate change on sea levels over time might significantly alter the characteristics of the wetland quite independently of the effects of any project. In such a case, concerns for the long-term effects of the project on the wetland may cease to be relevant due to the inundation of the wetland by the

increased sea level. If this occurred, the EIA could bring into question the viability of the project itself.

4. THE STEPS TO INTEGRATE CLIMATE CHANGE

The following sections address the steps required to determine how climate change is relevant in the EIA process and where climate change issues need to be specifically addressed. Figure 4-1 illustrates the steps in relation to the EIA process outlined in section 2.

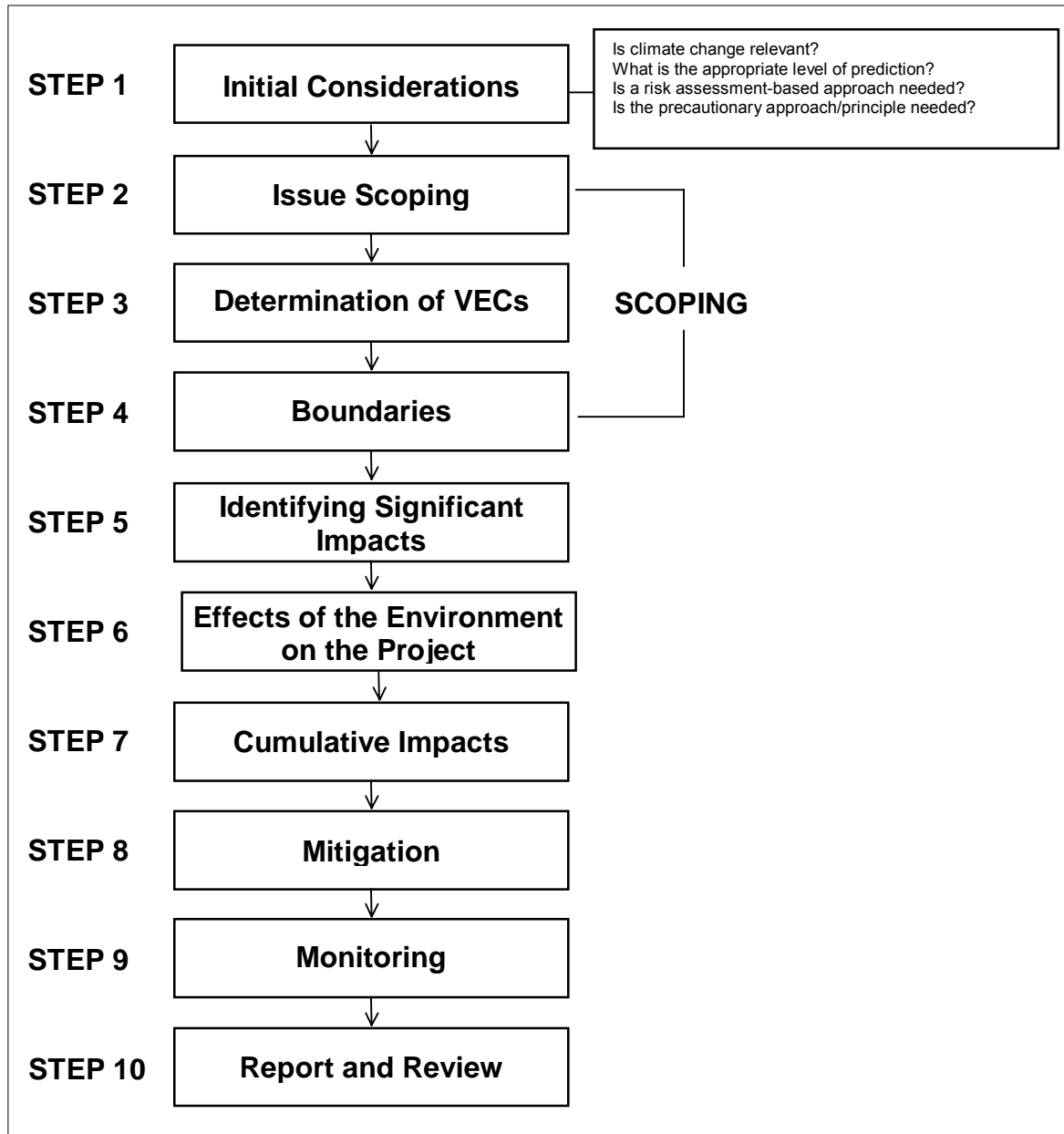


Figure 4-1: The Steps to Integrate Climate Change into the EIA Process

Background is provided for each step in the process followed by the specific guideline. Each guideline should be viewed as a complement to the traditional steps in the EIA process.

4.1 Step 1 – Initial Considerations

Practitioners must first determine if climate change is likely to be a potential consideration in the EIA process. Factors influencing this decision include:

- the nature of the project and its setting;
- the life of the project;
- climate-related parameters likely to influence the VECs and the project;
- anticipated changes to those parameters over the life of the project;
- applicable regulatory requirements, guidelines and expectations.

***Guideline #1:** In the initial step of the EIA process, the proponent should determine and document whether climate change is a potential consideration, and also declare in their submission all information sources used.*

The draft federal/provincial document (CEAA, 2002), described in section 1.2, suggests that four possible cases may result when climate change interacts with a project. These cases are:

- **Case One** occurs when a high confidence in data indicating changes to a climate parameter is combined with a high risk to the public, the project, or the environment because of the effect of climate change on a project. In this case, the practitioner should proceed with the next steps in the risk assessment and indicate the probable range of changes to the appropriate climate parameters.
- **Case Two** occurs when a high confidence in data indicating changes to a climate parameter is combined with a low risk to the public, the project, or the environment because of changes to a climate parameter on the project. In this case, no further action is needed.
- **Case Three** occurs when a low confidence in data indicating changes to a climate parameter is combined with a high probability that the public, the project, or the environment will be placed at risk due to the effects of climate change on the project. The next steps in the risk assessment should be conducted, with emphasis placed on the probable range of changes to the appropriate climate parameters and the uncertainty associated with this information.
- **Case Four** occurs when a low confidence in data indicating changes to a climate parameter is combined with a low risk to the public, the project, or the environment if the project is affected by climate change. In this case, no specific further action is needed.

The decision matrix illustrating these four cases and actions required are outlined in Table 4-1.

Table 4-1: Decision Matrix Related Risk of Impact and Confidence in Predictions

| | High Risk of Impacts | Low Risk of Impacts |
|---|--|---|
| High Confidence <ul style="list-style-type: none"> in the project's vulnerability to a climate change parameter | Case One <ul style="list-style-type: none"> Proceed with risk assessment outlined in guidance | Case Two <ul style="list-style-type: none"> Proponent should be provided with all relevant climate change information Report in EA No further action required |
| Low Confidence <ul style="list-style-type: none"> in the project's vulnerability to a climate change parameter | Case Three <ul style="list-style-type: none"> Proceed with risk assessment outlined in guidance Emphasize the uncertainty inherent in climate change data | Case Four <ul style="list-style-type: none"> No further action required Report in EA |

Source: adapted from CEAA (2002)

If it is decided that climate change should be included in the process, the next essential step is to determine the manner in which tangible values for appropriate climate-change parameters can be determined for use in the process. The following options may be available:

- generally available climate change regional projections from sources such as the IPCC reports (for example, Houghton *et al.*, 2001 and McCarthy *et al.*, 2001), and from the web-based regional climate change prediction system supported by the University of Victoria under the CCIS project (<http://www.ccis.uvic.ca>);
- country- or region-specific studies available from governments and other agencies;
- project-specific climate-change modeling, recognizing that this approach is both complex and potentially costly, and
- use of a risk-assessment-based approach to the consideration of climate change effects and the implications.

Project or location-specific prediction methods are currently under development by Environment Canada, but are not currently (April 2003) available over the Internet and generally require a 30-year dataset of climate information (G. Lines, pers. comm.).

Guideline #2: *Proponents of EIAs should consult with the appropriate regulatory personnel before deciding on the approach to be adopted to incorporate climate change into an EIA.*

4.1.1 Appropriate Level of Prediction

The appropriate levels of prediction of climate change parameters should be governed by the following considerations:

- the ability to predict ecological changes in response to predicted climate changes is currently limited and should therefore guide the level to which climate change prediction is undertaken;
- the prediction of intensity and frequency of extreme climate change events is currently less accurate than predictions for primary and secondary climate parameters (See Figure 3-1). Thus, in EIAs where extreme climate events may be an important consideration, the level of prediction should be guided by the current accuracy attainable for such events;
- the overall magnitude and cost of the EIA must guide the level of sophistication, and thus cost, of climate change prediction.

4.1.2 Use of a Risk-assessment-based Approach

The relevance and cost of obtaining climate predictions will vary between projects. It is conceivable that the cost of climate predictions could be large and time consuming in relation to project development. Therefore, a risk-assessment-based approach is recommended to achieve balance between uncertainty and affordability of regional or project specific climate projections given the potential impact implications.

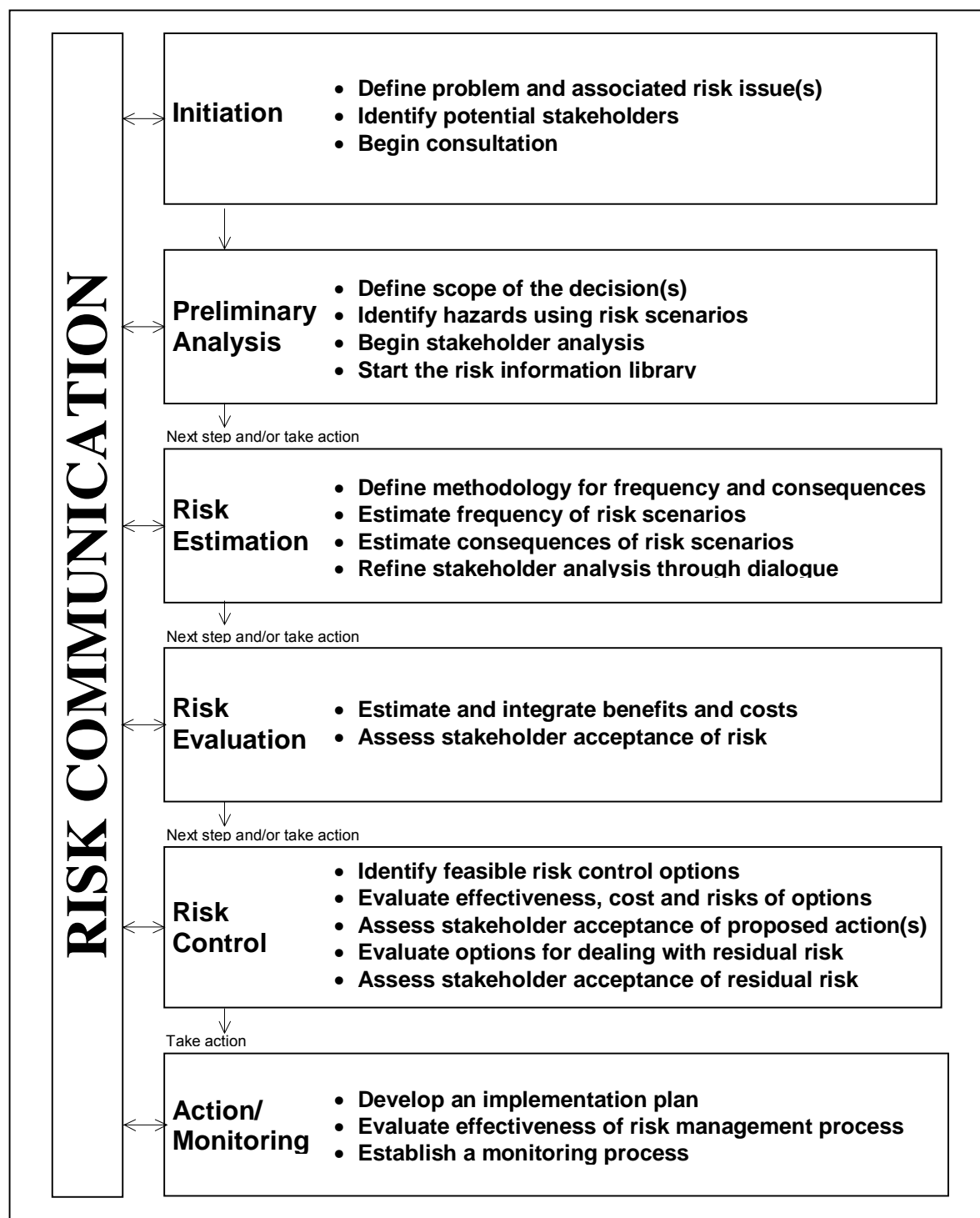
Risk is defined as the probability or likelihood that a hazard (such as increased sea levels) will develop into a consequence. The estimation of risk for discrete and independent consequences is defined as risk assessment.

The following three types of risk assessment provide differing levels of precision, required detail in their inputs, and sophistication in analysis:

- **Qualified risk assessment** in which risks are assessed in terms of probability and severity of consequence based on descriptors such as “very likely” and “possible”, often arranged in decreasing severity on a scale of 1 to 5.
- **Qualified-quantified risk assessment**, as above, except that each descriptor has a probability value assigned to it. These values are then combined using Boolean algebra.
- **Semi-quantified risk assessment** in which risks are calculated or estimated from statistics, modeling, or assignment based on descriptors. The probabilities are then combined using Boolean algebra.

Guidance is provided in the application and use of risk assessment methods in the Canadian Standards Association publication CAN/CSA-Q634-M91 *Risk Analysis*

Requirements and Guidelines (CSA, 1991) and in CAN/CSA-Q850-97 Risk Management: Guidelines for Decision Makers (CSA, 1997). The basic structure of a risk-based assessment is illustrated in Figure 4-1.



Source: Adapted from CSA (1997)

Figure 4-1: Structure of a Risk-Based Assessment

Guideline #3: *Proponents of EIAs, if using a risk assessment approach, should explicitly define the method used and justify the choice if the CSA standards are not followed.*

4.1.3 Use of the Precautionary Approach/Principle

The precautionary approach is appropriate when using the risk assessment approach to incorporate climate change into the EIA process (Government of Canada, 2001). The precautionary approach recognizes that the absence of full scientific certainty should not be used as a reason to postpone decisions where there is a risk of serious or irreversible harm, and that precautionary measures should be taken even if some cause and effect relationships are not fully established scientifically.

This perspective reflects the limitations inherently associated with the projection of climate changes, and the impact these changes will have on the environment and on the undertaking itself given the current state of knowledge.

Guideline #4: *The precautionary approach/principle should be used when incorporating climate change considerations into the EIA process, with disclosure in the EIA report of areas where it was applied.*

4.2 Scoping

Preliminary scoping should focus on general considerations rather than detailed, quantitative analysis. The practitioner should access and rely on readily available information sources such as regional climate patterns, IPCC reports, previous relevant EIAs, and local experience and ecological observations.

The scoping process incorporates issue scoping, and the related tasks of defining the VECs and the EIA boundaries. These three related steps of the incorporation process follow the initial consideration of the relevance of climate change and the prediction of the changes to be considered for the EIA.

4.2.1 Step 2 – Issue Scoping

Issue scoping involves identification of environmental concerns based on public opinion, applicable legislation and regulation, and professional judgment. Scoping can range from a complex process involving public meetings to a simple internal review of project characteristics and regulations. In all cases, specific consideration of climate change should be added to the existing process.

Scoping simply indicates whether or not there is concern. It does not determine the extent of an effect, or whether an effect actually occurs. Public concern raised at a meeting is sufficient at this stage to flag an issue as important enough to be included in the scoping task. Scoping must determine whether climate change is relevant, whether in relation to potential changes to the environment, or in consideration of the effects of the environment on the project.

Scoping must consider climate change in relation to:

- design criteria;
- ecology;
- physical factors;
- socio-economic issues, including human health and safety;
- cumulative issues, and
- uncertainty of predictions.

Table 4-2 describes the review process for considering climate change during scoping.

Table 4-2: Review Process for Considering Climate Change during Scoping

| Scoping Issue | Review Process |
|---|--|
| Design Criteria | Review and justify current design criteria and code-related issues with respect to predicted climatic changes and to the physical environment over the life-span of the project. If necessary, amend the design criteria appropriately and apply modified design factors to the project. |
| Ecological, Socio-economic and Physical Factors | Predict possible changes and additions to VECs, health and safety, or pathways due to climate changes over the life-span of the project, and incorporate them into the process. This includes possible physical environmental factors that might affect the project. |
| Cumulative Impacts | Identify possible cumulative impact issues based on primary and secondary effects associated with climate changes being considered for the life-span of the project. Incorporate those issues into the EIA process. |
| Uncertainty of Predictions | Identify the uncertainty associated with predictions and the way in which this affects risk of significant impacts. Incorporate uncertainty into the definitions of impacts. |

The review of design criteria would not necessarily require modification to codes, best practices or regulations, which would be outside of the scope of an EIA. In addition, it is important not to shift liability or introduce unreasonable costs into the EIA process when reviewing design criteria. However, it is important to consider the implications of the frequency and intensity of climatic extremes, for example, and their effects on both the project and its potentially modified impact on the environment.

Scoping should be revisited each time new information is received to determine if the project issues list should be amended. This is an example of the iterative nature of the EIA process. New information could derive from public input, field programs, or modeling results. Again, whether an impact actually occurs is not the issue at the scoping stage, but rather whether it needs to be considered. Impact analysis will determine whether there is an impact and whether it is significant.

The relevance of climate change for each of the issues identified in Table 4-2 should be succinctly described in the scoping section of the EIA report, stating whether climate change is relevant to the project being reviewed.

Guideline #5: *Review the scoping issues relative to climate change; determine how climate change has been, or may need to be, incorporated into design criteria, ecological, socio-economic and physical factors, cumulative impacts, and the definition of uncertainty of predictions.*

4.2.2 Step 3 – Determination of VECs

VECs are established during scoping and are determined by the same three factors: public concern, legislative requirements, and professional judgment. They may be broad categories of receptors of potential project impacts or specific species of concern. In either case, they should be linked to a project through specific pathways or potential interaction with project activities within the design, construction, operation and abandonment stages.

Detailed assessment of climate change will frequently need to consider specific parameters or species (especially rare or endangered species) or published guidelines or standards that might already be near the edge of their range. Issues such as temperature preferences or thresholds that vary by a few degrees can be extremely important in assessing the impacts of climate change. However, the VEC list does not need to specifically include every species to be considered in detail; vulnerable or indicator species for which there is the most information are frequently used to represent a class of organisms in impact analysis. For example, the temperatures lethal to cold-water recreational fish species, such as Atlantic salmon, are well established, and can be used in the evaluation of impacts of temperature increases. In many cases the VEC list will not be affected in any substantial way by incorporating climate change, but the possibility of changes to the VEC list must be determined based on the specifics of the project and its location.

Guideline #6: *VEC lists will not generally be modified by climate change variables given the broadness of categories used to define VECs in most environmental impact assessments. However, analysis of climate change impacts will often need to be based on specific parameters or species selected for their importance or as indicators of impacts.*

4.2.3 Step 4 – Boundaries

Boundaries need to be established for those periods during, and areas within, which the VECs are likely to interact with, or be influenced by, the project. The boundaries need to be individually established for each VEC. For example, potential effects on soils may be limited to the immediate project footprint; on the other hand, potential effects on migration patterns of birds or wildlife may require a more regional perspective.

Table 4-3 summarizes some potential assessment boundaries and the considerations relevant to each for climate change.

Guideline #7: *The relevance of climate change must be analysed within spatial, temporal, ecological, administrative and technical boundaries*

with reference to each VEC to be assessed. The analysis must identify any effects of the project beyond its lifespan.

Table 4-3: Issues to be Considered when Establishing Boundaries

| Boundary Types | Description | Potential Considerations for Climate Change Adaptation |
|---------------------------|--|---|
| Spatial Boundaries | Location where project activities are undertaken or facilities located. Includes any zones of influence (effluent or emission discharges) and the range of VECs. | Assess how the spatial boundaries of the project, including the individual VECs, may change in the context of potential climate issues. |
| Temporal Boundaries | The times that project activities overlap with the presence of VECs, including in the post-operation phase. This would include seasonal issues associated with the VECs such as migration or breeding periods. | Assess how the temporal boundaries of the project, including the individual VECs, may change in the context of potential climate change issues. |
| Ecological Boundaries | Consideration of the spatial and temporal scales of the natural systems. | Assess how the potential effects of climate change may influence ecological boundaries over and possibly beyond the lifespan of the project. |
| Administrative Boundaries | Boundaries imposed by political and regulatory frameworks concerning data collection for resource management. | Identify any new, or changes to, previously established administrative boundaries to address the management of climate change issues. |
| Technical Boundaries | Limitations imposed on the assessment by the measurability of effect, the availability of data, and the cost to gather and assess information | Evaluate these potential boundaries on the assessment in the context of climate change. If these boundaries are substantive, the previous described boundaries should be evaluated in that context. |

4.3 Step 5 – Identifying Significant Impacts

A common scale of reference for determining significance is required in order that the relative importance of various environmental effects can be compared. An environmental effect is defined by CEAA as:

- any change that the project may cause in the environment including any effect of any such change on health and socio-economic conditions, on physical and cultural heritage, on the current use of lands and resources for traditional purposes by aboriginal persons, or on any structure, site or thing that is of historical, archaeological, palaeontological or architectural significance; or
- any change to the project that may be caused by the environment, whether any such change occurs within or outside Canada (CEAA, 2001b).

The EIA process requires a detailed identification of significant impacts. Determining whether an impact is significant is a critical step in an EIA, and it is necessary to specifically identify the criteria on which significance is based.

Table 4-4 outlines the CEAA criteria that are typically used for determining significance, both before and after mitigation. Further information on dealing with significance can be found in background documentation from numerous regulatory agencies, including CEAA (2001b).

Table 4-4: Criteria for Significance of Impacts from Project Activities

| Key Terms | Criteria |
|--------------|--|
| Significance | magnitude; geographic extent; duration and frequency; irreversibility, and ecological context. |
| Likelihood | probability of occurrence, and scientific uncertainty. |

A traditional EIA views the environment in its current state, usually based on a four-season analysis of conditions. The existing status of each VEC is analyzed in a detailed description of the existing environment. Project activities are then superimposed on the existing environment to determine impacts.

Incorporating climate change may substantially alter this perspective, as the existing environment can no longer be viewed as remaining constant and separate from project effects. In fact, a specific analysis of the potential changes associated with climate change will be required before the impacts of project activities can be isolated and assessed. The essence of the EIA process does not change. Effects on VECs with and without the project are still determined, and the existing definitions of significance should be used to evaluate the impacts of the project after climate change is considered.

Recent experience in the application of this guide (ClimAdapt, 2003) served to emphasize the difficulty of predicting changes to VECs resulting from climate changes, particularly with respect to ecological elements. There is no doubt that specialist ecological input is vital to this important step in the overall process of determining significant impacts and later (see section 4.6) the appropriate mitigative measures. Should difficulty be encountered in accessing the appropriate ecological input, a risk-based assessment of the changes to the VEC in question should be used. An approach similar to that described in section 4.1.2 could be applied for this purpose.

Guideline #8: *The criteria for defining significance must be applied to the effects of the project on the environment as it will exist over, and possibly beyond, the life of the project, not only at the time when the EIA is prepared.*

Guideline #9: *Changes to VECs resulting from specific predicted climate changes must be determined with appropriate input from specialists knowledgeable in the VEC and in climate change implications. It is*

important that a balance be achieved in the accuracy of predictions for changes to both the climate and the VECs.

Guideline #10: *Once the VECs are identified and assessed, the scoping exercise should be revisited as an analytical loop within an iterative process.*

4.4 Step 6 – Effects of the Environment on the Project

The EIA process provides an excellent means to ensure that environmental effects on the project are considered and factored into project decision-making. New climate change-related issues will emerge as effects of the environment on the project. Possible adverse effects of the environment on the project may include:

- destruction of the project or components of the project;
- negative impacts to the operation and productivity of the project;
- increase to cost of project development;
- revisions to project design;
- increase maintenance frequency and costs, and
- requirement for future project modifications.

Potential effects of the environment on design criteria and uncertainty of predictions are the primary concerns. These are initially reviewed during scoping (section 4.1), but, if relevant, may also be addressed in detail at this stage. Design criteria must be justified within the boundaries established by predictions of climate change over the lifespan of the project. When describing the uncertainty of predictions, both the knowledge base and the ability to predict likelihood accurately must be documented in relation to the suitability of key elements of project design. Detailed analysis may not necessarily be done during this assessment, but the source of climate predictions and their specific magnitude must be described along with the rationale for accepting the design criteria. Overall, any adverse impacts of extreme climate events on the project should be identified and the likelihood of their occurrence specified.

Guideline #11: *Potential effects of the environment on the project must be examined using the same criteria for significance as used in the assessment of effects of the project on the environment. These include magnitude, geographic extent, duration and frequency, irreversibility, ecological context, and likelihood. Assessment should take into account the design criteria and uncertainty of predictions.*

The federal working document entitled “Incorporating Climate Change Considerations in Environmental Assessment: Guidance for Practitioners” (CEAA, 2002) also has relevance to determining the potential effects of the environment on the project.

4.5 Step 7 – Cumulative Impacts

Cumulative effect is a term that is used to describe the accumulative, progressive, or synergistic impacts of projects on the environment. They are defined by CEAA as:

“Changes to the environment that are caused by action in combination with other past, present and future human actions.” (CEAA 2001a)

Jurisdictions in Canada, as elsewhere, vary in their requirements for the inclusion of cumulative effect assessment. For example, the *Canada Environmental Assessment Act* includes this requirement, whereas EIA regulations in a number of provinces do not, like those of the *Nova Scotia Environment Act*.

Cumulative effect is an important consideration in the integration of climate change into the EIA process. Climate change can either create direct impacts over time, or can modify other non-climate-change related impacts and thus compound the effects of a project. The analysis of cumulative effects is therefore inherent in the inclusion of climate change issues in the EIA process. Cumulative effect assessment should be carried out whenever climate change proves an important element in EIA, even when the regulatory regime does not specifically require it.

Cumulative effects associated with climate change could include:

- increased transport of physical or chemical constituents beyond the spatial boundaries under consideration, by factors such as increased storm intensity and frequency;
- an increase or decrease in habitat area for a species or species group that is already affected by the project, and
- secondary effects related to climate-change modification to the environment or its effects on the project.

It is important that these be regarded as triggers for looping back to the consideration of boundaries and identification of significant impacts.

***Guideline #12:** Consideration of cumulative effects should be inherently included in the EIA process when climate change is a factor, whether or not the assessment is required by the particular jurisdiction.*

4.6 Step 8 – Mitigation

Standard mitigation through best management practices is normally an integral part of the project description. For example, routine mitigating measures such as erosion control techniques are assumed to be part of project design from the beginning, and an impact analysis is based on this assumption. The mitigation section of the EIA report focuses on the reduction or elimination of potential impacts remaining after standard design

measures are applied, as documented in the project description. Measures associated with climate change will normally fall within this category and may include a range appropriate to the project and its setting.

Mitigation, including any climate change adaptation measures, will remain focused on reduction or elimination of significant impacts of the project on the environment. These measures will also be incorporated into the project description following the iterative process illustrated in Figure 2-1.

***Guideline #13:** Mitigation measures specific to addressing climate change impacts, possibly including any appropriate adaptation measures, should be addressed in the mitigation section of the EIA and also incorporated into the project description section of the report.*

4.7 Step 9 – Monitoring

Monitoring during construction, operation and reclamation of a project tests whether predictions made in the EIA report were accurate. Furthermore, if climate change has been identified as an issue, ongoing monitoring in that regard should be considered. Monitoring should focus on areas where potentially significant impacts could occur, or where mitigating measures have been proposed.

The knowledge base for project-specific areas with respect to climate change will normally improve substantially over the life of a project. Thus, if a project is particularly sensitive to climate change over its predicted life, monitoring should include periodic assessment of climate change, based on reviewing new information and/or monitoring specific climate elements. The review should focus on confirming whether mitigative measures are performing as designed, or identifying changes needed to bring the project in line with the predictions of the EIA.

***Guideline #14:** If a project is potentially sensitive to climate change within its life, the project monitoring should also include periodic review of climate change data, and/or monitoring to test the appropriateness of the climate change working assumptions, and if necessary, allow modifications to be made to the project.*

4.8 Step 10 – Reporting And Review

The role of the EIA process is primarily to identify potentially significant impacts and to identify how to reduce those impacts to acceptable levels. In the short term, the knowledge about climate change and our ability to predict effects will remain limited, particularly in localized areas. Information deficiencies in relation to climate change may be relatively easy to identify, but they may not be necessarily connected to a potential for significant impacts. Where significant impacts from or on the project are not anticipated, deficiencies in climate change information may not be particularly important. Care will

need to be exercised to avoid over-emphasizing data gaps in relation to prediction of climate change, when the omission is not associated with significant impacts.

Guideline #15: *In EIA reporting, caution should be exercised to avoid over-emphasizing the need for accurate climate change predictions on a complete array of variables where significant climate change-related impacts from, or on, the project are not anticipated.*

5. SUMMARY OF GUIDELINES

In summary, the following guidelines should be used by proponents for including climate change considerations in EIAs. The assessment of impacts with respect to climate change will depend on the quality and specifics of the modeling data used. At present this data is, at best, regional in nature for a limited set of parameters. While the user should invoke the precautionary principle when applying these guidelines, the user should also be cautious in providing specific impacts that may not be supported by the current data set.

For Proponents:

Guideline #1: *As the initial step in the EIA process, the proponent should determine and document whether climate change is a potential consideration, and also declare in their submissions all information sources used.*

Guideline #2: *Proponents of EIAs should consult with the appropriate regulatory personnel before deciding on the approach to be adopted to incorporate climate change into an EIA.*

Guideline #3: *Proponents of EIAs, if using a risk assessment approach, should explicitly define the method used and justify the choice if the CSA standards are not followed.*

Guideline #4: *The precautionary approach/principle should be used when incorporating climate change considerations into the EIA process, with disclosure in the EIA report of areas where it was applied.*

Guideline #5: *Review the scoping issues relative to climate change; determine how climate change has been, or may need to be, incorporated into design criteria, ecological, socio-economic and physical factors, cumulative impacts, and the uncertainty of predictions.*

Guideline #6: *VEC lists will not generally be modified by climate change variables given the broadness of categories used to define VECs in most environmental impact assessments. However, analysis of climate change impacts will often need to be based on specific parameters or species selected for their importance or as indicators of impacts.*

Guideline #7: *The relevance of climate change must be analysed within spatial, temporal, ecological, administrative and technical boundaries with reference to each VEC to be assessed. The analysis must identify any effects of the project beyond its lifespan.*

Guideline #8: *The criteria for defining significance must be applied to the effects of the project on the environment as it will exist over, and possibly beyond, the life of the project, not only at the time when the EIA is prepared.*

Guideline #9: *Changes to VECs resulting from specific predicted climate changes must be determined with appropriate input from specialists knowledgeable in the VEC and in climate change implications. It is important that a balance be achieved in the accuracy of predictions for changes to both the climate and the VECs.*

Guideline #10: *Once the VECs are identified and assessed, the scoping exercise should be revisited as an analytical loop within an iterative process.*

Guideline #11: *Potential effects of the environment on the project must be examined using the same criteria for significance as used in the assessment of effects of the project on the environment. These include magnitude, geographic extent, duration and frequency, irreversibility, ecological context, and likelihood. Assessment should take into account the design criteria and uncertainty of predictions.*

Guideline #12: *Consideration of cumulative effects should be inherently included in the EIA process when climate change is a factor, whether or not the assessment is required by the particular jurisdiction.*

Guideline #13: *Mitigation measures specific to addressing climate change impacts, possibly including any appropriate adaptation measures, should be addressed in the mitigation section of the EIA and also incorporated into the project description section of the report.*

Guideline #14: *If a project is potentially sensitive to climate change within its life, the project monitoring should also include periodic review of climate change data, and/or monitoring to test the appropriateness of the climate change working assumptions, and if necessary, allow modifications to be made to the project.*

Guideline #15: *In EIA reporting, caution should be exercised to avoid over-emphasizing the need for accurate climate change predictions on a complete array of variables where significant climate change-related impacts from, or on, the project are not anticipated.*

REFERENCES

- Burton, I. and M. van Aalst. 1999. Come Hell or High Water – Integrating Climate Change Vulnerability and Adaptation into Bank Work. World Bank, Environment Department Papers, Climate Change Series, Washington, DC. Paper No. 72: 60p.
- Canadian Environmental Assessment Agency (CEAA). 2001a. What is Environmental Assessment? Date Modified: 2001-12-01. Retrieved September 18, 2002, from http://www.ceaa.gc.ca/0009/whatissea_e.htm.
- Canadian Environmental Assessment Agency (CEAA). 2001b. Reference Guide: Determining Whether A Project is Likely to Cause Significant Adverse Environmental Effects. Date Modified: 2001-12-01. Retrieved September 18, 2002, from http://www.ceaa.gc.ca/0011/0001/0008/guide3_e.htm#Reference%20Guide.
- Canadian Standards Association, 1991. Risk Analysis Requirements and Guidelines CAN/CSA-Q634-91. Rexdale, ON, Canada.
- Canadian Standards Association, 1997. Risk Management: Guideline for Decision Makers CAN/CSA-Q850-97. Etobicoke, ON, Canada.
- ClimAdapt. 2003. Evaluation of the ClimAdapt Guide to Incorporating Climate Change into the Environmental Impact Assessment Process. Prepared for the Canadian Environmental Assessment Agency, Ottawa, by ClimAdapt, Halifax, Nova Scotia.
- Government of Canada. 2001. A Canadian Perspective on the Precautionary Approach/Principle. Government of Canada Policy Statement, Ottawa.
- Houghton, J.T., Y. Ding, D.J. Griggs, M. Noguer, P.J. van der Linden, X. Dai, K. Maskell and C.A. Johnson. 2001. Climate Change 2001: The Scientific Basis. Contribution of Working Group I to the Third Assessment Report of the Intergovernmental Panel on Climate Change. Published for the Intergovernmental Panel on Climate Change, Cambridge University Press.
- Lines, Gary. Personal Communication. Climate Change Meteorologist, Climate Change Division – MSC Atlantic, Dartmouth.
- McCarthy, J.J., O.F. Canziani, N.A. Leary, D.J. Dokken and K.S. White. 2001. Climate Change 2001: Impacts, Adaptation, and Vulnerability. Contribution of Working Group II to the Third Assessment Report of the Intergovernmental Panel on Climate Change. Published for the Intergovernmental Panel on Climate Change, Cambridge University Press.

World Bank. 1999. Environmental Assessment Policy. Operational Policy (OP) 4.01. Retrieved September 18, 2002, from <http://lnweb18.worldbank.org/ESSD/essdext.nsf/47DocByUnid/F5089AD30EFC3D2B85256BBB00526DC1?Opendocument>.

GLOSSARY

Boundaries – Parameters within which there is potential for VECs to interact or be influenced by the Project. These parameters include spatial, temporal, ecological, administrative and technical issues.

C-CIARN – Canadian Climate Change Impacts and Adaptation Research Network.

CEAA – Canadian Environmental Assessment Act (or Agency).

ClimAdapt – Nova Scotia's Climate Change Adaptation Initiative.

Climate change – A term that is used to describe changes to the climate of the earth and typically includes changes to temperature, wind, precipitation levels, and sea conditions (levels, wave heights, currents, etc).

Climate change models – Empirical tools that have been developed to assist in predicting potential climatic changes for specific regions.

Cumulative impacts – Changes to the environment that are caused by action in combination with other past, present and future human actions.

Environmental Impact Assessment (EIA) – A process by which the potential effects of a proposed project on the environment are evaluated. EIA must also consider the potential effects of the environment on the project as well. Also referred to as Environmental Assessment (EA).

Greenhouse gas (GHG) – A general group of gaseous products and byproducts that cannot escape the earth's atmosphere. These gases then reflect longwave radiation back to earth, creating a warming effect.

IPCC – Inter-governmental Panel of Climate Change.

Mitigation – Refers to the implementation of specific measures during the Project that are designed to eliminate or minimize potential impacts from the Project on VECs.

NSEIA – Nova Scotia Environmental Industry Association.

Practitioner – This term refers to individuals that are involved in the development, preparation, and review of EIAs. This can include project proponents, consultants, government regulators, and EIA researchers.

Precautionary approach/principle – Refers to a decision-making process that seeks to avoid serious risk or irreversible harm to the environment, in the absence of detailed information regarding cause/effect relationships.

Risk assessment - The estimation of risk for discrete and independent consequences to occur.

Scoping – An initial step in the EIA process that identifies any environmental components of concern, with respect to the development of the Project. These components are then carried forward for further evaluation in the EIA.

Valued environmental component (VEC) - Categories of receptors of potential project impacts that are linked to project activities through specific pathways or potential interactions.