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Doing CBA for CMP Regulations: Canadian perspectives

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Canada

Outline

A Canadian perspective on CBA for CMP regulations:

1) Outline the cost-benefit analysis (CBA) framework for regulations published by the Government of Canada

2) Examine two case studies, which reflect the recent work Health Canada (HC) and Environment and Climate Change Canada (ECCC) have performed under the Chemicals Management Plan (CMP)

3) Review the CBA framework, identify some key challenges and questions for improving CBA for CMP regulations

Canada

Population:

36 million

GDP: $1.8 trillion USD

GDP per capita:

$52 000 USD

Federal Policies & Tools

When determining whether and how to regulate, departments and agencies are responsible for assessing the benefits and costs of regulatory and non regulatory measures. This analysis should include quantitative measures and, when it is not possible to quantify benefits and costs, qualitative measures.

The Cabinet Directive on Regulatory Management (2012)

Bisphenol A (BPA): A Case Study

The science says:

- Use in Canada has declined significantly, from about 12 kilotonnes per year in 1986, to under 1 kilotonne in 2006.

- There is evidence that **low-level exposure** to BPA particularly at sensitive life cycle stages, may lead to permanent alterations in hormonal, developmental or reproductive capacity.

- In laboratory testing, these effects have occurred within the range of concentrations measured in Canada, indicating that there is potential for adverse effects in populations, particularly close to point sources.

Therefore, it is concluded that Bisphenol A should be classified as a toxic substance, based on threats to human health.

Bisphenol A (BPA): A Case Study

What we did about it…

Ban it! Baby bottles containing BPA are no longer allowed to be imported into or sold in Canada.

Bisphenol A (BPA): A Case Study

Quantified Costs: **$2.2 million**

- Cost to industry: $0. Industry has already phased it out.

- Cost to consumers: $2.2 million PV, if they buy new baby bottles to replace existing ones

Bisphenol A (BPA): A Case Study

Unquantified Benefits

- Bisphenol A is potentially harmful to the neurological and behavioural development of newborns and infants.

- Given [the health science], it is considered appropriate to apply a precautionary approach when characterizing risk. The prohibition will eliminate the risk from this source altogether.

- Health Canada is proceeding with the prohibition as it is considered the most effective option to reduce the exposure to bisphenol A to newborns and infants.

Total benefits to this initiative are expected to justify the costs.

Mercury: A Case Study

The science says:

- Canadian mercury emissions have already been reduced by roughly **90%** since the 1970s through aggressive action to curb industrial emissions.

- Methyl mercury, a very harmful organic substance, is of particular concern since it can build up in living organisms through their surrounding environments as it moves up the food chain.

- **Human exposure** to mercury can cause brain, nerve, kidney, lung or cardiovascular damage, or — in extreme cases — coma or death. Exposure can be quantified as the risk of the percentage (%) releases to air.

Mercury: A Case Study

What we did about it…

Prohibited the manufacture and import of all products containing mercury (with some exemptions and permits where applicable) as of 2015.

Mercury: A Case Study

Quantified Costs: **$9 million** (over 19 years; 2014-2032)

- Estimated increased cost of products with more expensive inputs: $5.5 million
- Administrative costs: $1.4 million
- Costs to government: $2.1 million

Mercury: A Case Study

Quantified Health Benefits: **$18 million**

Assuming that there is no lower threshold with respect to the negative impacts of mercury on brain development, these authors estimate benefits of $10,000 to $11,000 per kg of emissions avoided.

Unquantified Environmental Benefits

The environmental benefits associated with the Regulations are discussed qualitatively as the parameters of interest have yet to be studied and quantified in a manner that is suitable for a cost-benefit analysis.

Total benefits of this regulation are expected to justify the costs.

Summary: CBA Framework

Quantitative Risk Assessment

Challenges

Although a qualitative risk assessment is always performed for regulations under CMP, certain issues persist with quantifying risk…

- The links between reduced human exposure and reduced health risks cannot be quantified in certain cases, due to a lack of data
- Even when willingness-to-pay (WTP) estimates are available, there may be a lack of information on other factors such as the number, location and quality of the receiving environment, which prevents the monetization of total benefits
- The **precautionary principle** is the principle rational for putting regulations in place when there is insufficient evidence or data

Summary RIAS Table

Regulations	Year	Impact	Risk (Q)	Reduction (Q)	Costs ($)	Benefits ($)
PCB	2008	High	✓	✓	✓	✓
2-BE	2006	Medium		✓	✓	
Chromium	2009	Medium	✓	✓	✓	✓
Prohibition	2013	Med		✓	✓	
Mercury	2014	Medium	✓	✓	✓	✓
Prohibition Amendments (2-ME)	2006	Low	✓	✓	✓	✓
PFOS	2008	Low	✓	✓	✓	✓
PBDE	2008	Low			✓	
Phosphorus Amendments	2009	Low		✓	✓	
PCB Amendments	2014	Low		✓	✓	
Prohibition Amendments (HBCD)	2015	Low		✓	✓	
ODSHAR	2015	Low				

Conclusion(s)

From a Canadian perspective:

- We can almost always estimate costs and quantities
- We can value benefits when we have quantified risks
- We don’t always have quantified risks

Questions for Discussion

1. What do we need in order to perform more robust risk analyses?

2. What research could best address data gaps regarding valuation?

3. When can we use CBA alternatives such as cost-effectiveness analysis or break-even analysis?

Thank You!

Comments/Questions?

Special credit to Margot McComb (one of our ECCC economics graduate students) who worked tirelessly and without complaint on 44 versions of this presentation

Appendices

Additional information on CBA work performed under CMP in Canada

CMP Regulations 2006-2010[1]

Regulations under CMP (2006-2009)	Abbreviation	Year	Impact
Regulations Amending the Prohibition of Certain Toxic Substances Regulations, 2005 (2-ME)	Prohibition Amendments (2-ME)	2006	Low
2-Butoxyethanol Regulations	2-BE	2006	Medium
Perfluorooctane Sulfonate and its Salts and Certain Other Compounds Regulations	PFOS	2008	Low
Polybrominated Diphenyl Ethers Regulations	PBDE	2008	Low
Polychlorinated Biphenyls Regulations	PCB	2008	High
Chromium Electroplating, Chromium Anodizing and Reverse Etching Regulations	Chromium	2009	Medium
Regulations Amending the Phosphorus Concentration Regulations	Phosphorus Amendments	2009	Low

[1] This table excludes regulatory proposals with only administrative costs as well as SNAc Orders and additions to Schedule 1

CMP Regulations 2011-2015[1]

Regulations under CMP (2010-2015)	Abbreviation	Year	Impact
Prohibition of Certain Toxic Substances Regulations, 2012 (BNST)	Prohibition	2013	Medium
Regulations Amending the PCB Regulations and Repealing the Federal Mobile PCB Treatment and Destruction Regulations	PCB Amendments	2014	Low
Products Containing Mercury Regulations	Mercury	2014	Medium
Regulations Amending the Prohibition of Certain Toxic Substances Regulations (HBCD)	Prohibition Amendments (HBCD)	2015	Low
Ozone-depleting Substances and Halocarbon Alternatives Regulations	ODSHAR	2015	Low

[1] This table excludes regulatory proposals with only administrative costs as well as SNAc Orders and additions to Schedule 1

Monetized Impacts

Regulations	Year	Impact	Benefits (M$)	Costs (M$)
PCB	2008	High	317.0	365.0
2-BE	2006	Medium		17.0
Chromium	2009	Medium	58.5	18.8
Prohibition	2013	Medium		20.0
Mercury	2014	Medium	18.0	9.0
Prohibition Amendments (2-ME)	2006	Low	33.4	-3.0
PFOS	2008	Low	6.4	6.0
PBDE	2008	Low		0.2
Phosphorus Amendments	2009	Low		0.2
PCB Amendments[2]	2014	Low		-0.1
Prohibition Amendments (HBCD)	2015	Low		2.4
ODSHAR	2015	Low		

[2] **Note**: For the purpose of this presentation, cost and benefits for the PCB Amendments are reversed. The PCB Amendments extends an exemption period (costs are to the environment and benefits are to industry).

Overview – CBA Framework

- Three components are crucial to the estimation of benefit impacts:

Summary of CBA Benefit Estimations

Regulations	Year	Impact	Release	Risk	Benefits ($)
PCB	2008	High	✓	✓	✓
2-BE	2006	Medium	✓		
Chromium	2009	Medium	✓	✓	✓
Prohibition	2013	Med	✓		
Mercury	2014	Medium	✓	✓	✓
Prohibition Amendments (2-ME)	2006	Low	✓	✓	✓
PFOS	2008	Low	✓	✓	✓
PBDE	2008	Low			
Phosphorus Amendments	2009	Low	✓		
PCB Amendments	2014	Low	✓		
Prohibition Amendments (HBCD)	2015	Low	✓		
ODSHAR	2015	Low			

Topic #1: Quantity

- Regulations under CMP mostly focus on reducing the **release of substances** into the environment

- This environmental discharge is commonly categorized as releases to air, soil and water

- Releases are quantified <u>where possible</u>

Quantified Release Estimates

Regulations	Impact	Release Reduction Estimates (tonnes)	Elimination Ratio (Regulation/BAU)
PCB	High	1.7	100%
2-BE	Medium	159.0	88%
Chromium	Medium	31.0	4%
Prohibition	Medium	200.0	100%
Mercury	Medium	4.1	68%
Prohibition Amendments (2-ME)	Low	9625.0	100%
PFOS	Low	88.6	100%
PBDE	Low		Preventative Elimination
Phosphorus Amendments	Low	28 400.0	Partial Elimination
PCB Amendments[3]	Low		
Prohibition Amendments (HBCD)	Low	0.4	100%
ODSHAR	Low		

[3] PCB Amendments cause a release to the environment, rather than a reduction of releases (0.9 kg).

Topic #2: Risk

- Risk assessments are performed in order to determine the health and environmental risks associated with a specific activity

- A quantitative risk assessment is *critical* to the valuation process in order to link quantity to value

- This is because the **value** of a chemical reduction is related to both the **quantity** of the chemical reduction and the risks posed by **exposure** to the chemical

Quantified Risk Assessment Completed

Regulations	Year	Impact	Risk Assessment
PCB	2008	High	Yes
2-BE	2006	Medium	
Chromium	2009	Medium	Yes
Prohibition	2013	Medium	
Mercury	2014	Medium	Yes
Prohibition Amendments (2-ME)	2006	Low	Yes
PFOS	2008	Low	Yes
PBDE	2008	Low	
Phosphorus Amendments	2009	Low	
PCB Amendments	2014	Low	
Prohibition Amendments (HBCD)	2015	Low	
ODSHAR	2015	Low	

Quantitative Risk Assessment

Challenges

Prohibition Regulations, 2012

- The willingness-to-pay (WTP) for a marginal improvement in water quality for aquatic species, estimated between $3.07 to $6.89 annually, was found based on a meta-analysis of 30+ U.S. studies
- However, total monetized benefits could not be derived from this estimate due to the lack of data on the number, location and quality of receiving environment in Canada

2-Butoxyethanol Regulations

- The links between reduced human exposure and reduced health risks could not be quantified, because of the lack of epidemiological data.

Topic #3: Value

- The valuation (monetization) of benefits allows for benefits and costs to be compared using a common metric ($$$)
- Benefits are not always monetized in CMP regulations and only selected impacts are monetized
- We have a range of tools for valuing benefits

Key valuation tools

- 2015 ECCC/HC Willingness-to-Pay study
- Value of a Statistical Life (VSL)
- Environmental Valuation Reference Inventory (EVRI)

Monetized Benefits

Regulations	Year	Impact	Environment (M$)	Health (M$)	Other (M$)
PCB	2008	High	151.2		
2-BE	2006	Medium			
Chromium	2009	Medium	0.5	58.0	
Prohibition	2013	Medium			
Mercury	2014	Medium		18.0	
Prohibition Amendments (2-ME)	2006	Low		33.4	
PFOS	2008	Low			0.25
PBDE	2008	Low			
Phosphorus Amendments	2009	Low			
PCB Amendments[5]	2014	Low			
Prohibition Amendments (HBCD)	2015	Low			
ODSHAR	2015	Low			

[5] Benefits to industry, not the environment, were monetized for PCB Amendments.

Triage Stage Evaluation

- The Cabinet Directive has developed a triage template to facilitate the early assessment of the expected impacts of regulatory proposals

- *Preliminary cost estimation* is an essential component of this assessment, as it sets out the framework and motivation for the entire CBA (refer to table below)

☐ **No costs** ☐ **Not quantifiable**	☐ **Low costs** If less than $10 million PV or Less than $1 million annual	☐ **Medium costs** If $10 million to $100 million PV or $1 million to $10 million annual	☐ **High costs** If greater than $100 million PV or or greater than $10 million annual

Mercury: A Case Study

- The Products Containing Mercury Regulations (2014) quantify exposure as the percentage of release reductions emitted to the air, since there is lack of scientific evidence regarding the impacts of mercury exposure in landfills

- The sum of avoided releases (21 166 kg) can be broken down between releases to
  - land (80% or 16 882 kg)
  - **air (19% or 4 102 kg)**
  - water (1% or 182 kg)