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カナダ天然資源省

ロバートW・モリソン局長

（ウラン・原子力担当）

Radioactive Waste Policy in Canada and the Nuclear Fuel Waste Disposal Concept

by R.W. Morrison, P.A. Brown and G.A. Underdown

Presentation at the Tokyo
Conference on High-Level Radioactive Waste Management

by
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Natural Resources Canada

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Purpose

- Outline the Canadian Nuclear Program
- Describe the Policy Framework for Radioactive Waste in Canada
- Present the Canadian approach to nuclear fuel waste management and disposal
- Discuss Canadian experience in establishing radioactive waste disposal facilities

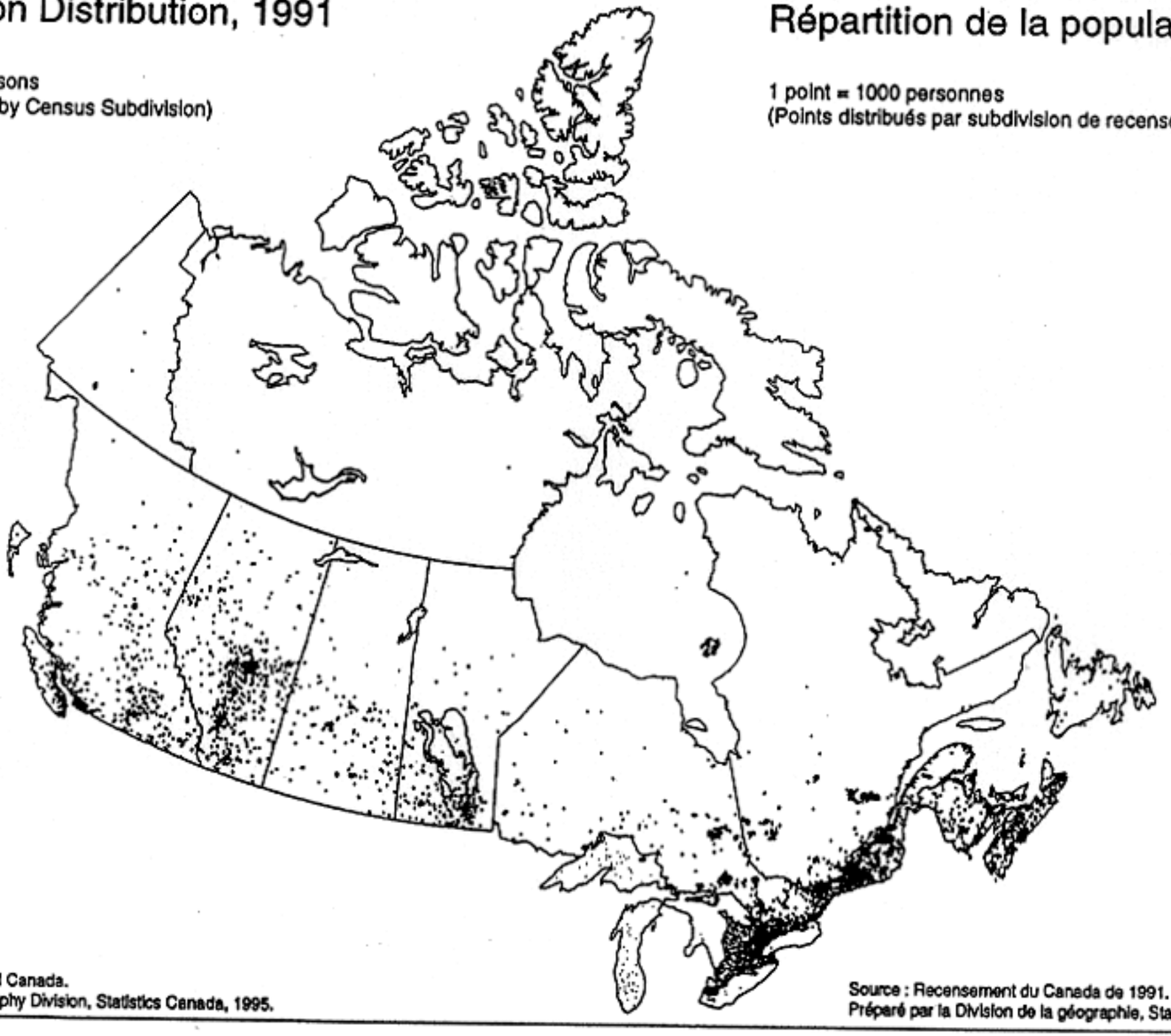
CANADA

Population Distribution, 1991

1 dot = 1000 persons
(Dots distributed by Census Subdivision)

Répartition de la population, 1991

1 point = 1000 personnes
(Points distribués par subdivision de recensement)



Source : 1991 Census of Canada.
Produced by the Geography Division, Statistics Canada, 1995.

Source : Recensement du Canada de 1991.
Préparé par la Division de la géographie, Statistique Canada, 1995.

The Nuclear Fuel Cycle in Canada

- Uranium
- Refining and Conversion
- CANDU Power Reactors
- Radioisotopes
- R&D
- Waste Management


Canada
ELLESMERE ISLAND
BAFFIN ISLAND
YUKON
N.W.T
BRITISH COLUMBIA
ALBERTA
SASK
MANITOBA
ONTARIO
QUEBEC
NFLD
P.E.I
N.B
N.S
Surrey
Vancouver
Whiteshell
Gentilly
Chalk River
Ottawa
Point Lepreau
Port Hope
Darlington
Pickering
Bruce
Toronto
Scarborough
U.S.A
NULCEAR POWER STATIONS
RESEARCH LABORATORUES
URANIUM MINES

Federal and Provincial Roles and Jurisdiction

- Nuclear energy under federal jurisdiction

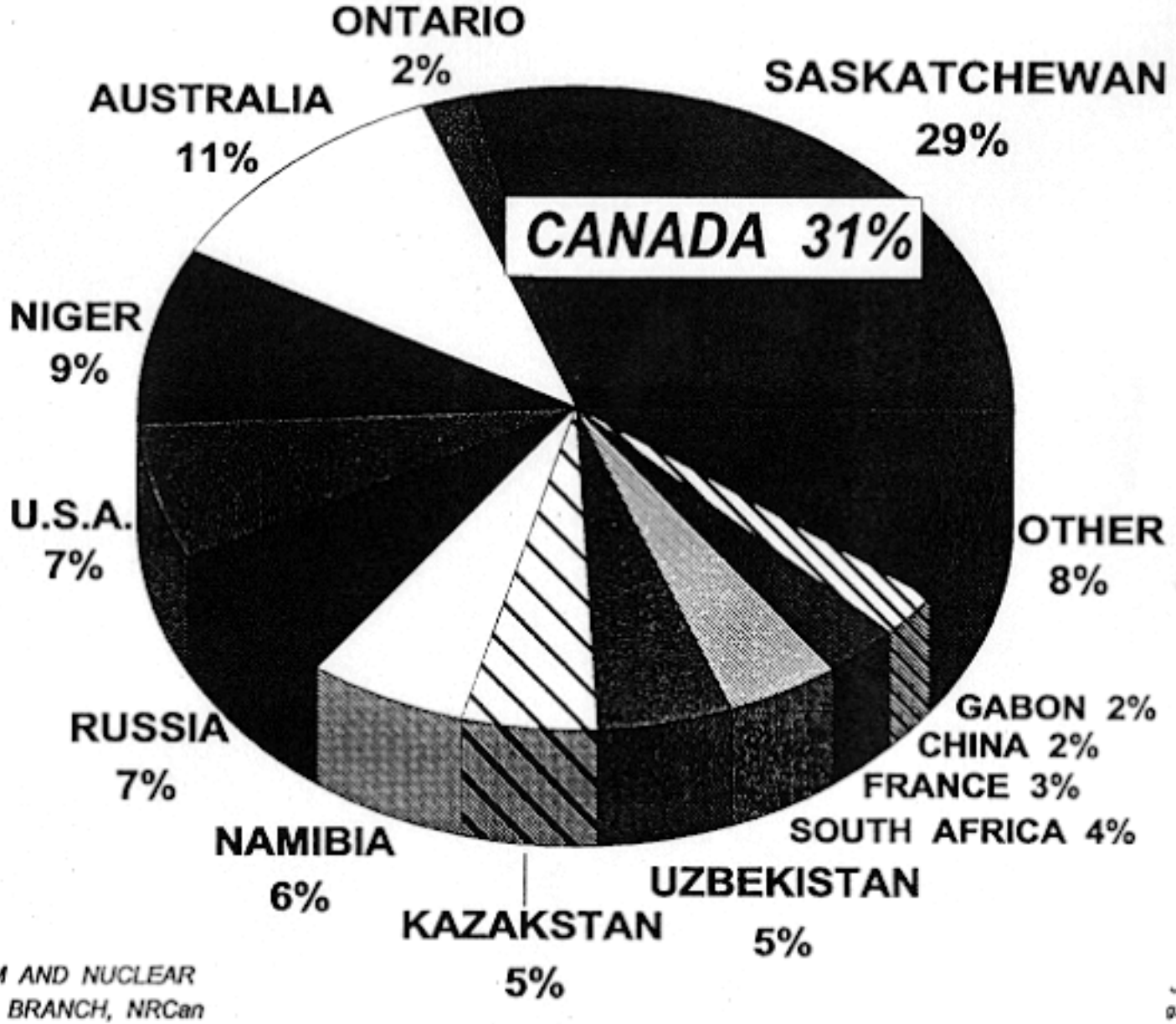
- Minister of Natural Resources Canada responsible for federal energy policy including nuclear energy and radioactive waste

  - AECB - regulation ~ Nuclear Safety and Control Act to replace Atomic Energy Control Act
  - AECL - nuclear R&D, CANDU

- Provinces - natural resources and electricity, including nuclear electricity

WORLD URANIUM PRODUCTION

- 33 600 TONNES U IN 1995 -



SOURCE: URANIUM AND NUCLEAR ENERGY BRANCH, NRCan

January 1997

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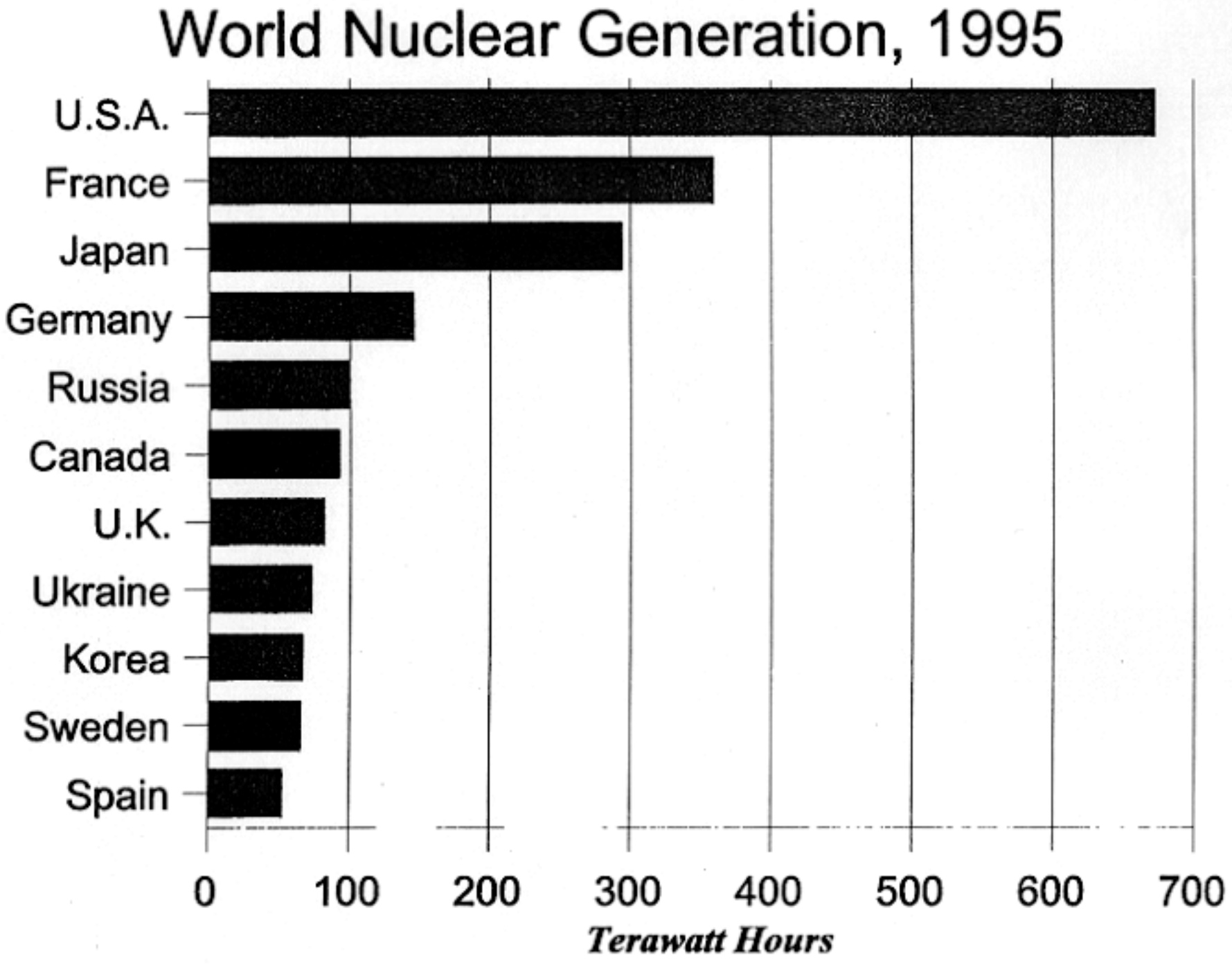

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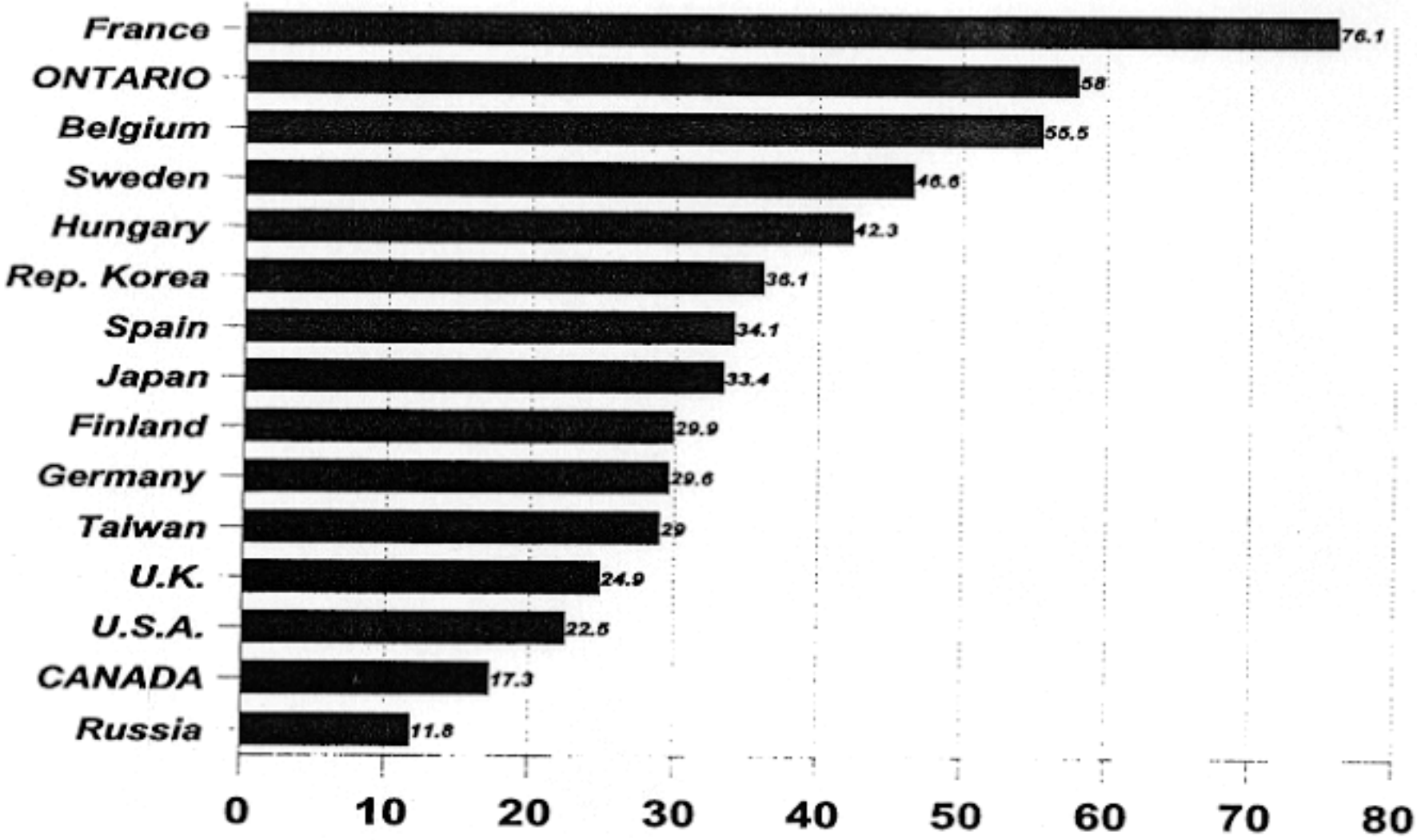
NUCLEAR SHARE OF 1995 ELECTRICITY GENERATION IN SELECTED COUNTRIES



SOURCES: IAEA INTERNET SITE, MAY/96 and
URANIUM AND NUCLEAR ENERGY BRANCH, NRCan

May 1996
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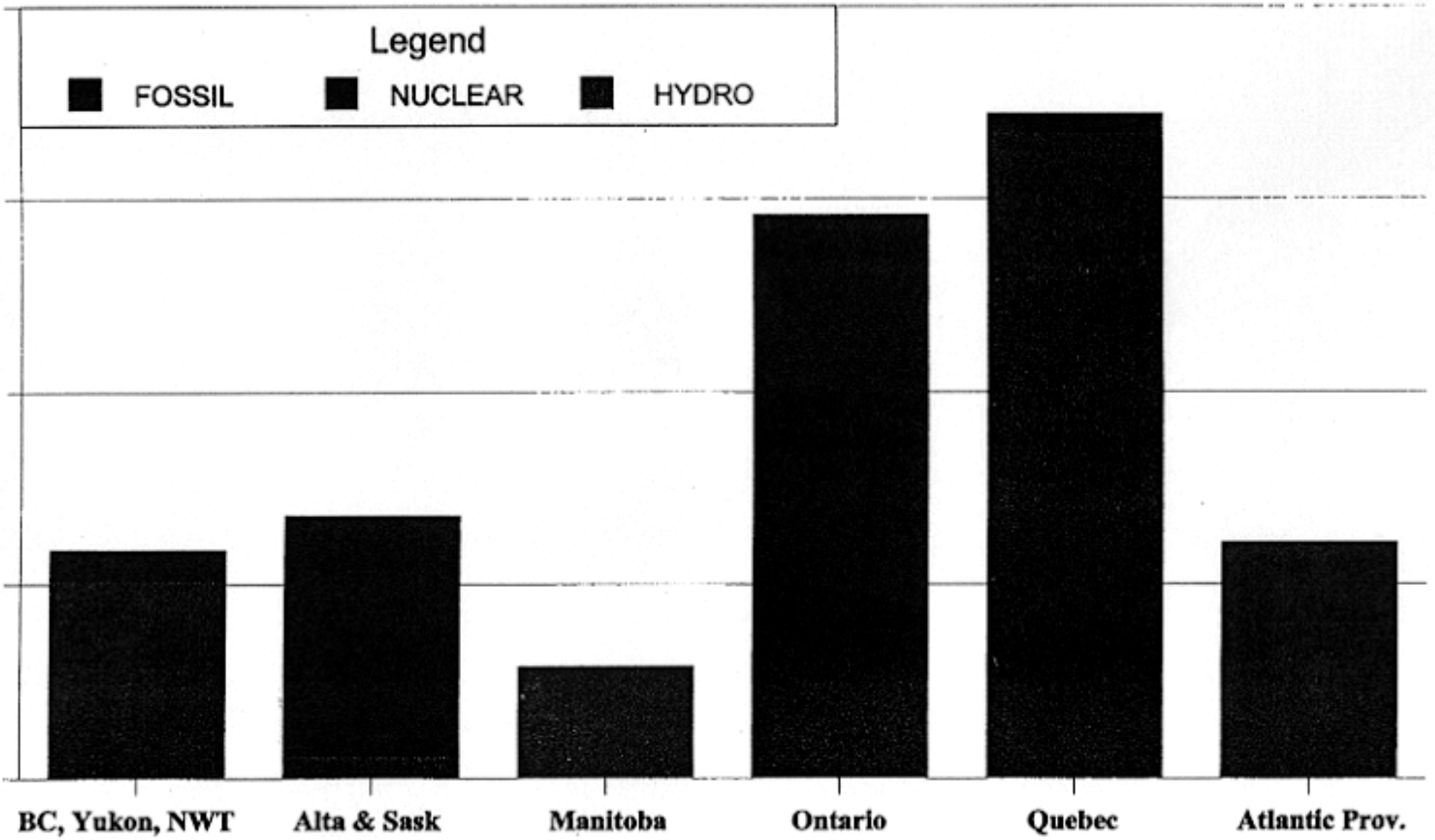
Electrical Energy Production - 1995

TWh



Source: Renewable & Electrial Energy Division

Updated: March 1996

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Radioactive Wastes in Canada

- Three types of radioactive wastes
- Nuclear fuel waste ~ less than 20,000 tonnes; nuclear utilities, AECL
- Low-level radioactive waste ~ several million m^3; federal government, AECL, nuclear utilities and others
- Uranium mine and mill tailings ~ two hundred million m^3; uranium mining companies
- Moving from storage to disposal
- Public review processes, regulation and legislation

Policy Framework for Radioactive Waste

- July 1996 ~ Minister of Natural Resources announced a set of principles for a comprehensive policy framework governing institutional and financial arrangements for disposal of radioactive waste in Canada

Principle 1

The federal government will ensure that radioactive waste disposal is carried out in a safe, environmentally sound, comprehensive, cost-effective and integrated manner.

Policy Framework for Radioactive Waste (continued)

Principle 2

The federal government has the responsibility to develop policy, to regulate and to oversee producers and owners to ensure that they comply with legal requirements and meet their funding and operational responsibilities in accordance with approved waste disposal plans.

Policy Framework for Radioactive Waste (continued)

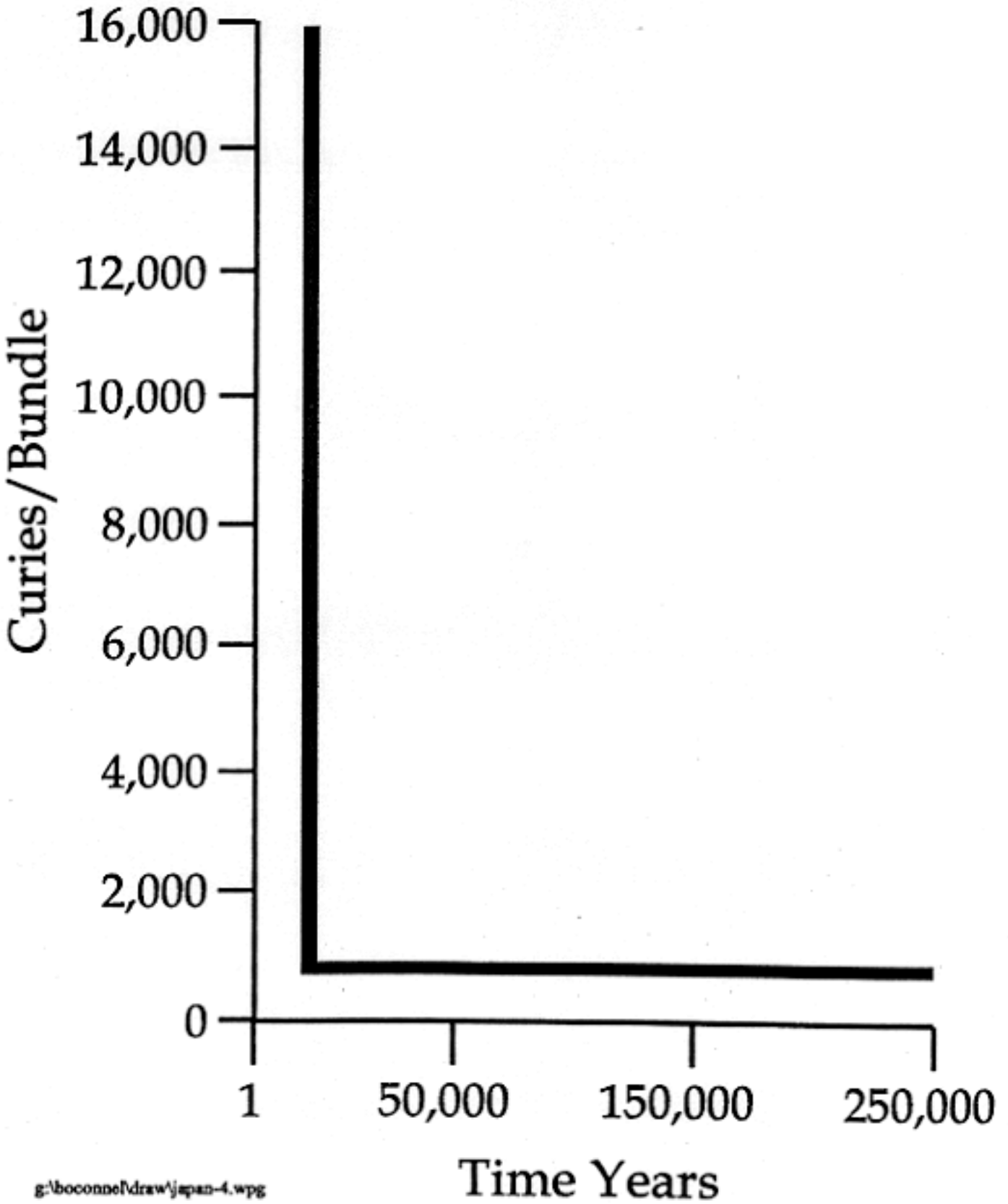
Principle 3

The waste producers and owners are responsible, in accordance with the principle of "polluter pays", for the funding, organization, management, and operation of disposal facilities and other facilities required for their wastes. This recognizes that arrangements may be different for nuclear fuel waste, low-level radioactive waste and uranium mine and mill tailings.

Nuclear Fuel Waste

- CANDU fuel ~ uranium dioxide (UO_2), fuel bundles
- Waste volume small, less than 20,000 tonnes
  - safely stored in swimming pools or dry concrete canisters
  - AECB regulatory controls
- Ontario Hydro has over 90 per cent of waste
- Waste highly radioactive but radioactivity decreases rapidly
- Longer term, radioactivity comparable to original uranium orebody

FISSION PRODUCT and ACTINIDE CURVES



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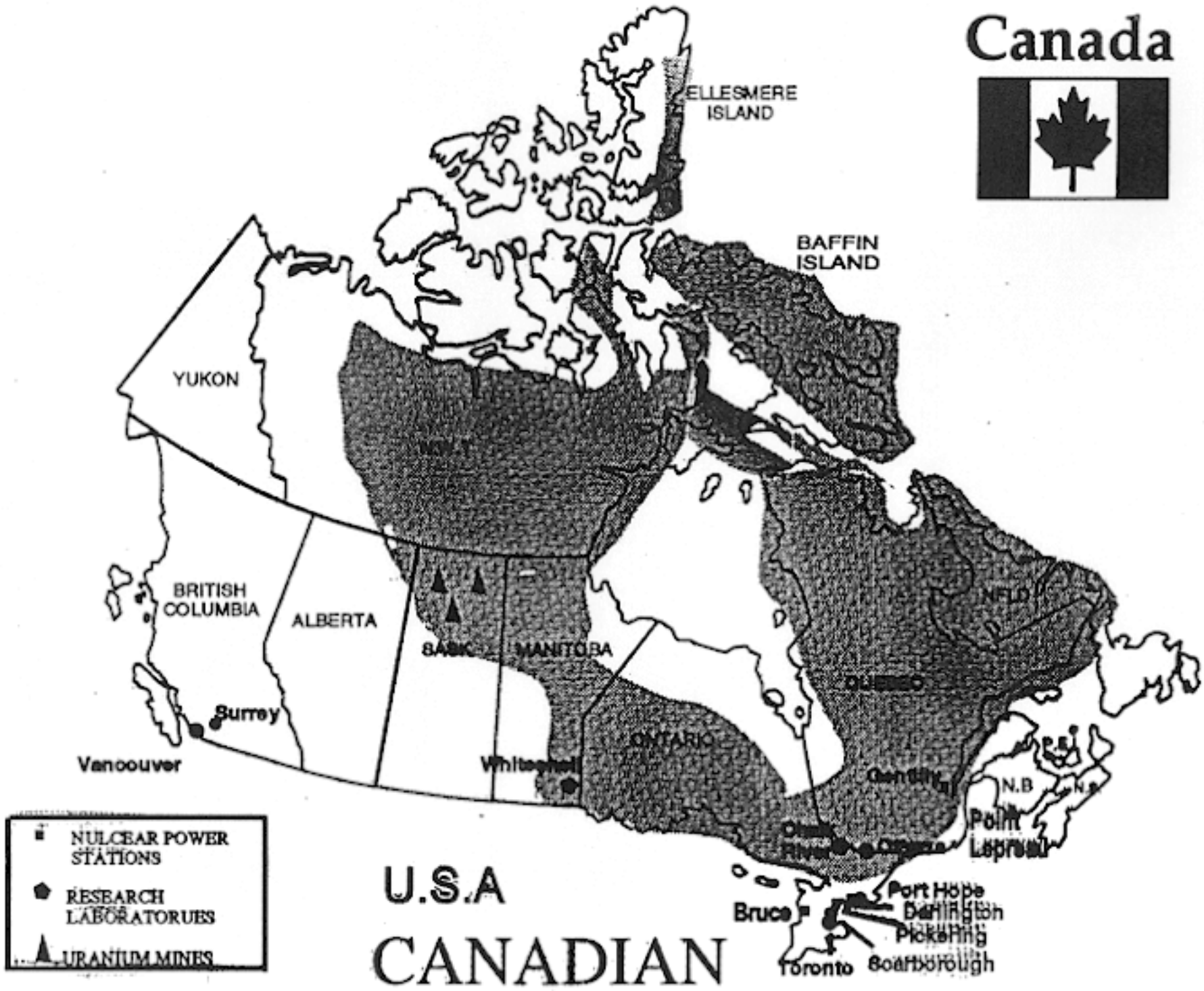
Development of Disposal Concept for Nuclear Fuel Waste

- Research and development program initiated in 1978 to develop concept for deep geological disposal of nuclear fuel waste in stable plutonic rock of the Canadian Shield
- AECL developed disposal concept; Ontario Hydro developed interim storage and transportation technologies
- AECL and later Ontario Hydro fund development of concept
- Over $500 million: Concept development and Underground Research Laboratory
- International cooperation


Canada
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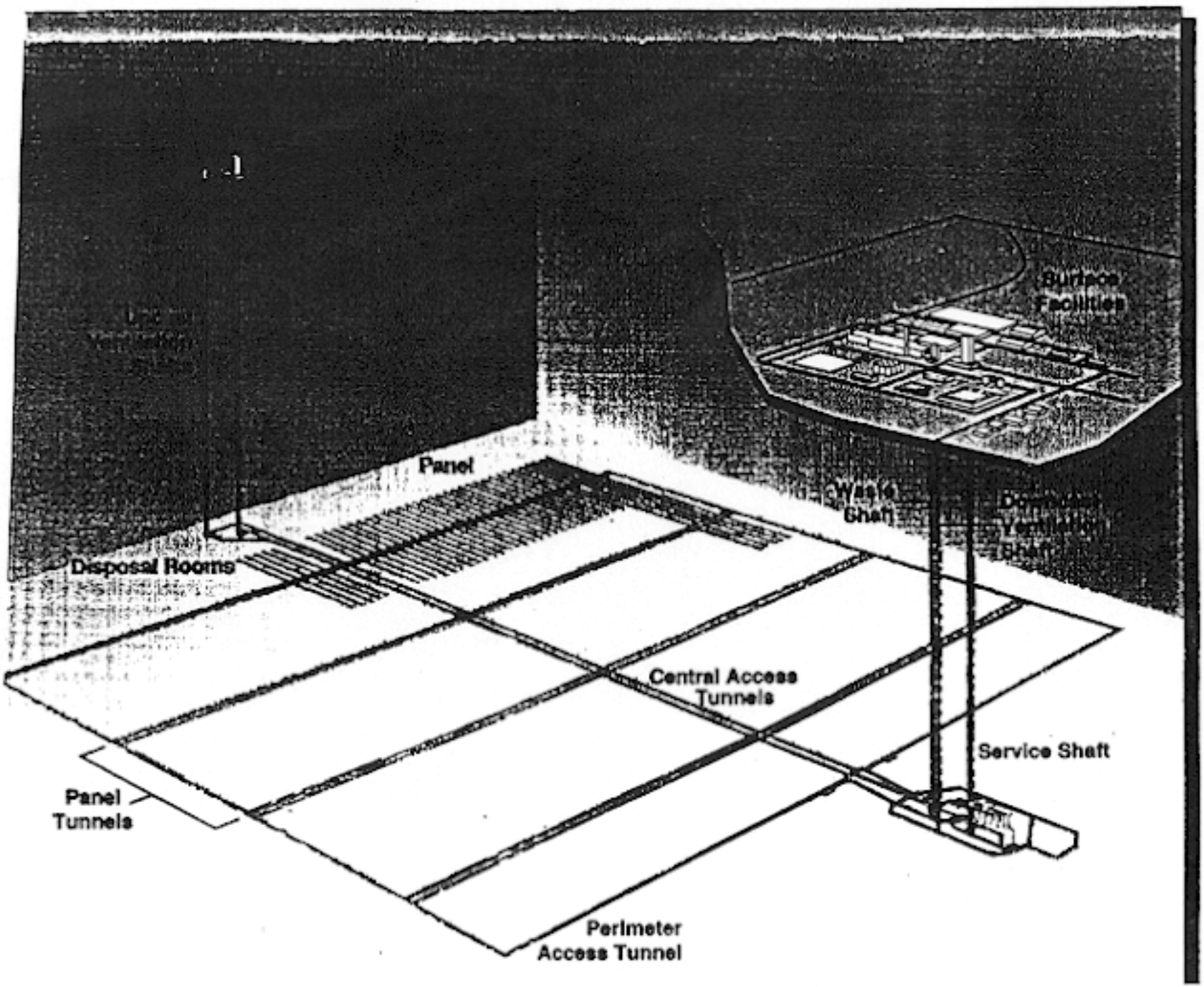
U.S.A
CANADIAN

DISPOSAL CONCEPT, WITH A CUT VIEW OF THE VAULT



Disposal Concept and Panel Review Process

- Major projects, including nuclear projects, subject to federal environmental assessment under Canadian Environmental Assessment legislation
  - authority of the Minister of the Environment

- Independent panel appointed to carry out public review of the safety and acceptability of the concept and next steps

- Generic review of the concept
  - no site selection until concept found acceptable and safe
  - site specific environmental assessment will follow

- Key dates in Panel Review Process
  - 1989 - Panel appointed
  - 1994 - AECL submits Environmental Impact Statement to Panel ~ 9-month public review (about 70 submissions made to the Panel)
  - 1996, March - Public hearings begin

Public Hearings

- Major event, wide range of issues - both scientific and of public concern
- Potential for broad public participation
  - many participants come from environmental groups
- More than 50 public hearing days in 18 communities, including 3 aboriginal communities; attendance from 30-100 people
- Several thousand pages of documentation to consider
- Three phases:
  - Phase I - March to May 1996: Broad societal issues
  - Phase II - June to November 1996: Technical hearings on disposal concept
  - Phase III - Jan. to March 1997: Community hearings in Saskatchewan, Manitoba, Ontario, Québec and New Brunswick

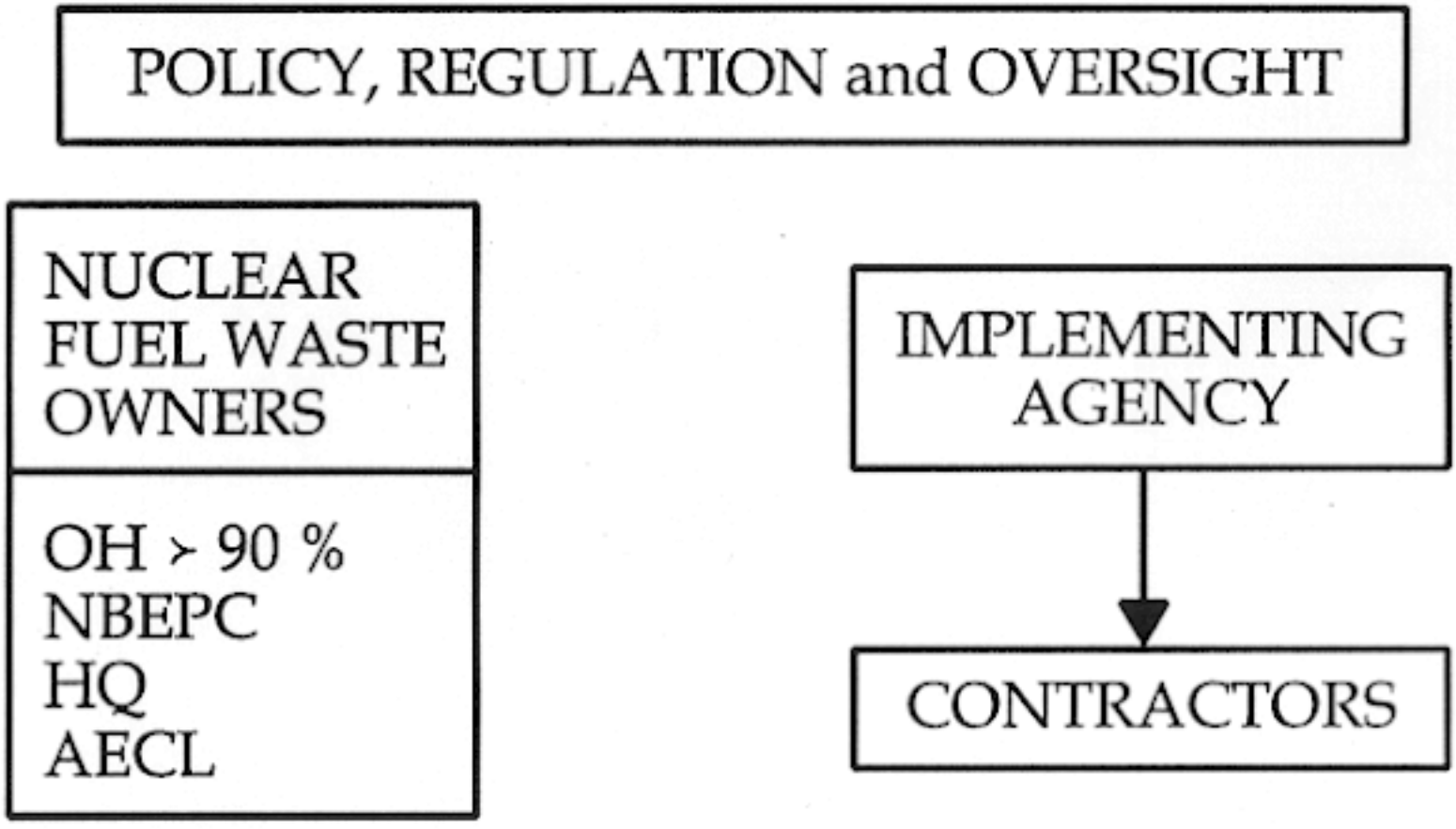
Issues Raised During Public Hearings

- Storage versus Disposal
- Importation of foreign waste
- Lack of energy policy review
- Long-term safety, monitoring, retrievability
- North-South issues
- Health of women and aboriginal people
- Aboriginal consultation
- Sufficient research done; need to move to siting to prove out
- Site specific, integrated assessment of safety and environmental impact of repository needed

Looking Forward

- Fall 1997 - Panel recommendations to Natural Resources Canada and Environment Canada
- Spring 1998 - Government response will set major waste policy directions
- Siting
- Implementing Agency - Ontario Hydro interested
- Utilities incorporate cost of disposal in rates for electricity usage
- Disposal cost a small fraction of electricity bill
- Policy Framework consultations underway to determine best approach for institutional and financial arrangements for response to Panel

NUCLEAR FUEL WASTE MANAGEMENT and DISPOSAL



Factors in Establishing Radioactive Waste Disposal Facilities

- Siting Process - some key elements
- How to build public trust?
- Partnering with the host community

Siting Process - Some Key Elements

- Will likely be based on principles used and experience gained in siting low-level waste facilities:
  - Health, safety and the environment not compromised
  - Communities volunteer, can opt out
  - Community is a partner in decision-making process
    - defines site and technology options
  - Compensation for: (1) impacts; (2) volunteering a site
  - Host community involved in management of disposal facility
  - Community Consensus

- Social and political factors key
  - safety is necessary but not sufficient

- Trust essential - credibility of process, of proponent, of regulator

Siting Task Force on Low-Level Radioactive Waste Management - Process and Results

- Independent Siting Task Force to site a waste facility in Ontario
- Process based on voluntary participation of communities
- All 850 Ontario municipalities contacted by the Task Force
- Siting Process took six years; one volunteer community - Deep River
- Deep River is a nuclear community, next to AECL Chalk River Facility
- Major lessons learned:
  - Need to identify a clear proponent and decision-maker
  - Discuss benefits up front
  - Set goals, decisions and timetable transparently
  - Women key to community acceptance
  - Need to see operating disposal facilities - technical assessments are not sufficient

How to Build Public Trust?

- Effective community outreach program
- Need to define the community
- Need to define the mechanism for consensus
- Community involvement at early planning stage
- Take the time and effort to work through community concerns
- Clear, complete and fully accessible information at every step
- Sufficient funding to address non-technical aspects
- Sensitivity to local issues on the part of the proponent
- High-level commitment by Government and proponent to process and to follow through

Partnering with the Host Community

Pre-Research/Drilling Phase

- In voluntary approach, drilling would follow consensus
- Benefits and disbenefits of the waste management proposal should be explained in an honest and clear manner to the potential host community (Proponent)
- Decision to look for potential volunteers would need to be a socio-political one - no facility should be imposed on the community (Proponent, government)
- The community should be involved in the management and monitoring of disposal facility and their involvement would need to be adequately funded

Partnering with the Host Community (continued)

Operation and Pre-Closure

- Is disposal facility performing safely as anticipated? (Regulator)
- What are ongoing benefits to the host community?
- Develop decommissioning and closure plan (Proponent)
- Establish clear guidelines and performance objectives based on regulatory and other socio-political, economic and environmental requirements for allowing closure steps to be taken including assigning responsibility (Proponent, regulator, government, host community)
- Identify institutional control requirements, long-term monitoring and documentation requirements (Proponent, regulator, government, host community)

Final Closure

- Only when all key stakeholders, including host community, are in agreement

Conclusions

- Complete nuclear fuel cycle - 3 types of radioactive waste.
- Policy Framework sets the ground rules for who is responsible for what.
- Panel recommendations and government response will set the stage for the next steps in long-term management and disposal of nuclear fuel waste.
- Policy Framework consultations on best approach for institutional and financial arrangements will help in responding to Panel recommendations.
- Fundamental premise is that any waste management and disposal proposal must be safe if implemented.

Conclusions (continued)

- Establishing radioactive waste disposal facilities should include the following elements:

  - implementation of a credible and fair siting process
  - a high level of public trust
  - effective public participation in public review and siting processes
  - community consensus on the acceptance of disposal facility
  - host community is a partner in decisions regarding the facility - community control.

- Need for a credible, supportive government infrastructure for the long term.

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の略歴

1. 生年月日

1939年7月1日生まれ

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1960年	マッギール大学工学部卒業
1964年	パリ大学工学博士（高エネルギー物理学）
1964～1966年	スタンフォード大学研究員
1966～1968年	ペルー国立工業大学客員教授
1968～1980年	カールトン大学準教授
1976～1977年	MIT客員研究員
1980～	天然資源省
1991～1992年	国際エネルギー機関仏エネルギー政策諮問委員会議長
1991～1994年	経済協力開発機構原子力機関（OECD/NEA）運営委員会議長
1991～1995年	欧州エネルギー憲章原子力WG議長