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THE CANADIAN GOVERNMENT PERSPECTIVE ON COST-EFFECTIVE REGULATION

James K. Martin, Executive Director
Cassandra Iwankow, Economist

Regulatory Affairs Directorate
Treasury Board of Canada Secretariat
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Abstract

Fiscal constraint, globalization of markets, and accelerated technological change have resulted in a new focus on the cost-effectiveness of government activities and, in turn, on methods of policy evaluation. An exploration of regulatory problems, and the use of regulation as a public policy instrument, reveals a commonality of experience in all industrialised countries. This paper provides a brief synopsis of the Government of Canada's perspective on cost-effective regulation.

To understand cost-effective regulation, this paper examines the principles of regulatory reform which underlie the current strategy of the federal government (collaborative decision-making mechanisms, methods of clear policy evaluation, and well defined lines of accountability). It discusses the nature of, and rationale for, government regulation, the reasons for regulatory reform in the economy, and the principal aims of Canadian regulatory reform and regulatory policy assessment. It does so by specifically addressing the role of cost-benefit analysis in the process of regulatory assessment – a method which involves systematically identifying, and quantifying where possible, the social benefits and costs associated with alternative public policy actions – with a particular focus on regulation which affects the Canadian nuclear industry.

Preamble¹

In Canada, issues pertaining to atomic energy fall under the exclusive jurisdiction of the federal government.² In 1946, safety and security concerns following World War II led to the passage of the *Atomic Energy Control Act*,³ which established the role of the Atomic Energy Control Board (AECB) in protecting the national interest in atomic energy regulation. The mission of the AECB today, "to ensure that the use of nuclear energy in Canada does not pose undue risk to health, safety, security and the environment," is accomplished by "controlling the development,

¹ The authors wish to thank Dr. Jatin Nathwani for his valuable comments on an early draft of the present paper, as well as Mr. Todd-Jeffrey Weiler for his insightful remarks and assistance.

² *Ontario Hydro v. Ontario (Labour Relations Board)* [1993] 3 S.C.R. 327; D.L.R. (4th) 457.

³ R.S.C. 1985, c. A-16.

application and use of nuclear energy in Canada, and by participating on behalf of Canada in international measures of control."⁴

Along with other highly regulated industries, the nuclear industry shares concern for the quality and effectiveness of the regulation that affects it. This includes four primary types: (1) regulation governing prices of the product; (2) international anti-proliferation protocols; (3) occupational health and safety of nuclear workers; and (4) safety of nuclear power reactors (including source materials, waste, and operations).⁵ Price regulation, being a question of provincial policy, is not discussed in this paper, nor are the international treaties negotiated by the Department of Foreign Affairs. The focus, rather is on those areas of nuclear industry regulation administered by the Atomic Energy Control Board.

While the AECB exercises authority over the various terms and conditions of permits and licenses it issues, the regulations it may design are subject to the approval of the "Governor in Council." The authority of the "Governor in Council" to make regulations is mandated by statute and exercised by the cabinet of the federal government. This guarantees that the AECB does not act independently of the policy directions set by the Government of Canada. It also makes the AECB subject to the same general policies and guidelines as other federal regulating bodies. The reform and administration of these general regulatory policies and guidelines is the focus of this paper.

Introduction

This paper addresses the Government of Canada's perspective on cost-effective regulation. We begin by exploring why regulation is used as a public policy instrument as well as the common problems that all industrialized countries have encountered because of the extensive utilisation of regulation. The principles of regulatory reform which underlie Canada's current federal government strategy – the need for collaborative decision making mechanisms, methods of clear policy evaluation, and well defined lines of accountability – are then examined.

Fiscal constraints, globalization, and accelerated technological change have made the cost-effectiveness of government activities much more critical to the nation. In this paper, specific emphasis is placed on the role of cost-benefit analysis in the process of regulatory assessment, a method which involves systematically identifying, and quantifying where possible, the social benefits and costs associated with alternative public policy actions. We will pay particular attention to three theoretical challenges to valuing costs and benefits in the nuclear energy industry: public risk perception, valuing human life, and measuring environmental benefits.

The flow of the paper is as follows:

- Section I discusses the character of and justification for government regulation;
- Section II considers regulatory reform in the economy, the existing weakness within the system, and the challenges facing the current process of regulatory reform;

⁴ Atomic Energy Control Board, 1995, Page 3

⁵ Nuclear Energy Agency OECD, 1983, Page 38.

- Section III details the aims of Canadian regulatory reform, focusing on the Government of Canada's Regulatory Policy;
- Section IV discusses policy assessment and the usefulness of cost-benefit analysis, highlighting some difficult issues regarding the analysis of nuclear related regulations; and
- a concluding section briefly summarises the main points of the paper.

Section I - Why do governments regulate?

a) The rationale for government intervention

Like expenditure and taxation, regulation is a fundamental tool of public policy. It is used by government decision-makers to address a variety of social and economic issues and affects virtually every aspect of the lives of Canadians. For instance, governments employ regulation:

- to promote health and safety;
- to prevent both unfair competition and unequal access to goods, services and markets;
- to protect common and natural resources and allocate the use of public property; and
- to protect institutions and organizations that are deemed to be culturally or economically important to Canada.⁶

All successful regulation responds to identifiable social or economic problems. Protecting the public interest is the primary motivation for most government regulation. Government intervention for any of the reasons described above (whether by regulation, or by an alternative to regulation) operates by changing the behaviour of the central players in such a way as to reduce the risk and/or social costs associated with the problem being addressed. Regulations are, therefore, often described in terms of the types of behaviour that they seek to change:⁷

- **Economic Regulations** - are set in the context of economic markets and seek to improve efficiency by changing the way firms set prices, introduce new services or products, or deal with competitors. Regulation usually involves such issues as price determination and/or market entry. It may also focus on aspects of the framework within which economic activities are conducted, including competition, contract law, bankruptcy rules, treatment of intellectual property, financial practices, or specific industry activities.
- **Social Regulations** - are set in the context of social issues and often have a cross-cutting impact on the economy. These regulations deal with safety, health, the environment and the quality of life of Canadians. They stem from social values concerning the rights of individuals and groups, and they seek to change the production and distribution conditions under which goods and services are produced, as well as product or service quality.

⁶ Treasury Board Secretariat, 1994, Page 2.

⁷ For further discussion of the definition of regulation, see A. Alexandroff and R. Schultz, 1985 and J. Strick, 1994.

- **Administrative Regulations** - deal with the efficiency of government operations and seek to improve the effectiveness of government actions. These regulations deal with the administration, allocation and collection of government financial resources, with the management of information involving individuals and firms, and with issues of government-private sector relations.

b) A theoretical perspective on what regulation seeks to accomplish

Economists, who have the unnerving tendency to look at all problems as issues of market failure, argue that there is a good rationale for government intervention when "externalities" exist that have not been priced, when there are problems of concentration of market power, or when there is insufficient information available to all market players to make an efficient choice.⁸

In cases of market failure, social costs are passed from identifiable parties to the general public. These costs can be registered in the destruction of public goods (i.e. goods that are not owned explicitly by individuals, e.g. a lake or clean air), or in situations where actions cannot be attributed to a single agent. The social and economic outcomes would not be optimal if those suffering the negative consequences were not compensated, which requires that the responsibility for any compensation costs be imposed on the project decision-makers to induce them to act responsibly. Without government intervention, society's resource allocation decisions would generate too many polluted lakes.

To illustrate the use of regulation to correct problems in the market, ponder what monopoly utilities (such as cable, telephone, or electricity companies) would do with prices if managers had carte blanche to increase profits. Again, the socially optimal outcome would not emerge if prices were set too high, or the supply of goods or services artificially restricted. Competition law is the classic example of government regulation to address this problem. For regulated industries, price-setting boards or provincial government directives perform the same function.⁹

Governments also regulate goods and services, such as drugs, banking operations, securities markets or hazardous consumer products because it is difficult, if not impossible, for average consumers to have adequate, up-front information about the efficacy of every product. Government regulation becomes crucial when the consequences of ignorance in this context are severe, (i.e. trial and error learning about potentially hazardous products is not feasible without creating "excessive risks" to personal health or finances, or the environment).

This economic classification of regulation fits the Canadian nuclear industry well. Consider the safety of radio-pharmaceuticals (a Health Canada responsibility), the protection of workers from

⁸ These ideas can be illustrated with some hypothetical cases involving questions of "externalities":
 • a lake is polluted by a factory's run-off, killing fish, waterfowl, and the local fly-fishing industry; or
 • a wealthy and reputedly risk-loving entrepreneur wants to build an experimental nuclear power plant in a residential neighbourhood.

For a rigorous and informative discussion of the economic rationale for government intervention in the economy, see R. Boadway and D. Wildasin, 1984.

⁹ The Canada Labour Code is arguably intended to serve the same purpose of balancing market power within the labour market.

radiation hazards, nuclear reactor licensing, or the prices of electricity. Each of these areas fits within the previously described framework. For example, the nuclear energy industry involves building and operating reactors that pose a potential risk to the health of the employees, the citizens in the communities they serve, and to the environment in the case of an accident. In addition, such facilities operate in markets with traditionally few competitors because of the excessive capital costs (leading to a local monopoly or oligopoly).

c) A more precise definition of regulation

Before discussing regulation further, it is important to be more precise about what it is. Regulations may be generally defined as government-created rules which modify the behaviour of individuals and firms and which are enforceable through penalties for non-compliance.¹⁰ A regulation describes a set of actions which are required or prohibited and *clearly states the consequences if the rule is not observed*.

This definition implies that it is necessary for the regulator to be able to observe and attribute actions to specific parties. For instance, expanding on the example of the polluted lake,¹¹ in order to correct the pollution problem we may wish to design a regulation to prohibit the dumping of any chemicals into the identified lake, or alternatively to impose a fee for every unit of pollution discharged into the water to fund amelioration of the damages. The penalty for non-compliance might entail the imposition of fines, or even the closure of the offending factory. If there is one lake and one factory, it is relatively easy to link the problematic action, the cost of damages, and to identify control options. If there are two or more factories, the regulator must incorporate the impact of the cumulative actions of multiple actors into the solution strategy. The regulator needs to know who is dumping chemicals and if possible, how much. As stated above, in the ideal case the specifics of the regulation, as designed by the regulator, should reflect the means most likely to correct the behaviour leading to the problem in question.

The next section will present the challenges facing our regulatory system and begin to address why we must amend the last statement to read: *the specifics of regulation should reflect the means mostly likely and affordable to correct the problem in question*.

Section II - Why focus on cost-effective regulation?

a) Is there a need to change the way government regulates?

"We regulate in order to improve public welfare. Yet, ironically, regulations – if ill considered or poorly designed – set our welfare back, by making it much more difficult for business to generate the productivity improvements on which

¹⁰ This is based on the definition employed by the Economic Council of Canada (1979) in their report "Responsible Regulation: An Interim Report" published by the Minister of Supply and Services, Ottawa, Canada. For further detail see W. Stanbury, 1992.

¹¹ Supra note 8.

improvements in our standard of living depend... When regulation is as pervasive in our economy as it now is, bad regulation is something that we cannot afford."

Regulations and Competitiveness, A Report of the House of Commons' Standing Committee on Finance, February 1992¹²

Regulations, however well intentioned, can have significant impacts on Canadian businesses and the economy. It is currently thought that federal regulations annually cost Canadians about \$30 billion (an estimate with a wide margin of error), or the approximate equivalent of one-fifth of federal government budgetary expenditures.¹³ Estimates for 1995-96 place the number of people working in inspection and regulation fields at close to 20,000 and the operating costs of regulatory programs was some \$1.8 billion;¹⁴ these would be substantially larger if the administration of tax regimes were also included.

Regulations can create serious market distortions. For instance, if a regulation makes it difficult for new firms to enter a given market, the resulting barriers to entry will give an advantage to existing firms and may cause resource inefficiencies which ultimately hurt all Canadians. Similarly, regulations which are enforced sporadically or inconsistently can result in strategic firm behaviour to avoid compliance thereby causing further distortions.¹⁵

Since 1978, the page volume of Canadian federal regulations and statutes has approximately doubled to 120 megabytes and 65 megabytes of computer storage respectively. While regulatory inflation (defined simply as the growth of regulation) is not bad in and of itself, it is certainly the case that where regulation has costs that exceed benefits it lowers productivity, lowers the standard of living, costs jobs, and also increase mortality and morbidity.¹⁶

It should be acknowledged that much federal regulation uses detailed, prescriptive language which can quickly become outdated and inflexible to the demands of rapid technology change, or to changes in the economy. Inflexible regulation limits innovation and poses a disincentive to research and development in Canada. For example, in the late 1980s, the rigorous technical standards in regulation pertaining to the safety of baby cribs were not sufficiently flexible to allow for an innovation for wheelchair-using parents. A new design, which met the safety goals, would have allowed the crib's side panel to slip underneath the crib bed without disassembly. Regulators did not anticipate this innovation, resulting in a significant delay in the introduction of an invention which would have enhanced both child safety and the quality of life for disabled parents.

Regulatory reform is necessary to address such weaknesses in our current regulatory regime.

¹² Treasury Board Secretariat, 1993, Page 1.

¹³ Based on an extrapolation of Thomas Hopkin's estimate in the cost of regulation in the United States of America found in "The Cost of Regulation", 1992.

¹⁴ Treasury Board of Canada data available from the authors. See also Stanbury, 1992, Page 23A:15 for earlier estimates.

¹⁵ See J.T. Scholtz, 1984; J.V. Rees, 1988.

¹⁶ For further discussion, see Treasury Board Secretariat, "Tackling Regulatory Inflation: The Canadian Approach", 1995.

b) What external challenges are driving regulatory reform?

In addition to these weaknesses in our regulatory system, there are a number of new challenges arising from the growth of technology and the continued opening of international markets. The 1992 government response to a parliamentary committee report, *Regulations and Competitiveness*, identified the following key challenges facing Canada:

- an increasingly global market place in which business survival depends on timeliness and quality;
- the difficult fiscal situation facing all governments;
- increasing concerns about internal trade barriers;
- a rapid pace of technological change;
- a public that is cognisant of health and environmental issues; and
- more sophisticated business and labour communities.¹⁷

Perhaps the most consistently identified motivator for reform for all aspects of government systems is the attention to fiscal constraints and debt obligations. Revenue generation through escalating taxes has little support among citizen-taxpayers. Increasingly, political rhetoric at all levels focuses on the need to find efficiencies and to re-evaluate spending priorities. The cumulative cost of regulation on citizens and businesses requires a thorough assessment.

As a federation, Canada faces the additional challenge of co-ordinating regulatory actions across the federal government and between levels of government. Geographic, linguistic, and political differences between provinces complicate any attempt to reduce overlap and duplication of programs that have become thoroughly entrenched in the political and legal systems. Indeed, Canadians have shown considerable interest in not rationalising the roles between governments, while insisting that we co-operate better.¹⁸ Ten provincial authorities and the federal government operating in closely related fields adds unnecessary bureaucracy to the regulatory process, results in barriers to internal trade, and may seriously threaten Canadian competitiveness.

Internationally, competitiveness is a central theme of discussions on regulatory reform. Capital and information mobility feed globalization, and this in turn has focused attention on the need for governments to consider new approaches to achieving their regulatory goals. The majority of OECD member nations now have reform programs in place. For many, the strategic issue is how to better manage regulatory systems, in some cases, built up through decades of piecemeal action. There is also the international movement toward eliminating barriers to trade (both the WTO and NAFTA contain obligations to avoid erecting barriers) which increases pressure to break down regulations that favour domestic firms.¹⁹ As a trading nation, Canada has an interest in positioning itself as a country with a sensible regulatory regime. To this end, Canada participated

¹⁷ Treasury Board Secretariat, 1993, Pages 1-2.

¹⁸ This can be evidenced in the many rounds of constitutional negotiations which have taken place over the past two decades, none of which have laid to rest the shape of the Canadian federation. This experience seems to confirm the familiar refrain that Canadians (and their political leaders) know they want something different from government; they just don't know what it is that they want.

¹⁹ See, e.g.: J. Braitewaite, 1993; or T.J. Weiler, "What Colour is Your Margarine?" [unpublished] available through Internet URL: <http://www.cyberus.ca/~tweiler/papers.html>.

in the design of the 1995 *OECD Recommendation on Improving the Quality of Government Regulations*,²⁰ the first international standard on regulatory quality.

Regulatory reform is necessary to address the new challenges facing the Canadian regulatory regime.

Having identified the significant challenges facing the Canadian system, we will turn to the Government of Canada's perspective on cost-effective regulation and how we combine the notions of behavioural change or regulatory compliance and concern about the cost of the implementation of regulations.

Section III - What is cost-effective regulation, and what is the Government of Canada's perspective on it?

a) First and foremost – a compliance focus

Regulators are asked to take a compliance-oriented approach in thinking about programs. Why? Because that is what regulating is all about. It is not about criminal behaviour, by and large;²¹ it is not about the number of enforcement actions taken in any given period. Regulation is about getting Canadians (and others affected) to act in the public interest and to avoid certain otherwise perfectly legal behaviours leading to unsatisfactory results. The main criteria for assessing whether a regulation had the desired impact is to determine whether in fact regulatees complied with the regulatory requirements, and were able to do so at reasonable cost.

Regulators are encouraged to focus on those factors and conditions conducive to promoting compliance, and then to select the most cost-effective mix of tools to enforce or to encourage compliance.²² As alluded to in the description of regulation,²³ effective regulations are those that are carefully designed to address a specific problem. A broad degree of consensus among regulators, regulatees and other affected parties on how to frame regulatory issues and objectives will lead to "smarter regulation" – where regulation is indeed the appropriate response. A good consensus should result in higher compliance rates and the realisation of higher social gains.

Regulatees are more likely to comply with the rules if they:²⁴

1. perceive rules to be fair;²⁵

²⁰ See Appendix A.

²¹ See, generally: L.S. Fairbairn, 1993.

²² *Infra* note 32.

²³ *Supra* note 11.

²⁴ Based on a study conducted by D. Millar entitled *Psychological Factors Influencing Compliance* (a Study for the Federal Statutes Compliance Project) 1985.

²⁵ For example, by having regulatees participate in rule formation; getting consensus on the goals for regulatory systems; ensuring regulatees agree that rules will be effective; building in flexibility to allow regulatees to achieve goals in alternative ways; providing clear and feasible direction; being sensitive to differences in context; and ensuring equal impact of rules on regulatees.

2. perceive enforcement and monitoring of rules to be fair;²⁶
3. have good knowledge of the rules;²⁷
4. are committed to rules;²⁸
5. feel personally responsible for compliance; and
6. believe there are benefits for compliance and costs for non-compliance.

Second, regulators can promote compliance by developing and maintaining effective relationships with regulatees. Regulators will be able to affect regulatees' behaviour if regulatees feel that they are active participants in the regulatory process and not the recipient of a series of "command and control" dictates from a regulatory body unresponsive to the concerns of the industry.²⁹

b) Cost-effective regulation is regulation which meets the Government of Canada's Regulatory Policy

Regulatory reform in Canada, as a response to identified weaknesses and new challenges, has manifested itself in a strategy for "regulating smarter".³⁰ Recognising that managing risks on behalf of the Canadian public and allocating rents through intervention in the economy are complex tasks and important responsibilities, the Treasury Board Secretariat has adopted policies to promote good governance across government departments. Consistent with the principles of the 1995 *OECD Recommendation on Improving the Quality of Government Regulation*,³¹ the Canadian regulatory reform strategy endeavours to promote decision-making and policy design concordant with democratic principles. This approach has dialogue with affected parties and the public as its corner stone, and is centred on openness, transparency and political accountability, with an additional emphasis on effective analysis of the impacts of regulatory proposals.

The objective of the Government of Canada's Regulatory Policy is to ensure that the use of the government's regulatory powers results in the greatest net benefit to Canadian society, in other words, cost-effective regulation.³² When regulating, authorities must ensure that they comply with six general policy requirements:

1. A problem or risk exists, federal government intervention is justified and regulation is the best alternative.
2. Canadians are consulted, and they have the opportunity to participate in developing or modifying regulations and regulatory programs.
3. The benefits outweigh the costs to Canadians, their governments and businesses, and in managing risks, resources are used where they do the most good.

²⁶ For example, by treating regulatees consistently; being sensitive to regulatees' motives; reacting appropriately to violations according to their seriousness; and take into account the record of compliance.

²⁷ This requires regulatees to be educated in regard to not just the rules, but the underlying rationale. Also they have to know how well they have complied with requirements.

²⁸ Regulators can work towards this by having regulatees participate in rule development; getting them to publicly commit to following the rules; encouraging self-regulatory behaviour (i.e. they take on personal responsibility); ensuring regulatees are aware of their level of compliance; and ensuring there is some stigma to non-compliance.

²⁹ See, generally: B. Mannix, 1994.

³⁰ See J. K. Martin, 1995.

³¹ Ibid., J. K. Martin 1995.

³² Treasury Board Secretariat, "Regulatory Policy 1995", November 1995.

4. Adverse impacts on the capacity of the economy to generate wealth and employment are minimized and no unnecessary regulatory burden is imposed.
 - information and administrative requirements are limited and imposed costs are as low as possible;
 - the special circumstances of small business are considered; and
 - parties proposing equivalent means to conform with regulatory requirements are given positive consideration.
5. Intergovernmental agreements are respected and full advantage is taken of opportunities for co-ordination with other governments and agencies.
6. Systems are in place to manage resources effectively. In particular to ensure that:
 - the Regulatory Process Management Standards are followed;
 - compliance and enforcement policies are articulated, as appropriate; and
 - resources have been approved and are adequate to discharge enforcement responsibilities effectively and to ensure compliance where the regulation binds the government.

In other words, cost-effective regulation is regulation which is flexible, focused on ends rather than means, focused on high priority problems, based on a partnership model (with other governments and regulatees), and is the result of an open and transparent development process. Furthermore, it is regulation where the overall benefits clearly exceed the costs.

c) Costs matter

Despite the fact most recognise we are in a period of fiscal constraint and global competition, it is probably worth stating the obvious, namely that costs do matter. Regulatory programs are established to meet goals (usually quite generally stated) established by Parliament. In the desire to act in the public interest, it is easy for public officials to fall into the trap of focusing only on the benefits in the specific area covered by the legislation being administered. This is a problem because, in a society and economy with limited resources, *there are always trade-offs* to be made. Resources, whether government or private sector, used to address one problem cannot be used elsewhere.

It is critical that we, as regulators, remind ourselves that the most important factor behind a healthy population is income and wealth. There is a well established correlation between income and health, that is, members of wealthier societies have longer life spans.³³ By allocating large amounts of public funds to risk reduction in one field we may be inadvertently raising the risks in another. For example, eliminating certain pesticides may reduce the number of related cases of cancer associated with that product, but the action may cause lower yields, higher prices and

³³ Wildavsky, 1980 argues that it is economic growth and not government intervention that plays the most important role in improving life expectancy and health. Hadley and Osei, 1992 using US census data determine that the relationship between income and mortality expressed as the income elasticity, that is a change in mortality from all sources related to changes in income, can be stated as a 1% change in income reduces mortality by approximately 0.05% on the average. Huber 1984, Page 37, states "for a forty-five year old man working in manufacturing, a 15 % increase in income has about the same risk-reducing value as eliminating all hazards - every one of them in the work place...It appears that money is the ultimate transferable safety permit, and...finally, if wealth is so important in the risk market, perhaps we should be less quick to accept unnecessarily expensive risk control strategies."

ultimately poorer health in those who can no longer afford the higher priced food stuffs. Likewise, spending several million dollars on an aspect of a nuclear safety system that will further reduce an already infinitesimally small risk of a mishap may divert funds from activities with a higher return to national wealth and thus national health. Viscusi estimates that in the USA regulations that cost \$30 million to \$70 million (US) per life saved will have a net adverse effect on mortality because of the offsetting increases in risks created by these expenditures.³⁴

Our counterparts in the US Government Office of Management and Budget believe that the range is somewhat lower in keeping with the earlier work of Keeney, who has developed a model for estimating the number of fatalities by induced expenditures or costs related to costly regulations and programs designed to save lives.³⁵ Keeney estimates that for every \$7 million (US) in cost, there is a statistical death. Moreover, Keeney estimates that, given the presence of income level inequalities, a loss of disposable income of \$100 leads to an increase in the annual risk to individuals in low income classifications (<\$5,000) by a factor of approximately 200% over that of the higher income classification (>\$40,000).

Looking at risks from the perspective of cost per life saved shows wide discrepancies. For instance, the Office of Management and Budget has found that the range is \$0.07 million to \$132 million (US)³⁶ for regulatory initiatives in the USA. The Harvard School of Public Health has estimated, on the basis of their work on some 200 life saving government interventions (designed to advance human health), that an additional 60,000 people could be saved each year if resources were simply allocated to the more cost-effective interventions. Alternatively, the USA could save upwards of \$31 billion per year while saving the same number of lives it does presently.³⁷

The bottom line is that regulation which is not cost-effective is a killer.

Section IV - What is the role of cost-benefit analysis in ensuring cost-effective regulation?

a) Cost-benefit analysis

Cost-benefit analysis (CBA) is a process of identifying and quantifying, where possible, the costs and benefits associated with a particular policy proposal. A cost-benefit analysis "enables decision makers to determine if a project (in this case a regulatory proposal) is justifiable, serves to identify marginally valid proposals, and serves to weed out undesirable or non-economic proposals where costs to society may exceed benefits."³⁸

³⁴ W. K. Viscusi, 1994, Page 94.

³⁵ Keeney, 1990.

³⁶ Table 1, "Risk-cost Trade-offs For Selected Regulations, Page 36 of the "Regulatory Program of the United States Government" (1988-1989) states regulation regarding unvented space heaters is thought to cost \$70,000 per statistical life saved while regulation regarding a DES ban in cattle feed costs \$132,000,000 per statistical life saved.

³⁷ Harvard School of Public Health, March, 1995, Page 15-16.

³⁸ J. Strick, 1994, Page 12.

To perform a CBA, one must begin with a well defined action proposal. This action is then systematically appraised to determine the direct and indirect benefits and costs associated with its implementation. The practitioner will ask a series of questions:

- what are the costs/benefits;
- to whom do the costs/benefits accrue;
- over what time frame do the costs/benefits extend;
- where do the costs/benefits occur geographically; and
- in what form will the costs/benefits be realised?

Undertaking a good CBA is not a trivial task. Regulators are often plagued by lack of information on impacts, lack of good risk probabilities, unquantifiable benefits and costs, and difficult policy issues. Consider just some of the questions regulators have to cope with on a day-to-day basis: what is the value of pristine air; what is the value of fair and equitable treatment of individuals; what value has national unity; and how should one take into account the obviously real "public discomfort" about risks they may well have grossly over-estimated? Moreover, the distribution of costs and benefits does matter, which places regulatory decisions directly in the middle of value judgements.

Despite such difficulties, the CBA is required by the Government's Regulatory Policy for good reason. It is only through this logical process that regulators can know whether they are acting in the public interest (as difficult as that may be to define at times). Actions imposing restrictions on the behaviour of citizens should be undertaken only in a considered fashion, and in the public interest, properly construed.

b) The CBA is as much a process as a quantitative methodology

The CBA in Canada's regulatory system cannot be accomplished strictly in offices in Ottawa. Analysis must be "reality-checked" and generally much of the benefit and cost information must come from the regulated community. The CBA also provides a framework for discussion with regulatees which, if done well, will ultimately promote their acceptance of the implemented solution. Indeed, the Regulatory Policy now mandates the use of the *Business Impact Test*³⁹ when major regulatory proposals will affect business operations. In essence, however, this boils down to a requirement that regulatory authorities engage in an explicit dialogue regarding the impact of regulatory proposals on business operations.

In addition, a CBA advances the regulatory reform's goals of transparency, openness and political accountability because:

- requiring departments to use objective, rational criteria to assess policy increases transparency and openness as a cost-benefit assessment can be performed by any practitioner familiar with the concepts; and

³⁹ This is a mechanism, facilitated by computer software, whereby a regulator engages in full consultation with potential regulatory stakeholders. See: Treasury Board Secretariat, "Using the Business Impact Test Effectively", 1995.

- cost-benefit estimates will affect political accountability since they can be drawn on in the appraisal of implemented programs. A formal evaluation, once a regulation is in place, will determine if departments correctly anticipated the impacts of their programs on jobs, markets and individuals in their CBA.

c) Issues in CBA for nuclear regulation

As the Treasury Board publication *Benefit-Cost Analysis Guide for Regulatory Programs* (1995) indicates, there is a significant difference between saying that something could go wrong and knowing that it will go wrong.⁴⁰

Canadians face a multitude of risks everyday: reckless driving, natural disasters, crime, or even a nuclear accident. Government, through its agencies, can be effective in reducing certain types of risks and, as a general principle, it is reasonable to reduce risks until such time as the costs are greater than the benefits from doing so. But accomplishing this ideal in the context of the regulation of the nuclear industry entails unique problems – problems which vary markedly with the type of regulation.

First, the area of occupational safety and health (OSH) is by far the easiest to tackle conceptually because its regulation is undertaken with a reasonable degree of certainty regarding the risk probabilities, and because the practical issues fall into relatively well-known territory. That is, there is little conceptual difference between OSH nuclear regulation and regulation against more "classical" OSH risk situations. However, there remains challenges associated with determination of the long term effects of exposure (e.g. new evidence leading to consideration of tightening exposure limits).⁴¹ Also, the inevitable trade-offs of cost versus morbidity and mortality are always difficult to address.

The second area is much more difficult: namely, the regulation of nuclear reactor and waste safety. Obvious problems include the degree of technical difficulty in formulating risk assessments (complex interactive systems and the human factor make it next to impossible to identify and quantify all possible risk scenarios), the limited evidence available from accidents to formulate overall risk assessments (although the probability of catastrophes is obviously low), and the difficulty in assessing the benefits associated with disaster prevention. Approaches such as ALARA (as low as reasonably achievable), which is the prevailing philosophy underlying nuclear reactor regulation in North America,⁴² are fairly easy to explain but rather difficult to implement.

⁴⁰ Treasury Board Secretariat, "Benefit-Cost Analysis Guide for Regulatory Programs", 1995, Page 73.

⁴¹ The Atomic Energy Board of Canada has included the Radiation Protection Regulations, (AECB/92-4-1), as an initiative in the 1996 Federal Regulatory Plan thereby indicating its intention to make changes to radiation exposure limits. The initiative states that it "will bring Canadian regulations into line with the latest recommendations of the International Commission on Radiological Protection (ICRP). Review and analysis by the Commission of recent information on the health effects of radiation have indicated that radiation dose limits should be lowered." (Page 230)

⁴² D. Okrent, 1987.

i) Risk Perception by the Public

We will now turn to a more systematic review of the issues. Dr. C.E.S. Franks has observed that "no major modern industry began with such hopes as nuclear energy, and no major industry has engendered such great fears."⁴³

As risk is a constant feature of people's lives, we are continually making risk assessments. We are bombarded with information, much of it contradictory, which we must sort through in making our daily decisions. For instance, fire retardant fabrics reduce the risk of injury but fire retardants are thought to be carcinogenic. Alcohol is constantly targeted as dangerous to one's health but moderate consumption is linked with positive health benefits and indeed red wine has been linked to a reduction in the risk of heart attacks.⁴⁴ In addition, public perception of risk can vary quite dramatically from risks as they are measured. An example is air travel versus automobile travel. Few individuals realise that the most important risk consideration when flying on a reputable airline is not how many kilometres are travelled but how many times the aircraft takes off and lands. By focusing on accidents per air mile travelled, air travel appears astoundingly safe in comparison to automobile travel. Nonetheless, studies show that riding in a car with a safe driver on good highways in good weather is actually statistically safer than an airline flight if one is travelling a distance less than 750 km.⁴⁵

When individuals are well informed and take on risk voluntarily there is little reason for the government to intervene. In fact, there is evidence to suggest that individuals will adjust their behaviour in the face of government risk reduction programs in such a way that the level of risk reduction is less than targeted. This theory (risk homeostasis theory may be considered a psychological equivalent of rational expectations theory in economics) implies, for instance, that car safety improvements will encourage drivers to take more chances and the number of accidents will tend to remain relatively constant.⁴⁶ If the public is not well informed about levels of risk involving situations where risks are assumed voluntarily, there could in fact be an increase in accidents (e.g. child-resistant package and poisonings), a substantial decrease (e.g. the temporary reduction in accidents when Sweden changed to left-hand drive cars from right-hand drive – the rates went back to normal once everyone figured out that safety had not in fact been compromised), or no change at all (e.g. ABS brakes do not affect the accident rate). This has important implications in the design of both OSH regulation – which depends to a considerable degree on worker and management behaviour – and for nuclear safety regulation which has to cope with the "human factor" in regulating operating procedures.

In the nuclear OSH area, science, the education of workers and management, and smart regulation can combine to provide cost-effective programs as they have in other OSH areas. While, as with most OSH areas, "engineering" solutions will normally be preferred to "behavioural" solutions (e.g. minimal exposure built into the workplace as opposed to protective

⁴³ C.E.S. Franks, 1985, Page 1.

⁴⁴ L. Laudin, 1994, Page 135.

⁴⁵ Ibid. Laudin, 1994, Page 58.

⁴⁶ G. J. S. Wilde, 1994.

equipment), both workers and management must assume a significant amount of the responsibility for ensuring a safe working environment. Attitude and knowledge count for a lot.

Situations in which risk is imposed on the public in an involuntary manner justify government involvement to protect the public interest. Where citizens' perceptions of risk differ widely from technical estimates, governments may face pressure from two potentially irreconcilable positions, the concerned public and the industry expert.⁴⁷ Indeed, there is good evidence that the public systematically over-estimates small likelihood occurrences, and under-estimates high probability events.⁴⁸ More importantly, however, there is evidence that the public thinks not so much in terms of risk probabilities, but rather in terms of potential "hazard" (i.e. negative consequences).⁴⁹ These observations are particularly poignant for nuclear reactor safety, where the likelihood of catastrophe is extremely low but the potential consequences enormous.

The public, of course, will not be concerned only about a catastrophe like Chernobyl but also with overly complex and worrisome issues such as the long term hazards associated with fission waste products, or the threat of terrorism.

Finally, communication is particularly difficult because of the lack of good science education in Canada and a healthy scepticism over whether scientists, engineers, or economists like ourselves actually know what we are talking about.⁵⁰

All this is to say that a classic CBA will always be a much easier task in the OSH area, and a real challenge for both industry and the regulating body when addressing the risks to the public associated with nuclear technology. The reality is, of course, that trade-offs are made in nuclear reactor safety, and should be made, to ensure that society's resources are put to the best possible use in reducing the risks they are subject to.

To place things in perspective, it is perhaps useful to consider that the probability of a large asteroid striking the earth and doing considerable damage sometime during our lifetime is estimated to be in the order of 1 in 3125.⁵¹ Since society has devoted close to no resources to that particular risk, it may be telling us something about society's consistency in addressing the risk-cost trade-off for catastrophes.

ii) The Value of Life

Most people would agree that the protection of life is a goal worthy of public investment. We often hear individuals arguing that as long as one life is saved by a public program then the cost is justified, no matter how great. However, is it reasonable to argue that we should spend money

⁴⁷ See, generally: B. Evanson, 1995; P.K. Howard, 1994; R.A. Kagan, 1989 citing L.M. Friedman, *Total Justice*, New York, Russell Sage Foundation, 1985; A. Painter, 1992; P. Slovic, 1987.

⁴⁸ *Ibid.* P. Slovic, 1987. See also S. Breyer, 1993.

⁴⁹ *Ibid.*

⁵⁰ A 1994 study conducted by Optima consultants to investigate consumer interest in the biotechnology industry found that education was one of the most influential variables affecting the public's attitudes on biotechnology. Similar evidence demonstrating a divergence between expert opinions and that of the public can be found in P. Slovic, 1987.

⁵¹ L. Laudan, 1994, Page 142. Calculation based on the assumption of an eighty year average life span.

for as long as lives can be saved? Risk of death can never be reduced to zero and such a position implies that society ought to spend all its resources on reducing risk of death. This is obviously not viable. Public policy makers are left in the precarious position of having to determine the appropriate level of investment in risk reduction.

Several recent studies have begun to lay out a framework and establish principles for managing risks in the public interest.⁵² Keeney asserts that "it is a fact that economic costs and risk of loss of life must be traded off in many risk problems. It is not unethical to trade off economic costs and risk of loss of life."⁵³ In fact, Thoreau states in 1852 that "the cost of a thing is the amount of what I will call life which is required to be exchanged for it, immediately or in the long run".⁵⁴

Valuing human life is a controversial aspect of the analytical approach to policy assessment. It is true, however, that life is finite and certain conditions may prematurely end it. There are a variety of estimation techniques that one may employ to assess this value. Obviously the value of one's life to oneself is extremely high (however, it is demonstrably not infinite as illustrated by the research behind the risk homeostasis theory, or simply observation of human behaviour). The question of interest to social scientists is what is the value consistent with the behaviour of typical individuals. Mishan (1971) suggests four methods that one might employ to attain a monetary estimate of the value of a human life:

1. Estimate the present discounted value of a deceased individual's expected future earnings.
2. Estimate the present discounted value of the losses to others of a deceased individual.
3. Use the average government spending per life saved on past public decisions involving risk.
4. Calculate the value of the premium a worker is willing to accept to compensate for increased risk as a measure of their own value of life estimation.⁵⁵

The first three of the above methods focus on certain or identified lives. The researcher has to be able to target the exact individual at risk. Current thinking in risk literature has moved away from discussions of preventing the death of identified individuals to reducing the statistical probability of death to large numbers of people or saving statistical lives. As in method four above, the basis for this approach is the valuation that individuals place on small risks of death. Since statistical lives involve small risks and are nameless, it is understandable that estimates of the value of a statistical life are usually lower than that of an identified life.⁵⁶ In addition, there are contingent valuation techniques to estimate how much people are willing to pay for additional safety features, and how much one would charge to give up safety features of products purchased. The most widely used procedure for estimating the value of a statistical life is to pair workers' occupational classifications to a measure of risk using statistical data on fatalities collected through insurance sources or statistical gathering organizations.⁵⁷

⁵² See JCHS, 1993; Nathwani and Narveson, 1995; Keeney, 1995; and Tengs 1995.

⁵³ Keeney, 1995.

⁵⁴ Nathwani, et al 1996 develops this point. One may wish to consider life as a measure of things or as an economist would express it, lifetime is made the numerator for risk of loss of life. This implies that if we are able to budget a fraction of available resources to the improvement of the quality of life through improved regulation and safety improvements, then the challenge to decision-makers is to develop regulations that use the least resources for the largest public gain.

⁵⁵ E. J. Mishan, 1971.

⁵⁶ For further discussion see W. K. Viscusi, 1992.

⁵⁷ Ibid. Mishan, 1971.

Not surprisingly different techniques result in different estimates for a statistical value for a life. Indeed, different studies using the same techniques result in different estimates, depending on the period and data source analysed. However, the results usually fall into a range of some \$3 million to \$7 million (US).⁵⁸ Interestingly, if one devoted the entire Canadian GDP to saving the lives of all those who will die this year, only about \$3.7 million per death could be spent.⁵⁹

There is no single number for the value of a statistical life that could ever be fully justified, of course, so analysts normally use a range to see if their regulation makes sense. There is no Government of Canada policy on the issue, but we normally recommend performing a sensitivity analysis using \$3, \$5 and \$10 million as the value. It should be noted in passing that this range covers the level Viscusi recommends \$7 million (US) to ensure "conservative" decisions.

Victim identifiability and the catastrophic nature of events are important considerations when using any number as an estimate of the "value of statistical lives." First, the public usually values identifiable victims higher than the estimates for statistical lives.⁶⁰ In the context of nuclear reactor safety, that translates into using significantly higher values when considering the potential impact of catastrophes on identifiable communities. Similarly, experiments have shown that people systematically assign higher values when more people are involved. To see that this is the case, simply consider media reports on plane crashes. Even though they represent a minimal threat in comparison to the number of people who die in large numbers (but normally few at a time) in car accidents, they receive considerably more attention. For nuclear safety, if the public thinks that a large catastrophe will potentially kill large numbers of people, then they will think it is appropriate to devote considerably more resources to safety measures than one might expect on the basis of the low probabilities involved. Personally, we believe that typical people show considerable wisdom in this matter, an area not well explained by theoretical models of economic man.

One implication to note, however, is that if this analysis is reflected in decision-making then the dollars per life saved on nuclear reactor safety will be greater than the dollars per life saved in the OSH area. Unfortunately, there have been few studies from which to obtain any reasonable range of values to use for analysing the benefits for avoiding catastrophic events, or at least one which appears to reflect social values.

When these difficulties are combined with the genuinely difficult task of estimating the overall risk reduction associated with any particular action, it becomes clear that we cannot turn such decision-making over to a computer – deciding to do X because it had the highest expected benefit-cost ratio. Frankly, the benefit and risk calculations will usually have too much

⁵⁸ W. K. Viscusi, 1992, Pages 51-74.

⁵⁹ This estimate is derived by dividing an estimate of the gross domestic product for the nation by the number of estimated deaths expected to occur in Canada in a one year period. These numbers are reported annually by Statistics Canada.

⁶⁰ This is due to what S. Breyer, 1993 identifies as the "ethics aspect." The author explains that "the strength of our feelings of ethical obligation seems to diminish with distance. That is to say, feelings of obligation are stronger (or we have different, more time-consuming obligations) toward family, neighbours, friends, community and those with whom we have direct contact, those whom we see, than toward those who live in distant places, whom we do not see but only read or hear about." (Page 36)

uncertainty built into them to use formal optimisation techniques. However, everyday judgements must be made whether a particular action is warranted. And costs do matter as indicated earlier. Perhaps the "test" for regulator and regulatee alike must be whether, if something did go wrong, they would still argue that, even with the aid of hindsight, they had made the right decision given the available information.

iii) Measuring Environmental Benefits

Environmental considerations for project approval by government have received increasing attention in recent years. Environmental assessments are targeted at studying project impacts prior to implementation. Unlike investigations in the occupational health and safety areas where probabilistic data does exist for the majority of work related diseases and accident risks, environmental benefits/risks are not widely available for theoretical and practical reasons.

From a theoretical perspective, it is unclear how one should appropriately value the loss to society of potentially negative environmental impacts. How does one value the loss of species or an ecosystem? How do we begin to anticipate the loss to society of reductions in biodiversity? What are the implications of major environmental damages? And at a more fundamental level of questioning, is there sufficient evidence to accurately predict what these damages will be?

This issue is particularly significant for the atomic energy industry because the scope of potential damage of a catastrophic accident are severe. Economists have, with some success, attempted to value environmental resources using variants of the willingness-to-pay approach. However, such an approach has serious limitation when the magnitude of impacts is large. It is not obvious that the value that society is willing to pay to preserve a million acres of forest is one million times what it will pay to save an acre of virgin timber from destruction (that is, based on a purely linear extrapolation). If we were analysing an incident that would affect most of New Brunswick, the figure one arrives at by adding up property values, lost species and resource values, is not likely to reach what we would be willing to pay to prevent the loss of the whole province at once. In other words, size of losses matter or the whole is greater than the sum of the parts.

In addition, we must consider timing and the implications for intergenerational impacts (from a distributional point of view, who is bearing risks and the potential for future costs?). The benefits of nuclear power are concentrated in current generations, that is over the life of the reactor. Yet, future generations should also benefit from reduced environmental impact of this method of electricity generation, compared to more environmentally destructive means. However, the risk of environmental damages are also borne by future generations who will inherit any long lasting damages associated with waste storage, and they will certainly inherit the responsibility for managing that waste.

It should be noted in passing that some argue that the impacts on future generations should not be "discounted" to present value terms (i.e. the principle that a dollar tomorrow is worth less than a dollar today).⁶¹ Unfortunately such ideas are simply wrong since the timing of any statistical lives

⁶¹ Cropper, et al 1993 observe that discounting is an empirical fact that is reflected in the answers people give when asked how much they would pay to save a life at a future date compared to one now. People discount future risks at the same

saved or costs avoided are important. There is a momentous difference between saving 3 billion lives today and 1 life every year over an infinite time horizon. The latter is a larger number than the former but no one is going to choose it as a policy option, nor should they. Discounting, by the way, is quite consistent with principles of sustainable development that have been endorsed by the Government of Canada and reflected in the *Canadian Environmental Assessment Act* which affects nuclear safety decision-making.⁶²

In practical terms, the investigation of environmental impacts is expensive and time consuming. The distribution of benefits is not well known, benefits are difficult to measure in the first place, and there is a great deal of uncertainty. And while our information is often incomplete, public policy decisions need to be made. The case of nuclear issues is complicated by the fact that the probabilities of mishaps are extremely small, sometimes approaching zero but the costs of such an accident are correspondingly extremely large.

It is necessary for regulators, the public and the industry to confront these issues, taking advantage of the existing relevant literature which helps us to conceptualise them. At the end of the day, we require a realistic and considered decision-making process and sound human judgement. Exact specification of costs and benefits is not exhaustive and one needs to be satisfied with "sensible," open and transparent decision-making procedures instead of mathematical certainty. In short, we develop processes that allow us to make the best decisions we can. These involve consultation and information sharing to facilitate the development of a reasonable degree of consensus. This approach is captured in the Treasury Board's Regulatory Policy, and what we mean by cost-effective regulation.

Section V - Conclusions

This paper has examined some of the issues of regulation that affect the nuclear industry in Canada. Central to our discussion, was the argument that the development of cost-effective regulation involves a clear, coherent approach to assessing alternative courses of action in an open and transparent process. This assessment process, completed in the development of any regulation, must involve the regulatees and other affected parties to ensure acceptance of the inevitable trade-offs. Cost-benefit analysis, as a formal methodology, will be the easiest to implement, and in all likelihood the most successfully employed, in the area of occupational safety and health.

However, even with respect to nuclear reactor safety regulation, questions of costs and benefits must be identified and addressed. The inherent difficulties in valuing the safety or environmental benefits of a regulatory decision does not mean that trade-offs will not occur – only that they will not be as deliberate as all of us might like them to be.

rate as money. Keeney 1995, goes on to assert that discounting future loss of life "does not imply that we value future lives less than our own" but instead is a responsible and logical way to treat all lives regardless of time of occurrence.

⁶² S.C. 1992, c. 37, s. 2.

Annex A

OECD Regulatory Checklist

The following checklist can be used to evaluate the quality of both proposed and existing regulations:

1. Is the Problem correctly identified?
2. Is government action justified?
3. Is regulation the best form of government action?
4. Is there a legal basis for regulation?
5. What is the appropriate level (or levels) of government for this action?
6. Do the benefits of regulation justify the costs?
7. Is the distribution of effects across society transparent?
8. Is the regulation clear, consistent, comprehensible, and accessible to users?
9. Have all interested parties had the opportunity to present their views?
10. How will compliance be achieved?

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