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**SCIENTIFIC ADVICE IN GOVERNMENT DECISION-MAKING**

**THE CANADIAN EXPERIENCE**

**IC**

**A Report In Support of the Work of the  
Council of Science and Technology Advisors**

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**Project Team**

Janet E. Halliwell, JEH Associates Inc.

William Smith, University of Auckland

In Association with

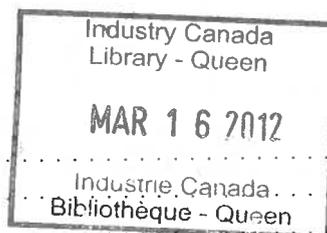
Martin Walmsley

And Acknowledgment of the Contributions of  
Guy Steed

JEH Associates Inc., 62 Rothwell Drive, Gloucester, Ontario K1J 7G6

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## Abstract

Widespread controversies over fish stocks, tainted blood and rBST highlight the interplay of science and political culture. They underscore the fact that policy decisions often are taken with uncertain scientific knowledge and either implicit or explicit consideration of social, economic, environmental, legal and ethical risks and benefits. Policy options are identified and broader implications are considered in a risk assessment/management process that builds on and goes beyond science.

The use of credible science is a well established and important part of decision-making within government at both federal and provincial levels. Understandably, how science is used and integrated into decision-making and policy takes different forms at different levels of government and in response to different needs. Program Review (1995), budget constraints, and recent and ongoing controversies in public policy have triggered widespread debates and active examination of policies and procedures for the use of science in decision-making.

Other countries are having similar debates. They are exploring options to ensure the credibility and refine the use of science in government decision-making. Underlying these debates are three fundamental concerns - public confidence in the science decision-making process; the tension between the opportunities opened by science and their acceptability in the face of prevailing social values; and the role of science as a public good.

Addressing these concerns requires a series of initiatives to redefine the environment in which science is used for policy and to improve the mechanisms, processes and risk communication involved in science-based decision-making. A shift towards a more open debate on those broad issues of public concern which have a strong science component and large social and economic implications would provide a powerful underpinning and be fully in line with international experiences in addressing such concerns.

### *Strengthening the Process*

The development and implementation of a set of science advice guidelines for use in policy making is important to support and strengthen existing practices. This will require active promotion and communication of science guidelines within the government system, as well as the explicit identification of individuals responsible for their implementation within departments and agencies. An adequate system of monitoring the implementation will be necessary.

There is a high degree of support within the Canadian federal system for an approach similar to the principles and guidelines articulated by Sir Robert May for use in the UK. They focus on the early identification of issues for which scientific advice will be needed, how sound science is integrated into the decision-making process and the importance of openness in the interpretation of scientific evidence. Effective processes in each of these three areas are particularly important where government decisions relate to policies drawing on science with a significant degree of

uncertainty or where conflicting opinions are strongly held.

Guidelines benefit from being applied at the highest level of decision-making. One way to do this in Canada would be to require a check off on any Memorandum to Cabinet (MC) with some science component to acknowledge the use of the science guidelines in the formulation of that advice.

### *Clarifying the Policy Context for Science Advice in Government*

There is concern with the capacity to integrate science advice with government decision-making. Two issues arise. First, the purpose of in-house science, as either source or recipient of the science for science advice, is undermined in the absence of a well-defined client (and hence a well-defined demand). Secondly, there is a major cultural clash between science and policy within many departments. Among the means of addressing the first issue would be to extend the existing requirements for Annual S&T Outlooks and Performance Reports to include a stronger articulation of the linkage between a department's research strategy and its policy responsibilities. These policy responsibilities often extend well beyond any one department; those cross-cutting issues could be a particular focus of attention. Among the means of addressing the second issue are the provision of in-house training to staff on the complementary role of science and policy within government; and means of ensuring recognition of individual contributions to bridging science and policy in the career reward system.

However, better and more explicit use of science in government decision-making and improved understanding of the role of science in government does not resolve the broad contextual issues within which the science decision-making system operates.

The risk assessment/management process is an important means of integrating science into policy. Risk analyses are now well established in most agencies of government. However, too often, risk assessment/management is viewed as a simple extension of the science advice process. Risk assessment/management goes well beyond science. It is important not to define the "hazard" too narrowly, ignoring citizens' concerns with acceptable risk. Departments and agencies could better articulate their risk assessment/management processes, with guidelines to ensure that the full range of necessary expertise is utilized, including scientists (natural, physical and social), ethicists, economists and others. An effective communications strategy would be an integral part of the risk assessment/management process and be targeted at improving public understanding of risk and uncertainty, and providing evidence that there has been proper consideration of all factors.

### *Managing Uncertainty and Perception*

Most government decision-making which includes science advice is routine and hence "invisible" and non-controversial. The approaches explored in this report will strengthen this broad area of decision-making and will bolster public confidence. Regardless of the presence of guidelines, however, some issues will unexpectedly move to headline status and beyond routine status. Good

process will help governments manage such controversies.

Standard procedures are inadequate to address a growing array of high profile, inter-disciplinary, cross-departmental issues that face Canada, and indeed other nations. Typically, these issues involve a high degree of scientific uncertainty, impinge on emerging, contentious areas of science and have the potential to generate a clash between science, social values and economic interests. Climate change, biotechnology, development of large scale mega projects are examples.

As many countries have found, pursuit of the government goals, and indeed management of larger horizontal public issues cannot be addressed without a stronger commitment and leadership that transcends traditional ministerial divides in matters relating to science for government decision-making.

International experience reveals the importance of one individual being assigned the role of honest broker in matters of S&T with responsibilities and accountability for leadership and coordination of cross-cutting issues that involve science within government. Experience is that such a responsibility is best exercised without assuming operational activities or budgetary control for science. The focus is on support to Ministers and line managers in delivering on their individual S&T responsibilities and accountabilities. The position would also reinforce and be responsive to the need to evaluate scientific evidence within the framework of the standards of evidence used within the judicial system.

Managing the science component of large complex science issues is not simply a matter of good communications after an in-house decision has been made. It requires a cultural shift in favour of more open decision-making, one in which the public is firmly engaged.

Both federal and provincial governments use a range of mechanisms to obtain external, and some public, input on controversial issues. Different mechanisms suit different political cultures and individual issues. The overall need is to i) stimulate a broader public involvement, ii) draw on a larger knowledge base, whether in our universities, boardrooms, or communities, or from off-shore and iii) contribute to more timely and better decision-making. While there is no one "best practice", there does appear to be a gap in the existing national science infrastructure for broader public engagement.

Canada needs some fora for securing greater public understanding and support, e.g. a means to raise issues in the public domain prior to decision-making to engender public confidence in the decision-making process itself. Lessons could be drawn from the experiences of countries such as Norway (the Nordic Ethics Committees) that have established structures to promote informed debate and trigger timely science and risk assessment processes. Additionally, providing a formal channel to receive and assess public input and concern regarding science-based decision-making in government could be considered. Such moves would signal a cultural shift in addressing changing social values and emerging ethical concerns outside government.

## **1 Background**

### **1.1 Introduction**

There is an expanding range of sensitive public policy issues on which governments and civil society expect science to provide insight and illumination of policy options. Front page news profiles the ongoing public debates on the sustainability of Canada's natural resource base (e.g. the ground fish stocks in the East and old growth forests in the West), rapidly increasing concern with public health and safety (e.g. the security of the blood system, registration of new drugs, the safety of genetically engineered food products), and the larger question of the sustainability of the biosphere. But the insights of science go well beyond this - to virtually every aspect of the daily business of government.

Good science advice is a necessary, but not sufficient, condition of good policy making. The use of science can support management and decision-making, provide new information and understanding, and help evaluate the probable impact of decisions. It can also help define alternatives and better balance competing interests. This use of science for policy can span a wide range of environmental, economic, social or other concerns and can also involve most functions of government. When well founded and effectively communicated, its use can maintain and restore public and political confidence. Heightened public concerns about the integrity of the science or the integration of science into the government's decision-making process can seriously compromise public confidence.

### **1.2 Genesis of the Study**

The Council of Science and Technology Advisors (CSTA) has the mandate to provide an external perspective on internal federal government science and technology issues and identify opportunities for interdepartmental cooperation. Working in close consultation with the ADM Committee on S&T, CSTA reports to the Cabinet Committee on Economic Union (CCEU).

CSTA has been asked to develop a set of guidelines for the use of scientific advice in government decision-making. Inherent in this charge are the questions highlighted in a recent CSTA paper:

- Increasingly the media in Canada has raised concerns regarding the government's ability and credibility in addressing science-based issues, particularly as they relate to government regulations and policy. Does the public have confidence that the government has an effective process to identify and use "good science" and scientific advice in reaching policy and regulatory decisions? If not, where are the particular areas of concern?
- If public confidence is eroding, what is required to re-capture it? In particular, what mechanisms or processes are required to ensure public confidence that the government is effectively using scientific advice in making critical decisions? How does government ensure that accountabilities exist to sustain public trust?

This study was commissioned by CSTA to help characterize the current policies and practices for integrating science with policy and to provide some insights on principles and procedures, including those relating to implementation and adherence, which appear to be successful in ensuring that government decisions take account of scientific advice. Appendix A reproduces the Terms of Reference for the study.

### ***1.3. Definitions and Understandings***

In this report the term “science” in scientific advice is interpreted broadly, framed by the Statistics Canada conventions, to embrace research and development (R&D) and related scientific activities (RSA):

“Research and experimental development (R&D) comprise creative work, undertaken on a systematic basis in order to increase our stock of knowledge, including knowledge of man, culture and society, and the use of the stock of knowledge to devise new applications.”  
(Frascati Manual; 1993, page 29)

Related scientific activities (RSA) include data collection, surveys, routine testing and science assessments.

This definition captures a spectrum of activities that range from creative activities designed to resolve scientific and technological uncertainty through data gathering and interpretation to systematic examinations and characterizations of the state of knowledge, including what is not known and the uncertainties associated with what is known. It includes the social and human sciences.

Decision-making on science related issues entails a number of other concepts, including risk assessment and management. Definitions of these and other concepts used in this report are no more neat and tidy than the above definition of R&D and there is a wide range of interpretation in the literature. Appendix B provides the working descriptions of the various terms used in this study.

The second component of the mandate for the study refers to the use of science in “government decision-making”. This report, therefore, focuses on the integration of science into government decisions, whether policy, regulation or operational, but does not refer to “policy for science” except where there is a direct relevance to the effective use of science in decision-making .

### ***1.4 The Study Methodology***

The study methodology was designed to develop a general picture of the use of scientific advice in Canadian government decision-making (primarily federal, but with some provincial focus) and to provide insights for improving the framework for science based decision-making at the federal

level. The study topic is wide ranging and the focus of much debate within the federal government system at present. As such, the study is a “snapshot in time” during a period of fairly rapid evolution in the interface of science and decision-making.

A four-step approach was used:

- i Review of the literature and development of a set of discussion issues that draw down on Canadian and international experience and best practice
- ii An intensive set of interviews with individuals within government (both federal and provincial and at various levels of responsibility) and key external stakeholders designed to provide information and insights on current policies, practice and issues
- iii Analysis of available documentation (guidelines, case studies and reviews)
- iv Synthesis of the key issues and preparation of the report exploring means of improving the integration of scientific advice in government decision-making.

Consistent with the background CSTA documents, the study examined current policies, procedures and practices in Canadian government departments and agencies in the context of the science guidelines framework that has been developed and used in the UK.

The investigative phase of this report involved an extensive set of interviews with officials involved in a number of federal agencies and departments - Fisheries and Oceans, Health Canada, Environment Canada, Natural Resources Canada, Agriculture Canada, The Canadian Food Inspection Agency, Industry Canada, and Privy Council Office. Additionally a number of external stakeholders with a direct interest in the mandate, operation or oversight of these departments were interviewed, including representatives of the Royal Society of Canada.

Five provinces were also the focus of a necessarily more cursory review: Alberta, Ontario, Quebec, Nova Scotia, New Brunswick.

The names of those interviewed and the set of issue questions utilized are reproduced in Appendices C and D respectively.

## **2 The Environment for the Use of Science in Government Decision-Making**

*“Science and technology will require ethical and governmental decisions that involve scientific sophistication and complexity that many politicians and individuals will not understand and for which governing systems are unprepared. Governments will face severe questions on who benefits from (and who pays for) very expensive high technology medicine, how and in what ways the state will regulate genetic engineering, and how to allocate funds among competing claims for scientific research. They will face challenges from the intervention of scientists and other knowledge elites in issues of wide public concern.”*

Uncertainty is the Price of Freedom - paper prepared for discussion at the 1996 OECD Ministerial Symposium on the Future of Public Services”

## 2.1 *Why Governments Need Science*

While this study is designed to focus on “how” government uses science in decision-making, that discussion must be framed by a reasonable understanding of “for what functions” and “why” government needs science. In 1991 the Carnegie Commission on Science, Technology, and Government suggested that in its policy role, government:

- supports S&T as a public good
- controls S&T for the public good (health and safety, environment, security)
- uses S&T in decisions to inform decisions on major public issues

This report concerns the last two roles, i.e., *where governments use science in decision-making*, including that science performed for government. Adapting a useful taxonomy from a recent paper prepared for the Science ADMs by John de la Mothe, one can identify the following governmental decision-making functions that are informed by science:

- Security
  - Defence, international and civil security
  - Emergency preparedness, especially for natural disasters, e.g. earthquakes, floods (responsiveness, warning, and universality)
  - Adaptation to foreseen threats, e.g. the design of PEI fixed link incorporating provisions for rising sea level forecast to result from climate change
  - Economic security, e.g. in areas such as data encryption where there is both a security issue for Canada (in privacy for example) that will involve government regulatory functions and economic considerations
- International policy and negotiations
  - Establishment and negotiation of standards in order to harmonize Canadian and international regimes to protect Canadians (many non-tariff barriers are heavily technological)
  - Provision of a favourable export climate through demonstration of high standards for high risk products and rigorous resource management standards
  - Negotiation of international conventions (e.g. biodiversity, Law of the Sea)
- Individual health and safety
  - Evaluation and verification of the safety of new products, including drugs, bio-medical devices, vaccines, blood products
  - Management of a regulatory regime (making regulation, compliance and enforcement process, monitoring and reporting) that provides public confidence,

adequate monitoring and regulatory control of products and activities that could have an adverse effect on human health and safety, e.g. food, drugs, consumer product safety, transportation safety

- Environmental protection
  - Management of a regulatory regime (making regulation, compliance and enforcement process, monitoring and reporting) that provides domestic and international confidence in environmental protection consistent with sustainable development
  - Monitoring and reporting on the Canadian eco-system
  - Meeting negotiated international treaty levels (e.g. greenhouse gases), and provision of the necessary cross-cutting monitoring and reporting to international norms
  - Management of the “commons” (e.g. fish stocks, biodiversity)
- Development of effective policies in all sectors of the government mandate.

Governments use science advice in various ways *to deliver on these functions* (Smith 1997):

- *Factual insights* - to help identify and frame problems and to understand a situation
- Knowledge to allow *assessment and evaluation* of the likely consequences of a policy
- *Arguments, association and contextual knowledge* to help policy makers reflect on their situation and to improve and sharpen their judgements
- *Procedural knowledge* to help design and implement procedures for conflict resolution and rational decision-making.

## 2.2 *Government Science-Based Decision-Making*

While many of these functions and the needs of government for knowledge input are of long-standing, several forces have raised the stakes in government decision-making and hence made more urgent the need to reassess what and how scientific advice is integrated in decision-making. These forces include: i) new science and new technologies (especially biological) that are seen to impinge directly on individual health and safety, environmental sustainability or personal privacy and security; ii) the interdependence of nations in governmental decision-making that frequently involves high-level scientific understanding, for example the Kyoto agreement on reductions in greenhouse emissions and non-tariff trade issues under the World Trade Organization and the North American Free Trade Agreement; iii) a greater public sensitivity to perceived risks, fueled by a few major public policy failures that have a strong science component, e.g. Hepatitis C and cod stocks.

Internationally governments have found that traditional procedures are inadequate to address the growing array of high profile, inter-disciplinary, cross departmental issues. Governments need access to cogent, pertinent, and timely science advice targeted at their specific needs. But there

are many *complexities in integrating science into policy*. Among these are:

- the fact that research is not neat and tidy. Research is not value neutral; factual evidence must be clearly distinguished from individual values and assessments. Research and science do not necessarily produce pertinent evidence on a time frame consistent with political decision-making; Science and scientists stress areas of uncertainty and inadequacy of information; governments face decision-making in the context of uncertainty;
- the nature of government decision-making - e.g. that policy issues requiring science input are frequently complex, with wide social, cultural, political or economic implications and hence require an equivalent array of inputs to the decision;
- the need to bridge the differing value systems and norms for communication of science and of policy. Science relies on broad dissemination and academic challenge through open publication and peer review. Policy, on the other hand, tends to be developed and determined from internal sources in the context of the Westminster model of government.

The use of science extends to all levels of government decision-making, but the area where energies and international “rethinking” is particularly focused is on the level of decision-making where the time horizons are long, the decisions required are complex, and involve many different types of expertise, where the risks are high, uncertainty great and where public (and political) concern is probable.

As examined in the companion study on international experiences, there is international rethinking of the structures and processes of government decision-making, that in turn reflects the evolution of thought about participatory democracy and citizen engagement. Underpinning all the debates is a common theme, that of a cultural shift in favour of more openness in the use of science in decision-making. Increased openness is designed to help deal with three common concerns: risk, uncertainty and ethics.

There has also been a significant shift in what is an acceptable basis for government decision-making dealing with a potentially serious risk. Ministers and officials are being called to account for the use, and disregard, of science in their decision-making. The “*precautionary approach*” (see Appendix B) was developed initially in the field of environmental protection, but its applicability to public health and safety was a key issue in the Krever inquiry, and effectively crystallized in the question to witnesses “when you first suspected that something was wrong, what did you do about it?” More formally, the Rio Declaration of 1992 adopted Principle 15:

*“In order to protect the environment, the precautionary approach shall be widely applied by States according to their capabilities. Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation.”*

There is a growing consensus that the precautionary principle, judiciously applied, and followed up with appropriate action to address areas of uncertainty, should stand up to legal scrutiny. The issue then becomes what are the implications of the precautionary principle and what is “due process” in its application. This raises the issue of “how” science advice is integrated with government decision-making and what are the legal expectations of governments in investing in reducing scientific uncertainties once the initial “precautionary” decision has been made.

Internationally there are efforts to transform regulatory regimes from a focus on up-front analysis of product data prior to approval ( sometimes termed the science-based approach) to a new *risk-analysis based paradigm* that focusses on the potential for risks and benefits, and the adequacy of post-market surveillance, reporting and communication systems (in all of which science is integral, but not supreme). In this new regulatory regime “science occupies a broader spectrum of shared advisory space containing numerous kinds of knowledge, expertise, evidence and values” (Bruce Doern; Therapeutic Products 1998).

At the same time as these changes are occurring in the policy environment in which government functions, profound changes are underway in *how governments are doing business*. The reforms reflect concern about economic performance, the evolving demands of citizens and a decline of confidence in government (OECD 1996). Discussions at a 1996 OECD symposium on the Future of Public Services highlighted a number of common themes in both problems and approaches to solutions among OECD governments.

In one session of that symposium - dealing with provision of public services in an environment of strong media influence, single-issue groups and rapid increases in the amount of information available and the speed with which it is transmitted - four “directions” of change were highlighted:

- i more active communications with the public;
- ii more effective and balanced dealings with pressure groups;
- iii strengthening of ethical frameworks for public officials, and
- iv broad, open and fair discussions of policy issues.

These “directions” are simply another way of stating the shift to openness and inclusiveness in how governments deal with science in decision-making.

Along with diverse approaches to achieving more openness is the concept of “due process”. While it is a mistake to imagine that policies or practices can be simply lifted from one country to another, there are a number of insights from international work that provide a useful framework for this report, in particular recent work in the United Kingdom and New Zealand.

The United Kingdom has recognized and reinforced the need for an effective process of oversight that promotes compliance and continuous improvement (see companion study). The science guidelines generated in the U.K. represent a strong foundation for development of Canadian guidelines and serve, therefore, as a framework for this report.

New Zealand has taken two additional steps that recognize the challenge of moving from policy to implementation:

- Developed explicit operational tools to assist government managers in the implementation process of approved policies.
- Examined the legal issues surrounding the offering of expert advice, especially as it pertains to the scientists, professionals and consultants who offer advice and make delegated decisions (internal and external to government).

### **3 Mapping the Dynamics of Decision-Making in Federal Science-Based Departments and Agencies (SBDAs)**

#### **3.1 The Federal Context**

The structure within which science advice is developed and integrated into policy in Canada has undergone significant changes in the last decade. Rather than providing an extensive review of the changes in the federal system, two critical events between 1994 and 1996 are highlighted:

- *Program Review* - a government wide initiative aimed at reducing expenditures and rationalizing activities. This has induced major changes in in-house science capacity.
- The development of a *Federal Strategy for S&T* released in 1996 - "Science and Technology for the New Century" articulated a common framework of operating principles and more importantly, new institutions and mechanisms for governance. It also enshrined the principle of Ministerial authority and accountability for S&T related to their departmental mandates. The Minister of Industry, supported by the Secretary of State (Science, Research and Technology) has responsibility for leading the coordination of S&T policy and strategies across the federal government.

Until recently, much of the discussion and action following from these two events related more to "policy for science" than to "science for policy". It is only now, with structural change being consolidated and rising public controversy concerning a number of key public health, safety and resource issues, that significant policy attention is being refocussed on "science for policy" - or the role of science in informing government decision-making in what is a radically changed context from that prior to 1994.

No department or agency is isolated from the need to access and present balanced science information in order to reduce uncertainty, identify gaps in knowledge and analyze alternative courses of action. All departments face an increasing need to access good science (information and/or knowledge).

This report focusses attention on a subset of departments - those with the most dominant need for good linkages between science and policy. Many others, e.g. the Communications Research Centre within Industry Canada and the National Research Council, are considered to be more

oriented towards the private sector as the client for their science and are not the prime focus of this report. CSTA should, however, ensure that their interests are adequately served by new guidelines.

One important dimension in Canada is the division of constitutional powers between federal and provincial governments. The federal dimension is highlighted in the linkage of the activities of Natural Resources Canada and Agriculture and Agri-Food Canada with provincial governments as clients for science advice. An additional dimension is the management of federal-provincial coordination in the follow-up to Kyoto.

### ***3.2 Characterizing Current Principles and Practices***

This report reveals the enormous amount of activity currently underway to improve the policies and practices for integrating science with government decision-making. In order to maintain a clear focus on the key issues for consideration by CSTA, while responding to the Terms of Reference, this report adopts the following approach:

- It is organized on the basis of issues, not initiatives or departments
- A number of specific initiatives are outlined or referenced in the detailed departmental profiles (Appendix I)
- Interdepartmental initiatives and initiatives that involve external players are discussed in the core of the report

In his March 1997 policy statement on “The Use of Scientific Advice in Policy Making” Sir Robert May, Chief Scientific Advisor to the Government and Head of the Office of Science and Technology in the UK, lays out a set of key principles and guidelines for the use and presentation of scientific advice in policy (Appendix E). The core elements of the U.K. policy are:

- i departments should ensure that their procedures allow the early identification of issues for which scientific advice or research will be needed;*
- ii policy making should draw on the best available sources (including overseas), and should also take into account the views of experts in other (not necessarily scientific) disciplines; and*
- iii there should be a presumption towards openness in explaining the scientific advice and its interpretation.*

Robert May, U.K. 1997

These principles form an analytical and organizational framework for this report. They are generally appropriate to the Canadian context, and have been found effective when implemented. They have a high degree of support from Canadian officials. Suitably translated into a Canadian context they offer a reasonable means of achieving the overall goals of improved political

confidence in the input to decisions and public confidence in the decision-making process. What they do not do is

- i provide adequately for two key dimensions of the Canadian context
    - the need to incorporate provinces as providers, users and partners in science-based decision-making
    - the importance of S&T in foreign policy
  - ii speak to the means of implementation and accountability for that implementation
- The first requires careful crafting of Canadian guidelines; the second is a larger challenge for Canada.

The purpose of the guidelines in the U.K. is to provide a consistency across departments for managing the science input to decision making, thereby improving the overall operation of departments and better achieving government objectives. The guidelines are also seen as a key means of improving public confidence. At one level, these guidelines are quite non-controversial, to some extent a codification of common sense. They do not diverge greatly from what most officials and departments actually do; indeed they appear to have broad support in the UK and in Canada. What they do is provide a useful basis for the assessment of the current state and operation of the science-to-policy process in Canada. For that reason, this report presents its analysis of the current state of the Canadian system of science advice under the same framework.

### 3.3 Identifying Issues

*“Departments should ensure that their procedures allow the early identification of issues for which scientific advice or research will be needed.”* U.K. Guidelines

In assessing implementation of this principle this report examines four elements:

- i procedures to anticipate issues that will need scientific advice
- ii pluralism in sources of insight
- iii capacity for fast response once issue identified
- iv mechanisms for identification of horizontal or cross-departmental issues

#### 3.3.1 Emerging Issues

The U.K. guidelines stress the need for procedures to anticipate and identify as early as possible those issues for which scientific advice or research will be needed, particularly those which are potentially sensitive.

The majority of departments and sectors identified their “*anticipatory capacity*” as less than adequate. Industry Canada described the capacity of the overall system as “very limited”. The imperatives of maintaining routine operations for compliance with regulations, and priorities for private sector clients and cost recovery appears to have taken prominence following Program Review.

- wide range of viewpoints
- 4. making public the data on an issue to draw out a wider range of insights
- ii The involvement of scientists in helping to frame policy options
- iii Attention to effective integration of science in risk assessment
- iv Assurance of the quality and relevance of in-house science activities
- v Consideration and appropriate representation of diverse views and uncertainty

### 3.4.1 Sources of Advice

The U.K. guidelines stress the need to draw on a sufficiently wide range of the best expert sources, both within and outside Government. They seek independent advice of the highest calibre and to avoid or document potential conflicts of interest, so that the impartiality of advice is not called into question.

This report refers to both “expert advice” and “independent expert advice”. *Expert advice* is a normal component of science-based decision-making. It is sought in a variety of ways, including in-house analysis and working groups (some interdepartmental), federal–provincial working groups, external experts working under contract to a department, or expert panels operating under the jurisdiction of a department or agency. In all such cases, the department or agency determines the constitution of the group and the disposition of the final report. *Independent expert advice* is obtained from sources outside government and under explicit provisions for freedom of voice. It is likely to be needed in situations where there is a high degree of public sensitivity or skepticism and where fully independent advice will lend credibility to government’s consideration of complex science-based issues.

Examples of sources of expert advice involving external players:

- Climate change issues tables that are developing options for meeting targets established under the Kyoto agreement (multi-stakeholder)
- Community involvement in the development of remediation plans for Hamilton Harbour
- The particulate matter science assessment undertaken in response to the regulatory requirements under CEPA for new National Ambient Air Quality Objectives (federal-provincial and territorial governments; health and environment)
- The Regional Stock Assessment Process of the Department of Fisheries and Oceans that involves fishers and academic scientists as well as in-house scientists
- The expert advisory committees of the Canadian Agricultural Research Council that involve some 800 persons, including government scientists

There is an enormous range of *approaches used to access, formulate and validate the science* used in the decision-making process among departments and agencies. Much of the routine

decision-making, especially on the regulatory compliance functions, operates on an in-house basis (e.g. the Canadian Food Inspection Agency) using expert advice, but not independent expert advice. There is broader participation in the regulatory development process where stakeholders are increasingly brought into discussions before regulations are formulated. No one pattern emerges for dealing with the broader long-range policy issues, in part because of the rapidity of change in practice in this area. While there is a significant reliance on in-house expertise for the initial science advice, departmental culture and managerial expectations appear to play a key role in determining what approaches are used to supplement that internal capacity.

The extension to experts external to the federal government takes a number of different forms, each of which brings benefits and costs:

- scientists from provincial and territorial governments who normally bring a mix of practical science expertise and policy awareness (vast array of federal-provincial working groups)
- academic scientists, who bring the strength of expert knowledge, international contacts and independence of thought, but normally without familiarity with the policy context
- representational experts, individuals from an organization with a vested interest in the outcome of the policy decision, and a concomitant insider knowledge of the operational realities (e.g. federal expert committee on sulphur in gas)
- independent experts with practical knowledge (e.g. fishers in stock assessment; practicing doctors in pharmaceuticals)

Management of relationships and conflict of interest can be a challenge. The following extract from a recent report to Environment Canada assessing the outcomes of a multi-stakeholder expert panel highlights the issues that can emerge:

*"It appears that the benefits of having stakeholder participation in the scientific stages anyway, are largely theoretical and anticipated to be reaped in the future whereas some of the problems associated with this approach are more immediate and apparent...very few tangible benefits had been gained in return for their involvement up front during scientific stages of the assessment, for it was felt that little if any real contributions were made by stakeholder scientists."*

E. Bush; 1998. Report to Environment Canada  
Science Assessment

The message in this example is the need for i) a clear articulation of the reasons for, and nature of, external stakeholder involvement; ii) guidelines for the conduct of the advisory/assessment process consistent with the expected benefits; iii) a means of evaluating costs and benefits.

One recent example of an ***open, inclusive approach*** to the science advice process involves the National Climate Change Process which involves a multi-stakeholder consultative process of expert "issue tables" that are charged with expert and detailed input to the identification and

analysis of greenhouse gas reduction opportunities. This includes an analysis of the various options open to Canada to meet its obligations under the Kyoto agreement. Fifteen issue tables have been established, focussing on sectors (e.g. electricity, forestry) or issues (e.g. CO<sub>2</sub> sinks, technology, public education and outreach), each involving 15-25 experts from a wide range of backgrounds, including both policy and technical expertise. The target for completion of the initial sets of options papers for consideration in the National Implementation Strategy is May 31, 1999.

There have been changes in the science assessment process within some departments to include *non-traditional sources of knowledge and more external participation*. On the East Coast, the Department of Fisheries and Oceans has introduced a two-tier approach to fish stock assessment (the Regional Resource Assessment Process, or RAP) and "oversight" (Fisheries Resources Conservation Council, or FRCC). The RAP involves a broader group in the peer review of the stock assessment data, including fishers and academics. There is also an opportunity for challenge of the interpretations of the science and further input to the data on which stock assessments are based through access to aggregate stock data on the DFO web site. The FRCC itself is more broadly based and has responsibility for quality assurance in the process of stock assessment and recommendations to the Minister on total allowable catches and other conservation measures. However, the new structure for stock assessment and strategic oversight is not uncontroversial. It has institutionalized a regional approach to stock assessment (separation of the Gulf, the Bay of Fundy, Newfoundland). Questions have been raised within the FRCC as to how regional conflicts in science interpretation, e.g. between Newfoundland and the Gulf, will be reconciled and whether there is sufficient external, particularly international, expert advice. Perceptions from outside Canada are that the system requires further external expert challenge. A comparable system is being established on the West Coast where aboriginal rights and the interests of the sports fisheries add broader societal dimensions to the ultimate decision-making process on catches and conservation measures.

In general, there is a receptivity among senior officials to the concept of acquiring *independent external advice* to assist the decision-making process for issues that are, or are likely to be, very controversial. The example of the Royal Society of Canada study on the Health Canada Primate Colony was cited as means of bringing a structured advisory process and credibility of independence to bear on an issue. The appointment of a philosopher as Chair of this committee was seen to have been a factor in its success, enhancing sensitivity to social values and their integration with scientific perspectives. The report made a difference to the disposition of the colony.

Despite some success stories, however, there is not a strong tradition of independent reviews in Canada, unlike the US where over 200 expert reports are produced annually by the academy system (the Canadian equivalent would be 20; we are far from that). Officials noted the lack of a single consortium of existing "societies" (along the lines of the U.S. National Research Council), the lack of an adequate infrastructure in the Royal Society, perceptions that most societies are not representative of Canadian society and values, and the limited number of Canadian experts.

### 3.4.2 Validating the Quality of Advice

Validation of the quality of the science advice is handled differently according to the *scale of the issue* and whether the major science input is external (various types) or internal. The quality assurance of the membership, review process and outputs of Independent External Panels is provided by the organization that manages the review. Demonstrated independence and externally managed quality assurance standards are two of the chief attributes of independent reviews.

*Multi-stakeholder panels* established by government were seen to be more problematic from the standpoint of i) managing conflicts of interest, especially of industrial participants, and ii) the equity of opportunity for all stakeholders (including government) to have a full voice in the proceedings. The more visible stakeholders can dominate, regardless of content knowledge. There is no *a priori* reason, however, for science assessments from such bodies not to be peer reviewed and formally published as a means of validation. Environment Canada is currently reviewing a recommendation that:

*Where appropriate, assessment documents should be published as a collection of peer reviewed papers in an internationally recognized journal, although the trade off may be that "integration" of the document is sacrificed to some extent.*

E. Bush, 1998

A few documented procedures exist regarding quality assurance and validation of multi-stakeholder panels, but most are specific to each department and developed on the basis of in-house experience rather than founded in international "best practices".

*Validation of the quality of in-house science advice* is more difficult to characterize. To a large extent, proxy measures are used. For example, the quality of the scientific personnel within the department may be measured by a combination of publication in peer reviewed articles, external assessment of research units, and the assessment by managers of the science related activities of their groups. Not all departments and agencies currently have a policy of external evaluation of science/research units (i.e. at a program, rather than individual scientist level), but in at least two departments new policies are under review: i) Health Canada is considering approaching MRC for periodic review of its science activities and ii) Environment Canada has developed a draft framework for a formal system of regular expert review of the departmental R&D. The Earth Sciences sector of NRCan already has in place a well established process for a relatively arms length review of the quality and relevance of its science units over a 5-6 year cycle, using the Canadian GeoScience Council (CGC) to manage expert reviews that include international reviewers.

One department (Environment Canada) has commissioned a report on the production of scientific knowledge (in an international context) as measured by bibliometric techniques using a data base that was recently made available through the joint action of Statistics Canada and the University of Montreal.

*In summary*, while there is an increasing diversity in sources of science advice and validation of the quality of that advice, practices vary widely among departments and the potential benefits of increased external advice (both as sources of science and validation of science) have not been fully realized.

### 3.4.3 *International Dimensions*

There are two distinct international dimensions - the use of foreign nationals in the system of science advice and the increasing role of science advice in framing Canada's foreign policy.

Canada is a small country. Contributing at most 4% of the world's science, there are limitations on the range of Canadian expertise that can be brought to bear on any one issue. The close interconnection of scientists within the Canadian community limits insights and perspectives, to say nothing of the potential for conflict of interest. As an example, international observers commenting on the controversy surrounding the use of science for decisions on the management of the East Coast cod stocks have suggested that Canada would be well advised to engage more overseas experts in the Canadian science advice process.

Many expert and independent expert panels involve non-Canadians. The recent expert panels on sulphur in gasoline comprised up to 50% non-Canadians. The Royal Society panel process allows for up to 40% international participation. Availability and cost are often key constraints, but the cost of not casting the expertise net sufficiently widely can exceed the incremental costs of foreign participation.

The second dimension - providing science advice to help position Canada more effectively in the international milieu - is increasingly important. Again, there are a number of venues for this, including such examples as:

- Canadian participation in the establishment of international standards, for example the Codex Alimentarius Committees dealing with food safety (under the auspices of FAO and WHO). Health Canada maintains the Codex Secretariat for Canada; Canada chairs the Codex committee on food labeling (through CFIA)
- Development of the Canadian negotiating position on the next Law of the Sea. Assessment of the scientific implications of various options and interpretation of the scientific/technical dimensions at the negotiating table is critical, and said to have been inadequate in the previous international negotiations.
- Harmonization of regulatory regimes, as is being done through Agriculture and Agri-Food Canada work on identifying approved zones for field trials of agricultural products that would be acceptable to both Canada and the USA. There is further work proceeding on accepting common data inputs in the US and Canada for assessment under separate national regulatory regimes.
- Ensuring that the appropriate tool is used for regulation of health and safety issues in light of current and evolving scientific evidence and concerns with non-tariff trade barriers.

Guidelines for the integration of science into foreign policy require additional consideration by CSTA. The U.K. guidelines are set in the context of a large and influential country within the

European Commission and assume a much greater awareness of the interdependence of science and foreign policy than is seen in Canada.

#### 3.4.4 *The Mechanics of Integrating Science in Policy*

Each department, and often a sector within a department, has its own approach to the role of scientists in the *development of the policy options* in a “Memorandum to Cabinet” (MC). At present there is no consistent policy among departments; this may reflect the fact that some departments structurally separate science from operational and policy activities (e.g. Fisheries and Oceans and Agri-Food and Agriculture); others (e.g. NRCan) integrate science and policy in sector units.

Also, there is no explicit reference to the science component of the MC in the instruction manual issued by the Privy Council Office (PCO) in regard to the nature, validation and presentation of the science advice, or a requirement that the source of any science advice be identified. PCO managers appear receptive to the potential inclusion of a science component. The instruction manual for MCs is highly regarded by senior staff (including science managers) and also widely disseminated among other countries as a “best practices” document.

Science managers at all levels view the *interaction of scientists with policy makers* as at the heart of good policy development, and an interface that warrants more attention. There are different ways in which the two groups interact in the development of an MC as typified by the following example.

### Sample route to a science-based MC

- The MC process is initiated through identification of a policy need by the policy group within a department. This may be stimulated by a Ministerial request (top down) or through departmental discussions (bottom up).
  - Typically, one of two approaches is used:
    1. Broad team assembled from a mix of science, science managers, policy, government process people to develop consensus, or
    2. Policy group that has strong day-to-day working relationships with science personnel develops the MC with informal, but intense interactions with science, reaching down to tap experts wherever found;
- The extent of direct involvement of scientists appears to be a combination of departmental traditions and personality.
- Consensus developed on options and the implications of the policy options built within the department, a process that involves vertical and horizontal consultations.
  - Interdepartmental consultations undertaken. Two representative models for this consultation:
    1. Policy group manages the consultation and is the contact point for comments from other departments.
    2. A senior science/technical manager manages the consultation and is the contact point.
  - Following revision, including acknowledgment of the diverse reactions of other departments, the MC is advanced to the Minister. The relevant scientific authority may be called on to present contextual information to senior management.
  - Potential problems:
    - if the appropriate scientists at the working level are not brought in at the right time by managers, or if there is a lack of policy sensitivity among scientists, the scientific advice may be dropped on the process as simply being too difficult to include.
    - the final “pen” on the MC is a policy person. If the science message is politically difficult and not well advanced by the science people, key messages can be dropped at this stage.
    - There are no formal guidelines on attributing source or validation of science.

Individuals interviewed stressed the importance of improving *communications* between scientists and policy makers to make this process more effective. There is a natural tendency of scientists to worry that there will be an overly simplistic interpretation of a complex scientific issue and that a professional scientific opinion will be perceived as a statement of “the opinion of science”. As a result, scientists will frequently qualify a scientific opinion and provide a conservative science interpretation that will stress the need to amass additional data and focus on the uncertainties in

knowledge. On the other hand, the policy process deals with the expectation of cogent, timely and pertinent advice, in response to pressures for an early decision and both public and political expectation of action. The challenge for senior managers and policy analysts is to present scientific results in a way that provides input to the policy process without implying more certainty than is realistic. Managing the relationship between science and policy requires constant attention and mutual understanding.

There is a widely accepted need to provide more *training opportunities* for in-house staff to promote a better understanding of the complementary role of science and policy within government, the limits on scientific knowledge, and how best to present a scientific argument in a policy context. The Canadian Forestry Service has initiated an innovative in-house workshop program on bridging this science - policy communication gap. This is delivered to the scientists in their home bases (away from headquarters). A focussed set of resource materials has been developed. This example of good practice should be widely shared among departments.

Personnel with a scientific training are relatively infrequent in policy units, despite the fact that many are expected to deal with complex scientific information and inputs. Many officials urge active incentives for scientists with policy capabilities to move into policy positions.

*In summary*, there are a diversity of approaches designed to manage the science-to-policy process, with scope for improvement in through guidelines and an improved means of implementation. The two dimensions that could be addressed through guidelines are i) the introduction of formal procedures for inclusion of science advice in MCs and ii) the expectation of more consistent use of independent advice for sensitive issues where this would add credibility to the overall process of decision-making

### 3.5 *Presenting Policy/Openness*

*“There should be a presumption towards openness in explaining the scientific advice and its interpretation.”*  
U.K. Guidelines

Key issues in implementing this principle include:

- i open dissemination of the scientific evidence and analysis underlying sensitive policy decisions
- ii communication of how the analysis has been used in the policy formulation
- iii publication of the underlying science
- iv release of information to stimulate greater critical discussion of the scientific basis of policy proposals
- v professional communication of issues, uncertainties and policy options to public
- vi giving scientists a lead role in explaining scientific advice to Ministers and policy officials
- vii early communication with key interest groups

The issue of increased openness lies at the heart of the U.K. guidelines. They recommend that

“departments should aim to publish all the scientific evidence and analysis underlying policy decisions on the sensitive issues covered by these guidelines and show how the analysis has been taken into account in policy formulation. Scientists should be encouraged to publish their own associated research findings.” Even short-term controversy over early releases of information are seen to be preferable to greater controversy resulting from inadequate discussion of conflicting opinions at a formative stage of the policy process.

### 3.5.1 *Publication Policies*

All departments and agencies reviewed actively expect and encourage *scientific publication* in refereed journals (with the exception of economic analysis that was described as being too close to government policy). Policies regarding publication are frequently embodied in simple sign-off forms that provide a record of internal peer review and authorization from management to publish work done under the auspices of the department. There appear to be few written policies that articulate clearly the actual role of internal peer review, the authority of managers to block publication, or restrictions on scientists addressing government policy (as contrasted with scientific interpretation of the data).

Interviews indicated that some management reviews focus primarily on quality of presentation (copy editing) or validation that management concurs with the public release of intellectual property. Others indicated more concern with the avoidance of statements that can be interpreted as public policy. Within these constraints, there appears to be considerable freedom of communication and interpretation of scientific findings but the lack of codification of the policies may be a potential source of problems.

### 3.5.2 *Public Information*

Underlying discussions with officials on the issue of openness is the concern that many scientists have difficulty *drawing the line between expert science advice and policy*. Public confidence in decision-making requires clear communication of scientific evidence, uncertainty and risk by scientists - both in formal scientific meetings and publications and in interactions with the media. But scientists must also be careful not to over-simplify the decision-making process, implying that science is the unique input, or to appear to provide expert comment on policy.

While again there seem to be few written guidelines, several departments support *direct interaction of individual scientists with the media* without prior clearance from management. The only requirements are to speak only about the science and its interpretation, not to comment on political decisions that have been taken and to advise the departmental communication sector following an interview. In some departments a spokesperson is named for a controversial issue. Where guidelines are not written there is room for misinterpretation by both scientists and managers. Professional development and training for scientists in both communications skills and public policy, including professional ethics, are important.

An increasing amount of material relating to science-based decisions - both the scientific analysis on which a decision is based and the decision process itself - is available on departmental/agency *web sites*. The new Canadian Food Inspection Agency has a comprehensive web site that documents the various functions and structure of the agency, the Federal acts under which it is charged with administration, enforcement and compliance, the operational approaches used (e.g. plant-pest risk assessment), presenting copies of decision documents and other related information designed to enhance public understanding of generic and regulatory issues of food safety. The Fisheries and Oceans stock status reports are now released regularly and quickly after peer review (on web site within days of the peer review). The full text of the two external reports to Health Canada that informed the rBST decision were on the web almost coincident with release of the decision by Health Canada. The press release on that decision also identified the role of the science input.

New technology has brought new communication capabilities that are being widely and effectively exploited. At the same time, there are an increasing number of related *legal and information management issues* that require careful management attention, including legal liability for external advice, protection of intellectual property, and questions of how far commercial confidentiality of industrial data on which a decision is based should extend.

### 3.5.3 *Communicating Risk and Uncertainty*

The *communication of risk and uncertainty* is an ongoing challenge. Fisheries and Oceans has introduced explicit recognition of risks and uncertainty through use of graphs of probability of stock increases versus catch level that appears to have made a significant difference in non-specialist understanding of the concept of probabilities. There is a growing body of academic literature on managing risk information that could likely be used more effectively to facilitate the science - policy interface. A Canadian, W. Leiss, has published widely on this issue and a number of international experts contributed their perspectives to a publication on an international conference hosted by Queen's University in 1996 on "Statistics, Science and Public Policy".

In a paper given at the international conference hosted by Queen's (Leiss 1996), Leiss suggests four means of improving risk information:

- i make the communication of probabilistic estimates as accessible as possible, in terms of the ways in which the non-expert public thinks in everyday life situations;
- ii make an effort to understand the terms in which the intended audience is framing the risk issues, so that your information addresses their concerns, rather than yours exclusively;
- iii tell the whole truth and nothing but the truth when communicating about risks, including uncertainties, and do so voluntarily and in a timely fashion;
- iv avoid "there is no risk", or "there is nothing to worry about", statements."

#### 3.5.4 *Presenting to Decision Makers*

There is no set procedure for involvement of scientists in *presentation of science advice to senior officials or to the Minister*. Ad hoc decisions are made on the basis of the likely sensitivity of the issue and the extent to which the senior official who would otherwise make the case has a scientific background. For example, the President of The Canadian Food Inspection Agency (who is a lawyer by training) did not hesitate to involve the responsible scientist in presenting to the Minister the scientific case on the Asian Long-Horned Beetle.

#### 3.5.5 *Openness Recapitulation*

In summary, while there are a large number of healthy changes occurring, the majority deal with openness “after” the decisions. There is increasing outreach to the expert community, but relatively little scope for the involvement of broader society in discussions of sensitive issues while they are still in the policy formation phase.

The lack of a clear coordination point on issues of “science in policy” may well have contributed to an apparent lack of codification of procedures and policies on openness and the emerging issues of information management, ethics and legal standards of evidence. There is enormous opportunity for supporting the ongoing activities of departments and agencies through better application of existing knowledge and through exchange of “good practices”.

### 3.6 *Interdepartmental Initiatives*

The 1996 *Federal Strategy for S&T* stressed Ministerial accountability for S&T. At the same time it noted that “achieving greater coherence while preserving flexibility, responsiveness and ministerial accountability requires a more rigorous collective review of priorities and greater coordination of activities”.

The locus of responsibility for policies and practices related to science for government is not clearly established. However, in addition to CSTA, two groups have adopted a “collective” role in the overall S&T coordination function:

- The *Science ADMs* - a group of the science ADMs and their chief advisors from some 14 science-based departments and agencies. This group is co-chaired by the Assistant/Associate Deputy Ministers from Industry Canada and Environment Canada. While it does not yet appear to have a formally endorsed mandate it has taken on overall coordination of generic horizontal issues, e.g. science capacity, technology transfer. This is a large group, said to number up to 40 in full session, and is reported to function best at the level of task-oriented subcommittees.

- The *5 NR Group* - a group of five departments (Agriculture and Agri-Food Canada, Environment Canada, Fisheries and Oceans Canada, Health Canada and Natural Resources Canada) that have signed a Memorandum of Understanding on S&T for Sustainable Development. The origins of this group are reported to go back to a pointed question from the Clerk of the Privy Council to the original four founding Natural Resource Departments (the above minus Health Canada) concerning a series of individual Memoranda to Cabinet on related issues that demonstrated a lack of communication among departments. Since that time, a formal MOU has been signed, an annual report published and most importantly, a high degree of respect has been generated for the ability of this group to coordinate S&T policy related to sustainable development and to stimulate collective action on substantive issues.

One significant action to emerge from the 5 NRs group has been the “*Best Practice*” initiative led by Health Canada - an initiative designed to develop a codified set of best practices for the conduct, management and utilization of science.

In preparing this initiative, several regional workshops were held involving scientists, science managers, policy advisors and senior executives to identify key issues relating to the conduct, management and use of science in the federal government, and to develop a set of “values, stakeholder traits and best practices” that could in turn be reviewed by senior officials for adoption across departments. The document is still under development, but the January 15, 1999 version lays out proposals for:

- Fundamental Values - standards that all members of the federal science community should apply in their daily work.
- Traits of Key Stakeholders - expansions of the values as they apply to specific groups within the federal science community.
- Best Practices - specific measures and advice to resolve current issues in the federal science community.
- Ideas for Implementation - ideas for a range of tools to maintain a focus on values over the long term.

The document recognizes that departments and agencies will customize any “values” and implementation strategies to their own mission and operations. It has yet to receive critical review by the 5NRs and/or the Science ADMs.

While not strictly “within government”, the Public Policy Forum is both a mirror and catalyst for the evolution of the public sector. Its explicit recognition of the centrality of the interaction of science and public policy through the sponsorship of an executive exchange and a special project on the theme highlights the current interest of politicians and senior officials in doing a better job with science-based decision-making.

Two outputs from the project to date are receiving wide circulation - “The Role and Responsibilities of the Scientist in Public Policy” (Jarvis 1998) and the summary of a round table discussion of senior officials “Blood, Fish and Tears” (November 23, 1998). Both signal an

emerging sensitivity to the need for good principles and practices in science advice and are ideal source materials for workshops designed to improve the mutual understanding of science and policy communities.

The fact that these initiatives are emerging spontaneously from diverse sources the importance of a collective policy capacity to underpin the development of policy for the use of science in government, as well as the lack of a clearly identified focal point at present.

### 3.7 *Relevant Initiatives External to Government*

As outlined in the companion international study, many “national academies” in other countries have either a mandate for, or have assumed a role in, providing governments with *independent expert advice*. In many cases this role is enshrined in legislation, but not in Canada. There is not, however, consensus that there is a single body or an existing consortium of bodies in Canada that should be so identified through legislation (e.g. 1992 report from B. Segal to Industry Canada).

Despite this situation, the Royal Society of Canada (RSC) has committed to an expanded program of independent expert advice. It has published a detailed set of procedural guidelines for Independent Expert Panels (issued in 1996). This initiative has the strong support of the Society in the belief that it can and should be an important mechanism for authoritative independent advice to enhance government decision-making on complex knowledge based issues. These activities are overseen by a standing committee of the RSC .

The procedural guidelines are based on international best practice, and tailored to realistic time lines and budgets for Canada - budgets of the order of \$0.25M and a 6 month time line. The essence of the process (that can be customized to specific situations) is:

- RSC names panel members (following a review of suggested names)
- RSC approaches the best people, not necessarily RSC members; will include non-Canadians
- Expert panel reports are reviewed by external peers before being released to the government under strict rules of confidentiality
- The report is made public the same day that it is sent to the government
- Target time frame - six months

This commitment to an expanded advisory role is not yet matched with core RSC resources. The Expert Panel program is forecast to grow at a controlled rate under careful supervision to demonstrate capability and value to the point that a small infrastructure can be maintained to coordinate studies that may, in fact, be managed by external “accredited” units.

Spokespersons for the society noted the culture change that will be required for the public service to champion the importance of independent external advice for sensitive issues, reflecting that many departments rely on their own “in house” experts. An additional observation related to the difficulty in adapting the contracting out rules to the needs of independent expert reviews.

There are a number of other groups that provide independent expert advice to government. The recent reviews by the Royal College of Physicians and Surgeons and the Canadian Veterinary Medical Association for Health Canada on the two key issues relating to rBST - human health and animal health are examples of another approach. Both panels were charged with providing an objective scientific review of data, and operated with intellectual independence, but under the conflict of interest rules of Health Canada. The membership was all Canadian. The level of public debate over the role and “independence” of the panels resulted in the inclusion of the following commentary in the report of the Royal College of Physicians and Surgeons:

*It rapidly became apparent that other issues were important to the Canadian public, to some employees of Health Canada, to members of the Senate Committee on Agriculture and Forestry and to the media. The work of the panel has been complicated by suggestions in the press and in verbal communication with members of the panel that one or more of our members, including the Chair, may have conflicts of interest. Such criticisms have persisted although the panel has proceeded on the basis that it is dealing with objective matters of science and a review of evidence on biological matters that are beyond conflict of interest. All members of the panel had previously complied with normal government standards concerning disclosure of professional activities. In the fields important to the current consideration it would be almost impossible to assemble an expert panel in Canada without including individuals who have worked with pharmaceutical companies in a scientific or consultative role. The panel wishes to underscore its role as an objective scientific review body qualified to provide advice as requested to public and private sectors.*

Report of the Royal College of Physicians and Surgeons Canada  
Expert Panel on Human Safety of rbST January 1999

The use of recognized professional societies for expert advice and/or the validation of various mechanisms of providing independent advice would benefit from additional attention within the overall system of science advice. External sources of advice are under-developed, under-resources and under-utilized.

### **3.8 Canadian “Science in Policy” Recapitulation**

The following table attempts to capture a complex and evolving set of activities designed to improve the way in which the federal government manages its science-based decision-making. They are grouped according to the key principles of the U.K. guidelines. The extent of activity is impressive, the coverage and impact patchy.

In addition, two case studies are outlined in Appendix F as illustrations of how issues are currently being handled in the science to policy process.

The U.K. guidelines have provided a powerful means of assessing the overall effectiveness and operation of the Canadian system of using science advice in decision-making. They provide a

conceptual framework for the reviewer to integrate a wide range of actions and to assess strengths and gaps. However, there is a missing link - a means of ensuring their implementation. As in the U.K. the establishment of guidelines is a necessary, but not sufficient step.

**Science Advice in Government Decision-Making**  
**Examples of Government Policies, Procedures, Current Studies and Good Practices**

	<b>Initiative</b>	<b>Relevance to Science in Decision-Making Agenda</b>	<b>Comments/Examples</b>
<b>Identifying issues</b>			
	Policy Research Initiative	Mechanism to develop a research strategy for Canada to prepare for the complex public policy challenges 2005 and beyond. Future oriented, horizontal issues, multi-disciplinary, inclusive.	Launched by Clerk of PCO in 1996; appears not to incorporate natural and physical sciences to any great extent. Important S&T opportunity.
	Long-term S&T strategy established within departmental mission	Solid framework for linking policy goals with long term departmental science strategy. Context for ongoing scan of emerging national and international developments.	NRCan, (e.g. the Energy Sector which has a group looking at energy futures 2030). General agreement that capacity should be strengthened.
	Science ADMs	Possible mechanism for interaction on long term foresight; however appears to be focussed more closely on internal management issues.	Very large body (about 40 attendees). Some skepticism that it could come to grips with emerging issues of substance.
	MOU among 5 NRs on S&T for sustainable development	Provides a forum for exchange of views about emerging issues among cognate departments. Sufficient common interests for cohesiveness and joint action.	Involves AAFC, EC, DFO, HC, NRCan; focus of sustainable development is long-range.
<b>Building science into policy</b>			
	Precautionary Principle	Constant references in SBDAs to this as an emerging issue of importance. Wide diversity in understanding of what implementation means - from inaction to taking action without scientific certainty.	Health Canada in the lead. Should be priority for more rigorous thinking and definition of concept and implications.

	S&T Management Frameworks	Guiding principles, management tools and decision-making authorities designed to increase the effectiveness and efficiency of S&T. Documents focus on the linkage between S&T and government priorities. (One document also addresses return on the S&T investment).	NRCan and Environment Canada have both developed departmental S&T management frameworks. These could be expanded to incorporate the science guidelines.
	Proposed decision-making framework - Risk Management and Science	Initiative to formalize the risk management process for rigour, consistency, accountability, transparency. Documentation to date only "overhead" decks.	Health Canada in lead. Need inter-departmental discussions to develop common language as it relates to science assessment and risk assessment/management.
	MOU among 5 departments on S&T for sustainable development (also referred to above)	Provides for collaboration via ad hoc working groups, joint science assessments, national science fora, joint science promotion and other mechanisms	MOU among AAFC, EC, DFO, HC, NRCan; seen as a cohesive and important group that is starting to make a difference.
	The Best Practices Initiative. Best Practices for the Conduct, Management and Use of Science in the Government of Canada.	Document developed through a consultative process. It outlines fundamental values, traits of key stakeholders, best practices and ideas for implementation. Addresses the organizational environment, accountabilities, the science - policy interface, the review process and communications (including limits to openness).	Health Canada led initiative among the MOU 5NR group. Document to be presented to the science ADMs. Appears more compliance oriented than facilitating.
	Existing Guidelines for External Review of internal science units	Terms of Reference for regular external unit review of quality and relevance. Effective use of external Review Agency (e.g. Canadian GeoScience Council) to manage review. Sector Advisory Board assesses the review and comments to ADM.	Earth Science Sector of NRCan has long-standing mechanism in place. Spectrum of approaches in other departments, ranging from no reviews to more ad hoc.
	Framework for External Review of R&D in Environment Canada	Draft version of operating policy and guidance on implementation of external reviews of large, significant R&D efforts within department.	Environment Canada is reviewing for possible implementation. Guidelines would underscore importance.

	Science Assessment: A report on science-policy linkages in the Atmospheric Environment Service	Report addresses the purpose and process of science assessment, use of science assessment for improved communication between science and policy and a critical evaluation of the current process through two case histories.	Environment Canada. Set of 22 recommendations to Env Can designed to facilitate science-policy interface. Generally consistent with U.K. guidelines.
	Article - The Role and Responsibilities of the Scientist in Public Policy	A discussion paper that explores various issues relating to the science - policy interface, with a particular focus on the role of the scientist.	The Public Policy Forum. New report stimulating discussion of science-policy linkages. Highlights key questions that would be partially addressed by guidelines.
	Workshop on Science-Policy Linkages	Workshop (full documentation package) designed to help scientists and policy personnel in the Canadian Forest Service (CFS) understand and manage the science-policy interface more effectively. Designed following consultation with researchers and research managers.	CFS in house initiative. Focussed and effective means of exposing scientists to the policy process and policy makers to the perspectives and concerns of scientists. Guidelines should reinforce importance of such initiatives.
	Blood, Fish and Tears: A Round Table Discussion on the Credibility and Acceptability of Science Advice for Decision-Making	Report of a Round Table, November 23, 1998. Report on the outcome of discussions among federal, provincial and a few academic leaders on policy decisions founded on or utilizing a scientific input.	Public Policy Forum. Report is witness to the importance of the science - policy interface for senior officials and ministers.
	CCMD S&T Network	Monthly meeting of S&T ADMs	CCMD-led. Useful opportunity for informal discussions
	CRUISE Conference - October 1998	Conference on "Science, Government and Global Markets: the State of Canada's Science-Based Regulatory Institutions". Dealt with many issues of managing science-based regulation on a department by department basis.	External comments on the robustness of relevant policies and practices. CSTA could consider acting as catalyst for agenda of future such meetings.

	Royal Society of Canada - Independent Expert Panels	Rigorous set of guidelines for the creation and management of an Expert Panel process. Initiative draws down on US experience, but is customized to tighter time lines and budgets.	Activity gaining respect. e.g. Primate Colony Report done for Health Canada.
<b>Presenting policy - presumption towards openness</b>			
	Comprehensive operational Web site	Extensive web site with text of decision documents, overview of all field trials, processes of risk assessment etc.	Canadian Food Inspection Agency (CFIA)
	Regional Resource Assessment Process	Integration of stakeholder community in peer review process of stock assessments and open dissemination of outcomes - New process.	DFO
	Multi-stakeholder processes	Many experiments ongoing with multi-stakeholder processes, e.g. the Climate Change issue tables and the Sulphur in gasoline review.	Need to have a means of evaluating and drawing out lessons from these activities to integrate into evolution of policies and practices.
	National Forum on Climate Change	"Citizen's Jury" approach to providing input on policy issue. Use of panel of Order of Canada recipients with no technical training to assess science-based policy issue.	National Round Table on the Environment and Economy. Important initiative in citizen engagement.

## **4 Provincial Experiences, Perceptions and Issues**

An effective characterization of the use of science in government decision-making at the provincial level is well beyond the scope and time frame of this report. Practices differ dramatically among jurisdictions and among government departments within any one jurisdiction. However, the interviews and surveys provide an initial glimpse at a decision-making environment with a complex set of science-related interfaces within government and with the public and the federal government.

### **4.1 Objectives and Methodology**

The objective in approaching provinces was to obtain insights on the extent to which science is a consideration in provincial decision-making, provincial perspectives on “good practices” and “lessons learned” in regard to the science to policy process and related communication with the public, and the interface of federal and provincial science in decision-making.

The project team carried out a series of interviews (some by telephone and some face-to-face) with senior officials in each of five provinces - Alberta, Ontario, Quebec, New Brunswick and Nova Scotia - during December 1998 and January 1999. In some instances, these interviews were supplemented by completion of a short questionnaire on existing policies, practices and barriers in the science - policy linkage. The selection of provinces for the study was influenced by need to gather primary data in a very short time. Hence, the presence of a “coordinating body” that could provide an integrated look at the use of science in government decision-making within various sectors within a province was a factor in some choices.

As in the case of the federal government, the bulk of the analysis is organized within the analytical framework provided by the U.K. science guidelines. While some examples make reference to individual provinces, certain observations are deliberately not attributed to a specific province.

### **4.2 Science in Provincial Governments**

The science activity within science-based ministries of provincial governments runs the gamut from research (relatively infrequent and under pressure), adaptive science (not bench research, but applications and interpretation), monitoring and data collection, analysis and use. Science is targeted to missions, regulatory requirements and the socio-economic characteristics of each province. Policy is seen to drive the science, although science is seen as essential in helping to set priorities and inform good policy.

In some provinces there is relatively little science in discussions at the cabinet table; in others, there is an emerging political demand for validated scientific input to underpin decisions that has been generated by public expectations for evidence based decision-making. In some ministries there is a mature, if lean, system of incorporating science into decision-making.

There is no simple characterization of the federal-provincial interface in regard to policy-relevant science, other than a recognition of the growing interdependence of federal science capacity and decisions and provincial interests.

#### **4.3 Identifying Issues**

*“departments should ensure that their procedures allow the early identification of issues for which scientific advice or research will be needed”*

Provincial officials describe their capacity to identify emerging issues as “reasonable” to “weak”. They work closely with stakeholder groups and see their linkage to real problems and issues as closer than that for many federal departments, but recognize that these linkages generally have a shorter-term focus. Down-sizing has reduced the provincial capacity for long-term science foresight and for being an intelligent receptor for science.

Many rely on federal science activities to provide a long-term window on emerging issues. For the majority of officials, federal provincial committees and working groups provide an important avenue for identifying emerging issues and sources of science advice. But this interface is not without its tensions. A concern was voiced that the cost sharing of research in the federal government (Agriculture and Agri-food Canada) has reduced early access to valuable research insights (interim reports used to be available to provincial officials; cost shared work is now released only in the form of a final report). There is also some skepticism of the independence of federal science from political influence, especially on environmental issues.

Linkages with universities have generally been weakened by the erosion of direct funding programs between provincial ministries and universities, reducing easy access to that source of insight. This is an unfortunate development, although in one province - Nova Scotia - provincial discussions on a “Research, Development, and Innovation (RDI)” policy have strengthened the potential for joint action and stronger international linkages. For some officials there are concerns with the lack of policy relevance of much academic research.

#### **4.4 Building Science into Policy**

*“policy making should draw on the best available sources (including overseas), and should also take into account the views of experts in other (not necessarily scientific) disciplines”*

For most officials, government scientists are seen as a key part of the decision-making process, providing there is recognition of the limit to scientific knowledge and clarity that the role of the scientist is to ensure the accuracy of the science interpretation. There is a reduced chance of public controversy when the scientist has been part of the policy team. A contrary view was expressed by a few, that the separation of science and policy is important to delineate the need for openness in communication of science from the confidentiality of decision-making.

Generally there are few written processes for the integration of science into decision-making, instead a significant reliance on departmental/ministerial traditions and approaches. However, in one provincial ministry there is a requirement for a “science sign off” on all submissions to Cabinet and Management Board.

*Capacity* is an ongoing problem highlighted by many provincial officials, in both areas of traditional responsibility and in areas of emerging technologies. One of the consequences of the restructuring and cut backs is an erosion of provincial in-house science and policy capacity, a weakened connection between the two, and less ability to deal effectively with federal science activities and decisions. Particular difficulty is expected in dealing with biotechnology where science is advancing faster than public acceptance or the capacity of the government to identify and deal with issues. In the natural resources (e.g. agriculture and forestry), there is more reliance than in the past on the federal government for science input, supplemented by a more targeted activity in-house. Increasingly there are attempts to access international science and insights from the private sector.

There are two interesting *models* for alternative modes of providing government with science input:

- A partnership of the Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA) and the University of Guelph in which the university manages the former OMAFRA research and analysis function from a university base, with a performance-based contract oriented towards provincial needs. The linkage is tightened by the co-location of the ministry and the university. It is too early to assess the impact of this new marriage, but the commitment to bridge science and policy is clear.
- The Institut de recherche en santé et sécurité du travail headquartered in Montreal that is managed jointly by government, industry and university partners. Even under fiscal constraints it is seen as providing serious and effective input to government.

A number of provincial ministries use formally structured *advisory committees* or expert panels (that incorporate external experts as well as in-house personnel) as a mechanism for building science into policy and for providing a forum for multi-stakeholder debate concerning regulation and policy. The Ontario Pesticides Advisory Committee is described as a success story. It comprises representatives from ministries within government as well as external stakeholders and makes recommendations directly to the Minister.

Provincial approaches to *risk assessment* are diverse. In some jurisdictions it is only rarely an input to the decision-making process, in others it is a strong component. Two factors appear to influence the use of risk assessment - the political ideology about evidence based decision-making and the extent to which there is industry support for a well founded risk assessment process. There is a widespread belief that public communication on risk and risk management needs much more attention.

As in the case of the federal government, there tends to be tension between those with responsibility for the environment and those responsible for resource development (e.g. minerals and mines). This tension extends to federal-provincial fora.

#### 4.5 *Presenting Policy/Openness*

*“there should be a presumption towards openness in explaining the scientific advice and its interpretation”*

Policies on the open dissemination of science are similar to those of the federal government, with **publication** encouraged. There appears to be a trend in some provinces to publication in trade journals, more than the international science literature, as a better means of reaching the target audience. Time lines for publication in the international literature are a barrier to openness of communication because of the time lead involved. Like the federal government, publications are expected to focus on science and to avoid policy.

Much of the primary data and interpretations are placed on the web for the use of departmental/ministry stakeholders. In some instances these data are available only on a cost recovery basis.

Provincial governments are experimenting, not without some controversy, with new approaches to **citizen engagement** in the process of decision-making. Features of two such processes are noted below.

##### Lands for Life in Ontario

- 1997 extensive planning document placed in public domain with the objective of outlining the proposed plan for land-use management and identifying roles of stakeholders. Supporting data and analysis on the web site.
- Extensive, but time limited consultation carried out through structured process involving regional and sub-regional round tables, aboriginal peoples and citizens committees.
- Public controversy resulting from dissonance between government and stakeholder positions. The process is seen as slow and high risk by some, as too tightly constrained by unrealistic deadlines by others, but in the main constructive in terms of the quality of understanding and likely the ultimate decision.

##### Sydney tar ponds in Nova Scotia

- Remediation of the Sydney tar ponds has been a long-standing issue in Nova Scotia with a high degree of public concern and complex science/technology issues. It has also been a continuing area of shared federal-provincial interest and responsibility.
- Two initial approaches to tackle the problem were unsuccessful. The first involved an excavation/incineration approach that proved not to be technologically feasible. The second approach, following external advice from consultants involved encapsulation. While there was some citizen involvement in the process, it was deemed unacceptable by the population.

- The most recent approach relies on a Joint Action Group to bring in broad public participation and buy in, effectively offering ownership of the solution to the local community. The process of science and risk assessment has been public, and has involved broad public consultation. While there is still controversy over the best course of action (and who will fund the action needed), there is now improved public understanding of the nature and extent of the problem.

#### 4.6 *Federal-Provincial Issues in the Formulation and Use of Science Guidelines*

While articulation of a Canadian version of the U.K. guidelines is a positive step, the constitutional division of powers between federal and provincial governments in such areas as natural resources, environment and agriculture will make their implementation more complex. Some circumstances will require active provincial participation in the process and decision-making; in other cases provincial buy-in to the decision-making process may be sufficient.

For federal science-based decisions to be accepted there must be a shared understanding at a provincial level of the nature of the issue, the integrity of the science, and the validity of its interpretation and an acceptance of the overall framework for decision-making. These conditions will prevail only when:

- There is a *capacity* within a provincial government for understanding and interpreting science advice whatever its source (within or external to government). An inadequate science capacity within a provincial governments is a serious handicap for federal decision-making, even in federal areas of authority. The lead-up discussions to the Kyoto agreement demonstrated large gaps in this respect.
- There is *trust* between federal and provincial officials working in the issue area. Such trust is cumulative, being built over time through mutual respect and productive working relationships that respect the diversity of interests and responsibilities of federal and provincial parties. Interviews demonstrated that, particularly for some environmental issues, tension rather than trust is the operational culture at the federal-provincial level.
- There is a mechanism for implementing the decision-making process in *partnership* where there is shared jurisdiction or provincial jurisdiction drawing on federal science. The guidelines proposed by Sir Robert May have the advantage of being at a sufficiently high level that the means of achieving the objectives can be tailored to the specific circumstances.

Provinces would not need to adopt a comparable set of guidelines for integrating science advice into decision-making at the provincial level for the above conditions to apply, but it would be an advantage. Guidelines at a provincial level would reinforce a common understanding of the means of accessing and validating science advice, as well as the role of, and limitations to, the use of that advice in a larger policy context.

Interactions with the provinces in the course of preparing this report resulted in two important comments - a) an expression of interest on the part of one province in developing a set of

guidelines for its own use; and b) a suggestion that CSTA could serve a useful role in hosting (or perhaps co-hosting with provincial S&T councils) a one-day federal-provincial workshop on science guidelines, providing an opportunity to discuss international and federal practices and exchange views among provinces.

#### **4.7 The Provinces - a Recapitulation**

In their range of approaches to the incorporation of science into policy advice the provinces exhibit a diversity that parallels the alternative mechanisms and processes characteristic of individual nation states. But they are all wrestling with a series of common policy concerns. They are all dealing with an often skeptical public. They are being pressed to address issues of credibility, quality control, openness, risk and uncertainty in science and science-related issues. There are also external pressures that impact directly at a provincial level to meet standards and levels of confidence in the use of science which meet national, or even international objectives. The expectations and requirements under international conventions and new trade rules are bringing new issues to provincial cabinet tables that require more access to science in a larger policy context.

### **5 Discussion**

#### **5.1 Guidelines and Implementation**

Many countries are exploring means of better integrating science in government decision-making. Underlying these debates are three fundamental concerns - public confidence in the science decision-making process; the tension between the opportunities opened by science and social values; and the role of science as a public good.

Addressing these concerns requires a *series of initiatives to redefine the environment in which science is used for policy and to address the mechanisms, processes and risk communication* involved in science based decision-making. What is needed is an assurance of sound science being brought to bear on relevant decisions, an openness in how and what science has been taken into account in policy formulation, and a meaningful engagement of citizens in shaping the decision parameters. This entails a shift towards a more open debate on those broad issues of public concern which have a strong science component and large social implications.

The development and implementation of a set of *principles and guidelines* for integrating science advice with policy-making is important to support and strengthen existing practices. Guidelines will facilitate consistency in practices across government and enhance public confidence in the processes of government. As in the United Kingdom, it would be appropriate for individual departments to determine how the principles and guidelines should be implemented at an operational level in a way that reflects the wide range of requirements for science advice across government.

However, the existence of such guidelines is not a panacea. First, guidelines must be viewed within the context of the continuum of the science - technology - public policy - decision-making process, reflecting both the contributions of, and limitations on, expert knowledge. Secondly, the effectiveness of guidelines depends on their active promotion and communication within the government system, as well as the explicit identification of individuals responsible for their implementation within departments and agencies. Ensuring implementation of guidelines is at least as important and more challenging than preparation of the guidelines themselves.

## 5.2 *The Broader Context for Science Advice*

Better and more explicit use of science in government decision-making and improved understanding of the role of science in government does not resolve the broad contextual issues within which the science decision-making system operates. Policy decisions are taken with explicit consideration of social, economic, environmental, legal and ethical risks and benefits. Bridging the science and policy dimensions is a process that goes beyond science.

*Science* is not an orderly encyclopedia of facts, but a way of looking at the world through the testing of scientific hypotheses based on accumulation and analysis of data. To integrate science into decision-making requires an expert assessment of the state of knowledge/ignorance and the scientific implications for the issue at hand. This is normally carried out through a process of *science assessment* in which the state of knowledge and or ignorance with respect to a specific policy issue is characterized, initially in technical language and then in language accessible to the policy maker. That process may be carried out in-house, through a multi-stakeholder process or completely external to the department. Like science, a scientific assessment is not a neat and tidy process. It draws on a mix of published literature, in house expertise and grey literature. The data utilized have uncertainties, and suffer the limitations of existing models and simulations of reality. But the end product must withstand external scrutiny, be as free from bias as possible and reveal the implications of uncertainty, all under the pressure of time. The “best professional judgement” under these circumstances requires the best professional minds.

Expert involvement in science assessment is thus crucial, but the definition of expert needs precision. Even while maintaining the highest standards in research, the interest of individuals and traditions of disciplines, as well as those of scientific publishing, can introduce undue bias into the science assessment process unless it is carefully structured. Hence there is a need for careful design and monitoring of the process for obtaining and validating scientific knowledge.

Economic, social, cultural, ethical and legal considerations are key decision elements. The U.K. guidelines provide for a reasonable balance of inputs to ensure the full range of necessary expertise is represented in the ultimate decision-making process.

### 5.3 *Enhanced Management Tools*

The development and implementation of a set of guidelines for science advice will provide an umbrella within which a robust, government-wide body of “best practices” could be developed. There is an unfulfilled need for solid management tools to better support the initiatives of individual departments and agencies in science-based decision-making. At present, there is an ad hoc sharing of insights and experiences, but no collective knowledge base among departments and agencies of policies, principles and practices that have been effective in Canada or internationally.

Policy work is required for better understanding, and the development of useful management tools, on the relationship between the way the scientific advice is structured and its potential shortcomings/robustness. Appendix G, adapted and expanded from a recent article by David Fisk (1998), is a sampler of the type of S&T management tool that could be pursued. It explores the relationship between the way a review or assessment panel is structured and the quality/integrity of its advice.

Without some formalization in the process of interactions among departments and agencies, there will be no single point of responsibility and accountability for the development of effective management tools that could then be used by departments according to their needs. Also important is a knowledge base that will support the implementation activities of the various players.

### 5.4 *The Environment for the Use of Science Advice*

The 1996 S&T Strategy established the basic policy framework for S&T activities and funding for the federal government. The main focus of the strategy is on “policy for science” and was framed by the very real economic challenge facing Canada at the time; “science for policy” is an inherent, but not a dominant element. The 1997 report “Minding our Future” provides an update on progress towards the objectives and structures laid out in the 1996 S&T Strategy. Consistent with the theme of the original document, the update focuses primarily on the deployment of government S&T activities and funding instruments to the “wealth generation/innovation” component of the federal agenda.

In many departments, officials have a concern that the nature and importance of science for government decision-making has taken a back seat to science that is directed towards more direct support of private sector innovation and firm-level competitiveness. Without challenging the legitimacy of the “science for wealth generation” agenda, officials highlight the need for a balance of that wealth creation agenda with the mandated responsibility of governments to act in the public interest - in regard to individual health and safety and sustainability of “the commons”. There is a widely held view that there is inadequate attention being given to i) the substantive policy dimensions of using science in decision-making (e.g. the changing paradigms of risk assessment and their applicability to current regulatory regimes, the implications of the precautionary principle), ii) the nature and level of in-house science capacity, and iii) the capacity

of the structures of government and its linkages with external partners to deal with complex science-based issues that touch directly on public trust.

This view is not held only within government. In a recent paper, Bruce Doern (*Risky Business*, 1998) suggested that Canada is dealing with a “science deficit” within the science-based regulatory regime analogous to the “financial deficit” of the 1980s and 1990s. This “science deficit” is characterized as a reduced capacity for action (in regard to science for policy) that results in an inability to cope with sustained risk.

It is not the purpose of this report to address the issue of morale within the federal S&T system, but it is clear that effective implementation of the science guidelines will benefit if both the importance and the role of science in government are better articulated. There has been a decline both in the numbers of scientists and the investment in science within government. The role of in-house science has been particularly uncertain since Program Review. Reinforcement of the fact that good science is fundamental to good policy and that the areas of policy requiring science input now extend well beyond the traditional science based departments would bring returns.

Two issues arise. First, the purpose and vitality of in-house science is undermined in the absence of a well-defined client (demand). Secondly, there is a major cultural clash between science and policy within many departments.

There are a number of means of addressing the first, among them i) direct championing of the role of science in government decision-making by the Clerk of the Privy Council Office (PCO) and ii) an extension of the existing requirements for Annual S&T Outlooks and Performance Reports to include a stronger articulation of the linkage between a department’s research strategy and its policy responsibilities, and formal reports on the delivery of these responsibilities in keeping with “best practice” guidelines. These policy responsibilities often extend well beyond any one department; those cross-cutting issues could be a particular focus of attention. The effect of Canadian science guidelines should extend to the highest level of decision-making.

Among the means of addressing the second dimension are i) in-house training of existing staff to better understand the complementary role of science and policy within government and ii) recognition of the contributions to bridging science and policy in the career reward system. Means must be found to address directly the concern of scientists that the policy process is irrational and likely to distort research findings and the corresponding concern of policy advisers that scientists are inflexible and unsophisticated in their approach to policy.

#### **5.4 *Coordination Within Government***

Internationally there is increasing evidence of the need to identify an honest broker in matters of S&T with responsibilities and accountability for leadership and coordination of cross cutting issues that involve science within government. Such a responsibility is best exercised without assuming operational activities or budgetary control for science in order that it support Ministers

and line managers in their individual S&T responsibilities. The position would also reinforce the need to evaluate scientific evidence within the framework of the standards of evidence used within the judicial system.

As has been described, the Science ADMs committee is important, but it is not structured to act as a nimble and flexible “honest broker” as described above. While tackling horizontal issues, it has very little policy infrastructure and is seen as being a collectivity of operational interests as opposed to the independent facilitator/broker of relationships.

This is a gap in the internal government S&T infrastructure that will be important to address for confidence that a set of science guidelines will be fully embedded in the culture and practice of the federal system of science-based decision-making.

### **5.5 Public Engagement and Trust**

More than any other message, international experience has revealed the importance of increased openness and public engagement in the policy making process. In a recent hearing, Sir Robert May noted:

*“...If there is one word it would be openness. It would be making sure that the process of gathering advice takes on all the difficulties of public debate, that you consult widely, that the contrary opinion be expressed, that you make such data as are available to anyone who wants them, recognizing that the result will often be a variety of opinions contending in the marketplace. This is uncomfortable...but in my view is the best single way to engender public confidence. ”*

R. May. June 17, 1998, Select Committee on S&T;  
Minutes of Evidence

Both federal and provincial governments use a range of mechanisms to obtain public input on controversial issues. These mechanisms include Royal Commissions, Independent Expert Panels, House of Commons and Senate Committees and the now disbanded Science and Economic Councils of Canada. Different mechanisms suit different political cultures and individual issues. While all are important in this array of mechanisms, there does appear to be a gap in means of providing for broader public engagement that is more pronounced today than a decade ago.

While individual departments have engaged stakeholders increasingly in the business of science-based decision making, this is not a sufficient response. The recent National Forum on Climate Change reveals the dimensions of the gap.

The National Round Table on the Environment and the Economy brought together 25 accomplished Canadians with no predetermined views or technical expertise on the issue of climate change in a National Forum on Climate Change. The process was modelled on a “citizen’s

jury". The Forum was designed to engage them as a group of concerned citizens in the process of contributing to a complex area of science-based public policy through the development of a "responsible opinion" on climate change. Expert scientific opinions were presented, not infrequently divergent. The methodologies and uncertainties of science were exposed and discussed. Economic, legal, environmental, ethical and social issues were exposed and debated. After three sessions over a 3-4 month period, the panel prepared a declaration that was presented to Ministers and the Prime Minister in 1998.

In addition to the power of the process of participatory democracy and the integrative approach to a complex issue, there are some critical lessons to be learned from the exercise. Many members of the panel were skeptical of the possible political motivation for the exercise, and deeply concerned that they not be used to endorse a pre-determined policy or political position. The strict adherence to an independent and thorough process and the "honest broker" role of the National Round Table on the Environment and the Economy were effective in overcoming some aspects of this concern, but a continuing skepticism of government scientists persisted. An additional concern developed during the Forum proceedings. The panel members became irritated with the manner in which scientists presented their findings and interpretations. They found the links to public policy poorly articulated, inadequate treatment of risk, and the aggressive interactions among scientists with conflicting views unproductive.

This example illustrates the need to open up the debates on social values, ethics and science in order to provide a means to address the larger, horizontal and high profile issues that are facing government. While such processes of citizen engagement take time and resources, it is important to find means of securing greater public understanding and support for major public policy decisions that involve managing uncertainty and risk.

It is unreasonable to transplant a model directly from one culture to another, but lessons can be drawn from the experiences of other countries such as Norway and Denmark that have established structures to promote informed public debate and around controversial issues. These structures provide a means for improving public involvement in, and understanding of, policy issues on which government decisions are required. They should also shape the decision itself, through the integration of social ethics and values in the wider debate. Critical for their success is a high degree of public trust in the intellectual independence and overall strength of the agent responsible for directing and managing such an initiative.

These structures can provide an effective means of dealing with the larger horizontal issues. But even the smallest issue can become high profile if poorly managed. The extent of public concern with the science - ethics interface is demonstrated in the public press being given to "whistle-blowers" legislation and questions of muzzling scientists. A more effective and less intrusive approach than whistle blowers legislation would be to provide a formal channel for receiving and assessing public input and concern regarding science-based decision-making on a day-to-day basis. This could function within the existing structures, principles and practices of the federal government (including access to information legislation) to respond to ongoing public views and

concerns with the science - policy interface that could not be addressed in a larger thematic arena. Such moves would signal a cultural shift in addressing changing social values and emerging ethical concerns outside government.

Effective governance in a science-based society requires a series of initiatives to redefine the environment in which science is used for policy and to address the mechanisms, processes and risk communication involved in science-based decision-making.

*"...governments that exploit opportunity will be those that have the capacity to identify risks and respond with effective long-term strategies, that engage the public in meaningful participation in decisions, and that maintain national coherence in the face of diversity. Effective governments will function as learning organizations, that is they will be creative and incorporate both new information and new concepts into their decision-making processes. Such governments will be able to operate more effectively in a world of complex systems, where forecasts are uncertain and initial conditions can lead to a multiplicity of outcomes."*

Uncertainty is the Price of Freedom - paper prepared for discussion at the 1996 OECD Ministerial Symposium on the Future of Public Services"

## Appendices

- A Terms of Reference
- B Definitions and Interpretations of Terms
- C Individuals Interviewed or Who Acted as Resources in the Study
- D Issues for Interview with Federal Officials
- E The U.K. Science Guidelines
- F Two Case Studies
- G Examples of Enhanced Management Tool
- H References
- I Profiles of Federal Departments and Issues (separate document)



## *Appendix A - Terms of Reference*

### Scope of Study

Scientific advice is broadly defined to include advice provided by internal and external sources to those involved in recommending and making policy and regulatory decisions within the federal government, including Ministers.

The consultant will review the principles, procedures and enforcement measures documented and employed by federal government science-based departments and agencies (SBDAs) and by provincial governments regarding the use of scientific advice in government decision-making. The consultant will review if and how scientific advice guidelines are employed in cases where decisions affect and involve more than one federal department or level of government. The consultant will assess whether the principles and guidelines are adhered to and the impact of these guidelines.

The consultant will identify the consequences of an absence of, or inadequate, guidelines and where possible, review cases where scientific advice is purported to have been ignored, altered or suppressed.

### Methodology

The consultant will draw on his/her past experience, the available literature and interviews with at least five key federal science-based departments and agencies and five provincial governments to report on the principles and practices employed by these organizations for the use of scientific advice in government decision-making. Key federal SBDAs should include those departments which have been the object of recent public and media concern regarding the ability of departments to effectively use scientific advice in reaching decisions.

The consultant will also review available literature, including media reports and those generated through public hearings, and interview external experts, as appropriate, to assess the effectiveness of the principles and practices employed by these organizations.

The final report will provide details on the scientific advice principles, practices and enforcement mechanisms currently utilized and identify those elements that appear to be most effective.

### Deliverable

The consultant will produce a report which addresses the following:

- the role and impact of scientific advice in government decision-making;
- principles and procedures currently utilized by federal SBDAs and provinces for:

- identifying issues for which scientific advice or research will be needed;
  - building science into government decisions (i.e. how is “the best science” accessed and built into decisions);
  - performing risk assessments;
  - communicating/presenting policy (including current departmental and government policies and procedures regarding public access to scientific findings, advice and decision making); and,
  - implementing and ensuring the use of scientific advice guidelines.
- the consequences in cases where SBDAs and provinces have not employed guidelines on the use of scientific advice in decision-making.

The consultant will provide recommendations on principles and procedures, including those relating to implementation and adherence, which appear to be successful in ensuring that government decisions take account of scientific advice.

The consultant will provide a bibliography of literature reviewed and a listing of interviews conducted.

## Appendix B - Definitions and Interpretations of Terms

### *Science Assessment*

A science assessment presents the definition of a science-related problem, reviews the state of knowledge on the relevant issues and may go further to lay out the science-related implications for government decision-making and propositions for further research.

### *Risks and Hazards*

There is no single agreed definition of hazard and risk, but there is evidence of a number of common threads in their usage in the context of risk assessment and management:

“Hazard” - a phenomenon or circumstance perceived to be capable of causing harm or costs to society or the environment. It is associated with the *cause* of the perceived adverse condition. Three types of hazards have been explored in the literature - technological, natural and social. (adapted from Jones and Hood in “Accident and Design”)

“Risk” - the probability that a substance or situation will produce harm under specified conditions. Risk is a combination of two factors:

- the probability that an adverse event will occur
- the consequences of the adverse event.

Risk encompasses impacts on human health and arises from exposure and hazard. Risk does not occur if exposure to a harmful substance or situation does not or will not occur. (From *Framework for Environmental Health Risk Management* Final Report Vol 1. 1997; The Presidential/Congressional Commission on Risk Assessment and Risk Management. USA).

### *Risk Assessment* (US Presidential Commission)

Risk assessment is the systematic, scientific characterization of potential adverse effects of exposures to hazardous agents or activities. The four steps identified by various US bodies are hazard identification, dose-response characterization, exposure assessment and risk characterization.

NAS-NRC Model of Risk Assessment (US National Research Council. 1983. *Risk Assessment in the Federal Government: Managing the Process*. National Academy Press. Washington)

- Hazard identification - the determination of whether a particular chemical is or is not causally linked to particular health effects

- Dose-response assessment - the determination of the relation between the magnitude of exposure and the probability of occurrence of the health effects in question
- Exposure assessment - the determination of the extent of human exposure before or after application of regulatory controls
- Risk characterization - the description of the nature and often the magnitude of human risk, including attendant uncertainty

Questions arising on risk assessment:

- is hazard identification sufficiently different in process and impact as to warrant a separate category and consideration?
- can questions of science be clearly separated from policy in the assessment process?

### ***Risk Characterization*** (US Presidential Commission)

The process of organizing, evaluating and communicating information about the nature, strength of evidence, and likelihood of adverse health or ecological effects from particular exposure.

### ***Risk Management*** (adapted from Powell, Jones and Hood...)

The process of analyzing, selecting, implementing and evaluating actions to reduce risk. It involves identifying and weighing policy instruments/alternatives in the light of the results of risk assessment. The outcome of the risk management process is the development of approaches, standards, guidelines and other recommendations for reducing and/or mitigating risk. The risk management process would normally include responsibility for defining the parameters for risk assessment.

### ***Risk Management Framework*** (adapted from Shugart and the US Presidential Commission)

The US Presidential Commission identifies 6 stages in the risk management framework:

1. Define the problem and put it in context
2. Analyze the risks associated with the problem in context
3. Examine options for addressing the risks
4. Make decisions about which options to implement
5. Take actions to implement the decisions
6. Conduct an evaluation of the actions

The decision-making framework is used to manage risks. Process documentation would include:

- roles and responsibilities of all players
- identification of how the risk management process should proceed
- the decision-making criteria applicable in risk management context (health and safety, social/cultural, environmental, ethical, economic, other)
- the range of strategies and instruments (including non-intervention, communication, certification guidelines, regulation, economic incentives, direct service provision)
- means of making explicit and transparent
  - assumptions
  - uncertainties
  - differing opinions
  - how criteria were used (including competing criteria)
  - what evidence was considered (including conflicting evidence)
  - what strategies were considered and how they were assessed

#### *The Precautionary Principle* (derived from Shugart)

In regard to public health, action to reduce risk should not await scientific certainty. Essential preventative measures should not be delayed until causation has been proved with scientific certainty.

This principle is interpreted in the context of the level of risk that society regards as reasonable, and in comparison with other risks in everyday life.

There are science-related implications for government in the application of the precautionary principle, in particular there must be a capacity to identify when to act and how best to act.



## Appendix C - Individuals Interviewed or Who Acted as Resources in the Study

Bruce Archibald, Ontario Energy Science and Technology  
Cam Baker, Ontario Ministry of Northern Development and Mines  
Doug Barnes, Ontario Ministry of the Environment  
Laure Benzing-Purdie Policy, Planning & Coordination Health Protection Branch, Health Canada  
Ray Bollman, Statistics Canada  
Karen Brown, Environment Canada  
Jim Bruce, Independent and Advisor to Environment Canada  
Gary Boyd, Program Science, Fisheries and Oceans  
Rita Burak, Ontario Secretary to Cabinet  
Diane Campbell, Mining and Minerals, NRCan  
Ken Campbell Plants, Research Branch, Agriculture and Agri-Food Canada  
John Carey, Environment Canada  
Steve Chadwick Information and Planning Services, Agriculture and Agri-Food Canada  
Nicole Charest Research, Planning and Coordination, Agriculture and Agri-Food Canada  
Bryan Cook Energy Technologies, NRCan  
Dick Cowan, Ontario Ministry of Northern Development and Mines  
Steven Desroches, Privy Council Office  
Ron Doering, Canadian Food Inspection Agency  
William Doubleday, Science Directorate, Fisheries and Oceans  
Malcolm Drury, Strategic Planning and Coordination Branch, NRCan  
Jan Dyer Director Policy Branch, Agriculture and Agri-Food Canada  
David Elder, Machinery of Government, Privy Council Office  
Phil Enros, Science Policy, Environment Canada  
Chummer Farina, ACST, Industry Canada  
Bob Fessenden, Alberta Science and Research Authority  
Luc Fortin, Health Protection Branch, Health Canada  
Brad Fraleigh, Research Planning and Coordination, Agriculture and Agri-Food Canada  
John Gammon, Ontario Ministry of Northern Development and Mines  
Vinceza Galatone, Canadian Forest Service, NRCan  
Fred Gault, Statistics Canada  
Camil Guy, Conseil de la science et de la technologie, Quebec  
Francois Lalonde, Environment Canada  
Camille Limoges, Conseil de la science et de la technologie, Quebec  
Richard Haedrick, Memorial University  
Yvan Hardy, Canadian Forest Services, NRCan  
Richard Haworth, Geological Survey of Canada, NRCan  
Lorne Heslop, Science Policy and Planning, Agriculture and Agri-Food Canada  
Robin Hill, Health Protection Branch, Health Canada  
Norris Hoag, Ontario Agriculture, Food and Rural Affairs  
Glen Holder, Ontario Ministry of Natural Resources  
Paul Hough, BioTech Canada

Frank Ingrassia, Ontario Agriculture, Food and Rural Affairs  
Bill Jarvis, Public Policy Forum  
Ken Knox, Ontario Energy Science and Technology  
Dan Lane, Fisheries Resources Conservation Council and U of Ottawa  
Paul LeBlond, Fisheries Resources Conservation Council  
Bill Leiss, Royal Society of Canada and U of Calgary  
Dalia Kudirka, Special Advisor, Biotechnology Agriculture and Agri-Food Canada  
Robert MacKay, Science and Technology Secretariat, Nova Scotia  
Anne MacKenzie, Science Evaluation, Canadian Food Inspection Agency  
Jim MacLean, Ontario Ministry of the Environment  
Fatma Maged, Strategic Planning and Coordination Branch, NRCan  
Mike Maloney, Department of Agriculture, New Brunswick  
Art May, Memorial University  
Dan McLeod, Health Protection Branch Health Protection Branch  
Mary Mes-Hartree, Canadian Forest Services, NRCan  
Stéphan Mercure, Strategic Planning and Coordination Branch, NRCan  
Marshall Moffat, Innovation Policy Knowledge Infrastructure Directorate, Industry Canada  
Gene Nyberg, National Round Table on the Environment and the Economy  
Alan Nymark, Health Canada  
Donald Obonswain, Ontario Ministry of Northern Development and Mines  
Chris Riddle, Ontario Energy Science and Technology  
Bob Seguin, Ontario Agriculture, Food and Rural Affairs  
Robert Slater, Environment Canada  
Stuart Smith, National Round Table on the Economy and the Environment  
Andrei Sulzenko, Industry Canada  
Marie Tobin, Industry Canada  
Ron Vrancart, Ministry of Natural Resources  
Jean Pierre Wallot, The Royal Society of Canada  
Brian Wilson, Strategic Planning and Coordination Branch, NRCan

## **Appendix D - Issues for Interviews with Federal Officials**

1. What principles or procedures are used (and under discussion) to ensure effective integration of science into government decisions/policy advice? How are these procedures implemented, monitored and enforced? How is quality/objectivity evaluated?
2. What sources are used to obtain science input for policy advice and decision-making?
3. What practices are used to address policy issues which transcend traditional departmental mandates or federal-provincial mandates and which require science input?
4. What approaches or systems are used to identify emerging issues that may require science input?
5. What is role of, and receptor capacity for, risk assessment in science/decision-making?
6. What principles are applied with respect to public access to science advice and communication of policy and regulatory decisions?
7. What improved practices, principles or methods of enforcement (if any) are needed to address all of above issues?



## Appendix E - U.K. Science Guidelines

### Compendium of Guidelines - Scientific Advice in Government Policy United Kingdom - 1997 Policy Statement by R. May, Chief Science Advisor

#### A *Identifying Issues*

1. Individual departments and agencies should ensure that their procedures can anticipate as early as possible those issues for which scientific advice or research will be needed, particularly those which are potentially sensitive. Early identification of issues should always be the aim.
2. No single approach is likely to be adequate. Instead, information should be drawn from a variety of sources and monitored by those responsible for the department or agency function as an intelligent customer for science, engineering and technology.
3. Sources may include:
  - i departments' own programmes of research. It is important that departments maintain adequate support for broadly-based longer term research to help them identify and/or respond to new and unexpected findings;
  - ii research from non-departmental sources, including international bodies (e.g. the European Commission);
  - iii departments' existing expert advisory systems, where members of committees may be specifically asked to draw attention to new areas in the scientific literature. Membership should be kept under review to ensure an appropriate range of scientific opinion is represented;
  - iv discussions with those in the Research Councils, industry, academia and elsewhere, including through the network of Foresight panels. These are likely to be most fruitful when held against the basis of long-standing relationships developed with departments;
  - v issues brought to the attention of Government by the interests directly concerned (e.g. individuals, companies, scientists or lobby groups) or by reports in the media.
4. Nonetheless, some issues will inevitably arise with little or no prior warning. Departments should ensure that they have the capacity to recognise the implications and to react quickly and efficiently to such crises.
5. It is important that there should be mechanisms for early identification of issues which affect more than one department/agency, or may have an international dimension, and for early provision and exchange of information. The Office of Science and Technology has responsibility for ensuring that SET issues which cross departmental boundaries are effectively handled. It will keep emerging transdepartmental issues under regular review, in liaison with departmental Chief Scientists.

## ***B Building Science into Policy***

6. Once a potentially sensitive issue has been identified, departments should consider how to access the best available scientific advice. They should ensure that they draw on a sufficiently wide range of the best expert sources, both within and outside Government. They should seek wherever possible:
  - i to take independent advice of the highest calibre (whether provided by eminent individuals, learned societies, advisory committees, or consultants). Efforts should be made to avoid or document potential conflicts of interest, so that the impartiality of advice is not called into question;
  - ii to ensure that Research Councils are invited, where appropriate, to provide scientific input and contribute to interdepartmental discussions;
  - iii to involve experts from outside the UK, for example those from European or international advisory mechanisms, particularly in cases where other countries have experience of, or are likely to be affected by, the issue under consideration;
  - iv to involve at least some experts from other, not necessarily scientific, disciplines, to ensure that the evidence is subjected to a sufficiently questioning review from a wide ranging set of viewpoints;
  - v to ensure that data relating to the issue are made available as early as possible to the scientific community to enable a wide range of research groups to tackle the issue. Scientific advance thrives on openness and competition of ideas.
7. Where the policy issue falls within European Community competence, or is likely to affect intra-Community trade, particular attention should be paid to encouraging a sound scientific basis for Community decision-making. This may involve contributing to Community-level scientific committees, briefing the Commission on developing scientific opinion, and exchange visits by scientific experts from other Member States.
8. Drawing particularly on the principles set out in paragraph 6, departments should involve the scientists whose advice is being sought in helping them frame and assess policy options. This will help maintain the integrity of the scientific advice throughout the policy formation process.
9. In practice, deliberations frequently involve a risk assessment of one type or another. Separate guidance on risk assessment is listed in the Annex. Recent public debate, to which the Minister for Science and Technology and the Chief Medical Officer for England have contributed, has focused in particular on the presentation and communication of risk.

The Interdepartmental Liaison Group on Risk Assessment (ILGRA), chaired by HSE, provides a forum for taking forward cross-Government dialogue on these issues.

10. Departments should systematically review priorities to see whether funding needs to be directed to programmes of further research to illuminate outstanding areas of uncertainty identified. Departments' R&D programmes should conform to competitive tendering rules and be subject to robust quality assurance systems involving peer review.
11. Scientific advice will often involve an aggregation of a range of scientific opinion and judgement as distinct from statements of assured certainty. Departments should ensure that the process leading to a balanced view is transparent and consistent across different policy areas, in the light of the guidance above.

### **C** *Presenting Policy*

12. In line with the Government's *Code of Practice on Access to Government Information*, there should be a presumption towards openness in explaining the interpretation of scientific advice. Departments should aim to publish all the scientific evidence and analysis underlying policy decisions on the sensitive issues covered by these guidelines and show how the analysis has been taken into account in policy formulation. Scientists should be encouraged to publish their own associated research findings.
13. Openness will stimulate greater critical discussion of the scientific basis of policy proposals and bring to bear any conflicting scientific evidence which may have been overlooked. These are good reasons for releasing information, an action which could in itself avoid greater controversy in the longer run. Departments must ensure appropriate procedures are agreed with the academic community and industry for handling intellectual property rights when information is released.
14. It is important that sufficient early thought is given to presenting the issues, uncertainties and policy options to the public so that departments are perceived as open, well prepared and consistent with one another and with the scientific advice. The difficulties associated with presenting uncertain or conflicting conclusions should not be underestimated.
15. In public presentation, departments should whenever possible consider giving scientists a leading role in explaining their advice on the science, with Ministers or policy officials describing how the Government's policies have been framed in the light of the advice received. Further advice is available in the Government's *Code of Practice on Access to Government Information: Guidance on Interpretation*.
16. Early communication with key interest groups may be appropriate. Consideration should also be given to providing early warning of significant policy announcements to other governments and international organisations, where there are likely to be implications for

other countries. Where possible, scientists from such countries or organisations should be involved in the process of consultation and advice.

*D Review*

17. Issues coming to Ministers for collective consideration should make clear to what extent it has been practicable to follow the advice in this note.
18. The Government's official committee on science and technology, EDS(O), will keep under review departments' and agencies' procedures for early anticipation and identification of issues for which scientific research or advice will be needed. OST will keep emerging transdepartmental issues under review. OST will also monitor implementation of the principles across departments, and include a report in the annual Forward Look of Government-funded Science, Engineering and Technology.

## Appendix F - Two Case Studies

### Case Study - Pulp and Paper Effluent Regulations

#### *Situation Genesis*

- 1984-85 - Swedish publication linking the level of AOX<sup>1</sup> as a measure of chlorinated compounds in the effluents with toxic effects. This was in turn linked to the use of the kraft process dominant in Canadian pulp and paper mills.
- Mid 1980's - significant pressure from environmental NGOs (within Canada and off-shore) on the Canadian government to introduce strict controls over AOX emissions.
- 1988 question put to researchers within Environment Canada to provide and justify a target level of AOX effluent for regulatory purposes in Canada.

#### *Science and science advice to government*

- Building on an existing strategic research program, the National Water Research Institute (NWRI) carried out strategic research that demonstrated sub-lethal physiological effects of pulp mill effluents in rivers and lakes, but did not demonstrate a link between levels of AOX and toxic responses.
- By 1991 a reasonable body of evidence was building that AOX was not a good predictor of the sub-lethal effects of pulp and paper effluents. That evidence was some 2-3 years from being sufficiently well documented (would require more data) for rigorous peer review, but there was confidence in the investigators and in the science inferences to warrant action.
- A judgement call was made that there was sufficient evidence to advise the policy makers that “we do not have the scientific evidence to make this regulation”.

#### *Process issues*

- The question from the policy level was good - seeking a “number” based on good science that could be defended as an appropriate base standard for organo chlorines in pulp and paper mill effluent. It provided scope for NWRI to do a science assessment and some necessary follow-up research to provide input.
- Anticipatory capacity - prior NRWI research had indicated analogous effects to Swedish situation, but no demonstration of link with AOX. Researchers had good awareness of

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<sup>1</sup>AOX = Adsorbable organic halogen.

international literature and controversy over issue.

- Timing - NWRI did not wait until iron-clad evidence was in. It took action to advance scientific opinion on the basis of a reasonable level of confidence (precautionary approach/principle). Had it waited, the decision-making process might have been forced into action by strong NGO pressure.
- Science - policy interface - main scientist involved had i) an understanding of the needs of the policy community and how to frame scientific advice and ii) the opportunity to present the science case to the ADM and DM.

#### *Overall outcomes assessment<sup>2</sup>*

- Canada - Science and science advice from NWRI influenced regulators at the federal and provincial levels in designing regulations for AOX emissions. In the case of federal regulations, AOX was not included; in some provinces, AOX limits were not as stringent as they would otherwise have been. Environment Canada's assessment is that there were no foregone environmental benefits as a result of these regulatory decisions
- International Markets - science underpinning Canadian decision changed perceptions of AOX as a toxic substance, and moderated bias against Canadian products using the kraft process.
- Economic impact - estimates:

1.	Direct savings in Canada	\$1.17 billion
2.	Export market protected	\$762 million
- Further research - research initially focussed on identification of "compound X" (whether or not it is chlorinated) and then moved to examine design and process changes that would minimize overall toxic effects, recognizing the complexity of interactions between the effluent and aquatic/marine environment.

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<sup>2</sup>Measuring the Impacts of Environment Canada's R&D. Case Study: Pulp and Paper Effluent Research. Report to Environment Canada (Marbek Resource Consultants in association with Secor Inc.). September 1997

## Case Study - Regulating Sulphur in Gasoline

### *Situation genesis*

- In 1995 the Canadian Council of Ministers of the Environment (CCME) accepted a report to develop national approaches to vehicle emission and efficiency standards and fuels formulations for Canada. One aspect of this report - sulphur in gasoline - was highly controversial with the industry and some provinces.
- Following representations from the industry, CCME asked for multi-stakeholder assessments to be undertaken to set a cost effective limit for sulphur in gasoline, taking into account associated health and environmental benefits.

### *Process approach*

- Purposeful segregation of process into 3 phases - preparatory, fact finding and policy making (interpretation and formulation of recommendations to ministers). Final phase under control of government.
- Partnership of Environment Canada and Health Canada with provincial counterparts (both health and environment) in overseeing review.
- Stakeholder involvement - industry and NGO on Steering Committee (phase 1 and 2). The Secretariat also had an industrial nominee.
- Focus on neutrality and independence - Assessment panel process chaired ("Studies Chair") by an independent high profile person - David Johnston for credibility with the general public and private sector. Johnston also oversaw the selection of experts for the panels, panel process and Secretariat. There were negotiations with stakeholders at all stages of the process.
- Three expert panels were formed drawing in top flight expertise, including non-Canadians - Atmospheric Science; Health and Environmental Impacts; Cost and Competitiveness Assessment. The two scientific panels comprised leaders in their fields (Canada and the US) and worked autonomously, drawing on other experts as required. Much of the work on the policy side - cost and competitiveness panels - was done by consultants.
- Acceptance of outputs of expert panels - On sharing of interim reports of the expert panels, industry participants challenged the validity of the findings and attempted to discredit the review, despite active participation. Expert panel reports were not peer reviewed.
- Interpretation phase - federal-provincial working group could not reach consensus; opted

for set of options and associated analysis that would go to Minister for decision. New regulations have now been gazetted.

*Process issues and lessons*

- Balancing stakeholder involvement - need for careful articulation of ground rules up front to ensure balance of public and private interests and to be able to provide Ministers with the necessary tools to deal with lobbying efforts.
- Structure of process - critically important are the credibility and objectivity of the panel chair, the breadth of interests and expertise on the panel, the provision of the necessary resources to underpin the expert panel work. Observation - every individual, no matter what background or affiliation, has vested interests.
- Impact of process - even with controversy, the process of an expert panel review involving stakeholders rises the substantive level of understanding of an issue among a broader community, including decision makers.
- Dealing with uncertainty in a policy context - there is a natural tendency of expert panels and stakeholders to seek an iron clad level of proof in relation to the scientific inferences. Government involvement in the process was seen to enhance the likelihood of a policy relevant outcome focussed on “best professional judgement given the state of knowledge and uncertainty today”.

**Appendix G - Example of Enhanced Management Tool  
Overview of Issues in the Constitution of an Advisory or Review Panel<sup>3</sup>**

<i>Potential Bias or Pitfall</i>	<i>Problem Caused</i>	<i>Means of Mitigating Problem</i>
Single expert bias	Use of one expert; tendency to overestimate extent of agreement with own view	Peer review of science assessment
Disciplinary paradigm bias	Working assumptions set in cognitive framework of a single discipline. Can produce limiting set of interpretations and a lack of a systems approach	Careful definition of the question that is being addressed by the science assessment Multi-disciplinary panel
Erroneous logic	Assumption that absence of error to support a proposition is equivalent to the presence of evidence that refutes it.	Careful training of scientists in the presentation of implications.
Non-systems bias	Analytical methodology of science assessment does not address integrated resource management	Careful definition of the question that science is informing Science assessment in context of integrated resource management
Undue certainty	Inadequate attention to uncertainty, probabilities and risk	Develop protocols for presenting uncertainty and probabilities (e.g. small scale probabilistic models)
Exclusionary bias	Data from non-traditional and un-peer reviewed sources excluded, regardless of potential relevance and contribution to conceptual framework (e.g. fisheries)	Incorporate knowledgeable users in science assessment process. Provide means of integrating and reviewing data from non-traditional knowledge sources . Also provide means of voicing divergent views
Unbalanced data sample	Data in the public domain not representative of actual knowledge base (publishing habits of industry and/or journals). Tends to exaggerate uncertainty of knowledge	Release interim findings of science assessment for wider public comment than simply peer review

<sup>3</sup>Derived from Fisk (1998).

Imagination block	Lack of imagination regarding the significance and implications of available data. Tendency to limit full range of interpretations	Wide circulation of interim findings to groups that would not participate in the science assessment from concerns of being compromised
Gender or ethnic bias	Limitations on the source of data or nature of interpretations considered	Ensure that expert panel draws on an appropriate diversity of members and sources of input
Future funding implications	Conjectures support research funding decisions favorable to participants interests. Tendency to focus on hypotheses that require more research	Separate science assessment from the assessment of a future research agenda. Include in the process individuals who would not benefit from funding

## Appendix H - References <sup>4</sup>

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#### ***Public Involvement in Assessing the Implications of Science Advice***

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2. Joss, Simon. *Consensus Conferences: Danish consensus conferences as a model of participatory technology assessment: an impact study of consensus conferences on Danish Parliament and Danish public debate*. Science and Public Policy, Volume 25, Number 1, February 1997. pp. 2-22.



## Appendix I - Departmental Profiles

This appendix to the report *Science in Government Decision-Making: The Canadian Experience* is a set of departmental profiles that are intended to provide more focussed insights on the science based departments and agencies that were targeted in the study. Each profile touches on the departmental mandate, the key features of its use of science for government decision-making, and some of the existing policies and procedures in place or under consideration. They also highlight current issues (as seen by various interviewees) concerning the use of science in decision-making.

These are necessarily very condensed and contain some subjective assessments by the project team in terms of the policies and procedures relevant to this study and the current issues. Time constraints also precluded an extensive review of any one of the target departments. The authors take full responsibility for the views expressed.

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## Agriculture and Agri-Food Canada

### 1. *Context for Use of Scientific Advice*

The mandate of the Minister of Agriculture and Agri-Food is to promote the development, adaptation and competitiveness of the agriculture and agri-food sector. The Minister has the ultimate responsibility for strategic policy and planning for the Agriculture and Agri-Food Portfolio which includes, inter alia Agriculture and Agri-Food Canada (AAFC) and the Canadian Food Inspection Agency (CFIA).

The mission of Agriculture and Agri-Food Canada (AAFC) is primarily economic, “to work with industry and other partners to:

- improve and secure market access and enable the agriculture and agri-food sector to capture opportunities for trade in domestic and export markets, with a focus on higher value-added agri-food products;
- support the sector’s efforts to develop and produce competitive products and processes in an environmentally sustainable manner;
- enhance the sector’s economic viability while strengthening opportunities for rural economic development.”

Reporting to the Deputy Minister of AAFC are the Assistant Deputy Ministers (ADMs) responsible for Policy Branch, Research Branch, Market and Industry Services Branch, and Corporate Services Branch and the Directors General responsible for Review Branch, Communications Branch, Prairie Farm Rehabilitation Administration (PFRA) and Human Resources Branch.

There are four business lines, that entail branches working together to deliver on departmental priorities:

- Expanding markets;
- Innovating for a sustainable future;
- Strong foundation for the sector and rural communities;
- Sound department management.

All activities of Research Branch are aligned under the second business line which is shared with PFRA and the Policy Branch’s Environment Bureau. The immediate client for most of the outputs of its science capacity is the agricultural and agri-food industry in supporting the sector efforts to develop and produce competitive products and processes in an environmentally sustainable manner. Government decisions on the environmental, land and water policies, and transportation and trade policies will involve departmental input, normally in cooperation with other departments and agencies. While some component of AAFC’s activities continue to be related to safety and health (disease control and food safety), the creation of a separate Canadian Food Inspection Agency (CFIA) and Pest Management Regulatory Agency (PMRA) have

modified the balance of activities within the department. Note: CFIA, while separate from AAFC, is still under the Agriculture and Agri-Food Portfolio and under the responsibility of the Minister of Agriculture and Agri-Food; PMRA is under the responsibility of the Minister of Health.

A Memorandum of Understanding (MOU) between the AAFC and CFIA includes an appendix concerning research that provides a framework for cooperative activities by:

- confirming the business of both parties;
- defining the nature and responsibilities of each organization;
- identifying priorities and the areas of common interest;
- establishing joint planning activities.

The Research Branch has five “Key Result Area Expected Outcomes”:

- Resources - services and technologies which conserve soil, water and air quality, as well as genetic resources;
- Crops - new stress resistant crop varieties and crop production and protection systems;
- Animals - new animal production and protection systems;
- Food - new value-added food and non-food products and processes;
- Collaboration - increased level of collaborative research between industry and the department.

## **2. *Practices and Procedures***

External advisory structures:

- Canadian Agri-Food Research Council (CARC) structure (including its Expert Committee system) seen as being a prime source of external science advice. It includes members from federal and provincial governments, industry, academe, scientific societies, producers’ groups, civil society organizations (industry personnel represent more than half the membership).
- Research Branch Advisory Committee (RBAC) comprising people from the food processing and producer industries that meets twice a year, provides networked advice from well connected people, a sounding board for priorities developed by the Research Branch and an environmental scan. The Committee is oriented to industry; no environmentalists or consumers at present.
- Each of approximately 18 research centres has access to a research advisory committee comprising producers, industry and university representatives. The four centres in Atlantic Canada are served by one advisory committee.

Sources of scientific advice to AAFC:

- In-house expertise contributes a significant component of the science input to decision making. Research Branch does not commission R&D, but does cooperative work with industry and university researchers.

- Additionally, AAFC participates in and uses multi-partite advice on technical issues developed through the 27 expert and Canada committees of the Canadian Agri-Food Research Council. These examine issues related to natural resources, crops, animals, and food. The 7 provincial agricultural coordinating committees also input information and recommendations to CARC.
- Joint action with other stakeholders in the “issue round tables” (e.g., Kyoto convention - greenhouse gases).

#### External Review:

- Every 5 years a research centre gets a full scientific review. The bulk of the members are external, the focus is strategic. These reviews are managed by AAFC.
- There is no recent written policy framework for the reviews. Operationally, a Centre DG prepares Terms of Reference and appoints a Chair; together they select the members of an external review committee. Such review may include international experts. A staff person outside the unit under review may act as secretary.

#### Quality assurance:

- Quality for partnered work validated through client willingness to cost share; work with industry/client/producer/stakeholder.
- Peer reviewed publications as indicators of quality for long-term work that is funded from core budget.
- Client orientation needed for relevance, including research partnerships through matching investment incentives.

#### Horizontal Issues:

- Participation in 5 NR MOU on sustainable development is very important. Initial focus - discussions on common issues, including rationalization and priorities. This evolved to a forum for more specific cross cutting issues, e.g., coastal zone management, nutrients in water, heavy metals in water, and has led to collaborative research initiatives particularly development/synthesis of scientific information for policy (e.g., Kyoto).

#### Science-policy interface:

- Policy Branch deals with larger policy issues, including sustainable development, climate change, biodiversity and income support. The Policy Branch relies extensively on the Research Branch for scientific advice.
- A policy unit within the Research Planning and Coordination Directorate of Research Branch is responsible for the management of horizontal issues in S&T, (e.g., intellectual property issues, ethics and best practices, coordination of the activities under the 5NR MOU).
- Designated issue and sector coordinators in the Research Branch have a mandate to bridge the science to policy interface.
- Policy Branch deliberately makes the effort to bring in people to the policy shop who can

deal with science; this is relatively difficult and rare, but essential for policy development and decision making in areas that are highly technical such as greenhouse gases emissions, biodiversity and biotechnology.

- Examples of how the planning process translates policy into S&T activities that in turn supports further policy:
  - international trade → targets → policy changes needed → impacts on sustainable development → S&T agenda.

### 3. *Current Issues*

Anticipatory capacity:

- Some big gaps - e.g., identity preservation system for wheat; many biotechnology policy issues, including consumer acceptance.
- The importance of greenhouse gases in the agricultural sector was not foreseen in time to build internal capacity to respond effectively to the Kyoto Agreement on emission levels.

Capacity issues:

- Capacity to deal with various dimensions of biotechnology, including protection of IP, genetic material from developing countries; the dominance of one industrial player.
- Nutraceuticals - Question of capacity to understand the policy implications and bargain internationally in good faith on functional foods and genetically modified food stuffs, even before the question of what is government policy is addressed.
- Ethical dimensions of food production.

Horizontal issues:

- Biotechnology file - difficulty in championing a cross-cutting issue (7 departments for each of which it is important, but not the #1 priority). Has a strong 'public good' component. Such initiatives can too easily fall through the cracks.

Industry orientation:

- Industrial orientation of department and the matrix of advisory boards excludes, in large measure, participation of the ultimate consumer and environmental groups. There is a question of whether the "science for policy" component of the AAFC mission is adequately represented in the current structure as it pertains to identification of emerging issues or development of the science capacity to underpin policy decision making. This also becomes a question of openness.
- Provincial governments, as users of the science outputs, have noted a decrease in AAFC contributions to their "science anticipatory capacities" and attribute this to funding AAFC research through the Matching Investment Initiative. The previous practice of interim reports on research activities served a very effective foresight role. While final reports are still available under the new approach, they do not have the same lead time.

- Question of whether the committees of CARC are too close to the department to give broadly based independent advice.

Identified barriers to science in decision making:

- Significant issues continue in setting priorities in research that respond to policy needs, while retaining long term flexibility.
- Need to better bridge science and policy; need training, cross assignments, more interchange among departments.
- Lack of capacity within PCO for dealing with science issues; need for more understanding of nature and role of science advice.
- Concept of return on investment seems not to extend to public interest.
- Difficulties in communicating uncertainties in policy.
- Science advice not available in a timely fashion.

#### 4. *Documentation*

- *Agriculture and Agri-Food Canada 1996-97 Estimates: A Report on Plans and Priorities. Pilot Document.* Review of Departmental programs, priorities and performance framework.
- *Agriculture and Agri-Food Canada Performance Report For the Period Ending March 31, 1998.* Report of progress against goals established in the 1996-97 year.
- *Research Branch Business Plan 1995-2000.* Includes an overview of the structure of the Branch, the advisory committees and the process for priority setting.  
<http://www.agr.ca/research/resplan/businee.html#department>.
- *Innovating for a Sustainable Future: Plans for 1999-2002.* Plan and responsibility centres for activities of AAFC in relation to three “key results areas”:
  - innovation
  - sustainable resource use
  - integrated policies and decision making
 Outcomes, rather than process oriented. Outlines indicators.
- *Canada's National Strategy for Agri-food Research and Technology Transfer 1997-2002.* Canadian Agri-Food Research Council of Canada 1997. Five-year strategy developed following consultation with members of the agri-food community in the federal, provincial, university and private sectors. Focus - competitiveness and viability.
- *Memorandum of Understanding between Agriculture and Agri-Food Canada and the Canadian Food Inspection Agency - Appendix Concerning Research.* Outlines the relationship between AAFC and CFIA, including the relative responsibilities of both

parties and the process to identify areas of mutual interest and the support of AAFC Research for the CFIA mandate.

- *Make it Happen with the Matching Investment Initiative.* Brochure on the AAFC program to boost R&D investment in areas of mutual interest with partners.

### ***Appendix - Agriculture and Agri-Food Canada Advisory Committee Structure***

National agricultural research needs are identified and priorities established through consultation with several key sources. Guided by the Minister's priorities, organizations that have input into this process include:

1. Research Branch Advisory Committee (RBAC);
2. Research centre advisory committees;
3. Canadian Agri-Food Research Council.

#### ***1. Research Branch Advisory Committee (RBAC)***

##### *Background*

The purpose of the Research Branch Advisory Committee (RBAC) is to provide advice and counsel on research and development priorities and programs to the Research Branch, Agriculture and Agri-Food Canada.

The RBAC will provide a focus for food and agricultural research priority setting to support the competitiveness of the agri-food sector by: identifying broad research needs; reviewing research activities and recommending a balanced response to both regional and national needs.

##### *Functions*

More specifically, the role of the RBAC will be to:

1. Make recommendations with respect to the development of food and agricultural research programs and priorities.
2. Advise on ways to foster more effective technology development, application and transfer to client groups.
3. Advise on ways to increase private sector investment in agri-food R&D.
4. Evaluate the business plan of the Research Branch advising on operational issues.

5. Advise on strategic research directions and ways to avoid competition with existing private sector, university and provincial government activities in research and technology development.
6. Foster communication between public sector researchers and industry.

### *Composition*

The RBAC will be comprised of senior private sector appointees representing agribusiness, processors, producers and consumers. Private sector membership will be limited to a maximum of ten (10).

A private sector appointee will serve as Chairperson of the Committee. The Assistant Deputy Minister, Research Branch, will serve as Co-Chairperson. The selection criteria for the position of Chairperson will be seniority based. The Chairperson will be identified by consensus of the members.

Appointments to RBAC will be made based on nominations made by, and subsequent approval of, both the Chairperson and Co-Chairperson.

Appointments should reflect the business lines within the Research Branch. Specifically, there should be representation from the resource, animal, crop, and food sectors. Insofar as is possible, every effort should be made to address geographic balance, linguistic and gender considerations.

The duration of appointments will be three years, to ensure continuity. Appointments may be extended for one or two additional years to a maximum five year term of appointment.

Two senior Agriculture and Agri-Food Canada officials may be appointed as federal government representatives on RBAC. The Chairman of the Canadian Agri-Food Research Council (CARC) will be an ex-officio member of the Committee.

### *Operations*

The RBAC will meet at least annually at the call of the Chair.

Secretariat support to the RBAC will be provided by the Research Branch.

The RBAC shall be empowered to establish sub-committees and make reasonable work assignments to its members. Any sub-committees could be chaired by private sector members.

## *Compensation*

Members will be compensated by the Research Branch for travel expenses in accordance with Treasury Board guidelines. No other compensation will be paid.

### **2. *Research centre advisory committees***

Each research centre has an advisory committee to provide advice and counsel on research priorities and programs. These advisory committees focus on research and technology issues that pertain to the national or regional mandate of the centre they serve.

### **3. *Canadian Agri-Food Research Council (CARC)***

The Canadian Agri-Food Research Council (CARC) helps to focus the research efforts by all performers of R & D nationwide to avoid duplication, ensuring that research performers get the most out of their investment.

Objectives:

- to identify emerging research and related educational issues, and recommend suitable action;
- to coordinate and to be a catalyst for research priority setting in Canada;
- to be a catalyst for strategic planning on commodities, products, and special issues;
- to build networks among industry, governments, and universities for mutual benefit;
- to communicate CARC's activities to all participants;
- to advise all participants concerning current agricultural research issues;
- to review and renew regularly the National Strategy for Agri-Food Research and Technology Transfer.

CARC has 32 members, representing the federal and provincial governments, industry, scientific societies civil society, organizations and the universities. Reporting to CARC are:

- 5 standing and ad hoc committees;
- 7 provincial agricultural coordinating committees, with the Atlantic provinces operating as a unit;
- 4 Canada committees and their 27 expert committees investigating issues related to natural resources, crops, animals, and food.

## Canadian Food Inspection Agency

### 1. *Context for Use of Scientific Advice*

CFIA, which came into being on April 1, 1997, has a mandate to enhance the effectiveness and efficiency of federal inspection and related services for food and animal and plant health. Reporting through the Minister of Agriculture and Agri-Food Canada, its creation brought together inspection services previously distributed across four departments - Health Canada, Agriculture Canada, DFO and Industry Canada.

The driving force behind the creation of CFIA was the recognition that Canada's food inspection system operated in a changing domestic and international context. International trade agreements, the application of biotechnology to the food industry, changing demographics and dietary needs, as well as the ethnic makeup of Canada required a more proactive and flexible approach in system design and delivery than was likely under the former complex division of responsibilities between various departments and levels of government. The new organizational structure is described as facilitating a more uniform and consistent approach to safety and quality standards, and risk-based inspection systems, contributing to consumer protection, facilitating market access, improving service delivery and a greater degree of coordination among federal departments and with other levels of government.

The role of CFIA as a key regulatory arm of government in the overall food system (extending to animal, plant and fish) was characterized in the original Blueprint in the context of the responsibilities of all partners:

1. **Industry** has primary responsibility for the safety and quality of product, and to provide a reasonable level of descriptive product information to permit consumers to make informed decisions.
2. **Consumers** have a right to be informed and the responsibility to handle food properly.
3. **Government** has a responsibility:
  - to set and enforce standards pertaining to health and safety, based on sound scientific risk assessment and management principles;
  - to ensure that product information provided by industry is sufficient and accurate;
  - to provide health and safety information to consumers; and
  - to interact internationally to represent the interests of Canadian consumers and producers.

Interpreting these functions led to a redefined role for government in food inspection activities and the development of options for the delivery of non-health and safety related programs, through the use of public good and private good criteria:

*Generally, governments will focus their resources towards the continued assurance of the health and safety of the food supply, as well as economic fraud prevention. Services which are clearly defined as having only private benefit will be discontinued or provided on a cost recovery basis.*

### The Blueprint

The actual allocation of responsibilities for standards and compliance in regard to the various elements of the food system (gate to plate) is summarized in the table below.

	<i>Sets Standards</i>	<i>Ensures Compliance</i>
Food safety and human health	Health Canada	CFIA
Animal and plant health	CFIA	CFIA
Fish health	DFO	CFIA

At present there is a major process of legislative reform underway including modernization of statutes to reflect the food continuum (gate to plate) and national harmonization of standards. Among the intents is to improve CFIA's ability to address new and emerging scientific and technological advances and development (e.g. biotechnology).

In addition to maintaining an effective inspection service, CFIA provides support for the Minister in his responsibilities for establishing animal and plant health standards and underpins Canadian participation in international organizations for the purposes of maintaining and expanding international market access and protecting Canadian interests in relation to the food system.

These collective activities draw on the science competence of CFIA. CFIA views its clients as including all Canadian stakeholders in the food continuum.

## 2. *Practices and Procedures*

Source of science in advice:

- CFIA takes considerable care not to be seen to be allied with a large industrial firm to ensure credibility of its operations (in contrast with AAFC which considers the agri-food industry as prime client). Data considered in science and risk assessments may come from the firm, but joint projects would bring the perception of conflict of interest.
- Given the nature of the science and the time demands, science input is in-house; not the type of science that is done in universities.

Risk Assessment and Management:

- CFIA is a central player in risk assessment/management. Risk assessment is a shared responsibility with Health Canada (HC - risks to human health and safety; CFIA - risks to

animal and plant health). Risk management is the cooperative responsibility of CFIA and partners (industry and government). There is an Animal Plant and Food Risk Assessment Network (APFRAN) within CFIA that harmonizes risk assessment methodologies across disciplines, serves as a liaison between science and management, and communicates with other agencies.

- Consistent with models evolving in other countries, CFIA has committed to inspection systems based on the principles of scientific risk assessment and to the allocation of resources to activities that result in effective risk management.
- New inspection methodologies entail charting the food continuum from production to consumption, identifying hazards along the continuum, examining the effectiveness and efficiency of control strategies in place and designing new strategies.
- At the heart of this approach are the principles of Hazard Analysis Critical Control Point (reproduced in the appendix to this profile). It is applied as a type of science-based benchmarking of critical points in the overall food production process at which problems can occur and used to trigger a product rejection/acceptance decision. In Canada compliance is voluntary; in the US, mandatory. CFIA registers companies (not a certification process, but a registration process) under HACCP. Appears effective.
- CFIA is also examining new approaches to risk assessment/management, including solicitation process (Harvard University) in which a sophisticated process of obtaining broad input on an issue is carried out by trained and skilled people. This is an FDA funded initiative in the US.

#### International:

- CFIA has a responsibility to identify and respond to food safety concerns from around the globe. Similarly, the inspection and quarantine services can affect the competitive position of products on world markets.
- As the “competent authority” for Codex Committees<sup>1</sup> in Canada (and in other like fora), CFIA participates in discussions on such issues as appropriate levels of protection and equivalency under global trade agreements. Such participation is expert-based.

#### Transparency:

- CFIA has an extensive web site that documents the various functions and structure of the agency, the various Federal acts under which it is charged with administration, enforcement and compliance, the operational approaches used (e.g., plant pest risk assessment), decision documents and other related information designed to enhance public understanding of generic and regulatory issues of food safety.

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<sup>1</sup>The Codex Alimentarius Commission is a subsidiary body of the UN World Health Organization and the Food and Agriculture Organization. It deals with a wide range of food issues related to safety, composition, additives, contaminants, nutrition, pesticide residues, and labelling. Following the most recent GATT discussions, Codex standards carry more weight and are becoming increasingly more important to national governments.

- Strong tradition of publication in refereed journals within CFIA.

Quality assurance:

- Strong reliance on publications of individual scientists.
- Initiating a focussed discussion with clients (often with very sophisticated industrial labs) to explore issues of quality, especially the extent to which units are fully up-to-date.

Science - Policy Interface:

- In science advice/risk assessments, dissenting opinions are exposed to the Minister.
- Scientists will present to and respond to questions from Minister where issues likely to be controversial.

### 3. *Current Issues*

Capacity:

- Agency concerned that even with new models of delivery, it may not have the science capacity to underpin its regulatory mandate in regard to new products, especially biotechnology.
- Science and science capacity for regulation is different than academic science.

Structure:

- Debate on CFIA structure among public policy analysts external to government. Some characterize CFIA as a model case history of structural reform with a carefully structured accountability regime for an integrated portfolio in which Ministerial accountability is retained, but significant regulatory responsibility is delegated. Others challenge it as not going far enough. At the same time, CFIA is generally regarded as having many “best practice” attributes, including:
  - new paradigm of industry managed system of inspection based on science and risk analysis;
  - integration of the larger food inspection system in a single organization;
  - cooperative action of federal and provincial governments on harmonization;
  - strong core of scientific expertise that is well linked with experts in Canada and internationally.

Precautionary Principle - interpretation across government:

- Need for more precision as to what it means.
- Need a cost/benefit element in decision-making framework.
- Need more intellectual rigour in how risk is approached (assessment and management).

Code of practice:

- Need to develop a clear code on what scientists can and should say in public to ensure balance of openness and respect for Cabinet solidarity.

#### 4. *Documentation*

- *A Blueprint for the Food Inspection System: A Statement by the Joint Steering Committee of CFIS, the Federal/Provincial Agri-Food Inspection Committee and the Federal/Provincial/Territorial Food Safety Committee.* 1995.
- *CFIA Corporate Business Plan 1997-2000.* Outlines the legal and program basis for CFIA, the operating environment and the business priorities and strategies.
- *CFIA Annual Report 1997-98.* Provides an overview of the first year of operation of the new agency.
- *CFIA A Plan for Legislative Renewal: Summary Report.* October 1998. Sets out a legislative plan for modernization and consolidation of the CFIA legislation following consultation with stakeholders.
- *CFIA Regulatory Process Overview.* Process for adopting and adapting regulations. September 28, 1998. Extract from Standard Operating Procedures.
- *Report of the Twenty-First Session of the Joint FAO/WHO Codex Alimentarius Commission. Rome 3-8 June 1995.* Includes a section on consideration of proposals to base Codex standards and other recommendations on scientific principles and the extent to which other factors need to be taken into account.
- *Alternative Service Delivery and the Public Interest: The Case of the Canadian Food Inspection Agency (CFIA).* Ronald L. Doering, CFIA. Presentation to the International Congress of Administrative Science. Paris, France. May 30, 1998.
- *Reforming Canada's Food Inspection System: The Case of the Canadian Food Inspection Agency (CFIA).* Ronald L. Doering. September 1998. Journal of the Association of Food and Drug Officials, Volume 62, No. 3.



## **Appendix - Canadian Food Inspection Agency**

### **Hazard Analysis and Critical Control Point (HACCP) Seven CFIA Principles for the Development of an HACCP Plan**

The Hazard Analysis Critical Control Point approach for health and safety risks has gained international acceptance and is a priority thrust for CFIA. Over the next few years CFIA will move towards a staged requirement for HACCP in federally registered food-processing facilities. The seven principles of HACCP are:

- Identification of hazards and development of preventive measures;
- Determination of critical control points (CCPs) required to control the identified hazards;
- Establishment of limits that must be met at each CCP;
- Appropriate monitoring procedures for CCPs;
- Establishment of deviation procedures at CCPs;
- Procedures for verification that an HACCP plan is working;
- Documentation of all procedures and records appropriate to the above principles.

### **Codex Alimentarius Commission<sup>2</sup> Food and Agriculture Organization of the UN**

Statements of Principle Concerning the Role of Science in the Codex Decision-Making Process and the Extent to Which Other Factors are Taken into Account

1. The food standards, guidelines and other recommendations of Codex Alimentarius shall be based on the principles of sound scientific analysis and evidence, involving a thorough review of all relevant information, in order that the standards assure the quality and safety of the food supply.
2. When elaborating and deciding upon food standards Codex Alimentarius will have regard, where appropriate, to other legitimate factors relevant for the health protection of consumers and for the promotion of fair practices in food trade.
3. In this regard it is noted that food labelling plays an important role in furthering both of these objectives.

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<sup>2</sup>Codex Alimentarius Commission (established 1962 under the FAO/WHO):

- sets international food standards: concerned with public health and safety, food born disease ...
- operates through 30 volunteer committees, including significant scientific base - set international standards: mode of functioning - through consensus.
- Canada chairs Codex Committee on food labelling. CFIA the "competent authority" for Codex committees in Canada.

4. When the situation arises that members of Codex agree on the necessary level of protection of public health but hold differing views about other considerations, members may abstain from acceptance of the relevant standard without necessarily preventing the decision by Codex.

Note - in June 1995 the Joint FAO/WHO Commission asked the Secretariat to draw to the attention of the Directors-General of FAO and WHO the Commission's desire to increase transparency in the working procedures of expert panels, including procedures for the selection of experts, declaration of interest, and assurance of adequate geographical representation of experts.

## Environment Canada

### 1. *Context for Use of Scientific Advice*

The departmental mission is to “make sustainable development a reality in Canada”. Environment Canada undertakes and promotes programs to support four mutually reinforcing business lines:

- clean environment;
- weather and environmental predictions;
- nature and management administration;
- policy.

There is a strong international dimension to the mission of the department and extensive linkages with the activities of other departments and agencies.

Environment Canada is a strongly science based department with approximately 90% of its expenditures devoted to S&T, within which some 20-25% is R&D and the residual “related scientific activities” RSA (a very high level of RSA in comparison, for example, with NRCan). Of the overall S&T activity, officials estimate that approximately 50% is dedicated to delivery of mandated activities under a number of federal acts, chief among them being the Canadian Environmental Protection Act (CEPA) and the Migratory Birds Convention Act. In total 14 acts are administered in whole by Environment Canada and an additional 18 are administered in part by Environment Canada (7) or administered by others with the support of Environment Canada (11). The residual 50% of S&T activities support policy development, international negotiations and surveillance, and a range of other related activities.

The range of S&T activities includes:

- providing the scientific underpinning for environmental policies;
- determining methods of measuring pollutant concentrations, transport and processes;
- developing environmental policies, regulations and technologies that aim to prevent pollution;
- conducting studies of biodiversity, wildlife preservation, and conservation of endangered species;
- monitoring the state of the environment;
- developing and maintaining environmental data bases;
- responding to environmental disasters;
- collecting information to ensure compliance with regulations;
- developing global and regional climate models and predictions of the state of the atmosphere;
- operating the Canadian weather and climate monitoring networks and providing weather and air quality forecasts;
- conducting assessments of the state of science regarding particular environmental issues;
- technology transfer.

Departmental officials characterized the science-to-policy process in Environment Canada as very different from that of a regulatory agency that was mandated to respond to external developments. Within Environment Canada, the science is said to drive the policy, or determine what is done (e.g., insights on endocrine disruptors). Additionally, there is an extensive federal-provincial interface. The provinces are the prime source of regulation, while the federal government provides the overarching framework--a science based assessment of what will make the most difference, using the power of knowledge as a means for influence. Federal-provincial committees are a normal part of business and a key linkage between science and policy. The Canadian Forest Service functions in a similar manner.

Within Environment Canada, some decisions reside at Ministerial level, some are delegated. For example, decisions on harvest levels for endangered species are delegated to the DG level; effluents from pulp mills go to the Governing Council, renewal/revision of the CEPA legislation would go to Cabinet.

## **2. *Practices and Procedures***

### Science Assessment:

- Major thrust in developing a strong science assessment process. Formal science assessment process has been developed that involves :
  - Separate group of science advisors who work with policy makers to design the policy questions that need to be answered for policy development;
  - Review of these questions by policy and science managers and the science community before assessment process is set up;
  - Preparation of science assessment document;
  - Peer review of science assessment document;
  - Advice to policy makers developed and provided.
- The process can involve stakeholders and a range of Canadian (in-house and external) and international scientists. There is a procedure for dealing with dissenting opinions. Overall the process is recognized as important, but time consuming.
- Environment Canada is attempting to become more systematic about what should be in science assessments (including indicators) through the 5 NRs<sup>3</sup> group. Also, a draft document has been produced that integrates the requirements for State of the Environment reporting with science assessments prepared for specific decision-making needs.
- Several different types of inputs to science synthesis activity: EC assessments; Federal government assessments (inter-departmental); Canadian assessments; international assessments; integrated assessment modeling; science forums.

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<sup>3</sup>5 NRs - Group of 5 Natural Resource Departments that have signed a Memorandum of Understanding on sustainable development - Natural Resources Canada, Environment Canada, Agriculture Canada, Fisheries and Oceans Canada and Health Canada.

S&T management framework in place (one of two such frameworks in place in federal SBDAs; see Appendix to this profile for more information) that, inter alia:

- links research activities with departmental priorities;
- promotes excellence in S&T.

Quality assurance:

- Currently under consideration is a draft framework for a formal system of regular expert review of the departmental R&D. If adopted, this would pertain to:
  - programs involving large numbers of researchers (>10) or resources (> \$1M);
  - research branch or cross branch activities;
  - international studies where significant contributions are expected from the department.
- Major elements include:
  - Review of proposals by external stakeholders (ex ante);
  - Scientific peer review of R&D programs and results (concurrent) every 3-5 years (e.g., publications in peer reviewed journals);
  - External impact assessment on completed programs (ex post) - documenting environmental, social and economic impacts of the research.

Anticipatory capacity:

- Vital for nature of mandate. For example, the department determines what goes into the Toxic Substances List - there is a cost of making major errors on inclusion or exclusion;
- Gap - biotechnology. An adequate knowledge base takes time to develop, it is cumulative. Significant deficit.

Preparation of MC's:

- Major scientific role likely to be played by technical person at a director level. Bench scientists unlikely to be directly involved;
- Environment Canada requires scientific/technical skills in management. This is not adequately recognized in the set of competencies developed for senior civil servants, which is a barrier to the science-to-policy linkage.

Consultations/Openness:

- Environment Canada has a written policy on the web that reflects its pledge that "consultation is an interactive and iterative process that elicits and considers the ideas of people and provides opportunities to influence decisions before they are made";
- Written policy outlines the guiding principles, the characteristics of an effective consultation and participant funding guidelines (see appendix for more information);
- Tools for departmental practitioners planning and managing consultations are available (consultations calendar, electronic network for sharing of experiences, a Guide to Public Involvement).

### 3. *Current Issues*

#### Guidelines:

- High degree of comfort with science guidelines analogous to those in the UK. Senior officials believe it is important to recognize the need to customize for different operating environments.

#### Capacity:

- Serious capacity problem. Both emerging areas of importance (biotechnology) and in ability to maintain core monitoring activities needed for mandate (e.g., toxic chemicals in the environment, Fisheries Act).
- While regulatory responsibility is moving to the provinces, the provinces themselves are reducing science capacity, adding pressure to the federal side.
- Social sciences capability weak; needs strengthening.
- Significant concerns with capacity to deal with boundary problems (prov-prov or Can-US).
- International/foreign affairs - critical need for more capacity to analyze some of the international agreements before they are signed. Also, for international negotiations on trade agreements etc., need to be able to sense the currents at play among nations, including the science issues and their implications. Environment Canada as the substantive department should likely play a more dominant role.

#### Science Assessment as a bridge between science and policy:

- A recently commissioned report (Bush, 1998) on the science to policy linkages in the Atmospheric Environment Service (AES) identifies a number of key barriers and recommendations for improvement.
- The proposed directions of evolution are convergent, if more specific in nature to the type of activities within AES, with the science guidelines issued in the U.K. The full set of recommendations is reproduced in the appendix to this profile.
- The report also proposes a framework for science assessment that would function as a bridge between science and policy - a four phase process:
  - science review and assessment;
  - synthesis;
  - policy integration;
  - science and risk communication .

The defining characteristics of each phase are summarized in the appendix to this profile. Science and risk communication is assessed as the least well-developed phase.

#### 4. *Documentation*

- *Environment Canada's Science and Technology: Leading to Solutions*. March 1996. Outlines the departments mission and new directions following program review.
- *Performance Report For the Period Ending March 31, 1998*. Environment Canada web site. <http://www.ec.gc.ca>
- *Our commitment to effective consultations*. May 27, 1996. A policy that articulates the guiding principles and practices of consultations that provide public involvement for all facets of EC's activities. [http://www.ec.gc.ca/consult/policy\\_e.html](http://www.ec.gc.ca/consult/policy_e.html)
- *Management Framework. Science and Technology*. November 1998. Document designed to guide the management of S&T within Environment Canada - the "how" within the directions established in strategic and business planning activities. It sets out the principles, elements and management tools that have been adopted or are under development.
- *Framework for External Review of R&D in Environment Canada*. Draft version - October 29, 1998. Presents the operating policy (and guidance on implementation) for a formal system of regular expert review of the departmental R&D.
- *Environment Canada's Scientific Research Publications in 1995*. Report to the Science Policy Division June 1998. A quantitative overview of EC's production of scientific knowledge in 1995 - publications, collaborations, international rankings.
- *Biodiversity in Canada: A Science Assessment - Summary*. 1994. A review of the state of knowledge on biodiversity in order to identify implications for policy and for further research.
- *Briefing Note: A Science Assessment Process - Atmospheric Issues*. November 1998.
- *Science Advice in Government*. March 1998. Internal briefing note on science advice in government, including a focussed look at the role of science assessment in science advice for government decision-making and recommendations on the topic by the EC R&D Advisory Board.
- *Measuring the Impacts of Environment Canada's R&D. Case Study: Pulp and Paper Effluent Research*. Report to Environment Canada (Marbek Resource Consultants in association with Secor Inc.), September 1997.

- *Measuring the Impacts of Environment Canada's R&D. Case Study: Stratospheric Ozone Depletion Research.* Report to Environment Canada (Marbek Resource Consultants in association with Wintergreen Consulting), May 1998.
- *Science Assessment. A Report on Science-Policy Linkages in the Atmospheric Environment Service.* Elizabeth Bush, November 1998.
- *A New Vision for State of the Environment Reporting.* Draft text December 1998. Prepared by the 4NR MOU ad hoc SOE group. Designed to develop common approach for presenting policy driven science assessments within the framework of a coordinated State of the Environment reporting program. Document addresses the minimum content and presentation criteria for an SOE report and an internal validation process. Initiative appears to be voluntary.

### ***Appendix - Environment Canada***

#### ***S&T Management Framework - Environment Canada***

##### **Goals of S&T Management:**

1. to promote excellence in the performance of environmental S&T in the department;
2. to ensure that S&T activities are clearly linked to broader Departmental planning and priorities;
3. to ensure that S&T is effective and that opportunities for integration of S&T conducted throughout the department exist;
4. to ensure that S&T within the department is conducted in a manner that promotes the public good;
5. to give S&T employees opportunities to grow, develop skills and be challenged;
6. to ensure accountability for the delivery of S&T throughout the department;
7. to listen and respond to stakeholders, clients and partners;
8. to monitor the effectiveness of the management of S&T resources at Environment Canada;
9. to promote continuous improvement in the management of S&T at Environment Canada.

##### **Framework Elements for S&T Management:**

1. The S&T management system - committee structure.
2. Strategic planning, coordination and integration - processes for identification of long-term requirements and establishment of S&T objectives and priorities to meet mandate.
3. Accountability - establishment of responsibility centres and description of methods and guidelines for measuring effectiveness of S&T programs and services.
4. Partnerships and alternate service delivery.
5. S&T operating practices - for undertaking and delivering S&T activities, including IP management, peer review, cross appointment practices, technology development, etc.

6. Managing S&T human resources.
7. Communicating S&T - reporting to and communicating with partners, stakeholders and the general public for a broad understanding of key findings.

***Consultations - guiding principles (web site)***

1. Building relationships and trust - Open channels of communications and constructive working relationships with organizations, partners and clients are valued as a key foundation for effective consultations.
2. Influencing decisions - Consultations will be designed as an integral part of the decision making process. The process will be transparent and consultations will take place while options are still open.
3. Balancing listening with leadership - Environment Canada information, knowledge and positions will be shared openly and in a timely fashion with those being consulted. Consultations will be balanced with getting things done.
4. Tailoring our approach - Consultations will be tailored to reflect the particular circumstances and variables of the decisions at hand.
5. Striving for greater effectiveness - Consultations led by Environment Canada will be designed with a view to make the most efficient use of existing mechanisms and internal resources while maximizing the contribution of participants.
6. Adhering to high quality and performance standards - Consultations will be planned, carried out and assessed based on the best practices in the field. Environment Canada has adopted the Guide to Public Involvement, a national standard of Canada published by the Canadian Standards Association (March 1996), as its benchmark for effective consultations.

***Recommendations to Environment Canada regarding Science - Policy Linkages in the Atmospheric Environment Service (Bush 1998)***

Time frame disparity:

1. Scientists must recognize that policy makers cannot wait for resolution of all scientific uncertainty and therefore must document clearly how the uncertainty limits decision making, and the timeframe for resolving the uncertainty. In the meantime, interim advice arising out of the science that would be prudent to follow, should be clearly communicated.

2. A political commitment is required to support assessment program on a long-term basis so that the science is in a process of constant evolution and directed towards answering policy needs even during period of relative inattention on the policy front. This should help minimize the disparity in timeframes for development of science and policy.
3. Communication strategies should be linked to assessment processes and should specifically include communication of the processes underway to address risks to public health and the environment in order to create understanding among the public regarding any delays in the development of policy on these issues.

Engagement of the scientists:

4. A mechanism for rewarding the contribution of government scientists to assessment work needs to be formalized in the promotion system, and the fact that this has been said before and yet still arises as a problem, indicates that little has been done to date to rectify this recurrent problem.
5. The critical role of the assessor in coordinating the science review stage, thus facilitating the participation of scientists and freeing them of administrative responsibilities related to the assessment, should be recognized and appropriately resourced.
6. Where appropriate, assessment documents should be published as a collection of peer reviewed papers in an internationally recognized journal, although the trade off may be that “integration” of the document is sacrificed to some extent. Alternatively, review papers could be written by experts, which would themselves be publishable. The assessor would then assume the task of writing the assessment document with the review paper as reference material. At a minimum, chapter authors should be identified and where possible, individual chapters in an assessment document should undergo peer review, to facilitate accreditation of the work and subsequent publication of the work by the scientists themselves in the scientific literature.

Resourcing of science reviews and assessment documents:

7. Assessments should be sufficiently resourced to allow the assessor to contract authorship of sections of the assessment documents. This would encourage the participation of experts and also impose more control over the process, including over the imposition of deadlines.

Responding to research needs:

8. As part of the science assessment process a mechanism should be put in place to coordinate a research program (which may often be inter-departmental in nature) that will

follow through on areas of research identified in the assessment document.

Synthesis:

9. The production of synthesis type documents should become a formal component of Science Assessment. It should also be recognized that such documents are unique undertakings, and that they serve a communication function beyond that of executive summaries, both for the policy community and the general public.
10. Involvement of the policy community in the preparation of synthesis documents is critical to ensuring that the science advice is communicated in a manner that facilitates its incorporation into policy making.

Role of the assessor:

11. The role of the science assessor should be formally acknowledged and the position should be adequately supported in recognition of the critical function served by this person in communicating science advice to policy makers.

Characterization of scientific uncertainty:

12. The nature and scope of scientific uncertainty and the implications of this uncertainty for decision making must be addressed as part of the science advice to policy makers. Also, scientists must be clear about where the science provides definitive answers and on the contrary, where some element of subjective decision making in the form of professional judgement was required.

Participation of scientists in the policy process:

13. Scientists (and the science assessor) should be actively involved in the process(es) established for developing policy on an issue to promote the integration of science into decision making (i.e., the science assessment process cannot be seen to end with delivery of the assessment and synthesis documents to policy makers).
14. Given that the revised PSL2 assessment process by Environment Canada has taken steps to involve policy makers (Risk Managers in this case) in their science assessment process and likewise to involve scientists in the risk management phase, consideration should be given to evaluating the success of this process in light of the upcoming completion of a number of PSL2 assessments under the new process.

Role of science versus other factors:

15. The science assessor should be involved in the development and reporting of government policy decisions on science based issues, to ensure that the decision-making process is explicit with respect to the treatment of that science advice.

Lack of long-term commitment to science programs:

16. Science assessment should be a stimulant for a long term commitment to a science program, not an end in itself, with periodic reviews or updates of the assessment being a critical part of the process for tracking progress on an issue and providing some accountability.
17. Scientists should promote also the establishment of a science program, as part of Action Plans developed to address an issue. This will help establish the science assessment process as an iterative and cyclical process whereby anticipated policy needs are communicated to scientists and research programs are established to respond to those long term needs.

Responsibility for communication:

18. Consideration should be given to integrating a communication phase into the science assessment process in order to fulfill the responsibility of the government to educate the public about both the science and attendant risks of air pollution.

Need for coordinated and comprehensive communication strategies:

19. Development of a communication strategy should begin as early as possible in the assessment process and consideration of communication needs should become an integral part of each phase of the assessment process. Adequate resourcing of communication efforts is required to develop effectively and timely communication materials on which to base communication efforts.
20. The need for a communications expert should be recognized and sufficient resources should be provided to that person in recognition of their role, like that of a science assessor, in bridging the gap between the scientists and in this case, the general public.

Timing and form of stakeholder involvement:

21. There is a need to establish rules regarding the timing and form of stakeholder participation in science assessments and for these rules to be made clear to the stakeholder community. These rules should be consistently applied from one assessment to another.

Thought should be given to the costs and benefits of alternative approaches to stakeholder consultation.

Equity/inequity in stakeholder participation:

22. Measures to bring more equity into the process of stakeholder consultations are required and the resources required to do this should be considered when decisions are made regarding the timing and form of stakeholder consultation.

Framework for science assessment (Bush 1998)

	Activity	Implications	Product and Audience
<b>1. Science review and assessment</b>			
	Develop a state of the art understanding of all critical aspects of an issue, and of areas of uncertainty in a way that retains the integrity of the science, while rendering information useful for decision makers	Expert review: will involve scientists; may involve external stakeholders Peer review of the output critical	Product - technical document Audience - science community and science assessors
<b>2. Synthesis</b>			
	Effectively and accurately synthesize complex science review into a concise summary that is understandable to non-scientists and to decision makers Structured as a response to specific policy needs	Science assessor key Extend scope of inquiry if needed May involve stakeholders Expert review (science and policy) of output wise	Product - concise document Audience - policy community
<b>3. Policy integration</b>			
	Integration of science into the deployment of policy, ensuring that the scientific basis for control measure is accurately represented and that implications of various control measures are understood	Science assessor and Policy issue manager key Stakeholder participation important	Product - Action Plan laying out government response Audience - public and regulated
<b>4. Science and risk communication</b>			
	Communication about risks and risk management	Communications expert key Link to various phases of the assessment process	Product - Information Audience - The general public



## Department of Fisheries and Oceans

### 1. *Context for Use of Scientific Advice*

The DFO mission is to manage Canada's oceans and major waterways so that they are clean, safe, productive and accessible, to ensure sustainable use of fisheries resources, and to facilitate marine trade and commerce. The department defines five specific objectives:

- manage and protect the fisheries resource;
- manage and protect the marine freshwater environment;
- understand the oceans and aquatic resources;
- maintain maritime safety;
- facilitate maritime trade, commerce and ocean development.

Science advice for fisheries management is the most dominant "science in policy" issue for the department, followed by climate change. There is a long history of collectively reviewed science advice integrated into policy that evolved from the International Commission on North Atlantic Fisheries. When the fisheries jurisdiction was extended, Canada put in place its own committee structure that has evolved over the years with the most significant changes in practice occurring during the 1990s, especially in the last two years. There remains a significant international element in the management of fisheries stocks.

The collapse of the East Coast cod fishery, and the public debate between Hutchings et al (1997) and the Department (see articles by Healey and Doubleday and Parsons) have focused media attention on the Department and its decision-making process. Changes in the procedures of stock assessment and quota allocation had been initiated prior to the most public debates, but the process of change has been slow, with the West Coast reforms only just being introduced at the time of this report. There has been a significant increase in transparency and community involvement. The overall context for decision-making has also evolved by virtue of the change in departmental philosophy from maintenance of the fishing community to stewardship of the resource.

At the present, the impact of science advice in DFO is described as being very direct. Scientific advice is normally a constraint on decision-making. Ministers are very reluctant to go against science advice.

### 2. *Practices and Procedures*

Science input derives primarily from both DFO scientists and partnership programs (such as the Sentinel Survey Program) that is a cost shared program of DFO and external stakeholders, utilizing commercial vessels in survey work.

The process of fisheries decision making on quotas and conservation measures has three main

elements:

- Regional Resource Assessment Process (RAP) - compilation, interpretation, validation and integration of information on stock assessment, that includes a “peer review process” coordinated by the Canadian Stock Assessment Secretariat.
- Fisheries Resource Conservation Council (FRCC) and other mechanisms that involve some public consultations and recommend total allowable catches and other conservation measures (FRCC currently in place in the Atlantic and being established on the Pacific).
- Arrangements in the North are somewhat different, with the Management Board (which has a significant representation of Aboriginal interests) having a major say in decisions. The Minister does, however, have a veto power over decisions.

There are explicit guidelines for the conduct of the RAP peer review processes (which vary among the regions and among stocks). Key features include:

- Participation of DFO staff (any employee may participate; key scientists are expected to justify their science and interpretations in this public forum);
- DFO Chair;
- External participation (full participation in the process and decision making, with access to all documentation) by invitation of individuals from the fishing industry, academia, other government departments, public interest groups and the general public. Invitations based on individual merit. DFO does not normally reimburse travel costs for outside participants;
- Outcomes include statements of divergent views with supporting and contradictory evidence for each, levels of uncertainty and risk;
- Public release of results of RAP meetings as stock status reports quickly after the RAP peer review (on web site within days of the peer review);
- An audit trail is maintained of draft documents and edits;
- If there is a high level of public interest, there would be a press release immediately after the peer review (Chair of peer review committee is the spokesman).

DFO documentation provides guidelines on the desirable characteristics of participants, including knowledge, stature, understanding of peer review and a diversity of opinions (including traditional knowledge). The guidelines also state that “to assure the perception of objectivity of the RAP process, individuals widely recognized as strident advocates of narrow perspectives or specific sectoral interests generally are not selected.”

A Fisheries Resource Conservation Council (FRCC) was established on the East Coast in 1993; a West Coast Council under the Chairmanship of John Fraser is being created at the time of preparing this report. The FRCC is a partnership between government, the scientific community and the direct stakeholders in the fishery. The mandate and objectives are reproduced in the appendix. FRCC reports are on the web.

Independent external review panels are used from time to time for review of major issues of significant public interest, e.g. Dr. Les Harris (Independent Review of the Status of the Northern

Cod Stock) and the Hon. John Fraser (Fraser River Sockeye Public Review Board). They are seen as being good at providing high quality credible advice on difficult issues, but costly and slow.

Publication policy:

- Internal peer review before going to publications - i) other scientists and ii) departmental management - to ensure that the paper is accurate, clear and well-written, the findings are supported by the data.

External review of science units:

- External reviews are carried out “as needed” according to the call of a manager or the DFO senior officials. There is no systematic external review of all science operations on a regular basis, other than the normal review by federal auditors and evaluators.

Preparation of policy documents:

- Done in headquarters, where there are science advisors who work with Fisheries; Management in drafting Memoranda to Cabinet and other policy documents;
- Memo to Minister typically signed off by the science sector.

### 3. *Current Issues*

Resource management:

- Continuing resource management issues relate to the East Coast - seals and cod - and the West Coast salmon fisheries.
- The opening up of the RAP process and the creation of a somewhat differently structured FRCC on the West Coast are seen as means to tackle this.
- While there is significant support for the direction of change, there is some concern with the Resource Assessment Process in that it has institutionalized a regional approach to management of a stock that is not itself regional. Example - stocks in the Gulf and in Newfoundland.

Public trust:

- A significant issue is rebuilding the public trust following the public storm fueled by publicly stated concerns from the scientific community regarding muzzling and misrepresentation of data. DFO suggests that some DFO scientists appear to be developing a higher comfort level with the process. There is evidence that there is less discomfort than in the past, although the external research community continues to be wary of DFO headquarters.
- International comments suggest that more external insights (non-Canadian) in the stock assessment process could be useful to keep all honest.

#### Structural:

- There is concern that the actual structure of DFO - the separation of science from operations - is a systemic problem, creating barriers where there should be cross walks between science, operations and policy. The connection of science with the industry should also be promoted, all of which would instill a stronger linkage of policy and science.
- The Minister of Fisheries has enormous responsibilities. Is this reasonable? The Fisheries Act is pervasive. In Australia some of the responsibilities have been farmed out to an arms length body with executive power. Should Canada look at a comparable approach?
- Where is the oceans component of the mandate? It tends to get swallowed by the more controversial fisheries side.

#### Nature of science advice:

- In terms of the nature of science advice, DFO has moved from single species biology to taking some account of the broader ecosystem interactions in the stock accounts. However, risk calculations still relate primarily to single species. Explicit recognition of risks and uncertainty is handled through the use of graphs of probability of stock increases versus catch level. Non-specialists appear to have little trouble with the concept of probabilities.
- There are no comprehensive, quantitative ecosystems models, but many scientists advocate an aggressive move from what is now being described as a population dynamics approach within DFO to ecosystem based management.

#### 4. *Documentation*

- DFO Mission, mandate and long-term priorities [http://www.dfo-mpo.gc.ca/dfo\\_mpo/mandat\\_e.htm](http://www.dfo-mpo.gc.ca/dfo_mpo/mandat_e.htm)
- Fisheries Resource Conservation Council - description, mandate, membership. [Http://www.dfo-mpo.gc.ca/frcc/Baseinfo/terms\\_of\\_reference.htm](Http://www.dfo-mpo.gc.ca/frcc/Baseinfo/terms_of_reference.htm)
- Regional Resource Assessment Process
  - Overview of the RAP process across regions and species groups. DFO (undated);
  - Outside participation in peer review sessions. DFO guidelines (undated).
- Canadian Stock Assessment Secretariat
  - Terms of Reference. DFO (undated);
  - Description. DFO undated.
- Sentinel Survey Program
  - Sentinel Survey 1998. Update for FRCC. October 1998.
  - 1997 4VSW Sentinel Program. Program description. A Joint project of Fishermen

- and Scientists Research Society and Marine Fish Division, DFO Science Branch. Agreement on program to monitor fish stocks, migratory patterns, fish populations and dynamics, and to engage in co-education.
- *Report of the Sentinel Survey Programs in the Canadian Atlantic 1994-1996*. G. Chouinard, B. Davis, P. Fanning, T. Lambert, and A. Fréchet. DFO publication. June 1997.
  - Group of papers dealing with issues of scientific freedom
    - Hutchings, J.A, Carl Walters and Richard L. Haedrick. *Is scientific inquiry incompatible with government information control?* Can. J. Fish Aquat Sci. 54: 1198-1210 (1997) .
    - Doubleday, W.G., D.B. Atkinson and J. Baird. *Comment: Scientific inquiry and fish stock assessment in the Canadian Department of Fisheries and Oceans*. Can J. Aquat. Sci. 54: 1422-1426 (1997)
    - Healey, M.C. *Comment: The interplay of policy, politics and science*. Can J. Fisheries and Aquatic Sci. 54: 1427-1429 (1997).
    - Rowat, W.A. Deputy Minister's letter to National Research Council June 1997.
    - Parsons, L.S. *A Perspective on Department of Fisheries and Oceans Science* (Response to a Canadian Press Story June 21) DFO web site.

## **Appendix - Department of Fisheries and Oceans**

### ***The Fisheries Resource Conservation Council***

#### **Mission**

To contribute to the management of the Atlantic fisheries on a “sustainable” basis by ensuring that stock assessments are conducted in a multi-disciplined and integrated fashion and that appropriate methodologies and approaches are employed; by reviewing these assessments together with other relevant information and recommending to the Minister total allowable catches (TACs) and other conservation measures, including some idea of risk and uncertainty associated with these recommendations; and by advising on the appropriate priorities for science.

#### **The Council Objectives**

Note - the following objectives include a number of activities directly related to the management of science for policy and decision making.

- To help the government achieve its conservation, economic and social objectives for the fishery. These conservation objectives include, but are not restricted to:
  - rebuilding stocks to their ‘optimum’ levels and thereafter maintaining them at or

- near these levels, subject to natural fluctuations, and with 'sufficient' spawning biomass to allow a continuing strong production of young fish; and
- managing the pattern of fishing over the sizes and ages present in fish stocks and catching fish of optimal size.
- To develop a more profound understanding of fish-producing ecosystems including the interrelationships between species and the effects of changes in the marine environment on stocks.
- To review scientific research, resource assessments and conservation proposals, including, where appropriate through a process of public hearings.
- To ensure that the operational and economic realities of the fishery, in addition to scientific stock assessments, are taken into account in recommending measures to achieve the conservation objectives.
- To better integrate scientific expertise with the knowledge and experience of all sectors of the industry and thus develop a strong working partnership.
- To make public recommendations to the Minister.

#### Constitution of Council

##### Different constitution on east and west

- 14 members, selected on individual merit;
- East Coast - does not include NGOs;
- East Coast - each of 4 Atlantic provinces nominate one delegate (who do not formally endorse recommendations).

#### ***Publication Policy for Maritimes Region***

Scientific communication is the essential element of the scientific process. The purpose of this policy is to encourage Science staff to disseminate their findings through written and oral presentations that meet the high standards of scientific communication. An ancillary purpose is to ensure that communications that address sensitive issues or that can be construed to contradict Department policy are identified in a manner that permits the Department to respond in a timely fashion after the issue or article has been made public.

This policy recognizes the primacy of the peer-review system in maintaining scientific standards and establishes separate manuscript submission and review processes for primary, secondary, and RAP publications. The policy also establishes procedures for oral and poster communications. A diagram which provides an overview of the procedures described below is attached.

## Procedure for Submission of Manuscripts as Primary Publications

Primary publications refer to scientific journals, special issues, books, and conference proceedings in which submitted manuscripts are reviewed by independent referees appointed by an editor. The procedure for submission of manuscripts intended for primary publications is:

1. This procedure only applies to manuscripts where the senior (first) author is an employee of the Department and/or where a significant amount of DFO resources has been expended in its production.
2. Prior to the submission to the journal editor, the author should have the manuscript reviewed for scientific content by at least two qualified experts. It is the responsibility of the author to select suitable reviewers who should be informed of the journal name and format to which the manuscript will be submitted. The names of the reviewers are to be recorded on the Manuscript Record form, a copy of which is attached.
3. The author submits the manuscript to the Division Manager, along with the Manuscript Record form. The latter examines it for statements that may address sensitive issues or contradict the current Department policy, or for use of proprietary data and/or information.
4. If no controversial or sensitive material is identified, the Division Manager signs the Manuscript Record form, returns the form and manuscript to the author, and forwards a copy of the Manuscript Record form to the Regional Director of Science's office.
5. In the rare case where controversial or sensitive subjects are identified, the Division Manager first consults with the senior author to confirm the intent of the manuscript. If there are no changes, the Division Manager signs the Manuscript Record form, sends it and a copy of the manuscript (with a note that the manuscript contains sensitive subjects) to the Regional Director of Science. The Regional Director of Science signs the Manuscript Record form and returns it to the author but may retain the copy of the manuscript. If the author wishes to make changes, these are made and then the process proceeds as in (4).
6. In the rare case where an author has used proprietary data and information, the Division Manager and the Regional Director of Science shall withhold permission for the paper to be submitted for publication until appropriate written permission to use the data in the publication is obtained from the owner of that data.
7. A limit of ten working days is given after the time of submission of the manuscript by the author to the Division Manager to identify potentially sensitive issues. Regardless of the outcome of this review, after ten working days, the author can submit the manuscript for publication without waiting for the Manuscript Record form to be returned by either the Division Manager or the Regional Science Director's office.
8. In the case of publication of personal opinions and commentary, and assuming the manuscript is accepted for publication, the Regional Director of Science retains the right to request a disclaimer be included with the final revision, e.g., "The opinions and conclusions contained in this paper do not necessarily reflect the current policy of the

employer". The disclaimer would be placed on the title page of the final revision of the manuscript that is sent to the journal.

9. One reprint of the published paper should be forwarded to the Regional Director of Science's office and one to the Division Manager's office.

### **Procedure for Submission of Manuscripts as Secondary Publications**

Secondary publications include Canadian Technical Reports of Fisheries and Aquatic Sciences, Canadian Data Reports of Fisheries and Aquatic Sciences, Canadian Industry Reports of Fisheries and Aquatic Sciences, and Canadian Manuscript Reports of Fisheries and Aquatic Sciences. These documents often contain preliminary findings and appropriate disclaimers are frequently included for individual publication series. The Department normally provides the only review for these documents. For the purposes of this publication policy, RAP documents, such as status reports, proceedings and research documents are not included under this heading. The procedure for review of manuscripts intended for secondary publication is:

1. This procedure only applies to manuscripts where the senior (first) author(s) is an employee of the Department.
2. It is the responsibility of Division Managers to either appoint an individual in their division as a Secondary Publications Editor or fulfill this task themselves. In either case, this individual is responsible for quality assurance of secondary publications produced by the division.
3. The author submits the draft manuscript to the divisional Secondary Publications Editor.
4. The Editor forwards the manuscript to two reviewers where appropriate (e.g., Canadian Data Report of Fisheries and Aquatic Science normally requires no review), who may be either internal or external to the Department. Reviewers are asked to evaluate the scientific content of the manuscript, to document their comments and to recommend: (i) acceptance of the manuscript; (ii) acceptance following appropriate revisions; or (iii) rejection.
5. On the basis of reviewers' comments, the Secondary Publications Editor either accepts the manuscript as is, specifies the revisions required, or rejects the manuscript. The author is informed of the decision and if changes to the manuscript are required, the author makes these before resubmitting it to the Secondary Publications Editor.
6. Upon receipt of the final version of the manuscript, the Secondary Publications Editor signs the Manuscript Record form and submits it and the manuscript to the Division Manager. The latter examines it for statements that may address sensitive issues or contradict the current Department policy or for use of proprietary data and/or information.
7. If no controversial or sensitive material is identified, the Division Manager signs the Manuscript Record form, returns the form and manuscript to the Secondary Publications Editor, and forwards a copy of the Manuscript Record form to the author and the Regional Director of Science's office.

8. In the rare case where controversial or sensitive subjects are identified, the Division Manager first consults with the senior author to confirm the intent of the manuscript. If there are no changes, the Division Manager signs the Manuscript Record form, sends it and a copy of the manuscript (with a note that the manuscript contains sensitive subjects) to the Regional Director of Science. The Regional Director of Science signs the Manuscript Record form and returns the Manuscript Record form to the Division Manager, who then copies it to the Secondary Publications Editor, but may retain the copy of the manuscript. If the author wishes to make changes, these are made and then the process proceeds as in (7).
9. In the rare case where an author has used proprietary data and information, the Division Manager and the Regional Director of Science shall withhold permission for the paper to be submitted for publication until appropriate written permission to use the data in the publication is obtained from the owner of that data.
10. A limit of ten working days is given after the time of submission of the manuscript by the Secondary Publications Editor to the Division Manager to identify potentially sensitive issues. Regardless of the outcome of this review, after ten working days, the Secondary Publications Editor can submit the manuscript for publication without waiting for the Manuscript Record form to be returned by either the Division Manager or the Regional Science Director's office.
11. The Secondary Publications Editor then makes arrangements to have the manuscript published in the appropriate series. A "Record of Scientific Report" form (0844) is submitted to Headquarters to obtain a report number.

### **Procedure for Submission of Manuscripts as CSAS Research Documents**

Research documents are produced as a result of the RAP peer review. Given that these documents have undergone an extensive peer review, the purpose of the internal DFO review is to ensure high quality of style, format and readership, rather than technical accuracy. The procedure for the review of these documents is:

1. This procedure only applies to Research Documents where the senior (first) author(s) is an employee of the Department.
2. The author first obtains a Research Document number directly from Canadian Stock Assessment Secretariat (CSAS) (613-992-0029), the governing agency.
3. The author submits the Research Document to the chair of the meeting at which it was discussed. The chair confirms that the technical basis of the status report produced by the meeting is covered in the document. In some instances, meeting chairs are individuals from outside DFO. In this case, the author can submit the Research Document to his/her Division Manager, who is responsible for confirming that the technical basis of the status report is covered in the document.
4. The meeting chair arranges for the Research Document to be reviewed to ensure the style, readability and format of the document, but not its technical merit which has already been

reviewed at the RAP meeting. Divisions are free to define the editorial process to fulfill this function. Once this editorial review is complete, the meeting chair completes the Manuscript Record Form, attaches it to the Research Document and returns the document to the author, who is responsible for incorporating any identified changes.

5. The author submits the final manuscript to CSAS, and sends a copy along with a completed Manuscript Record Form, to his/her Division Manager for filing.

### **Procedure for Review of RAP Stock Status Reports and Proceedings**

RAP Status Reports and Proceedings are produced as a result of the RAP Peer Review process. Given that these documents have undergone an extensive peer review, the purpose of the internal DFO review is to ensure high quality of style, format and readership, rather than technical merit. The procedure for the review of these documents is:

1. The Regional Director of Science has delegated final approval of Status Reports and Proceedings to the RAP meeting chair.
2. The documents are provided by the meeting chair to the RAP Coordinator, who arranges an Editorial Board meeting. The Board is chaired by the RAP Coordinator, and consists of the relevant meeting chair and the author(s) of the status reports under review. Notice of an Editorial Board meeting is copied to members of the RAP Coordination Committee in the event they wish to participate. Individuals, such as regional scientists and members of the fishing industry can be requested to assist the board in its editorial function.
3. In the case of status reports, if substantive comments are made at the Board meeting, the meeting chair may wish to reconvene the subcommittee to review the comments. Otherwise, the comments are incorporated into the status report by the author(s). The status report is then returned to the meeting chair, who approves the final product, and sends the document to the RAP Secretariat, which arranges for the translation, distribution and transmittal of the document.
4. In the case of Proceedings, editorial comments are addressed by the chair and the document then provided to the RAP Secretariat for further processing.
5. The RAP meeting chair prepares a briefing note, based on the Summary section of the status report, for transmission through DFO line management. These documents are needed to brief DFO and the Minister prior to public release of the status reports.

### **Procedure for Review of Oral Presentations and Posters**

Oral presentations and posters take several forms. One type of oral presentation includes those invited at various institutions within or outside of government and can take the form of lectures, seminars, round tables, industry consultations, etc., where no abstract is produced. More formal oral presentations usually require that an abstract be submitted for dissemination before the conference, workshop, or symposium. Usually, posters presentations are restricted to

conferences, workshops, and symposia and require submission of an abstract to be circulated before the meetings.

The supervisor should be apprised of the title of the presentation, date, location, and a brief outline of the topics to be covered. On rare occasions, the supervisor may advise the speaker that they are dealing with sensitive issues, identify the specific issues, and suggest how the speaker should handle the matter, especially if members of the media could be present. It is expected that the speaker will stay within his/her area of expertise.

A copy of all abstracts should be sent to the Division Manager's office who will forward a copy to the Regional Director of Science's office.

### **Controversial or Sensitive Material**

It is incumbent upon the Division Manager to identify those instances where a publication contains actual or potentially controversial or sensitive material. It is then the Division Manager's responsibility to develop a communications plan to deal with this potential issue. At no time will the potential controversial/sensitive nature of the publication restrict, restrain or retard the author(s) ability to publish.



## Health Canada

### *1. Context for Use of Scientific Advice*

Health Canada's mission is to help the people of Canada maintain and improve their health. That mission is delivered through a matrix of six business lines and eight organizational structures, all of which involve a significant interplay of science and decision-making. In partnership with provincial and territorial governments Health Canada develops health policy, enforces health regulations, and contributes to disease prevention and control and promotes healthy living.

Health Canada officials estimate that more than 50% of its science capacity is deployed to broad support of Public Health Acts; and the remainder to the Health Canada mandate more generally. This more discretionary 50% relates to leadership (including future vision) and coordination functions of the departmental mandate.

The Health Protection Branch (HPB) is the most science intensive of the Health Canada Branches. It has the responsibility to:

1. assess the safety, effectiveness and quality of drugs and medical devices;
2. protect Canadians from potential health hazards associated with tobacco, food, radiation-emitting devices, certain consumer products and working and living environments;
3. develop and enforce regulations under consumer and environmental protection laws;
4. carry out surveillance and risk assessment activities to prevent and control diseases of national and international concern.

The Health Promotions and Programs Branch (HPPB) and the Medical Services Branch play a national role in enhancing the physical and mental health and well being of Canadians. By focussing on factors that influence health during childhood, adolescence, mid-life and later life, the HPPB works toward improving the health of these population groups. The Branches incorporate a significant social science research activity that is a key component of the departmental science capacity. There are additional activities relating to the capacity for strategic and evidence-based decision making within Health Canada and in the Canadian health system through the Policy and Consultation Branch. These also draw on a social science base.

The Pest Management Regulatory Agency (PMRA) is part of HC and reports to the Deputy Minister. Although the agency does not have laboratories, it evaluates pesticide submissions, a related scientific activity (RSA). PMRAs activities are captured under the Business Line "Management of risks to health".

Given the dominance of public concern with health and safety, and the concentration of the science based decision making in this Branch, the profile deals primarily with the Health Protection Branch.

### *The Health Protection Branch Transition*

Health Canada is responding to a number of challenges and emerging issues by developing a management system which is more accessible, open and transparent to the public and stakeholders. Health Protection Branch (HPB) Transition is a three-year process to strengthen and modernize the way Health Canada approaches and implements its health protection policies and activities. Consultations are a cornerstone of the Transition process which continues to include staff across the department, a wide range of stakeholders and the public across the country. The HPB Transition will result in a number of proposals to renew the health protection program:

- a decision-making framework and process that is transparent and open to public and stakeholder input;
- a legislative framework that provides the necessary authorities to protect the health of Canadians;
- a comprehensive Risk Management Framework that is clear on the accountability of HPB scientists and managers;
- access to leading-edge science in laboratories and through national and international networks;
- stronger surveillance tools to link local, national and international public health authorities, in order to improve the response time and to track disease and other risks to health;
- integrated programs that respond to current and emerging health issues whose effectiveness can be measured and evaluated.

The current legislative framework is a significant impediment to good decision-making. It is characterized (Shared Responsibilities Shared Vision) by the following:

- some laws are irrelevant or outdated, including their applicability to newly emerging pathogens, the ethics of bioengineered products, human organs;
- fragmented and inconsistent legislation, e.g. that provides an awkward framework for dealing with current consumer products and therapeutic goods (e.g. the blurring of the lines between drugs and medical devices);
- flexible and innovative responses to new and emerging issues are inhibited, e.g. new pathogens like the Ebola virus;
- the patchwork quilt of laws provides a poor basis for policy making;
- lack of recognition of the importance of risk management, and the concepts of population health and sustainable development.

Two consequences of the present legislative framework reveal the societal impact of the rigid legislative framework. First, the normal decision making process on a drug such as rBST is focussed on scientific considerations. The current regulatory framework, as depicted in the Food and Drugs Act and Regulations, restricts the decision criteria to a science-based audience, thus not providing for balanced inclusion of broad ethical and social values (although in therapeutics, drugs must go through an ethics board before approval). Secondly, Health Canada cannot initiate a drug approval process. Regardless of the potential value of a new product to Canadians,

its approval can only be triggered by a private sector application.

## 2. *Practices and Procedures*

Policy framework:

- Policy framework for science based decision-making articulated and on the web site (see appendix); it is under review for further refinement in light of changing health and regulatory paradigms (especially risk assessment/management).
- Key issues for the department are in how policy framework is implemented and in the legislative context for departmental operations.

Risk assessment/management:

- Along with CFIA, DFO and Environment Canada, Health Canada is one of the most significant players in risk assessment within the federal system of SBDAs.
- Health Canada is taking the lead on an interdepartmental discussion on risk assessment/management. A December 4, 1998 presentation to Science ADMs proposed a formalization of the process, involving partnerships with other stakeholders, consideration of the full range of appropriate criteria, identification of the roles and accountabilities of all players, and making uncertainties and assumptions explicit. The elements of this risk assessment/management approach are outlined in the Appendix.
- Proposed criteria for decision making:
  - health and safety;
  - social/cultural including impacts on communities;
  - environment/sustainable development;
  - ethical, especially with new technologies;
  - economic, including analysis of how to mitigate risks;
  - other.

Precautionary Principle:

- Key concept for Health Canada.
- Effectively means acting on issues that are expected to have policy significance before all of the data are available. Requires a capacity to act.
- Requires a cultural change on the part of scientists and the department. To operationalize need to change decision frameworks, in particular the risk management information and surveillance systems.

Identifying emerging issues:

- Capacity limited at present; Science Advisory Board seen as critical element.
- HPB has implemented a means of flagging potentially controversial issue within the Branch on a regular basis (building in accountability for “risk identification”).

- Various items from the Health Canada web site, including the Terms of Reference - Science Advisory Board.
- *Risk Management and Science: Proposed Decision-Making Framework*. Presentation Deck December 4, 1998.
- *Report of the Canadian Veterinary Medical Association Expert Panel on rbST*. Prepared for Health Canada. November 1998.
- *Report of the Royal College of Physicians and Surgeons of Canada Expert Panel on Human Safety of rbST*. Prepared for Health Canada. January 1999.

## Appendix - Health Canada

### Risk Management - “Shared Responsibilities Shared Vision”

Risk management<sup>4</sup> is a scientific process for identifying health hazards and deciding what to do about them.

It involves several steps:

- identifying the public health issue (can be a disease, agent, product, process or behaviour);
- gathering information about the risk by studying, among other things, the size and nature of the potentially affected population, the specific nature of the risk and the conditions of exposure;
- identifying (and analyzing) options for dealing with the risk;
- deciding on a risk management strategy (the choice of strategies takes into account factors such as the severity of the risk, researcher’s degree of confidence in their data, legal requirements, public perceptions and socio-economic considerations);
- putting the risk management strategy to work;
- evaluating the effectiveness of the risk management strategy.

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<sup>4</sup>Health Canada integrates its consideration of risk assessment and risk management, unlike some of the international literature.

## Health Protection Branch Policy Framework<sup>5</sup>

### *Priority Setting*

It is the policy of the Health Protection Branch, in fulfilling its mandate:

1. To establish priorities on the basis of risk assessment and management, including consideration of benefits in the development of risk management strategies and to allocate resources accordingly.
2. To establish priorities for dealing with existing and potential health issues that are based on their potential impact on the health of Canadians and their potential for effective intervention, or their effect on Canada's health care system.
3. To establish health goals in the priority areas and monitor progress towards their achievement.

### *Risk Assessment/Risk Management*

It is the policy of the Health Protection Branch, in fulfilling its mandate:

1. To follow a structured process of risk determination for the assessment and management of health risks.
2. To identify and define risks to the health and well-being of Canadians through:
  - multidisciplinary, population or incidence-based investigations;
  - monitoring and evaluation of products and production processes;
  - research and laboratory investigations; and
  - evaluation, synthesis and interpretation of evidence-based information.
3. To quantify the relationship between health outcomes associated with the hazard, and exposure to the hazard and the level of risk involved.
4. To identify various courses of action that could potentially address health issues under review.
5. To assess possible risk management options in a consistent manner, taking many factors into consideration including health benefits.
6. To select, implement and monitor appropriate courses of actions.

### *Regulatory Approach*

It is the policy of the Health Protection Branch, in fulfilling its mandate:

1. To use a regulatory approach which is flexible enough to permit responsiveness to innovative and changing circumstances.
2. To promote voluntary compliance and, where necessary, to enforce compliance with regulations.
3. To provide a process for consultation in adopting regulations and to implement them fairly.

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<sup>5</sup>Reproduced from the Health Canada web site

4. To achieve health and safety objectives while promoting, where possible, enhanced Canadian competitiveness.
5. To maintain an effective and efficient regulatory system that is in balance with those of competitor nations so Canada is not economically disadvantaged.
6. To harmonize, where possible, with international regulatory standards and requirements, to increase efficiency.

### ***Internationalization***

It is the policy of the Health Protection Branch, in fulfilling its mandate:

1. To participate actively in the development and adoption of international health and safety standards to reduce health risks to Canadians.
2. To consult with, provide assistance to, and share information with, other national and international agencies. Liaison and collaboration with these agencies is necessary as global measures and information have a direct impact on the health of Canadians.

### ***Communication***

It is the policy of the Health Protection Branch, in fulfilling its mandate:

1. To make decisions publicly accessible in a timely manner, including the rationale leading to the decision, within the parameters of the *Privacy Act* and *Access to Information Act*.
2. To communicate risks and benefits to the public, both general and target groups, to:
  - assist in informed decision-making, and
  - explain strategies and actions.
3. To increase understanding among Canadians so they can improve their health (individuals, families, communities) through informed decision-making.
4. To develop communication strategies for new and existing health-related knowledge based on the needs and understanding of our partners and individual Canadians. These strategies will:
  - communicate new and existing knowledge using a wide variety of media;
  - link new information with existing knowledge, enhancing its value; and
  - facilitate the use of new and existing knowledge.

### ***Cooperation***

It is the policy of the Health Protection Branch, in fulfilling its mandate:

1. To work in collaboration with stakeholders in the development and delivery of programs.
2. To work with international agencies, other federal departments, and other levels of government in reducing harm caused by the distribution and use of controlled drugs and substances.
3. To encourage cooperation with industry, stakeholders and the public.
4. To recognize and incorporate public expectations into public health and safety decisions.

### ***Scientific Capability***

It is the policy of the Health Protection Branch, in fulfilling its mandate:

1. To develop, maintain and support a credible and competitive core scientific capability for research, evaluation, analysis and inspection, in support of reducing and managing risks associated with health-threatening hazards.
2. To conduct and support research aimed at developing, testing and maintaining effective measures for improving the health and safety of Canadians, through the reduction and management of risks associated with health-threatening risks and identifying health benefits.
3. To provide competent service by recruiting, developing, maintaining and supporting a high quality, professional and appropriately trained workforce.

### ***Management***

It is the policy of the Health Protection Branch, in fulfilling its mandate:

1. To manage according to principles that provide clear direction and create and support an environment that encourages excellence.
2. To assess and choose courses of action which make the best possible use of available resources while providing maximum public health benefit.

### ***Revenue Generation***

It is the policy of the Health Protection Branch, in fulfilling its mandate:

1. To identify opportunities for revenue generation so that health protection initiatives will:
  - minimize the direct or indirect negative impact on public health and safety, and
  - provide an incentive for effective and improved program delivery.



## Natural Resources Canada

### 1. *Context for Use of Scientific Advice*

Natural Resources Canada provides the knowledge and expertise for the sustainable development of Canada's natural resources and the global competitiveness of the resource and related sectors for the well-being of present and future generations of Canadians.

The department describes its business as bringing its strengths in science and technology to bear on the sustainable development of Canada's natural resources. It specializes in energy, minerals and metals, forestry and earth sciences, recognizing areas of federal responsibility in trade, science and technology, federal regulatory responsibilities, the environment, national data and statistics and the management of lands and offshore areas under federal control.

The four sustainable development business lines are:

- developing sound national policies and regulations for areas under federal responsibility;
- promoting Canada's international interests, whenever they relate to natural resources;
- conducting scientific research and transferring new technologies;
- building a national knowledge infrastructure on Canada's land and resources.

These Business Lines are delivered through four operational sectors - the Canadian Forest Service, the Earth Sciences Sector, the Energy Sector and the Minerals and Metals Sector.

The department is highly S&T intensive with close to 70% of the total departmental budget being devoted to S&T and of that 86% to R&D. This reflects the very different mandate and mode of NRCan in comparison, for example, with Environment Canada which has 27% of its S&T in R&D and the rest in "related science activities". NRCan's contributions to science based decision-making take the form of a sort of S&T knowledge infrastructure for the business of government, and generally require cooperation with other government departments and external stakeholders. This includes:

Policy and regulation:

- Development of natural resource policies and strategic framework (e.g. the Minerals and Metals Policy);
- Review of federal acts in collaboration with other departments (e.g. the Canadian Environmental Protection Act);
- Administration of federal regulations (e.g. Explosives Act);
- Advisory role to Department of Indian and Northern Affairs on resource issues;
- Advisory role to Revenue Canada and the Department of Justice on resource-related tax issues.

#### International Issues:

- Contributions to formulation and implementation of the Framework Convention on Climate Change and the Global Convention on Biodiversity;
- Contributions to establishing and defending Canada's position on the UN Law of the Sea;
- Contributor to international work relating to a Global Forest Convention, waste and recycling issues;
- Harmonization of energy efficiency standards and regulations.

#### Science and technology:

- Science and technology relating to sustainable resource development for provincial clients (e.g. integrated pest management strategies).

## 2. *Practices and Procedures*

NRCan as it exists today was forged following Program Review from a restructuring of a number of units and a decision to integrate the science and policy activities within each of the four sectors (at that time only the Canadian Forest Service had that structure). While there remains today a diversity of activities and cultures among the four operational sectors, the department has developed a comprehensive set of principles and practices as a unifying force for the conduct of its operations. Some of these guidelines are of particular relevance to science in government decision-making (see the Appendix to this profile where some or all of the more relevant guidelines have been reproduced for easy reference):

- A The S&T Management Framework
- B Coordination of S&T with policy activities
- C Consultation through external advisory councils
- D Consultation with clients and stakeholders on S&T programs
- E Human resources management for S&T organizations
- F Scientific assessment
- G External S&T communications

Following program review the DM asked for strong linkage of policy and technology. The integration process forced a number of developments, including the strengthening of the client - supplier relationship. This developed more rapidly in some sectors than others. Those with a private sector client moved more rapidly, those with a government client are still evolving. Generally, however, there is a very strong planning ethic within the department that is attributed to a clarity of vision and purpose that was developed following the Program Review challenges.

Actual practice varies among the four sectors. In the following section, some sample issues and practices are profiled.

#### Anticipatory Capacity:

- Considered an essential capacity for a resource department; priority to strengthening what is seen as embryonic or inadequate capacity.
- Energy Sector already working on 2030 scenarios.
- Most other sectors moving horizon towards 10 to 15 years (longer for climate change).

#### Structural:

- Structural challenges vary among sectors. In the case of the Mining and Metals sector, a major challenge is the relationship with Environment Canada.
- CFS is attempting to overcome cultural and structural difficulties (science in the regions versus policy at headquarters) through identifying a science advisor for each major issue (e.g. biodiversity) responsible for linkages among science in networks, Ottawa HQ and other departments (these people come from a science background but are embedded in a policy environment in Ottawa).

#### Unit Reviews:

- The tradition of external peer review developed in the Geological Survey of Canada and managed in partnership with an “external review agency” has been adopted by the Earth Sciences Sector with a 5-6 year life cycle for each unit. The Canadian Geoscience Council frequently acts as external review agency, providing credibility and independence to the process. A generic terms of reference is appended for this process.
- Following the restructuring of Program Review, some sectors (e.g. the Canadian Forest Service) have not yet re-instated unit reviews. This is being planned with both science and policy dimensions.

#### Publication policy:

- Scientists are expected to publish.
- Peer review within department; fairly routine management sign off.

#### Source of advice:

- Variable practices among sectors. Minerals and metals has a long tradition of multi-stakeholder programs (e.g. Mine Environment Neutral Drainage Program (MEND)) which engages external stakeholders in discussions on regulatory issues in the formative stage and involves partnerships in the development of science input.
- The Canadian Forest Service works closely with the provincial DM's of Forestry;
- Stakeholder consortia are used in some areas to bring private sector data to the table prior to drafting of regulation.

#### Cross cutting initiatives:

- Inter-departmental initiatives are important, but difficult.
- Climate change secretariat management that crosses vertical reporting lines; really difficult to get reporting/accountabilities right.

- The creation and functioning of the interdepartmental group of the five natural resource departments was characterized as a major milestone in planning and cooperative initiatives (in science and in using science).

#### Staff Training:

- CFS has developed a series of workshops targeted at bridging the science to policy cultural divide. Drawing insights from earlier surveys of scientist and policy perspectives, a set of resource materials and a workshop protocol was developed that was designed to expose the two communities to the actual task of devising science-based policy through case studies and role playing.
- Workshops delivered in the regions, not headquarters.

#### Communications with the press:

- All scientists are expected to be available to speak with the press, with the only requirements being to keep to NRCan activities, speak with the media shop immediately after interview with press, avoid commenting on policy or provincial decisions.

### 3. *Current Issues*

#### Internationalization:

- Need to increase the science/technology component of dealings on international trade through DFAIT. Serious issue with respect to the international image of the resource sector. Government plays a role in how it is portrayed internationally.

#### Barriers:

- Inherent difference in culture between science and policy, including the disconnect in time lines and methodologies.
- Inter-departmental tensions; there is as yet inadequate understanding of the roles and responsibilities of other departments and their stakeholders as well as a lack of respect for the science capacity in other departments.

#### Cynicism:

- Scientists concern that there is not the political will to take the necessary steps to live up to international commitments such as Kyoto for fear of constitutional structure, economic disruption, belief in “let the market rule” philosophy (anti subsidy). In this case it won’t be enough.

#### The client:

- A significant part of the NRCan activity is a sort of “science infrastructure” for the decision making of other departments and for provincial governments. Nurturing this linkage is an ongoing challenge.

#### 4. *Documentation*

- *Business Plan 1997-2000* From the NRCan web site <http://www.nrcan.gc.ca>
- *Natural Resources Canada Performance Report For the Period ending March 31, 1998.* Government of Canada
- *The Science and Technology Management Framework. May 1996.* A set of guiding principles, management tools and decision-making authorities designed to increase the effectiveness and efficiency of S&T activities in support of the sustainable development of Canada's mining, forestry and energy sectors. It focusses on return on the S&T investment and the linkage between the S&T and government priorities.
- *Compendium of S&T Management Practices. 1998 (?)*. Designed by NRCan staff as a "tool box" of sound management practices relevant to the diverse components of the Department. Also designed as an assessment and evaluation tool.
- *Science and Technology in the Natural Resources Sectors: The Key to the 21<sup>st</sup> Century.* Selection of S&T Activities 1997. Published 1998. States the eight NRCan strategic goals for 1996-97 and highlights the S&T activities relating to the seven federal S&T operating principles.
- *Guide to Planning. September 1997.* Guide outlines the basic rationale and requirements of planning and reporting and covers the cross linkages among priorities, strategies, goals and implementation.
- *Framework for Revenue Generation, External Funding and Collaborative Activities.* Outlines the philosophy and principles underlying revenue generation and provides a "how to" tool kit.
- *Managers Guide to S&T Impact Assessment.* September 1997. Provides guidance on available methods for assessing the impact of S&T, and the various considerations that should be kept in mind when making choices on what process to follow. Includes some consideration of S&T for policy support and development of codes and standards.
- *Participant's Resource Materials: Policy Making - A Workshop on the Interface Between Science and Policy.* Vinzenza Galatone, Canadian Forest Service. 1999.



## Natural Resources Canada - Appendix of Reference Notes<sup>6</sup>

### A. S&T MANAGEMENT STRATEGY

#### Objectives

1. NRCan will incorporate a strong client focus in all S&T programs and projects to ensure that they are relevant and useful.
2. NRCan will implement rigorous accountability mechanisms for measuring and reporting progress to relevant parties, including clients and public.
3. NRCan will enhance its management practices by investing in employees.

#### Guiding Principles

1. Employees are treated fairly and they will be given the opportunities to acquire the skills and expertise they need to deliver S&T.
2. S&T involves creativity and innovation. Appropriate risk taking in the conduct and management of S&T activities is encouraged.
3. An S&T vision for NRCan and a clear definition of performance criteria are prerequisites for success.
4. Effective interaction among science, technology, policy and programs must be demonstrable.
5. A clear link to government priorities and planning is essential.
6. Accountability based on results is necessary and requires a common, yet flexible, approach among sectors.
7. Responsiveness to clients, partners and stakeholders is essential.
8. Return on public investment must be demonstrable and open to public scrutiny.
9. Effectiveness in managing S&T resources will be monitored.
10. Continuous improvement is key to good S&T management.

### B. COORDINATION OF S&T WITH POLICY ACTIVITIES

#### Purposes

1. To ensure that policy advice on government and sectoral policy priorities helps establish S&T priorities and activities.
2. To ensure that sectoral policy advice is based upon sound S&T advice, knowledge and experience.

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<sup>6</sup>From NRCan reference documents and web site <http://www.nrcan.gc.ca>

3. To ensure that S&T and sectoral policy advisors understand and support each other's initiatives in areas of shared responsibility, and give consistent advice to ministers.

### **Working Assumptions**

1. Policy considerations are a crucial factor in the formulation of S&T priorities and activities.
2. Policy development and advice are based upon sound advice from S&T organizations.

### **Key Elements**

1. S&T and policy advice to ministers is consistent.
2. Ensure that S&T and policy partnership are in place.
3. Establish partnerships at working, middle manager and senior manager level, as appropriate, allowing for information to be passed from S&T to policy and vice versa.
4. Record decisions related to advice.
5. Report back jointly on resulting actions to parties involved.
6. Review regularly the partnership process.

## **C. CONSULTATION WITH CLIENTS AND STAKEHOLDERS ON S&T PROGRAMS**

### **Purposes**

1. To ensure that the views of clients and stakeholders are known and considered.
2. To obtain buy-in and support from clients and stakeholders.
3. To open and maintain an effective dialogue.
4. To initiate contact for future business opportunities and partnerships.

### **Working Assumptions**

1. Consultation is the most efficient way to obtain the necessary information.
2. Consultation with clients and stakeholders can be either formal or informal, periodic or ongoing.
3. Consultation is carried out at all stages of management (planning, organization, implementation, monitoring and evaluation).

### **Key Elements**

1. Develop a consultation strategy and mechanisms for each consultation:
  - Define needs and objectives;
  - Identify and select clients and stakeholders (should cover client base - current and potential); and
  - Establish mechanisms and schedules for consultation.

2. Contact clients and stakeholders (e.g., through phone interview, Internet survey, meeting).
3. Compile, analyze, evaluate the information and validate the information gathered with clients and stakeholders.
4. Integrate consultation outputs into the decision-making process.
5. Communicate results of decision making to clients and stakeholders.
6. Maintain an ongoing dialogue.
7. Synchronize the various consultative processes for programs and projects with the same clients and stakeholders.

## **D. HUMAN RESOURCES MANAGEMENT FOR S&T ORGANIZATIONS**

### **Purposes**

1. To provide S&T managers with the means to manage effectively human resources.
2. To optimize the effectiveness of staff by ensuring a healthy and favourable work environment, by continuing to attract the right people, and by developing and motivating them.

### **Working Assumptions**

1. Effective S&T requires skilled, highly trained and highly motivated scientists, technicians and managers. In meeting current and future recruitment needs, federal organizations will have to compete with the private sector and other levels of government.
2. S&T organizations have clear and commonly understood mission and goals around which staff can be mobilized within evolving mandates, roles and responsibilities.
3. Management of human resources is achieved within a culture and under a leadership that emphasize excellence. That culture reflects program values (service quality, economy, efficiency, effectiveness and the value of diversity), and promotes ethical values (fairness, prudence, probity, equity and non-partisanship).
4. Leadership involves integrity and credibility on the part of senior and middle management, team leaders and team members. Shared leadership, innovation and risk-taking, empowerment, upward feedback, teamwork, collaboration and client service have become increasingly important.
5. The planning and management of human resources involve addressing through a common framework organization-wide concerns such as future labour needs and availability, promotion, training and retraining, mobility, performance, morale issues, etc. Needs analysis and succession planning are especially important in the highly specialized S&T environment.
6. A healthy and favourable work environment is especially important in fostering creativity, teamwork, change and productivity in S&T organizations. People are valued as key assets to be managed wisely. Staff are encouraged to achieve their full potential and share responsibility for continuous learning and growth.

7. Management communicates to employees its commitment to adhere to all federal human resource directives, policies, regulations and procedures that impact on human resources (e.g., Official Languages, Employment Equity, Harassment, Workforce Adjustment policies, etc.).
8. Increased management flexibility is required for hiring, demoting, letting go and reassigning staff to respond quickly to S&T opportunities and to changing priorities when the required skill mix changes.
9. Given the fast pace of S&T changes, managers and employees work jointly to seize opportunities for training and development in new skills to meet performance expectations; managers have increased flexibilities on conference participation and work travel.
10. Promotion criteria and rewards are based on contribution to the objectives of the S&T organizations, including client satisfaction. Performance standards are clearly defined and understandable.
11. A close working relationship exists between senior managers and employee bargaining agents.

### **Key Elements**

1. Analyze future labour requirements (e.g., forecast departures, confirm requirements of positions to be filled). Forecast future supply; plan and implement initiatives to avoid labour shortages and to rejuvenate the workforce (e.g., explore alternatives to recruitment such as secondments from outside the department, contractors, etc.).
2. Managers and employees work jointly to develop and implement a plan for career management. This is achieved by identifying gaps between employees profile and career aspirations and organizational needs, evaluating employees' potential and discussing possible measures to achieve career expectations and enrichment.
3. Managers and employees work jointly to develop learning initiatives to ensure continuous improvement and innovation. This is accomplished by identifying and prioritizing learning needs, determining ways for acquiring competencies (e.g., management training for senior scientific staff), and evaluating the impact of training programs on organization's effectiveness.
4. In consultation with employees, manage performance by setting explicit roles and work objectives, coaching, counselling, monitoring, providing ongoing feedback, evaluating performance, dealing with ineffective performance and linking these activities with organizational objectives, incentive and performance pay, training, promotion, and career and succession planning.
5. Address further the question of promotion by establishing clearly defined promotion criteria aligned to business objectives, elaborating promotion plans (e.g., training, rotational assignments, tutoring), and determining methods for assessment and evaluation.
6. Establish a system of incentives, clearly defining what is to be recognized, how, and why.

## **E. SCIENTIFIC ASSESSMENT**

### **Purpose**

1. To provide S&T organizations with scientific assessments of their S&T programs or projects.

### **Working Assumptions**

1. S&T organizations periodically assess their S&T programs or projects.
2. All S&T activities conducted or delivered by the S&T organizations are assessed.

### **Key Elements**

1. Put in place an objective peer review process to assess the overall direction and level of effort, adequacy of coordination and collaboration, and scientific quality, and to provide up-to-date and forward-looking assessments of the S&T programs or projects.
2. Link scientific assessment with project management, including the development or updating of S&T strategic and business plans; as appropriate, incorporate the results of the assessments into such plans, and into the resource allocation and the external evaluation processes.
3. Establish assessment panels that reflect internal and external scientific expertise and the breadth of partners' and stakeholders' interest and involvement in the research.
4. Foster direct participation by research managers and scientific staff in the assessment.
5. Assign responsibility for follow-up actions to appropriate program managers and project leaders.
6. Communicate follow-up actions to scientific staff and the review panel.

## **F. EXTERNAL S&T COMMUNICATIONS**

### **Purposes**

1. To inform clients, partners, stakeholders, employees of the S&T organization and the general public about its activities, services, products and policies, and impacts of its activities.
2. To provide them with a means to have their concerns and interests taken into account in the formulation and implementation of policies, programs and projects.

### **Working Assumptions**

1. Communication is an essential management tool for:
  - increasing the science awareness of the Canadian public;
  - generating business opportunities, increasing sales and encouraging partnerships;
  - creating awareness, by demonstrating the value and benefits of S&T to Canada;

- enhancing employees' awareness of external communications requirements, with the view of providing a more sensitive, responsive service to the public, clients and stakeholders; and
  - providing clients, partners, stakeholders and employees opportunities to influence the development and implementation of policies, programs and projects.
2. Scientific and communication staff are aware of their respective roles and responsibilities and the need to maintain effective internal working relations.
  3. S&T organizations have a coherent corporate approach to S&T communications.

### **Key Elements**

1. Ensure the existence of an S&T communications infrastructure which provides a proactive S&T communications strategy that incorporates an international perspective.
2. Provide accurate, clear and consistent information and messages to targeted publics.
3. Provide the means for dialogue between S&T staff and external audiences.
4. Integrate communications plan and activities in project management.
5. Explore and use all appropriate forms of communications vehicle.

## **G. EXTERNAL REVIEWS OF PROGRAMS IN THE EARTH SCIENCES SECTOR**

The terms of reference for this review follow the general prescription adopted by NRCan for reviews of programs in the Earth Science Sector. These are as follows:

### **General**

1. Determine and document the current level and types of science activities within the program under review;
2. Assess the relevance and adequacy of these activities to users in industry, university and government sectors, and for the sectoral and departmental national responsibilities and mandates;
3. Assess the timeliness, relevance, quality and quantity of publications reporting on the results of science activities within the program under review;
4. Assess the range, adequacy and quality of research infrastructure available to support the science activities within the program under review;
5. Examine the methods and procedures used in originating, implementing, assigning priorities and managing research projects within the program;
6. Identify new potential initiatives and opportunities for the program;

The Review Agency(ies) will report their findings and appropriate recommendations in writing to the Assistant Deputy Minister, Earth Sciences Sector. The report of the Agency will be made public, but the mechanism and format of publication will be determined by mutual agreement of the Assistant Deputy Minister, Earth Sciences Sector and the Review Agency(ies);

The Minister's National Advisory Board for Earth Sciences (MNABES) will assess the reviews with respect to the methodologies, standards, conclusions, and recommendations, therein, and report their assessments to the Assistant Deputy Minister.

### **Accountability**

The Review Agency(ies) is accountable to the Assistant Deputy Minister, Earth Sciences Sector.

### **Duration**

The Review Agency(ies) will issue an interim report within three months from the date of the commencement of the review. The final report will be issued not more than three months later.

### **Composition of Science Review Panels**

Nominees to the Review panels will be selected jointly by the ESS science program managers and the Review Agency(ies) with each having a veto over the other's nominations if the qualifications or specialization of nominees are considered inappropriate. The Chief Geoscientist would ensure that the review process is rigorous and conforms with best practices in this field; that there are no conflicts of interest among the peer reviewers; and that review panels contain a good representation of peers from the diverse client base.

Each Review Panel will:

- be composed of top-quality scientists and R&D managers from universities, industry and government, and be specialists in the fields under review. Each panel can include members of the international scientific community. No panel member will participate in a review of his/her own research establishment.
- have full access to previous peer quality review processes.

### **Advice/Consultation**

The Review Agency(ies) can seek advice and counsel from any source (national or international) it deems appropriate.



