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**A Framework for  
Science and Technology Advice:**

**Principles and Guidelines  
for the Effective Use of  
Science and Technology Advice  
in Government Decision Making**

Canada

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# Contents

Introduction . . . . .	1
Context . . . . .	1
Desirable Outcomes . . . . .	2
Principles and Guidelines . . . . .	3
Implementation . . . . .	11
Glossary . . . . .	15
References . . . . .	17

# Introduction

This Framework will ensure that government policy, regulatory and management decisions are informed by sound science and technology (S&T) advice.<sup>1</sup> The Framework derives from a report of the Council of Science and Technology Advisors (CSTA), an external advisory committee, and reflects extensive consultations within government and with external stakeholders.<sup>2</sup> Broad implementation measures will promote adoption of, and ensure accountability for, these principles and guidelines across government. This Framework builds on many of the practices currently employed by Canadian federal government departments.

## Context

The emergence of the knowledge-based society has underscored the importance of sound science advice as a key input to policy formulation both nationally and internationally. Science and technology (S&T) now affect most core government functions. There is every indication that the importance of science advice will grow as the emergence of new science-based issues intensifies.

As we enter the 21st century, the issues facing governments are increasingly complex and require decisions that have profound impacts on societies and economies. Fuelled by increased access to information, there is heightened public interest in science-based issues, and greater emphasis on public participation in decision making. Recent government decisions in the areas of natural resources management, public health and safety, and other areas have undermined public confidence and contributed to public

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1. Hereafter, “science” should be construed broadly to include the sciences, engineering and technology.

2. The CSTA report, *Science Advice for Government Effectiveness (SAGE)*, was submitted to Cabinet in May 1999.

concern regarding the ability of the federal government to address science-based issues effectively.

At the same time, the public expects government to capture the full benefits of new scientific discoveries and new technologies. Government must be diligent in using science advice to capitalize on the opportunities afforded by advancements in science and technology.

These principles and guidelines address science advice as one input in government decision making. Clearly, decision making in government must consider a wide range of other inputs (including traditional knowledge, ethical and cultural considerations, etc.) and decision makers must consult, as appropriate, advisors competent in many aspects of public policy (including law, public administration, international affairs, etc.). Decision makers must exercise their legitimate role to weigh these multiple inputs and make choices.

Science advice has an important role to play by contributing to government decisions that serve Canada's strategic interests and concerns in areas such as public health and safety, food safety, environmental protection, sustainable development, innovation, and national security. The effective use of science advice may also contribute to Canada's ability to influence international solutions to global problems.

## **Desirable Outcomes**

Canada requires a science advisory process that leads to sound government decisions, minimizes crises and capitalizes on opportunities. An effective advisory process brings both sound science and the best science advice to bear on key issues, and ensures that:

- ministers are confident that a rigorous and objective assessment of all available science was made in providing the advice;

- credible science advice is considered by decision makers; and
- the public and parliamentarians are confident that government is using science in the best interests of all Canadians.

## **Principles and Guidelines**

The principles and guidelines contained in this report address how science advice should be sought and applied to enhance the ability of government decision makers to make informed decisions. They reflect the evolving context for government decision making. Their adoption and consistent application will lead to the desirable outcomes identified above.

These principles and guidelines should not inhibit action, but rather guide it. The principles should be reflected in the science advisory processes employed by government. The guidelines suggest means by which the government can demonstrate adherence to the principles. The objectives and spirit of all the guidelines should be met, but the specific measures or instruments employed by government departments will reflect their respective mandates, existing advisory processes and codes of conduct.

### **Principle I: Early Issue Identification**

*The government needs to anticipate, as early as possible, those issues for which science advice will be required, in order to facilitate timely and informed decision making.*

The need to recognize when science advice is required and to seek science advice actively is of critical importance. An extensive advisory base contributes to the government's ability to identify issues on a timely basis.

## Guidelines

- I-1 Decision makers should cast a wide net — consulting internal, external and international sources<sup>3</sup> — to assist in the early identification of issues requiring science advice.
- I-2 Decision makers, policy advisors and scientists should communicate emerging issues requiring advice, and improve the connections between research and potential policy or regulatory issues.
- I-3 Departments should support and encourage their science and policy staffs to establish linkages with each other and with external and international experts.
- I-4 Departments should maximize interdisciplinary and international cooperation, and the use of expertise across government departments and levels of government, to identify, frame and address horizontal issues.
- I-5 Departments should maximize the use of new and existing science and expert advisory bodies.

## Principle II: Inclusiveness

*Advice should be drawn from a variety of scientific sources and from experts in relevant disciplines, in order to capture the full diversity of scientific schools of thought and opinion.*

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3. Internal sources include government departments' scientists and experts. External sources include science advisory boards, other government departments, provincial governments, academe, industry, professional and learned societies, and other interested parties.

Inclusiveness enhances the debate by getting conflicting viewpoints on the table, generating a full and open discussion, and drawing in scientific findings that may not otherwise be considered. The market for science advice is global, and the growing body of science knowledge available internationally must be brought to bear on policy issues. In addition to improving the early identification of issues, inclusiveness aids in achieving sound science advice by reducing the impact of conflicts of interest or biases that may exist.

## Guidelines

- II-1 Departments should seek science input and advice from a wide range of sources, and decision makers should consider the multiple viewpoints received. Departments should also consider engaging external, independent agencies to create advisory panels or to solicit advice on complex or controversial issues.
  
- II-2 While advice from external and international sources should be sought regularly, departments should ensure that such advice is sought when:
  - a. the problem raises scientific questions that exceed the expertise of in-house staff;
  - b. the issue is horizontal in that it cuts across disciplines or lines of jurisdiction within or among departments or levels of government;
  - c. there is significant scientific uncertainty;
  - d. there is a range of scientific opinion;
  - e. there are potentially significant implications for sensitive areas of public policy; or
  - f. independent scientific analyses can strengthen public confidence.
  
- II-3 Departments should ensure that the selection of advisors:
  - a. is matched to the nature of the issue and the breadth of judgment required;



- b. is balanced to reflect the diversity of scientific opinions and to counter potential biases; and
- c. includes some experts from other, not necessarily scientific, disciplines.

II-4 Departments should ensure that members of external advisory bodies are regularly rotated, with replacements chosen to preserve balance of representation.

II-5 Decision makers should be open to both solicited and unsolicited advice.

### **Principle III: Sound Science and Science Advice**

*The government should employ measures to ensure the quality, integrity and objectivity of the science and science advice it uses, and ensure that science advice is considered in decision making.*

Due diligence procedures for assuring quality and reliability, including scientific peer review, should be built into the science advisory process. Sound science thrives on the competition of ideas facilitated by the open publication of scientific findings and analyses. The science advisory function should be treated as an integral part of the management process. Effective relationships between decision makers and science advisors benefit from an understanding of their differing perspectives and approaches. Communication between decision makers and science advisors helps maintain the integrity of the science advice throughout the decision-making process.

#### **Guidelines**

III-1 Departments should:

- a. ensure that all science and science advice used for decision making is subject to due diligence (this should include rigorous internal and external review and

- assessment of all findings, analyses and recommendations of science advisors — the fact that information is proprietary should not preclude external review, although confidentiality of such information should be appropriately maintained);
- b. ensure that in-house expertise exists to assess and communicate science (whether performed internally or externally) to decision makers;
  - c. ensure that a strong link exists between science advisors and departmental policy advisors;
  - d. promote professional practices for those involved in the conduct, management and use of science, and provide and enforce conflict of interest guidelines, with these considerations:
    - i) science advisors should declare any conflicts of interest prior to serving in an advisory capacity, and update such declarations throughout their term of service;
    - ii) decision makers should have the ultimate responsibility for protecting against actual or perceived conflicts of interests; and
  - e. support and encourage government scientists to publish their research findings and conclusions in external, peer-reviewed publications.

### III-2 Decision makers should:

- a. require that science advice be provided to them unfiltered by policy considerations;
- b. be conscious of possible biases among the science advisors and in the science advice received; and
- c. involve science advisors in the identification and assessment of policy options, to help maintain the integrity of the science advice.

III-3 Scientists and science advisors should:

- a. have the flexibility, within the issue being examined, to explore the range of conclusions and interpretations that the scientific findings might suggest;
- b. assist decision makers and science managers to set research priorities and design a research base that will support future science-based decision making; and
- c. recognize the existence of other considerations in decision making.

III-4 Decision makers should take care to exclude personal and political views in formulating the questions to be addressed, and science advisors should clearly distinguish scientific fact and judgment from personal views in their advice.

## **Principle IV: Uncertainty and Risk**

*Science in public policy always contains uncertainty that must be assessed, communicated and managed. Government should develop a risk management framework that includes guidance on how and when precautionary approaches should be applied.*

The goal of risk management should be scientifically sound, cost-effective, integrated actions that reduce risk while taking into account social, cultural, ethical, political, economic and legal considerations. Effective risk communication is of critical importance.

### **Guidelines**

IV-1 Departments should adhere to a government-wide set of risk management guidelines, once they have been developed, to maintain confidence that a consistent and effective approach is being used across government.

- IV-2 Scientists and science advisors should ensure that scientific uncertainty is explicitly identified in scientific results and is communicated directly in plain language to decision makers.
- IV-3 Decision makers should ensure that scientific uncertainty is given appropriate weight in decisions.
- IV-4 Starting well before decisions are made, scientists, science advisors and decision makers should communicate to stakeholders and the public the degree and nature of scientific uncertainty and risks, as well as the risk management approach to be used in reaching decisions.

## **Principle V: Transparency and Openness**

*The government is expected to employ decision-making processes that are open, as well as transparent, to stakeholders and the public.*

Transparency implies an articulation in plain language of how decisions are reached, the presentation of policies in open fora, and public access to the findings and advice of scientists as early as possible. Openness implies early and ongoing consultation with stakeholder groups, as well as public discourse, to ensure that public concerns are considered in making decisions on science-based issues. The level of expected risk and controversy, and the need for timely decisions, should guide the nature and extent of consultation undertaken, with higher levels of risk and controversy demanding a greater degree of transparency.

### **Guidelines**

- V-1 Decision makers should balance the need for timeliness in reaching decisions with the need for effective consultation, while recognizing that transparency is always imperative.

- V-2 Decision makers should provide early warning of significant policy and regulatory initiatives to key interest groups and other governments or international organizations, as appropriate.
- V-3 Departments should make publicly accessible, on an ongoing basis, all scientific findings and analysis underlying decisions, and demonstrate how the science was taken into account in the decision making or policy formulation.<sup>4</sup>
- V-4 Departments should consider using a variety of means (including Web sites, press releases, newsletters, direct communication with stakeholders, public meetings, etc.) to present policy. Science advisors should be given a leading role in explaining their advice, while policy officials should describe how the science advice was secured and how the policies or regulations have been framed in light of the advice.
- V-5 Inevitably, circumstances arise where scientific conclusions conflict with existing policies, or where government scientists believe their findings or advice are being muzzled. In these cases, departments should employ a well-defined and transparent procedure involving review by departmental management and then, if necessary, examination by a third party. The process should emphasize early conflict resolution and ensure departments do not restrict release of scientific findings that meet the guidelines for sound science.

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4. This guideline should not be construed to override existing government policies regarding limitations on the release of information (for example, for the protection of privacy, proprietary information, intellectual property, national security, etc.).

## **Principle VI: Review**

*Subsequent review of science-based decisions is required to determine whether recent advances in scientific knowledge have an impact on the science advice used to reach the decision.*

### **Guidelines**

- VI-1 Departments should establish a follow-up procedure that documents the government's actions in response to science advice and recommendations. Departmental responses should become part of the official record and provide a useful input to subsequent reviews.
  
- VI-2 Departments should review key decisions to determine whether recent advances in scientific knowledge affect the science and science advice used to inform the decision. The time period for review should depend on the state of the science (for example, the level of uncertainty, the rate of change in the scientific knowledge, etc.) and should be identified at the time the decision is made (for example, establish a "best before" date for the science advice).
  
- VI-3 When asked to review past decisions, and the science and science advice that supported them, science advisors should have access to all relevant information, including previous analyses and official responses.

## **Implementation**

Implementing the principles and guidelines will help build public confidence in government decision making. Accountability for the principles and guidelines will also lead to better understanding of the contribution of science to departmental and government-wide missions and mandates. A strategy for implementing the science and technology advice principles and guidelines must include three

elements: promoting their adoption, ensuring accountability for them within individual departments and across government, and evaluating their effectiveness. While individual departments will bear responsibility for a number of the specific measures, cooperative initiatives are important to enhance the use of science advice across government. The following measures are recommended.

## **A. Promoting the Adoption of the Science and Technology Advice Principles and Guidelines**

- A-1 Departments should ensure professional development and training programs for government scientists, science advisors, policy analysts and decision makers on the Framework for Science and Technology Advice, science communication and the science-policy interface in government.
- A-2 Departments should promote the Framework internally.
- A-3 Departments should publish the Framework, and communicate its existence to stakeholders and the public.
- A-4 Departments should publicize cases that illustrate best practices in the use of science advice. Such cases could enhance awareness for the public, the media and parliamentarians of science, and its impact on government decision making.
- A-5 Departmental S&T advisory bodies should periodically provide advice on how departments should implement and use the principles and guidelines.

## **B. Ensuring Accountability**

- B-1 Science-based departments and agencies should designate a departmental “science advice champion” who reports to the Deputy Minister, or equivalent, and is responsible for:
- a. guiding the implementation of the principles and guidelines, and ensuring the department has reflected them in its priorities and business plans;
  - b. requiring that a science advice checklist accompany advice to decision makers on key issues, to ensure departmental adherence to the principles, and consistency in the implementation of the guidelines;
  - c. preparing a report for inclusion in the departmental annexes of the Annual Report on Federal Science and Technology, on how the principles and guidelines have been implemented and adhered to; and
  - d. sharing best practices and lessons learned with respect to implementation of the principles and guidelines.
- B-2 Memoranda to Cabinet, Treasury Board Submissions and Regulatory Impact Analysis Statements should explain how recommendations on science-based issues have taken account of science advice in accordance with this Framework. Documents should, at a minimum, address sources of science advice, levels of uncertainty and risk, and a recommended review period.

## **C. Evaluating Effectiveness**

- C-1 Upon approval of the Framework, the Assistant Deputy Ministers’ (ADM) Committee on Science and Technology should assemble experts to develop common criteria for the evaluation of departmental adherence to, and effectiveness of, the science advice principles, guidelines and implementation measures. The results of these evaluations will be reviewed by the ADM Committee as a means to



share best practices, and included as an annex in the Annual Report on Federal Science and Technology. Initial evaluations should commence within three years.

- C-2 The Auditor General should be made aware of the Framework. If the Auditor General should decide to conduct an evaluation of the government's implementation of, and accountability for, the principles and guidelines, this evaluation could provide a valuable contribution to the public perception of science in government decision making.
- C-3 Departments should work cooperatively to measure, through the use of public surveys, focus groups, case studies and other means, the level of public confidence in the government's ability to address science-based issues. These efforts should measure whether the public is confident that an appropriate process was used to inform decisions with the best available science advice.

# Glossary

**Department:** the Framework was developed for application primarily by federal government science-based departments and agencies. However, given the pervasiveness of science and technology, the principles and guidelines will be of increasing importance to all departments called upon to make decisions related to science. For the purposes of this document, departmental responsibility rests with the Deputy Minister or other senior managers, as appropriate. As recommended in the Implementation section, responsibility for implementing the principles and guidelines should rest with the departmental science advice champions.

**Decision maker:** anyone with the authority to make decisions in the federal government. In general, this typically involves ministers and deputy ministers, but may also include assistant deputy ministers, directors general and other senior officials, in certain matters.

**Policy advisor:** anyone engaged in the formulation and provision of policy advice within the federal government. In general, this refers to policy analysts/advisors who work at the interface between those who contribute advice, and senior managers or decision makers.

**Precautionary approach:** according to the 1992 Rio Declaration, “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.” Beyond threats to the environment, this concept is increasingly being applied in cases involving threats to public health and safety.

**Risk:** combines the probability that an adverse event will occur and the consequences of the adverse event.

**Risk management:** used broadly to include the assessment of risk, the communication of risk and the process of identifying, analysing, prioritizing, implementing and evaluating actions to reduce risk. The goal of risk management is scientifically sound, cost-effective, integrated action that reduces or prevents risks while taking into account social, cultural, ethical, political, economic and legal considerations.

**Science:** broadly defined to include the sciences, engineering and technology. The principles and guidelines may also be applicable to advice from other disciplines.

**Science advice:** defined as value-added guidance deriving from scientific and technological knowledge, theories, data, findings and conclusions, to inform policy, regulatory and management decision making.

**Science advisor:** a person who engages in the formulation and provision of science advice. Often, scientists will fill this role.

**Scientist:** a person who has expert knowledge of, and who is typically engaged in the conduct of, science. **Government scientist** refers to a scientist employed by the federal government.

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