The Contribution of Impact Assessment and Science to Decision Making

Perspective 1: ***The Practice of Environmental Impact Assessment does not add value to decision-making. It does not advance our scientific knowledge about the environment and has failed to present credible scientific evidence to decision makers. It has not lived up to its original expectations.***

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Dr. Neil Hutchinson is President of Hutchinson Environmental Sciences Ltd., a firm of 11 aquatic scientists working across the country since 2009 with offices in Bracebridge and Kitchener ON, and Edmonton AB. Prior to 2009 he worked for 11 years as a consultant with Gartner Lee Ltd. and 13 years as an aquatic scientist with the Ontario Ministry of the Environment. He has contributed to Class and Individual EAs in Ontario; Screenings, Comprehensive Studies and Joint Review Panels in the federal CEAA process and the EA processes of the Nunavut Impact Review Board and the Mackenzie Valley Environmental Impact Review Board, as a technical expert in water quality and in linking outcomes of the EA process to the regulatory process through monitoring and formalized adaptive management. He feels that EA practitioners in Southern Canada could learn a lot from the EA processes in the Northwest Territories and Nunavut.

As a scientist, he sees the need for clear and direct presentation of the necessary information in the EA process and the need to ensure that all voices are heard, and that all voices bring clear presentation, real questions and opinions that are substantiated by information to the process.

My Premise

Although the science-based EA process has added some value to decision making, it has fallen short of its potential because the process, as practiced, does not adhere to the scientific process, does not advance our scientific understanding of the environment or provide the right scientific evidence to decision makers.

My Argument

Let's start with a review of the scientific process and test the EA decision making process against it.

The EA process is focussed on arriving at a decision as to whether or not a project can be carried out without producing significant adverse effects on the environment. The scientific process, on the other hand is one which I call "structured curiosity" – It seeks to understand the environment through series of questions and a series of steps to answer them.

These are:

- The formulation of hypotheses and alternative hypotheses.
- Information gathering
- Interpretation and assessment of information and evidence
- Testing of the hypotheses against the evidence
- A defensible standard by which to accept or reject the hypothesis and accept the alternative
- A defensible standard of certainty to inform the conclusion
- The conclusion as to whether or not the original hypothesis was valid.

The scientific process is therefore based on investigations in which the decision and outcome are clear.

The EA process, by comparison, proceeds by documenting a pathway along which the project can proceed without generating significant adverse effects. The outcome of the experiment is not clear at the time the decision to proceed is made and the outcome may not be apparent for a long time, perhaps decades. As such, the scientific method must be adapted to the EA process to test, over the life of the project:

- If the decision to proceed was valid or not
- Means to improve the certainty of the prediction and the outcome, to ensure that the environment is protected.

Problem #1

The practice of EA is focussed on demonstrating that the project can proceed because it is not likely to generate significant adverse effects, or on showing how a problem in environmental protection can be addressed through a particular prescribed form of mitigation (The Class EA process). This provides for project approval, but does not add value to the decision making process.

The EA practice, in fact, rarely addresses serious alternatives to a project: it skips directly to alternative means, or provides the standard three alternatives: Do Nothing, something flawed or non-feasible, and the preferred alternative. I will provide two examples:

> In 1998 and 1999 the Comprehensive Study of the Diavik Diamond Project was carried out under CEAA. The problem statement for the EA was "to provide a Canadian source of diamonds", not to provide more diamonds to the world, because the alternative to the undertaking would then have been to open up a highly controlled market of diamonds that are kept off of the market to keep prices high. The EA process did not identify a need for more diamonds, only that there was a valid economic case to be made for developing a second source of diamonds within Canada (we already had the Ekati mine, 60 km from Diavik).
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> A second example is the Class EA for Municipal Waste Water Treatment in Ontario. The Class EA process was written by engineers and is run by engineers, and always arrives at a conclusion that a WWTP is the preferred solution, a WWTP that is built by engineers. Perhaps a more objective process would be one which is lead by planners or environmental scientists. My example comes from southwestern Ontario, where the Class EA process concluded that replacing septic systems with a $24M WWTP (for a town of 2500 people) was the preferred solution to ongoing bacterial pollution at a popular beach. Independent scientific studies by Environment Canada and the Town showed that beach bacteria were not likely related to faulty septic systems as was suspected, and that the $24M expenditure was not therefore likely to solve the problem. There are many good reasons to build WWTPs, but they are costly and should be built with a clear scientific demonstration of their need.

So the EA process can be threatened by a focus on demonstrating how a project can proceed, with no serious consideration of "Alternatives To"

The question of providing credible scientific evidence to decision makers is important however, and so the EA process is based on the use of credible scientific evidence and does provide the means to do so:

- It requires collection of baseline information,
- It includes use of a source-pathway-receptor approach linking activities to environmental impacts,
- It focuses decision making through a series of criteria such as extent, duration, magnitude, reversibility which can, in theory, be done in a repeated fashion – but which are also open to subjective and non-repeatable application as the intent is approval. The reader is referred to the September 2013 critique of the OPG Deep Geologic Repository EA by Dr. Peter Duinker, as an example (http://www.ceaa-acee.gc.ca/050/documents/p17520/94202E.pdf).

Problem #2

The EA process proceeds through these steps and concludes that there are no significant adverse effects that cannot be mitigated – the intent is to get in under the bar of significance. The problem with this is that no one defines what a significant adverse effect would look like in quantitative, predictable and measurable terms – the hypothesis is not set up to be testable on the basis of information received at the time of decision. Instead effects are predicted, some form of mitigation applied and the proponent concludes no significant adverse effects after mitigation. The proponent documents potential effects without an understanding of "how much is too much". I would add this this is as much a problem with ecology as it is with an EA process – it is very difficult for an ecologist to predict how many caribou or fish we can lose, or how much their reproduction can be impaired, before we should be worried.

The conclusion of no significant adverse effects may, in fact be valid, but the process is flawed as we do not know how much of an impact would be significant ahead of time and so there is too large of an opportunity for value judgements which lie outside of the realm of science or which are considered expert opinion. The process is subjective and the determination of significance depends on the orientation of the proponent.

> My example here is a recent oil sands submission which concluded that impacts were not significant because they would be reversible after 150 years. I can only mote that 5 human generations will have lived with the impacts over that period.)I await the proponent who will use the next ice age to conclude that impacts of climate change are reversible and hence, not significant.)

The EA process is therefore flawed in its failure to define significant adverse effects in measurable and testable ways. In 30 years of EA practice we have not advanced the science of significant adverse effects and this understanding is central to EA practice. This flaw also impairs one of the most frequently used mitigation tools – "adaptive management" which is often invoked for mitigation of uncertainty in EA conclusions. How can adaptive management be effective without an understanding of when to invoke additional mitigation in time to prevent an unpredicted significant adverse effect?

Problem # 3

The EA process deviates from the scientific method and does not advance science because the linkage between hypothesis testing and hypothesis validation is severed at the conclusion of the EA process. It is severed by:

- The time period, often several decades, that is required to test the hypothesis that the effects were not significantly adverse,
- The absence of a means of formal follow up and testing of the EA conclusions.

There is need for a stronger linkage of the EA process, which ends with project approval, and the regulatory process which will run until the end of the project.

Although the EA may specify conditions or follow up measures to decrease the uncertainty in the conclusions, there is rarely a formal process to assure that this occurs, to link these back to the EA predictions, to modify the project or to improve the science that lead to an invalid prediction

> My example – in 2003 I listened to a proponent argue that *" …it was beyond the realm of scientific credibility"* that a specific, testable change in water quality would exceed their predictions and it was not, therefore, necessary to address this possibility in the EA. Ten years later, that change was exceeding the prediction. We are fortunate that the Mackenzie Valley Land and Water Board has a regulatory process that, if it cannot go back and correct the EA prediction, can at least address it in the regulatory phase by way of the Water Licence renewal. Unfortunately, the proponent's first response was to rewrite the water quality objective so that it is less protective, but the Board also directed them to investigate source reduction and pollution prevention.

The testing of the EA conclusion is therefore left to the regulatory process and this does not provide assurance:

- In Ontario, an environmental compliance approval (ECA) can require monitoring and reporting for water or air but there is no formal process that shows when changes require management actions. It is left to the judgement of the regulator.
- The NWT, specifically the Mackenzie Valley Land and Water Board, are now moving towards a formal process linking the EA outcome to the regulatory process, to adapt to unforeseen changes in an a-priori, quantitative way.

CEAA 2012 does provide an avenue for fines in the event that EA predictions are invalid, but the process of doing so is not spelled out and the outcome remains to be seen. Although a fine is a start, it is punitive and does not address the science that lead to the invalid prediction. CEAA and most terms of reference also contain requirements that proponents document how their assessment incorporates previous studies and past history, but the requirement is loose and interpreted subjectively.

Therefore although the EA process does add value to decision making through the opportunity for use of

- Scientifically valid baseline information
- Documentation of specific project pathways of effect
- Prediction and quantification of specific impacts
- Investigation of mitigation

It falls short of full value through the lack of a scientific framework to address uncertainty. This does not advance the science.

Problem 4

Finally the value of science-based evidence in the EA process must also be balanced against the influence of non-scientific, opinion-based evidence or "public outcry". This may reflect the opinion of a vocal minority but the EA process does not provide a valid means to assess whether or not this reflects the majority public opinion. Public opinion is important but the means to provide a representative public opinion is lacking. This can be seen in examples of:

- The public opposing a new Waste Water Treatment Plant through in the EA process for servicing as their means of opposing population growth which has been allocated to their community through another process,
- Public outcry and political expedience changing the conclusion of an EA process after the fact (as in the cancelation of two Ontario gas plants by the McGuinty government in 2013).

Closing Summary

So, in summary, the practice of environmental assessment has not added full scientific value to decision making or to our understanding of environmental impacts because:

1. The EA process, being proponent driven, is focussed on demonstrating how a project can proceed, not in testing alternatives to it.
2. The EA process tests for significant adverse effects in the absence of understanding or documenting what a significant adverse effect would look like – of what quantifiable and measurable change in the environment would be considered adverse. This reflects two problems
    a. The need for better ecological definition of what level of impact is considered significant and,
    b. Subjective interpretation of the significance criteria such as duration, extent, magnitude and reversibility
3. The EA process does not fully advance the science for the benefit of future decision makers because the linkage between hypothesis testing and hypothesis validation is severed by:
    a. The duration of projects, and
    b. The lack of a structured response framework linking EA predictions to the regulatory process in order to
        i. Respond to predicted changes
        ii. Improve overall environmental performance and environmental understanding
4. The need to balance the weight given to structured scientific assessment and opinion based public outcry and the need to focus public opposition on the correct question and bring it into the decision making process in a fair and structured manner.

Addressing these challenges is necessary in order to achieve the full potential of the EA process.