

**Cumulative Effects
and the
Energy Resources
Conservation Board's
Review Process**

by George L. Hegmann

and

G.A. Yarranton



At the University of Calgary

Macleod Institute Working Paper #1

July 1995

TABLE OF CONTENTS

	Page
<i>Abstract</i>	<i>i</i>
<i>Disclaimer</i>	<i>i</i>
<i>Table of Contents</i>	<i>iii</i>
<i>List of Tables</i>	<i>viii</i>
<i>List of Figures</i>	<i>viii</i>
<i>List of Abbreviations</i>	<i>ix</i>
1. INTRODUCTION	1
1.1 Purpose of the Paper	1
1.2 Guiding Principle	2
1.3 Contents of this Paper	2
2. THE ERCB	3
2.1 Mandate of the ERCB	3
2.2 Role of the ERCB	3
2.3 Should ERCB Be Concerned With Cumulative Effects?	4
2.4 Internal Project Review Process	4
2.4.1 Screening stage	5
2.4.2 Hearing Stage	5
3. WHAT IS CUMULATIVE EFFECTS ASSESSMENTS?	9
3.1 Definitions	9
3.2 Relationships between EIA and CEA	9
3.3 Types of Cumulative Effect	10
3.4 Reaching Towards CEA	11
3.4.1 The EIA continuum	11
3.4.2 Expanding EIA horizons	12
3.5 Is There a “State-of-the-Art” in CEA?	13
3.6 Examples of Approaches Used by Other Jurisdictions	14
3.6.1 Canadian Examples	14
3.6.1.1 Hudson Bay Programme	14
3.6.1.2 Northern River Basins Study	15
3.6.1.3 Oak Ridges Moraine Area Planning Study	15
3.6.1.4 Northern Saskatchewan Uranium Mining	16
3.6.1.5 Westcastle Valley Resort	17
3.6.1.6 Alberta-Pacific Pulp Mill	17
3.6.2 United States Examples	18
3.6.2.1 Bureau of Land Management	18
3.6.2.2 North Fork Flathead River Basin	19
3.6.2.3 U.S. Courts	19
3.6.2.4 Greater Yellowstone Ecosystem	20
3.6.3 An Australian Example: Commonwealth Environment Protection Agency	21
3.6.4 Lessons learned from the examples	21

Table of Contents (continued)

4.	CUMULATIVE EFFECTS AND ERCB	23
4.1	Elements of an Evolving Treatment of Cumulative Effects Suitable for ERCB	23
4.1.1	Adaptive process through an inquiry approach	23
4.2	CEA and Energy Project Concerns	25
4.2.1	Can ERCB deal with cumulative effects Given its regulatory mandate?	25
4.2.2	What projects should be included in a CEA?	27
4.2.3	Does CEA necessarily imply comparison of total impact with a threshold?	28
4.2.4	Is there a single best analytical method for CEA?	29
4.2.5	Can a prescriptive, standard-setting approach be used for cumulative effects in general?	29
4.2.6	Is regional planning the ultimate solution?	29
4.2.7	Who should be responsible for gathering data and performing analyses with respect to cumulative effects.	30
4.2.8	Can CEA provide a prescription for sustainable development?	30
4.3	Mitigation and Cumulative Effects	30
5.	HOW ERCB MIGHT DEAL WITH CUMULATIVE EFFECTS IN THE FUTURE	31
5.1	Introduction	31
5.2	Essentials of the ERCB Review Process	31
5.2.1	Role of the Board	31
5.2.2	Role of the Applicant	33
5.2.3	Role of the Interveners	33
5.2.4	What kinds of cumulative effects are of concern to the Board?	33
5.3	Pre-Submission	34
5.3.1	Preliminary disclosure	34
5.3.2	Before submission to ERCB	34
5.4	Screening	34
5.4.1	Role of the Board	34
5.4.1.1	Current Situation	34
5.4.1.2	Possible Changes	35
5.4.2	Role of the Applicant	33
5.4.3	Role of the Interveners	37
5.4.4	Outcome of Screening: alternative pathways	37
5.5	Post-Screening Review: Following the Adaptive Inquiry Process	37
5.5.1	Determining the principal avenues of inquiry	39
5.5.1.1	Determining what is important	41
5.5.1.2	Selecting Valued Ecosystem Components	41
5.5.1.3	Types of Effects on VECs	42
5.5.1.4	Hierarchies of cumulative effects	47
5.5.1.5	Determining which potential effects, Impact hypotheses or issues require examination	49

Table of Contents (continued)

5.5.2	Determining information needed to test effects hypotheses	50
5.5.3	Conclusion of the Adaptive Inquiry Process	52
5.5.4	Recommendations for post screening reviews	53
5.5.4.1	Recommendations to ERCB	53
5.5.4.2	Recommendations to participants in ERCB reviews	53
6.	A CEA TOOLBOX: METHODS AVAILABLE TO APPLICANTS AND INTERVENERS	
	AND INTERVENERS	55
6.1	Introduction	55
6.2	The Toolbox Concept	55
6.2.1	Limits of analytical capability	56
6.2.1.1	Obstacles to quantitative analysis caused by the properties of complex systems	57
6.2.1.2	Practical responses to limits of analytical capability	57
6.3	Catalogue of Methods and Their Applicability	58
6.3.1	Explanation of the tool catalogue	58
6.3.2	List of tools	60
6.4	Disciplines	65
6.5	Concepts	66
6.6	Frameworks	67
6.6.1	Adaptive Inquiry Process	67
6.6.2	Classical EIA Approach	68
6.6.3	EPA Synoptic Approach	68
6.6.4	Federal Environmental Assessment Review Office	69
6.6.5	US Army Corps of Engineers Permitting Process	69
6.6.6	US Fish and Wildlife Service Coal Mining Impacts	70
6.6.7	US Forest Service Limits of Acceptable Change	71
6.6.8	World Wildlife Fund Decision Boundary Process	71
6.7	EIA Techniques	72
6.7.1	Information Organizers	72
6.7.2	Analysis	73
6.7.2.1	Hypothesis-Evaluation process	73
6.7.2.2	Indicators	73
6.7.2.3	Indices of Environmental Quality	74
6.7.2.4	Multi-variate Analysis\	75
6.7.2.5	Simulation Modelling	75
6.7.2.6	Ecotoxicology	76
6.7.2.7	Visual Impacts	76
6.7.2.8	Environmental Information Systems	76
6.7.3	Teamwork	77
6.7.3.1	Professional Judgement	77
6.7.3.2	Mediation	78
6.7.3.3	Adaptive Environmental Assessment and Management	78
6.7.3.4	Panel Evaluation Method	79
6.7.3.5	Independent Administrative Agencies	79

Table of Contents (continued)

	6.7.3.6 Scenario building through gaming	80
6.7.4	Socio-economic Impact Assessments	80
6.7.5	Comprehensive Economic Approaches	81
6.7.6	Comprehensive Socio-economic Models	81
	6.7.6.1 Social - Organization Models	81
	6.7.6.2 Integrated Regional Models	81
	6.7.6.3 National Economic Development Goals	82
6.7.7	Risk Assessment	82
	6.7.7.1 Overview of ecological risk assessment	82
	6.7.7.2 Cairn’s Ecosystem Integrity Response	83
	6.7.7.3 Cincotta Critical State Variable Limits	83
	6.7.7.4 EPA framework for ecological risk assessment	84
	6.7.7.5 Oil sands biological indicators	84
	6.7.7.6 Green Bay simulations	84
	6.7.7.7 Hunsaker Regional Risk Assessment	85
	6.7.7.8 Contaminated Sites Tiered Approach	85
	6.7.7.9 Sour Gas Facility Set-backs	85
	6.7.7.10 Suter Risk Function Curves	86
	6.7.7.11 Structural and functional tests	86
6.8	CEA Techniques	86
	6.8.1 Argonne Multiple Human Development Model	86
	6.8.2 CEQ’s Biodiversity Conservation	88
	6.8.3 Cocklin Quadrant Matrix	88
	6.8.4 Duval and Vonk Semi-quantitative Approach	89
	6.8.5 FERC Cluster Impact Assessment Procedure	91
	6.8.6 Regional Planning	91
	6.8.7 Stakhiv’s Exchange Rate Model	93
	6.8.8 Weaver Habitat Disturbance Model	94
6.9	Technical Aids	95
	6.9.1 Air Quality	95
	6.9.1.1 Dispersion and Deposition Modelling	96
	6.9.2 Water Quality	96
	6.9.3 Wildlife Populations	96
	6.9.3.1 Habitat Evaluation Procedure	96
	6.9.3.2 Population Viability Analysis	97
	6.9.4 Geographic Information Systems	97
	6.9.5 Gap Analysis	98
	6.9.6 Remote sensed imagery	98
	6.9.7 Fiscal	98
	6.9.8 Social/demographic	99
	6.9.8.1 Social Surveys	99
	6.9.8.2 Economic-demographic models	99
	6.9.9 Economic	99

Table of Contents (continued)

6.10	Project-based examples	100
6.10.1	AEAM and Hypothesis-Deduction Beaufort Environmental Monitoring Program	100
6.10.2	Landscape Indicators Gosselink Bottom Land Hardwood Forest Study	101
6.10.3	Landscape Ecology and GIS: Oak Ridges Moraine Landscape Model	101
6.10.4	Semi-quantitative Approach Monkman/Grizzly Valley Natural Gas Field Development	102
6.10.5	Economic Impact Analysis: Three Sisters Golf Resorts	103
6.11	Selecting an Appropriate Tool	103
7.	SUMMARY OF CONCLUSIONS AND RECOMMENDATIONS	111
7.1	Conclusions	111
7.2	Recommendations	113
8.	ACKNOWLEDGEMENTS	115
9.	REFERENCES	117