Quarterly Report on the National Inuit Specific Consultation on the Long-Term Management of Nuclear Fuel Waste (April 1, 2004 – June 15, 2004)

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INUIT TAPIRIIT KANATAMI

Submitted to:

Elizabeth Dowdswell
President
Nuclear Waste Management Organization (NWMO)

By:

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Outline of March 31 – June 15, 2004 Activities

Throughout the past three months, and as part of its Natural Resources Canada (NRCan) funded activities, ITK has been actively engaged in the setting up of the consultation model in the form of a National Inuit Consultation on the Long-Term Management of Nuclear Fuel Waste.

The particulars of ITK's recent activities in preparation for these consultations will be addressed as follows:

1. Selection of the permanent members (originating from the Regional Inuit Land Claims Organizations, ICC-Canada, the Pauktuutit Inuit Women's Association and the National Inuit Youth Council) of the National Inuit Task Force on the Long-Term Management of Nuclear Fuel Waste;
2. Finalization of the TORs of the Task Force and approval of the 2004-2005 work plan and strategy;
3. Development of information gathering templates to be completed by regional consultation participants;
4. Development of educational materials;
5. Selection of locations for the four regional consultations;
6. Next Steps.

As part of its Nuclear Waste Management Organization (NWMO) funded activities, ITK will be coordinating and conducting the four Inuit specific consultations in the four Inuit regions (Labrador, Nunavik, Nunavut, Inuvialuit). The final locations for these four Inuit specific consultations will be chosen by the members of the National Inuit Task Force on the Long-Term Management of Nuclear Fuel Waste early within the next quarter.

1. Selection of the permanent members of the National Inuit Task Force on the Long-Term Management of Nuclear Fuel Waste

The membership of the ***National Inuit Task Force on the Long-Term Management of Nuclear Fuel Waste*** currently consists of the following individuals. This will obviously require further coordination.

Organization	Permanent Member	Interim Member	Title of Member
Nunavut Tunngavik Inc. (NTI)		George Hakongak	Senior Advisor - Environment, Water and Marine Management
Labrador Inuit Association (LIA)		Keith Chaulk	Biologist
Inuvialuit Regional		Norm Snow /	Executive Director /

Corporation (IRC)		Nelson Perry	Resource Person
Makivik Corporation	Robert Lanari		Project Coordinator
Inuit Circumpolar Conference – Canada (ICC-Canada)	TBA		
Pauktuutit Inuit Women's Association	Jennifer Dickson		Executive Director
National Inuit Youth Council (NIYC)		Adamie Padlayat	President
Inuit Tapiriit Kanatami	Soha Kneen		National Coordinator on the Long-Term Management of Nuclear Fuel Waste

2. Finalization of the Terms of Reference (TORs) and approval of the 2004-2005 work plan and strategy

A draft Terms of Reference, which was introduced and subjected to a preliminary review, is currently being reviewed by the permanent and interim members of the Task Force on the Long-Term Management of Nuclear Fuel Waste. Finalization of these TORs will hopefully take place by the end of July 2004.

3. Development of Information Gathering Templates to be used at the regional consultation

The current version of the information gathering templates is in draft format and is awaiting feedback and subsequent approval from the members of the Inuit Task Force on the Long-Term Management of Nuclear Fuel Waste in Canada (see Appendix A for the draft template).

4. Development of Educational Materials for the four Inuit Regions

ITK's National Coordinator on the Long-Term Management of Nuclear Fuel Waste has begun the preparations for the National Inuit Consultation by designing a draft Education/Information Kit (please see Appendix B). Further educational materials will be developed and submitted for review and subsequent approval to the members of the Inuit Task Force on the Long-Term Management of Nuclear Fuel Waste in Canada early within the upcoming quarter.

5. Possible locations/communities for the four regional consultations (listed in no particular order)

Region	Regional Inuit Land Claims Organization	Option #1	Option #2	Option #3
Labrador	Labrador Inuit Association (LIA)	Makkovik	Postville	Nain
Nunavik	Makivik Corporation	Kuujjuak	Inukjuak	Puvirnituq
Nunavut	Nunavut Tunngavik Incorporated (NTI)	Baker Lake	Igluligaarjuk (Chesterfield Inlet)	Qurluqtuuq (Coppermine)
Inuvialuit	Inuvialuit Regional Corporation	Inuvik	Paulatuuq	Ulukhaqtuuq (Holman)

6. Coordination of Meeting Specific Items

(a) Setting the final dates for the regional consultations

The dates for the regional consultations will be finalized once the locations have been chosen and all Task Force members have been consulted. The TORs and work plan will also have to be finalized and approved prior to the setting of the regional consultation dates. This work required for this item to be completed is in process.

(b) Possible Invitees

ITK is currently working with the current members of the Task Force on the creation of a list of invitees. Discussions with the current members have taken place on an individual basis. The final lists will be available by the end of August and invitations will be sent out once the final dates for the regional consultations have been set.

Possible invitees could include representatives of each community in the region, representatives of the Regional Inuit Land Claims Organization, as well as elders, youth and women's representatives. The task of selecting the regional participants of this consultation will, however, lie with the regional member of the Task Force on the Long-Term Management of Nuclear Fuel Waste.

In addition to the regional invitees, experts in the area of the long-term management of nuclear fuel waste will be invited. Further invitations may include representatives from both the NWMO and NRCan to present at each of four regional Inuit consultations.

7. Next Steps

The work in preparation of the upcoming Inuit specific consultation process on the Long-Term Management of Nuclear Fuel Waste in Canada, which has received funding from the NWMO, is a part of an ongoing process. Throughout the upcoming quarter, this process will result in (but will not be restricted to) the following activities:

1. Translation all necessary materials prior to the consultations taking place;
2. Production of educational/information materials prior to the consultations taking place;
3. Dissemination of educational/information materials prior to and during the consultations taking place;
4. Hiring of on-site staff to help prepare and assist in the coordination of the regional consultations;
5. Travel and accommodations arrangements for all participants of the consultations (including experts and staff);
6. General logistics/planning/preparation for each regional consultation (including the rental of the space for the consultation, translators, and all necessary equipment);
7. Selection and invitation of experts to attend the four Inuit specific regional consultations;
8. Provision of the questionnaire to all selected participants of the four Inuit specific regional consultations
9. Completion of survey questionnaire - to be completed by all participants at the four Inuit specific regional consultations.

Appendix A (Draft Information Gathering Template):

⇒ This draft information gathering template is subject to feedback and approval by the National Inuit Task Force on the Long-Term Management of Nuclear Fuel Waste

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Inuit Specific Consultation on the Long-Term Management of Nuclear Fuel Waste in Canada

Community Name: ______________________________

Representative's Name: ______________________________

1. What is your understanding of issue of the long-term management of nuclear fuel waste in Canada?

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2. Which of the management options for nuclear fuel waste is the most viable /acceptable to you/your community/region?

(a) deep geological disposal in the Canadian Shield;
(b) storage at nuclear reactor sites; and
(c) centralized storage (either above or below ground).

Comments:

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3. Why did you choose this management option as the most viable one?

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4. What are your thoughts on the management options titled ‘Methods Receiving International Attention’ that have been mentioned in NWMO/NRCan documentation?

(a) Reprocessing, Partitioning and Transmutation
(b) Storage or Disposal at an International Repository
(c) Emplacement in Deep Boreholes

Comments:
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5. What are your thoughts on the management options titled ‘Methods of Limited Interest’ that have been mentioned in NWMO/NRCan documentation?

(a) Direct Injection
(b) Rock Melting
(c) Sub-seabed Disposal
(d) Disposal at Sea
(e) Disposal in Ice Sheets
(f) Disposal in Subduction Zones
(g) Disposal in Space
(h) Dilution & Dispersion

Comments:
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6. Do you believe that nuclear fuel waste should be stored in your region?

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7. If not, where do you believe it should be stored?

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8. What are your concerns regarding the possible regional effects of the long-term management of nuclear fuel waste in Canada?

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9. Is there a benefit/drawback to your community/region that you can perceive?

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10. Are there any concerns that community members would like you to convey to us regarding this issue?

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8. Is there anything else you'd like to tell us?

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Appendix B (Draft Educational/Information Materials)

⇒ These materials are subject to further review and approval by the National Inuit Task Force on the Long-Term Management of Nuclear Fuel Waste

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NUCLEAR FUEL WASTE MANAGEMENT INFORMATION KIT

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INUIT TAPIRIIT KANATAMI

COMPILED BY:

SOHA KNEEN, NATIONAL COORDINATOR ON THE INUIT SPECIFIC CONSULTATION ON THE LONG-TERM MANAGEMENT OF NUCLEAR FUEL WASTE IN CANADA – ITK

SOURCE OF MATERIALS:

ASKING THE RIGHT QUESTIONS? THE FUTURE MANAGEMENT OF CANADA'S USED NUCLEAR FUEL – DISCUSSION DOCUMENT 1 (NWMO)

1.0 Key Terms:

1.1 Disposal:

A method of isolating used nuclear fuel from humanity and the environment; the method must be conclusive and without the intention of retrieval or reuse. In principle, disposal can be achieved by placing the waste deep underground, at sea, in ice sheets, in space, or in deep boreholes. Internationally, the most commonly pursued disposal method is to place the used fuel deep in a geological repository which can involve horizontal placement in a mountain (as in the U.S.), or vertical emplacement deep underground in stable rock (as in Sweden and Finland). In addition to 'engineered barriers' offered by the containers and other design considerations, geological disposal methods rely on depth (at least a few hundred metres below the surface) and the geology of the area to provide additional natural barriers to slow the movement of radionuclides which may eventually be released from the used nuclear fuel. Geological disposal methods are also seen to provide protection to humanity and the environment, should institutional controls fail. Disposal methods may require transporting used nuclear fuel to a centralized location, whether in the home country, to an international repository or to an offshore location.

1.2 Storage:

A method of maintaining used nuclear fuel in a manner that allows access, under controlled conditions, for retrieval or future activities. Most storage methods rely on engineered barriers for radiation protection. The used nuclear fuel is placed in engineered facilities (which can be concrete containers, silos or modules) at or below the surface (in vaults or caverns). Some countries, like Sweden, use underground wet fuel bays for storage. Storage methods can vary widely depending on the duration of time the used nuclear fuel is to be stored, the amount of used nuclear fuel to be stored, the number of storage locations, as well as the existing interim storage facility design (some may require repackaging). Storage methods require institutional controls; they may require repackaging of the fuel containers over time and will require transportation if the storage facilities are not located at the reactor site where the waste is created.

1.3 Treatment:

Processes applied to used nuclear fuel that change its characteristics. Currently these include processes that reduce the volume of the used nuclear fuel and separate the components for individual treatment (reprocessing, partitioning and conditioning). Some countries have programs in place to further examine and optimize these treatment processes. Also included in this category are processes to reduce radiotoxicity of the used nuclear fuel (transmutation). A few countries are doing research in this area, but the process is still largely developmental. Treatment methods involve applying chemical and physical processes to the used nuclear fuel, recovering desirable components and separating and treating residual, radioactive and hazardous waste streams. Treatment methods may require that the used nuclear fuel be transported to the treatment facility, and recovered components and residual waste streams may need to be transported back.

1.4 Sustainable Development:

Sustainable Development – Focusing on Human and Ecosystem Well-being
Sustainable development was popularized in the 1987 Report of the World Commission on Environment and Development (the Brundtland Commission). It is a concept that guides decision-makers toward choices which are economically, environmentally and socially sustainable.

Sustainable development calls for decisions to be made in a way that ensures both human and ecosystem well-being are maintained (or improved) over the long-term. Maintaining or improving one, at the expense of the other, is not acceptable from a sustainability perspective, because the foundation for life is undermined when only one factor is considered.

Key considerations for elements of an approach, and building blocks which might be adopted in the study, are:

- inter-generational equity;
- integrated decision making;
- living off income rather than capital; and
- equivalent consideration of social, environmental and economic factors.

In applying the concept of sustainable development to the issue of managing nuclear waste, 10 potential questions surfaced in the work commissioned by the NWMO

2.0 Proposed Methods of Disposal/Storage:

The 2002 Nuclear Fuel Waste Act directs the NWMO to examine three methods for the long-term management of used nuclear fuel:

- deep geological disposal in the Canadian Shield;
- storage at nuclear reactor sites; and
- centralized storage (either above or below ground).

In addition to these three methods, many others have been advanced in the past, by governments, industry and researchers. It is within the NWMO's mandate to examine any, or all, of these approaches, and options that have not been proposed in the past, as may be appropriate.

2.1 Deep Geological Disposal

Disposal is a method of isolating used nuclear fuel from humanity and the environment. It is conclusive and without the intention of retrieval or reuse.

Deep geological disposal involves burying the used nuclear fuel deep underground. This method is currently favored by many countries and by most international agencies[29]. It would require transporting used fuel from interim storage facilities to a disposal facility (wherever it is located).

The main challenge in effective disposal is to limit the potential for migration of radioactive and toxic contaminants away from the used nuclear fuel. The most worrisome migration process is through the groundwater flow system. Even if contaminants moved one metre per year – that still means the contaminant stream could be five kilometres long in 5,000 years, if ever the contaminants breached their containment barriers.

In the AECL disposal concept (the specific concept referred to in the Act), multiple barriers are proposed for limiting such movement. Barriers include:

- the fuel pellet itself, which is made of ceramic and retains almost all of the fission products;
- the Zircaloy holding tube that seals in the pellets;
- the waste container of materials selected to inhibit corrosion, cracking and perforation;
- multiple buffer zones surrounding the waste container; and
- a host geological medium that naturally limits long-term contaminant movement.

If contaminants should escape from the engineered containment, their movement would depend on the nature of the contaminants themselves, the host rock and the groundwater flow system. Several rock types naturally impede these movements, including granite, rock salt, sedimentary clay and volcanic tuff and, depending on local hydrogeological conditions, can be advantageous as host rock.

In Canada, the stable plutonic granites of the Canadian Shield have been the focus of investigation. In Germany, the feasibility of burial in rock salt formations has been assessed. Switzerland has examined clays, and the U.S. Federal Government has made a commitment to Yucca Mountain, which is composed of unsaturated tuff rock formed by the accumulation of glassy fragments from a volcanic eruption[30].

Industry has continued work on key issues around a deep geological repository in Canada. One design proposes that 324 fuel bundles would be contained in a steel inner vessel which is surrounded by a copper outer shell. The fuel container would be encapsulated in bentonite self-sealing clay which, in turn, would be packed in a buffer material, a dense backfill, and a light backfill. The container would be buried 500 – 1000 meters below the surface of the Canadian Shield. Figure 4.2 illustrates the extent of the Canadian Shield.

Models have predicted that the depth of the facility, the rock and the nature of the groundwater flow system would, in combination, greatly impede the movement of radioactive and toxic contaminants. The location could withstand significant geological change and extreme events (storms, earthquakes, meteor impact, glaciation and changes in temperature).

Originally, the AECL concept of deep geological disposal included backfilling and sealing the repositories soon after waste emplacement. Today, however, some countries are considering a “staged” approach in which final closure would be postponed for many years. In the meantime, this would mean fuel could be retrieved, should that be desirable. This staged approach may also allow further research to be undertaken and technical change to take its course. Also, monitoring systems would allow us to see how effectively the system is functioning.

The AECL approach and the staged approach are sometimes referred to as the “early seal” and “late seal” options. A “no-seal” option is also possible; this would really be a form of extended centralized storage and is described next.

2.2 Centralized Storage

Storage is a method of maintaining used nuclear fuel in a manner that allows, under controlled conditions, access for retrieval or other future activities. Long-term storage at a central site requires transporting the fuel from the reactor sites. Storage facilities can be located either above or below ground.

Facilities above ground can be designed with varying degrees of longevity in mind. ‘Conventional’ storage buildings could be designed that may need to be replaced every century or so, depending upon the durability of the construction materials that are used. Alternatively, more permanent engineered structures could be designed to remain sealed for up to several thousand years.

Underground storage is either by shallow burial or in caverns or tunnels some tens of metres beneath the surface. The goal is to enhance the degree of security (compared to above-ground methods) while retaining the ease of fuel retrieval. The facilities’ integrity would depend on ongoing maintenance, and future generations would inherit oversight-related responsibilities.

Here in Canada, industry has completed a preliminary review of centralized extended storage. Their above-ground alternatives include casks and vaults in storage buildings; and surface modular vaults. Below-ground alternatives include casks and vaults in buried storage containers; and casks and vaults in rock caverns. These alternatives are shown for above ground centralized extended storage in Figures 4.3 and 4.4.

2.3 Reactor-Site Extended Storage

Both above and below-ground storage alternatives are in use today. Additional possibilities could be designed by simply scaling down the designs and costs of the larger versions of centralized facilities. Each site has its own distinguishing characteristics, and many conditions must be factored into the design, construction, operation and maintenance processes. The breadth of variation is shown in Table 4.1, which describes the alternatives that have received at least some degree of review at various sites in Canada.

Above-ground storage facilities have been operational for a number of decades. However, underground interim storage facilities for used nuclear fuel have not been widely developed – most storage facilities are above ground. The best-known example of an operating underground interim storage facility is the CLAB facility in Sweden, where used fuel is stored in pools some 30 metres below the surface; this is in fact a centralized storage facility, not a reactor site storage facility. France is currently examining 'very long-term interim storage' methods, involving either near-surface pools like CLAB, or deeper facilities set in small hills.

One advantage of storing used fuel at the reactor site is that it eliminates the need to transport the fuel to another (centralized) location. Further, because there are multiple facilities, no single facility is particularly large.

3. 0 Methods Receiving International Attention

This discussion looks at additional methods that are being considered in some national programs around the world, and at methods that are likely to receive some attention in the future.

3.1 Reprocessing, Partitioning and Transmutation

"Processing" refers to the preparation of fresh fuel before it goes into the reactor. "Reprocessing" is a general term for applying chemical processes to used nuclear fuel for the purpose of recovery and recycling of fissionable isotopes.

No country currently employs reprocessing for the sole purpose of managing nuclear waste. The primary purpose is to recover and reuse materials extracted from the used fuel. The long-term management of the residual wastes must still be addressed.

Reprocessing technology first was developed and exploited in the nuclear weapons programs of such countries as the United States, the United Kingdom, Russia, then later in the military programs of a number of some other countries, including France, China and India. The aim was to extract weapons-grade plutonium from used nuclear fuel. (The other main weapons material, uranium-235, is produced in uranium-enrichment plants specifically for military purposes). This military-related investment in infrastructure has significantly influenced the choice of fuel cycle-related infrastructure in countries that have later begun civilian nuclear power programs.

Recently, because of nuclear disarmament initiatives in the United States and the former USSR, the need for uranium recycling – and for the recovery of plutonium for fast reactors – has declined, as has interest in weapons-related reprocessing. At the same time, interest has increased in the possible use of reprocessing to mitigate some of the problems associated with the disposition of used nuclear fuel.

Reprocessing takes place after the used nuclear fuel has cooled for a few years. The fuel is moved to a reprocessing facility where it is stored in large lead and steel casks. There, it is dissolved in nitric acid and the volatile radioactive gases are carefully contained. Separation and segregation processes isolate products into different streams, such as useable uranium and plutonium; highly radioactive liquid waste; and less radioactive solids, liquids, and gases. These processes are referred to as "partitioning."

Reprocessing and partitioning rearrange and recycle components. A further process might be developed to actually transform some radioactive components into non-radioactive elements, using nuclear reactions initiated by neutrons or protons. This process changes one element to another, and is called "transmutation."

Transmutation is the subject of research programs in many countries, including Japan, France, the United States, Russia, the Republic of Korea and Italy, as well as the European Community[33]. The process is of interest because successful transmutation could significantly reduce the time horizon of risk associated with used nuclear fuel, unwanted nuclear weapons and surplus plutonium.

3.2 Storage or Disposal at an International Repository

In the early 1990s, the international organization Pangea conceived of an international repository project. The project was based on the conviction that the long-term containment of nuclear waste materials would be easier to demonstrate and achieve if a simple, stable geological environment were chosen using global considerations, rather than being hindered by artificial national boundaries34. Natural geological barriers would, it was claimed, provide the main measure of safety, and would avoid the need for complex engineered solutions. Using geological and climatic data, broad regions were identified as potentially able to provide optimal conditions for an underground repository.

Pangea sought to identify and develop a high- isolation site for a repository capable of accepting used fuel and high-level waste from any country. A potentially suitable site was identified in Australia, but there was considerable political opposition and the project was abandoned. Pangea itself ceased activities in 2002 and was replaced by the Association for Regional and International Underground Storage (ARIUS). Membership is open to organizations and individuals who support these aims. ARIUS is currently lobbying national and international bodies with a view to developing pilot facilities. This is the only body actively pursuing international disposal, although a proposed Directive from the European Commission recommends that such methods should be explored[35].

In April 1999 an American company, 'Non-Proliferation Trust Inc.' (NPT) was established to pursue developing an international storage facility at Zheleznogorsk in Russia. The facility, with a design life of 40 years, would be developed in an existing cavern in a hillside, employing dry storage casks. A memorandum of understanding between NPT and the Russian nuclear ministry was signed in 2000.

Any assessment of international storage or disposal would necessarily include all the costs, benefits and risks of the site and related infrastructure (including transportation), linked to all affected societies and cultures. Transborder movement of used fuel would not be in violation of any international treaty, but in some cases might contravene the self-sufficiency principle that most countries with substantial nuclear programs apply to their radioactive waste management. This principle suggests that any state generating electricity using nuclear power must assume responsibility for the long-term management of used fuel within its own boundaries[36].

In theory, the design could be either above or below ground. The facility could either be based in another country and accept Canadian waste, or be based in Canada to accommodate its own and other countries' waste. Should this repository method be considered, a complex issue would be choosing a suitable site.

3.3 Emplacement in Deep Boreholes

Some countries, which must dispose of only small quantities of high-level waste, are looking at a method called "emplacement in deep boreholes." In this method, solid packaged waste would be placed in deep boreholes drilled to depths of several kilometres, with diameters of typically less than one metre. The waste containers would be stacked in each borehole and would be separated from each other by a layer of bentonite or cement. The borehole would not be completely filled with waste: the top two kilometres would be sealed with materials such as bentonite, asphalt or concrete.

Sweden, Finland and Russia, among others, have examined the deep borehole method as a possible alternative to a deep repository. Boreholes could be drilled both offshore and onshore in many types of rock, which broadens the number of possible disposal sites. Although proponents argue that related long-term risks to people and the environment would be very low, there are significant technical questions requiring further research.

4.0 Methods of Limited Interest

Eight methods are included in this category. They have been studied over the past 40 years, but none are being implemented, nor are they the focus of major research effort. Some are contrary to international conventions. Brief summaries are provided here to share information on the broad range of options that have been raised historically.

4.1 Direct Injection

This method involves injecting liquid radioactive waste directly into a layer of rock deep underground. The United States has used this method to dispose of liquid hazardous and low-level waste. The former Soviet Union has also used this method, to dispose of liquid high-level waste – at locations usually close to the waste generating sites.

Direct injection requires detailed knowledge of subsurface geological conditions. It does not incorporate any man-made barriers. There would be no control of the injected material after disposal. Retrieval would be impossible. There are many technical unknowns that would require extensive research to be confident of the suitability of this method for a specified site.

Although direct injection does not contravene international conventions, it would not be consistent with the spirit of international guidance on the long-term management of radioactive wastes.

Current published assessments do not suggest any substantive advantage and no country is pursuing direct injection as a means of dealing with an entire national inventory of used nuclear fuel.

4.2 Rock Melting

In this method, liquid or solid waste is placed in an excavated cavity or a deep borehole. Heat generated by the waste would increase, melting the surrounding rock and dissolving the radionuclides in a growing sphere of molten material. As the rock cools, it would solidify and incorporate the radionuclides in the rock matrix, dispersing the waste throughout a larger volume of rock.

In one variation of this method, heat-generating waste is placed in containers. When the rock melts around the containers, the waste is sealed in place.

Research was carried out on this method in the late 1970s and early 1980s, when it progressed to the stage of engineering design. The design involved a shaft or borehole which led to an excavated cavity at a depth of two to five kilometres.

It was postulated (but not demonstrated) that the waste would be immobilized in a volume of rock one thousand times larger than the original volume of waste.

Another early proposal was to use weighted containers of heat-generating waste that would continue to melt the underlying rock, allowing them to move downwards to greater depths as the molten rock solidified above them. There was renewed interest in this method in the 1990s in Russia, particularly to dispose of limited volumes of specialized waste, such as plutonium.

Russian scientists have also proposed that high-level waste, particularly excess plutonium, be placed in a deep shaft and immobilized by a nuclear explosion which would melt the surrounding rock.

There have been no practical demonstrations that rock melting is feasible or economically viable.

4.3 Sub-seabed Disposal

In this method, radioactive waste containers are buried in a suitable geological setting beneath the deep ocean floor. Sub-seabed disposal was investigated extensively in the 1980s, primarily under the auspices of the Seabed Working Group set up by the Nuclear Energy Agency (NEA) of the Organization for Economic Co-operation and Development (OECD). Canada participated in this group, along with the United States, the United Kingdom, Japan and several European countries.

The sub-seabed disposal concept involves using missile-shaped canisters called "penetrators" to hold solid waste. The penetrators are dropped from ships, and bury themselves to a depth of a few metres or more in the sediments on the ocean floor. The disposal sites would be ones where the sediments have a high capacity to absorb radionuclides, and where the water is a few kilometres deep.

The idea behind the concept is that the waste form, inner canister, penetrator and sediments would provide sufficient protection to prevent the release of radionuclides into the ocean for thousands of years. When release finally does take place, it would occur very slowly and there would be substantial dilution.

An alternative concept would draw on deep sea drilling technology to stack waste packages in holes drilled to a depth of 800 metres, with the uppermost container about 300 metres below the seabed. Research on sub-seabed disposal ceased in the early 1990s when it became clear that there would always be intense political opposition. International conventions may prohibit ocean access to a sub-seabed repository.

Another alternative concept is to access a sub-seabed location via on-land shafts and drifts. This is being studied in Sweden, where a deep geological repository would be located deep beneath the ocean floor. In this instance, the ocean itself is the last line of defense: in theory, if contaminants escaped and moved to the ocean environment, their volume would be small, and the buffering and diluting capacity of the ocean would mitigate any consequences.

4.4 Disposal at Sea

This method consists of placing packaged waste on the bed of the deep ocean. The packaging would consist of canisters designed to last for a thousand years or more. The waste would be in a solid form that would release radionuclides into the ocean very slowly when the canisters fail.

The site would be one where the water is a few kilometres deep, so that the waste would not be affected by human activity; there would be substantial dilution of radionuclides before they reach the surface.

Sea disposal was investigated by the NEA's Seabed Working Group, but not in the same detail as the sub-seabed disposal method. Sea disposal would be an extension of the 'sea dumping' method that was used until the early 1980s to dispose of solid low-level radioactive waste. It is now prohibited under international conventions.

4.5 Disposal in Ice Sheets

In this method, containers of heat-generating waste would be placed in very thick, stable ice sheets, such as those found in Greenland and Antarctica. Three possibilities have been suggested.

In the "meltdown" concept, containers would melt the surrounding ice and be drawn deep into the ice sheet, where the ice would refreeze above the wastes, creating a thick barrier. In the "anchored emplacement" concept, containers would be attached to surface anchors that would limit the containers' penetration into the ice by melting at around 200-500 metres. This would allow for possible retrieval for several hundred years (before surface ice covers the anchors).

In the "surface storage" concept, containers would be placed in a storage facility constructed on piers above the ice surface. As the piers sank, the facility would be jacked up to remain above the ice for perhaps a few hundred years. Then the entire facility would be allowed to sink into the ice sheet and be covered over.

There has been very little work on disposal in ice sheets because there has never been enough confidence about predicting the fate of the waste; also, it is possible radionuclides could be released into the ocean. Further, disposal of radioactive waste in Antarctica is prohibited by international treaty. Denmark has indicated that it would not allow such disposal in Greenland.

4.6 Disposal in Subduction Zones

This method was initially proposed in the 1980s. In theory, it involves placing waste in a subducting (or descending) plate of the earth's crust. Subduction zones are always offshore, so this concept can be considered a variant of emplacement in the sea or beneath the seabed. The waste could be emplaced close to an active subduction zone by means of tunneling, deep sub-seabed boreholes, or free-fall penetrators.

Little attention has been paid to this method because of the inability to predict the fate of waste. It has been suggested that waste might return to the surface via volcanic eruptions. This method has also been seen as a form of sea disposal (and so would be prohibited by international conventions).

4.7 Disposal in Space

This method would permanently remove radioactive waste from earth by ejecting it into outer space. Alternative destinations that have been considered include the sun, orbit around the sun, and ejection beyond the solar system. This method has been suggested for disposing of small amounts of the most toxic waste. This method has never been part of any major research and development program. Opposition to disposal in space has been reinforced by the Challenger and Columbia accidents.

4.8 Dilution & Dispersion

The method would involve dissolving the fuel in acid, neutralizing the solution and discharging it slowly down a pipeline into the sea. The discharge site and rate would be such that radiation doses to people never exceed internationally-accepted limits. Another possibility would be to transport the fuel solution by tanker to the open ocean and release it there.

"Dilution & Dispersion" differs from all other storage and disposal methods in that there is no containment of the waste or isolation from the environment. It has never been proposed or considered seriously for used nuclear fuel disposal because sea disposal is prohibited by international conventions.

Draft Fact Sheets on the Issue of the Long-Term Management of Nuclear Fuel Waste in Canada

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INUIT TAPIRIIT KANATAMI

COMPILED BY:

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MAY 2004

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Intent of the legislation (re: the Nuclear Fuel Waste Act and section 12(7) of Bill C-27):

On November 15, 2002 the Nuclear Fuel Waste (NFW) Act was brought into force. The NFW Act marked a substantial achievement by the Government of Canada in meeting its responsibilities regarding the long-term management of nuclear fuel waste and set in motion the processes, structures and decision-making steps necessary for successful implementation of the Act. The NFW Act was developed on the foundation of extensive consultation with the public and stakeholders, including several policy communications by the Government of Canada in 1996 and 1998. In the 1998 Government of Canada Response to the Seaborn Panel, the Government indicated that it would undertake a participation process for Canada's Aboriginal peoples to understand and assess nuclear fuel waste issues. The Government also indicated that, to the extent possible, the process would be designed and executed by Aboriginal people so that it is appropriate to their value system. Since 1998, the Government of Canada has been in discussion with representative Aboriginal organizations about how they want to be consulted.

Background:

In discussions with NWMO representatives, ITK staff members have underlined the fundamental importance of aboriginal, and specifically speaking, Inuit involvement in the development of management options that are required by the Nuclear Fuel Waste (NFW) Act. It is essential that comprehensive public consultations with Inuit will be conducted in order to develop long-term management approach options, which are to be submitted by the NWMO on November 15, 2005. It is furthermore of great importance that this consultation process takes place in a relevant, meaningful, and culturally appropriate way that takes into account the remoteness, as well as language needs of Inuit communities that must be consulted throughout this process.

In the past, Inuit have been opposed to the Long-Term Management of Nuclear Fuel Waste in the Canadian Arctic. The need remains, however, to consult and educate Inuit on this issue to back up/substantiate/explore Inuit views in a cohesive manner. Of particular interest to Inuit is, for example, the risk of trans-boundary problems associated with the Long-Term Management of Nuclear Fuel Waste.

As a result, ITK proposed a three-year process to consult Canadian Inuit on the issue of Nuclear Fuel Waste Management and Disposal, as mandated in section 12(7) of Bill C-27.[1] This multi-year process will culminate in a comprehensive report detailing Canadian Inuit ethical, social, environmental and economic considerations in regard to storing nuclear fuel waste, attempt to answer whether or not nuclear fuel waste storage on Inuit lands is acceptable, and if acceptable, what method of storage would be preferred.

This consultation model will allow Inuit to express their opinions in a culturally specific manner that will produce a comprehensive report that will accurately reflect the Canadian Inuit areas of concern on the questions surrounding section 12 of Bill C-27.

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[1] Section 12.(7) of bill C-27, An Act respecting the long-term management of nuclear fuel waste, states, "The waste management organization shall consult the general public, and in particular aboriginal peoples, on each of the proposed approaches."

INUIT TAPIRIIT KANATAMI

Consultation with the Inuit Land Claims Organizations:

ITK will consult on an ongoing basis with the Inuit Land Claims Organizations and facilitate consensus building on answers to the consultation questions. ITK will not and cannot speak for Regional groups until the consultative and consensus-building process is complete.

Reasons and objectives of the consultation:

- The design and execution of a culturally specific consultation program by ITK on the long-term management of nuclear fuel waste in Canada.
- To provide information, means and opportunity for Inuit people to conduct a dialogue amongst themselves and share their opinions and views with the Government of Canada;
- To provide a series of reports, and in particular a final report, to Natural Resources Canada, which will then be transmitted to the Minister, which outlines the views and opinions of ITK's constituents concerning the long-term management of nuclear fuel waste in Canada. That is, to create a body of knowledge related to the views and opinions of Aboriginal peoples on nuclear fuel waste;
- To provide the Minister with the views and opinions of Inuit peoples in advance of the recommendation to the Governor-in-Council on the approach for the long-term management of nuclear fuel waste;
- To assist in developing capacity for Inuit peoples at an organizational level, as well as allowing Inuit peoples to acquire knowledge on matters related to nuclear fuel waste management;
- To develop communications between Inuit peoples and the Government of Canada on the issue of nuclear fuel waste management.

Description/Scope:

The consultations are to be explicitly and strictly in relation to the long-term management of nuclear fuel waste in Canada and the structures and processes laid out in the Nuclear Fuel Waste Act. Issues for discussion include:

- The long-term management of nuclear fuel waste in Canada including opinions laid out in the NFW Act, and others as proposed by the Nuclear Waste Management Organization (NWMO);
- Traditional Aboriginal Knowledge (TK) in relation to nuclear fuel waste management; basis for utilization of TK and methods for doing so;
- Aboriginal, treaty and other rights as related to nuclear fuel waste management;
- Other relevant topics as they arise, which are approved by the Minister.