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Towards increasing the utility of follow-up in Canadian EIA

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Abstract

The importance of follow-up in the EIA process is clearly recognized in the Canadian Environmental Assessment Act (*Act*) in which, where it is considered appropriate, the responsible authority for a project will design a follow-up program and ensure its implementation. The *Act* is also explicit in recommending that the results of follow-up programs be used to improve the quality of environmental assessments (EAs). The purpose of this paper is to examine whether the specific requirements for follow-up under the *Act* in fact provide the best opportunity for such quality improvements.

The definition of follow-up under the *Act* requires the verification of the accuracy of the environmental assessment and determination of the effectiveness of measures taken to mitigate the adverse environmental effects of a project. We argue that the *Act*, generally, and the requirements for follow-up specifically, adopts a negative perspective towards project effects by focusing on the mitigation of adverse effects and discourages the follow-up of important social or economic effects which are independent of project-related changes to the biophysical environment. Secondly, we argue that verification of accuracy places an unwarranted emphasis on 'what was expected' rather than on 'what was wanted' in terms of environmental outcomes. Using examples from Canadian experience, we illustrate the limitations of the current approach to follow-up and suggest that greater

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utility would be achieved by focusing on whether the environmental objectives of the project in question have been achieved.

Keywords: EA follow-up; Impact mitigation; Management; Predictive accuracy

1. Introduction

'Follow-up', 'monitoring' and 'auditing' are familiar to environmental assessment (EA) practitioners as members of a family of terms that relate to the general concept of 'feedback,' which provides much of the basis for our understanding of development effects and their management. However, basic as feedback is to the learning process, there have been constant and consistent messages in the EA literature arguing that follow-up of projects or other actions is rarely done (e.g., Arts et al., 2001). Further evidence suggests that in many cases where follow-up has been done, it has rarely been done well (e.g., Morrison-Saunders and Bailey, 1999; Storey et al., 1991).

The need for follow-up in environmental assessment is well documented (e.g., Arts, 1998; Culhane et al., 1987; Sadler, 1987; Bisset, 1980), and there is a considerable literature on follow-up-related themes (e.g., Storey and Jones, 2003; Baker and Dobos, 2001; Canada, 1997; Bailey et al., 2001; Culhane et al., 1987; Tomlinson and Atkinson, 1987). It is not the intent here to review this material, as this too has been the focus of several important journal articles, rather, the objectives are to address a selective set of outstanding questions about the approach to follow-up in Canada and to suggest ways in which we might move EA forward through the adoption of a broader and a somewhat more practical approach to obtaining feedback on our EA efforts.

Under the Canadian Environmental Assessment Act (Canada, 2003) (*Act*), designing effective follow-up programs requires some consideration of verifying the accuracy of impact predictions and measuring the effectiveness of impact mitigation. We argue that we need to and can do a better job of follow-up in respect to improving EA quality. Part of the problem, however, is there has been very little consideration given to the nature and value of impact predictions in EA and their relation to design requirements of management strategies such that they can effectively be followed-up, measured and verified. Furthermore, what has not been considered in recent literature is whether follow-up, that requires proponents to verify the accuracy of the EA of a project, is itself an impediment to effective and efficient follow-up action.

Two themes that focus on current Canadian follow-up requirements are explored in this paper: predictive accuracy and effectiveness of mitigation measures. We argue that requirements under the current *Act* to verify predictions and to examine mitigation effectiveness should be replaced by a single requirement to determine whether the environmental objectives of the project in question have been achieved. The arguments presented are illustrated by the lessons learned from Canadian EA case studies. The paper concludes with a discussion of how EA practice could be improved by a reallocation of our follow-up efforts.

2. Requirements of follow-up

Under the Canadian Environmental Assessment Act (Canada, 2003) a "follow-up program" means a program for:

- verifying the accuracy of the environmental assessment of a project; and
- determining the effectiveness of any measures taken to mitigate the adverse environmental effects of a project.

Follow-up programs defined in this way can be said to represent part of a much larger process of monitoring and auditing. In essence, follow-up is the element that can transform EA from a static to a dynamic process, the missing link between EA and effective project implementation and management (Arts et al., 2001). While in some cases the literature makes no distinction between these terms (e.g., Carley, 1984), in others they are defined as conceptually separate activities (e.g., Arts and Nooteboom, 1999). Wlodarczyk (2000), for example, notes that some EA practitioners interpret follow-up to mean strictly ensuring that mitigation measures identified in the assessment were implemented. Others view follow-up as an umbrella that encompasses all activities such as routine monitoring or quality assurance inspections, assessment and management audits undertaken during the postdecision stages of the EA process.

Under paragraph 38 (1) of the *Act*, a responsible authority "...shall consider whether a follow-up program for the project is appropriate...and, if so, shall design a follow-up program and ensure its implementation." Additionally, under 38 (5), it is recommended that the results of a follow-up program may be used "for implementing adaptive management measures or for improving the quality of future environmental assessments". We believe that we have the tools to accomplish this, but that for the most part, the reason that it has not happened is that the legislative or regulatory requirements and other commitments to undertake more broadly based and useful follow-ups are not there.[2] More specifically, there has been little consideration given to the nature of impact predictions and their relation to design requirements of mitigation strategies such that they can effectively be followed-up. Rethinking the objectives and scope of follow-up can help Canadian EA meet these goals.

[2] We agree with Morrison-Saunders et al. (2003) in that a formal requirement to undertake follow-up is a necessary prerequisite, but not itself sufficient for good-practice.

Accuracy and effectiveness are two concepts that need to be explored, but if the value-added of follow-up activities is to be maximized, then a broader perspective must be taken and more comprehensive procedural and methodological approaches considered. In the sections that follow, the two basic requirements of follow-up under the current *Act* are critically assessed. We start with a discussion of predictive accuracy, followed by impact mitigation; each based on the lessons learned from recent EA case studies. An argument is then made for a single requirement for follow-up—to determine whether the objectives of the project in question have been achieved.

3. Predictive accuracy case studies

3.1. Hibernia offshore oil platform construction project

A proposal submitted to develop the Hibernia offshore oil field, discovered on the Grand Banks of Newfoundland, Canada in 1979, was subject to a Panel review[3] under the Canadian Federal Environmental Assessment Review process. Approval for the project was granted in 1986 and development began in 1990. Responsibility for the Hibernia Social Environmental Effects Monitoring Program was assigned to a socioeconomic technical working group. The purpose of the monitoring program was to determine the accuracy of predictions and forecasts contained in the environmental impact statement (EIS) and environmental protection plan (EPP). Monitoring was expected to allow the mitigation of negative effects and enhancement of beneficial effects.

An audit of socioeconomic impact predictions in the Hibernia EIS (preapproval) and the EPP (postapproval) was undertaken by Locke and Storey (1997) in an attempt to indicate the degree of accuracy of impact predictions. A total of 143 predictions were identified in the EIS, of which 78 were considered suitable for testing. The reasons why predictions were not considered suitable were because the:

- wording of the prediction was too general;
- prediction was contingent on other events which had not yet occurred;
- prediction was no longer relevant due to design changes;
- prediction was not yet relevant as specified time had not yet reached; and
- prediction was repetitive and descriptive of established quantitative data.

[3] There are four types of environmental assessments in Canada: screening, comprehensive study, mediation, and assessments by a review panel. A review panel is appointed by the Minister of the Environment to assess a proposed project when the environmental effects are uncertain, likely to be significant, or when warranted by public concerns. Once a review panel has completed its assessment, an environmental assessment report is prepared which is taken into consideration before making any decision with regard to project approval. See http://www.ceaa.gc.ca.

There was a 5-year interval between project approval and implementation. By project start, there had been several major changes in project design, notably, the decision to consolidate construction and fabrication of the platform and some of its main components at a new site. No new impact assessment was considered necessary, but EPPs were required. The EPPs updated a number of key construction-related issues and specified the means to address them. In comparing predictions in the EPP with the original EIS, those in the EIS that were no longer relevant were excluded and those that were updated were replaced. A total of 21 of the original suitable EIS predictions were removed and 29 from the EPPs were added for a total of 86 impact predictions. Of these 86 predictions, 67 could not be followed up, as there were no monitoring data. Of the 19 for which there were monitoring data, 11 predictions had insufficient or inadequate data for auditing. Eight of the total number of predictions was found to be auditable, of which two were employment-related, one demographic, while three concerned housing and two were related to the local fishing industry.

Comparison of these impact predictions with actual outcomes demonstrated considerable differences in accuracy. Employment levels, construction site work camp occupancy and demographic predictions were related, and this was reflected in the patterns of similarity and difference between their respective predicted and actual outcomes. Employment predictions differed considerably from actual levels, ranging from +215% (over-predicted) in 1990, the first year of the project, to −44% (2265 predicted, 4019 actual) in 1994, the year of peak employment. Similar "inaccuracies" were evident in the related-variable predictions and in housing demand predictions. The fishery-related predictions were nonquantitative and consequently less precise but were generally accurate.

The conclusions from the audit are similar to those of most other EA audits, illustrating that in particular the poor wording of predictive impact statements, a paucity of adequate monitoring data and a changing project environment severely constrained the ability to determine the accuracy of the predicted project-related impacts.

The Hibernia case study illustrates two important points concerning the nature of impact predictions. First, the precision and specificity of impact predictions present considerable problems when attempting to evaluate and verify the accuracy of project predictions. It is possible to generate very accurate impact predictions when such predictions are couched in very imprecise terms. Impact predictions such as 'slight reduction' or 'minor effect', for example, are of little value for monitoring and follow-up with any degree of precision. Bernard et al. (2001), in a review of Canadian hydroelectric project EAs, report similar findings, in that of the 2073 impact predictions that were identified in a study of 11 Canadian hydroelectric projects, only 29% were judged to be testable. In international EA experience, very little has changed since Bisset and Tomlinson (1988) noted that 697 of a total 791 predicted impacts across a survey of four UK impact assessments could not be followed-up due to the vagueness of impact predictions and the lack of suitable monitoring data. These findings are supported by Morrison-Saunders and Bailey (1999) who, more recently, analyzed six Australian case studies and found that there was little evidence of impact quantification or precision in prediction, with most predictions being vague and qualitative in nature.

Second, determining accuracy becomes problematic and less valuable when the characteristics of the variables for which specific predictions are made are subject to change (Locke and Storey, 1997; Buckley, 1991). In any environmental or socioeconomic system, several different processes are often involved that may affect the variable or environmental component of concern. Thus, impact predictions often turn out to be inaccurate because of the mix of assumptions that normally have to be made and the multiplicity of exogenous factors involved (Mitchell, 2002, p. 56). Bisset (1984) found similar problems in a review of the Redcar Steelworks project, UK, where 73% of the impact predictions were made obsolete by design changes. Similarly, Frost (1993), in a study of 30 projects in the UK, found that 15 of them had undergone some form of design alteration after the impact statement had been submitted. Project design and environmental changes can make many initial impact predictions obsolete. There is little practical value in comparing obsolete predictions with actual outcomes. This reinforces the need to move away from the emphasis on determining predictive accuracy to one that focuses on objectives in follow-up.

3.2. Rabbit lake uranium mining project

Rabbit Lake is the oldest operating uranium mining and milling facility in northern Saskatchewan. Open-pit ore production at the Rabbit Lake site commenced in 1975. Subsequent exploration activity identified several additional radioactive occurrences in the area, and in 1987, Cameco, the project proponent, submitted an EIS to federal and provincial regulatory agencies for approval to mine three new ore bodies. The Atomic Energy Control Board, the federal agency responsible for the administration of uranium mining and processing, determined that the environmental effects of the proposed project would be mitigable. The project was approved under the Canada and Saskatchewan Environmental Assessment Acts and license was issued for development.

In 1991, 4 years following the submission of the initial EIS, a joint federal–provincial EA Panel was appointed to examine the environmental, health and socioeconomic effects of uranium mining activities in northern Saskatchewan. Cameco subsequently updated its 1987 EIS for the Rabbit Lake project and submitted it for review. The Panel's report was released in 1993.

Contamination of the biophysical environment by radionuclides and heavy metals was of primary concern in both the initial EIS and the 1993 Panel report. In its presentation to the review Panel, Cameco noted that it had been collecting baseline data and monitoring the local biophysical environment for the past two decades and had data for approximately 7000 samples of air, water, lake sediments, plants and fish (Rabbit Lake Uranium Mine Environmental Assessment Panel, 1993).

While the monitoring program did meet regulatory agency approval, there was some concern by the Panel as to the quality of the monitoring program and the monitoring data. The Panel noted that the procedure for testing radionuclides and trace elements in fish were changed in 1982, 1984, 1986, and data collected during 1989 and 1990 were discarded due to quality control problems. After more than a decade of environmental monitoring, there were few comparable data concerning the effects of mining operations on fish—a resource of considerable socioeconomic value to northern residents. The Panel also noted that vegetation-monitoring plots established in 1979 could not be found in 1986, thereby making spatial and temporal impact evaluations near impossible. Overall, the Panel concluded that the Rabbit Lake monitoring program and baseline data did not meet professional standards and failed to provide assurance to those most affected by the project.

The Rabbit Lake case study illustrates problems with quality control in data collection. In other cases, however, experience points towards the frequent absence of baseline data. Baseline monitoring typically requires several seasons or years to sufficiently quantify ranges of natural variation and directions and rates of change (Therivel and Morris, 2001). In the case of Hydro Quebec's La Grande-2A and La Grande-1 hydroelectric generating stations, located on the La Grande Riviere, Quebec, for example, a 3-year program was initiated to establish baseline environmental conditions between 1987 and 1990 (Denis, 2000). However, this is perhaps an exception to conventional practice in that neither baseline monitoring is rarely done nor is it done sufficiently. Time constraints in EA usually preclude lengthy survey and data collection programs, and impact predictions typically have to rely on existing data. In frontier areas, even existing data can be minimal, thereby limiting the value of processes to verify the accuracy of impact predictions. In the case of the Ekati Northwest Territories Diamond project, for example, most biophysical impact predictions and mitigation measures in the EIS were based on data collected during just one field season (Mulvihill and Baker, 2001).

Impact prediction is fundamental to EA (Therivel and Morris, 2001), and EA itself is designed with the intent to provide information of the changes that will occur in the environment if a particular proposed activity is implemented (De Jongh, 1988). However, where outcomes are predicted, numerous studies (e.g., Locke and Storey, 1997; Buckley, 1991; Culhane et al., 1987; McCallum, 1987; Canter, 1983; Murdock et al., 1982) serve to illustrate the difficulties of determining impact prediction accuracy.

4. Is determining accuracy worthwhile?

The conclusions from the previous case studies suggest that experiences attempting to assess the accuracy of impact predictions have had very limited success, and even where testable predictions were available the coincidence of observed and predicted effects is typically quite low. The main source of prediction data is project impact statements. These are seen to be deficient insofar as they typically offer:

> vague, imprecise and untestable statements about potential outcomes including little indication of when impacts are likely to occur;
> nonexistent, insufficient, inadequate or accessible monitoring data, both pre-project baseline and during project implementation;
> obsolete, one-time "static" impact predictions resulting from changes in environmental conditions between the time that the predicted outcome was made and the monitoring activity, or changes in project design, schedules, etc., each of which can affect the relevance of project outcomes

The net result is that for most assessments the accuracy of only relatively few predictive statements can be determined. As previously noted, very little seems to have changed since Bisset and Tomlinson (1988, p. 124) noted the difficulties of coming to firm conclusions regarding the accuracy of predictions because monitoring data often give only a general indication of accuracy. The lack of a systematic follow-up program perpetuates this situation.

None of the above implies that predictive accuracy is not 'nice to know.' Clearly, accuracy could contribute to improvements in predictive techniques and methods in future projects and is valuable from a scientific and learning perspective; however, there is little evidence that follow-up programs in which accuracy has been demonstrated have in fact done this. Rather, much of the learning and new practice in EA has (arguably) been greater in terms of the development of impact management approaches than in the development of predictive techniques and methods. In situations where outcomes may be uncertain, but potentially manageable, and where the proponent's responsibility is first and foremost to managing their specific project, it may be simpler and more effective to use effects management and monitoring as (experimental) tools through which action is taken to address a potential effect; the outcomes of which are then monitored and evaluated; and the action revised as appropriate. A reasonable question, then, is whether verifying the accuracy of impact predictions is an appropriate focus for follow-up programs.

Where attempts are made to define accuracy, the results can be complex and idiosyncratic (e.g., Culhane et al., 1987). How close should the prediction or forecast be before it is considered 'accurate'? Is a 5% or 10% margin of error acceptable? Intuitively, one might expect that different types of predictions could have different permissible margins of error, depending on the implications of such errors. Such decisions are dependent on value judgments, or 'professional opinion,' for which there may be little theoretical basis. In sum, determination of accuracy is at best difficult, and, as the following sections suggest, it may not be the most effective or efficient use of EA resources to improve either EA practice or EA outcomes. The current requirements under the *Act* tend to focus attention regarding potential project outcomes on residual adverse environmental effects after mitigation measures have been applied. In so doing, the emphasis on impact predictions tends to be downplayed in favour of mitigative measure effectiveness. This is carried through into postimplementation follow-up programs that in practice are not designed to determine prediction accuracy.

A collaborative approach, in which EA scientists use a particular project as the basis for predictive accuracy experiments, might offer some possibilities for achieving accuracy determination. This would still require that proponents and scientists interact and cooperate on project monitoring design and implementation, but it might make more sense for this collaboration to occur later in the EA process after project management and follow-up objectives have been identified. While this may mean 'losing' some monitoring data, proponents are less likely to collaborate early in the EA process when uncertainties about the project design; the assessment and management tools may still exist.

5. Impact management case studies

5.1. Hibernia construction project, socioeconomic effects management

The Hibernia project, described above, was the first of its kind to be developed in North America. In the absence of experience, many initial impact predictions, particularly those concerning economic benefits, were unrealistic and overly optimistic. The social consequences of project construction, on the other hand, were generally expected to be dire, associated with an influx of outside workers to rural communities, new social divisions, the erosion of social equality, the out migration of the skilled and the young to the metropolitan oil centre and the entailed loss to rural communities. These views were often based on the boom and bust experiences of energy developments in Alaska and the western US (e.g., Oilen and Oilen, 1982; Davenport and Davenport, 1980). While the parallels were far from exact, one effect was that considerable attention was given to the question of the means by which the benefits of the Hibernia project could still be captured, but the negative social consequences avoided.

Of particular concern were the negative community social impacts associated with project employment. After considering experiences elsewhere, and based on consultation with local residents, the proponent determined that a self-contained work camp designed to feed and house up to 1500 workers at peak production was the preferred option. The work camp would potentially avoid the disruptive social impacts associated with an influx of workers into the small communities adjacent to the site, which were not equipped with the infrastructure and services necessary to accommodate them. Consequently, the impact assessment only considered the residual social impacts after taking the self-contained work camp into account. Social impacts on the communities near the project were therefore predicted to be minimal. Although demand for labour subsequently proved to be significantly greater than that which had been predicted, the fact that a plan was in place from the outset to add capacity to the work camp should it be necessary; the general objective of minimizing social disruption was achieved.

This isolation–insulation strategy to avoid the population influx problem was adopted by the proponent for all project development scenarios and thus became part of project design. By minimizing demographic effects on the local communities, demands on social and community services, infrastructure and potential impacts on community composition, interactions, values and behaviours were either avoided or minimized.

5.2. Voisey's Bay mine mill postimplementation follow-up programs

In 1997, the Voisey's Bay Nickel Company (VBNC) submitted an EIS for review by a CEAA Joint Panel to approve development of a nickel–cooper–cobalt mine in northern Labrador, Canada. The principal components of this mine/mill project would include open pit and underground mining operations, the mill, waste disposal areas, an accommodations and services complex, a port facility, maintenance and storage areas, site roads, an airstrip and related infrastructure and a power supply and distribution system. Given the potential effects of the project on caribou and the importance of this resource for local Innu aboriginal populations in Labrador, caribou were identified as one of the valued ecosystem components to be assessed. A number of activities were identified which could affect caribou and a variety of modeling techniques were used to predict outcomes, for example, with respect to noise, visual disturbance and bio-accumulation of contaminants. The conclusion was that no significant residual effects were anticipated if the measures proposed in VBNC's Environmental Management Plan were implemented.

There are no regulatory monitoring compliance requirements for caribou, but VBNC indicated that they proposed to initiate follow-up activities that would allow verification of predictions made, validation of the predictive models used, determination of whether mitigative measures implemented were effective and verification that the environment was being protected. However, the monitoring program proposed in the EIS was limited in scope and would not allow many of these objectives to be realized.

The issue here is the integration of follow-up with the assessment process generally and the EIS document specifically. While most authors argue that follow-up plans be incorporated as early as possible in the EA process, in practice, this seems not to be the case—most follow-up programs are designed in the postdecision/preimplementation phase—and usually for practical reasons. This may mean that some baseline monitoring data are never collected if follow-up is delayed, but there is the advantage of being able to determining priorities for follow-up at a time when project design, schedules, etc., have been more precisely defined.

Focusing on outcomes will require a learning process on the part of all concerned, as it is unlikely to be a simple matter to identify and agree upon desired outcomes. As suggested by the Voisey's Bay Mine and Mill Environmental Assessment Panel (1999, p. 168), "...everyone wants to see monitoring that delivers meaningful information ... it will be important to put adequate time and effort into reaching agreement on the monitoring framework itself, which should be more than a list of things to monitor. Emphasis should be placed on determining objectives and parameter selection criteria first."

6. Predicted versus actual effects

The study of the socioeconomic effects of the Hibernia construction project illustrates that while several of the key impact predictions made proved to be incorrect, the ultimate outcomes of the project met the intended objectives (see Storey and Jones, 2003). This was not the case with the Sizwell B nuclear power station in Suffolk, UK in the late 1980s. While the Sizwell B study methodology for follow-up was seen as robust in the way monitoring data were collected and over a relatively long period (Frost, 1993), follow-up results showed that there was a considerable underestimate of the build-up of construction employment. While a significant proportion of the jobs went to local people and was seen as a major benefit, surveys of local residents revealed more negative than positive perceived effects, with increased traffic being viewed as the major negative effect. During peak employment in 1990, impaired driving cases increased 125% during the first 3 months of the year, while criminal offences, mostly alcohol-related, increased to 250 incidents during the first 5 months of the year compared with 309 for the whole of 1989. In the case of Sizewell B, it was not that the monitoring program itself was weak, rather, the impact management methods adopted proved to be ineffective.

The Hibernia biophysical follow-up program (Storey, 2002), in contrast, was designed after project approval. The primary objective of the program, however, the detection of early warning of undesirable change, was identified early in EA process (LGL, 1993–1997). Testing of impact predictions and assessment of the effectiveness of impact management measures were secondary. This draws attention to the question of the relative importance of follow-up objectives and an argument can be made that, from a sustainable environment perspective, it is not *predicted* effects, but *real* effects that are relevant (Arts et al., 2001). In this sense, it is more important to determine what the *intended* outcome objectives of the project are and to compare these with *actual* outcomes.

6.1. Uncertainties and project outcomes

Uncertainty is a key criterion in determining the need for follow-up, but the EA review process is designed to discourage discussion of uncertainties, which in turn may distort the resources allocated to follow-up. The priority of the proponent is to get their project approved. Accordingly, they will be reluctant to concede to decision-makers any uncertainties associated with project design, schedule or implementation methods or outcomes during the preapproval stage. Consultants who undertake assessments and prepare the impact statements on behalf of the proponents often have to work with what is often very preliminary design information provided by the proponent or their subcontractors, either of whom may have little understanding of the need for their data or of the use to which those data will be put. The predicted effects statements, and particularly those of a social–economic nature, that appear in EIS documents are often based on a string of assumptions; failure to meet anyone of which could result in the inaccuracy of the prediction, nevertheless, effects are typically presented with a confidence that may not be justified.

A greater willingness to recognize that uncertainties exist should not necessarily be punished by withholding project approval; rather it implies a more important role for both effects management and follow-up. However, recognizing uncertainties requires that EIS documents offer a more comprehensive discussion of the range of potential outcomes and likelihoods, the variables subject to change, expected magnitude of change under various outcomes and the anticipated spatial and temporal scales of such change. A hypothetico-deductive approach can help in this regard (Curtis and Epp, 1999), where hypotheses as impact predictions, as in the case of environmental monitoring and research for the Beaufort Sea hydrocarbon development project or the Hibernia biophysical effects monitoring program, are formulated in relation to project design and implementation and are later used as a basis for investigating actual effects and, in the process, either verifying or rejecting initial predictions (Everitt, 1991). This approach requires that assumptions underpinning impact predictions should be clearly stated, and issues of probability and confidence in predictions should be addressed at the outset (Glasson et al., 1999) including any exogenous factors associated with the impact prediction.

That said, however, and given the difficulties associated with predictive accuracy, the potential benefits of follow-up for the environment generally, and to proponents specifically, a broader argument about EA tasks and EA 'good practice' can be made to reallocate resources from providing extensive baseline analyses and sophisticated predictions towards better management and follow-up of effects (see, for example, Frost, 1993; Storey, 1986). In this respect, scoping and follow-up requirements are linked insofar as an EA, designed with a view to follow-up at the outset, may result in a more focused EA and, subsequently, more effective follow-up.

7. Towards a single requirement

The above case studies are not to suggest that verifying the accuracy of impact predictions is not a useful exercise in EA, as it serves a particular learning function, nor that it is impossible to do. However, the investment of time and resources in improving EA predictive accuracy seems unlikely to soon be common practice. EIS documents appear to be becoming more standardized and formulaic, less concerned with presenting specific impact values and more focused on adverse impact limitation through management. This is illustrated by the recent Ekati diamond mine project in the Northwest Territories and ongoing environmental monitoring program.

7.1. BHP Billiton Ekati's independent environmental monitoring agency

The Ekati mine, 300 km northeast of Yellowknife in the Northwest Territories (NWT), is Canada's first diamond mine. The proponent, now BHP Billiton (BHPB), submitted its assessment documents, and a full Panel review was carried out between 1994 and 1996. The range of biophysical environmental issues associated with the mine include wildlife (particularly caribou), aquatic resources (dewatering and nutrient level changes), mine waste (including acid mine drainage) and cumulative effects (including other diamond exploration and development and winter road use). The project was approved in 1996, subject to a number of conditions specified in the Environmental Agreement signed by BHPB, the Government of the NWT and the Government of Canada, one of which was the creation of an independent 'watchdog', the Independent Environmental Monitoring Agency (IEMA). Construction of the project commenced in 1996 and production from the mine began in October 1998.

BHPB's approach to managing environmental impacts is described as an adaptive environmental management approach—"in effect to monitor results, evaluate them and manage any unacceptable results to make them acceptable" (Ross, 2002). In its 2000 annual report, the IEMA observed that: "[BHPB's] environmental management and compliance has, to date, been good and improving" (IEMA, 2000). In Ross's view, other than for some significant adverse effects on wolverine that have since been addressed, there have been no other identified significant impacts to date. One of the successes of the Agency has been to help BHPB significantly improve their monitoring programs from those originally proposed; a view supported in the findings of an evaluation of the Agency's performance by the Macleod Institute (2000) which noted the strength of the Agency's technical and scientific contributions. These have included identification of relevant issues, such as changes in dissolved oxygen levels under winter ice, leading to improvements in environmental management at the mine.

The IEMA represents an innovative experiment in monitoring and management. Its mandate is that of a watchdog, finding solutions is a primary objective. This is significantly different from the Institute for Environmental Monitoring and Research, which although a monitoring agency, was primarily a research unit set up to monitor the effects of military low-level flying training in Labrador.

7.2. Follow-up for management

Under the present requirements of the *Act*, the objectives of follow-up are both 'science'- and 'management'-oriented. The primary purpose of verifying the accuracy of impact predictions is to improve predictive modeling capabilities, an essentially scientific objective. Achieving this may have scientific value for future projects, but it offers little immediate benefits to most proponents. Prediction verification has proven difficult to do in practice, and the value, in terms of improving predictive capabilities, is questionable.

On the other hand, follow-up that measures the effectiveness of mitigation is concerned primarily with project management. The primary purpose here is that of addressing uncertainties by providing an 'early warning' of unexpected changes and an opportunity for the various parties at interest to respond before significant, adverse, environmental, social and other project-induced changes occur. It can also serve to eliminate concerns and the need for monitoring. It can have immediate payoff, preventing or minimizing potential harmful outcomes to the physical, social and other environments, and potential cost savings for proponents in particular. Follow-up in this sense may be very cost effective. It is not surprising, therefore, that in practice, the emphasis of most follow-up programs is on this component of the legislative requirements.

Follow-up effectiveness could be improved by a clearer separation of these functions. In our view, the primary objective of follow-up should be the management function. Proponents are not typically research-oriented. This was evident in the Voisey's Bay mine/mill hearings (Voisey's Bay Mine and Mill Environmental Assessment Panel, 1999), in which while both the proponent (VBNC) and the responsible authority [Department of Fisheries and Oceans (DFO)] agreed that project follow-up programs should be scientifically defensible, with specific monitoring objectives based on testable hypotheses; there was disagreement over the approach and emphasis of such programs. DFO appeared to be advocating a scientific approach looking to use monitoring as a means of gaining greater understanding of the way ecosystems work, while VBNC was more interested in an engineering approach that seeks primarily to avoid problems or to detect and fix them.

Where follow-up generates information that increases scientific knowledge, this should be seen as a bonus, but it should not be the task of proponents to be EA researchers. This is better left to government, academic and other scientists. The purpose of follow-up would thus become a determination of whether what was intended as project outcomes were in fact realized. In current practice EA follow-up, we spend a disproportionate amount of time and effort attempting to predict outcomes; however, none of the predicted outcomes might be those that are most desirable. Thinking about what we want to achieve from a project and broader sustainability perspective will help focus the attention of proponents, regulators and the public alike on fundamental and substantive issues. While sustainability is supposed to be an objective of the current *Act*, there is nothing 'practical' in the *Act* that would encourage this—particularly with regard to follow-up programs. If we are to successfully chart a new future, then the EA must generate more than compliance, it must generate commitment (Senge, 1994).

In current EA practice, there is often no explicit consideration of what we might *want* the outcomes to be and whether or not we have achieved those outcomes that are most desired. In the preamble to the current *Act*, EA is identified as an effective means of integrating environmental factors into planning and decision-making processes, in a manner that facilitates sustainable development. However, if sustainable development is an important underlying principle of EA, then we cannot continue to treat outcomes in an abstract manner, rather, they must be linked to the larger issue of whether what we do is in fact sustainable. To this end, we believe that project outcomes must be goal-oriented. By this, we mean that the outcomes of any project should result in:

- changes in environmental conditions which are within current acceptable limits and reversible (suboptimal);
- no change in pre-project environmental conditions (status quo);
- improvements in pre-project environmental conditions (optimal).

Most project developments involve changes that have adverse biophysical effects (socioeconomic effects are more likely to be both adverse and beneficial, and vary among different groups). In the long run, the cumulative consequences for the environment of multiple project developments may not be sustainable. At minimum, project effects should be within current acceptable limits before the project is allowed to proceed. If a fundamental of EA practice is that of continuous improvement, then, over time, the thresholds that represent those acceptable environmental limits should become more stringent. Projects that result in environmental changes, but within acceptable limits, represent 'best worst-case' scenarios. Preferable scenarios would be project outcomes that result in no environmental change, thereby maintaining the *status quo*, or, even better, outcomes that make a positive contribution toward sustainability resulting in some level of environmental improvement.

If project outcome objectives can be clearly articulated at the outset, the net result should be that EA resources are used more effectively, especially those allocated to management and follow-up activities. In a constantly changing environment, the larger question of outcome objectives is of greater importance than predicted impacts when designing and implementing follow-up programs.

8. Summary

Given that the primary EA goal of proponents is to get their projects approved so that they can proceed with their business, any approach to follow-up that is science-, rather than business-focused, is unlikely to be well received. Recent practice experience suggests that advances in EA have been greater in terms of the development of impact management and mitigation approaches than in the development of predictive techniques and methods. It is managing the real, rather than the predicted, impacts that matters. Predictive accuracy thus becomes of secondary importance to the effectiveness of management measures. Improving the environmental management role of EA follow-up in Canada requires building values into management and follow-up practice and a broader consideration of 'environment' to include socioeconomic variables, goals, and objectives. Rather than allocating time and resources to address the probability and the likelihood of an impact materializing as predicted, in our view, the primary objective of follow-up should be ensuring whether what were intended as project outcomes were in fact realized.

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