

Cumulative Effects Assessment: Current Practices and Future Options

EXECUTIVE SUMMARY

Alberta is one of only three Canadian jurisdictions to have enshrined cumulative effects assessment in its legislation. Overall, the practice in Alberta matches or exceeds the level of sophistication anywhere in this country. Proponents, environmental non-governmental organizations (ENGOS) and regulators all deserve recognition for their efforts in meeting previous challenges and in responding to the challenges which continue. This report was commissioned by Alberta Environmental Protection as part of its ongoing efforts to improve performance in the area of environmental assessment. Specifically, the report examines existing practices addressing cumulative effects and looks to ways to improve them. It summarizes:

- highlights of current practices,
- important challenges that need to be met, and
- options for meeting those challenges.

BACKGROUND

The *Alberta Environmental Protection and Enhancement Act* (EPEA) provides for cumulative effects assessment as part of environmental impact assessment reports. Section 47 (d) of the *Act* states that, unless the Director responsible for environmental assessments provides otherwise, those reports must include:

a description of potential positive and negative environmental, social, economic and cultural impacts of the proposed activity, including *cumulative*, regional, temporal and spatial considerations [*emphasis added*]

Cumulative effects assessments are used to help Alberta's environmental assessment process achieve its four purposes (section 37 of the *Act*):

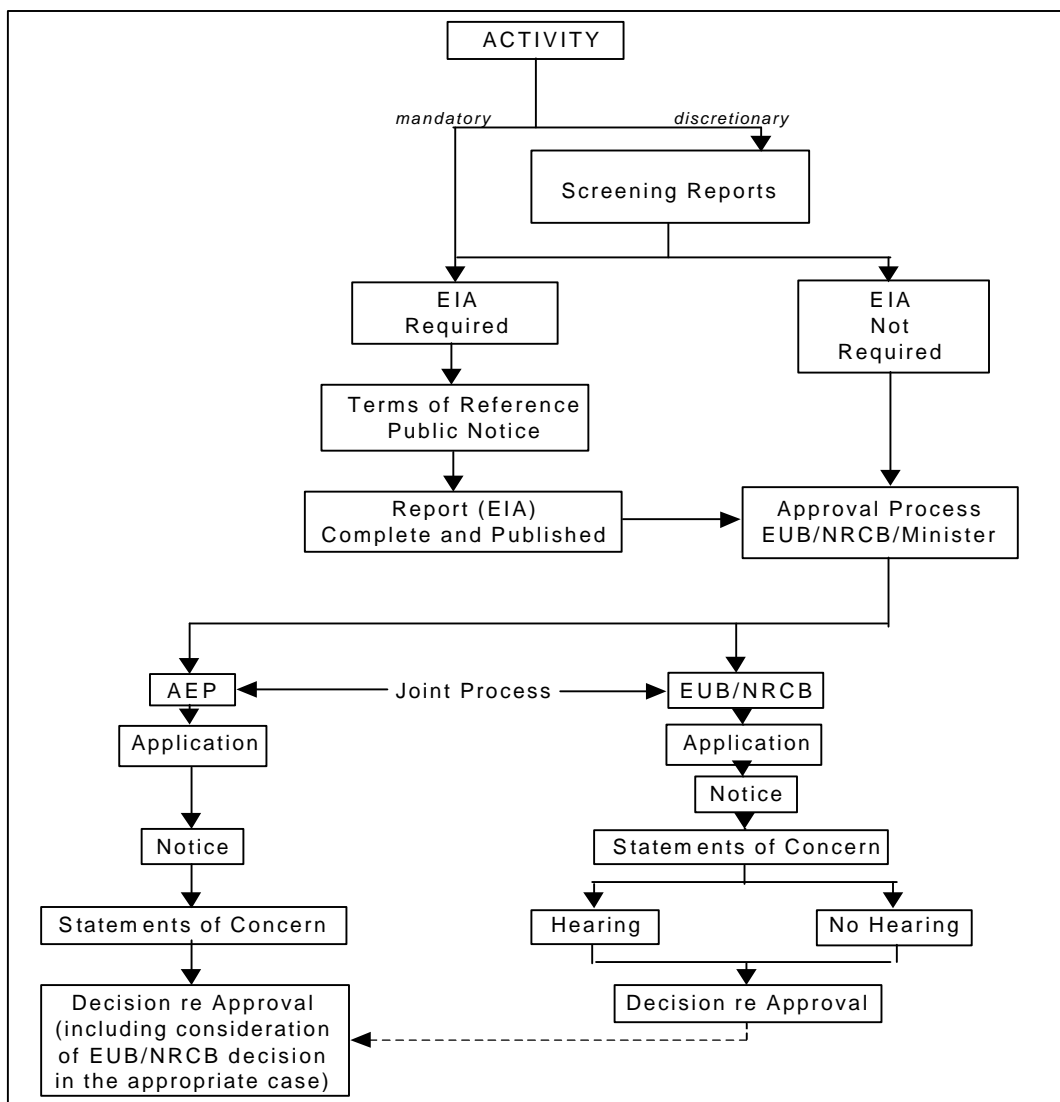
- to support the goals of environmental protection and sustainable development;
- to integrate environmental protection and economic decisions at the earliest stages of planning an activity;
- to predict the environmental, social, economic and cultural consequences of a proposed activity and to assess plans to mitigate any adverse impacts resulting from the proposed activity; and
- to provide for the involvement of the public, proponents, the Government and Government agencies in the review of proposed activities.

In pursuit of these goals, the *Act* and its regulations delineate a regulatory process which, on the one hand, is quite strict and on the other is fairly flexible when addressing the need for environmental assessments. Activities subject to environmental assessment are listed and then assigned to one of three categories - mandatory, exempt or discretionary. All mandatory activities and some discretionary activities require an environmental impact assessment (EIA). Exempt activities do not.

Alberta Environmental Protection is responsible for managing the EIA process. If an EIA is required, proponents are responsible for completing the assessment following Terms of Reference established for each project and review. Regulatory reviews are conducted by either the Energy and Utilities Board (EUB) or the Natural Resources Conservation Board (NRCB), which consider whether the proposed project is in the public interest. Cabinet makes the final decision in most cases, which government then implements through approvals, licences, monitoring and other regulatory measures.

Alberta Regulatory Process

Alberta Environmental Protection and Enhancement Act and Regulations

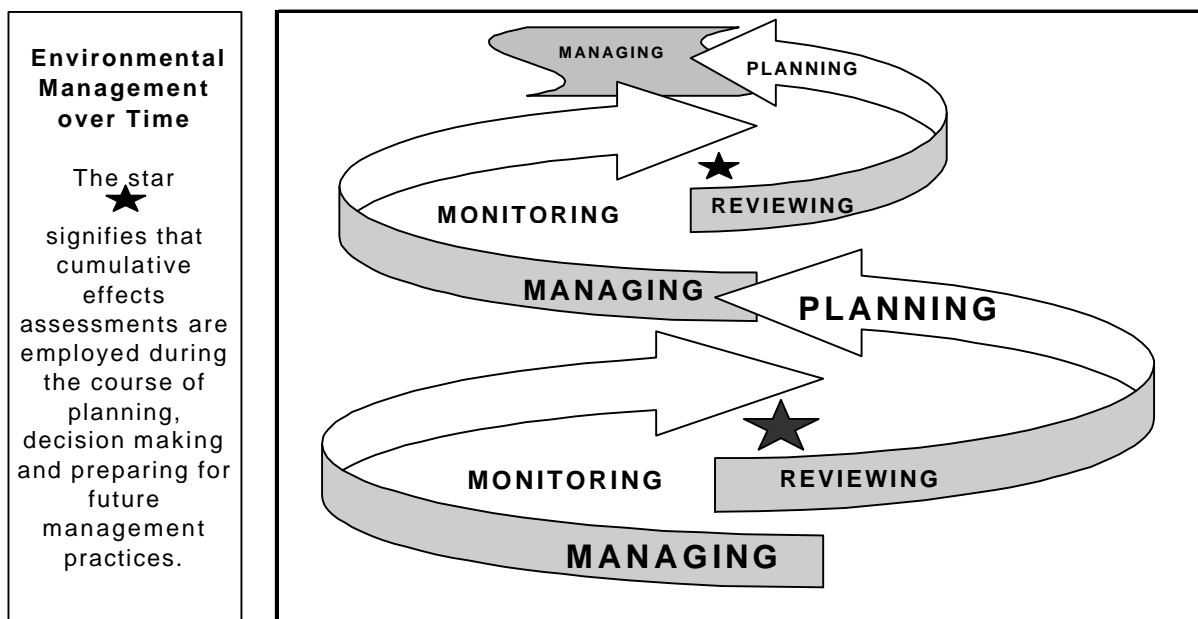


Environmental assessments have been part of Alberta's regulatory framework since 1973. The process was formally legislated in 1992, when the *Alberta Environmental Protection and Enhancement Act* (EPEA) was introduced after extensive public consultations. For the first time, cumulative effects was explicitly included as a component of EIAs (section 47 (d), EPEA). Then, as now, practitioners, regulators and environmental managers around the world were engaged in considerable debate over what role cumulative effects assessment (CEA) should play in regulatory, planning and decision-making processes. Two main positions developed, characterizing discussions in Alberta as elsewhere:

- 1) CEA is, essentially, an environmental impact assessment done well, and
- 2) CEA is a regional planning assessment tool.

Those who take the first position ascribe responsibility for conducting the assessment to individual project proponents. Those who take the second position ascribe responsibility to government. They argue that regional planning falls within the public domain and extends beyond the scope of a single project or the reasonable capacity of a single proponent to assemble databases on environmental conditions and account for past, present and reasonably foreseeable projects. In fact, the two positions are not mutually exclusive and can be complementary parts of an overall system for managing cumulative effects.

Management of environmental effects can put CEAs to good use at both project-specific and regional levels. A common factor is information gathering for the purpose of making management decisions – at any level. The figure below portrays how cumulative effects assessment can fit into the ongoing management of environmental effects associated with an activity, with planning and decision-making processes interceding from time to time. When new developments are initiated, or periodically as activities are monitored and resulting data are reviewed, regulators and stakeholders undertake assessment and review processes in preparation for making decisions on the future management of projects or resources. It is important to recognize the two possible roles of CEA and to link the project-specific and regional levels of assessment and management.



CUMULATIVE EFFECTS ASSESSMENT

Recent efforts in cumulative effects assessment have focussed more on improving assessments, rather than on debating who should take responsibility for conducting them. Cumulative effects assessment, simply described, is a set of tools used to help determine the likely and potential consequences of proposed actions. CEAs are used to help determine what projects and actions are acceptable and how an activity, development or resource must be managed over the coming years to meet public goals.

CURRENT PRACTICES

Practices in Alberta are becoming more consistent in their approaches to cumulative effects assessments. For example, most CEAs today include the nine key components listed below:

- Issue identification;
- Valued Ecosystem Components (VECs) and associated indicators;
- Spatial bounding;
- Temporal bounding;
- Included projects;
- Assessment methods;
- Impact characterization;
- Significance of cumulative effects; and
- Future management options.

The components are presented in the usual order in which they are addressed when completing a CEA, although the process is somewhat iterative. For example, the choice of valued ecosystem components or indicators will influence the choice of spatial and temporal boundaries, which in turn often results in modifications to the indicators selected.

All nine components are essential for effective cumulative effects assessments (Beanlands and Duinker, 1983; CEAWG, 1997; Hegmann and Yarranton, 1995; Smit and Spaling, 1994). In an assessment, each component is addressed in the context of the specific project in question, taking relevant cause-and-effect environmental relationships and the current or baseline state of the environment into account. The choice of the baseline state of the environment is particularly important when predicting future impacts and attributing significance to those impacts. Impacts on an already disturbed system may be much more significant than those on a system which has seen little disturbance. Baseline information is in any event fundamental to managing future environmental impacts.

Although current practice is converging to some degree, still the quality of assessments is somewhat variable. A representative sample of 19 projects was reviewed. The projects were chosen to represent a cross-section of different types of industrial developments and of different cumulative effects on various resource groups such as air quality, groundwater, vegetation and wildlife. The projects included 13 Alberta projects (11 of which were subject to the *Alberta Environmental Protection and Enhancement Act* or its predecessors), four projects not located in Alberta, and two projects situated in Alberta for which federal agencies carried principal regulatory responsibility.

Emphasis was placed on contemporary examples. Only three projects from before 1990 were reviewed. The Mercoal (Manalta Coal Ltd.), Athabasca Pulp Mill (Alberta Pacific Forest Industries Inc.) and Caroline (Shell Canada Ltd.) projects were included as examples of CEA practice and regulatory process in Alberta before legislative requirements for CEA were introduced in 1992.

Each project was summarized under headings corresponding to the nine components listed above. Project Summaries are attached to the report as Appendices. The nine components were evaluated for each project, and both highlights of current practice and major challenges currently facing CEA implementation in Alberta were identified.

HIGHLIGHTS OF CURRENT PRACTICE

The highlights represent the best current practices demonstrated by the cumulative effects components of project-specific EIAs. They are a compendium of practices generally accepted by current practitioners, regulators and the public in Alberta, and considered by the Institute/Axys to be the best of practices revealed in the 19 projects reviewed. In particular, practices were identified as highlights based on the following criteria:

Expert Consensus: the practice has been generally accepted in the literature, conferences and workshop proceedings.

Public Acceptance: the practice has been generally accepted in formal regulatory proceedings.

Accepted Practice: the practice is generally accepted by practitioners in the field and industry.

Historical Progression: the practice reflects an advancement of the science and availability of data.

Opinion: the practice is considered to be a highlight in the opinion of the Institute/Axys based on knowledge and experience in the field.

Two practices can improve the quality and usefulness of the content of each component and constitute good practices in their own right:



- clearly stating the assumptions and criteria used in addressing that component, and
- ensuring that each assessment is well defined so that expectations are clear at the outset.

Regarding the latter, one strength of Alberta's approach is the effort spent on establishing good Terms of Reference for each EIA. This practice is accomplished by government staff and the proponent working together and includes opportunities for other stakeholders and the public to review and provide input before the Terms of Reference are finalized.

The highlights of current practice in each component are summarized below.

Issues Identification

A balanced approach to identify issues of concern based on a thorough understanding of the project and cause-effect relationships, and involving

- Consultation with interested and affected parties and regulators prior to EIA
- Thorough baseline characterization
- Expert opinion and literature review
- Structured approaches for issues identification



VEC and Indicator Selection

Valued Ecosystem Components (VECs) are selected based on identifying:

- Issues, effects and species of greatest public concern
- Different resources (e.g., air, ground water, wildlife) which may be affected for each type of major pressure or stress
- One or more species likely to respond to each major pressure or stress
- Specific parameters that will be used to assess the response of the VECs to each effect



Spatial Bounding

A regional study area is chosen taking the following factors into account:

- Maximum detectable zone of influence for each project effect (e.g., range of audible noise);
- Spatial extent of the effect on the relevant VEC (e.g., zone of habitat alienation due to sensory disturbance); and
- The most appropriate spatial unit for the VEC that is likely to be affected by the project (e.g., a distinct subpopulation for wildlife; the ground water aquifer) which usually results in more than one spatial boundary.



Temporal Bounding

The assessment of cumulative effects covers the following time frames:

- Pre-development period: some information on the environment;
- Present period: a thorough characterization of baseline conditions;
- Project activities period (including construction, operation and reclamation, if relevant): snapshot information on the environment; and
- Period without proposed project: an analysis of environmental change in the absence of the project.



Included Projects

All existing and reasonably foreseeable developments and activities which have the potential to affect the same resource or VEC as the proposed project are included.



Assessment Methods

Assessment methods are iterative and include the following features:

- Impact hypotheses or models used to characterize possible impacts and interactions among impacts;
- Quantitative or qualitative analysis as appropriate;
- Verification of modelled results through field data collection, baseline characterization and ongoing monitoring programs; and
- Modification of impact hypotheses or models if necessary.



Impact Characterization

Impact characterization is distinguished by the following:

- All terms characterizing impacts (e.g., scope, magnitude) are clearly defined;
- Specific categories or measurements characterizing impacts are defined;
- Impacts are related to standards or desired thresholds for cumulative effects; and
- Uncertainty associated with predictions is explicitly acknowledged and levels of confidence are estimated.



Significance of Cumulative Effects

The rationale for determining significance of cumulative effects is explicitly presented in the assessment.



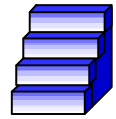
Future Management Options

Collaborative long-term regional initiatives to manage impacts are stipulated, and include current or future programs of action designed to avoid potential cumulative impacts.

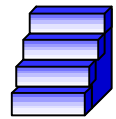


CHALLENGES

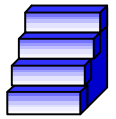
A major challenge facing regulators and proponents alike is the lack of sufficient data on baseline and regional conditions. Understanding of complex environmental interactions is also limited and, combined with data deficiencies, detracts from the accuracy and usefulness of any cumulative effects assessment.



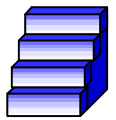
In weighing the net environmental, social and economic costs and benefits of a development, regulators are faced with the further challenge of making decisions in the absence of clearly defined goals, standards or thresholds. A key part of this challenge is the lack of — and difficulty of establishing — definitive goals for most biological resource groups such as soils, vegetation, aquatic ecosystems and wildlife and for human pursuits such as recreation and traditional use. It is a challenge which faces environmental managers everywhere, not only in Alberta.



Another challenge is to resolve the present degree of uncertainty in terms of what a CEA should contain and what constitutes preferred or acceptable approaches. Current practices show considerable inconsistency from case to case. A clear statement of a CEA's purpose as a decision-making tool and a straightforward description of what type of information is required to make well-founded decisions would aid in improving practice.



A significant challenge facing project or resource management in Alberta is the task of integrating project-specific assessments, including consideration of cumulative effects, with regional policies, plans and management. A systematic process providing integration at the provincial level would substantially improve the practice of CEA and the implementation of consequent decisions. Without such integration, complementary contributions from both assessing project-specific effects in a regulatory context and managing them in a broader context will not be fully realized. Proponents, practitioners and the public are likely to become sceptical about the value of project-specific CEAs, and Alberta will not receive the full benefit of the assessment process.

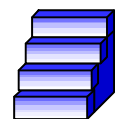


Particular challenges for improving implementation of CEA practice include the following:

Issues Identification

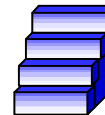
Ensuring smaller projects and dispersed human activities are considered when cumulative effects issues are being assessed, because such activities may substantially affect regional resources.

Identifying issues on the basis of common effects (rather than on the basis of separate professional disciplines). It is the combined effects of various aspects of development on ecological systems and human health which ultimately matter.



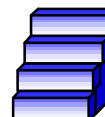
VEC and Indicator Selection

Linking indicators to environmental change is a challenge worth meeting, although it is a distinct challenge to current assessment methods. A reliance on discipline specific Valued Ecosystem Components (VECs) often results in a fragmented analysis which bears little connection to overall environmental quality or health.



Spatial Bounding

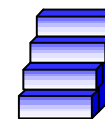
Standardized criteria for analysing and choosing the spatial extent of study areas would improve the practice of setting boundaries. Preliminary analysis based on the criteria would be used to set reasonable and appropriate boundaries.



Temporal Bounding

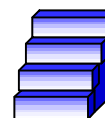
One challenge is to avoid choosing the present as the start of the study period, making contemporary conditions the only baseline. Such an approach can distort conclusions based on a cumulative effects assessment in at least two ways:

- a) Incremental changes attributable to a single project may be termed insignificant when compared with cumulative environmental changes caused by previous and continuing activities. Nevertheless, the incremental changes may in fact be significant when compared with some overall measure of ecosystem integrity.
- b) Incremental changes attributable to a single project may be termed insignificant when compared with contemporary environmental conditions. Nevertheless, cumulative changes taken as a whole, including changes caused by previous and continuing activities, may in fact be significant when compared with some overall measure of ecosystem integrity.



It is also a challenge to select the appropriate end point for the period that will be assessed, and to make reasonable assessments of the future. Conclusions of a cumulative effects assessment about the future can be distorted in at least two ways:

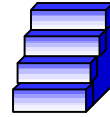
- a) Far future scenarios rely on long-term projections, which by their nature cannot be verified and which may support the illusion that participants are better at predicting than is in fact the case.
- b) The significance of effects is assessed and mitigation measures are predicted to succeed in the context of environmental conditions which are assumed to remain the same throughout the study period. In fact, anticipated results may be altered by natural variability and events which exert considerable forces on ecosystems.



The challenge is to select a study period that looks far enough to the future that it covers the issues of concern, to explicitly recognize the limitations of that assessment, and to adjust the assessment and management in response to ongoing monitoring.

Included Projects

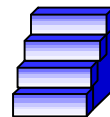
Choosing the relevant projects and activities (both existing and future ones) for inclusion in the assessment is an important challenge. Projects should include smaller scale and dispersed activities which may be significant, such as agricultural operations, which can have substantial effects on water quality or native prairie. Furthermore, the critical question in any given region may be whether existing operations are likely to undertake activities such as expansion, reclamation or decommissioning which, in combination with a proposed project's effects, will cause adverse environmental changes, or ameliorate them.



As to future projects, resolving the meaning of the term "reasonably foreseeable" and addressing the issue of "induced projects" would improve practice.

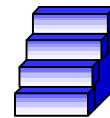
Assessment Methods

Models are used extensively to mimic reality when conducting CEAs, but model outputs are only as good as the understanding, assumptions and data used to create them. Updating models and frequently verifying predictions by comparing them to current field data would improve CEA practice in Alberta.



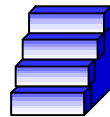
Impact Characterization

Cumulative effects assessment will be improved if practitioners consistently provide clear definitions of the terms they use to characterize impacts and acknowledge and delineate levels of confidence in their predictions.



Significance of Cumulative Effects

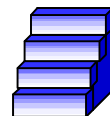
A minimum assessment standard for determining significance needs to be established. Often, the real questions are either not asked or not answered, namely: Is the resource being significantly affected by current pressures on the ecosystem? and, Will the incremental change move a resource near or beyond a sustainable threshold?



Further challenges include considering human factors and impacts over time and identifying a desired standard of environmental quality or integrity. For some parameters, standards have been identified through risk assessment (e.g., drinking water quality parameters), but no such standards exist for overall environmental quality. Some means of agreeing to overall environmental standards is needed.

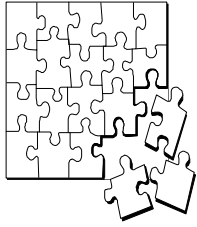
Future Management Options

Planning for future management poses a challenge in that it generally requires a better understanding of environmental changes over the life of a project and of the degree of uncertainty associated with predictions than most participants currently demonstrate. It will also require ongoing cooperation among government departments, the different levels of government, proponents and other stakeholders.



Routine mechanisms to engage stakeholders in planning future management options need to be encouraged. As the EPEA states, all Alberta citizens share responsibility for ensuring the protection, enhancement and wise use of the environment through individual actions.

FUTURE OPTIONS



The practice of cumulative effects assessment in Alberta matches or exceeds the level of sophistication anywhere in Canada. Proponents, ENGOs and regulators all deserve recognition for their efforts in meeting previous challenges and in responding to the challenges which continue. Still, CEAs can be improved and made more useful, partly by meeting the challenges summarized in the previous section.

This section summarizes some options for improving the practice of CEA in two broad categories: systemic approaches and improvements to specific assessment practices.

Options for Systemic Improvement

Systemic approaches are directed more towards overall environmental management as it relates to CEA and include improvements in:

- regional databases, their understanding and use;
- definition of the purpose and content of CEAs;
- integration among regional, sectoral and project-specific management; and
- establishing thresholds.

Regional Databases and Data Interpretation:

Practical, effective options to improve future Alberta assessments of cumulative effects need to address the question of access to accumulated data. Regional databases could fill the deficiency and could also be used to identify further research or data collection requirements, to assess significance of existing data and to predict trends.



Preliminary design considerations with respect to regional databases include ensuring they each have an impartial custodian, equal access and financial support, which could be provided, at least in part, by service fees. The EUB's Core Research Centre may serve as one precedent. Rather than transferring all data to one location, the possibility of linking existing databases needs to be explored. Many databases are maintained in Alberta, including the Alberta Natural History Information System (ANHIC), the recently developed provincial and regional wildlife database maintained by AEP's Wildlife Branch and the commercially developed "Oil sands Regional Database". The Internet might also offer some practical possibilities. The US Geological Survey disseminates regional data through the Internet, allowing users to browse data freely although a fee is charged to download most GIS files.

Also, all participants in environmental management need to improve their ability to understand both what the data mean and, particularly, how different resources and activities interrelate.

Defining a CEA's Purpose and Content:

Providing stakeholders with a standard definition or description of cumulative effects assessments in Alberta would pay dividends in terms of improved practice. Alberta Environmental Protection could take the lead by recognizing in legislation, regulations or policy that CEA is a set of tools used to help determine future management practices for daily operations associated with an activity, development or resource. Building on such an acknowledgment, Alberta regulators should be encouraged to issue a simple analytical framework for the purpose of guiding other stakeholders who conduct or evaluate CEAs in Alberta. A framework document, likely issued in the form of guidelines, would:



- include an operational definition;
- outline minimal expectations with respect to spatial and temporal bounding;
- identify preferred parameters for choosing which projects and indicators to include;
- provide some direction with respect to characterizing and interpreting the significance of impacts, and devising impact management and mitigation initiatives;
- encourage practitioners to articulate and justify all assumptions adopted in an assessment; and
- emphasize public participation.

A framework document, or guidelines, would also help in further improving the development of terms of reference for project-specific CEAs. Not only would standard criteria be applied to components of CEA, such as spatial and temporal boundaries, but the growing practice of conducting workshops and using other techniques to engage stakeholders when scoping a cumulative effects assessment would be reinforced.

In particular, the guidelines should sanction the specific practices summarized in “Options for the Practice of CEA” found later in this section.

Integrating Regional, Sectoral and Project-Specific Management:

Another option likely to be popular with proponents, practitioners and interested parties is formalization of a mechanism to integrate project-specific and regional management. Any process chosen for Alberta should involve a constant dialogue sanctioned in some fashion by government. Provided the dialogue is endorsed by formal legislative or municipal schemes, by regional protocols or simply by government participation in ongoing regional management, research and monitoring programs, participants will derive greater confidence from the process when discussions continue over time.



Thresholds:

Improved, regionally integrated CEAs may also lead Alberta to establish clear thresholds for various resources. This approach would make it easier to interpret a CEA and to make decisions based on it. It may also result in discussion of the issue of limits of various kinds (resource capabilities, types of development, human use and human population size) in order to protect environmental integrity and resource availability for future and current generations. Three questions would immediately engage the government in the event this key issue became the centre of attention:



- Will existing activities that are sources of environmental impact be required to minimize their effects to make room for new developments, or will the “last-proponent-in” be severely restricted or refused?
- Do Albertans acknowledge that there may be limits to development or growth?
- How would such limits be identified?

Options for the Practice of CEA

Specific ways to improve the practice of conducting cumulative effects assessments include the following:

Issues Identification

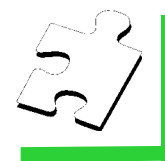
Identifying issues on the basis of common effects rather than on the basis of separate professional disciplines would lead to improved CEAs.



VEC and Indicator Selection

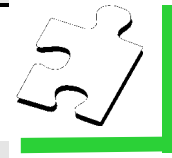
The practice of selecting indicators could be improved if standard criteria were applied. One useful set of criteria, for instance, stipulates that indicators should be:

- Easily understood by, and reported to, the public;
- Sensitive to changes as a result of land use or human activities (in addition to natural changes);
- Capable of serving as an early warning indicator of change;
- Capable of characterizing the relationship between the variable and ecological integrity;
- Capable of addressing concerns for rare and endangered species;
- Capable of providing a continuous assessment from unstressed to stressed conditions (e.g., pristine to polluted conditions); and
- Cost-effective for monitoring reliably in future studies (e.g., can be monitored during routine patrols inside and outside of parks, monitoring programs already in place).



Spatial Bounding

Effects-based scoping of spatial boundaries is important for focusing the assessment. Preferably, a study area is defined as the spatial area within which cumulative effects are most likely to occur and be significant.



Temporal Bounding

When identifying temporal boundaries, practitioners need to be encouraged to characterize cumulative environmental changes from baseline; evaluate relevant historical cumulative effects; restrict future scenarios to include reasonably defensible data; take natural variability into account; anticipate future events caused by both natural and human agents and allow for uncertainty.



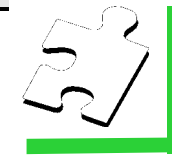
Included Projects

Criteria for including projects could refer to existing activities having the potential to affect the same resources that are likely to suffer impacts from the proposed project; to small scale projects; to activities such as expansion, reclamation or decommissioning likely to be undertaken by existing projects; to “reasonably foreseeable” projects and to “induced projects”. In addition, practitioners need to be encouraged to include consideration of environmental changes in the absence of the proposed project.



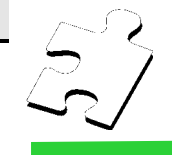
Assessment Methods

Practitioners need to be encouraged to update the models and frequently verify predictions by comparing them to current field data. Regulators can reinforce such a practice by periodically evaluating the models themselves and by insisting on receiving information based on current field data.



Impact Characterization

Terms used to evaluate impacts need to be defined on a discipline-specific basis since standard definitions and categories for all disciplines and all effects can be misleading.



Significance of Cumulative Effects

Significance needs to be determined on the basis of total changes experienced by a receptor over time, not on the basis of incremental changes caused by a project at discrete intervals.

A framework document, or guidelines, could encourage practitioners to determine the significance of effects caused or experienced by human populations.



Future Management Options

Multi-stakeholder assessment and management programs constitute a practical, effective future option. One note of caution, however: constancy and responsiveness are hallmarks of a successful multi-stakeholder program. All stakeholders, including government, need to be prepared to implement alternative measures if the initial program fails or is not as effective as expected.



CONCLUSION

Cumulative effects assessments constitute a powerful set of tools to assist with planning and preparing for future management practices that contribute to the protection, enhancement and wise use of Alberta's environment. Alberta is a leader among Canadian jurisdictions, as CEA is currently practised. Challenges continue, however. Improved access to accumulated data through regional databases needs to be pursued, accompanied by better understanding of what the data mean, especially when all resources and activities are considered together. Regulators should press forward with an operational definition or description of cumulative effects and issue a framework document or guidelines which sanction progressive practices. Formalizing a mechanism which integrates project-specific, sectoral and regional planning and decision-making processes would further contribute to improved CEA practice in Alberta. Such a mechanism may also encourage Albertans to start exploring the issue of regional thresholds and to approach the inevitable question – are limits a real possibility?