Scenarios of Future Developments in Cumulative Effects Assessment:

Approaches for the Mackenzie Gas Project

Prepared for:

Mackenzie Gas Project – Joint Review Panel
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Executive Summary

Some of the Parties to the Mackenzie Gas Project (MGP) - Joint Review Panel (JRP) hearing process, have referred to the Project as "basin-opening" in that it will undoubtedly stimulate new (induced) exploration and development of hydrocarbon resources in the Mackenzie Valley along with additional associated (secondary) developments. Interveners participating in the JRP hearing process have identified issues of potential cumulative effects of such future developments as an important concern.

This paper considers the current requirements and guidance relevant to the MGP environmental impact statement (EIS) for inclusion of future developments within the cumulative effects assessment (CEA) that is part of the EIS. It provides a discussion of current practice in regard to the assessment of future developments in CEA, and approaches that could be taken to explore the potential cumulative effects of future developments related to the MGP. It is intended to inform the discussion between the proponent, the JRP and interveners of how the cumulative effects of such future developments may be reasonably anticipated and planned for.

The guidance and policy that directs preparation of cumulative effects assessments prepared under the Canadian Environmental Assessment Act (CEAA) requires that proponents include in their assessments projects that are "certain" to proceed in concert with the project under review and encourages proponents to consider projects that are reasonably foreseeable (e.g. projects that are being planned, permits are being sought, projects included in land-use plans, and for which some project descriptive information is available). While the guidance for assessments prepared under CEAA recognizes that consideration of induced development represents "best practice", policy directs that this is not required. The guidance given by the Mackenzie Valley Environmental Impact Review Board for preparation of environmental impact assessments (EIAs) under the Mackenzie Valley Resource Management Act (1998) sets a more stringent expectation for inclusion of future developments in CEA practice. It directs proponents to include as reasonably foreseeable "other developments that have not been formally proposed but can be reasonably foreseen". The guidance given to the proponent in the terms of reference for the MGP does not, however, reflect this higher standard.

The current practice of CEA in Canada is not strong and is fraught with a number of problems that compromise its ability to provide useful information with which to anticipate possible cumulative effects of proposed developments. Determining which future projects to include in assessments has proven especially problematic. Despite the encouragement in the guidance and the policy, proponents usually do not go beyond the requirement to include in their analyses only those projects which are considered certain.

Scenario development as an aid to planning is focused on developing alternative visions of the future. By working with scenarios of quite different futures, the analytical focus is shifted away from trying to estimate what is most likely to occur toward questions of what are the consequences and most appropriate responses under different circumstances. Scenarios usually serve one of two functions: one is risk management, where scenarios enable strategies and decisions to be tested against possible futures, while the other is creativity and sparking new ideas. Scenario-based work is most powerful when several alternative scenarios are created and analyzed, and each should provide significant contrast from the others. Scenarios have found application at all spatial scales.

Cumulative effects are the effects that valued ecosystem components (VECs) will experience in reality. VECs are effects integrators in that they must respond to or cope with all the relevant stressors simultaneously. Therefore, the most important part of any EIA, and especially an EIA for a large development such as the MGP, is actually the CEA.

Cumulative effects (positive and negative) of many types clearly depend heavily on government preparedness and choices. Strategic environmental assessments, land use plans and systems of protected areas are instruments with which governments prepare themselves to manage such effects. Unlike some other jurisdictions, however, the Mackenzie Valley contains regions where some or all of these management instruments are absent.

The creation and exploration of scenarios of plausible futures that may be associated with implementation of the MGP would provide an opportunity for the stakeholders (proponents, governments and affected peoples) to begin to anticipate and prepare for possible futures. In the absence of such analysis, seeking a sustainable future may require an approach that, in concert with limits on the pace of development, would seek to respond to cumulative effects as they arise.

Scenario-based CEA cannot guarantee VEC sustainability. It is meant specifically to help to cope with uncertainties about the future - the development future, the future of ecosystems, and the future of human communities. It is meant to assist in managing risks - perhaps reducing risks - associated with human actions that inadvertently may compromise VEC sustainability. It is meant to replace blindness caused by unwillingness to peer forward with glimpses of possible outcomes so that we might choose the best among them.

Disclaimer

This is one of four papers developed for the Joint Review Panel for the Mackenzie Gas Project. Each paper in the series is intended to assist the members and staff of the Joint Review Panel (JRP) for the Mackenzie Gas Project (MGP), together with parties to the review of the MGP, in assessing the significance of project-related impacts, and in considering impact trade-offs as they relate to the determination of net impact benefits.

Other themes covered in this series include: Socio-economic effects of oil and gas developments in the far north (Kruse, 2006), Determination of significance in environmental assessment (Lawrence, 2006), and Sustainability appraisal (Gibson, 2006).

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List of Acronyms

The following acronyms are used either in the main body of this report or in the presentation slides included in the appendices.

CEA	-	Cumulative Effects Assessment
CIA	-	Cumulative Impact Assessment
CEAA	-	Canadian Environmental Assessment Act
EA	-	Environmental Assessment
EIA	-	Environmental Impact Analysis
EIS	-	Environmental Impact Statement
EPEA	-	Environmental Protection and Enhancement Act (Alberta)
ISR	-	Inuvialuit Settlement Region
JRP	-	Joint Review Panel
MGP	-	Mackenzie Gas Project
MVEIRB	-	Mackenzie Valley Environmental Impact Review Board
MVRMA	-	Mackenzie Valley Resource Management Act
MVLWB	-	Mackenzie Valley Land and Water Board
NCN	-	Nisichawayasihk Cree Nation
NEB	-	National Energy Board
NT2	-	Nam Thuen II Hydro-electric development
RA	-	Responsible Authority
the Act	-	Canadian Environmental Assessment Act
the Panel	-	Joint Review Panel for the Mackenzie Gas Project
VEC	-	Valued Ecosystem Component
WPQ JRP	-	Whites Point Quarry Joint Review Panel

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1. Introduction

This report has been prepared for the Joint Review Panel (JRP; the panel) for the Mackenzie Gas Project (MGP; the Project). The panel was formed to conduct a public review of the Environmental Impact Statement (EIS) (Imperial Oil et al., 2004) prepared for the Mackenzie Gas Project. The proponent of the project is a consortium of companies led by Imperial Oil Resources Ventures Ltd. Other members of the consortium are Shell Canada Limited, Conoco Philips Canada (North) Limited, ExxonMobil, and the Aboriginal Pipeline Group.

The geographic scope of the project includes parts of the Inuvialuit Settlement Region (ISR), the Mackenzie Valley within the Northwest Territories, and northwest Alberta. Consequently parts of the project are subject to the requirements of the Canadian Environmental Assessment Act (the Act; CEAA) (applicable to the ISR), the Western Arctic (Inuvialuit) Claims Settlement Act (Department of Justice, 1984) (applicable to the ISR) and the Mackenzie Valley Resource Management Act (MVRMA) administered by the Mackenzie Valley Land and Water Board (MVLWB) and the Mackenize Valley Environmental Impact Review Board (MVEIRB). While each of these Environmental Assessment (EA) regimes have some requirements in common they also have differences. Consequently the requirements of the three EA and review processes have been amalgamated to facilitate an integrated and expeditious review of the EIS, and a JRP was formed to conduct the review of the EIS . The EIS requirements for the purposes of the panel review are found in the Terms of Reference for the preparation of an EIS for the MGP (Inuvialuit Game Council et al., 2004), and the Agreement for an Environmental Impact Review of the MGP (AEIR) (Mackenzie Valley Environmental Impact Review Board et al., 2004). Annex 2 of the AEIR outlines the factors to be considered by the JRP in conducting the public review of the EIS, in particular, "The environmental Impact Review will have regard to the protection of the existing and **future** social, cultural and economic well-being of residents and communities…" [emphasis added].

The proposed project includes development of three natural gas "anchor fields" located in the Mackenzie River delta plus a pipeline with associated facilities (e.g. interconnection lines to the anchor fields, gas processing and separation facilities, gas compressor and heating stations) for transport of gas from the anchor fields to an interconnection with the existing pipeline network terminus in northern Alberta near the boarder with the Northwest Territories. The volume of natural gas liquids to be carried from the anchor fields is forecast in the EIS to be 24.8 Mm^3/d (0.88 Bcf/d). An additional 9.2 Mm^3/d (0.32 Bcf/d) is expected to be transported from gas fields that are not yet identified. The design for the pipeline includes features that would permit its expansion to accommodate transport of 51 Mm^3/d (1.8 Bcf/d).

Some of the Parties to the panel's hearing process, have referred to the Project as "basin-opening" in that it will undoubtedly stimulate new (induced) exploration and development of hydrocarbon resources in the Mackenzie Valley along with additional associated (secondary) developments. Interveners participating in the JRP hearing process have identified issues of potential cumulative effects of such future developments as an important concern.

The paper considers the current requirements and guidance relevant to the MGP EIS for inclusion of future developments within the cumulative effects assessment (CEA) that is part of the EIS. It provides a discussion of current practice in regard to the assessment of future developments in CEA, and approaches that could be taken to explore the potential cumulative effects of future developments related to the MGP. It is intended to inform the discussion between the proponent, JRP and interveners of how the cumulative effects of such future developments may be reasonably anticipated and planned for.

2.0 Current Practice in CEA of Future Developments

2.1 WHY ASSESS THE CUMULATIVE EFFECTS OF FUTURE DEVELOPMENTS

The preamble to the Canadian Environmental Assessment Act states that

> "… the Government of Canada seeks to achieve sustainable development by conserving and enhancing environmental quality and by encouraging and promoting economic development that conserves and enhances environmental quality."

and Section 4 of the Act states (in part) that

> "(1) The purposes of this Act are
>
> (*a*) to ensure that projects are considered in a careful and precautionary manner before federal authorities take action in connection with them, in order to ensure that such projects do not cause significant adverse environmental effects;
>
> (*b*) to encourage responsible authorities to take actions that promote sustainable development and thereby achieve or maintain a healthy environment and a healthy economy;"

Thus a goal of the Act is to help to achieve sustainable development in part by ensuring that projects do not cause significant adverse environmental effects, but also by pushing federal responsible authorities to promote positive steps towards sustainability. Toward this end, Section 16 of the Act stipulates the factors that must be considered in environmental assessments, and in particular Section 16 (1) requires that environmental assessments include consideration of

> "the environmental effects of the project, including the environmental effects of malfunctions or accidents that may occur in connection with the project and any cumulative environmental effects that are likely to result from the project in combination with other projects or activities that have been or will be carried out"
> (Department of Justice Canada, 1992).

When done well, environmental impact assessment (EIA) provides information to decision-makers, in both the private and public sectors, about two key considerations of the potential environmental effects of a proposed project. The first consideration has to do with the feasibility of mitigating a project's anticipated negative effects in order to reduce or eliminate them. Typically this involves analysis to provide answers to questions such as

- How would the project be expected to interact with valued ecosystem components (VECs[1]) to produce an impact on them? (i.e. what ecological pathways of direct and indirect effects lead to impacts on VECs?).
- Could a predicted adverse impact be reduced with additional mitigation measures? If so, by how much?
- Could a predicted adverse impact be reduced by selection among the alternative approaches to achieving the objectives of the undertaking, or by making a change in the project design (e.g.

[1] Throughout this paper the term VEC should be understood in a broad sense that includes, biophysical, social and cultural values that together comprise the character of the socio-ecological system upon which communities rely.

timing, location, technology, etc)? If so, by how much?
- How might positive effects of the project be enhanced?
- What would be the expected magnitude of the impact with and without mitigation?

Getting good answers to such questions is critical to understanding how to design and implement projects in a way that reduces undesirable environmental impacts to acceptable levels and enhances positive contributions to sustainability.

The second key consideration is: what is the expected consequence of the influence of the project on the status of VECs? The word "status" here is a surrogate for some measure of the quality, health or abundance of VECs that has meaning in the context of sustainability. This second consideration is what has come to be known in current EA practice as cumulative effects assessment (CEA). CEA was not an explicit requirement of EA when it was first introduced. After several years of experience with EA focused primarily on the first of these two considerations, it became a subject of much interest. The need for CEA, really the need to pay attention to the second of these key considerations, was advocated for example by Ross (1994) who asserted that "The environmental effects of concern to thinking people are, simply put, not the effects of a particular project; they are the cumulative effects of everything. Hence it is essential logically to address cumulative effects if one wishes to consider the environmental effects of development projects" further Duinker (1994) argued that "CEA is what EIA was meant to be!". Early work in Canada was supported by the Canadian Environmental Assessment Research Council (e.g. Beanlands et al., 1985; Sonntag et al., 1987). Much of the literature on CEA has focused on classifying how cumulative effects might occur. While this can be helpful for conceptualizing cumulative effects, such classifications can also distract from focusing on the critical task of assessing the aggregate stresses that affect VECs (Duinker and Greig, 2006a).

There are of course other important questions to be addressed in any EIA, for example in relation to the feasibility of detecting impacts in a well-designed monitoring program. However, the two considerations discussed here are what is critical to understand how best to design a project, and the likely future environmental consequences of implementing it. As such, they are key questions for consideration by the Panel.

It is possible to assess the first of these considerations with a relatively narrow focus that looks at the details of the interaction between proposed project alternatives and options and potentially affected VECs. While such analysis is useful for thinking about project selection/design and effects enhancement/mitigation, it generally does not yield insight into the consequences of a project for VEC sustainability. The reason for this is quite simple - the sustainability of VECs depends upon the totality of stresses that affect them, not just those imposed by a particular project, should it be implemented. Consequently, any analysis of the potential consequences for VECs that is done, for example, by considering only existing developments together with a single proposed development would be certain to be wrong, unless, of course, we could be assured there would be no other future developments during the time that the project would be active. Hence there is a requirement in the Act to consider "the environmental effects of the project … in combination with other projects or activities that have been or will be carried out" (Department of Justice Canada, 1992).

Conducting a good CEA is a substantial challenge. For past and existing projects that have been in place long enough that their effects can actually be observed in measures of the current VEC status it may not be necessary to assess their individual contributions explicitly (unless they are due to be retired during the time horizon of the analysis). For recently built projects whose effects are not yet fully expressed in current observations of VEC status[2] more explicit analysis is needed. Since the effects of any

[2] Due, for example, to lags in the socio-ecological pathways that will give rise to the effects.

development proposal will occur only in the future, after it has been implemented, CEA, and indeed EIA, is inherently about the future. For a proposed project, and other future projects that will cumulatively influence the VEC sustainability, the analysis must be based on a knowledge of how the project will interact with the VECs. Thus the analysis done for the first consideration in EIA should serve to inform the second (CEA).

Identifying what future projects to include in CEA, however, has proven to be one of the most difficult and controversial aspects of CEA practice. This is due in part perhaps to the wording in the Act which directs proponents to assess future projects that "**will**" be carried out. Proponents are thus put in the awkward position of trying to predict the future, which is virtually impossible. Despite its challenges though, to be able to effectively anticipate and manage the consequences of implementing development proposals, we must find ways to help us to think clearly about their potential future cumulative effects. For such analysis to be truly meaningful it cannot be mere fanciful conjecture; it needs, however, to be focused on explorations of plausible futures.

2.2 REQUIREMENTS AND GUIDANCE

The Canadian Environmental Assessment Act governs all projects conducted by the federal government itself, and any private or provincial projects which would require approvals from federal departments or agencies that meet established criteria as triggers for assessment under it. Where projects do not trigger assessment under the Act they may nevertheless be subject to the requirements of environmental legislation mandated by provinces, or territories. Not all such legislation requires CEA (see Appendix 1 for a brief summary of requirements in Canada). Internationally, countries such as the United States and New Zealand, among others, require cumulative effects to be addressed in EIAs. Major international lending institutions such as the World Bank and Asian Development Bank have policies that require EIA to be carried out for major development proposals but not CEA. Despite this, these institutions do require from time to time that CEA be done for some of their projects.

The specific requirements for the Mackenzie Gas Project stem from the Act, the Mackenzie Valley Resource Management Act, the Western Arctic (Inuvialuit) Settlement Act, and the specific Terms of Reference for preparation of the Mackenzie Gas Project EIA. As discussed above in Section 2.1 of this paper, the Act requires consideration of cumulative effects of past, present and future projects that may act cumulatively to affect the status of VECs. Both the Mackenzie Valley Resource Management Act and the Alberta Environmental Assessment Act also require that EAs address cumulative effects.

The Alberta Environmental Protection and Enhancement Act (EPEA), section 47 specifies what must be included in an EIA report, and subsection (d) requires that EIA reports 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".

The EPEA does not identify specifically that future projects should be included, although as discussed below, the guidance provided by the Province of Alberta does. The Mackenzie Valley Resource Management Act, Section 117 (2) (a) mirrors the language in CEAA and requires that every environmental assessment prepared under the Act shall include

> "the impact of the development on the environment, including the impact of malfunctions or accidents that may occur in connection with the development and any cumulative

> impact that is likely to result from the development in combination with other developments" (Department of Justice Canada, 1998).

It does not provide an explicit definition of "other developments".

As noted previously, the question of what future developments should be included in CEAs has proven problematic. In the absence of policy guidance, the requirement in CEAA to assess projects that **will** occur would seem to require proponents to foresee the future, which is not possible[3]. Policy guidance is, however, given to proponents to guide their preparation of CEAs under the Act and is found primarily in three documents[4]:

- the *Reference Guide for the Canadian Environmental Assessment Act – Assessing Cumulative Environmental Effects* (Federal Environmental Assessment Review Office, 1994),
- the *Cumulative Effects Assessment Practitioners Guide* (Cumulative Effects Assessment Working Group and Axys Environmental Consulting Ltd., 1999),
- and the *Operational Policy Statement – Addressing Cumulative Environmental Effects Under the Canadian Environmental Assessment Act* (Canadian Environmental Assessment Agency, 1999).

The earliest of these, the *Reference Guide*, asserts the phrase "that will be carried out" in the Act "implies that, **at a minimum**, (only) projects or activities that have already been approved must be taken into account. The environmental effects of uncertain or hypothetical projects or activities need not be considered" (emphasis added). However, the text further states that "Nevertheless, it would be prudent to consider projects or activities that are in a government approvals process as well." Appendix A to the *Reference Guide* titled *Identifying Future Projects to be Considered in an Environmental Assessment* indicates that "best professional judgement and consultation should be used. There is no simple rule that can be applied to include or exclude future projects from the environmental assessment of the project in question." It goes on to say that "Other types of project approvals, such as issuing permits, licenses, leases or easements, the completion and acceptance of an environmental assessment and land use plans can be considered as sufficient evidence that a future project will proceed, depending on the circumstances." It also suggests that with knowledge of the intention of other proponents to carry out additional development, "it would be wise to consider the expansion as a future project that will proceed for the purposes of the Act." Interestingly it goes on to assert that "In most cases, future projects that may result from the project's 'growth' inducing ability, unless they have been approved, or are in an approvals process will not be considered as part of the cumulative effects analysis." Thus the guidance offered in the *Reference Guide* is essentially that the phrase "that will be carried out" means where it is reasonably certain that a future project will proceed.

Five years later, the term "reasonably foreseeable" was used in both the *Practitioners Guide* and the *Operational Policy Statement* to refer to future developments that should be considered in CEAs prepared under CEAA, and the view of whether induced development should be included had shifted toward favouring its inclusion. Section 2.2.2 of the *Practitioners Guide* identifies the "growth-inducing potential" of projects as one way that cumulative effects can occur and states that they should be considered as *reasonably foreseeable* actions[5]. A more detailed discussion is provided in Section 3.2.4.1

[3] All impact prediction suffers from this.

[4] A *Responsible Authority's Guide* (http://www.ceaa.gc.ca/013/0001/0008/guide_e.htm) also echoes the direction given in the *Reference Guide.* Various government departments and agencies have also prepared their own internal guidance documents.

[5] The *Practitioners Guide* discusses actions rather than projects. Actions tend to be either subcomponents of a larger project, or other types of activities that might not be thought of as projects in the sense of an infrastructure project, but which will nevertheless affect VECs. For the purposes of this discussion, actions should be read as synonymous with projects.

of the *Practitioners Guide* which deals with identifying other actions during scoping. Here, three categories of future actions are identified:

- those that are certain – i.e. actions that will occur or which are highly likely,
- those that are reasonably foreseeable – i.e. actions that may proceed, but there is uncertainty about them occurring, and
- hypothetical actions – i.e. actions about which there is considerable uncertainty as to whether they will ever proceed.

Figure 1 in this section of the *Practitioners Guide* illustrates a continuum of actions from certain through hypothetical. Induced development is included in the category of reasonably foreseeable actions. An important feature of this figure is that it distinguishes two types of induced actions: an action that is "directly associated with [the] project under review, but is conditional on that project's approval (e.g. induced action for which some information is available)", and actions that are "not directly associated with the project under review, but may proceed if that project is approved (e.g., induced action for which little information is available)". The text in the guide directs that selection of other actions to include in a CEA should "at least reflect the certain scenario, and at best the most likely future scenario", and **encourages** practitioners "**to consider the opportunity** to include foreseeable actions" (emphasis added). In subsequent discussion of induced actions the *Practitioners Guide* notes that induced actions may not be officially announced or part of any official plan, and observes that "Best practice suggests that effort should be made in identifying actions if there is reason to believe they may occur, yet are not overly hypothetical." It also states that "induced actions are best considered as part of Regional Land Use Planning Studies…". Also of interest is a case study presented in Section 3.2.2 of the *Practitioners Guide* which discusses the selection of appropriate spatial scales. The case study, entitled *Natural Gas Field Development: Regional Development Scenarios"* briefly describes a CEA in which seven companies collaborated in the development of an analysis of the Monkman/Grizzly-Valley gas development area in northeastern British Columbia. The assessment "used a regional development scenario to 'identify the scale of development likely to occur in the near to medium term'".

While the *Practitioners Guide* points the way toward best practices, the *Operational Policy Statement* gives the currently authoritative policy direction on what projects must be included in CEAs prepared under CEAA. It recommends that Responsible Authorities (RAs) consult both the *Reference Guide* and the *Practitioners Guide*[6] and notes that the latter offers a "best practices" perspective. In regard to the selection of future projects, the *Operational Policy Statement* draws attention to the wording in the Act that specifies that CEAs must include consideration of projects that "will be carried out". It directs that "RAs **should** consider projects that are 'certain' and 'reasonably foreseeable'" (emphasis added). The text also states that it is now recognized that the conservative approach advised in the *Reference Guide*, i.e. that analysis focus on imminent projects "may not always be adequate to understand the implications of development activity on the future well-being of environmental resources. Also, it may limit the ability of CEA findings to contribute to informed environmental planning and decision making in future in the project area". In Annex I entitled *Selection of future projects of CEA under the Act*, it again states that "RAs **should** focus on the most likely future scenario". In so doing, the *Operational Policy Statement* identifies contributing to informed future environmental planning and decision-making as a goal for CEAs prepared under CEAA.

It should be kept in mind that the guidance and policy provided for preparation of CEAs under CEAA is applicable to a wide spectrum of projects from the very small and likely insignificant to the very large and likely consequential. Consistent with the Act, the policy and guidance are clear that RAs (and hence proponents) **must** consider projects that are certain (imminent). It notes that this is a **minimum**

[6] In fact, on the agency web site, the *Reference Guide* is presented as section III in the Responsible Authorities Guide.

requirement, and **encourages** RAs to consider reasonably foreseeable projects (e.g. induced development). The more recent guidance in both the *Practitioners Guide* and the *Operational Policy Statement* clearly describes this more-inclusive perspective (most-likely future scenario) as best practice, but leaves RAs with discretion for determining whether reasonably foreseeable projects will indeed be assessed, or not.

The guidance developed for preparation of CEAs in the Inuvialuit Settlement Region (Kavik-Axys, 2002) is consistent with that given for CEAA. This is to be expected since CEAA is the applicable EIA legislation in the ISR[7].

The guidance given for preparation of cumulative effects assessment under the Alberta EPEA (Alberta Energy and Utilities Board, Alberta Environment, and Natural Resources Conservation Board, undated), is more direct in asserting the need to consider future developments. The guidance prepared for the EPEA states that "CEA predictions should take into account that baseline conditions, i.e., those without the project under review, are not static. …CEA predictions **must** therefore have regard for reasonably foreseeable projects, activities and natural events that could affect the magnitude, duration or significance of a project's cumulative effects" (emphasis added). It goes on to say that "It might appear simpler to avoid uncertainty by including only those projects and activities known with certainty. However, such seemingly more solid predictions almost certainly underestimate cumulative effects by neglecting the current understanding of what is reasonably foreseeable. Predictions of this kind are of limited value in the exploration of potential cumulative effects because they anticipate the lower bounds of plausible future conditions." It also asserts that unless there is a particular circumstance to warrant their exclusion, "reasonably foreseeable" should include projects that are: approved, currently undergoing regulatory review, about to be submitted for review, officially announced by a proponent, directly associated with the project under review, not directly associated (but induced if the project is approved), or identified in a development plan for the area.

The guidance given by the Mackenzie Valley Environmental Impact Review Board (MVEIRB) for preparation of EIAs under the MVRMA (Mackenzie Valley Environmental Impact Review Board, 2004) sets a more stringent expectation for inclusion of future developments in CEA practice. It states that "Identifying reasonably foreseeable future developments involves a broad prediction for which less detail is expected than when identifying present or past human activities". It directs proponents to include as reasonably foreseeable "other developments that have not been formally proposed but can be reasonably foreseen" and, in discussing an example of a proposed pipeline through a previously inaccessible area with little existing development, asserts that "if looking at similar cases indicated that a certain type and intensity of induced development routinely followed, then these types of induced developments should be considered reasonably foreseeable for the proposed development, even though no applications for them have been submitted." This more forward-looking view of what should be included in CEA also seems consistent with the language in the MVRMA which refers only to "other developments" without qualifying their degree of uncertainty.

With its emphasis on certainty in identifying reasonably foreseeable developments, the guidance provided for preparations of CEAs under CEAA seems focused more toward the first of the two considerations for EIA (section 2.1), while that provided for the EPEA and MVRMA seems focused on the less certain but equally important second consideration.

Specific guidance provided in the Terms of Reference for preparation of the EIA for the Project is discussed, below in Section 3.1.

[7] The Western Arctic (Inuvialuit) Settlement Act also establishes an environmental review process for development in the ISR that provides for certain considerations that are supplementary to CEAA, but not specific to CEA.

2.3 COMMENTARIES ON CURRENT PRACTICE

The current practice of CEA in Canada is not strong and is fraught with a number of problems that compromise its ability to provide useful information with which to anticipate possible cumulative effects of proposed developments (Baxter et al, 2001; Duinker and Greig, 2006a). Determining which future projects to include in assessments has proven especially problematic (Greig et al., 2002). Despite the encouragement in the guidance and *Operational Policy Statement*, proponents usually do not go beyond the requirement to include in their analyses only those projects which are considered certain.

As stated in the guidance provided by the Province of Alberta, this approach provides an analysis that will underestimate the likely cumulative effects, essentially providing only a minimum view. There have, however, been some efforts to provide a more useful analysis of future cumulative effects. Bernard et al. (1995) developed a series of future development scenarios for the Slave Geological Province intended as a resource for project assessments. We do not know whether these scenarios were actually used in subsequent assessments. Hegman (1995) took a scenario approach in developing a CEA for projects in the Kluane National Park Reserve, in which he worked with a single development scenario that estimated other developments for five and twenty year time horizons. Below, we briefly outline three case studies of recent CEAs, two from Canada and one from international CEA practice. The two Canadian examples are indicative of the general practice in Canada. The international CEA provides an example of using scenarios to explore future cumulative effects under different levels of government preparedness. Interestingly, the international CEA was undertaken by the Asian Development Bank in cooperation with the World Bank, neither of which require that CEA be routinely done for their projects.

2.3.1 Whites Point Quarry and Marine Terminal, Nova Scotia

Bilcon of Nova Scotia Corporation is proposing to build and operate a basalt quarry, ship-loading facility and marine terminal on the north shore of the Digby Neck, NS (Bilcon of Nova Scotia Corporation, 2006). The project, with an overall footprint of some 150 ha, will be operated over a period of 50 yr and annually produce two million tonnes of crushed basalt for shipment to the parent company in New Jersey. At this time of writing, the Joint Review Panel (WPQ JRP) (Governments of Canada and Nova Scotia) has yet to schedule final public hearings on the application and associated EIS.

In having advised the proponent to undertake formal CEA (WPQ Joint Review Panel, 2005), the WPQ JRP helped the proponent interpret the concept of reasonable foreseeability. We quote from the guidelines (WPQ Joint Review Panel, 2005): "Specify other projects or activities that have been or will be carried out that could produce impacts on each selected VEC"; "Evaluate the likelihood of development of other quarry or aggregate operations, by the Proponent or others, that may appear feasible because of the proximity of the Project's infrastructure"; "A reasonable degree of certainty should exist that proposed projects and activities will actually proceed for them to be included. Projects that are conceptual in nature or limited as to available information may be insufficiently developed to contribute to this assessment in a meaningful manner".

The proponent responded with a 10-page chapter in the EIS on CEA (Bilcon of Nova Scotia Corporation, 2006). Only VECs potentially affected on a regional scale and over the long term were considered in the CEA. The proponent said this in Chapter 9 of the EIS (Bilcon of Nova Scotia Corporation, 2006): "Little ongoing or proposed future development reduces the possibility of developmental cumulative effects in conjunction with the proposed . . . project". Chapter 10 of the EIS (Bilcon of Nova Scotia Corporation, 2006) concludes that there will be no significant negative cumulative effects of the project, and indeed there will be significant positive ones associated with species at risk and municipal tax revenues!

The WPQ JRP did not like the CEA provided in the EIS and noted that the proponent did not follow the WPQ JRP's requirements as spelled out in the guidelines (WPQ Joint Review Panel, 2006). It also demanded a thorough reworking of the CEA. In particular, the WPQ JRP instructed the proponent to "assess effects over the lifecycle of the Project", which in essence means 50 years. It also instructed the proponent to consider reasonably foreseeable projects of all kinds, not just similar projects. The proponent responded with a modestly elaborated CEA, using a 50 year horizon, and the main additional developments considered were several liquefied natural gas facilities around the shores of the Bay of Fundy. These improvements did not change the proponents conclusion of no significant negative cumulative effects of the project.

Overall, neither the WPQ JRP nor the proponent seemed interested in the merits of taking a scenario-based approach to the CEA.

2.3.2 Wuskwatim Generating Station and Transmission Line, Manitoba

Manitoba Hydro and the Nisichawayasihk Cree Nation (NCN) teamed up as proponents for the Wuskwatim Project. It includes both a run-of-the-river 200-MW generating station on the Burntwood River in Northern Manitoba and an associated transmission line to take the new electricity to the Manitoba grid (NCN and Manitoba Hydro, 2003). The Project is subject to both federal and provincial environmental reviews.

The guidelines for the EIA included requirements for CEA: " . . . CEA shall form an integral part of the environmental and socio-economic assessment. The [CEA] shall look at all effects that are likely to result from the project when they are anticipated to occur in combination with other projects or activities that have been, or will be carried out. The environmental impact statement shall explain the approach and methods used to identify and assess the cumulative effects and provide a record of all assumptions and analysis that support the conclusions, including the level of confidence in the data used in the analysis."

In response to these guidelines, the proponent undertook a series of CEA analyses: as reported by NSN and Manitoba Hydro (2003). First, the CEA was scoped at workshops of experts and included First Nations representatives. The report of the 2000 workshop said this: "The focus of the CEA will be the future with and without the Project. Past and existing developments are important to the extent that they have changed or continue to change the existing environment. The future environment will be considered with existing developments (to the extent that they continue to affect the environment), in conjunction with other potential future developments and the proposed Project" (NCN and Manitoba Hydro, 2003).

The scoping exercise identified potential future projects to consider and what the potential CE issues might be in conjunction with the Wuskwatim projects. A second workshop refined the results of the first. "A wide range of actions was considered at the 2002 workshop for potential inclusion in the CEA. In determining the list of actions that was ultimately included, the goal of conducting a CEA that represents the "most likely" future scenario needed to be balanced against practical considerations, such as the availability of specific information for the potential developments. Developments that may occur in the future for which there is insufficient information related to key characteristics, such as location, were not included. . . In identifying future projects to be included in the CEA, the following should be noted:

- At minimum, otherwise eligible projects or activities that have already approved (sic) must be taken into account;
- It would be prudent also to consider otherwise eligible projects or activities that are already in a government approvals process;
- Other eligible projects or activities not subject to a formal government approvals process should be included if there is a high level of certainty that they will occur; and

- The environmental effects of uncertain or hypothetical projects need not be considered." (NCN and Manitoba Hydro, 2003).

Future projects considered during the workshops (and discussed in the EIS, even if determined to be well outside the zone of biophysical influence of the Wuskwatim project) included: other hydroelectric generation and transmission lines, commercial forestry, commercial mining and smelting, roads and trails, NCN activities in the Nelson House Resource Management Area (population growth, cabins, domestic harvests of renewable resources, commercial fishing and trapping, ecotourism), climate change (even though not a project or activity).

Our evaluation of this exercise is that it was still very cautious with respect to future developments, even if reasonably thorough. It did not go beyond CEAA requirements, but met those requirements reasonably well. It favoured the idea of a most likely scenario which. according to our current thinking is not a fruitful approach.

2.3.3 Nam Thuen II Hydroelectric Development, Laos PDR

The Nam Thuen II (NT2) Hydroelectric Development Project is being funded jointly by the World Bank and the Asian Development Bank. As noted in Section 2.2, the policies of these institutions do not require that CEA be done for their projects, but from time to time they do require that CEA be done for some projects. The CEA done for the NT2 development is one such assessment, and was the first CEA done for the Asian Development Bank. The project includes a 48 m high dam on the Nam Thuen River in Lao PDR that will create a reservoir covering an area of 450 km^2 in the wet season. Water will be diverted through a headrace tunnel to a powerhouse located on the Gnommalath Plain and will be discharged by way of a channel into the Xe Bangfai River. Minimum bypass flows from the dam will be 2 m^3/s, significantly reducing the input of water from the Nam Thuen River to the Nam Kading River which discharges into the Mekong River upstream of the confluence of the Mekong and Xe Bangfai. Water discharged from the NT2 development will double the flow in the Xe Bangfai during the dry season and increase flows in the Xe Bangfai by about 10% in the wet season.

The cumulative effects assessment conducted for the NT2 development (Norplan and EcoLab, 2004) assessed the cumulative effects of the NT2 in combination with future scenarios of "assumed" developments in 11 sectors: hydropower, transport, irrigation, water supply and sanitation, urban development, fisheries, forestry, industry, mining, social development, and conservation. In developing the scenarios, both national and local perspectives (and in some cases an international perspectives) were considered in identifying development trends. Development in neighbouring districts in Viet Nam and Thailand were also considered. Two future development scenarios were designed to permit CEA at 5 and 20 years following the development of NT2.

In addition, a scenario approach was also employed to consider how the cumulative effects could be expected to differ under two management scenarios: 1) "based on the assumption that the proposed safeguard plans and initiatives proposed in connection with the NT2 project are implemented and working according to the intentions", and 2) "based on the implementation of recommendations and initiatives that come **in addition to the NT2 safeguard activities**. Most of these recommendations are related to potential impacts outside the main NT2 project area and to sector developments and projects other than NT2" (Norplan and EcoLab, 2004). In this regard, the CEA paid special attention to the readiness of government to manage the potential future cumulative effects, not just those contributed by NT2, and sought to inform future environmental management.

An overview of the cumulative impact study recommendations is provided in the summary report of the NT2 EIA (Asian Development Bank, 2004) "The CEA concluded that the Nam Thuen 2 Project alone

will have an insignificant negative impact on the Mekong floodplain and on all aspects of the Tonle Sap[8] including fish production. It recommends several best practice actions to mitigate and compensate for impacts of developments and predicts the results of these actions on the 5-year and 20-year scenarios. Other recommendations include (i) establishing staffing and training needs in connection with Nam Theun 2, improving coordination and strengthening RMU and District Resettlement Working Groups, (ii) strengthening integrated planning institutions at all levels and the role of government as regulator, (iii) developing comprehensive NPA plans, (iv) establishing legal arrangements among the neighbouring countries, and (v) implementing an equitable Basin Development Plan."

[8] Tonle Sap sometimes referred to as a Great Lake, is located on the Mekong River in Cambodia downstream of the confluence of the Mekong and Xe Bangfai. It has been designated as a Biosphere Reserve, LakeNet Biodiversity Priority, Ramsar, and WWF Global 200 site. In addition to the scenario analysis undertaken in this CEA, a detailed modeling analysis was conducted of potential hydrologic impacts on Tonle Sap.

3.0 Anticipating the Future of the Mackenzie Valley

The Terms of Reference for preparation of the Mackenzie Project EIA (Inuvialuit Game Council, Mackenzie Valley Environmental Impact Review Board, and Minister of the Environment, 2004), provides specific guidance for the preparation of the EIA for the Project. In regard to assessment of cumulative effects it states:

> "With respect to defining future projects and activities a degree of certainty that the project or activity will proceed is necessary for it to be included in this analysis. For clarity, the identification of future projects or activities should include those that are reasonably foreseen to be carried out. Projects that are conceptual in nature or otherwise limited with respect to information on specifications, timing or location may not be sufficiently developed to contribute to the assessment of cumulative impacts in a meaningful manner."[9]

Although it might seem that this statement focuses more on the reasons why reasonably foreseeable future developments may not need to be included in the assessment, it should be remembered that in essence it merely reiterates the thrust of the current guidance for preparation of CEAs under CEAA. Interestingly, it does not reflect the stronger emphasis placed on including less-well-defined future developments found in the guidance for the MVRMA, which in setting the higher test would be expected to define the requirements for the review.

The approach taken by the proponent in preparing the CEA chapter of the EIA is consistent with the guidance provided for preparation of CEAs under CEAA, in particular by the *Reference Guide*. The analysis of cumulative effects focuses on the combined effects of the Project together with three other projects which are imminent. This excludes consideration of development that is likely to be induced by the project. The qualitative analysis of these few projects suggests that their cumulative effects are relatively insignificant. For a "basin-opening project" such as this, however, of greater interest is the potential cumulative effects of the development that may be induced by the project.

The proponent provides a qualitative description of two "hypothetical" development scenarios: 1) a base case which corresponds to the proposed pipeline capacity (34 Mm^3/d; 1.2 Bcf/d) including production from the anchor fields in the Mackenzie Delta (24.8 Mm^3/d; 0.88 Bcf/d), and an assumed additional gas flow of 9.2 Mm^3/d (0.32 Bcf/d); 2) an expansion scenario of 51 MMm^3/d (1.8 Bcf/d) which corresponds to the maximum capacity to which the proposed pipeline could be expanded. In addition, the proponent included a brief discussion in the EIA document of the US National Research Council study of the cumulative environmental effects of oil and gas development on Alaska's North Slope (US National Research Council, 2003). In doing so, the proponent suggests that understanding the cumulative effects of projects such as this might be understood by looking for insight from experience with other similar developments, and points to a body of work that makes it clear that cumulative effects of induced development are likely to occur.

[9] There is an interesting question about the nature and degree of uncertainty that might distinguish reasonably foreseeable from hypothetical developments. The proponents of the Cheviot Mine proposal excluded consideration of activities about which they could not get detailed information. This is somewhat different from not considering future induced developments since the activities were known to be occurring. However, the court challenge was upheld on the basis that in the absence of detailed information, it would be reasonable to conduct the analysis based on an estimate of the activity characteristics. Thus from the perspective of the courts, it would seem that uncertainty about project details is not in itself sufficient to deem a project to be hypothetical.

4.0 Approaches for Generating Scenarios of Future Developments in CEA

Taking a scenario approach to CEA is not about predicting the future. It provides a way to deal with uncertainty by exploring the consequences of alternative futures. The question addressed here is how future projects should be identified and defined for CEA purposes. Below, we first relate a series of principles about futures studies, of which CEA is an example. The principles help frame the enterprise of generating plausible sets of future developments for assessment. Scenario techniques are described in detail as the most effective, indeed perhaps the only effective, approach to this task.

4.1 Some Principles of Futures Studies

(a) The future is essentially unknowable.

Any useful statement depicting a future situation is hypothetical. The term "useful" here admits that there are certain types of futures statements that are known now to be true, but they are tautological. For example, we could say with reasonable confidence that on the date 2017 07 01, people in Canada will celebrate the country's 150th birthday. However, can either of us say with complete (or indeed any) confidence that we two will be alive on 2017 07 01? The chances of this are good, given our current ages and prevailing actuarial understanding, but we really have no certainty about whether we will be alive then.

Thus, we can hope for a particular future, we can plan for it, we can determine its possibility and plausibility, but we can not know it with full certainty. No one can say for sure that a diamond mine will be established at a specific location along the MGP corridor in 2041. Indeed, no one can say for sure either that this will not happen (unless we knew for certain that there is no diamond deposit below the ground's surface at that location).

(b) All plans, of any type, rely on someone expressing expectations (i.e., expected outcomes) in the future.

Human endeavour is such that we constantly think about the future in terms of what we want to happen and expect will happen, and we make decisions to try to cause a particular outcome in the future to become reality. When one becomes engaged to marry, the expectation is that marriage will occur in the future, and actions are taken to cause that outcome to become reality. When a proponent files an application for approval to build and operate a hydroelectric generating station, the expectation is that the development will be approved, concrete will be poured, water impounded, and electricity generated.

Creating expectations for the future is part of human nature. Sometimes those expectations are informal, e.g., tonight's dinner menu. In development planning, they are formal, e.g., the plan for the MGP, and statements about its attendant environmental effects. So too can they be formal, and need to be, in CEA.

(c) The future has infinite possibilities.

Reality will unfold over time in only one way, but because we cannot know that reality in advance of its arrival, we are faced in the present with a vast (some would say infinite) array of possible and plausible futures. What are the practical implications of this? One is that analyses associated with one specific future, no matter how likely we deem it to unfold, will not be nearly as illuminating as examinations of multiple possible futures. The generation and study of global climate futures is a case in point - to enrich

climate-change impact and adaptation studies, the climate modelling community, led by the Intergovernmental Panel on Climate Change, offers up a rich array of possible climate futures.

Another implication is that the full array of possible futures, if indeed approaching infinity, can not practically be characterized, documented and analyzed. So while futures studies are well advised to develop and examine more than one possible future, they need also to avoid trying to cover all possible and plausible outcomes - there would be just too many. The key is to explore a full yet tractable range of futures, keeping the enterprise manageable while ensuring strong differences among the futures developed for analysis.

Finally, the future also has infinite impossibilities. It is important to evaluate each future offered for analysis for its implausibility and impossibility. If someone said that, next year, the earth will become the sun, the sun the moon, and the moon the earth, we would judge that outcome to be impossible. In judging impossibility, one must guard against too strong an anchoring in present-day technology. For example, claiming in 1960 that it would be impossible by 2007 to store on a USB memory stick the digital data then housed in a barn-sized computer would have been erroneous. However, for all practical purposes, thinking outside the box should not put us in the realm of science fiction.

(d) Developing what is considered to be a most-likely future is possibly misleading and probably foolish.

Since we are unable to say for sure which future will unfold, we often try to fall back on what may appear to be the next best option - which future is most likely to unfold. We have numerous ways to do this. One is the use of knowledge of past-event probabilities and the assumption that such probabilities will pertain in the future. If in the past all Dalhousie University MBA students got good jobs upon graduating, one could expect that a future graduate would have a high likelihood of getting a good job. Another is to seek expert consensus. This has been done with respect to possible futures for global warming.

Assessments of probability may work well when they do not involve decisions. For example, once a decision is made to toss a fair coin, then it is a firm prediction that, in a hundred tosses, the likelihood is high that about fifty of them will yield heads. As soon as people's decisions come into play, likelihood assessments are notoriously unreliable. The proposed Cheviot Coal Mine in Alberta was a high-likelihood project for its proponents during the EA some years ago, but economic circumstances changed at a pivotal moment and it now appears mothballed. In the 1980, the imminent dissolution of the Soviet Union might have been assessed as extremely unlikely, but it came to pass within a decade.

Thus, in the world of human affairs, including governance, economic development, technological progress and such, it is fair to say that things judged as unlikely today frequently come to pass, even sometimes soon, and things judged highly likely to come to pass frequently do not, even sometimes never. In thinking about possible futures for development in a region or province, assignment of likelihood is more or less wasted effort.

4.2 APPROACHES – DESCRIPTION AND EVALUATION

A spectrum of methods have been and are being used in a variety of contexts for making predictions about the future consequences of human activity. For example, quantitative trend analyses and projection has been used by utilities to predict future demand for electricity (Ontario Hydro, 1989), qualitative trend analyses have been used to predict future social trends (Naisbitt and Aburdene, 1990), systems modelling has being used to predict the future consequences of human activity for climate change (IPPC, 2001), gaming exercises and scenario analysis are used by military and business strategists to think through the potential effectiveness of potential strategies (Schwartz, 1996), and in some jurisdictions, including

Canada, proponents are required to assess the future environmental consequences of proposed developments by whatever means they choose.

Each method can be used to inform the development of future scenarios however they have different strengths and weaknesses that make the more or less suitable in different contexts. For example, visioning methods such as backcasting, policy exercises, and Delphi are often used for qualitative scenario development. Experience has shown that Delphi techniques may be most useful for scenario development over relatively short time frames (e.g. five to ten years). Both trend analysis/projection, and systems modelling can be useful approaches for quantitative scenario development. Their utility will be determined by the quality of information that supports them. Trend analysis is vulnerable to a key assumption that the trends will continue into the future, while systems modelling is vulnerable to errors in our understanding of how a system actually functions. Models are always imperfect representations of the actual system. However, if they capture the key relationships that drive a system they can provide quite useful insight. In the case of the MGP, modelling approaches have already been employed by the proponent and interveners (Canadian Arctic Resources Committee, Penbina Institute) to develop alternative views of possible induced development. We are also aware of at least one other initiative to develop a model for estimating the landscape distribution of oil and gas development[10]. Scenarios are likely to be more robust when different methods are employed in their development, for example qualitative visioning to think broadly about a range of possible outcomes, and quantitative methods for estimation, and to provide a check on plausibility.

In view of the principles discussed above, we are of the opinion that scenario analysis, supported by information and analysis generated with a variety of quantitative and qualitative methods, is the most appropriate approach to assessing the possible cumulative environmental effects of proposed developments.

4.2.1 Scenarios

Scenario development as an aid to planning is focused on developing alternative visions of the future. Visioning exercises typically look farther into the future (i.e., ten years or more) than other futures methods. Scenario planning (or scenario learning) has proven to be a disciplined method for imagining possible futures in which decisions may be played out (Schoemaker, 1995), and a powerful tool for asking "what if" questions to explore the consequences of uncertainty. By working with scenarios of quite different futures, the analytical focus is shifted away from trying to estimate what is most likely to occur toward questions of what are the consequences and most appropriate responses under different circumstances.

Numerous definitions of scenarios exist, for example:

> ". . . a description of a possible set of events that might reasonably take place. The main purpose of developing scenarios is to stimulate thinking about possible occurrences, assumptions relating these occurrences, possible opportunities and risks, and courses of action" (Jarke et al., 1998);
>
> " . . . an internally consistent view of what the future might turn out to be - not a forecast, but one possible future outcome" (Porter, 1985);

[10] Research at the University of British Columbia, supported by the Sustainable Forest Management Network, is developing a model to estimate the spatial-temporal distribution of oil wells in Northern British Columbia to enable CEA of oil wells on the forest ecosystem.

> ". . . a tool for ordering one's perceptions about alternative future environments in which one's decisions might be played out" (Schwartz, 1996);
> ". . . a set of reasonably plausible, but structurally different futures" (Van der Heijden, 1996); and
>
> " . . . conjectures about what might happen in the future" (Cornish, 2004).

The important commonality in these definitions is the idea that scenario-building does not focus on making predictions or forecasts, but rather on describing images of the future that challenge current assumptions and broaden perspectives.

Scenario-building for planning and analysis purposes originated in the late 1960s and early 1970s as key proponents, such as Stanford Research Institute, Hudson Institute, and RAND Corporation, undertook a number of studies designed to encourage systems-analytical, multi-faceted, and holistic thinking about the future (Thomas, 1994; Chermack et al., 2001). In the early 1970s, for example, the RAND Corporation studied the utility and desirability of basing defence-gaming and research scenarios on solid contextual foundations (DeWeerd, 1973). Royal Dutch Shell applied the scenario approach within a business context by developing a series of processes that enabled the company to think more creatively about the future by testing management assumptions (Schwarz, 1996).

Scenarios have found application at all spatial scales. For example, Kelly et al. (2004) outlined a systematic scenario process in the context of local sustainability planning in Ireland. At a regional level, Baker et al. (2004) reported using scenarios in planning for sustainability in the Willamette Basin of Oregon, and, Duinker et al. (1993) followed Brewer's (1986) propositions by developing scenarios of Europe's forest sector in experiments with so-called policy exercises. At the global scale, scenarios were central elements of the Millennium Ecosystem Assessment (MA) for exploring changes in ecosystem services and their influences on human well-being (Carpenter et al., 2006).

Scenarios usually serve one of two functions: one is risk management, where scenarios enable strategies and decisions to be tested against possible futures, while the other is creativity and sparking new ideas (Lang, 2001). Scenarios and scenario learning are highly applicable to mid- and long-range futures studies where there are considerable levels of both predictability and uncertainty. Scenario planning attempts to compensate for two common errors in decision-making - under-prediction and over-prediction of change - allowing a middle ground between the two to be charted (Schoemaker, 1995). Scenario planning approaches this by dividing knowledge into two areas: things we believe we know something about, and elements we consider uncertain or even unknowable. This contrasts with short-term futures analysis, where forecasting methods may be more applicable because of the higher degree of predictability (Kaivo-oja, 2001).

There are various approaches for developing scenarios (Schwarz, 1996; de Jouvenel, 2000; Godet, 2000; Masani and Vasquez, 2000; Wilson, 2000; Cornish, 2004). On one dimension, they can range from an informal imaginative exercise by a single individual to a systematic group process (e.g., Roubelat, 2000; Hulse et al., 2004). Common contrasts in scenario-building work include backcasting (starting from some assumed future state, testing it for potential feasibility, and then filling in the sequence of developments that could lead there) versus forecasting, descriptive versus normative, quantitative versus qualitative, and trend versus peripheral (unlikely and extreme events) (Greeuw et al., 2001). Both inductive and deductive methods can used to determine the basic premises of scenarios. The former is typically less structured and relies heavily on the patience of a group of individuals to continue their discussions until consensus is reached. In contrast, the steps followed in the deductive approach are usually similar to those laid out by Schwartz (1996), and those in the "intuitive logics" approach developed by Royal Dutch Shell:

1. Define the topic/problem and focus of the scenario analysis.
2. Identify and review the key factors/environmental influences on the topic.
3. Identify the critical uncertainties.
4. Define scenario logics (often using scenario matrices).
5. Create/flesh out the scenarios.
6. Assess implications for business, government, and the community.
7. Propose actions and policy directions.

The process of creating a scenario may make use of information assembled from a variety of the futures methods discussed above. For example, in some of its early scenario work, RAND Corporation made use of the Delphi method it had pioneered almost two decades earlier.

A key aim of scenario-building is to push thinking in terms of length of time (e.g., beyond five to ten years into the future) and breadth (e.g., across a range of possible futures). From a learning perspective, the methods, tools and techniques for scenario development and use are means to an end, i.e., aids to understanding how the world could unfold, and how that understanding can be incorporated into decision-making. If this objective is to be achieved, scenario methods must not take on a life of their own; scenarios are intended only to serve the purposes of augmenting understanding and informing good decisions (Kaivo-oja, 2001).

Scenario-based work is most powerful when several alternative scenarios are created and analyzed, and each should provide significant contrast from the others. While each scenario describes, in qualitative and/or quantitative terms, an alternative future, each must be plausible, i.e. not impossible (Schwartz, 1996). Depending on the situation, creating and using two to five scenarios is considered optimal, although Schwartz (1996) cautions that the use of three scenarios usually leads to an inevitable focus on the "middle" scenario as being most likely. By setting up several scenarios, a "possibility space" is created in which the future is likely to unfold (UK Cabinet Office Performance and Innovation Unit, 2001). Cornish (2004) suggested a menu of five, with generic themes: (a) a surprise-free or continuation scenario; (b) a pessimistic scenario; (c) a disastrous scenario; (d) an optimistic scenario; and (e) a transformation (or miracle) scenario.

Key to the success of scenario analysis is avoiding the temptation to become attached to a particular scenario. Understanding the implications of each scenario permits insightful analysis of the uncertainties that the future holds. While it is possible to develop any number of stories about how the future may play out, the art of scenario-building is in the delicate blend of artistry and method to choose those stories that shed the greatest light on the issue under consideration (Schwartz, 1996).

Weaknesses

In common with other approaches to trying to deal with complexity and uncertainty, scenario analysis is not without its problems. Schoemaker (1998) and Godet (2000) identified typical pitfalls in both scenario process and content. Those particularly relevant to EIA include the following:

* lack of diverse inputs
  Scenario analysis and scenarios have much more credibility if generated using diverse inputs rather than just a few perspectives; diversity of inputs helps ensure proper vetting of ideas and increase stakeholder buy-in.

* failing to gain early high-level support
  If scenarios and analytical results based upon them are to carry influence into the corridors of power, then the powerful must endorse the work right from the beginning.

* unrealistic goals and expectations of the process and product
  Scenarios offer insight; they do not give definitive answers; one must not expect them to resolve all issues in resource and environmental decision-making.

* failure to develop a clear road map
  It is easy to construct scenarios that give ambiguous and confounding messages; complexity in scenarios is expected, but lack of clarity is to be avoided.

* developing too many scenarios
  Because the future presents limitless options for exploration, there is a temptation to want to explore many variants. Analytical work becomes confused with too many scenarios.

* insufficient time for learning scenarios
  Discerning the range of possible impacts arising from a single development scenario, especially for large areas and long futures, requires great effort and should not be rushed.

* failing to link into the planning process
  Scenario analysis done in isolation from decision-making processes can be interesting and enjoyable, but results will have far greater practical utility if the work is done in the context of specific information needs.

* inappropriate time frame and scope
  A key decision in scoping scenarios is to determine what really matters to the VECs under assessment. Careful attention must be paid early in a scenario analytical exercise to determine an appropriate scope with respect to relevant developments and time/space domains.

* too limited a range of outcomes
  Because the longer-term development future can not be predicted, especially with acceptably low levels of uncertainty, a broad range of possible outcomes should be explored. Likelihood of such outcomes, unless determined by consensus to be virtually nil, should not be assessed.

* too much focus on trends
  Trend extrapolation is a weak means for determining long-term development futures. Non-linear paths and abrupt surprises are as common in development futures as are smooth transitions.

* internal inconsistencies in scenarios
  The key to determining scenario plausibility is the impossibility test. Do the laws of nature support the kinds of changes depicted by the scenario?

* insufficient focus on drivers
  Given the global nature of most social, ecological and economic influencing factors in modern society, much of what will happen in economic development will be driven by forces external to the system of interest in CEA. The potential futures of such drivers, and their possible effects on system behaviour, are paramount.

Interestingly, these problems, which fall within the two broad domains of scoping and analysis, are similar to those observed in EIA practice today. Nevertheless, we believe the benefits of incorporating scenario analysis into EIA far outweigh the potential pitfalls.

5.0 Discussion

5.1 Challenges and Opportunities

The CEA for the Mackenzie Gas Project highlights a conundrum that plagues CEA in project approval processes such as EIA. To understand the environmental consequences of proposed developments, we need at least to try to assess their influence on the sustainability of the environmental systems that support Valued Socio-Ecological Components, in the context of the totality of influences that may affect them. As pointed out in the guidance provided by the Province of Alberta, limiting assessment to imminent projects and ignoring future projects that are likely to occur yields only a minimal near-term view of potential cumulative effects. However, the specific details of how many future developments will occur, where they will be, exactly how they will be done, and precisely when they will occur are not certain.

At the heart of this conundrum rests the duality of objectives that underlie the two key considerations in EIA. On one hand with regard to project design and approval, we have an objective of conducting an assessment that provides the best possible understanding of how a project is expected to interact with its environment. Such an analysis should not necessarily lead to rejection of a project based on conjecture about future effects that may or may not occur. On the other hand, with regard to informing future resource management, we have an objective of providing useful information to help society (especially managers of the environment) think clearly about strategies for managing possible cumulative effects.

Since the future is inherently uncertain, scenario analysis (and indeed CEA that in taking a longer term view seeks to inform future environmental management) cannot be about what will happen, but rather must be about what could happen. In essence, this means supporting a process of risk management. When looking forward over the expected life span of the MGP, it is foolish to think that we can identify a "most likely" scenario; some events that seem likely now may not occur while others that we have not considered will. What is important is that the scenarios developed are plausible in the sense that they are physically possible, and that they present information that helps us to think clearly about possible cumulative effects and management strategies that might be effective for reducing unwanted cumulative effects, or encouraging positive ones. Some important insights may arise only from the contrast achieved by comparing alternative scenarios. In this sense, focusing on a single future scenario can be misleading. To avoid the trap of becoming attached to a single scenario, Schwartz (1996) also cautions against working with three scenarios as there is a misleading tendency to think of a middle scenario as being most likely.

The thinking needed to anticipate possible future levels of induced development is not foreign to the proponents of the MGP. The design of the pipeline includes capability for expansion by 50% above the base capacity to 51 Mm^3/d (1.8 Bcf/d). The report filed by the Mackenzie Explorers Group with the National Energy Board (NEB) suggests that considerably more development might occur (Chipperfield et al., 2005). At least some potential for other related developments (e.g. coal gasification) not considered in any of these views is already known. All these can be considered as directly induced development (the first of the two types of induced development identified in the *Practitioners Guide*). There is sufficient experience with oil and gas developments elsewhere in Canada that reasonable estimates could be made of the level of indirect induced development (supporting infrastructure and enterprises) that might be expected to accompany a given amount of primary induced development. Given current knowledge about the geology of the area, some reasonable guesses about the level and possible locations of other types of developments such as mines should also be possible.

The creation and exploration of scenarios of plausible futures that may be associated with implementation of the MGP would provide an opportunity for the stakeholders (proponents, governments and affected peoples) to begin to anticipate and prepare for possible futures.

5.2 THE PROCESS OF CREATING SCENARIOS OF FUTURE DEVELOPMENT

Interestingly, some of the seminal work done to develop capabilities for scenario analysis have been led by the oil and gas industry, in particular by a group working in Royal Dutch Shell. Schwartz (1996) outlined a series of steps for developing scenarios. Applied to the creation of scenarios of future development associated with the MGP, this approach would include:

(1) Identify the focal issue or decision

Getting clarity on the questions to be pursued and decisions that would be supported by the scenarios is a key first step. Understanding how the development scenarios will be used to assess cumulative effects can guide scenario creation toward including information that will facilitate the analysis. For example, is it necessary to have information about the specific location of developments, or might sufficient insight be gained with general information on the density and possible spacing of developments within a potential development area? Would the spatial scope of the scenarios be limited to assessing cumulative effects on the environment within the Mackenzie Valley, or would they also be used to explore the consequences elsewhere, perhaps from the end-use of the transported gas?

In regard to developments such as the MGP, to what degree are differences in the estimation of cumulative effects a function of: differences in estimates of the level of future development, differences in the potential distribution of future development, differences in the methods and assumptions employed in estimating the effects of an assumed level of development, or differences in the nature of government and other players' responses to these future developments? Addressing such questions will help in determining the types of contrast needed in the scenarios.

Another approach to scenario construction could begin with the question: how much of what types of induced development would be needed to give rise to significant cumulative effects? The question that would follow this, would then be: could such an array of future development conceivably follow from implementation of the MGP?

(2) Key forces in the local environment

A number of local forces could influence the level and pattern of future development. For example, will the distribution of potential future developments be determined solely by the geological potential? Or, will it also be influenced by other local forces, such as designation of protected areas or other land-use planning provisions? What other factors might influence how quickly development might occur, or where? To what degree would the pace of development be constrained by the available workforce or by changes to the prevailing fiscal regime or by new regulatory requirements (e.g. mandatory arrangements for sequestration of some significant percentage of the embodied carbon in the transported gas)? What is the range of uncertainty for each such factor?

(3) Driving forces in the macro-environment

Several factors in the macro-environment might influence the feasibility and nature of future developments. For example, the demand for oil and gas from the Mackenzie Valley might continue to

grow especially if global developments lead to greater insecurity about or constraints on overseas supplies. Strengthening the security of international supplies might counter this, as might aggressive efforts to reduce consumption in response to concern for climate change. Some groundwork is likely already laid for such analysis. We expect that energy companies and governments have already thought about this. What is likely needed to support scenario analysis for the MGP is not a reassessment of such factors, but a sense of the range of uncertainty for the demand and economic pressure for development. Since these are not properly mere market decisions, there are likely several factors to consider.

(4) Rank by importance and uncertainty

Schwartz and other futurists advise against working with too many scenarios; generally two to five are recommended. Alternative scenarios should reflect different themes (recall those suggested by Cornish, p. 19) and ranking the uncertainties guides thinking about how to do this. For example, what might be the relative strength of a regulatory response in land use relative to different levels of development? How uncertain is an effective government response vis-à-vis different levels of development?

(5) Select scenario logics

In this step, how the scenarios will be structured is decided, i.e. which assumptions about different sources of uncertainty will be included in which scenario. For example, would an assumption of aggressive development and an assumption of no improvements in technology be combined with other similar assumptions in developing a "maximum impact" scenario for contrast with reciprocal assumptions in a "minimum impact" scenario? Or would consistent assumptions of technology changes be employed within ambitious and less ambitious development scenarios? Would one scenario combine conservative assumptions of development with conservative assumptions about CE estimation, or would these be dealt with in different scenarios, or even in a step-wise analysis?

(6) Fleshing out the scenarios

The previous five steps all focus on different considerations needed to define the scenarios. In this sixth step, the actual scenarios are developed. Since each scenario needs to be plausible, it will need to be grounded within the realm of possibility. For example, the level of development and its potential location must be conceivable given the geological characteristics of the area (one should not be creating a scenario with gas wells where they simply could not or would not be put), but they do not need to be constrained to any particular view of what is thought "likely". Schwartz and others caution against assigning probabilities to scenarios or becoming attached to any one as being more likely than another. The scenarios must be internally consistent. Different approaches are available for developing the content for each scenario, and care needs to be taken either to employ the same methods for all, or by design consciously to employ different methods to increase the contrast among scenarios.

(7) Implications

Once estimates of the possible cumulative effects have been made, the next important question is this: if each scenario turned out to be right, then what strategies could be employed to reduce unwanted effects, by how much could they be reduced, what would the strategies be, and how early in the

development sequence would they have to be in place to be effective[11]. For example, could the environment be sustained by shifting the timing of different developments over the landscape, or changing the way they are implemented, or would some limit have to be imposed on the total amount of development?

(8) Selection of leading indicators and signposts

Schwartz (1996) asserts that "it is important to know as soon as possible which of several scenarios is closest to the course of history as it actually unfolds". This is a natural imperative, since the purpose of all this is for resource mangers to be able to anticipate and respond appropriately. This is also consistent with the intention for adaptive management which is supposed to be about conducting carefully designed management experiments with sufficient monitoring to help us learn how to manage the environment better. Scenario analysis needs ultimately to identify indicators that could serve to trigger a response as the future unfolds.

As understood by practitioners of adaptive management, surprise is a tremendous stimulus for strong learning. In a similar vein, Schwartz notes that good scenarios are both plausible and surprising.

An important consideration is who should be involved in the development of scenarios that would be used to support CEA. Experts have a key role to play in scenario construction, but ultimately the stakeholders - i.e., the parties engaged in the EA process - must accept that the scenarios represent plausible, useful and interesting accounts of how the development future could indeed unfold. That acceptance comes most effectively and efficiently from participation in scenario creation. Structured workshops are a superb means of engaging stakeholders in scenario work.

5.3 IMPLICATIONS FOR THE FUTURE

Cumulative effects are the effects that VECs will experience in reality. VECs are effects integrators in that they must respond to or cope with all the relevant stressors simultaneously. Therefore, the most important part of any EIA, and especially an EIA for a large development such as the MGP, is actually the CEA.

The "basin-opening" nature of projects such as the MPG means that if they are approved, we can be certain there will be directly and indirectly induced development. The induced development and its associated effects would not be expected to occur if such projects did not proceed. In addition, other future developments not directly related to such projects are also likely to occur. What is uncertain is how much development would occur and what the pace of development would be. Some interveners to the Panel process have made it clear that in the specific case of the MGP the possible consequences of the basin-opening nature of future developments is a substantial concern to them.

Cumulative effects (positive and negative) of many types clearly depend heavily on government preparedness and choices. Strategic environmental assessments, land use plans and systems of protected areas are instruments with which governments prepare themselves to manage such effects. Unlike some other jurisdictions, however, the Mackenzie Valley includes regions where some or all of these management instruments are absent.

[11] Different views of possible cumulative effects are already before the panel in materials filed with the MGP JRP by the proponent (MGP EIA Supplementary filing, 2005), the Canadian Arctic Resources Committee (Cizek and Montgomery, 2005), and the Pembina Institute (Holroyd and Retzer, 2005). The key question is not which of these correctly predicts the future (likely none does) but what management response would be appropriate if each were to occur.

Project-focused EIA can play only a small part in preventing undesirable cumulative effects. Indeed, it has been argued that project-EIA is not the appropriate instrument for this (Antoniuk, 2002: Kennett, 1999, 2002; Duinker and Greig, 2006a). CEA of projects such as the MGP in concert with imminent developments that are deemed to be reasonably foreseeable provides no insight into the potential cumulative effects of future developments. Thus, it cannot help to identify management strategies that could serve to avoid unwanted effects, or to encourage positive effects of future development. The need to address CEA of future developments in project EIA is logically greater in contexts where it has not been addressed by other instruments. When this is the case, such as with the MGP, CEAs associated with project EIAs, can play a substantial role in preventing undesirable futures, but **only** if the development futures are broadly enough defined and the associated cumulative effects are fully assessed.

In the absence of the instruments that would normally be employed to help secure a sustainable future, an important question is: what approaches might guide future development toward a sustainable outcome, should the project proceed?

We believe that in cases such as this, the best approach is to conduct a forward-looking CEA based on long-term scenarios of possible alternative future developments. In the specific context of the MGP this would be more in keeping with the guidance given by the MVEIRB. The process for creating the development scenarios would follow the approach described above (section 5.2). It would also:

(a) Be implemented prior to permitting future induced development.

With agreements among key parties to proceed with scenario work, and adequate human and financial resources, the process should be able to deliver scenarios for CEA within a few months. Actual assessment of the possible cumulative effects arising from each scenario would take several additional months, or perhaps more.

(b) Engage all relevant stakeholders in a dialogue about scenario content.

(c) Explore opportunities to manage induced development in such a way as to keep unwanted cumulative effects acceptably small and promote desirable ones.

(d) Engage independent professional facilitation.

Despite several decades of progressive work on how to create and use scenarios in the context of resource and environmental management, many people are still uncomfortable with them and lack relevant knowledge for direct application in scenario development. Anyone who is identified as a stakeholder in a review process is indeed a stakeholder in scenario work, and needs to be engaged in scenario content, not directing the process of scenario development. Independent scenario-development experts are needed to guide process design and implementation.

In the absence of such analysis government may be left in a situation where it must try to manage the cumulative effects of induced development as they arise. For this to have any chance of success it would likely be necessary to limit the pace of development to enable government response in a timely fashion[12]. It would require a comprehensive regional monitoring program combined with regular analysis of trends. Effective management of future cumulative effects would be unlikely to succeed if left to the purview of future project based CEAs.

[12] In the case of the MGP this might for example mean constraining the implementation of the project to its base-case configuration.

Scenario-based CEA cannot guarantee VEC sustainability. It is meant specifically to help to cope with uncertainties about the future - the development future, the future of ecosystems, and the future of human communities. It is meant to assist in managing risks - perhaps reducing risks - associated with human actions that inadvertently may compromise VEC sustainability. It is meant to replace blindness caused by unwillingness to peer forward with glimpses of possible outcomes so that we might choose the best among them. As May (1996) entitled his book, “the future is ours”. But it can only be ours if we claim it and examine it incisively.

6.0 Literature Cited

Alberta Energy and Utilities Board, Alberta Environment, and Natural Resources Conservation Board. undated. Cumulative Effects Assessment in Environmental Impact Assessment Reports Required under the Alberta Environmental Protection and Enhancement Act. 6 pp.

Antoniuk, T. 2002. Cumulative effects assessment of pipeline projects. Pages 143–161 in A. J. Kennedy (ed.), Cumulative environmental effects management: Tools and approaches. Alberta Society of Professional Biologists, Edmonton, Alberta.

Asian Development Bank. 2004. Summary Environmental and Social Impact Assessment – Nam Thuen 2 Hydroelectric Project in the Lao People's Democratic Republic. 75 pp. http://www.adb.org/Projects/Namtheun2/project-docs.asp

Baker, J.P., D.W. Hulse, S.V. Gregory, D. White, J. Van Sickle, and P.A. Berger PA. 2002. Alternative futures for the Willamette River Basin, Oregon. Ecol Appl 2002;14(2):313–24.

Baxter, W., W.A. Ross and H. Spaling. 2001. Cumulative effects assessment: Improving the practice of cumulative effects assessment in Canada. Impact Assessment and Project Appraisal, V 19, No. 4, pp. 253 – 262.

Beanlands G. E., W. J. Erchmann, G. H. Orians, J. O_Riordan, D. Policansky, M. H. Sadar, and B. Sadler. 1985. Cumulative environmental effects: A binational perspective. Canadian Environmental Assessment Research Council, Ottawa, Ontario, and US National Research Council, Washington, DC, 175 pp.

Bernard, David P., M.E. MacCallum, S.B. England, R. Hornal, and W. Bryant. 1995. Tools for Assessing Cumulative Environmental Effects in the Slave Geological Province, NWT: Development Scenarios, Ecological Footprints, Impact Hypotheses, and Procedural Framework. Prepared by ESSA Technologies Ltd., Vancouver, BC. for the Department of Indian Affairs and Northern Development, Yellowknife, NWT. 114 pp.

Bilcon of Nova Scotia Corporation. 2006. Whites Point Quarry and Marine Terminal: Environmental Impact Statement. Bilcon of Nova Scotia Corporation, Digby, NS.

Brewer, G.L. 1986. Methods for synthesis: policy exercises. In: Clark WC, Munn RE, editors. Sustainable development of the biosphere. Cambridge, UK: Cambridge University Press; 1986. p. 455–73.

Canadian Environmental Assessment Agency. 1994. The Responsible Authority's Guide. http://www.ceaa.gc.ca/013/0001/0008/guide_e.htm

Canadian Environmental Assessment Agency. 1999. Operational Policy Statement – Addressing Cumulative Environmental Effects Under the Canadian Environmental Assessment Act. Canadian Environmental Assessment Agency. http://www.ceaa.gc.ca/013/0002/cea_ops_e.htm

Carpenter, S.R., E.M. Bennett, and G.D. Peterson. 2006. Scenarios for ecosystem services: an overview. Ecol Soc 2006;11(1):29 [online] http://www.ecologyandsociety.org/vol11/iss1/art29/.

Chermack, Thomas J., Susan A. Lynham and Wendy E.A. Ruona. 2001. A Review of Scenario Planning Literature. Futures Research Quarterly (Summer 2001): 7-31.

Chipperfield, John L, Mathew J. O'Blenes and Kenneth J. Drummond. 2005. Natural Gas Assessments and Delivery Forecasts, Beaufort-Mackenzie and Selected Northern Canadian Basins. Sproule Associated Limited. 174 pp.

Cizek, Peter, and Shelagh Montgomery. 2005. Cumulative Effects Modelling of the Mackenzie Gas Project – Scoping and Development. Cizek Environmental Services. Yellowknife. NWT. (January 10, 2005) 29 pp.

Cornish, E. 2004. Futuring: the exploration of the future. Bethesda, MD: World Future Society; 2004. 313 pp.

Cumulative Effects Assessment Working Group and Axys Environmental Consulting Ltd. 1999. Cumulative Effects Assessment Practitioners Guide. Canadian Environmental Assessment Agency. http://www.ceaa.gc.ca/013/0001/0004/Cumulative-Effects_e.pdf

Department of Justice Canada. 1984. Western Arctic (Inuvialuit) Claims Settlement Act (1984, c. 24) http://laws.justice.gc.ca/en/ShowFullDoc/cs/W-6.7///en

Department of Justice Canada. 1998. Mackenzie Valley Resource Management Act (1998, c. 25) http://laws.justice.gc.ca/en/ShowFullDoc/cs/M-0.2///en

Department of Justice Canada. 1992. Canadian Environmental Assessment Act (1992, c.37) http://laws.justice.gc.ca/en/ShowFullDoc/cs/c-15.2///en

de Jouvenel, H. 2000. A brief methodological guide to scenario building. Technol Forecast Soc Change 2000;65:37–48.

DeWeerd, Harvey A. 1973. A Contextual Approach to Scenario Construction. Santa Monica, CA: Rand Corporation Doc. No. P-5084.

Duinker, P.N., S. Nilsson, and F.L. Toth. 1993. Testing the "policy exercises" in studies of Europe's forest sector: methodological reflections on a bittersweet experience. Working Paper WP-93-23; Laxenburg, Austria: International Institute for Applied Systems Analysis; 1993. 25 pp.

Duinker, Peter N. 1994. Cumulative Effects Assessment: What's the Big Deal? Conference on Cumulative Effects Assessment in Canada: from Concept to Practice. Edited by Alan J. Kennedy. Alberta Society of Professional Biologists, Calgary, AB.

Duinker, P.N., and L.A. Greig. 2006a. The Impotence of Cumulative Effects Assessment in Canada: Ailments and Ideas for Redeployment. Environmental Management Vol. 37, No. 2, pp. 153 – 161.

Duinker, P.N., and L.A. Greig. 2006b. Scenario analysis in environmental impact assessment: Improving explorations of the future. Environ Impact Asses Review (2006), doi: 10.1016/j.eiar.2006.11.01

Federal Environmental Assessment Review Office. 1994. A Reference Guide for the Canadian Environmental Assessment Act – Assessing Cumulative Environmental Effects. Canadian Environmental Assessment Agency.
http://www.ceaa.gc.ca/013/0001/0008/Cumulative-Environmental-Effects_e.pdf

Greeuw, Sandra C.H., et al. *Cloudy Crystal Balls: An Assessment of Recent European and Global Scenario Studies and Models*. Experts' Corner Report. Prospects and Scenarios No. 4. Environmental Issues Series 17. November 2001. Copenhagen: European Environment Agency. URL: http://reports.eea.eu.int/Environmental_issues_series_17/en

Godet, M. 2000. The art of scenarios and strategic planning: tools and pitfalls. Technol Forecast Soc Change 2000;65:3–22.

Hegmann, George A. 1995. Cumulative Effects Assessment of Proposed Projects in Kluane National Park Reserve, Yukon Territory. Prepared for Department of Canadian Heritage. Hull, QC.

Holroyd, Peggy, and Hal Retzer. 2005. A *Peak* into the Future – Potential Impacts of Gas Development in Northern Canada. Pembina Institute. 39 pp.

Hulse D.W., A. Branscomb, and S.G. Payne. 2004. Envisioning alternatives: using citizen guidance to map future land and water use. Ecol Appl 2004;14(2):325–41.

Inuvialuit Game Council, Mackenzie Valley Environmental Impact Review Board, and Minister of the Environment. 2004. Environmental Impact Statement Terms of Reference for the Mackenzie Gas Project. 77 pp.

IPPC. 2001. Climate Change 2001: Impacts, Adaptation and Vulnerability. Cambridge University Press. ISBN 0 521 01500 6. http://www.grida.no/climate/ipcc_tar/wg2/index.htm

Jarke, Matthias, X. Tung Bui and John M. Carroll. 1998. Scenario Management: An Interdisciplinary Approach. Requirements Engineering 3 (1998): 155-173.

Kaivo-Oja, J. 2001. Scenario Learning and Potential Sustainable Development Processes in Spatial Contexts: Towards Risk Society or Ecological Modernization Scenarios? Futures Research Quarterly 17, 2 (2001): 33-55.

Kavik-Axys Inc. 2002. Cumulative Effects Assessments in the Inuvialuit Settlement Region: A Guide for Proponents. Prepared for the Environmental Impact Screening Committee and the Environmental Impact Review Board. 59 pp.

Kennett, S. A. 1999. Towards a new paradigm for cumulative effects management. CIRL Occasional Paper #8, Canadian Institute of Resources Law, Calgary, Alberta, 55 pp.

Kennett, S. A. 2002. Lessons from Cheviot: Redefining government's role in cumulative effects assessment. Pages 17–29 in A. J. Kennedy (ed.), Cumulative environmental effects management: Tools and approaches. Alberta Society of Professional Biologists, Edmonton, Alberta.

Kelly R, L. Sirr, and J. Ratcliffe. 2004. Futures thinking to achieve sustainable development at local level in Ireland. Foresight 2004;6 (2):80–90.

Lang, Trudi. *Scenario Planning: Your Key to the Future.* Overview of a presentation given Nov. 14, 2001 at Curtin University of Technology. 2001.
http://www.gsb.curtin.edu.au/SPARU/ScenarioPlanning.pdf

Mackenzie Valley Environmental Impact Review Board. 2004. Environmental Impact Assessment Guidelines. 94 pp.

Mackenzie Valley Environmental Impact Review Board, The Inuvialuit, and The Minister of the Environment. 2004. Agreement for an Environmental Impact Review of the Mackenzie Gas Project. http://www.ngps.nt.ca/jrpa_final_e.htm

Masini, E.B., and J.M. Vasquez. 2000. Scenarios as seen from a human and social perspective. Technol Forecast Soc Change 2000;65:49–66.

May, Graham H. 1996. The Future is Ours: Foreseeing, Managing and Creating the Future. Praeger Paperback. Greenwood Publishing Group. ISBN: 0-275-95679-2

MGP EIA Supplementary filing. 2005. Response to JRP Information Request Round 2. Cumulative Impact Matters. Question JRP_R2_23 (JRP.2.23)

Naisbitt, John and Patricia Aburdene. 1990 Megatrends 2000: Ten New Directions for the 1990s. William and Morrow Co., Inc.

NCN and Manitoba Hydro. 2003. Wuskwatim Generation Project Environmental Impact Statement. Nisichawayasihk Cree Nation and Manitoba Hydro, Winnipeg, MB.

Norplan and EcoLao. 2004. Cumulative Impact Analysis and Nam Theun II Contributions. Prepared for Government of Lao PDR and Asian Development Bank. 122 pp. http://www.adb.org/Documents/Studies/Cumulative-Impact-Analysis/default.asp

Ontario Hydro. 1990. Providing the Balance of Power, Ontario Hydro's Plan to Serve Customers' Electricity Needs, Demand/Supply Plan Report, Ontario Hydro, Canada, 1990

Porter, Michael E. 1985. The Competitive Advantage. New York, NY: Free Press.

Ross, William A. 1994. Assessing Cumulative Environmental Effects: Both Impossible and Essential. Keynote address. Conference on Cumulative Effects Assessment in Canada: from Concept to Practice. Edited by Alan J. Kennedy. Alberta Society of Professional Biologists, Calgary, AB.

Roubelat, F. 2000. Scenario planning as a networking process. Technol Forecast Soc Change 2000;65:99-112.

Schoemaker, Paul J.H. 1995. Scenario Planning: A Tool for Strategic Thinking. Sloan Management Review. (Winter 1995): 25-40.

Schoemaker, Paul J.H. 1998. Twenty Common Pitfalls in Scenario Planning. Pp. 422-431 in L. Fahley and R.M. Radall (Eds.). Learning From the Scenarios: Competitive Foresight Scenarios. New York, NY: John Wiley & Sons.

Schwartz, Peter. 1996. The Art of the Long View: Planning for the Future in an Uncertain World. Doubleday, 1540 Broadway, New York, NY. 272 pp.

Sonntag, N. C., R. R. Everitt, L. Rattie, D. L. Colnett, C. P. Wolf, J. Truett, A. Dorcey, and C. S. Holling. 1987. Cumulative effects assessment: A context for further research and development. Prepared for Canadian Environmental Assessment Research Council (CEARC), Hull, Quebec, 91 pp.

Thomas. Charles W. 1994. Learning from Imagining the Years Ahead. Planning Review 22, 3 (1994): 6-

National Research Council. 2003. Cumulative Environmental Effects of Oil and Gas Activities on Alaska's North Slope. Committee on the Cumulative Environmental Effects of Oil and Gas Activities on Alaska's North Slope, National Research Council. ISBN: 0-309-50625-5, 304 pp.

Van der Heijden, Kees. 1996. Scenarios: The Art of Strategic Conversation. Chichester: John Wiley & Sons.

Whites Point Joint Review Panel. 2005. Environmental Impact Statement Guidelines for the Review of the Whites Point Quarry and Marine Terminal Project. Joint Review Panel Secretariat, Halifax, NS.

Whites Point Joint Review Panel. 2006. EIS Information Request. Joint Review Panel Secretariat, Halifax, NS.

Wilson I. 2000. From scenario thinking to strategic action. Technol Forecast Soc Change 2000;65:23–9.

Appendix 1: Summary of Canadian Legislative Requirements for CEA

Jurisdiction	Legislation or Land Claim	Guidance Relevant to CEA
Canada	*Canadian Environmental Assessment Act*, S. 16(1)	• Responsible Authorities Guide (Part III is Reference Guide: Addressing Cumulative Environmental Effects) • Addressing Cumulative Effects Operational Policy Statement • Cumulative Effects Assessment Practitioners Guide
	National Energy Board Act	• Filing Manual : Guide A.2.6 on CEA.
British Columbia	*BC Environmental Assessment Act (2002)*, S. 229	• Guide to the BC EA Process • Guide to Preparing Terms of Reference for an Application for an Environmental Assessment Certificate (only requires CEA pursuant to federal requirements under CEAA)
Alberta	*Environmental Enhancement and Protection Act*, S. 47(d)	• Cumulative Effects Assessment in EIA Reports • EUB Informational Letter 93-9 (Oil & Gas Developments Eastern Slopes (Southern Portion)) – requirement to consider CEA only, not guidance
Saskatchewan	*Environmental Assessment Act – No mention of CEA*	None found
Manitoba	*Environment Act* – No mention of CEA	None found
Ontario	*Environmental Assessment Act* – No mention of CEA	None found
Quebec	*Loi sur la qualité de l'environnement* (Ch.I) & the associated regulations for southern QC, northeastern QC, & James Bay & Northern QC	• EA Procedural Guidance (in French)
New Brunswick	*Environmental Impact Assessment Regulation* in the *Clean Environment Act* – No mention of CEA	None found
Nova Scotia	*Environmental Assessment Regulations* under the *Environment Act* – No mention of CEA	None found
Prince Edward Island	*Environmental Protection Act* – No mention of CEA	None found
Newfoundland & Labrador	*Newfoundland Environmental Assessment Act* – No mention of CEA	None found
Yukon	*Yukon Environmental and Socio-Economic Assessment Act* S. 42(1)(d)	• DIAND's User's Guide for Level 1 Screening of Cumulative Effects (available through the Yukon Department of Energy, Mines & Resources website)
Northwest Territories	*Mackenzie Valley Resource Management Act* S. 117	• Mackenzie Valley Environmental Impact Review Board's 2004 Environmental Impact Assessment (EIA) Guidelines – Appendix H: Additional Cumulative Effects Guidance. • NWT Cumulative Effects Assessment and Management (CEAM) Strategy and Framework (includes an implementation blueprint)
NWT & Yukon	*Inuvialuit Final Agreement* S.11	• EISC and EIRB Operating Procedures and Guidance (e.g., http://www.bmmda.nt.ca/outgoing/EISC-OPG.pdf)

		• Cumulative Effects Assessments in the Inuvialuit Settlement Region: A Guide for Reviewers (2002) • Cumulative Effects Assessments in the Inuvialuit Settlement Region: A Guide for Proponents (2002)
Nunavut	*Nunavut Land Claims Agreement, S. 11 & 12*	• Nunavut Impact Review Board's Guide to the Preparation of Environmental Impact Statements (CEA required for all NLCA S.12 Part 5 reviews) • Nunavut Planning Commission Procedures
United States	*National Environmental Policy Act* - Council on Environmental Quality's regulations (40 CFR SS 1500 - 1508) implementing the procedural provisions of NEPA define cumulative effects	• Considering Cumulative Effects Under the National Environmental Policy Act • Consideration of Cumulative Impacts in EPA Review of NEPA Documents (EPA 315-R-99-002/May 1999) • Programmatic assessments
European Union	*Environmental Impact Assessment Directive 97/11/EC, amending Directive 85/337/EEC:* Original Directive required that the description of likely significant effects of the proposed project on the environment should include cumulative effects. Annex 3 of the amending Directive provides that the relevant selection criteria for projects to be assessed include "the cumulation with other projects" and "the existing land use", thus making the requirement to look at how a project interacts with other projects to affect the environment explicit. Essentially, this refers to the assessment of effects resulting from adjacent concurrent projects	• Recent guidance from EC DG XI defines cumulative impacts as "Impacts that result from incremental changes caused by other past, present or reasonably foreseeable actions together with the project"
	Habitats Directive 92/43/EEC - UK Regulation 48 which implements the Directive proposes that "appropriate assessment" be carried out before authorizing "a plan or project which is likely to have a significant effects on a European site (i.e., a designated Special Protection Area for birds or a Special Area of Conservation)in Great Britain (either alone or in combination with other plans or projects)"	
New Zealand	*Resource Management Act* – "Cumulative change over time" is one of the effects that must be considered in EIA.	