Cumulative effects assessment: learning from Canadian case studies

William A Ross

To cite this article: William A Ross (1998) Cumulative effects assessment: learning from Canadian case studies, Impact Assessment and Project Appraisal, 16:4, 267-276, DOI: 10.1080/14615517.1998.10600137

To link to this article: https://doi.org/10.1080/14615517.1998.10600137

Published online: 02 Jan 2013.
Cumulative effects

Cumulative effects assessment: learning from Canadian case studies

William A Ross

Cumulative effects assessment (CEA) for environmental impact assessments are required by some Canadian and American legislation. However, there is confusion concerning exactly what CEA involves. This clarifies the requirements of CEA and illustrates its use in a number of case studies. Practitioners must: identify valued ecosystem components (VECs) affected by the proposed project; determine what other past, present and future human activities have affected or will affect these VECs; predict the impacts on the VECs of the combined activities; and suggest how to manage these cumulative effects.

Keywords: cumulative effects assessment; environmental impact assessment; Canada

HIS PAPER DEALS WITH cumulative effects assessment (CEA) in the context of conducting environmental impact assessments (environmental reviews) of projects.1 Consideration of cumulative effects for such reviews is required by several pieces of environmental impact assessment legislation (in Canada, the federal Canadian Environmental Assessment Act and the Alberta Environmental Protection and Enhancement Act; in the United States, the National Environmental Policy Act). Yet there is confusion concerning exactly what CEA involves or how to meet CEA requirements (Kennedy, 1994; Sadler, 1996). While there are many definitions in the CEA literature (as documented by Ross, 1994a), the definition of cumulative effects used here is:

Cumulative effects assessment is environmental impact assessment that deals with cumulative effects.

Cumulative effects are effects of the project under review in combination with the effects of other past, present or future human activities.

The definition is intended to be simple and comprehensible. It clearly implies accumulation of impacts2 both from the project under review and from other human activities, and so addresses such legal requirements as the obligation under the Canadian Environmental Assessment Act to consider "any cumulative environmental effects that are likely to result from the project [under review] in combination with other projects or activities that have been or will be carried out" (Section 16).

William A Ross is in Environmental Design, The University of Calgary, Calgary, Alberta, Canada, T2N 1N4; Tel: +1 403 220 0961; Fax: +1 403 284 4399; E-mail: ross@ucalgary.ca.

The author acknowledges contributions from the members of the Cumulative Effects Assessment Study Group of the Canadian Environmental Assessment Agency including: Sylvie Dupuis, Canadian Environmental Assessment Agency; Roger Creasey, Alberta Energy and Utilities Board; George Hegmann, Axys Environmental Consulting; Alan Kennedy, Imperial Oil Resources; Harry Spaling, Kings College; Louise Kingsley, Parks Canada and the Canadian National Capital Commission; and Don Stalker, Environment Canada. Fellow instructors at a Cumulative Effects Assessment course at the Banff Centre have also contributed, including: Peter Duinker, Lakehead University; Stephen Herrero, The University of Calgary; Jeff Green, Axys Environmental Consulting; Sylvie Dupuis; and George Hegmann.
In this sense, CEA is an added responsibility in doing environmental impact assessment (EIA) for projects. As such it should improve EIA for projects because the information so developed will be more useful to decision-makers since it deals with the true consequences (impacts) of proposed projects, the impacts people will experience not just those caused by the proposed project alone. As Ross (1994a, pages 6–7) put it:

“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. This … is the intellectually defensible reason for requiring cumulative effects assessment.”

CEA then involves a better standard of EIA practice than does single project assessment.

Note that, even in the early days of EIA, practitioners did assess some cumulative effects. It was routine, in assessing air or water quality issues for example, to do baseline studies. In effect, these determined empirically the cumulative impacts of all past human activities on those valued ecosystem components. Practitioners would then predict how the project would change the situation.

Since CEA is done in the context of EIA, it would be wrong to contrast the two. Hence I contrast CEA with the “straw person” process of single-project EIA. In this sense, CEA is an improvement on single-project EIA, or, as others have put it, “CEA is just EIA done right” (Kingsley, 1997, section 1, page 2), or “CEA is what EIA was meant to be!” (Duinker, 1994, page 15).

Requirements of CEA

In accordance with the above definition, it can be determined easily what would be required of an EIA that met CEA requirements.3 To see this it should be recalled that EIA is conducted by a generic process involving the following steps: issue identification (scoping); impact prediction; mitigation; and follow-up studies (monitoring, evaluation and management) (Sadler, 1996, page 19; Ross, 1994b).4

Considering cumulative effects while doing EIA would require the following adjustments. First, the scoping process involves identifying the valued ecosystem components (VECs) (including the social ones) worthy of study to provide information that will influence any decisions about the project (Beanlands and Duinker, 1983; Environmental Assessment Branch et al, 1993; Kennedy and Ross, 1992).5 Put simply, we ask what are the important VECs that will be affected by the project?

Second, in meeting CEA responsibilities, the next question must be what other (past, present and future) human activities will affect these same VECs? This involves answering such complex questions as what activities should be considered and how far into the past and how far into the future applicable human activities must be identified. There is some guidance on this matter in CEA guides (for example, Kingsley, 1997; CEQ, 1997; Hegmann et al, 1998), but, as will be discussed shortly, minimally meeting legal requirements may not be enough to meet the standards of best professional practice. This requirement also involves obtaining information from a much greater variety of sources than is common for single-project EIA.

Third, the impacts of the proposed project on the VECs must be predicted in combination with other past, present and future human activities. Determination of significance of these impacts is also part of this step. Impact prediction is harder when doing CEA than in single-project EIA for a variety of reasons. As Ross (1994a) observed,

“assessing the effects of single development projects is difficult enough. …The requirement imposed by cumulative effects assessment that we must assess the effects of a development project in combination with effects of other past, present, and reasonably foreseeable future developments places even more emphasis on our understanding of the natural and social systems affected by developments. Cumulative effects assessment thus implies the need to assemble more information from a wider variety of sources, to use this greater diversity of information to predict (cumulative) impacts, to assess the greater variety of impacts and to manage or mitigate the impacts meaningfully.”

Others, such as Hegmann and Yarranton (1995), Sappington and Smit (1994), Damman et al (1995) and Canter (1997), have discussed CEA methods. Many focus on the importance of using appropriate spatial and temporal bounds to include the full range of cumulative effects. There is, however, general agreement that the means of doing such impact prediction exist (Clark, 1994).

Fourth, and last, the impact assessment must make suggestions about how to manage the cumulative

The requirements of any CEA are to: identify valued ecosystem components (VECs); determine what other human activities will affect these VECs; predict cumulative impacts of project and human activities; suggest how to manage the cumulative impacts.
impacts that will be created by the project and in combination with other human activities. This is, after all, what environmental impact assessment is all about — "to facilitate sound, integrated decision making in which environmental considerations are explicitly included" (Sadler, 1996, page 13). Such recommendations should be based on the determination of significant cumulative impacts.

In summary, then, the four requirements expected of any CEA are to:

- identify valued ecosystem components (VECs) affected by the proposed project (scoping);
- determine what other past, present and future human activities have affected or will affect these VECs;
- predict the impacts on the VECs of the project in combination with the other human activities, and determine the significance of the impacts; and
- suggest how to manage the cumulative impacts.

In the sections that follow, these four requirements of CEA will be discussed more fully. The discussion will be based, not only on the literature, but also on my personal experience and on lessons from case studies. First, these case studies are described briefly. They are drawn mostly from personal experience and tend to represent reasonably good examples of doing CEA. The criteria for selecting them were that they: be (a part of) an environmental impact assessment for a project; involve assessing cumulative impacts as a part of that assessment; and have dealt with the cumulative impact assessment in a reasonably sound manner. From these case studies, lessons about cumulative effects assessment will be drawn.

Canadian case studies

Alberta-Pacific Pulp Mill

The Alberta-Pacific Pulp Mill (Al-Pac) is a bleached kraft pulp mill in north central Alberta, Canada. A joint federal-provincial review was conducted for this project (Al-Pac EIA Review Board, 1990). The terms of reference for the review included the requirement to examine the cumulative effects on the Peace Athabasca river system. So, in a limited way, this case study was a real EIA requiring consideration of all sources of cumulative impacts. Significant contributors to BOD loading on the rivers were pulp mills (the communities on these rivers were all small) and BOD loads were regulated and the information was public. This overcame the often important CEA concern that Al-Pac would need to wrestle trade secrets from the other mills (its competitors); the Government did the work and had ready access to the data.

The method used was a DO-BOD simulation model, one that was carefully calibrated to the river system being studied. While participants in the review argued otherwise, the Al-Pac EIA Review Board (the panel conducting the hearings and recommending to the federal and provincial governments concerning the project) found this model to be very credible and an excellent tool for predicting DO in the rivers.

The emission of chlorinated organic compounds was much more difficult to deal with. The recent discovery that such pulp mills produced (very small amounts of) dioxins and furans and the very high costs of analysis for such compounds in fish (at such low concentrations) meant that there was a dearth of information.

Again governments came to the aid of the Review Board. The federal Department of Fisheries and Oceans had excellent people who, in concert with experts from the proponent and, modestly, from others provided useful information on the cumulative impacts of the various bleached kraft pulp mills on the system. In the end, another rather crude model was presented, and it was able to alert the Board to the potential impacts of the emission of dioxins and furans from the Al-Pac Mill in combination with other existing and planned pulp mills.

One of the important features of these methods is that they clearly included consideration of all sources of the BOD or dioxins and furans, not just the Al-Pac mill. Another is that the problem of access to data was dealt with by governments, not by the proponent. (This is not to suggest that the proponent would have been denied access in this case, only to note that the problem did not arise.) The third feature is that the methods were developed by experts in the respective fields who knew how best to predict these specific impacts. This reflects well on the scoping process used by the Board, which identified the most important issues and then allows those who know what they are doing to devise the best ways to carry out the necessary studies.

National Park visual impact cases

Next let me describe two case studies involving visual impacts in two of Canada's National Parks (Banff and Glacier). These impacts arose in the context of public hearings for the twinning (making a two-lane highway into four lanes) of the TransCanada Highway in Banff National Park (FEARO, 1979; 1982b) and for the twinning (adding a second track) of the CP Rail main railway line under Rogers Pass in Glacier Park (FEARO, 1982a; 1983).
Cumulative effects assessment

These were CEAs in the sense that they involved EIAs undertaken under the federal process for which environmental impact statements were produced and public hearings were conducted by panels. They involved cumulative considerations only because there were existing projects (highways, railways and some other developments) that combined with the proposed project to create cumulative effects.

In both cases, the Parks are widely regarded for their beauty, and the scoping process quickly identified visual impacts to be a very significant issue. In the Banff highway twinning project, the issue became how best to deal with the impacts of the existing highway, the new project and the other developments in the Park. The method adopted by the proponent was to use a landscape architect who compared photographs from the existing highway with predicted views and sketches from the same locations after the project was complete. The predictions of how the view would appear after construction were based on the design of the reclamation program for the cut and fill slopes. This allowed the reader of the environmental impact statement to visualise how the project would lead to an improvement on the visual impacts created by the construction of the previous highway.

This method (comparing photos with sketches) clearly is fully capable of integrating the cumulative effects of everything in the images and thus is fully suitable for CEA. These reviews were carried out in the early 1980s and the work was done by the proponent, with no difficulties gaining access to information, since the view sheds were public.

There is another consideration here that is noteworthy as it applies especially to cumulative effects situations. In many respects, the fact that previous impacts (badly done cut and fill slopes) were being mitigated meant that the cumulative effect of the twinning project would be an enhancement in the visual quality of the Highway. This does not mean that the new project itself was void of impacts, but that mitigating existing impacts resulted in an enhancement that would not have been possible were it not for the previous existence of adverse impacts.

I believe that is likely to be a fairly common situation with CEA. Whether we should be pleased that, through CEA, we are able to improve the environment and make room for more projects or whether we should be wary of having new projects in locations with significant adverse impacts is something I leave to others to consider.

The Rogers Pass railway twinning project also had the potential to create unacceptable visual impacts in locations along the TransCanada Highway viewed by travellers, who frequently stop to admire the scenery. Again the impacts were accumulative with those of the existing railway line along a surface route east of where the tunnel was to be constructed. There was also some forest harvesting just outside the Park but readily visible from the 'key observation points' within the Park.

The method used to deal with these impacts was a photo montage: comparing existing photos with those photos retouched to simulate what the view would be like after the project was completed. For both projects, the actual visual impacts were determined by methods commonly used by landscape architects. In addition, the landscape architect who did the work was closely involved with the project design team and a number of significant revisions were made to the design to minimise the visual impacts. This combination of prediction with mitigation is important in CEA and, while it has little to do with the cumulative effects aspect of the case study, I cannot help but comment favourably on CEA done well.

The CEA features of the method used for Rogers Pass is both clear and the same as for the other visual impact case study.

Cheviot Mine wildlife case study

This case study is relatively current. The public hearings were completed in early 1997 and the decision report was released in June 1997 (Alberta Energy and Utilities Board, 1997). A coal mine is proposed in west central Alberta in a relatively well used, but definitely rural, portion of the province. An EIA is required under both the Alberta and federal EIA legislation. In 1996, that meant consideration of cumulative effects is functionally required. There are many component parts of the EIA but I will describe only the cumulative effects assessment for the 'large mammalian carnivores', dominantly grizzly bears, a species particularly sensitive to people-induced environmental change (BIOS, 1996).

Present and historical land uses in the area are recreation, oil and gas exploration, a coal mine that is virtually depleted, and forestry. The area was originally excellent bear habitat. The proposed mine would remove a chunk of existing habitat and so, on its own, would cause what could easily be construed to be a significant adverse effect on wildlife habitat. Because of the extent and intensity of mining, this impact would not be mitigable during the several-decade operation of the mine and, given that the area is valued for wildlife habitat, this would be a real difficulty in obtaining approval for the new mine.

The method used to do the cumulative effects assessment was a variation of the "cumulative effects model" (USDAFS, 1990). It assesses the effects of all developments on habitat. Thus, all land uses were mapped and, using indicators for the effects of developments on wildlife that have been suitably verified for environments similar to this, the effects of these developments on wildlife use of the land is predicted. (For example, land within x metres of a heavily used road is significantly underutilised by grizzly bears; land within y metres of lightly used hiking trails is reduced in use by z%; land within w metres of industrial activity is reduced in use by r% and so on.) By mapping all land uses and applying these empirical factors influencing habitat usefulness, it can be
determined how much habitat is alienated both by existing land uses and by existing land uses in combination with the proposed mine.

The results of the study appear to indicate that the cumulative regional impact of development, with or without the mine, is rather unacceptable, given the intent of Alberta Government policy for the region. The percentage of total impact created by adding the mine is quite modest, but the existence of a significant local adverse effect is largely demonstrated.

The first observation I must make is that, once again, the method used is suited to the particular type of impact and is capable of dealing with the several causes of impact, integrating them to predict the cumulative effect. Second, the information required comes from a great variety of accepted sources and, in this case, was entered into a geographic information system, which was used to model the extent of impact quantitatively.

Third, an interesting feature of CEA manifests itself here. The greater the area assessed for the regional CEA, the smaller will be the percentage of impacts caused by the project, because more other sources of impact get captured in the analysis. While I would not suggest this happens on purpose (a proponent wishing to have it appear that a project causes impacts), it is an interesting feature of this and other regionally based CEAs.

The last point I would make based on this case study is that a regional response to the existing impacts is apparently required, since the impacts are (probably) unacceptable even in the absence of the proposed mine. The CEA does indeed suggest a variety of ways of undertaking regional action to mitigate the existing impacts (restrictions on recreational activity, reclamation of seismic lines, management of forest harvest effects on wildlife). Indeed, a major 'mitigation' measure proposed is the Carnivore Compensation Program, to compensate for unmitigable losses to carnivore habitat by improving the habitat on a regional scale.

Now the interesting conclusion is drawn. If these regional mitigation measures were indeed taken, the cumulative regional effects could be made satisfactory, even with the addition of the mine. The interesting question arises as to how much of the mitigation costs should properly be borne by the mine proponent, given that the adverse impacts were created almost exclusively by others, or given that the proponent of the mine would be a significant beneficiary of these measures.

I find this consequence of CEA to be one of the most interesting and potentially controversial. Should we care a great deal? After all, following such a CEA, the regional environment could be improved at the same time as a new development is added, provided other resource users accept restrictions on their activities.

In its decision report, the panel concluded (Alberta Energy and Utilities Board, 1997, page 85):

How much of the mitigation costs should properly be borne by the mine proponent given that the adverse impacts were created almost exclusively by others or the proponent of the mine would be a significant beneficiary of these measures?

"many carnivore populations within the region have already been negatively affected by a range of man-induced factors and that, with or without approval of the Cheviot Coal Project, there is a reasonable likelihood that these impacts will continue."

The panel also required the proponent to (page 159):

"advise the [Energy and Utilities Board] on an annual basis regarding the status of the Carnivore Compensation Program and, within three years and before unmitigable impacts have occurred, shall provide evidence of measurable success in establishing the proposed Carnivore Compensation Program"

This moderately weak requirement is interesting since most of the members of this program would not be from the energy industry. Nevertheless, this decision of the panel indicates a clear recognition that such integrated regional approaches are valuable in cumulative effects situations.

Indeed, the panel, in discussing the Carnivore Compensation Program, indicated that (Alberta Energy and Utilities Board, 1997, page 89):

"In order to assist [the proponent] in gaining the economic as well as the moral support of other industries in the region, the Panel believes that both the [Energy and Utilities Board] and [Alberta Environmental Protection] may need to re-examine the process by which new licences are granted to other regional industry players for developments [that] may also have cumulative effects on carnivores. Such changes may be timely, given the fact that both provincial and federal environmental legislation now recognize that it is no longer adequate to examine the environmental impacts of a proposed development in isolation, but rather the cumulative effects must be considered."

This completes the description of the case studies. Next, we continue with a discussion of the four requirements of CEA: scoping, determination of other human activities, prediction of cumulative effects and management of cumulative effects.
Cumulative effects assessment

Scoping

Scoping is the most straightforward of the four requirements, as it is virtually the same as is done in single-project assessment. The focus in CEA must be on the individual VEC. CEQ’s third principle of cumulative effects analysis (CEQ, 1997, page 8) is “Cumulative effects need to be analysed in terms of the specific resource, ecosystem, and human community being affected”. In all the case studies, the generic process of doing good EIA was (more or less) followed in that a scoping (issue identification) process was used to determine what to study.

In doing scoping for CEA, other human activities are not quite ignored, but rather attention must be paid to the setting and issues of likely importance, given reasonably anticipated other human activities. One important principle is that, if a project has no effect on an ecosystem (or social system) component, it has no cumulative effects on that component. It matters not if there are significant cumulative effects created by other activities; if the project has no effect on that component, it is not a VEC for the purposes of the CEA for the project under review.

Conversely, however, it does not follow that, if the project under review has an effect on a component that is not itself significant, then the component is not a VEC. That is because the cumulative effect on that component could be significant and therefore would require consideration as a VEC.

Determination of other human activities

The determination of other human activities that may affect the same VECs is both essential to CEA and one of the more challenging requirements of CEA practice. Critical questions that need to be answered include: How far into the past should we search for such activities? In assessing a project in ancient cities, must all activities there for millennia be considered? How far into the future should we gaze in identifying likely future projects? How do we determine what existing or future projects there are in the region if these projects are very different from that activity. Critical questions that need to be answered include: How far into the past should we search for such activities? In assessing a project in ancient cities, must all activities there for millennia be considered? How far into the future should we gaze in identifying likely future projects? How do we determine what existing or future projects there are in the region if these projects are very different from that proposed?

If, for example, the project proposed is a forestry operation, the proponent should certainly be expected to know about other forestry projects, but how does it get information about present or planned oil and gas activities, municipal planned expansions, recreational activities, and the like? This task will take some time for EIA practitioners to develop the requisite skills and contacts, but decent advice on how to do this is now provided in recently released guides for CEA (CEQ, 1997; Kingsley, 1997).

CEQ (1996, page 17), for example, suggests that, while proximity of another human activity can be a determining factor, “proximity of other actions to the proposed [project] is not the decisive factor for including these actions in an analysis; these actions must have some influence on the [VECs] affected by the proposed [project].”

The CEQ (1996, page 19) also suggests that “the first step in identifying future actions is to investigate the plans of the proponent agency and other agencies in the area” and “the analyst should use the best available information to develop scenarios that predict which future actions might reasonably be expected ... based on experience obtained from similar projects located elsewhere in the region”.

Parks Canada (Kingsley, 1997, section 2, page 9) notes:

“When there are potential impacts stemming from a project, they can interact with other impacts stemming from the project or with impacts from other projects or activities, including past projects, projects occurring outside the park or site boundaries, or even global impacts. When such interactions occur, it becomes necessary to assess the impacts of the project in combination with all of these other existing stressors.”

Kingsley (1997, section 2, page 13) also notes:

“...previous studies may have dealt specifically with cumulative effects, providing information that can be applied to several different environmental assessments. Using this information can avoid duplication and save lots of work.”

The question of what future human activities to include in CEA has caused the most difficulty and has, correspondingly, received more study. The simplest test for inclusion, under the Canadian Environmental Assessment Act, is provided by the Canadian Environmental Assessment Agency. It suggests that “at a minimum, (only) projects or activities that have already been approved must be taken into account” (FEARO, 1994, page 144). This is enhanced by a recent decision of a joint Canadian Environmental Assessment Agency–National Energy Board panel, which ruled that three requirements must be met for cumulative effects to be considered. They are (Express Pipeline Project Joint Review Panel, 1996, pages 187–188):

• First, there must be an environmental effect of the project being assessed.
• Second, the environmental effect must be demonstrated to operate cumulatively with the environmental effects from the other projects or activities.
• Third, it must be known that the other projects or activities have been, or will be, carried out and are not hypothetical.”

The third of these requirements again suggests that only those activities that are approved need be considered. Such a modest subset of future activities seems significantly to understate the true cumulative
Impact Assessment and Project Appraisal

A Canadian example of doing (partial) cumulative effects assessment in which the proponent is required to consider more than approved projects is for oil and gas development in the environmentally sensitive southern portion of the eastern slopes of the Rocky Mountains. There, the regulatory body, the Energy and Utilities Board, requires, even for a single exploratory well, that an environmental assessment must include a determination of "whether some form of development is appropriate within the project area" (Energy Resources Conservation Board, 1993). Thus, the proponent is required to anticipate success in the exploratory well and to ask about the environmental feasibility of subsequent development in the area. Such an approach seems much more consistent with excellence in CEA.

Another Canadian example of cumulative effects assessment is the proposed Keenleyside Hydroelectric Dam Project on the Columbia River in British Columbia, Canada. The Keenleyside Project Committee has determined that the scope of projects to be considered in assessing the cumulative impacts of the dam includes existing projects (hydroelectric facilities, requirements of the Canada–United States Columbia River Treaty and other regulatory requirements which are applicable to managing the Columbia River, pulp mills, smelters and forest harvesting) and future projects (future hydroelectric projects, regulatory changes applicable to the Columbia River, flow requirements for fisheries, changes to the electric transmission facilities, forest harvesting and other smaller projects). A workshop with stakeholders is also required in order to determine the final list of activities to be included in the cumulative effects assessment (Keenleyside Project Committee, 1997).

It should be noted that, in this case, there is some incentive for the proponent to include all future hydroelectric projects in the cumulative effects assessment because the same proponent would be involved. Thus, it would want to know, in terms of cumulative effects, how to design and manage this project in such a way as to 'leave room' for its future projects.

The CEQ requirements noted above (the most reasonably expected future must be estimated) also seem more consistent with excellence. Rumrill and Canter (1997) provide a useful analysis and discussion of this topic for the US NEPA (National Environmental Policy Act). They analyse legal decisions regarding future actions in CEA and conclude that all formal proposals should be included as well as other "possible, plausible, conceivable, and probable future activities" that impact on the same VECs as the project under review. In addition, they suggest including future activities found in a variety of planning documents linked to the project under review. They argue insignificant future activities should be excluded. The emphasis is properly on connectedness between the project and the other activities and so must be close to best professional practice in CEA.

It must be noted that, even for excellent cumulative effects assessments, there is always a difficult choice between the ideal and the practically attainable. Opening the door to all possible, or even plausible, projects would make the practicalities of doing cumulative effects assessments nearly impossible. Consultants, pursuing professional practice and knowledgeable about excellence in cumulative effects assessments, will have to strike a compromise between doing a theoretically perfect assessment (that is, including a large suite of other human activities) and doing what really, in the end, best serves the goals of cumulative effects assessment, by examining a smaller sub-set of projects that are most important for assessing the project under review and its cumulative effects.

State of the environment reporting can also be used to characterise trends, and thus allow the analyst to determine the impacts of development without knowing the details of the development specifically. Such an approach may be useful when future development is likely to consist of many small developments and the cumulative effects are all that matter.

The assembly of relevant information about developments that might contribute to the effects being studied is also mentioned for the case studies. For single-project EIA, this information consists of the environmental studies that must be assembled (or carried out) plus information about the proponent's project. For CEAs, information will often be required about other projects (existing or planned), about which it may be very difficult to obtain the necessary information. I have often heard complaints from EIA practitioners about precisely this feature of CEAs: "it is virtually impossible to get information from ..." is often heard about the pragmatic difficulty of doing CEA. In reality, availability of good information might determine, not only a proponent's ability to do a CEA, but also the methods a proponent might end up using to predict impacts.

Prediction of cumulative effects

Predicting cumulative impacts can be quite complex or very simple depending on the project, the environment and the other human activities. Papers describing CEA methods, as noted above, abound in the literature, but most are not particularly helpful to practising professionals. The principles of choosing methods to predict cumulative impacts are presented very succinctly.

The case studies all suggest that, after having determined the impacts to be studied, the people who understand those impacts should determine what will work best with the following important constraint.

The method must be able to incorporate the effects all the relevant human activities that might contribute to the impact being studied.
Cumulative effects assessment

This is virtually the only important CEA constraint on method selection. In view of this conclusion, I seriously doubt the value of long lists of CEA methods. What is far more important is that those with expertise in predicting impacts on the particular VEC be encouraged to adopt the best methods available.

The case studies illustrate the effective use of simulation modelling well calibrated to the local aquatic ecosystem for dissolved oxygen in rivers, integrative comparative visual presentations for visual impacts, and geographic information system based modelling for the effects of various types of human activities on wildlife. However, it would be wrong to infer that these are the best methods for predicting cumulative effects. What would be right is that these methods were chosen by good EIA practitioners to fit the needs of predicting cumulative effects on the specific VEC. Good case studies illustrating how such choices are made would be valuable (for instance, Hegmann et al., 1998), since many practitioners find the choice of impact prediction methods to be an extremely difficult aspect of CEA.

One other aspect of CEA methods that can be very valuable is the ability to determine what portion of the cumulative effects are contributed by each of the various sources: past activities, present activities, the project under review, and future activities (CEQ, 1997, page 43). Knowing this can be extremely useful in managing the cumulative impacts.

With respect to determination of significance, I believe that the presence of cumulative effects makes virtually no difference to this step of EIA. The conceptual and sometimes pragmatic usefulness of thresholds, and the pragmatic difficulty of applying many threshold concepts is as useful in single-project EIA situations as it is for CEAs.

Management of cumulative effects

Management recommendations and decisions (for instance, mitigation measures or follow up studies — monitoring, evaluation and management of impacts in the implementation phase) are the main purpose of environmental impact assessment, in order to make better development decisions. For projects involving cumulative effects, the key is to manage properly the impacts predicted in light of the causes of these impacts.

For example, if the cumulative impacts are caused primarily by the proposed project, the mitigation measures are likely to be very much like those adopted in a single-project assessment situation. However, if the cumulative impacts are caused mainly by past human activities, mitigation would most reasonably involve cleaning up those past impacts. (Who pays for such mitigation measures is an interesting question.)

Or, if the most significant cumulative impacts will be created by a few identifiable future projects, careful planning will be required to accommodate them by mitigating current impacts suitably, thus making ‘room’ for the future projects. CEQ (1997, page 43) notes that “identifying incremental effects [of past, present and future activities], therefore, is an important part of informing the decisionmaker”.

The mitigation measures that may be applied in CEAs, as noted above, especially for the Cheviot Mine case, may be boldly different from those applicable to single-project EIA situations. CEA mitigation measures can be applied to developments other than the proposed development. Opportunities for pollution trading and other economically efficient means of reducing adverse effects raise their heads. The difficulties of having mitigative measures over which the project proponent or the project regulators may have little or no control raises interesting management options. This is especially applicable to the Cheviot Mine case study.

Follow up studies (monitoring, evaluation and management) may also be adjusted given the greater diversity of sources contributing to a given impact. This use of adaptive environmental assessment and management is likely to be more important for CEA situations because of our reduced ability to make reliable predictions.

The ability to manage cumulative impacts, however, is not an easy matter. The agency responsible for regulating the proposed project may not be the agency responsible for regulating other human activities that contribute to the cumulative effects. The great strength of CEA is that it enables society to manage developments coherently to make them more environmentally acceptable and more sustainable. Yet this strength is also a weakness if our regulatory mechanisms cannot deal effectively with the information so obtained.

Concluding comments

Significant improvements are required for CEA to fulfill its promises and to contribute to more effective environmental impact assessment, and hence to better development decisions. Practitioners must see that CEAs meet the requirements specified.

The approaches outlined here should help practitioners to meet these requirements and to achieve excellence in their assessment of cumulative effects. Most important for CEA excellence is that regulatory agencies will need to become much better coordinated than they now are if society is to take full advantage of the benefits of CEA.

Notes

1. Cumulative effects assessments may also be undertaken, for example, for regional planning purposes. Such CEAs, while conceptually different from those examined here, have much in common with those for project reviews. Excellent examples of regional CEAs are found in the Banff Bow Valley Task Force...
Cumulative effects assessment

Impact Assessment and Project Appraisal December 1998

275

Report (Page et al. 1996); the Northern River Basins Study (Vincenta or in 1996); or in many smaller studies done for individual National Parks by Parks Canada. For the Parks Canada studies, Kingsley (1997) identifies how CEAs should be tiered from strategic overviews (regional planning CEAs) to site specific reviews.

2. The words 'impacts' and 'effects' are synonymous in this paper.

3. A different and compatible set of criteria for cumulative effects assessments is provided by Burnis and Canter (1997).

4. I have ignored screening, the determination of the appropriate level of environmental impact assessment to apply to a project. CEA in screening is an interesting and very worthwhile topic but not one that will be dealt with in this paper. The assumption is that, if the project is considered in this paper, a screening has been undertaken and a significant level of EIA is required.

5. Issue identification (scoping) consists of identifying the issues and the impacts, rather than identifying the VECs. For most practical purposes, however, the two are synonymous and I will treat them as such in this paper.

6. The information about this project is based on Al-Pac EIA Review Board (1990) and on the author’s personal experience, having served on that Board.

7. The descriptions provided here are based on the panel reports (FEARO, 1979, 1982a; 1982b; 1983) as well as the personal experience of having served on the environmental assessment panels that wrote those reports.

8. This case study is based on the decision report (Alberta Energy and Utilities Board, 1997), on a portion of the EIA documentation (BIOS, 1996) and on frequent discussions with Dr Stephen Herrero, a colleague who directed and undertook most of the work described here.

9. These three criteria were created by the panel, not to deter­
mine the project levels of environmental impact assessment to apply to a project.

10. The Energy and Utilities Board was formerly the Energy Re­sources Conservation Board.

References


R K Burris and Larry W Canter (1997), "Cumulative impacts are not properly addressed in environmental assessments", Environmental Impact Assessment Review, 17(1).


Energy Resources Conservation Board (1993), "Information letter IL-93, oil and gas developments Eastern Slopes (southern portion)". (Energy Resources Conservation Board, Calgary.)


Barry Sadler (1996), International Study of the Effectiveness of...
Cumulative effects assessment


Fredrick J Wrona, William D Gummer, Kevin J Cash and Ken Crutchfield (1996), Cumulative Impacts within the Northern River Basins (Northern River Basins Study Synthesis Report No. 11 (Northern River Basins Study, Edmonton, Alberta).