Classement CCEK

Titre Gestion des déchets radioactifs

Type Dossiers Environementaux

Date D'ouverture 2004

Notes 22 Décembre 2004: Additional comments to the BAPE concerning Hydro-Québec's G-2 reactor

14 Juillet 2004: Kativik Regional Government- Materials in preparation for the upcoming Inuit Specific Consultation on the Long-Term Management of Nuclear Waste in Canada

27-28 Janvier 2005: Draft Regional Inuit- Specific Dialogue on the Long-Term Management of Nuclear Fuel Waste in Canada: Determing the National Inuit- Specific Perspective.

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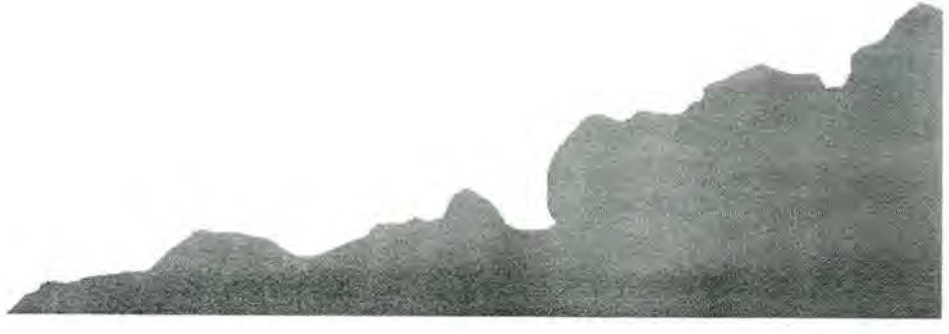
INUIT TAPIRIIT KANATAMI

Return of Results from the National Inuit Specific Dialogue on the Long-Term Management of Nuclear Fuel Waste

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

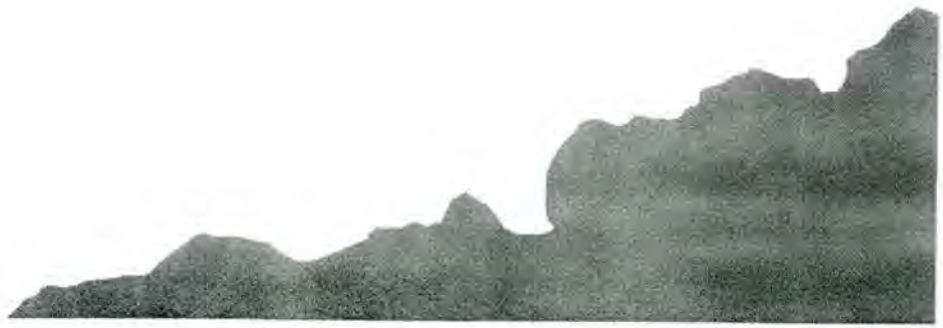
On November 15, 2002 the Nuclear Fuel Waste (NFW) Act was brought into force.

The NFW Act 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.



Intent of the legislation (continued)

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.

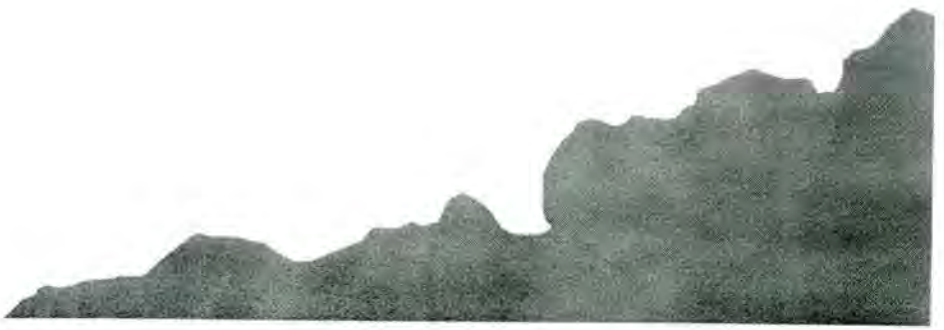


Background

- In discussions with Nuclear Waste Management Organization (NWMO) and NRCan representatives, ITK staff members had 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.

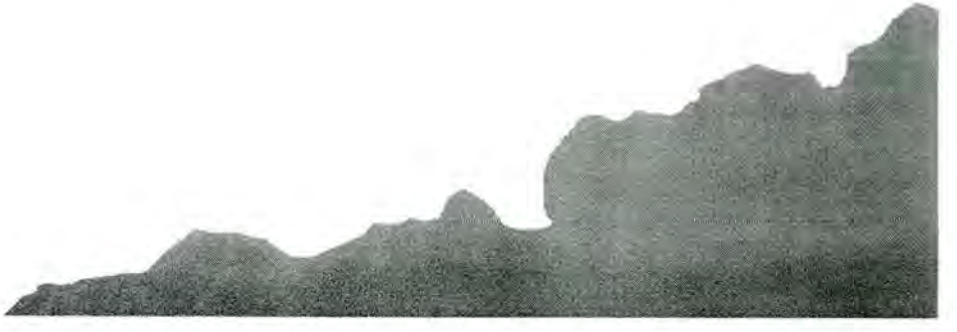
Background (continued)

This dialogue, which has now been completed, has allowed Inuit to express their opinions in a culturally specific manner that produced a comprehensive report that reflects Canadian Inuit areas of concern on the questions surrounding section 12 of Bill C-27.



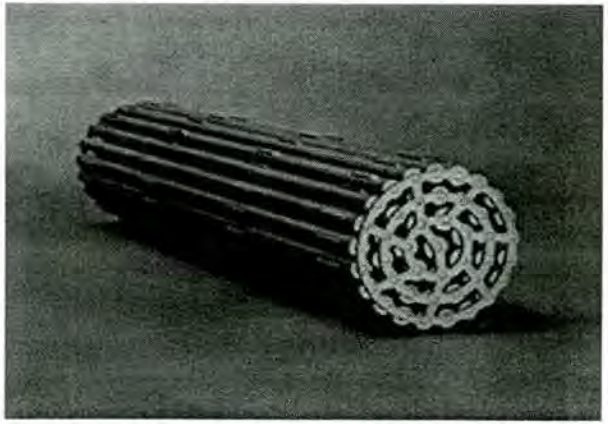
Description/Scope

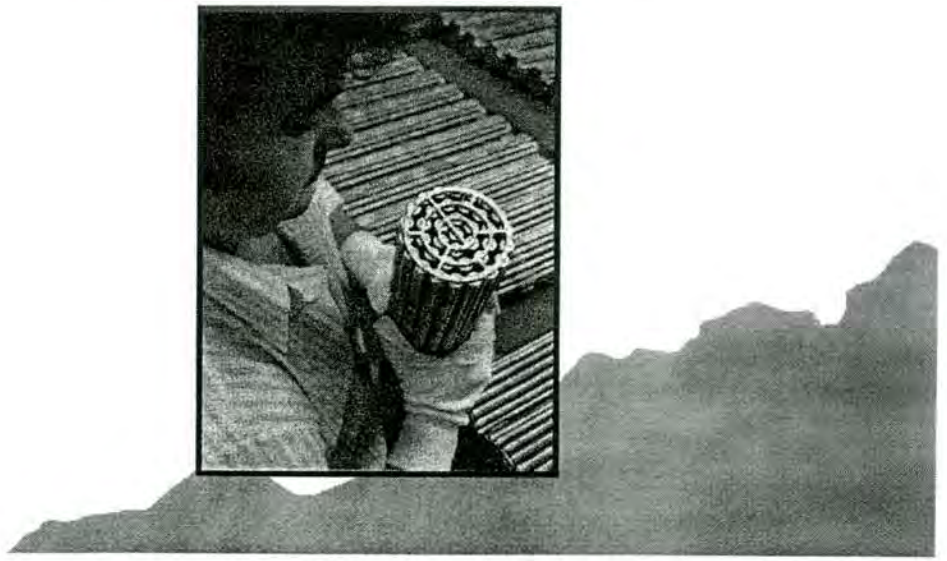
- The dialogues were to be explicitly and strictly in relation to the Long-Term Management of Nuclear Fuel Waste in Canada and the structures and processes laid out in the Nuclear Fuel Waste Act.



A Quick Review: What is Nuclear Fuel Waste?

- Nuclear Fuel Waste is the used uranium fuel from nuclear reactors, which is used to produce energy. This Nuclear Fuel Waste is contained within irradiated fuel bundles, which weigh approximately 20 kg each.
- Because of its radioactivity and toxic properties, Nuclear Fuel Waste is dangerous to human and environmental health.

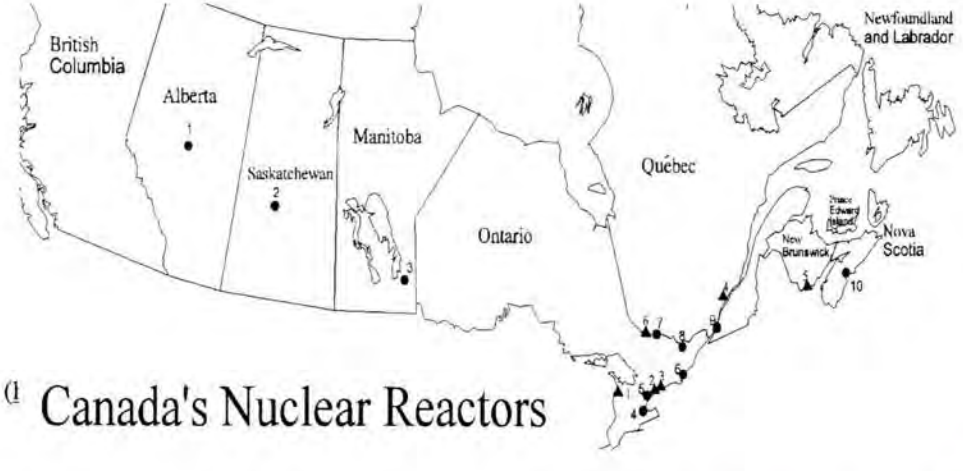




Where is used Nuclear Fuel Waste currently stored?

For the most part, Nuclear Fuel Waste is currently stored on-site at nuclear generating facilities, either in wet or dry storage. Some waste is also stored at the Chalk River and Whiteshell Laboratories.

On the map, circles represent research reactors; triangles represent commercial facilities



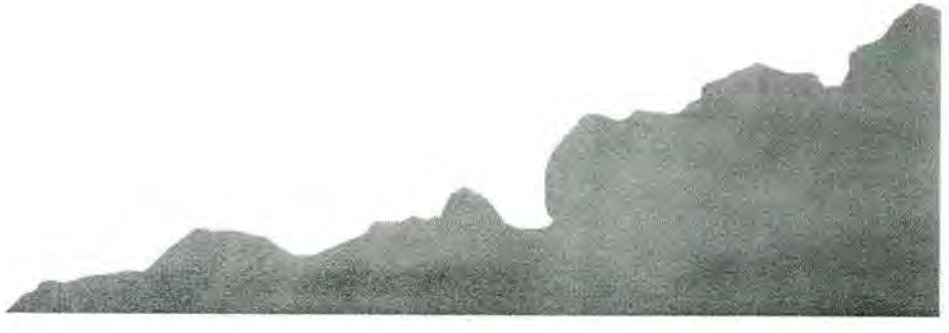
(1 Canada's Nuclear Reactors

Who produces Nuclear Fuel Waste?

- Nuclear Fuel Waste is produced by nuclear generating facilities that have been operating since the mid- to late 1970's.
- Ontario Power Generation is responsible for approximately 90% of the waste, New Brunswick Power for 4%, Hydro-Québec for 4%, and Atomic Energy of Canada Ltd. for 2%. Other waste owners (i.e. universities) produce much smaller quantities of Nuclear Fuel Waste.

How much Nuclear Fuel Waste is there in Canada?

As of 2002, approximately 1.7 million used nuclear fuel bundles (approximately 40,000 metric tones - enough to fill three hockey rinks) have been produced.



How long does Nuclear Fuel Waste remain dangerous?

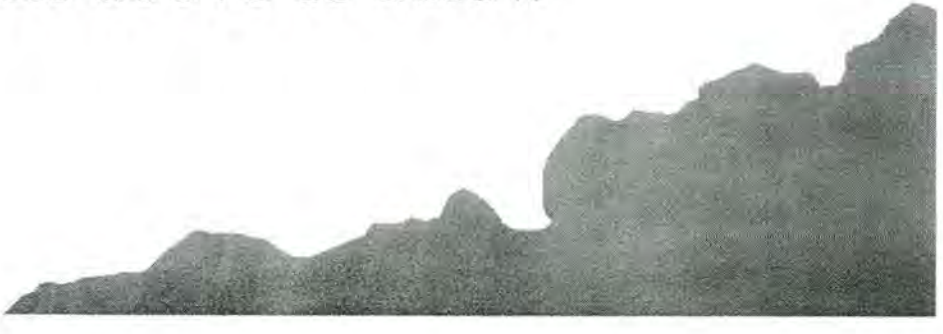
- The radioactivity of substances is measured in half lives, or the amount of time for the material to lose half of its radioactivity.

  Waste by-products such as uranium have half-lives as long as 710,000 years.

Outline of Proposed Methods of Disposal/Storage

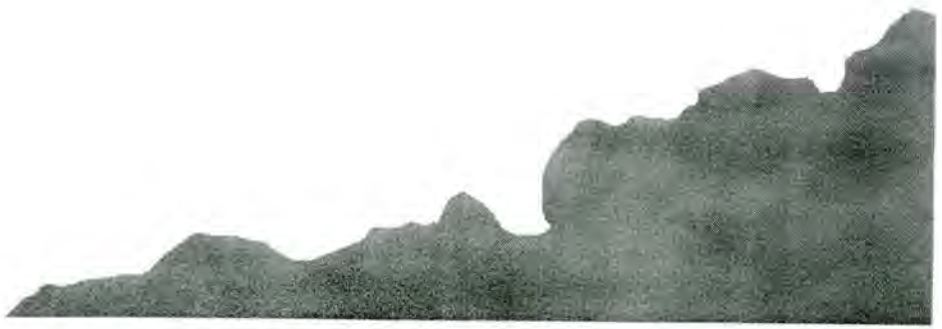
The 2002 Nuclear Fuel Waste Act directed the NWMO to examine three methods for the long-term management of Nuclear Fuel Waste:

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



The Way Forward – ITK's Final Report and Board of Directors Resolution

- At ITK's June 2005 Board of Directors Meeting (Nain, Nunatsiavut), a final report and resolution on the subject of the Long-Term Management of Nuclear Fuel Waste was passed unanimously.



Final Report on the Inuit-Specific Dialogues on the Long-Term Management of Nuclear Fuel Waste in Canada

- This report outlined that the relationship between Inuit and their environment continues to be a fundamental element of Inuit culture and identity.

- This report further stated that the environment is integral to Inuit social, cultural and economic development and well-being, to the extent that it is difficult to separate the health of the environment from the health of the people.

Conclusions of the Final Report

- Not enough time and funding were allocated in order to conduct a formal consultation that would be effective, meaningful and culturally appropriate. In section 12(7) the Act states that they shall consult the general public and in particular Aboriginal people. The dialogues, which took place within the four Inuit Land Claims Regions cannot not be considered consultations under this Act.

- Inuit in all four Land Claims Regions stated their complete opposition to the storage of Nuclear Fuel Waste in the Canadian Arctic and specifically speaking, their opposition to the storage of Nuclear Fuel Waste in their Land Claims Regions (which include marine areas and aerospace).

Conclusions of the Final Report (continued)

- The participants at each of the four Inuit-Specific Dialogues further stated their complete opposition to the storage/disposal and transport of Nuclear Fuel Waste in areas adjacent to Inuit owned lands (Nunavut, Inuvialuit Settlement Region, Nunavik and Nunatsiavut), Inuit co-managed lands and land governed by Inuit Land Claim Agreements.

Conclusions of the Final Report (continued)

- As Aboriginal Canadians, Inuit are also in opposition to the storage/disposal of Nuclear Fuel Waste anywhere else within Canada and insist that Nuclear Fuel Waste should remain on the site of existing nuclear reactors. The reason for this stance is that although Inuit directly oppose the storage/disposal/transport of Nuclear Fuel Waste on the "said lands," Inuit as Canadians also do not advocate that Nuclear Fuel Waste should be stored on any new sites.

- A follow-up process must take place in order for these dialogues to conclude effectively;

Conclusions of the Final Report (continued)

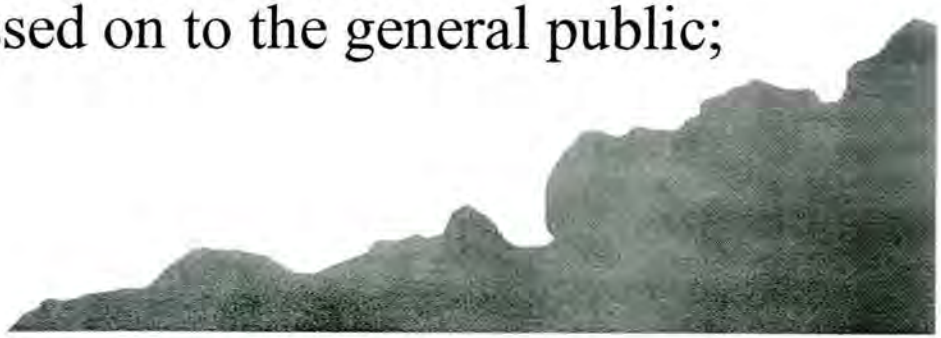
- Decision-making structures that may be initiated with regards to the implementation of a final management approach for the disposal/storage of Nuclear Fuel Waste, must include that mechanisms for direct community involvement are implemented and that potentially affected communities have the right to refuse to host a Nuclear Fuel Waste disposal/storage site;

- As Secondary Wastes (materials exposed to radiation within nuclear power plants) are also hazardous to human and environmental health, these wastes must be included when addressing the issue of the Long-Term Management of Nuclear Fuel Waste in Canada;

Conclusions of the Final Report (continued)

- As there will be a need to communicate the results from the Government of Canada reports to the Inuit Land Claims Regions, an Inuktitut/English terminology dictionary must be developed in order to facilitate the information distribution and translation of materials regarding the subject of the Long-Term Management of Nuclear Fuel Waste in Canada;

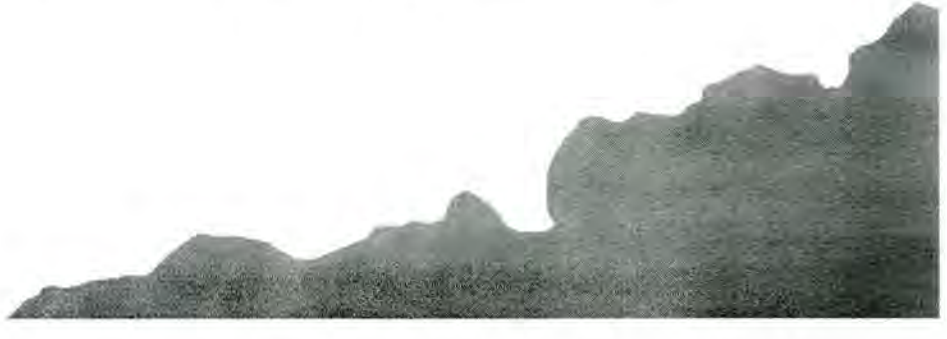
- Inuit encourage the honest and accurate disclosure of the true costs associated with the Nuclear Industry (development of technologies/costs of management methods) and where/to what degree these costs are passed on to the general public;



Conclusions of the Final Report (continued)

- The Nuclear Industry should in no way interpret the findings contained within the feedback provided by Inuit as an encouragement or acceptance of an increase in the production of nuclear energy and the subsequent production of Nuclear Fuel Waste;

- The Government of Canada must take the necessary steps to conduct research and develop alternative energy sources in Canada.



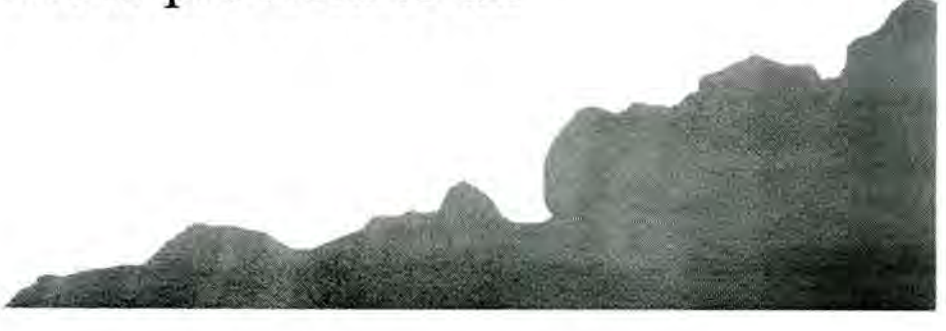
Final Statement contained in the Final Report

- The participants of the National Inuit-Specific Dialogues on the Long-Term Management of Nuclear Fuel Waste in Canada stated that the production of nuclear energy and the subsequent problem of the Long-Term Management of Nuclear Fuel Waste in Canada represent a volatile issue that will continue to be present in 30 years, 60 years or in 300 years. It was further stated that the production of nuclear energy was initiated without a thought towards a means of disposing of the inevitable and highly toxic byproduct of Nuclear Fuel Waste.

Final Statement contained in the Final Report (continued)

Nuclear Fuel Waste represents a very serious waste problem, which goes against Inuit ethics with regards to environmental protection and the inseparability of environmental and human health.

As such it is important to emphasize that environmental protection in the Canadian Arctic is of utmost concern to Inuit and that as Aboriginal Canadians, Inuit consider the implications of additional locations for the storage or disposal of Nuclear Fuel Waste a very serious problem to all Canadians.



Recommendations/Comments on Alternative Energy Sources in Canada

- The subject of renewable energy sources and the need to conduct research into this area by the Canadian Government was discussed at length at each of the four Inuit-Specific Dialogues. During the dialogues, which took place in the four Inuit land claims regions it was stated that the Government of Canada must take the necessary steps to conduct research and develop alternative energy sources in Canada with the goal in mind to eventually replace nuclear energy with alternative and clean energy options and to stop the production of Nuclear Fuel Waste.

Recommendations/Comments on Alternative Energy Sources in Canada (continued)

One region (Nunatsiavut) could, however, not reach consensus on this matter. As a result their feedback regarding this matter contains two sets of comments. The initial set of comments included an emphasis on the conducting of research on alternative energy sources, but it did not include any comments regarding the elimination of nuclear reactors as sources of energy. The secondary set of comments, however, advocated that the Nuclear Industry in Canada should be shut down and that more emphasis should be placed by the Canadian Government and Industry to eliminate the production of Nuclear Fuel Waste in Canada.

ITK Resolution on the issue of Nuclear Fuel Waste in Canada - June 2005

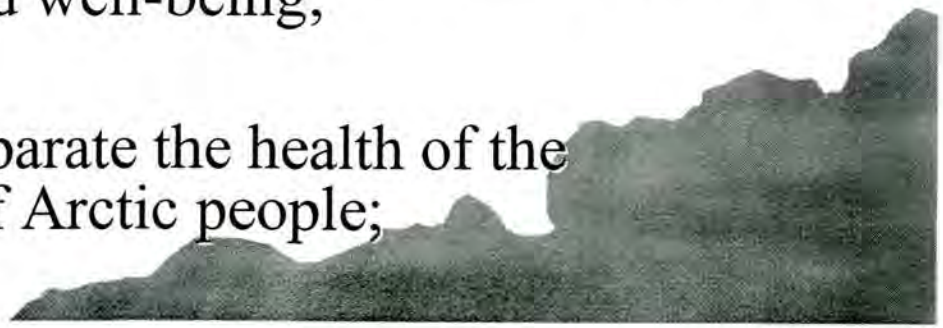
Resolution: B05/06/09-09 **Re: Nuclear Fuel Waste**

Moved: Paul Kaludjak
Seconded: Pita Aatami

WHEREAS the relationship between Inuit and their environment continues to be a fundamental element of Inuit culture and identity;

WHEREAS the environment is integral to Inuit social, cultural and economic development and well-being;

WHEREAS it is difficult to separate the health of the environment from the health of Arctic people;



ITK Resolution on the issue of Nuclear Fuel Waste in Canada - June 2005 (continued)

THEREFORE BE IT RESOLVED THAT the Inuit Tapiriit Kanatami and the four Inuit Land Claim Regions (Nunavut, Inuvialuit Settlement Region, Nunavik, and Nunatsiavut) are in complete opposition to the storage/disposal and transport of Nuclear Fuel Waste in the Canadian Arctic and specifically speaking in the four Land Claims Regions (incl. marine areas and aerospace);

ITK Resolution on the issue of Nuclear Fuel Waste in Canada - June 2005 (continued)

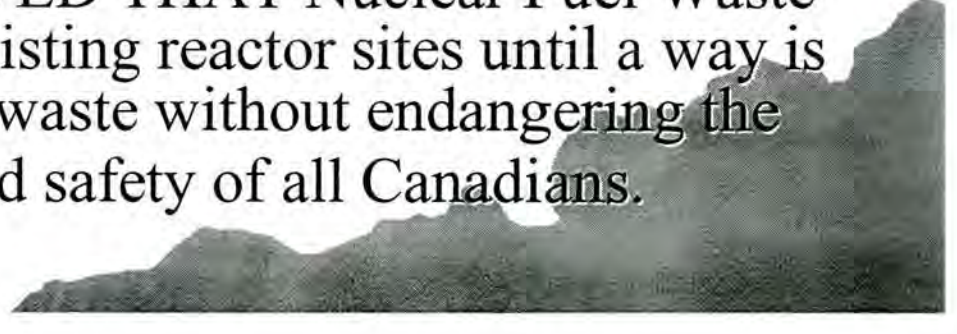
- THEREFORE BE IT RESOLVED THAT the Inuit Tapiriit Kanatami and the four Inuit Land Claim Regions (Nunavut, Inuvialuit Settlement Region, Nunavik, and Nunatsiavut) are in complete opposition to the storage/disposal and transport of Nuclear Fuel Waste in areas adjacent to Inuit owned lands, on Inuit co-managed lands and land governed by Inuit Land Claim Agreements;

ITK Resolution on the issue of Nuclear Fuel Waste in Canada - June 2005 (continued)

THEREFORE BE IT RESOLVED THAT the Inuit Tapiriit Kanatami supports the Government of Canada in making the necessary steps to conduct research and develop alternative energy sources in Canada;

THEREFORE BE IT RESOLVED THAT the Inuit Tapiriit Kanatami supports the Government of Canada in encouraging other nations to restrict the transportation of Nuclear Fuel Waste across international boundaries;

THEREFORE BE IT RESOLVED THAT Nuclear Fuel Waste continues to be stored at the existing reactor sites until a way is found to safely dispose of this waste without endangering the environment, human health and safety of all Canadians.



What has been done?

- Reviews of Discussion Documents # 1, 2, and 3 have been submitted to the NWMO;
- All reports from the Inuit-Specific Dialogues on the Long-Term Management of Nuclear Fuel Waste in Canada have been submitted to the NWMO;
- A final report on the results obtained from the Inuit-Specific Dialogues on the Long-Term Management of Nuclear Fuel Waste in Canada (approved by ITK's Board of Directors) has been submitted to both the NWMO and NRCan;
- The June 2005 resolution (on the Long-Term Management of Nuclear Fuel Waste in Canada), which was approved by ITK's Board of Directors has been submitted to both the NWMO and NRCan.

What Comes Next???

- ITK submits further feedback resulting from the Return of Results Tour to the four Inuit Landclaims Regions;
- The NWMO submits their recommendations on November 15, 2005 (containing the materials submitted from the Inuit-Specific Dialogues on the Long-Term Management of Nuclear Fuel Waste in Canada);
- The Minister decides which approach will be taken with regard to the Long-Term Management of Nuclear Fuel Waste in Canada.

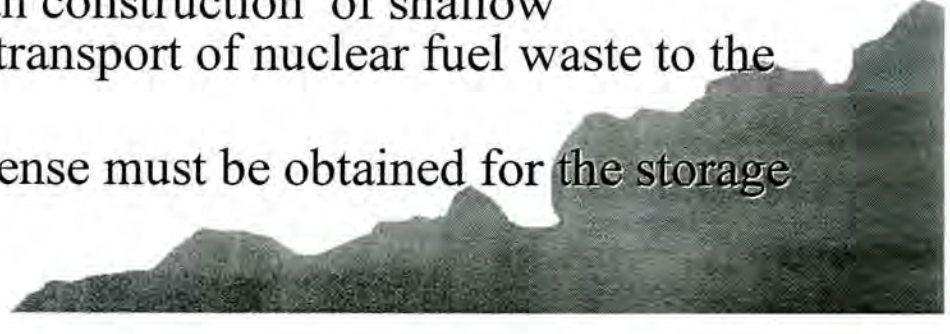
The Fourth Option proposed by the NWMO – Adaptive Phased Management

<u>Requirements</u>:

- The site selection process is intended to be focused within the provinces that are directly involved in the nuclear fuel cycle –
- A willing host community must be found;
- Transportation options - operation of a centralized facility requires that fuel from existing reactor sites be transported and that an emergency response plan is developed.

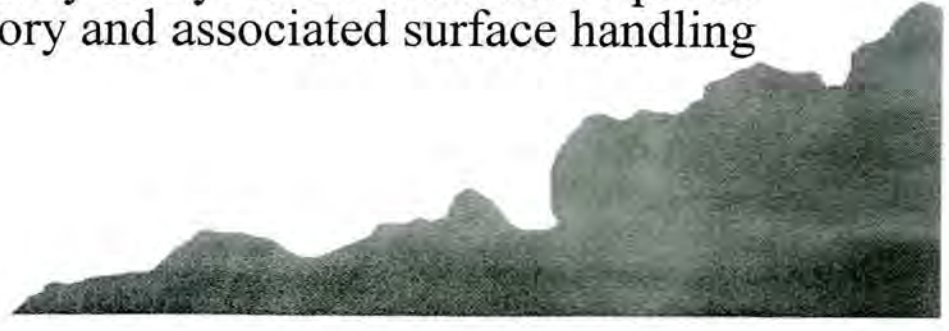
Phase 1 (first 30 years)

- Maintain storage and monitoring at current reactor sites;
- Develop with citizens an engagement program for activities such as design and the process of choosing a site;
- Development of technologies and key decisions
- Continued engagement with regulator authorities;
- Selection of a central site that has rock formations suitable for shallow underground storage, an underground research laboratory and a deep geological repository;
- Initiate licensing process, which triggers the environmental assessment process under the Canadian Environmental Assessment Act (CEAA);
- Undertaking of safety analyses and environmental assessment to obtain the required licenses and approvals to begin construction at the central site;
- Develop and certify storage containers and nuclear fuel waste handling capabilities
- Decide whether or not to proceed with construction of shallow underground storage facility and the transport of nuclear fuel waste to the central site during Phase 2;
- If decision is made – an operating license must be obtained for the storage facility.



Phase 2 (approx. the next 30 years)

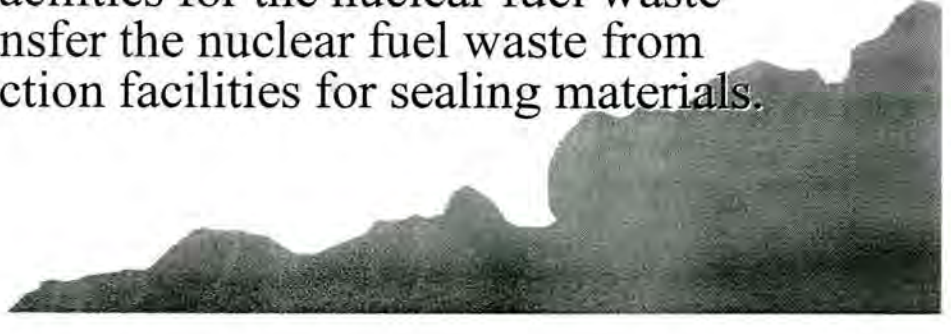
- If the decision is made to construct shallow underground storage, transport of nuclear fuel waste from the reactor sites to the central site for extended storage will begin after construction has been completed;
- If the decision is not made in favour of shallow underground storage, continued storage at the reactor sites will take place until a deep repository is available at a central site;
- Research and testing will be conducted at the underground research laboratory to demonstrate and confirm the suitability of the site and the deep repository technology;
- Citizens will be engaged in the process of assessing the site, the technology and the timing for placement of nuclear fuel waste in the deep repository;
- Decision will be made when to construct the deep repository at the central site for long-term containment and isolation during Phase 3;
- Completion of the final design and safety analyses to obtain the required operating license for the deep repository and associated surface handling facility.



Phase 3 (beyond approx. 60 years)

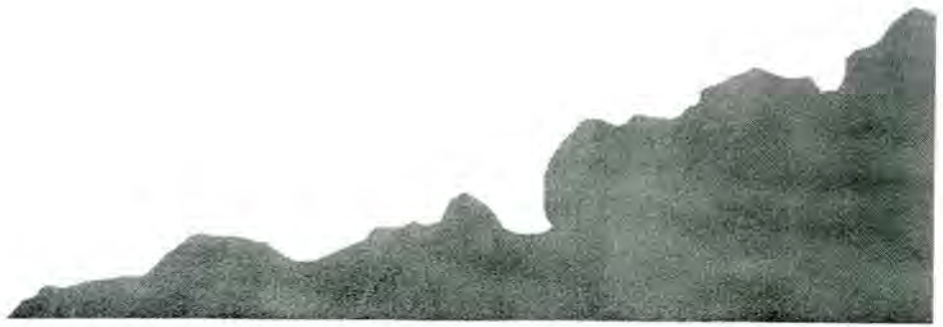
- If nuclear fuel waste is stored at a central shallow underground facility, retrieve and repackage nuclear fuel waste into long-lived containers;
- If nuclear fuel waste is stored at reactor sites, transport the nuclear fuel waste to the central facility for repackaging;
- Nuclear fuel waste will then be placed in containers into the deep geological repository for final containment and isolation;
- Continue monitoring and maintain access to the deep geological repository for an extended period of time to assess the performance of the repository system and to allow retrieval of nuclear fuel waste, if required;
- Engage citizens in ongoing monitoring of the facility – a future generation will decide when to close the repository, decommission the facility and the nature of any postclosure monitoring of the system

⇨ There may be a need for production facilities for the nuclear fuel waste containers; processing facilities to transfer the nuclear fuel waste from storage to deep repository; and production facilities for sealing materials.



Possible Feedback

- What do you think?
- Is there anything missing?
- What form of education should take place within the Inuit Landclaims Regions with regards to the issue of the Long-Term Management of Nuclear Fuel Waste in Canada?
- Anything else?



ITK Review of the NWMO Discussion Document #3: Choosing a Way Forward

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INUIT TAPIRIIT KANATAMI

August 2005

Ottawa, Canada

Introduction

Inuit Tapiriit Kanatami (ITK) represents the Inuit of Canada on matters of national concern. There are approximately 50,000 Inuit living in 53 communities. The Inuit territory of Canada is divided into four main regions: The Nunavut region (further divided into the Kitkmeot, Kivalliq and Qikiqtaaluk regions), the Inuvialuit region (the western Arctic), Nunavik (northern Québec) and Nunatsiavut (Labrador).

ITK is the national voice of the Inuit of Canada and addresses issues of vital importance to the preservation of Inuit identify, culture and way of life. One of the most important responsibilities of ITK is to promote Inuit rights and to ensure that Inuit are properly informed about issues and events that affect their lives, and that processes purporting to address Inuit interests are properly informed by Inuit knowledge, perspectives and vision.

The ITK Department of Environment has the responsibility of protecting and advancing the place of Canadian Inuit in the use and management of the Arctic environment. It acts on this responsibility in close cooperation with Inuit regional organizations.

ITK's comments on the latest NWMO report, "Choosing a Way Forward" are intended to complement our *Final Report on the National Inuit-specific Dialogues on the Long-term Management of Nuclear Waste in Canada*" submitted to the NWMO on June 30, 2005.

Further, ITK Resolution B05/06/09-09 adopted unanimously by the ITK Board of Directors on June 9, 2005, continues to state the Inuit's "complete opposition to the storage/disposal and transport of Nuclear Fuel Waste in areas adjacent to Inuit owned lands, on Inuit co-management managed lands and land governed by Inuit Land Claims Agreements". It is important in this regard to note that the Labrador Inuit Land Claims Agreement received Royal Assent on June 23, 2005. With the exception of the offshore area of Nunavik, this completes comprehensive land claims for the Inuit Canada. The Resolution goes on to select what was essentially Option 2 from the Discussion Documents - that is, storing waste at the existing sites "until a way is found to safely dispose of this waste without endangering the environment, human health and safety of all Canadians".

ITK's Response to "Choosing a Way Forward"

The NWMO is seeking input and opinion on a new option that emerged as thinking progressed through the evaluation of the original three options presented in earlier Discussion Documents. This new option is called Adaptive Phased Management and is based on a phased approach to eventual centralized containment of nuclear fuel waste and isolation deep underground.

From ITK's perspective, this option has value as its premise is that used fuel would continue to be stored at nuclear reactor sites until results from Phase I and Phase 2 research, analysis and consultation were obtained. This carries with it the assumption

that there would be no Phase 2 - interim shallow underground storage, or a Phase 3 - long-term deep centralized storage unless this was proven technically feasible and socially acceptable. Generally, this conforms to the position adopted by our Board of Directors.

Having said that, the siting criteria established for this option is also of interest to ITK. Choosing a Way Forward states..."we believe that fairness would best be achieved if the site selection process is focused within the provinces that are directly involved in the nuclear fuel cycle - namely Ontario, New Brunswick, Québec and Saskatchewan". With the exception of Québec, this effectively excludes the Inuit regions.[1]

The Report then further sets out another important criteria, that a willing host community is found. In this regard, it is clear that Inuit communities, including those in Nunavik (northern Québec) would not satisfy this criteria.

A further consideration, which serves to diminish interest in the Inuit regions, is the limit on transportation options. The operation of a centralized facility requires that fuel from existing reactor sites be transported and that an emergency response plan is developed. The lack of road or rail infrastructure in most Inuit regions and the degree of risk associated with sea or air transport combine to further discount the North as a suitable region. These same factors would make the development of satisfactory emergency response plans very unlikely.

ITK in no way wishes to appear to be advocating that the challenges be simply shifted to other regions and withdraw from the discussions. That would not be responsible. Rather, having read the report with care, we have noted that the NWMO process itself is coming to a conclusion that the North is not a suitable location for long-term storage. We also refer to the map on page 161 of the Report where the siting criteria associated with the Adaptive Phased Management Approach have been applied. Here too, with the exception of Nunavik, the Inuit regions have been totally excluded.

That being said, it is important to remind NWMO of one of the conclusions stated in the *Final Report on the National Inuit -Specific Dialogues on the Long-Term Management of Nuclear Waste in Canada*, namely:

> "As Aboriginal Canadians, Inuit are also in opposition to the storage/disposal of Nuclear Fuel Waste anywhere else within Canada and insist that Nuclear Fuel Waste should remain on site of existing nuclear reactors....Inuit as Canadians do not advocate that Nuclear Fuel Waste should be stored on any new sites".

[1] Note: The geological characteristics of the Labrador Trough, which extends through a large potion of Nunavik (northern Québec) make this part of Québec an unlikely candidate for technical reasons.

Questions and Observations Concerning the Adaptive Phased Management Approach[2]

ITK is making the assumption that unless the 30-year Phase I period comprehensively addresses all of the technical considerations implicit in moving to Phase 2 and is considered socially acceptable to Canadians at large, used fuel will continue to be stored at reactor sites.

What is not clear is in the case where there is no Phase 2 (interim storage), what would have to take place over the following 20-year period (to year 50) to address all the technical and policy issues necessary to make Phase 3 acceptable. We turn to Section 13.1 of the Report for guidance. Here we find a commitment to developing an Engagement Process which will lead to a final site selection and a technical description of a proposed project encompassing all surface and underground facilities, access and infrastructure requirements and a long-term monitoring program. An application for site preparation is made or intent to apply is then given. This triggers the environmental assessment process.

The Report further states:

> "The implementing agency would be required to demonstrate, during the Environmental Assessment process, that there would be no significant adverse impact on the environment resulting form the construction, operation, decommissioning and closure of the deep geologic repository."

While not explicit, ITK is assuming that environment in the context is used broadly to include all social, economic and cultural considerations. In Chapter 14 of the Report, we find more detail. "The intention is to avoid or minimize significant socio-economic effects on a community's way of life or on its social, cultural or economic aspirations." (page 202). The Report then takes a comprehensive view, stating that "socio-economic effects management involves the coordinated application of mitigation, enhancement, compensation, monitoring and contingency measures and community liaison measures." (page 202).

We note in Section 14 the attention paid to exploring innovative ways to address the socio-economic effects and encourages NWMO to work direction with Aboriginal organizations to benefit from their experiences and on-going analyses of processes established to address Aboriginal concerns in other contexts. In northern Canada, Inuit have treaty-based environmental assessment regimes in which they participate equally with government officials in making decisions. The decision-making processes set out in these treaties also require consideration and accommodation of Inuit knowledge, perspectives and values.

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[2] Posing questions on the Adaptive Phased Management Approach, which contemplates transport and storage at new sites, should not be understood by NWMO to imply any interest in this option beyond Phase I - maintaining the waste at existing sites.

Implicit in the environmental assessment processes established in our land claims agreements (as is the case generally in EIS processes) is the option that the project does not receive approval to proceed. We find no reference that this possibility is being entertained by NWMO. Nor do we find any reference to the possibility that all of the research, technical studies, etc. discussed in Chapter 16 could lead to a conclusion that there is insufficient confidence in safety aspects to support a decision to proceed. Rather, the underlying presumption of the Adaptive Phased Management option is that centralized, isolated containment will go forward. The timeframe may shift according to accepted science, but as stated on page 67 of the Report, "we can recommend the end point that we believe is the most desirable end state".

The Engagement Process will also need to pay particular attention to the views of Aboriginal Peoples, most often a minority voice in the larger debate. This could be even more acute in southern regions where Aboriginal Peoples are often demographically in a minority and politically marginalized. On behalf of other Aboriginal groups, ITK is concerned that their positions may be subsumed by the larger population if the process gets to the stage of searching for a host community. ITK urges the NWMO to be sensitive and alert to this possibility. This likelihood would further increase in a situation where there is an active lobby mounted in support of a site and a local Aboriginal group or community was opposed.

Finally, when reading this Report, we are left with the uneasy feeling that this huge and expensive effort is leading to a conclusion that collectively, as a society, we just don't yet know enough about how to safely manage nuclear fuel waste and yet, at the same time, will continue to produce it. The responsibility for decision-making is being pushed forward to future generations with the hope that science will have advanced to a point where more precise solutions are conceivable.

In our *Final Report on the National Inuit-specific Dialogues on the Long-term Management of Nuclear Waste in Canada* ITK advocates for a non-nuclear society in Canada where nuclear materials are neither mined, produced or transformed. We understand that this was not the mandate given to the NWMO. However, from the Inuit perspective, the long-term management of nuclear fuel waste is simply a component of the much larger issue of meeting Canada's energy needs into the future. Looking at the issue holistically requires consideration of broader questions of the role of hydrocarbons, nuclear fuel and renewables in the overall energy production picture. It is for this reason that Inuit brought forward recommendations related to alternative sources of energy that could eliminate the need to continue reliance on nuclear fuel.

ITK strongly encourages the Government of Canada to provide policy support and resources towards the development of alternative energy sources and energy conservation as the foundation for a truly sustainable "way forward".

ITK Review of the NWMO Discussion Document #2: Understanding the Choices

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INUIT TAPIRIIT KANATAMI

March 2005

Ottawa, Canada

Introduction

Inuit Tapiriit Kanatami represents Canada's Inuit on matters of national concern. There are approximately 50,000 Inuit living in 53 communities. The Inuit territory of Canada is divided into four main regions: The Nunavut region (further divided into the Kitikmeot, Kivalliq and Qikiqtaaluk regions), the Inuvialuit region (the western Arctic), Nunavut (northern Quebec) and Nunatsiavut (Labrador).

ITK is the national voice of the Inuit of Canada and addresses issues of vital importance to the preservation of Inuit identity, culture and way of life. One of the most important responsibilities of ITK is to promote Inuit rights and to ensure that Inuit are properly informed about issues and events that affect their lives, and that processes purporting to address Inuit interests are properly informed by Inuit knowledge, perspectives and vision.

The ITK Department of Environment has the responsibility of protecting and advancing the place of Canada's Inuit in the use and management of the Arctic environment. It acts on this responsibility in close cooperation with Inuit regional organizations.

ITK's comments on NWMO's Discussion Paper #2 are intended as a supplement to the on-going dialogue with Inuit that has been initiated on the long-term management of nuclear fuel waste in Canada. In commenting on Discussion Paper # 2 it is also important to note that, at this time, ITK is not purporting to present the Inuit view point on the process set out to select the assessment methodology nor its application to the disposal options. ITK is facilitating the Inuit Dialogues, but cannot report on behalf of the Inuit regions in advance of the final results from this process. These comments, therefore, are necessarily limited to the implications of the NWMO having proceeded to the stage of selecting and applying a methodology in the absence of more detailed Inuit input.

Background

Canada's Inuit have a long history of exposure to radionuclides. This history is thoroughly documented in the Canadian Arctic Contaminants Assessment Reports (I & II). Historically, anthropogenic radionuclides in the Canadian north originated from atmospheric testing of nuclear and thermonuclear weapons between 1955 and 1963 and the radioactive fallout from the Chernobyl accident in 1986. Cesium levels in Arctic biota have generally declined since 1963 and fallout from Chernobyl has imbedded itself in soil and lake sediment. Other possible, yet small, sources include the burning-up of nuclear powered satellites upon re-entry to the atmosphere, discharges from nuclear power plants and

reprocessing plants, and nuclear waste dumping directly into the Arctic Ocean. The impact of ocean disposal remains unmeasured.[1]

A large portion of the homeland of Canada's Inuit is part of the Canadian Shield. As a backdrop to ITK's comments is the concern that location, remoteness of communities and small populations, make Inuit and their lands vulnerable as a choice for the siting of nuclear waste disposal facilities. Canada's north is also experiencing a mining boom and a renewed interest in exploring and developing the north's mineral potential, including uranium, increasing the overall sense of vulnerability.

The preliminary results from the Inuit dialogues draw attention to a fundamental difference in approach to nuclear issues generally – one that has its origins in mandate of the NWMO. ITK understands that the NWMO was not instructed to take a position on the future role of nuclear energy in Canada, but rather to examine options for managing existing and future waste.

However, when seeking to involve and better understand the views of Inuit in this process it is important to know that representatives of the Inuit regions to the Dialogues share the common position that the ultimate goal of any nuclear debate in Canada should be focused on reduction and eventual elimination. Further they agree that Canada's northern region should not be an option for any form of nuclear waste facility, transport or production. Indeed, the Board of Directors of Nunavut Tunngavik Incorporated, the organization created pursuant to the 1993 Nunavut Land Claims Agreement to represent all Inuit beneficiaries in Nunavut, adopted a resolution in 1997 stating its objection to any storage of nuclear or other hazardous materials in the arctic.[2] ITK has verified that this resolution continues to stand today.

Further, as early as 1977, the Inuit Circumpolar Conference, an organization representing Inuit of the circumpolar region, adopted a resolution concerning peaceful and safe uses of the Arctic Circumpolar Zone, including a prohibition on the disposition of any type of nuclear waste.[3]

It is also important to recall, as was discussed in ITK's comments on Discussion Document # 1, that all the Inuit regions are now governed by constitutionally protected land claims. The subject of 'consultation' is an important feature of these treaties. Consultation with Inuit (and other Aboriginal peoples) has been litigated in Canada and legal jurisprudence now exists. We make this point because a very large portion of Canada's Arctic region is covered by Inuit land claims, including large tracts of land owned by Inuit. These treaties create legal obligations and processes that must be respected.

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[1] Chris M. Furgal and Robbie Keith, Canadian Arctic Contaminants Assessment Report: Overview and Summary, Northern Perspectives V25 no.2, Winter 1998.
[2] Nunavut Tunngavik Inc., Resolution No. B97/08-24, Arviat
[3] Inuit Circumpolar Conference, Resolution 77-11

For example, in the Labrador Inuit Land Claims Agreement, the most recent of Inuit treaties, consult is a defined term:

"Consult" means to provide:

(a) to the Person being consulted, notice of a matter to be decided in sufficient form and detail to allow that Person to prepare its views on the matter;
(b) a reasonable period of time in which the Person being consulted may prepare its views on the matter, and an opportunity to present its views to the Person obliged to consults; and
(c) full and fair consideration by the Person obliged to consult of any views presented.[4]

Understanding the Choices

In reviewing Discussion Document # 2, as well as the Assessment Team's report, ITK is particularly concerned that the NWMO process is moving forward ahead of the parallel process established to engage Inuit.

While the *Nuclear Fuel Waste Act* sets out a requirement for the NWMO to consult separately with Aboriginal peoples, there remains the question of how the results of these consultations are being incorporated into the broader values being assigned by NWMO to Canadians at large. Discussion Document # 2 sets out six core values, drawn from the National Citizens' Dialogue, that direct the long-term management of used nuclear fuel.

- **Responsibility** – we need to live up to our responsibilities and deal with the problems we create
- **Adaptability** – continuous improvement based on new knowledge
- **Stewardship** – we have a duty to use all resources with care, leaving a sound legacy for future generations
- **Accountability and Transparency** – to rebuild trust
- **Knowledge** – a public good for better decisions now and in the future
- **Inclusion** – the best decisions reflect broad engagement and many perspectives; we all have a role to play

[4] Labrador Inuit Land Claims Agreement, initialled on August 29th, 2005 by the Inuit, the Government of Canada and the Government of Newfoundland and Labrador, signifying their intent to recommend this agreement for ratification.

The preliminary results of the dialogues with Aboriginal peoples, however, appear to be limited to how traditional knowledge will be included in the development of a long term management approach and to be "responsive to their emphasis on planning within very long time horizons". There is further engagement that "to the extent that the NWMO is able, these principles [of Aboriginal Traditional Knowledge] will be carried forward as part of the values foundations on which the study will proceed". These are set as:

- **Honour**: the wisdom that can be garnered from speaking to elders in both the aboriginal and non-aboriginal communities

- **Respect**: the opinions and suggestions of all who take the time to provide insight into this process

- **Conservation**: particularly as it applies to the consumption of electricity, must be a major part of the solution, not just a footnote in the NWMO process

- **Transparency**: is essential to the process when NWMO (the producer of the problem) has to suggest the solution

- **Accountability**: must be part of the fabric of any solution so that those responsible (whether for the concept or the delivery) are held to high account by the public for their actions, given the nature of the problem.

As discussed in ITK's comments on Discussion Document # 1, there is a risk of isolating Inuit and their values from mainstream Canadian values. This identified risk appears now to have evolved into reality. Discussion Document # 2 makes it clear that the six core values articulated through the National Citizens' Dialogue, (where recall there was no Inuit involvement) will direct the long-term management of used nuclear fuel.

ITK is currently facilitating Inuit-specific Dialogues and a final report will soon be available. Through this process, Inuit are developing their own policy framework for addressing the management of nuclear fuel waste. It is essential that the NWMO await the results of this process before committing to an option.

Discussion Paper # 2 goes on then to describe the development of a methodology for assessing the various disposal methods based on a set of criteria constructed in the absence of results from the Inuit (and other Aboriginal) Dialogues. It would appear that the NWMO process is moving faster than the parallel processes established for Aboriginal peoples. Nowhere in Discussion Document # 2 is it made clear if and then how these processes will converge.

The Assessment Team that was assembled to select and apply a methodology for rating the selected options did not include any Inuit representation. Nor from our

reading of the "Assessing the Options: Future Management of Used Nuclear Fuel in Canada" were Inuit referred to other than acknowledging that they, as Aboriginal peoples, have a particular role to play in setting establishing public acceptance by providing input into the decision-making process.

From ITK's perspective, it is important to note the following statements in the Assessment Report, as this report formed the basis for the views presented in Discussion Document #2:

> *A key characteristic of multi-attribute utility analysis [the selected methodology] is its emphasis on the judgments of the decision-making team that the analysis is intended to serve. This is sometimes interpreted as a weakness, in the sense that applications may appear overly subjective. (pg.21)*
>
> *To take advantage of all inputs as the foundation for its work, the Assessment Team developed a synthesis of Canadian values drawing from all available inputs including early insights from the Dialogue and the Roundtable on Ethics. (pg.64)*

These clarifications on the foundations for the Assessment Report compound our concern over the timing of the parallel processes and if there can be a serious opportunity for the results of the Inuit-specific Dialogues to meaningfully influence the decision-making process.

Later in the Assessment Report, the Objectives Hierarchy developed by the Assessment Team is plotted against the original ten questions from Discussion Document #1. The Assessment Team concluded that Question 3 concerning Aboriginal Values was a generic question that would inform all the objectives. While this is laudable, once again, we are concerned about timing. The only input that the Assessment Team had to work with was the report on the Traditional Knowledge Workshop. While this is a valuable product, from ITK's perspective it cannot be considered as capturing the full scope for how Inuit should be involved in the decision-making process.

We move on in the Assessment Report to Section 5.6 where the eight objectives are described in more detail. We note with some alarm a statement in Objective 4: Community Well-being:

> *... Many groups may feel that their shared interests are affected regardless of whether they live physically close to used nuclear fuel management facilities. Depending on the sites that eventually are proposed for consideration, Canada's Aboriginal peoples may have a particularly significant stake... (pg.71)*

As reported in ITK's comments on Discussion Document # 1, Inuit have made it clear they do not want to see nuclear waste disposal facilities in their regions.

The Assessment Report then goes on to describe, in detail, how the assessment methodology was applied and summarizes the results.

> *Within the limits of the analysis, not only did the deep geological repository generally score better than the other alternatives, but it also generally scored at a level that suggests it will perform well in meeting the eight objectives not only in comparison to the others but also on its own merits, particularly over the long term. The favourable results for the deep geological repository derive largely from advantages realized over the long time period during which any management approach must perform. (pg.105)*

Finally, the Assessment Report sets out an implementation scenario "in the event that the Government of Canada agrees with and accepts the deep geological repository as the preferred technical approach."

Our intent in highlighting the Assessment Report is not to critique the report itself. We leave that to others with expertise in assessment and valuation methodologies. Our point is that a group of credible experts was established as an Assessment Team to select and apply an assessment methodology to the three disposal options without the benefit of any formal Inuit input other than ITK's participation in the Traditional Knowledge Workshop.

Discussion Document #2 then goes on to say that the Assessment Team "agreed that the geological repository would create the least adverse community impact. No significant long-term operations are required under a geological repository, making it likely that the facility would be largely forgotten in the long term. (emphasis added). From an Inuit perspective, this is a huge value judgment indicating an absence of sensitivity and understanding for how Inuit value their lands and environment.

Discussion Document #2 then acknowledges that ...

> *"While the importance of factoring in and addressing the concerns of Aboriginal peoples is recognized in general, and specifically concerning [community well-being], the Assessment Team did not feel capable of anticipating the perspectives of Aboriginal peoples. The perspective of Aboriginal peoples will need to be understood and brought into the assessment in regard to assessment the methods on community well-being, as well as on each of the other objectives identified in this assessment". (pg.64)*

The question remains: When and how?

ITK has worked very efficiently, given the shortened timeframe for the Inuit Dialogues. In conducting the Inuit-specific Dialogues, ITK is operating under the assumption that the results will be timely and able to influence adjustments to the framework developed by the Assessment Team. ITK seeks assurance from the NWMO that this will be the case. Otherwise, the commitment to involving Inuit will become a sidebar to decisions already taken.

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

"Determining the National Inuit-Specific Position"

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AGENDA AT A GLANCE

January 27, 2005

DAY ONE: OVERVIEW, PRESENTATIONS & PRIORITIES

MORNING –	INTRODUCTORY ROUNDTABLE; OVERVIEW AND PRESENTATIONS
AFTERNOON –	CONTINUED PRESENTATIONS; QUESTION PERIOD; GENERAL DISCUSSION; REVIEW OF DIALOGUE QUESTIONNAIRE

January 28, 2005

DAY TWO: PRESENTATIONS, DISCUSSION PERIOD, CONCLUSION OF THE REGIONAL DIALOGUE

MORNING -	DISCUSSION PERIOD
AFTERNOON -	DIALOGUE QUESTIONNAIRE; POSSIBLE RECOMMENDATIONS; KEY SUMMARIES

Location:

Municipal Building

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

"Determining the National Inuit-Specific Position"

DAY ONE: OVERVIEW, PRESENTATIONS & PRIORITIES

8:00-9:00 **Breakfast & Registration**

9:00-10:30 **Welcome & Introductions**
Introductions (names & organizations & role)
Expectations from dialogue (everyone)
Agenda Walk-Through, Facilitator –Soha Kneen (ITK)

10:30-12:00 **Update & General Information**
Inuit Tapiriit Kanatami opens the Dialogue
Focus on purpose & overarching theme, "Determining the National Inuit-Specific Position on the Long-Term Management of Nuclear Fuel Waste"

Soha Kneen - Presentation on the intent of the legislation, the reasons and objectives of the consultation

12:00-1:00 **Lunch Break**

1:00-5:30 **Presentations (Session #1)**

- **Nuclear Waste Management Organization – 2 hr.**
  Expert Presenter (Michael Krizanc)
- **External Presenter – 2 hrs.**
  Dr. Gordon Edwards/Dr. Robert DelTredici

question and answer sessions will follow after all presentations

5:30-6:00 Introduction of questionnaire & Daily wrap-up remarks

7:00 **Participant Dinner (Location: TBA)**

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

"Determining the National Inuit-Specific Position"

DAY TWO: PRESENTATIONS, DISCUSSION PERIOD, SUBMISSION OF DIALOGUE QUESTIONNAIRE

8:00-9:00	**Breakfast**
9:00-12:00	**Discussion of Options, Issues of Concern, General Questions**
12:00-1:00	**Lunch Break**
1:00-2:00	**Dialogue Questionnaire/Possible Recommendations**
2:00-2:30	**Key Su**
2:30-3:00	**Daily wrap-up remarks/Concluding remarks, farewells**

DRAFT

Regional Inuit-Specific Dialogue on the Long-Term Management of Nuclear Fuel Waste in Canada:

Determining the National Inuit-Specific Perspective

Kuujjuaq, Québec

January 27–28, 2005

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Day 1: January 27, 2005

Participants

Soha Kneen, National Coordinator of the Inuit-specific Dialogues on the Long-Term Management of Nuclear Fuel Waste, Inuit Tapiriit Kanatami (ITK)
PJ Akeeagok, Junior Researcher/Project Co-ordinator, Inuit Tapiriit Kanatami
Eli Angiyou, Member of Kativik Environmental Advisory Committee
Johnny Arnaituk, Vice-President, Nunavik Hunters, Fishers and Trappers Association
Michael Barrett, Kativik Regional Government Representative
Emily Emudluk, CAVAC Kuujjuaq
Jimmy Johannes, Secretary, Nunavik Hunters, Fishers and Trappers Association
Nathalie Girard, Biologist, Executive Secretary for the Kativik Environmental Advisory Committee
Michael Gordon, Mayor of Kuujjuaq
Vallee Gordon, ITK
Alec Gordon, Kuujjuaq CBC Radio
Michael Kwan, Research Scientist, Kativik Research Centre
Muncy Novalinga, Kativik Regional Government Representative
Adamie Padlayat, President, National Inuit Youth Council
Maggie Saunders, Kuujjuaq Municipal Councillor

Welcome and Introductions

Soha Kneen, National Coordinator of the Inuit-specific Dialogues on the Long-Term Management of Nuclear Fuel Waste, Inuit Tapiriit Kanatami (ITK), introduced herself. Kneen stated that this dialogue was intended to get the Nunavik Inuit perspective on the Long-Term Management of Nuclear Fuel Waste. Kneen asked participants to keep in mind the equally important national and regional perspectives and then invited introductions and expectations for the meeting.

One participant said his goal was to get more information on a potential regional environmental concern and his hope was that Inuit could have input. Other participants anticipated asking constructive questions, while gaining an understanding of the issue and providing recommendations.

Kneen explained that the purpose of the dialogue was to enable Inuit to have a voice on this national issue. "In no way is ITK saying that Nuclear Fuel Waste is coming to the North," she said. ITK aims to provide Inuit with a voice and to receive feedback from the regional representatives attending this meeting. "We don't know the outcome; there has been no final decision yet," she said. This meeting is meant to provide information on all aspects of the Long-Term Management of Nuclear Fuel Waste and to answer any questions.

Update and General Information: ITK Opens the Dialogue

Kneen said the *Nuclear Fuel Waste (NFW) Act* was, according to information provided by the Nuclear Waste Management Organization (NWMO), developed on the foundations of extensive consultations with the public and stakeholders between 1996 and 1998. In its response to the Seaborn Panel, the Government of Canada indicated that subsequent public dialogues must be appropriate to different value systems. The NWMO has been in discussion with ITK, the Assembly of First Nations, and the Métis National Organization since 1998 to conduct these dialogues.

In its negotiations with both NRCan and the NWMO, ITK underlined the importance of Inuit involvement in considering options for the Long-Term Management of Nuclear Fuel Waste and in the subsequent recommendations to the federal Minister of Natural Resources. ITK was successful in using a culturally appropriate process in previous Inuit dialogues on this issue. While Inuit will continue to oppose the storage and/or disposal of Nuclear Fuel Waste in their territory, Inuit should still be informed on this issue. Kneen noted the additional risks of transboundary contamination and possible transportation of Nuclear Fuel Waste through Inuit territories.

In response to a question about the number and locations of previous Inuit dialogues, Kneen stated that ITK held one session in Iqaluit in November 2004 and another in the Inuvialuit Settlement Area. The fourth dialogue will be held in Makkovik, Labrador. She elaborated on the reasons and objectives of the dialogues, including the encouragement of Inuit dialogue on the issue, the production of a series of reports leading to the final report, capacity development at the local level, and Inuit acquisition of knowledge on this issue. The scope of this dialogue focuses strictly on long-term Nuclear Fuel Waste storage and how Traditional Knowledge (IQ) may apply. Kneen noted that the Minister will be apprised of the Inuit opinions, Traditional Knowledge (IQ), and recommendations on this issue of waste that is produced in the South. Information has yet to be released about the site or sites of storage.

Nuclear Fuel Waste requires management because it "multiplies many times over," Kneen explained. Currently, Nuclear Fuel Waste is stored onsite where it is produced, in either wet or dry storage. The majority of Nuclear Fuel Waste is in Southern Ontario, with much smaller amounts at Chalk River and White Shell. Recalling her visit to the Pickering Nuclear Generating Station, Kneen described large dry storage containers and a facility that appeared safe and well-maintained. In response to a question, Kneen said the dry storage containers were steel-reinforced concrete vessels that were filled with Nuclear Fuel Waste and then welded shut. She suggested experts at this dialogue could better answer technical questions.

Kneen noted the complex nature of long-term storage. Nuclear Fuel Waste can only be held in dry storage after it spends seven to ten years in wet storage, making it unlikely that there could only be one storage site, especially when waste continues to be produced.

One participant asked if water in wet storage pools becomes radioactive and if it

evaporates. "Wouldn't there be a risk of contaminating the air?" he asked. Kneen said the water is in an internal continuous cycle within a completely sealed compression chamber. She added that the experts attending the dialogue could provide further information.

Kneen offered more details on the amount of Nuclear Fuel Waste in Canada. Ontario Power Generation produces 90% of Nuclear Fuel Waste in Canada, New Brunswick Power and Hydro-Québec each produce 4%, and other sources produce considerably less. In 2002, there were 1.7 million bundles of accumulated Nuclear Fuel Waste in Canada—enough to fill three hockey rinks in their entirety. At current levels of power production, this amount will double by 2033. One participant said it is important to understand who produces the waste.

Kneen stated that while nuclear reactors are not currently located in or close to Inuit communities, it is possible that nearby territories may be chosen for deep geological burial. She further elaborated on this by stating that the Labrador Inuit Association is opposed to storage and disposal of Nuclear Fuel Waste in its territory and adjacent territories. "We must also consider communities that may be along transportation routes," Kneen advised.

Kneen outlined the methods of Nuclear Fuel Waste disposal and storage under consideration by the NWMO: deep geological disposal in the Canadian Shield, storage at the reactor site, and centralized storage (either above or below ground).

Deep geological disposal is intended to isolate Nuclear Fuel Waste from humanity and the environment and is attractive to those who want to be able to retrieve the waste if scientists discover a way to safely eliminate or reuse it. However deep geological disposal involves risky transportation and the initial years of wet and then dry storage.

One member of the group characterized this explanation as contradictory messages. How can there be assurance of permanent disposal amidst a discussion of possible retrieval of the waste? Geological burial involves many risks, including that of transportation.

Kneen responded by stating that although the NWMO has predictive models that take into account repository depth, location, and even significant geological change, there is no concrete proof of safety. Permanent disposal does, at this point, not seem to be favoured. "Most countries are considering a staged Nuclear Fuel Waste management approach that would allow the waste to still be retrieved," she explained.

A participant asked if anyone had died from working at nuclear power generation facilities in Canada. Kneen said she did not have data to answer the question. She did, however, doubt that anyone had died given the safety measures evident at the nuclear reactor sites.

Another group member asked if there were any Canadian subsidiaries of international companies involved in this issue. Kneen said the power generation companies were Canadian and added that the NWMO representative could better speak to these concerns.

She apologized for her lack of scientific expertise in some areas, but encouraged all present to ask any questions they may have of the expert presenters that were to present later on in the afternoon.

Kneen continued by providing a brief overview of the second option under consideration, centralized storage. Above- or below-ground centralized storage is more expensive than deep geological burial because dry storage containers must be replaced every 50 years. One group member wondered if there were contamination issues associated with dry storage container replacement.

Kneen noted that shallow underground burial provides a degree of security from terrorism while still allowing access. A participant asked if the nuclear reactor sites were well-fortified or if security was lax. Kneen replied that facilities were very secure and that unauthorized entry would be difficult. Finishing her summary, Kneen said centralized storage does involve transportation and needed expertise and technology would be available onsite.

Kneen provided information on the third option being considered by the NWMO, reactor-site extended storage. Dialogue participants in the Inuvialuit Settlement Region said they would select this option if required, although their preference was not to choose at all. The CLAB facility in Sweden uses a centralized storage facility, storing Nuclear Fuel Waste in water 30 metres underground. France is also looking at long-term, interim storage options. One participant asked how a management option could be long-term and interim at the same time. Kneen agreed that this was contradictory and recommended that this question of "retrievable storage" be explored with the experts in the afternoon.

One participant asked if a community could intervene if chosen for Nuclear Fuel Waste storage or disposal. Kneen said it is not known if a site has been chosen, but stated that mechanisms to allow for community input would hopefully be implemented when the site selection process was completed. She further invited all present to ask this question of the NWMO presenter later on in the day.

Another participant asked if the NWMO was contemplating the transport of Nuclear Fuel Waste in the North. Kneen said this decision has yet to be made and will depend, in part, on the outcome of the national dialogues. If there is a national consensus to keep the waste at the site of the reactors, then transport will not be an issue. "If you have issues with the transport of Nuclear Fuel Waste, then you should voice them," she urged.

"They will most likely want to store it up North," a participant interjected. Kneen said deep geological burial depends on the conditions of the rock formation. First Nations are worried since the Canadian Shield in their territory may be deemed appropriate for deep geological burial. Kneen encouraged the participants to put these concerns in the recommendations while also maintaining a Canadian focus.

"There is absolutely no benefit to Nunavik from nuclear power generation. Only risks are generated. We don't use that energy," said one participant. Kneen agreed and asked

participants to bring their questions and points to the experts in the afternoon and to the draft recommendations on the following day.

Participants discussed the funding required for deep geological burial and continued environmental monitoring.

Kneen finished her presentation with a summary of the limitations of the deep geological burial approach. "Advance proof of such a system is not possible," she said. And yet deep geological burial remains the favoured approach.

Discussion and Concerns

"We live on the top part of the planet," said one participant. He expressed concern for fellow Inuit on the Russian coastline exposed to contamination from abandoned and deteriorating nuclear-powered submarines. Has this contamination spread along the Northern coastline? Kneen agreed that this is a huge concern and said Dr. Gordon Edwards might have information on this topic. The same participant asked if ITK was aware of this environmental issue. Kneen stated that ITK was aware of this issue, but also stated that she would look into this issue further and forward any available information.

A group member noted that the Northern Contaminants Program looks at radionuclear and other forms of pollution. Monitoring has indicated that the Russian nuclear submarine situation has remained regional. "Long-range transport of this pollution is not significant," he said.

In response to a question about beluga contamination from this radioactive source, the group member said belugas are far less radioactive than the animals in the region. Regional concern is focused on levels of organochlorine and other toxic compounds found in the whales.

Kneen agreed to include in the report the suggestion that ITK and the Inuit Circumpolar Conference address the problem of Russian nuclear submarines.

"The first and foremost recommendation is the rejection of Nuclear Fuel Waste coming to our territory," a group member stated. Inuit want to protect their health and well-being. Kneen acknowledged this perspective, reminding the group to also think about this issue from a Canadian perspective. What would be the best management approach?

Another participant said no community wants Nuclear Fuel Waste at its doorstep. "If you benefit from it, then you should pay the price. There is no reason that we should take it." Kneen suggested this point could go into the preamble if that is what the participants of this dialogue wished to do.

When asked about the wording of one of the paragraphs in her presentation, Kneen

explained that there is no guarantee that Nuclear Fuel Waste will not travel through or be stored on Inuit territory. The Canadian Shield does go into Inuit territory. "You said 'not over your dead body' is the waste going to the North," Kneen commented. The expression of this position effectively rules out Inuit support for deep geological burial.

One group member said decision-makers may choose the North for disposal because it is less populated. Another participant wondered if Nuclear Fuel Waste had already been dumped in the North. Kneen stated that there is no definitive answer on those questions and therefore it is important to have Nunavik's voice and its opposition to the disposal/storage of Nuclear Fuel Waste in the report to be submitted on November 15, 2005.

Presentations

Nuclear Waste Management Organization

Michael Krizanc, Communications Manager, NWMO, began his presentation with a 17-minute video, the second produced by the NWMO. This video provided an overview of the issue, the proposed approaches, and the methods used by the NWMO in comparing and assessing the options.

Following the video, Krizanc gave a PowerPoint presentation, explaining that there are 22 nuclear reactors in Canada, five of which are currently in extended shut-down mode. One of the closed reactors in Pickering, Ontario is coming back into production, and two at the Bruce facility may be returning. He stated that an environmental assessment is underway at Gentilly, Québec, and a government decision will be made on whether to refurbish the reactor. The New Brunswick government will soon decide the future of the Point Lepreau plant. Atomic Energy of Canada Ltd. currently stores used fuel in Manitoba, Ontario, and Québec. Small amounts of used nuclear fuel are also stored at universities across the country.

The used fuel is contained in 1.8 million bundles at seven sites—Pinawa, Chalk River, Bruce, Pickering, Darlington, Gentilly, and Lepreau—as well as the small amounts at universities. The supply amounts to 60,000 tonnes and is half of the eventual total that will be amassed in the lives of the current nuclear reactors. Most of the waste is in Ontario. The first stage—wet storage—lasts seven to 10 years and is followed by a period of dry storage. The dry storage units are designed to last 50 years, although engineers say they could last up to 100 years.

A bundle is about the size of a fire log. It is used in the reactor for 12 to 18 months and during that time, produces power that would supply a household for 100 years.

Krizanc displayed photographs of storage pools and dry storage casks. He described outdoor concrete dry storage silos that are made of reinforced high density concrete, with steel liners and outer shells. Dry-storage silos house four modules, each containing 80

bundles. When full, they are filled with helium and welded shut.

The NFW Act of 2002 required the establishment of the NWMO and its advisory council, whose chair is David Crombie. The NWMO budget—provided by the nuclear industry on the polluter-pay principle—was initially $550 million and has been increased by $110 million each year since, for a total of $770 million by December 2003. The NWMO study must have a financial formula in its recommendations and is required to study three options but may also consider others. The NWMO report is due by November 15, 2005. The federal government must make the final decision based on the approaches studied by the NWMO.

The mission of the NWMO is to develop collaboratively with Canadians a socially acceptable, technically sound, environmentally responsible, and economically feasible management approach for the long-term care of Canada's used nuclear fuel.

The NWMO's recommended management approach must include more than a technical method. It must include an overarching management system with components such as governance, financial surety, monitoring and reporting, a public participation mechanism, dispute management, and research and development. It must also include an implementation strategy.

Krizanc outlined the NWMO milestones since its inception. In its conversations with approximately 300 Canadians, the NWMO heard that Canadians want an iterative approach with regular reports. As a result, the study has been divided into four sections. The NWMO produced its first discussion document in November 2003 outlining 10 key questions concerning the following:

- Institutions and governance
- Full public engagement and participation in decision-making
- Aboriginal values
- Ethical considerations
- Synthesis and continuous learning
- Human health, safety, and well-being
- Security
- Environmental integrity
- Economic viability
- Technical adequacy

The second discussion document was released in the summer of 2004. The third will be the draft report, to be released in the spring of 2005. And the last stage will be the release of the final report in November 2005.

The NWMO's second discussion document moves toward a framework for assessment of the options. Through the values derived from the citizen dialogues, an ethics panel, and information assembled from experts, the NWMO identified eight objectives for an acceptable management approach. Each of the storage options was scored against these

eight objectives:

- Fairness
- Public health and safety
- Worker health and safety
- Community well-being
- Security
- Environmental integrity
- Economic viability
- Adaptability

Krizanc gave a brief overview of the three technological methods of managing Nuclear Fuel Waste, and their advantages and limitations. Storage at the current nuclear sites would eliminate the transportation element, but would require multiple administrations. Also, this option would not be particularly fair to the affected communities, who did not sign on to permanent involvement with nuclear waste. Deep geological storage, where nuclear waste would be encapsulated in rooms 500 to 1000 meters below ground, has been researched extensively—over $700 million has been spent on it.

Noting that the Canadian Shield encompasses Nunavik, a participant asked which area of the Shield is being considered. Krizanc responded that the study will not propose sites, just a management approach. The selection of a site can only occur after a method is chosen. Site selection will probably not be final for approximately 30 years after the method is chosen. While the legislation's description of deep geologic disposal is not limited to the Canadian Shield, the current process is not a site selection exercise.

The participant stated that he hoped the objective of fairness would be applied. Krizanc responded that involvement of citizens is very important. The DAD (decide, announce, and defend) process is no longer acceptable.

Asked what would happen if the community near a chosen site were to object, Krizanc said an increasingly important principle is a willing host community. "It would be reasonable to insist that this be part of the siting principle," he said.

Asked if the community would be paid for storing the waste, Krizanc said the issue would need to be discussed. There may be jobs associated with storage of Nuclear Fuel Waste, and at some point, Nuclear Fuel Waste may be considered a valuable resource. Alternatively, Nuclear Fuel Waste may cause damage, which would lever compensation. Krizanc referred to a different but illustrative issue, the talk of financial arrangement for Kincardine, Ontario, with the re-establishment of the Bruce nuclear reactor. He noted that some people have another name for this kind of financial arrangement—a bribe. One other aspect for consideration is that there must be agreement between the owner of material and the community if a material is to be moved. However, the current report will not go that far.

Returning to his presentation, Krizanc said the remaining milestones are the draft report

in the spring of 2005 and the final report by November 15, 2005. The final report will be made public at the same time it is delivered to the Minister of Natural Resources. The comments of the NWMO's advisory council will also be made public at that time. Since the owners of the Nuclear Fuel Waste are paying for the process and comprise the board of directors, an independent advisory council was established to balance and oversee the NWMO's work. The independent advisory council is providing ongoing comments and will make a final comment on whether the NWMO has done its job. The notes from this council's meetings are available regularly on the NWMO's website.

Krizanc said the NWMO is looking for ITK's thoughts on what to recommend to the government concerning the process, the three methods, the encompassing management system, the criteria to assess the options, and on who should have what responsibility.

Asked what the NWMO expects from the Minister of Natural Resources, Krizanc said that if the NWMO does not report on time, it will be fined $100,000 a day. However, it cannot give the government the same fine if it does not respond within a certain timeframe. Minority governments, changes of government, and perspectives of particular ministers will all affect the response of the government. Nuclear Fuel Waste must become an issue for the vast majority of Canadians to ensure the government will respond in a timely manner.

Asked how long Nuclear Fuel Waste remains dangerous, Krizanc said he did not know but that it would be many tens of thousands of years—"longer than recorded history." Kneen said the half-life is 710,000 years.

Krizanc added that it is difficult to answer questions about risk because of the diversity of views. The NWMO's work on the issue of risk includes an upcoming conference. "I am not here as an advocate for the nuclear companies," he said. "I know the benefits of nuclear and the seriousness of the waste issue."

A participant stated that it is difficult to select a method when there is little concrete information and disagreement about the information that does exist. Krizanc replied that the Seaborn Panel (officially called the *Nuclear Fuel Waste Management and Disposal Concept Environmental Assessment Panel*, it reported to the Government of Canada in 1998) concluded that deep geological disposal is feasible but that it is not necessarily socially acceptable. There is always uncertainty with something that has never been done before.

Responding to a comment that transportation is risky, Krizanc said nuclear material and other dangerous substances are transported frequently. The risk is not from the containers, but from traffic accidents.

A participant said it is common sense that to minimize transportation minimizes risk. As a result, onsite storage makes sense. With regard to fairness, the North does not benefit from nuclear power and should not have to store the waste. Krizanc replied that it would be costly to transport material as far as Nunavik. The participant reiterated that the

benefit from nuclear power is all in the South. Krizanc agreed and added that communities on transportation routes would be included in the risk. He pointed out that British Columbia, Alberta, and Newfoundland also do not use nuclear energy.

Another participant commented that when containers are decommissioned after 50 years they become waste too. Krizanc agreed, adding that decommissioned nuclear plants become waste, but this kind of waste is not as dangerous as fuel waste. He said he had stood close to Pickering's decommissioned reactor and assured participants that these materials can be cleaned.

A participant offered some advice: the NWMO should carry its commitment to fairness, justice, openness, and transparency to the end. Krizanc replied that it is important for people to talk about what kinds of structures should be in place to ensure these principles are implemented. "A totalitarian government could overthrow the whole thing," he said. A government can only act to the extent that citizens demand.

Speaking of balancing benefit and risk, a participant said communities should know what they are getting into. There is still a lot of uncertainty in the science. The most likely method—deep geological disposal—has never been tried before. Krizanc said that even the Egyptian pyramids have lasted for a fraction of the life of used nuclear fuel bundles.

A participant enquired about the health of the nuclear workers in the photographs in Krizanc's presentation. Krizanc said the health of nuclear workers is better than that of the average Canadian, but reminded the group that these workers are well paid and have health plans.

Asked if homes are close to the existing nuclear plants, Krizanc said the Bruce and New Brunswick plants are in remote areas while the Pickering and Darlington plants are in built-up areas, but within an industrial area.

Returning to the previous discussion of the health of nuclear workers, a participant added that even though all Canadians are exposed to some level of radiation, exposures are cumulative and there is no minimum safe level. Krizanc referred participants to a paper on the NWMO website from a physicist who argues that some radiation is good for humans and serves as an inoculation to further exposure. Krizanc clarified that he does not advocate this position.

Canadian Coalition for Nuclear Responsibility/Atomic Photographers Guild

Dr. Robert Del Tredici told participants that the effects of radiation and other invisible phenomenon are in reality highly visible. "No technology casts a deeper shadow than nuclear technology," he said, noting that it is time for transparency on the issue.

Dr. Gordon Edwards indicated that he and his colleague were present to explain this

complicated technology in words that make sense.

Edwards suggested the first question participants should ask is: "Why are they coming to ask for our opinion?" One answer could be that government and industry do not know what to do with Nuclear Fuel Waste. Edwards said he had been very interested in nuclear technology when he first graduated. Given its reputation as a "clean" source of energy, he had been shocked to learn that nuclear energy produced radioactive waste. He asked why it has taken 30 years to start asking questions about Nuclear Fuel Waste management. "Why are Canadians being consulted now and not back then?" he asked.

Showing slides of enormous cement silos, the presenters described the process of containing spent nuclear fuel bundles. "Once these bundles come out of the reactor, they are lethal and can kill someone in 20 seconds," said Del Tredici. Edwards underlined the danger of Nuclear Fuel Waste by relating the difficulty of maintenance work on the reactors. "At Pickering, some reactors have been shut down for seven years, both because of thousands of maintenance problems and the limited time workers can spend in the reactor," he said.

Del Tredici described the uranium atom—the basic fuel for the fuel bundles—and pointed out its heavy nucleus. As this nucleus is bombarded, it splits and releases energy. When this process is repeated on millions of uranium atoms, a huge flux of energy is produced, resulting in either an explosion (a nuclear bomb) or the production of energy.

One of Del Tredici's pictures showed a Russian monument dedicated to the splitting of the atom and the "father" of atomic energy. "This split results in new entities—literally the fall-out," he said. Edwards noted that the term "fall-out" is used after a nuclear explosion but not for the process contained in a nuclear reactor even though the material is the same. It is essential that Nuclear Fuel Waste be kept safe and monitored at all times. Atom splitting results in at least 211 fission products, which are different every time. "These fission products are the waste," he said. Del Tredici added that fall-out is still "coming down" from nuclear testing done by the United States, China, and Britain. "The fall-out of that testing is considered part of the natural background radiation," Edwards explained.

The speakers turned to the human toll from radiation exposure. An American marine, who was exposed at close range to an underwater nuclear explosion, suffered from multiple cancers. Only after his death did the lawsuits he had repeatedly launched while alive succeed in modest compensation for his wife.

Edwards explained that exposure to low levels of radiation may take years to manifest. While some body cells will be immediately killed, others will be permanently damaged and perhaps lead to cancers and blood disease. In children, low levels of radiation exposure have been linked to mental retardation. "Some say some radiation is good for you but all scientific evidence points to the probable fact that there is no safe level," Edwards said. However, the effects of radiation are difficult to prove without extremely expensive studies of an entire population.

Del Tredici said high rates of tumours, stillbirths, and other serious health problems in St. George, Utah were linked to the Nevada nuclear bomb test site, yet the suit against the United States government was overturned and no compensation was paid. Edwards underlined the common element in these cases: the government told the population not to worry. The problem, Edwards restated, is the time delay of up to 20 years. "Workers feel fine on the job but once they retire, health problems appear," he said.

Canada is the biggest exporter of uranium and prior to the 1960s all of it went to the United States bomb program. "Here is the problem with the transparency of the nuclear industry," Edwards said. There is no clear history of Canada's nuclear involvement and the nuclear industry that could provide answers to such questions has failed to do so. "Did they know of the dangers and go ahead anyway?" Edwards asked. The Canadian Coalition for Nuclear Responsibility knows the answer to this question but the NWMO does not address these points.

Switching the focus to uranium mining, Edwards recounted the tragedy of the Dene mine workers at Port Radium who carried burlap sacks of crushed uranium ore on their backs, unknowingly breathing in radioactive particles. Deline, on the shores of Great Bear Lake (Sahtu), otherwise known as the "Village of Widows," lost many of its men to cancers as a result. The mine workers were not told two key things: handling the crushed ore would be dangerous to their health and the uranium would be used to create bombs. The relationship between the nuclear industry and the military has led to the mystery and secrecy that still abound even though the dangers of radiation have been known since as early as 1931. The dangers to human health were relayed to government workers who assayed the uranium ore but not to the Dene miners.

Although alpha radiation is a very weak form of radiation easily stopped by a sheet of paper, its inhalation can seriously damage lung tissue cells. Referencing a picture of a radiograph, Edwards noted the pulses of radiation that are given off in affected lung tissue. Even though only a small number of cells are damaged, it is sufficient for the onset of cancer. In the U.S., the Surgeon General has identified home radiation (from radon) as the second most important cause of lung cancer. Edwards noted that the nuclear industry sometimes uses the argument of background radiation for justification to double exposure. "While it's true that it's natural, it doesn't mean you should add to the risk," he said.

Uranium mine tailings present another serious environmental and health concern. Although the original ore is gone, the same amount of radiation remains and is generally uncontained. This has been acknowledged by industry and a government committee that studied the issue, recommending that uranium mining be halted until a solution is found for high level wastes. Edwards noted that while radioactive tailings have not nearly been given the same attention as high level waste, it remains a serious concern for its ease of entering the food chain. "Why is the NWMO not dealing with all types of waste?" he asked.

In a subsequent overview of Canada's inventory of radioactive waste, Del Tredici and Edwards wondered why discussions of Nuclear Fuel Waste management have not included the notion of stopping its production.

Edwards then turned to the options for Nuclear Fuel Waste management under discussion. He noted the difficulty of safeguarding dry storage containers in the context of radioactive half lives of thousands of years. "We have never safely disposed of anything," he said. Even if an underground Nuclear Fuel Waste repository was built, complete with signs warning of the health and environmental dangers, there is no guarantee that the language would still be understood in a thousand or ten thousand years. The fundamental question remains: Why are we producing this stuff? "It's a very complicated and dangerous way to boil water for the steam, which turns the turbines that produce electricity," said Del Tredici.

Reactors are intended to operate for approximately 30 years. The high maintenance and renovation price tag begs the question: Are they worth refurbishing? Renovations are costly because of the radiation danger and unexpected problem, with renovations to Pickering Unit Four costing $1.4 billion. Despite the costs, the great attraction to nuclear production persists. Where else can one find such a tremendous concentration of energy in such a small pellet? Nuclear energy sounds like a good idea, so clean and well-safeguarded, but problem arise from its usage. "You have accepted an eternal commitment to look after the waste," Edwards said. The nuclear industry has failed in its responsibility to inform the public by perceiving major technical problems as a public relations problem.

The contamination of the food chain in Lappland from the fall-out of the Chernobyl plant disaster has shown that long-range transport is a serious concern. This release is more important than the original explosion. In reply to a question about the monitoring of the Chernobyl reactor site, Edwards indicated that a sarcophagus protects the melted core. International financial aid is being sought to maintain this protective structure.

Displaying a picture of wet storage, Edwards indicated that 14 feet of water is needed to cool the radioactive bundles. "The heat generated by the spent fuel bundles needs to escape; if the waste was sealed it would be very dangerous," he explained. Dry storage containers are necessarily large because the walls have to be thick enough to contain the radioactivity. Del Tredici noted that similar dry storage containers would be used for centralized storage. "Would this really be a simplification?" he asked.

The third option, underground storage, has problems as well. Del Tredici referred to a test shaft in Manitoba that runs one-quarter of a mile into ancient granite. No one can predict what would happen if Nuclear Fuel Waste was stored in rock containing millions of hairline fractures created by drilling the shaft. The concern is with the fracture zones. Furthermore, there is no doubt that such shafts would fill with water, which would then seep into fracture zones. "How can you restore the original integrity of the rock?" Edwards asked. There is no guarantee that this management option would work, and failure would be disastrous.

Reprocessing uranium brings its own dangers. Del Tredici noted that the amount of waste produced from reprocessing multiplies with the use of corrosive acids. The extracted plutonium is useful for only one thing: nuclear weapons production. Edwards suggested that plutonium is the reason countries want nuclear reactors. Canada's gift of a nuclear reactor to India was never used to generate electricity but was used to produce India's first nuclear bomb.

Edwards noted that the Government of Canada has never passed a law forbidding uranium reprocessing. "They have always kept that door open," he said. The suggestion that Nuclear Fuel Waste is a valuable resource can only refer to its capacity to be reprocessed into plutonium. The very fact that plutonium gives off alpha radiation while still being relatively safe to handle creates a significant safety issue.

Del Tredici showed a picture of the Hanford nuclear reprocessing storage site in the United States. Millions of gallons of contaminated acid have leaked into the ground causing serious environmental problems. It is immensely difficult to manage this reprocessing waste and the plutonium produced.

A community that accepted Nuclear Fuel Waste in an underground repository or centralized storage would be faced with the possibility of future reprocessing for plutonium and further environmental and security problems. "Shouldn't this be more overtly on the table?" asked Edwards.

Reprocessing of uranium has left its mark in Russia, said Del Tredici. For many years, radioactive liquid waste was dumped directly into a river upstream from Tartar villages. "They have been living with it unknowingly and now that they know about the contamination there is little they can do about it," he said.

Edwards noted that the uncertainty of underground storage is the very problem. "The evidence will come when it's too late," he said.

The question of whether or not it is responsible to store Nuclear Fuel Waste in an irretrievable process remains controversial. "It is arrogant to think that we have a solution and can determine Nuclear Fuel Waste management for future generations," Edwards said. There is no perfect solution and, furthermore, there is no known solution. "We are being asked to choose one of three management options. Are these the only options?" asked Edwards.

Del Tredici showed a photo of the Hiroshima peace bell to suggest that Canadians should not simply be accepting this situation. There is at least one more option: stopping the production of Nuclear Fuel Waste in the first place. Only then can Canadians talk about securely storing the waste.

Edwards contrasted this dialogue process with Sweden's national debate on the issue. The Swedish government provided money to different citizen's groups to educate

themselves on the Nuclear Fuel Waste issue. A subsequent referendum determined that nuclear power should be phased out. Similarly, Germany and Belgium are phasing out their nuclear reactors. The question of nuclear reactor phase-out in Canada clearly is not on the table and is not part of the NWMO's mandate. Edwards suggested the Government of Canada and the nuclear industry are determined to continue with nuclear power production.

Edwards questioned the validity of the three options being presented to Canadians. Onsite storage is not a long-term solution if Nuclear Fuel Waste is going to be produced indefinitely. Furthermore, all nuclear reactor sites are located near bodies of water, with the potential for serious environmental problems. Despite sounding like it implies one storage site for the country, centralized storage would actually involve at least eight sites—one centralized location plus the seven current and any new reactor sites. Another important question is if Canada's trade in nuclear reactors opens up the possibility of importing nuclear fuel waste.

Edwards suggested that any option Canadians choose will be interpreted as an endorsement to continue with nuclear production. "I believe that, eventually, they want to put Nuclear Fuel Waste underground and that the other options are just phases in that direction," said Edwards. The one positive thing about this dialoguing process is that for the first time people are hearing about Nuclear Fuel Waste and are being asked for their opinion. The NWMO has done a much better job of presenting the information than has the nuclear industry in the past.

In closing, Edwards clarified an earlier comment on the Seaborn Panel. Contrary to the claim that the Seaborn Panel said Nuclear Fuel Waste management options are safe but not publicly acceptable, the Panel said broad public support is required and safety is only one part of acceptability. Technical acceptability goes in hand with societal acceptability.

Discussion

One participant asked if there were any engineers working on Nuclear Fuel Waste management in the North. Edwards replied that while there was brief consideration of storing the waste in Antarctica, there is no serious research in this area.

Another group member wondered if there were any American industries interested in finding a management solution. Del Tredici indicated that the U.S. Department of Energy and the Government of Japan both contributed financially to the Manitoba test shaft. "Everyone has an interest in this," he said. Many countries need to deal with the problem of Nuclear Fuel Waste but there is little that science can do because of the lack of predictive models for radioactivity decay. Edwards noted that an inquiry into the safety of Nuclear Fuel Waste storage in California concluded that there was no acceptable means of dealing with the waste and was doubtful there that ever would be any. "Claims about safety are based more on engineering euphoria than on scientific evidence," he said.

"The Government of Canada and the nuclear industry are eager for this process to be concluded so they can get on with it," Edwards concluded. Why else would the Canadian Government forbid the NWMO to ask the question of stopping nuclear power generation?

Day 2: January 28, 2005

Discussion of options, issues of concern, general questions

Kneen announced that the morning session would start with a question and answer session with Krizanc, Edwards, and Del Tredici. Following a mid-morning break, there would be a recommendations session, for participants only.

A participant asked whether there had been any deaths of employees on Canadian nuclear sites. Edwards responded that radiation is carefully measured and workers only exposed to permissible levels. However, even this can lead to deaths. Over the years, invisible accumulations can develop into cancer. Approximately 10 years ago, two employees at Atomic Energy of Canada Limited (AECL) died of cancer and their widows asked for compensation. It was proven that recommended levels were never exceeded, but even AECL believed the cancer was probably caused by radiation on the job. This is something that no one can prove.

Edwards told the story of Bjarnie Paulson, who came to the Canadian Coalition for Nuclear Responsibility (CCNR) with cancer all over his body. He had undergone more than 100 surgeries for it. He had done some work on a cleanup operation at Chalk River in 1958, after a fuel bundle had broken on removal from the reactor. A fire resulted, filling the building with radioactive smoke. Six hundred young military personnel were brought in to help with the cleanup. Medical experts agree that Paulson's condition looks like radiation damage. He went to court seven times and eventually the court determined that he demonstrated beyond a reasonable doubt that his condition was caused by his exposure to radiation at Chalk River. Throughout the process, no one in the nuclear industry was interested in Paulson. It is possible that he continued to be contaminated from particles that were left on his body and in his hair follicles when he removed his protective clothing.

Edwards noted that thousands of people have been killed from working in uranium mines. Workers there have two to four times the incidence of cancer as the average population, caused by the cumulative effect of small amounts of radiation year after year.

A participant expressed concern about leakage of contaminants into the environment and the food chain, and its effect on humans as it is taken into their systems. People get a false sense of security if they are not directly exposed. Edwards agreed, saying that the NWMO document *Assessing the Options* notes that alpha radiation can be stopped by a sheet of paper but does not say that it is 20 times more damaging than gamma radiation when inside the body.

A participant commented that the key is getting information to the public. Edwards handed out the Canada Department of Mines 1931 *Precautions for workers in the treating of radium ores.* It described the internal hazards of long-term ingestion of small amounts of radioactive material. This means alpha radiation. When radiation gets into the

food system it becomes internal radiation.

Del Tredici returned to the question of whether Canadian nuclear workers have died. He said that using death as the unit of measurement asks the wrong question. Radiation damages the immune system, causing a variety of illnesses not related to exposure. Even before the development of cancer, there are many compromises to health. However, this is difficult to prove.

Edwards referred to a document not provided in the NWMO information kit, containing excerpts from government reports about high-level radiation waste. According to this document, people can die from being close to Nuclear Fuel Waste within the first 500 years of its existence. From 500 to 1000 years, the external hazard is almost gone, but what is left is toxic, because of alpha radiation. People in the nuclear industry agree that alpha radiation is a potential cause of millions of cancers if released into the environment. Alpha radiation is not traceable. Many people say that nuclear is a good source of energy and is worth the risk. Others say Canada should discontinue production and that none of the options make sense. With the NWMO saying that the waste will double, Canadians should ask if this is inevitable.

Krizanc said the NWMO and the legislation do not ask Canadians to address that question, but he is hearing that people want the discussion. However, the waste already exists and the question is what to do with it. Discussion is underway on whether to continue at Gentilly, Point Lepreau, and Pickering, and governments and policy-makers need to hear people's points of view. The Government of Canada appears to favour nuclear energy, but it does not deliver energy—the provinces do. There are also opportunities to express an opinion when the plants' licences are renewed. Returning to the original question, Krizanc said there has never been a death attributed directly to radiation exposure in plants. Two of the most serious incidents in the Canadian nuclear program occurred in 1952 and 1958—both in Chalk River, Ontario. The 1958 accident was the biggest black mark on the Canadian nuclear program.

Del Tredici pointed out that Jimmy Carter, who was at that time a member of the U.S. Corps of Engineers, was present for a cleanup in 1952—and he is still living.

A participant commented that any nuclear accident would make sensational news. Industrial accidents are not uncommon.

Krizanc stated that, while he generally does not raise this point, news from China discloses 7000 deaths a year in its coal mining industry. All forms of energy have impact—for example, land must be flooded to construct dams for hydroelectricity.

A participant said he worries about the population's accumulated exposure to low doses of radiation over a long period of time.

Edwards said there is a difference between nuclear accidents and other industrial accidents. Nuclear accidents produce very long-lasting repercussions, such as the large

areas of uninhabitable land near Chernobyl. He invited participants to consider the area that would be uninhabitable around Halifax if the 1917 explosion had been nuclear. The problem goes well beyond how many people are killed at the time.

A participant said it does not take a major accident to cause death. It would not be possible to clean up any leakage from deep geological disposal.

Edwards said the Seaborn Panel recommended an independent commission be established, not one run by the nuclear industry. He said Krizanc works for people committed to nuclear power. The 1978 report of the Royal Commission on Electrical Power Planning recommended an industry agency, but it is questionable whether this process can be fair and objective. He said he suspects that the first priority of the nuclear industry is not the health and safety of people, but rather that of the industry. He said he does agree that the polluter should pay.

Krizanc said the directors of the NWMO are representatives of the nuclear industry—they approve budgets and pay the bills, and have a right to a seat at the table. However, an independent advisory council comments on the NWMO's day-to-day work. Further, the NWMO will report to the Government of Canada, not industry.

Questioned by Del Tredici, Krizanc said a vote in Parliament would be necessary to enact any legislation resulting from the NWMO report. Edwards said the Government of Canada has been lobbied repeatedly to ask the people whether they want nuclear power, but it is not interested. It told the Seaborn Panel not to ask that question and promised a parallel set of hearings into whether or not Canadians want nuclear energy. When the government broke that promise, Blair Seaborn had to apologize to Canadians. Edwards asked how the government can represent the people when the nuclear question has not been asked. He said he worries that any choice among the disposal options will be interpreted as consent to nuclear power.

A participant commented that the previous spring his organization had indicated it was not interested in consultations that sounded like approval of nuclear power. He said he could not understand why there is still a nuclear reactor in Québec. Even though his organization has seen the damage from hydroelectric power in Québec, it still thinks there is no place in Québec or Canada for nuclear. Commenting on others' remarks that nuclear is not used in the North, making the question of waste inappropriate, he said that Northerners produce other waste—they are not good at conserving electricity. However, Northerners are not at all in favour of nuclear energy. Nonetheless, he congratulated the experts on the level and organization of their presentations.

A participant said that, as an Inuk, he finds the information scary. History tells Inuit that people holding power are not always fair and are sometimes arrogant and ignorant. It sounds as though people who hold the cards are using the government for their own benefit, and expanding that power through the current consultations. He recommended saying "None of the above," rather than choosing one of the presented options.

Edwards told participants of two opportunities for Québec citizens to express opinions on nuclear energy. Environmental hearings are being held over the expansion of waste sites at Gentilly II. The report is due in March, but it is not too late to send a letter. Other hearings are being held in Québec City with regard to Québec energy policy. CCNR has sent a brief to those hearings and any Québec citizen can have input. He offered to send Kneen the appropriate address. Politicians are elected by the people, but are usually advised by the industry on energy matters. Krizanc agreed that citizens have a responsibility to make their voices heard in these fora.

Asked the implications for the NWMO if Canadians voted for "none of the above," Krizanc said the NWMO will give the report to the Minister and will probably also appear before a Parliamentary Committee. In fact, all Parliamentarians will be on the NWMO mailing list.

A participant asked that more information be brought to communities on nuclear issues. Citizens should be aware. Krizanc promised to leave the DVD presentation and send more copies. In response to a request to have it translated, he said translated information is included in the paper version.

Edwards noted that CCNR's thanks for participation must go to ITK and not the NWMO because they were not invited to sessions in the South. Sessions in the South resulted in opinions from people who had not been fully informed. While the nuclear industry has a right to express its point of view, it is important to give Canadians a rounded picture.

"The nuclear industry is not here," responded Krizanc. "This is an ITK dialogue, not an NWMO dialogue." The 35 dialogues in Canada were well advertised—everyone was invited to attend.

Asked if people's response of "none of the above" was reflected in the NWMO documents, Krizanc replied that this is not what he said. There were many different advocates, and people in many communities said there should be a discussion about the future of nuclear energy.

Kneen suggested that it should be an issue for the NWMO report that it has no mandate to discuss the future of the nuclear industry. Krizanc responded that this fact is not hidden. There is information on the NWMO website and there has been a national citizens' dialogue about values.

Asked if the NWMO mandate includes waste from mining sites, Krizanc replied that it is just about used nuclear fuel. He mentioned the current intense discussion about Saskatchewan mining sites, but that it is not an NWMO issue.

Commenting that it is good to hear both sides of the picture, a participant suggested that Edwards should meet with the Inuit national leaders from Nunavut, Labrador, and the Northwest Territories. They would favour the phasing out of the nuclear industry, as it does not benefit the environment. "I would like to have kids some day," he said.

A participant commented that he was impressed with the photographs of nuclear testing and by the information about the collection of baby teeth to demonstrate the level of fall-out and therefore the level of risk. "It shows we did risky things in the past when we didn't know the results," agreed another participant.

A participant said it is discouraging to see the basic question not asked. "We have to stop nuclear power first," she said. "It will take time, but we have to speak up about the risks associated with the power."

Likening the photograph of the plutonium ball to the theme of the *Lord of the Rings,* a participant envisioned the start of a new cold war. "Canadians should shut the whole darned thing down now," he said.

In response to a suggestion to shoot the waste into the sun, Del Tredici said the technology does not exist. Edwards added that at one point the Select Committee on Ontario Hydro Affairs talked about disposal in "ice sheets," but no one is considering that now. Sending the material to outer space is no longer being seriously considered because a rocket explosion would cause widespread damage. However, Canadians can have faith that if they do not make the problem worse, there may eventually be a real solution.

Krizanc said that many of the first 14 suggestions have been ruled out as impractical, despite a threatened lawsuit if the NWMO does not consider disposal in subduction zones—tectonic plates that would push the material toward the centre of the earth.

Edwards said the fundamental question is whether any of the solutions are real solutions. "Maybe some day there will be a solution," he said, "but these are not."

Krizanc said the NWMO has found Canadians hope that at some point the knowledge will be there for good management. Continued storage until that time is one of the options and perhaps is the answer for now.

Del Tredici said the key is in the title of one of the NWMO documents—*Asking the Right Questions.* "The right question hasn't been asked," he said. The three options are a huge distraction. The industry is still talking about doubling the waste. That renders this discussion useless. Edwards agreed that the main question was whether to continue—the others are just a footnote, or should be. "It is quite possible to stop nuclear now," he said. "In fact, it will shut down unless $1 billion is spent on repairs." The Québec nuclear industry is proposing to enlarge its waste site and make repairs. If citizens say "no" now, there will be no more nuclear power. Agreement to store waste on site might be taken as agreement to continue producing waste. "The process is spring-loaded to have you answer 'yes,'" added Del Tredici.

Asked by Kneen about Tony Hodge's suggestion of a combination of solutions, Krizanc said it would be quite possible. The NWMO can study any option. Based on discussions at this point, he said it is clear that people will not accept deep geological disposal as

proposed by AECL. However, there are also trade-offs. Disposal means security. But Canadians also want adaptability, because there may be a solution at some point. With 90–95 per cent of the energy remaining in the used fuel, perhaps a way can be found to use it. Edwards said the only way to get the energy from the used fuel is to extract plutonium and the NWMO will not admit that.

Krizanc replied that for the NWMO "adaptability" does not mean "reprocessing." The management approach should monitor achievements in science. Kneen noted that Japan and France reprocess fuel and extract plutonium but that Canada does not, due to international treaties. Edwards countered that the U.S. has made it illegal to separate plutonium, but Canada has not. The NWMO wants to keep the reprocessing option open. In 1978 the Royal Commission on Electrical Power Planning recommended against interim storage of Nuclear Fuel Waste, because of the likelihood it would result in extraction of plutonium.

Krizanc said weapons-grade plutonium is not the only use for Nuclear Fuel Waste. Different reactors use different grades of fuel. Edwards disagreed, arguing that enriched uranium cannot be extracted from used fuel. Krizanc started to mention processes in other countries, but Edwards said again that it was not true and suggested that Krizanc check his facts and send a letter. Kneen clarified that the group now understood that reprocessing meant the extraction of plutonium.

A participant suggested that, for now, the NWMO can make sure the fuel waste is secure. Krizanc said all the locations are secure.

Formulation of Recommendations

After a 10-minute break, Kneen reconvened the meeting and displayed a preamble that she had written, saying that it did not have to be used.

> *These recommendations are provided with the understanding that they are informal submissions resulting from a regional dialogue, which took place in Kuujjuak, Nunavik, on January 27–28, 2005.*
>
> *Not enough time and funding were allocated in order to conduct a formal consultation that would be effective, meaningful, and culturally appropriate. Section 12(7) of the Nuclear Fuel Waste Act states that they shall consult the general public and in particular Aboriginal (Inuit, First Nations, Métis) people. The meeting that has taken place over the past couple of days cannot be considered a consultation under this Act.*

A participant suggested it would be worthwhile to send a letter to the Québec government hearings on the refurbishment of the Gentilly plant. ITK could send a letter of support to KRG in its request to abandon refurbishment of the reactor. Kneen responded that such a

letter would have to be approved by the ITK Board of Directors. Another participant commented that since it is an issue in Québec, KRG could proceed. Kneen promised to coordinate with Adamie when she returned to Ottawa.

Another participant offered to get a resolution from the NHFTA in support of the letter.

Another participant pointed out that the Québec Minister of the Environment, Thomas Mulcair, would be visiting Kuujjuaq on March 1. There would be an opportunity to speak to him for an hour and a half. Kneen said she would have time to speak to the ITK Board of Directors before that time.

Kneen drew participant attention to the displayed preamble. She invited comments, which would lead to the formulation of recommendations.

A participant said, "Make sure no one can say, 'They chose A, B, or C.'"

Kneen said that at the dialogue in Iqaluit, Nunavut Tunngavik Inc. (NTI) requested that it not be called a "consultation," and this is stated in the preamble.

A participant suggested beginning by listing the organizations represented, then the points upon which they agreed.

Another participant said she did not understand why the group should respond to the question of storage of Nuclear Fuel Waste, because there is none in the North. However, since the Canadian Shield is in Nunavik, there is fear that the waste will come. Kneen suggested that they might be happy to respond as Canadians, and the participant agreed that it is an issue of concern.

A participant said the three options do not contribute to the long-term solution of the Nuclear Fuel Waste problem at the national level. He said he hesitated to use the word "trick," but any decision on an option will be misrepresented as participants' consent to further nuclear production. Another participant agreed with him and added, "Which we do not—not at all."

Kneen clarified that the group was saying the generation of energy by the nuclear process should be stopped. A participant said the point was to discontinue nuclear as a source of energy and focus on the waste problem at hand instead of producing new waste.

Kneen suggested making a point about research into alternative sources of energy. Participants agreed and one specified that funds used to take care of Nuclear Fuel Waste should be redirected to alternative energy sources. "Cleaner energy," added another participant. When it was pointed out that nuclear energy is thought to be "clean" because it does not pollute the air when produced, participants suggested using the phrase "less risky."

A participant suggested some kind of legislation specifying that Nunavik be nuclear free.

Kneen asked if participants wanted to include the same wording as in the Labrador legislation, which specifies that adjacent areas be nuclear free too. Other participants suggested including the Northern Passage and other Northern routes.

Kneen read her notes from the dialogue so far:

- Possibly address the issue of the government not having a mandate after the national dialogues have been completed—answers could be seen as agreement to continue producing the waste.
- Possibly address the issue of whether nuclear energy should be used at all in Canada—why produce more waste when the government doesn't know what to do with the waste that exists right now?
- Option of "None of the Above" is much better than the three options listed!
- Don't want a disposal site in region or close to it
- Nuclear energy is not used in Nunavik
- No benefits if waste were to come to the region
- Edwards, Del Tredici, and someone from the NWMO should also meet with the national leaders on this subject—maybe presentations could take place at an ITK board of directors meeting?
- Basic question is not being asked—really have to stop nuclear power first and then try to find a solution to the waste issue
- There are too many risks from the mining process to the Nuclear Fuel Waste disposal/storage process
- Advocated the shutting down of the nuclear energy reactors—need to clean up selves first—could end up in disaster if the whole process isn't considered (as opposed to stop-gap solutions of storage or disposal, but waste still continues to be produced)
- Talked about how the price tag for each approach is a major factor in the "selection process"
- Should address issue of whether or not Canada should continue to produce the waste and as a footnote an option could be dealt with
- Talked about possibly being unrealistic about shutting nuclear power down now
- Talked about the possibility of the NWMO recommending a combination of approaches
- Reprocessing will result in weapons grade plutonium
- Should take the time to figure out what to do with currently existing materials and not produce more

A participant suggested a message should be sent to the Québec Minister of the Environment that he should agree to shut down the Gentilly reactor. Another participant added that the Minister should be reminded he would have supporters in Kuujjuaq for that position.

A participant said it might be better not to mention the price of the options.

Kneen asked the group how they felt about a combination of options. A participant responded that an open public discussion of whether to continue use of nuclear energy

should be held. Another participant pointed out that the group was not knowledgeable about possible option combinations. Kneen noted that early fact sheets listed options of limited interest that were no longer being considered. While that door is still open, she said she doubted these options will be considered.

A participant said she did not want to consider the option of reuse for fear the material would be used for a bomb. While it would be good if a way were found to diminish the radioactivity, it sounds too dangerous.

Another participant referred to the NWMO code of ethics. "They have to carry this to the end," he said. "The nuclear industry seems in history to have been ignorant, arrogant, and brutal in dealing with individuals. They seem to have no heart. This is scary," he said.

The government should keep its promise to have hearings on retaining nuclear power in Canada, said a participant. It would be interesting to see what, exactly, was promised.

Kneen promised to send participants the recommendations when they were written.

A participant commented that there should be an impartial organization—the NWMO is too close to the nuclear industry. He said he could see the point of making the industry responsible for its waste, but industry's top priority would be to keep the industry going in the best way possible. It "smells fishy" for the NWMO to be funded by the nuclear industry, a participant said. Another participant commented on the newness of the NWMO. It seems it is learning how to function while under pressure to produce.

A participant asked whether Inuit can get the government's attention. It seems to have already decided.

Kneen read the ideas that came out of the dialogue that could serve as part of the basis for recommendations:

- Attendees could not understand why the question of the disposal/management methods of Nuclear Fuel Waste was posed to this region, as the region neither consumes energy derived from Nuclear reactors nor produces Nuclear Fuel Waste as a result of the energy production process
- Nunavik should not, and cannot, shoulder the burden of dealing with the Nuclear Fuel Waste problem at the national level. Although attendees understood that this is an issue of concern to all Canadians, Nuclear Fuel is not used in the North.
- None of the options presented contribute to a long-term solution to the Nuclear Fuel Waste problem at the national level, and should all be rejected. Any decision on which option to pick would be misinterpreted as consent to the nuclear industry's activities on this matter.
- Nuclear energy should cease to be produced so no further waste will accumulate. A clear message should be sent to the federal Minister of Natural Resources and to the province of Québec asking them to discontinue of the use of energy derived from Nuclear reactors.

- There should be a focus instead on solving the current issue of managing existing nuclear waste.
- Research on alternative and low risk energy sources should be funded extensively. This should include research into energy efficiency.
- Nuclear Fuel Waste should not be stored, disposed of, or transported through this territory. Theses materials should also not be stored, disposed of, or transported through territories near or adjacent to Nunavik. This includes transportation through the Northwest Passage and other Northern routes.
- The NWMO should consider options (such as the discontinuation of energy derived from nuclear reactors) within a public dialogue process, such as the Seaborn Panel proposed.
- The reprocessing of Nuclear Fuel Waste in Canada should be banned. There is danger that it could be used for weapons grade plutonium.
- The NWMO's code of ethics should always be adhered to and carried out in a meaningful manner to the end of this process. The government should maintain its promise to hold public hearings on the question of whether nuclear reactors should be shut down or not (as had been intended by Dr. Seaborn).
- Assuming that the nuclear industry does not shut down overnight, an impartial and independent organization (not funded by the industry) should direct and conduct a public hearings process on the issue of whether or not nuclear energy should be continued to be used in Canada.

Discussion of Recommendations

Kneen gave participants the opportunity to review her summary (below) of the morning's discussion.

> **Preamble:**
> These recommendations are provided with the understanding that they are informal submissions resulting from a regional dialogue, which took place in Kuujjuak, Nunavik on January 27–28, 2005.
>
> Not enough time and funding were allocated in order to conduct a formal consultation that would be effective, meaningful, and culturally appropriate. Section 12(7) the *Nuclear Fuel Waste Act* states that they shall consult the general public and in particular Aboriginal (Inuit, First Nations, Métis) people. The meeting that has taken place over the past couple of days cannot be considered a consultation under this Act.
>
> Attending at this meeting were representatives from the Kativik Environmental Advisory Committee, National Inuit Youth Council, Nunavik Hunters, Fishers and Trappers Association, Kativik Regional Government, Northern Village of Kuujjuaq, Makivik Corporation, and individual community members.

Attendees could not understand why the question of the disposal/management methods of Nuclear Fuel Waste was posed to this region, as the region neither consumes energy derived from Nuclear reactors nor produces Nuclear Fuel Waste as a result of the energy production process

At this meeting the following was agreed on by those present:

Draft Recommendations:

- Nunavik should not, and cannot, shoulder the burden of dealing with the Nuclear Fuel Waste problem at the national level. Although attendees understood that this is an issue of concern to all Canadians, Nuclear Fuel is not used in the North.
- None of the options presented contribute to a long-term solution to the Nuclear Fuel Waste problem at the national level, and should all be rejected. Any decision on which option to pick would be misinterpreted as consent to the nuclear industry's activities on this matter.
- Nuclear energy should cease to be produced so no further waste will accumulate. A clear message should be sent to the federal Minister of Natural Resources and to the province of Québec asking them to discontinue of the use of energy derived from Nuclear reactors.
- There should be a focus instead on solving the current issue of managing existing nuclear waste.
- Research on alternative and low risk energy sources should be funded extensively. This should include research into energy efficiency.
- Nuclear Fuel Waste should not be stored, disposed of, or transported through this territory. Theses materials should also not be stored, disposed of, or transported through territories near or adjacent to Nunavik. This includes transportation through the Northwest Passage and other Northern routes.
- The NWMO should consider options (such as the discontinuation of energy derived from nuclear reactors) within a public dialogue process, such as the Seaborn Panel proposed.
- The reprocessing of Nuclear Fuel Waste in Canada should be banned. There is danger that it could be used for weapons grade plutonium.
- The NWMO's code of ethics should always be adhered to and carried out in a meaningful manner to the end of this process. The government should maintain its promise to hold public hearings on the question of whether nuclear reactors should be shut down or not (as had been intended by Dr. Seaborn).
- Assuming that the nuclear industry does not shut down overnight, an impartial and independent organization (not funded by the industry) should direct and conduct a public hearings process on the issue of whether or not nuclear energy should be continued to be used in Canada.

Comments:

Kneen asked participants to comment or add anything to the draft preamble and recommendations. One participant expressed gladness for the existence of ITK and its role in providing Inuit with two points of view on the Nuclear Fuel Waste issue. It was agreed that this point should be added to the report.

Another group member wondered if the proposal for an independent inquiry on the phaseout of nuclear reactors had been included in Kneen's draft. Kneen assured the participant that the point had been included.

Asked about the first two dialogues conducted by ITK, Kneen said there were many similarities among all three sessions. She promised to send copies of the Iqaluit and Inuvik dialogue reports to participants at this meeting.

Another member of the group asked to include a recommendation about an educational process on nuclear energy and its problems. It was agreed that this type of education is necessary, particularly in the North. Kneen worded this into a recommendation: "Attendees recommended that an educational program on the broad issue of nuclear energy specifically designed for the North should be conducted across the country." One participant suggested changes to this wording whereby nuclear energy should include all aspects of the nuclear industry. Kneen added uranium mining, production of nuclear energy, and disposal/management of Nuclear Fuel Waste in brackets. A participant asked that environmental and health effects of Nuclear Fuel Waste be included in this recommendation as well.

"Science will solve the problem someday but not today," a participant said. He suggested there should be ongoing research on finding permanent safe solutions, not to reprocess Nuclear Fuel Waste but to find an acceptable use for it. One participant argued that the phrase "until the time that a satisfactory solution is found" could be interpreted to support the nuclear industry. He added that the amount of money put into the nuclear industry to date justifies the continued production of nuclear-generated power. Participants agreed that the wording of the last recommendation could be perceived to condone the industry.

Kneen underlined the importance of education on this issue, noting that these dialogues mark the first real dissemination of information on the Nuclear Fuel Waste issue to Inuit. While there have been a number of such information sessions in the South, two initial attempts in the North essentially failed due to a lack of funding, poor planning, and limited understanding of logistics of travel in the Arctic. Kneen suggested that the recommended education process be targeted at the entire country not only the North.

Kneen agreed to a suggestion that TV could be a very effective educational tool and refined the point to include multi-media. One participant noted that education was a powerful tool and as such, the message should be very carefully crafted in order to bring

the appropriate message to the public. Group members discussed the need for a balanced education process. A group member suggested that balance is second to the need to bring forward the potential health and environmental effects. Kneen asked who should provide the education on this issue. Another participant said the format of the ITK dialogues with expert presenters was an excellent education means. "Efforts should be made to go to the community at large in such a fashion." ITK is in a good position to carry out such an educational campaign. Kneen added this point to the statement: "This type of educational program must be designed and conducted by external (to the government) independent agencies and /or national organizations."

Kneen noted that she and PJ Ageeagok had considerable work to do in the coming months with the preparation of the four regional reports by the end of March 2005. A task force meeting with the regional groups also had to be scheduled. The final regional reports are due at the end of June with the NWMO report going to the Minister by November 15, 2005. One participant asked when a draft of the NWMO report would be available. Kneen replied that ITK should have a copy by March or April, adding that while she had provided the NWMO with some information on the dialogues, she had not provided the details and would not until the regions had completed their review. "I want to ensure that the information that is included in the November report comes from the regions," said Kneen.

Another participant wondered if results of the dialogues held with First Nations and Métis would be available for comparison. Kneen noted that while she had seen some of the reports from the Assembly of First Nations, she had not seen anything from the Métis organization. She would follow this up. Kneen noted that both of these groups had rejected the notion of consultations in favour of dialoguing, given the short timeframe.

One group member wondered if there were any plans to build new nuclear reactors in Canada. Kneen and others indicated that currently nuclear reactors are only being refurbished with no known plans for new reactors. "I don't think they would tell us if there were," added one participant. Another group member wondered if power shortages and blackout periods were on the increase in Southern Canada. He also asked if Southerners were using less energy. Kneen indicated that while she did not have any data, her impression was that consumption of energy in Southern Canada has not dropped and that there was more concern with climate change than energy consumption.

Asking if participants felt the draft recommendations captured their discussion, concerns, and comments, Kneen indicated that she would reword the document, circulate it to members of this group, and include important timelines. She thanked everyone for his or her participation, noting that she was happy to have been invited to provide them with information on this issue. In turn, members of the group thanked Kneen for coordinating the dialogue and for bringing the Nuclear Fuel Waste issue to their attention in what they hoped would be a continued education process.

Draft Recommendations for Review:

Preamble:

These recommendations are provided with the understanding that they are informal submissions resulting from a regional dialogue, which took place in Kuujjuak, Nunavik on January 27-28, 2005.

Not enough time and funding were allocated in order to conduct a formal consultation that would be effective, meaningful and culturally appropriate. Section 12(7) the Nuclear Fuel Waste Act states that they shall consult the general public and in particular Aboriginal (Inuit, First Nations, Métis) people. The meeting that has taken place over the past couple of days cannot be considered a consultation under this act.

Attending at this meeting were representatives from the Kativik Environmental Advisory Committee (KEAC); National Inuit Youth Council (NIYC); Nunavik Hunters, Fishers and Trappers Association; KRG; Northern Village of Kuujjuak; Makivik Corporation; and individual community members.

Those present stated their appreciation that ITK had organized this workshop and that ITK staff had ensured that both sides of the issue had been made available to the regional participants of this meeting.

Draft Recommendations:

At this meeting the following was agreed on by those present:

- Attendees could not understand why the question of the disposal/management methods of Nuclear Fuel Waste was posed to this region, as the region neither consumes energy derived from Nuclear Reactors nor produces Nuclear Fuel Waste as a result of the energy production process;
- Although attendees understood that this is an issue of concern to all Canadians, they did not feel that the region should have to shoulder the burden of having to deal with the issue of Nuclear Fuel Waste in any manner;
- None of the options that were presented to attendees contribute to a long-term solution to the nuclear fuel waste problem at the national level. Any decision on which option to pick will be misinterpreted as consent to the nuclear industry's activities on this matter;
- Attendees further stated clearly that they did not want to choose any of the proposed options. Rather they stated that nuclear energy should cease to be produced (and the resulting Nuclear Fuel Waste should not continue to be accumulated) and that focus should be placed on solving the current issue of managing the existing Nuclear Fuel Waste;

- Attendees further stated that an emphasis should be placed on research that would examine alternative and low risk energy sources and that extensive funding should be directed into this area (including energy efficiency research - how to use more efficiently) ;
- Attendees wanted to further state clearly that they are in direct opposition to any Nuclear Fuel Waste to be stored, disposed of or transported through their territory. They further stated that these materials should also not be stored, disposed of or transported through territories near or adjacent to Nunavik (this includes transportation through the Northwest Passage and other northern routes);
- Attendees further wanted to send a clear message to the Minister (NRCan) and the province of Quebec that they are advocating the discontinuing of the use of energy derived from nuclear reactors (shutting down reactors);
- Attendees felt that the NWMO should be able to consider options (such as the discontinuation of energy derived from nuclear reactors) within a public dialogue process (such as what was proposed by Seaborn panel);
- Attendees are in direct opposition to the reprocessing of Nuclear Fuel Waste in Canada, as it will result in the possible extraction of plutonium;
- Attendees stated that the NWMO's code of ethics should always be kept in mind and to carry that code to the end of this process (in a meaningful manner);
- Attendees further stated that the Government of Canada should maintain its promise to hold public hearings on the question whether nuclear reactors should be shut down or not (as had been intended by Dr. Seaborn);
- Assuming that the nuclear industry doesn't shut down overnight – an impartial and independent organization (not funded by the industry) should direct and conduct a public hearings process on the issue of whether or not nuclear energy should be continued to be used in Canada;
- Attendees recommended that a balanced educational program (using multi-media) on the broad issue of Nuclear Energy (uranium mining, production of nuclear energy, disposal/management of NFW, Environmental and Health impacts of Nuclear Fuel Waste) should be specifically designed for the North and that this program should be initiated across northern Canada. This type of educational program must be designed and conducted by external (from the Gov't), independent agencies and/or National organization (Aboriginal or otherwise).

Attendees at this dialogue hoped that science would solve the problem of the disposal/management of Nuclear Fuel Waste some day. This is, however, not possible today. Until the time until there is a completely satisfactory solution to the problem of Nuclear Fuel Waste, nuclear reactors should be shut down and no more Nuclear Fuel Waste should be generated at this point in time.

Subject: <no subject>
Date: Friday, February 18, 2005 1:44 PM
From: Soha Kneen <kneen@itk.ca>
To: <mbarrett@krg.ca>, Nathalie Girard <Ngirard@krg.ca>, <a_padlayat@makivik.org>, <m_kwan@makivik.org>
Cc: Pauloosie Akeeagok <akeeagok@itk.ca>

Natalie and Michael:

Attached you will find the current version of the Draft Kuujjuak Report. I unfortunately just realized that I do not have the e-mail addresses/fax numbers for the following people.

Muncy Novalinga, Kativik Regional Government Representative
Eli Angiyou, Member of Kativik Environmental Advisory Committee
Johnny Arnaituk, Vice-President, Nunavik Hunters, Fishers and Trappers Association
Emily Emudluk, CAVAC Kuujjuaq
Jimmy Johannes, Secretary, Nunavik Hunters, Fishers and Trappers Association
Michael Gordon, Mayor of Kuujjuaq
Muncy Novalinga, Kativik Regional Government Representative
Maggie Saunders, Kuujjuaq Municipal Councillor

As they all need to receive this report could one of you please send me their e-mail addresses or fax numbers so that we can ensure that everyone receives this draft report?

Also, could the four of you please let me know by February 25, 2005 if I should make any changes or additions to this draft report?

Thanks and all the best,

Soha

Soha Kneen
National Coordinator on the Inuit Specific Dialogues on the Long-Term Management of Nuclear Fuel Waste
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*From December 2, 2001, Inuit Tapirisat of Canada's name has changed to Inuit Tapiriit Kanatami (ITK).

"Tapirisat" means "we will unite" and,

after 30 years of achievements and the signing of four land claims, Inuit felt it was time to acknowledge that Inuit are united, which is "Tapiriit" in Inuktitut. "Kanatami" means "of Canada".*

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a brief

on

Nuclear Power in Québec

and Radioactive Wastes

submitted by

Canadian Coalition for Nuclear Responsibility

to

La Commission parlementaire de
l'économie et du travail

Québec QC

January 26, 2005

The Toxic Legacy of Nuclear Wastes

This document addresses an important aspect of the energy debate in Québec, one that requires a clear sense of direction and strong political leadership. What is to be done about the awesome legacy of long-lived high-level radioactive wastes in Québec? Should Québec continue producing these wastes, or should it eliminate them completely from its territory?

From the point of view of energy supply, nuclear power is not a major player in Québec ; but from the point of view of the radioactive wastes that nuclesar power produces, Québec's well-being and security run the risk of being compromised for many centuries to come.

Now is the time for the political leadership of Quebec to examine this issue, because Hydro-Quebec wants to spend well over a billion dollars to expand its existing radioactive waste storage facilities near the shore of the St-Lawrence River and to prolong the life of the Gentilly-2 nuclear reactor for another 20 years, which would almost double the amount of high-level radioactive waste that is presently stored in Quebec.

Does Quebec want to assume permanent custody of all the irradiated nuclear fuel from the Gentilly-2 nuclear power plant? This waste will remain highly toxic for over ten million years (according to the Ontario Royal Commission Report on Nuclear Energy published in 1978; see annex C). The minimum cost estimate for managing this type of radioactive waste in Canada is $15 to $16 billion, according to the *Société pour la gestion des déchets nucléaire.*. This cost estimate could easily double, triple, or even quadruple as time goes by.

Recall that the decision to build the Gentilly-2 reactor was taken at the urging of the federal government of Canada, who offered to pay half the cost of construction. Ottawa made the same offer to New Brunswick, where the Point Lepreau reactor was built (a reactor with the same basic design as the Gentilly-2 reactor in Quebec).

Ottawa was eager to sell CANDU reactors overseas, and wanted to use Quebec and New Brunswick as showcases for their export model, the 600 megawatt CANDU-6 reactor, which has never been built in any other part of Canada. All the design work for Gentilly-2 was done by Atomic Energy of Canada Ltd., a crown corporation owned by the federal government – the same agency that markets CANDU reactors in other countries.

At that time (circa 1973) there was no official recognition by the government of Canada that the irradiated nuclear fuel would remain extremely toxic for countless millennia, and that the long-term management of this waste would be a costly and contentious political and environmental problem of monumental proportions.

Thus Quebec and New Brunswick were in effect duped into producing these nuclear wastes. Quebec politicians and members of the public were told that nuclear energy was clean, safe, cheap and abundant. There was no reason to suspect that Quebec would be creating a toxic legacy for thouands of generations of Quebec citizens. It was not part of the political agreement or the commercial contract.

Instead of spending over a billion dollars refurbishing Gentilly-2 so it can continue to produce more toxic material, we recommend that the government of Quebec should prohibit Hydro-Quebec from adding to the production of these nuclear waste materials. The government can accomplish this by simply withholding permission for the $70 million expansion of nuclear waste storage facilities near the Gentilly-2 reactor (a project currently under consideration).

Without such governmental permission, the Gentilly-2 reactor will have to be shut down by 2013 or sooner. The Quebec government can use this opportunity to pressure the Government of Canada to remove the existing nuclear wastes from Quebec territory. The political argument for this could make use of the following points:

(1) There is already, on the Gentilly-2 site, a shut-down nuclear reactor (Gentilly-1) and a stockpile of irradiated nuclear fuel, which are the sole property and responsibility of Ottawa. Quebec should ask Ottawa to remove this irradiated nuclear fuel and also remove the radioactive structures of the Gentilly-1 reactor building, since Quebec will no longer be maintaining an active nuclear facility at that site (due to the imminent shut-down of Gentilly-2).

(2) While it is removing the irradiated fuel from Gentilly-1, Ottawa ahould also be asked to remove the irradiated fuel from Gentilly-2, since nuclear energy will no longer play a role in Quebec's energy mix. Now is the best time to negotiate this transfer of nuclear waste, because Ottawa enacted a Nuclear Fuel Waste Act in November 2002 which will require some kind of

decision on the subject of irradiated nuclear fuel in the next few years (as early as November 2005); thus irradiated nuclear fuel will be on the federal agenda.

(3) There are serious questions about whether the nuclear industry in Canada will survive. It has had no domestic sales since 1978, and overseas sales are not being concluded on a timely and sustainable basis. It is much better to deal with the transfer of nuclear waste while the federal expertise and funding is still in place and while Ottawa is still trying to reassure its overseas customers that all these problems can be readily dealt with.

(4) The first official Canadian acknowledgment of the serious nature of the long-term management of irradiated nuclear fuel did not come until 1977, with the "Hare Report" (Managing Canada's Nuclear Wastes, Report EMR 77-6). Since Gentilly-2 was committed to be built in 1973, four years before any such official acknowledgment had been made, the federal government has a responsibility to deal with the wastes that have been produced by Gentilly-2. However, if Quebec decides to spend over a billion dollars now on refurbishing Gentilly-2, knowing very well about the problem of nuclear wastes, then Quebec will be acknowledging that it is willing to assume full responsibility for producing these wastes and presumably managing them in perpetuity.

(5) Talk about "refurbishing" the Gentilly-2 reactor is misleading. In fact, Hydro-Quebec wants to build a new reactor within the shell of the existing one. Since when does an over-haul or renovation cost over a billion dollars? The planners call it a "refurbishment" to circumvent Quebec's long-standing moratorium on the construction of new nuclear reactors in Quebec -- a moratorium first declared in 1978 by the Lévesque government and upheld by every subsequent government. If Quebec ever wants to rid itself of the nuclear wastes associated with this technology, now is the time to achieve that goal. After all, if a political solution cannot be worked out now, in the present context, when can it ever be done?

Naturally, people in the nuclear division of Hydro-Quebec and in the local community are concerned about the potential loss of jobs that may result from shutting down Gentilly-2. However there are some important considerations to be borne in mind on this subject:

(1) Since the reactor is intended to operate until 2013, and since staff at the plant will be required to stay on for a few years after shut-down, any loss of

jobs will occur over a period of a decade or so and can be dealt with in an orderly fashion.

(2) The dismantlement of the Gentilly-1 reactor will be the responsibility of the federal government, but this undertaking will probably supply good jobs to the local community -- and much safer jobs than those involved in refurbishing the Gentilly-2 reactor, because the Gentilly-1 reactor is far less radioactive. It is interesting to note that Hydro-Quebec's plans for the eventual dismantling of the radioactive structures of the Gentilly-2 reactor involve a 40-year cooling off period, so as to minimize radiation exposures to the workers who will be doing the dismantling. However, the refurbishment of the Gentilly-2 reactor involves many of the same operations needed for the final demolition of the reactor building, yet during the refurbishment, workers will be sent in to radioactive areas without the benefit of a 40-year cooling-down period. This problem does not arise in the case of the Gentilly-1 reactor for the reasons mentioned above.

(3) Dismantling of the Gentilly-1 reactor will not only provide safer local jobs at federal expense, but it will also assist in developing tools, techniques, and expertise for radioactive demolition work that can be marketed around the world. According to the International Atomic Energy Agency, there are about 100 nuclear power reactor worldwide that will have to be dismantled within the next 20 years, at a cost of about one or two billion dollars per reactor. Thus we are talking about a potential market of half-a-trillion dollar. Indeed the market for radioactive demolition is more promising than the market for new nuclear reactors.

Le Regroupement pour la surveillance du nucléaire therefore recommends that the Government of Québec deny permission for Hydro-Québec to expand the radioactive waste storage facilities at the Gentilly-2 reactor because the government has decided to halt the production of irradiated nuclear fuel. As a result, the Gentilly-2 reactor will not be allowed to be refurbished so the proposed expansion of radioactive waste facilities will not be needed.

The same group also recommends that the Government of Québec enter into negotiations with the federal government to ensure the removal of all irradiated nuclear fuel from Quebec territory, and to undertake the complete demolition of the Gentilly-1 nuclear reactor building, including the careful packaging of all radioactive waste materials resulting from the demolition activities and the transport of such materials out of Quebec.

For the better understanding of committee members, we are attaching our 2004 memoire to the BAPE on the subject of high-level radiative wastes in Quebec. There are a number of other important considerations raised in that document, together with 10 additional recommendations directed to the Government of Québec.

(from this point on, the text is that of CCNR's mémoire to the BAPE)

Who is CCNR?

The Canadian Coalition for Nuclear Responsibility (CCNR) is a federally-incorporated not-for-profit organization with a mandate to conduct research and education on issues of public concern related to nuclear power, nuclear weapons, uranium mining, radioactive materials, and alternative non-nuclear energy options.

CCNR Activities ~
(1) Quebec's Nuclear Moratorium

CCNR has been active on nuclear issues in Canada since its establishment in Montreal in 1975. In 1977 CCNR submitted a major memoir on the subject of nuclear power to the Energy Committee of the National Assembly in Quebec City. One year later, in 1978, the government of René Lévesque declared a moratorium on the construction of any further nuclear power reactors in the province of Québec.

CCNR Activities ~
(2) The Ontario Royal Commission

In 1977 and 1978, CCNR was a major participant in the Ontario Royal Commission on Electric Power Planning. In its Interim Report on Nuclear Power entitled "A Race Against Time", published in September 1978, the Royal Commission reported that:

- The extreme lethality of a freshly removed spent fuel bundle is such that a person standing within a metre of it would die within an hour. During the next forty years (and probably for thousands of years), the management of hundreds of thousands of such bundles (in Ontario alone), which at all times must be isolated from the earth's ecosystem, will clearly present a problem of massive proportions. (A Race Against Time, p. 87)
- An independent review committee should be established to report to the Atomic Energy Control Board (AECB) on progress on waste disposal research and demonstration. If the committee is not satisfied with progress by 1985, a moratorium on additional nuclear power plants would be justified. (A Race Against Time, Major Findings and Conclusions, p. xiii)
- Uffen *[Dr. R. J. Uffen, then Dean of Applied Science at Queen's University and former Vice-Chairman of Ontario Hydro]* is unequivocal in recommending that no nuclear programme be committed in Ontario, of "capacity greater than 20,000 MW", until "it has been demonstrated beyond reasonable doubt that a method exists to ensure the safe containment of the long-lived, highly radioactive waste for the indefinite future."
- We endorse the Uffen conclusion. However, we go further and conclude that continuous monitoring of waste disposal research should be undertaken by an independent panel of experts reporting to the AECB. This corresponds to the Uffen proposal for a "Canadian Nuclear Waste Management Advisory Council." If adequate progress is not being made, say, by 1985, the nuclear power programme should be reassessed and a moratorium on additional nuclear stations should be considered. (A Race Against Time, p. 95)

CCNR Activities ~
(3) The Vermont Geologic Repository

In the 1980's, CCNR was in the forefront in opposing the establishment of a permanent repository for high-level radioactive wastes in Vermont. At that time, the U.S. Department of Energy was searching for a site for a geological repository in crystalline rock in the Northeast region of the United States of America to house irradiated nuclear fuel and post-reprocessing wastes left over from the American military and civilian nuclear programs.

Jean Charest, then a federal MP from Sherbrooke, intervened with the Government of Canada to arrange for a diplomatic note to be delivered to the U.S. Government by the Canadian Ambassador in Washington expressing the great concern felt by Ottawa over the prospect of having such a potentially dangerous waste repository situated on the borders of Quebec. For his part, Premier Robert Bourassa made it known that Québec would never permit the establishment of a permanent repository for high-level radioactive wastes (i.e. irradiated nuclear fuel) anywhere within the territory of Québec or on its borders.

Eventually the US Department of Energy discontinued its efforts to site a permanent repository for high-level radioactive waste in the Northwest United States.

Hydro-Quebec's proposal
to refurbish the Gentilly-2 reactor

The proposed refurbishment of the Gentilly-2 reactor will commit Hydro-Québec and therefore the province of Québec to the continued production of high-level radioactive wastes (irradiated nuclear fuel) for decades to come, despite the fact that the government of Québec is opposed to the permanent storage of such wastes in Québec.

CCNR believes this would be a major mistake for both pragmatic and ethical reasons.

Moreover, CCNR believes that the proposed refurbishment of the Gentilly-2 reactor violates the spirit of the long-standing moratorium against any new reactors in Québec.

In effect, the proposed refurbishment is the creation of a new nuclear reactor inside the shell of the old one.

Hydro-Québec has determined that the Gentilly-2 nuclear reactor cannot continue to operate safely and reliably without major modifications. These modifications are mainly to the core area of the reactor, involving specifically the primary heat transport system which has become significantly degraded over time.

Put simply, the Gentilly-2 reactor core is reaching the end of its useful lifetime because of premature aging of crucial components. Although the reactor was intended to last for forty years, it has barely lasted for twenty years.

For safety reasons, the reactor core and other parts of the primary heat transport system will have to be completely rebuilt if continued operation is to occur for many more years. The proposed modifications involve replacing all of the zirconium-niobium pressure tubes in the core of the reactor as well as the steel feeder pipes which are connected to the pressure tubes

at each end of the calandria vessel.

These modifications are expected to cost well over a thousand million dollars, a figure which comes quite close to the original cost of construction of the Gentilly-2 reactor. This is not entirely surprising, because in effect, Hydro-Québec intends to build a new nuclear reactor within the shell of the existing one, thereby circumventing the existing moratorium on the construction of new nuclear reactors in Quebec.

Recommendation 1: CCNR recommends that the Québec government not allow Hydro-Québec to proceed with its proposed modifications to the radioactive waste storage facilities at Gentilly-2, because such modifications are predicated on assumptions which are completely repugnant to the expressed policies of successive Quebec governments:

- not to build any new nuclear reactors in Quebec, and
- not to allow Québec to be a long-term repository for highly radioactive, extremely long-lived, nuclear waste materials.

Hydro-Quebec's proposal to prolong the production of irradiated nuclear fuel

It must be recognized that irradiated nuclear fuel is the most toxic waste material produced by any industry on earth. Each irradiated fuel bundle contains hundreds of different radioactive poisons, created inside the reactor in the course of nuclear fission. Most of these "fission products", "activation products" and "actinides" were never present in the natural environment prior to the advent of nuclear fission reactors (see Exhibits A and B). They constitute an entirely man-made legacy.

It must also be recognized that this waste material remains toxic for many hundreds of thousands of years. Exhibit C is a graph from the 1978 Interim Report on Nuclear Power by the Ontario Royal Commission on Electric Power Planning, entitled A Race Against Time. It shows the toxicity of an irradiated CANDU fuel bundle for the first 10 million years after it has been removed from the reactor. It will be noted that the toxicity declines for the first 100,000 years, but then it increases again because of internal changes that continue to take place within the irradiated fuel (namely the in-breeding of more toxic radioactive byproducts as a result of radioactive decay).

A 1978 report from the US Geological Survey pointed out that even after a million years of storage, irradiated nuclear fuel from US nuclear reactors is so toxic that if it could all be dissolved in water, it would be sufficient to render all the water in the Great Lakes water system unfit for human consumption. This theoretical calculation was intended by the authors to emphasize the vital importance of perpetual safe storage of these largely man-made radioactive materials at an extremely high degree of perfection. (Geologic Disposal of High-Level Radioactive Wastes -- Earth-Science Perspectives, U.S. Geological Survey, Circular 779, by J.D. Bredehoeft et al.)

If Hydro-Québec plans to produce more of this highly toxic, long-lived material, it should be required to justify how it will manage this nuclear waste for hundreds of thousands of years to come in case the waste stays in Quebec.

Currently, the Nuclear Waste Management Organization has been created by order of the federal government to study three specific options for the long-term management of irradiated nuclear fuel in Canada, and one of those options is "on-site storage". (The other two are "centralized monitored storage" and "irretrievable geologic storage".) Thus Québec must be prepared, if necessary, to manage this nuclear waste on-site in perpetuity, or at least for a very long time.

- Nuclear fuel that has been used to generate electricity remains highly radioactive.. Unless it is properly managed it can be dangerous to people and the environment for a very long time. (NWMO, Understanding the Choices, p. 16)
- The Nuclear Fuel Waste Act . . . provides a framework for the Government of Canada to make a decision on the long-term management of used nuclear fuel. It requires the NWMO to develop and recommend an approach to the government by November 15 2005. At a minimum, the NWMO must study approaches based on three technical methods:
    - deep geological disposal,
    - centralized storage - above or below-ground, and
    - reactor-site storage. . (NWMO, Understanding the Choices, p. 16)

The cost of each of the three options being studied by NWMO is estimated to be in the neighbourhood of $16 billion or more. Hydro-Québec's share of that debt would no doubt increase if Gentilly-2 proceeds to produce twice as much irradiated nuclear fuel as it has already produced.. And it may well be that the $16 billion estimate is far too low. Already the estimated cost of geologic storage has doubled from $8 billion a few years ago to $16 billion today, without any site having been chosen as yet!

Extended on-site storage also poses many daunting challenges. The containers that house the irradiated nuclear fuel are only temporary containers. They will have to be replaced every fifty years or so. If the wastes are to be stored on-site for hundreds or thousands of years, then many generations of containers will be required. Moreover, each time the irradiated nuclear fuel is moved from one container to the next, it will likely be in a more corroded and degraded state, making the transfer that much more difficult and dangerous in terms of potential environmental contamination.

The dangers of terrorist attack on the exposed waste containers is another question, which is compounded by the close proximity of the high-level radioactive wastes to the St. Lawrence River.

Unless and until Hydro-Québec provides complete details on how it plans to manage the irradiated fuel in perpetuity here in Québec, if necessary, there should be no permission granted for expanding the production of this problematic waste material.

Recommendation 2: CCNR recommends that the BAPE not allow Hydro-Québec to proceed with its proposed modifications to the radioactive waste storage facilities at Gentilly-2, because there is no currently acceptable method for the permanent safe storage of high-level radioactive wastes (irradiated nuclear fuel) and therefore there is no justification

for the continued production of such highly toxic materials.

Recommendation 3: If however the BAPE is not inclined to disallow the project, Hydro-Québec should be required to produce a detailed contingency plan for the perpetual maintenance and protection of the radioactive waste materials long after the Gentilly-2 reactor has been permanently retired.

Nuclear Safety and Nuclear Waste ~ The Politics of Denial

It is worth remarking that when the Gentilly-2 reactor was first approved for construction in 1973 or thereabouts, there was no official acknowledgment of the monumental problems associated with the perpetual safe storage of high-level radioactive wastes from nuclear reactors. Politicians and the public alike were told that nuclear power was an inherently safe and clean technology, which was not the truth. At that time, only those in the nuclear industry knew of the problems associated with irradiated nuclear fuel, and the possibilities of catastrophic nuclear accidents. They did not share this information with the public.

Catastrophic nuclear accidents are possible in CANDU reactors just as they are in other types of reactors. The reason is straightforward. Not only is a nuclear reactor a machine for generating electricity, but it is also a repository for an enormous inventory of intensely radioactive materials which, if released to the environment, can have catastrophic consequences. As the Select Committee on Ontario Hydro Affairs reported in 1980:

- It is not right to say that a catastrophic accident is impossible . . . . The worst possible accident . . . could involve the spread of radioactive poisons over large areas, killing thousands immediately, killing others through increasing susceptibility to cancer, risking genetic defects that could affect future generations, and possibly contaminating large land areas for future habitation or cultivation. (The Safety of Ontario's Nuclear Reactors, 1980, p. 37)

And as the Atomic Energy Control Board reported to the Treasury Board in 1988:

- It is recognized now that, through the combination of a series of comparatively common failures which, on their own, are of little consequence, accidents can develop in a myriad of ways (as demonstrated most vividly at Three Mile Island and Chernobyl). This makes the calculation of consequences of potential accidents very difficult. Research to simulate accident consequences is often incomplete, and, perhaps most significant, human errors are an unquantifiable element. . . .
- Reports of significant events that have occurred in Canadian reactors show that human error plays a part in more than 50 percent of all such events. Both the nature and the probability of human error is difficult to quantify, and hence the probability of serious accidents which are a combination of system failure and incorrect human response is difficult to predict. . . .
- The consequences of a severe accident can be very high. The accident at Chernobyl has cost the Soviet economy about $ 16 billion including replacement power costs. The accident has generated anti-nuclear sentiment in the USSR and throughout the world. Three Mile Island has cost the USA $ 4.8 billion even though the Three Mile Island

accident had essentially no radiation impact on the public. The accident was a major contributor to the public distrust of nuclear power in the USA.

- The years of successful accident-free operation which are a hallmark of the Canadian nuclear program are not, by themselves, proof of adequate safety. . . . CANDU plants cannot be said to be either more or less safe than other types.

(Submission to the Treasury Board of Canada by the Atomic Energy Control Board Ottawa, October 16, 1989.)

And, as the Ontario Royal Commission on Electric Power Planning reported in 1978:

- When we talk about the safety of a nuclear reactor, we are referring essentially to how effectively the fantastic amount of radioactivity contained in the reactor core can be prevented from escaping into the ground and atmosphere in the event of major malfunctions.

  Clearly, if a major release of this accumulated radioactivity occurred, as discussed in the previous section, the consequences would be extremely serious and could involve several thousand immediate fatalities and many more delayed fatalities.

  (A Race Against Time, p. 76)

- An uncontained complete core meltdown would almost certainly give rise to a large release of radioactivity, the consequences of which were discussed previously. (A Race Against Time, p. 78)

- Assuming absolute independence of the process and safety systems, the proba-bility of a core meltdown per reactor at Pickering is said to be in the order of 1 in 1,000,000 years *[once in a million years]* . (A Race Against Time, p. 78)

- However, two well-informed nuclear critics who participated in the hearings, Dr. Gordon Edwards and Ralph Torrie, have argued that the probability of a dual failure could be about 100 times higher than the theoretical levels. This estimate is based on failure rates in the high pressure piping of the primary heat transport system being 10 times higher than has been assumed, and also on the fact that the availability of the Pickering ECCS *[Emergency Core Cooling System]* has been demonstrated to be 10 times lower than postulated by the designers.

  We believe that the Edwards/Torrie estimate *[of 1 in 10,000 per reactor per year]* is more realistic than the theoretical probability, not least because the Rasmussen Report *[Reactor Safety Study, US Nuclear Regulatory Commission, 1974]* has concluded that the probability of an uncontained meltdown in a light water (U.S.) reactor is 1 in 20,000 per reactor per year. It has been suggested, moreover, that this figure could be out by a factor of "5 either way".

  Assuming, for the sake of argument, that within the next forty years Canada will have 100 operating reactors, the probability of a core meltdown might be in the order of 1 in 40 years, if the most pessimistic estimate of probability is assumed.

  (A Race Against Time, pp. 78-79)

Even to this day, Hydro-Québec representatives often deny in public that such catastrophic accidents are possible at a CANDU reactor such as the Gentilly-2 reactor. Nevertheless, they are required to distribute iodine pills to the population to be used in the event of just such an accident, and to publish evacuation plans for the same reason.

While such accidents are indeed highly improbable, they are unfortunately possible. Moreover, such "accidents" could be precipitated by a terrorist attack or by sabotage from inside or outside the plant. The consequences of such an event could be a catastrophe of unimaginable magnitude for the province of Quebec, for it could contaminate the St. Lawrence River and render large areas of land unfit for human habitation for a very long time. It could also affect more distant populations centers such as Quebec City:

- . . . if a substantial quantity of radioactivity were to be released to the atmosphere, the radioactivity would collect in a "cloud" and would be carried down wind. . . . At distances of two or three kilometres, depending on wind velocity, the cloud would begin to disperse (the dispersal zone could extend to distances of several hundred kilometres) and radioactive materials would be deposited on the ground. In consequence, both prompt and latent cancers would be produced.
  (A Race Against Time, p. 73)

It is important to realize that the radioactive poisons referred to in these hypothetical accident scenarios are essentially the same radioactive poisons that Hydro-Quebec intends to deposit in the radioactive waste storage sites that are the subject of discussion in these BAPE hearings.

Recommendation 4: CCNR recommends that the Government of Quebec carefully consider the advisability of accepting the risk of massive and irreversible radioactive contamination of the environment, regardless of how small the probability of such an event may be estimated to be. What kind of economic benefits would be sufficient to justify taking such a chance on the future, when the nuclear technology that poses that risk is not needed in Quebec?

Recommendation 5: CCNR recommends that the BAPE require Hydro-Québec to provide a detailed inventory of the various radioactive species contained in the different waste streams, together with pertinent biological and environmental information on each one, indicating how each of these radionuclides is likely to behave if it were to be released into natural ecosystems or if it were to enter into the human body through ingestion, inhalation, or absorption through the skin. In the absence of such detailed information, CCNR recommends that approval for the proposed modifications of the radioactive waste storage sites should be withheld because an environmental assessment of a hypothetical failure of containment is impossible to carry out.

The Poloitical Cost of Continuing to Produce High-Level Nuclear Waste

As already remarked, the problem of safely containing high-level radioactive waste for millions of years was not acknowledged by either the nuclear industry or by the Government of Canada when Gentilly-2 was conceived.

The Government of Canada began producing irradiated nuclear fuel in 1945 at Chalk River Ontario, and accelerated the production of irradiated nuclear fuel through its promotion of

civilian nuclear electricity generation in Ontario beginning in 1954.

The Government of Canada received permission from Quebec to build the Gentilly-1 reactor at Bécancour, apparently without ever informing Québec about the long-term problem of managing irradiated nuclear fuel. That reactor (Gentilly-1), and the irradiated nuclear fuel produced by that reactor, are the sole property and responsibility of the Government of Canada despite the fact that both the reactor and its irradiated fuel are situated within the territory of Quebec (beside Gentilly-2).

The Government of Canada then induced Quebec to build the Gentilly-2 reactor (following AECL specifications) by offering to pay half the estimated cost of construction (about one-quarter of the actual cost of construction).

Gentilly-2 is a CANDU-6 reactor. The CANDU-6 is a particular model designed by Atomic Energy of Canada Limited for export purposes. It is distinctly different from any of the CANDU reactors operating in Ontario. The Point Lepreau reactor in New Brunswick is also a CANDU-6 design, and, there too, the Government of Canada offered to pay half of the estimated construction cost. CANDU-6 reactors have also been sold overseas to India, Pakistan, Argentina, Korea, Romania, and China.

Having CANDU-6 reactors operating in Quebec and New Brunswick was a great help in assisting AECL to sell similar reactors in other countries, at the behest of the Government of Canada. As far as CCNR has been able to determine, none of these CANDU customers were advised of the problem of the safe long-term management of irradiated nuclear fuel.

Consequently, whatever irradiated fuel has been produced in Québec to date has been in large part the result of a deception perpetrated by the federal government and by its crown corporation Atomic Energy of Canada Limited (AECL).

If the Government of Quebec decides not to allow the refurbishment of the Gentilly-2 reactor, a strong case can be made (given the history) that these existing wastes are principally the responsibility of the Government of Canada. However, if Quebec allows the refurbishment of the Gentilly-2 reactor to proceed, thereby guaranteeing that additional irradiated nuclear fuel will be produced in Quebec, there can be no other conclusion but that Quebec has willingly embraced the responsibility for producing this toxic material and is willing to be solely responsible for it.

Recommendation 6: CCNR recommends that the Government of Québec seriously consider the political and ethical cost of making a conscious and deliberate decision to allow Hydro-Québec to produce more high-level radioactive waste, in full knowledge of the enormous problems associated with finding an acceptable method for the safe permanent storage of such radioactive wastes. If the Government of Québec wishes to ensure, insofar as it is possible to do so, that Quebec will not become a permanent repository for such waste, it would be wise to disallow the further production of such waste.

The Failure to Require Public Hearings on the Entire Project

If the proposed billion-dollar reconstruction of the reactor core is not carried out, then the

present BAPE hearings are completely superfluous. There is no need to modify the radioactive waste storage sites if the life of the reactor is not going to be extended.

As a result, the current BAPE hearings run the risk of making a mockery of environmental assessment law in Quebec and the public hearings process associated with it. The main billion-dollar project - involving the dismantling of intensely radioactive structural components, stirring up radioactive dust, releasing radioactive corrosion, contaminating equipment and uniforms, irradiating and possibly contaminating contract workers, producing huge volumes of radioactive materials which must be handled, compacted, and packaged - is not being reviewed. The public hearings only cover the storage of these radioactive materials once they have been neatly packaged.

Hydro-Quebec has not yet made publicly available all the relevant documents associated with the refurbishment project. Even the financial estimates have not been finalized and itemized. Under such circumstances it is not possible to evaluate the environmental impacts of the refurbishment, nor to challenge the financial viability of the refurbishment, nor to compare the refurbishment with other more cost-effective energy policy alternatives.

Recommendation 7: CCNR recommends that the BAPE not approve Hydro-Québec's proposed modifications to the radioactive waste storage facilities at Gentilly-2, because it is a case of "project-splitting" whereby the proponent is seeking environmental approval for a small part of a larger project rather than submitting the entire project to a full environmental assessment with a public hearing on all aspects of the proposed refurbishment of the Gentilly-2 reactor.

The Lack of a Federal Panel Review of the Refurbishment

In effect, the modifications to the reactor core and the primary heat transport system currently proposed by Hydro-Québec amount to a "mini-decommissioning" operation. The word "decommissioning" is used in several different senses in the context of nuclear reactors; we are referring here to the most complete form of decommissioning, which is the total dismantlement of the radioactive structures of the reactor in order to return the reactor site to "green field" status.

In a complete decommissioning operation, the reactor is first de-fuelled: that is, all of the irradiated fuel is removed from the reactor core and placed in a water-filled spent fuel bay. Next, the reactor vessel is drained of its heavy water moderator, and the primary heat transport system is drained of its heavy water coolant. Chemical treatments are then used to remove as much of the radioactive contamination within the pipes as possible, in order to reduce radiation fields for the workers. This of course produces radioactively contaminated liquid wastes. Then the highly radioactive pressure tubes and the somewhat less radioactive feeder pipes are removed, creating the bulk of the radioactive solid wastes.

All of this work is intended to be carried out by Hydro-Québec in order to extend the lifetime of the reactor. Of course, total decommissioning would involve several additional steps, notably the dismantling of the huge irradiated calandria vessel itself. Nevertheless, the steps listed above are exactly the same as the initial steps that must be taken during any final and

complete decommissioning operation.

But all CANDU decommisioning plans suggest postponing the work of dismantling the radioactive structures for forty years or more in order to minimize worker exposures. The passage of time allows for the intensely penetrating radiation fields around the core of the reactor and the primary heat transport system to decline significantly due to radioactive decay. This, however, is not what Hydro-Quebec is proposing. Hydro-Quebec does not want to wait forty years to refurbish the reactor, so the work-force will be sent into highly radioactive areas that have not been allowed to "cool down".

Workers are thus exposed to high radiation fields and the ever-present possibility of radioactive contamination which could be tracked off-site. During the retubing of the Pickering A reactors, some Ontario Hydro workers became contaminated with radioactive carbon-14 dust and tracked it into their homes. For some days the very existence of this radioactive dust was not recognized by Ontario Hydro authorities because the weak beta radiation given off by carbon-14 did not register on the regular radiation monitors. When the fine carbon-14 dust was finally detected suspended in the atmosphere inside the plant, the contamination was traced to workers' homes. Some furniture and bed-sheets had to be confiscated and treated as radioactive waste material,

Clearly, the retubing of an old reactor is a major operation which has a far greater potential for environmental contamination than the construction of a brand-new reactor. When a new reactor is being built, the construction materials are not radioactive; but when an old reactor is being retubed, most of the materials are intensely radioactive.

In the case of nuclear facilities, The Canadian Environmental Assessment Act requires a full environmental assessment process for the construction of a new nuclear reactor or for the decommissioning of an old nuclear reactor. Clearly, it is the intent of the law that such an environmental assessment should also be carried out for the "mini-decommissioning" operation known as retubing.

However, the Canadian Nuclear Safety Commission (CNSC) - successor to the Atomic Energy Control Board (AECB) -does not see it that way. CNSC has decided to classify the refurbishment of the Gentilly-2 reactor as a regular "maintenance" operation, which is clearly inappropriate, given the scope of the operation, the amount of radioactive materials involved, and the radiation fields to which the workforce will be exposed.

Recommendation 8: CCNR urges the BAPE to recommend that the Quebec Environment Minister, Thomas Mulcair, contact his federal counterpart in order to arrange for a joint federal-provincial panel review of the potential environmental impacts associated with the proposed refurbishment of the Gentilly-2 reactor. Meanwhile, Hydro-Quebec's proposed modifications to the radioactive waste storage facilities should not be approved pending the outcome of such a provincial/federal initiative.

The Cost and the Adequacy of the Proposed Reactor Modifications

Expensive as the proposed modifications to the core of the Gentilly-2 reactor are expected to

be, they will not succeed in restoring the reactor to a condition which is "as good as new". The entire primary cooling circuit of the Gentilly-2 reactor has undergone significant degradation, due to:

- intense neutron bombardment,
- unremitting exposure to high temperatures and pressures
- repeated chemical and physical stresses which have had a serious deteriorating effect on the smaller pipes especially, and
- lack of adequate inspection and maintenance due to the intense radiation fields surrounding these pipes – which makes direct contact very difficult, extremely costly, and indeed in many cases impossible.

It has come to the attention of CCNR that much of the degradation in the primary cooling circuit has neither been studied nor documented in adequate detail. Because of this, it is entirely likely that within a decade or less, further expensive modifications may have to be made to the reactor's primary cooling circuit. Of course, this will make the total cost of all these modifications much higher than presently estimated, thereby compromising or negating any economic justification for the project that is offered at the present time.

For example, it may be that one or more of the 92-ton steam generators at Gentilly-2 may have to be replaced in years to come, as has been done in some nuclear reactors operating in the USA (e.g. the Turkey Point reactor in Florida). [See Appendix A]

There has never been a replacement of a steam generator in a CANDU reactor, and the Gentilly-2 reactor building was never designed to allow for such an operation. To remove a steam generator will be very costly, necessitating the creation of a large hole in the containment wall to allow for the removal of the old steam generator and the installation of the new one. Needless to say, this will also result in a very large and bulky piece of radioactive garbage (the old steam generator) for which there are no radioactive waste storage facilities in place or even contemplated.

It is also likely that the modifications to Gentilly-2 will be much more costly than anticipated, even in the absence of any future unpleasant surprises. Already the cost estimate has escalated from around $800 million to $1,200 million – an increase of 50 percent before any work has even been started!

Recently we have witnessed the spectacle of Ontario Power Generation attempting to restart the four Pickering A reactors near Toronto, which were shut down in 1997 for safety reasons. OPG originally estimated the cost of restarting all four reactor at $800 million, but so far they have only succeeded in restarting one of them, namely Unit 4, at a cost of $1.4 billion. In other words, that one reactor cost almost double the estimated cost for restarting all four reactors! And, let it be noted, all four of these reactors were retubed two decades ago! The current estimated cost of restarting all four reactors is between $3 billion and $4 billion – more than 4 times the original cost estimate of $800 million. [See Appendix B]

The problem is that the radiation fields around the pipes are so intense that direct observations are extremely limited. As a result, unanticipated cost escalations and time delays (which also add significantly to the cost) are frequently experienced. Thus the original cost

estimate may be off by a factor of two, or three, or even four. But once a few hundred million dollars have been spent, it becomes virtually impossible to stop just because the project is going over budget.

There is no complete cure for this problem. However, recognizing that there may be a built-in bias within Hydro-Quebec's nuclear division which tends to under-estimate costs in order to get the project approved, CCNR recommends that the Government of Quebec ensure that an independent assessment be carried out prior to project approval.

It will be remembered that in 1997 the Ontario Hydro Board of Directors did something comparable; they brought in an outside team of nuclear experts in order to give an independent assessment of the status of Ontario's nuclear reactors. As a result of this investigation, seven of Ontario's 22 reactors were shut down for safety reasons. It was the largest shut-down of reactors in the history of nuclear power around the world.

Recommendation 9: Given the enormous sums of money involved, and the high degree of financial uncertainty surrounding the estimation of the final cost of Hydro-Québec's proposed modifications, CCNR urges the BAPE to recommend that Hydro-Québec not be allowed to proceed until an independent team of experts from outside Canada is engaged by Hydro-Québec to assess the adequacy of the proposed modifications and the accuracy of the associated cost estimates. In particular, this external review should examine the possibility that steam generators or other components may have to be replaced at some future date.

A New Category of Long-Lived Radioactive Wastes in Quebec

Meanwhile, in preparation for these elaborate and costly modifications, Hydro-Quebec is seeking permission to store ever-greater quantities of radioactive waste materials at the two existing storage sites which are located away from the reactor buildings - the one for irradiated nuclear fuel (high-level radioactive waste) and the other for diverse radioactive waste materials (low- and medium-level radioactive wastes).

But that's not all. In addition, Hydro-Québec is also seeking permission to create a third radioactive waste storage site, a brand new one, also away from the reactor buildings, to house the intensely radioactive pressure tubes, feeder pipes, and other materials removed from the primary cooling circuit of the Gentilly-2 reactor.

These wastes represent an entirely new category of radioactive waste materials - they will be the most radioactive and the longest-lived radioactive wastes in Quebec other than the irradiated nuclear fuel itself.

It is important to note that the irradiated pressure tubes remain dangerously radioactive for a very long time - tens of thousands of years - because of the creation of numerous radioactive materials in the zirconium-niobium alloy resulting from neutron activation. Some of these "activation products" are intense gamma-ray emitters having a significantly long lifetime, in some cases measured in millennia.

It is a significant fact that these new radioactive wastes are solely the responsibility of Hydro-Québec, and not at all the responsibility of the Government of Canada. Gordon Edwards, President of CCNR, was recently in Toronto meeting with Elizabeth Dowdeswell, President of the NWMO. He asked whether the irradiated pressure tubes and other debris extracted from a reactor undergoing modifications would be covered by the NWMO or by the Nuclear Waste Act which created the NWMO. Her response was a categorical "No".

Recommendation 10. It is essential that Hydro-Québec elaborate detailed plans for managing the irradiated pressure tubes, feeder pipes, and other radioactive debris from the refurbishment of the reactor, for many millennia to come. In the absence of a full environmental assessment covering the long-term (perpetual) management of these highly radioactive and long-lived nuclear wastes, CCNR urges the BAPE to disallow the creation of a new waste site designed to house these retubing wastes.

Nathalie Girard
Executive Secretary, KEAC
P.O. Box 930
Kuujjuaq, Quebec, J0M 1C0

Date: December 20, 2004

Dear Ms. Girard;

Please accept this letter as invitation by Inuit Tapiriit Kanatami to attend the Nunavik region of the National Inuit Specific Dialogue on the Long-Term Management of Nuclear Fuel Waste in Canada.

This meeting will take place on January 27 and 28, 2005 in Kuujuaq. The exact location will be announced in the near future.

All arrangements (travel, accommodations) will be taken care of by Mr. Pauloosie Akeeagok, Jr. Researcher within ITK's Environment department. Mr. Akeeagok can be reached via phone at 1-866-262-8181 or by e-mail at akeeagok@itk.ca.

Should you be able to attend, could you please contact Mr. Akeeagok to confirm by January 7, 2005.

If you have any questions, please do not hesitate to contact Mr. Akeeagok at the coordinates listed above, or please contact me at the telephone number listed below.

Sincerely,

Soha Kneen
Environment Department Coordinator
Inuit Tapiriit Kanatami
170 Laurier, Suite 510
Ottawa, ON
K1P 5V5
1-866-262-8181, ext. 242
kneen@itk.ca
www.itk.ca

Subject: Invitation to the Inuit-Specific Dialogue on the Long-Term Management of Nuclear Fuel Waste in Canada (Kuujjuak)
Date: Monday, December 20, 2004 1:33 PM
From: Soha Kneen <kneen@itk.ca>
To: <ngirard@krg.ca>

Hello everyone:

My name is Soha Kneen and I'm ITK's National Coordinator on the Inuit-Specific Dialogues on the Long-Term Management of Nuclear Fuel Waste in Canada.

We are currently in the process of organizing the dialogue in Kuujjuak, which will be taking place on January 27-28, 2005. We would be very pleased if you could attend this dialogue.

Should you have any further questions, please do not hesitate to contact me (at the coordinates listed below) or PJ Akeeagok (our Jr. Researcher/Project Coordinator), who is currently assisting me on this file and who will be taking care of the travel and accomodations arrangements for this meeting. PJ can be reached at akeeagok@itk.ca.

All the best and I look forward to seeing you in Kuujjuak!

Sincerely,

Soha Kneen

Soha Kneen
National Coordinator on the Inuit Specific Dialogues on the Long-Term Management of Nuclear Fuel Waste Environment Department Inuit Tapiriit Kanatami

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*From December 2, 2001, Inuit Tapirisat of Canada's name has changed to Inuit Tapiriit Kanatami (ITK).

"Tapirisat" means "we will unite" and, after 30 years of achievements and the signing of four land claims, Inuit felt it was time to acknowledge that Inuit are united, which is "Tapiriit" in Inuktitut. "Kanatami" means "of Canada".*

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INUIT TAPIRIIT KANATAMI

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.

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.

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.

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.

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.

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.

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.

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.

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.

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.

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).

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.

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.

December 22 2004

Additional comments
to the BAPE concerning
Hydro-Québec's G-2 reactor
by Gordon Edwards, Ph.D.,
Président du RSN

I would like to make some further comments in connection with the testimony given to the BAPE on Thursday December 16 by myself and others concerning the proposed modifications to the radioactive waste disposal sites at Gentilly-2.

1. What should Hydro-Quebec do with the wastes that already exist?

My friend and colleague Michel Fugère has informed me that I did not provide a thorough answer to this question at the time of the hearing, due to my incomplete understanding of the question (my French is imperfect and I sometimes get confused when listening to someone else speaking). I will now attempt to address this question in the context of the current situation.

Let us first observe that there are two reactors at the Gentilly site, one of which belongs entirely to the federal government (i.e. AECL), and another which belongs entirely to Quebec (i.e. Hydro Québec). There are also two sets of irradiated nuclear fuel wastes, one which is federally owned, one which is provincially owned.

Secondly, let us note that because of the intense "decay heat" produced by irradiated nuclear fuel long after it has been discharged from the reactor, it is not possible to transport irradiated nuclear fuel until it has been stored for at least 7-10 years in pools of circulating water. Only then has radioactive decay reduced the heat output to a level which will allow dry storage or transportation off-site.

Third, let us consider that if Hydro-Québec is not given permission to go ahead with the "réfection" of Gentilly-2, the plant will nevertheless continue to operate until

2013 or thereabouts. This means that the transport of all irradiated nuclear fuel off-site could not possibly be accomplished until 2020 at the earliest.

Fourth, let us recall that Hydro-Québec has provided somewhat sketchy plans for the ultimate "decommissioning" (in the sense of complete dismantlement) of the Gentilly-2 reactor which is not intended to be undertaken until about 40 years after the complete shutdown of the reactor. This lengthy delay is included in order to minimize worker exposure to the intense radiation fields encountered in the core area of the reactor, which will persist for many years after the reactor has been completely shut down and the irradiated fuel has been completely removed.

Fifth, let us consider that Hydro-Québec has every intention of sending hundreds of men into the plant to carry out the "réfection" of the Gentilly-2 reactor, without waiting at all for the intense radiation fields to subside. This will likely include hundreds of men who are not employees of Hydro-Québec, who are not qualified as "atomic workers", who will have only a very minimal understanding of the risks to their own health and safety associated with working in such a radioactive environment.

I believe that Québec should consider its options very carefully. If the réfection of Gentilly-2 is not approved, then strong pressure can be brought to bear on the federal government to proceed with the complete demolition of the radioactive structure known as Gentilly-1, and to remove the resulting radioactive débris as well as the federal inventory of irradiated fuel from Québec territory. This would be justified by the fact that Québec has decided to phase out of nuclear power and wishes to deal with the legacy problems in a timely manner, starting now.

Since Gentilly-2 was built at the urging of the federal government (in fact G-2 would not have been built without the design work of AECL and the financial participation of Ottawa) the Québec government can pressure Ottawa (for a consideration) to take all of the irradiated nuclear fuel produced by Gentilly-2 to some active nuclear site (presumably in Ontario) so as to consolidate the inventory of irradiated nuclear fuel in a smaller number of locations. Again, this

would be justified by the fact that Quebec is phasing out of nuclear power.

Now, one may argue that Ottawa will not agree to remove the irradiated nuclear fuel from G-2. But if Ottawa will not agree to do so under the circumstances described above, then when will they agree to such an undertaking? Is it not better to find out sooner rather than later if Quebec is going to be able to rid itself of these wastes? By carrying out the réfection of Gentilly-2, and extending the life of the reactor for 10 or 15 or 30 more years (at very great expense), isn't Québec simply postponing this question for several decades? Doesn't it just allow Hydro-Québec and the Government of Québec to continue to ignore the problem while it grows in size and toxicity?

It is possible, of course, that in several decades the Canadian nuclear industry may be in better shape than it is today, but it is also possible (and much more likely) that it will be in worse shape. Since the mid-1970s, the industry has been getting steadily weaker. Domestic sales have been non-existent. Overseas sales have been too slow, too few, and not sufficiently profitable. Thousands of AECL employees have lost their jobs. The Whiteshell Research Centre in Manitoba -- one of two major nuclear research centres in Canada -- has been completely shut down.

Now may be the best time for Québec to try to divest itself of these nuclear wastes, if in fact that is the ultimate intention of the Government of Quebec. For at the present time, AECL and Ottawa want to create a favourable impression with their overseas customers that irradiated fuel can be safely and acceptably handled; they would not want there to be an apparent problem with one of its domestic clients such as Hydro-Québec. In other words, they would be highly motivated to find an acceptable accommodation.

It is worth remarking, moreover, that by getting Ottawa to undertake the complete dismantling of Gentilly-1, local Québec workmen would still likely get well-paying jobs, working in a much less radioactive environment than would be the case if they were carrying out the réfection of G-2. The Gentilly-1 reactor only operated for less than 200 days in total, and has already been shut down for many years; hence the working environment would be very much

safer for both the workers and for the environment.

Incidentally, the experience gained in dismantling the G-1 reactor would be an invaluable "practice" for the eventual dismantling of the far more radioactive G-2 reactor. Moreover, the robotic tools and specialized skills developed could become marketable overseas, as there is a growing world-wide demand for such expertise in radioactive demolition. The IAEA (International Atomic Energy Agency) has estimated that there are a hundred or more reactors around the world that will need to be dismantled by 2020, each one at a cost of a billion dollars or more (probably more). Thus Québec could get in on the ground floor in a new and marketable service area. There would undoubtedly be non-nuclear spin-offs as well, in terms of robotic tools and techniques for handling other types of toxic materials.

I will send this portion of my additional comments by e-mail now and send the remainder in a separate e-mail.

Yours very truly,

Gordon Edwards, Ph.D.,
Président du Regroupement
pour la surveillance du nucléaire.
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December 22 2004

Additional comments
to the BAPE concerning
Hydro-Québec's G-2 reactor
by Gordon Edwards, Ph.D.,
Président du RSN

(continued)

2. In my testimony, I stated that the exercise currently being conducted by the Société pour la gestion des déchets nucléaires (SGDN) is more of a public relations exercise than a serious attempt to solve the problem of the long-term management of irradiated nuclear fuel. Let me explain.

For many years, the Canadian nuclear industry and AECL (Atomic Energy of Canada Limited) have maintained that the problem of managing irradiated nuclear fuel in perpetuity is not so much a technical problem as a public relations problem. In the late 1970's and throughout the 1980's, spokesmen from the industry often made this very point at public meetings.

In fact, prior to 1976, there was no official acknowledgment by the industry or by the government that this problem even existed. Most politicians and members of the general public had no idea that irradiated nuclear fuel was highly toxic and extremely long-lived, and that it would be quite costly to manage. It was viewed by the industry as a "non-problem". and was simply overlooked as an issue.

Things changed in the late 1970s. By 1978, the Ontario Royal Commission on Electric Power Planning (the "Porter Commission") had concluded that the problem of the long-term management of irradiated nuclear fuel was very serious, and recommended that if insufficient progress was made on this dossier by 1985 (a deadline that was later extended to 1990 in the Final Report) then a moratorium on new nuclear power plants would be justified.

In fact, several of the Major Conclusions and Findings of the Porter Commission which appeared in the Interim Report on Nuclear Power entitled "A Race Against Time" (1978) are, in my view, quite relevant to the current BAPE hearings:

> "An independent review committee should be established to report to the Atomic Energy Control Board (AECB) on progress on waste disposal research and demonstration. If the committee is not satisfied with progress by 1985, a moratorium on additional nuclear power plants would be justified."
>
> (Major Findings and Conclusions, p. xiii)

> "Nuclear energy should no longer receive the major portion of energy research funding. There should be much greater expenditure on the development, demonstration and commercialization of energy storage, energy-efficiency (co-generation and fluidized

bed combustion) and renewable technologies which are compatible with Ontario's energy needs."
(Major Findings and Conclusions, p. xvii)

"An assessment of the acceptability of the risks and benefits of nuclear power must include an assessment of the social, ethical and political implications of its use."
(Major Findings and Conclusions, p. xv)

"New and imaginative approaches to inform and involve the public in nuclear decisions which extend well beyond the public hearing process must be developed."
(Major Findings and Conclusions, p. xv)

"The principle of "openness" of the regulatory process is important. Public participation should increasingly be recognized as an essential component of decision-making on nuclear matters."
(Major Findings and Conclusions, p.xvii)

"Governments must recognize that decisions about nuclear power are fundamentally political in the widest sense of the word; they relate to quality of life and quality of the environment; they cannot be left to the utility alone."
(Major Findings and Conclusions, p. xviii)

The recommendations of the Porter Commission echoed those that had appeared in a 1976 Royal Commission Report from Britain (the "Flowers Report") which had concluded that

"There should be no commitment to a large programme of nuclear fission power until it has been demonstrated beyond reasonable doubt that a method exists to ensure the safe containment of long-lived, highly radioactive waste for the indefinite future."
(Flowers Report, Summary of Principle Conclusions and Recommendation, para. 533)

A very important aspect of these strong recommendations is that the future of the nuclear industry came to depend directly upon finding an acceptable solution to the long-term

management of nuclear wastes. This fact put the nuclear industry in a serious conflict of interest position; for the temptation to give the APPEARANCE of a solution, if it is not possible to find an actual solution, is very great.

If expanding the nuclear industry is the number-one priority, then the absence of an acceptable waste disposal method is an intolerable nuisance. It is an enormous public relations problem. It is tempting to do something with the waste, just to give the appearance that something is being done, even if what is being done is not really an acceptable solution to the problem. Burial of the irradiated nuclear fuel in the Canadian Shield is AECL's preferred option; they spent $700 million over a period of 15 years researching that single solitary option. From a political perspective, it has one great advantage : "out of sight, out of mind." People don't worry so much about things which are far away from them.

Since the federal government is and always has been a strong promoter of nuclear power, this same conflict of interest that afflicts the nuclear industry also extends to the government of Canada. (Our figures show that the federal government has invested over $17 billion of taxpayer's money in promoting nuclear power : see http://ccnr.org/sunset_table.html.)

It seems evident that both Ottawa and the nuclear industry want to continue producing irradiated nuclear fuel; therefore, they must find either an actual solution or an apparent solution to the waste problem.

This conflict of interest soon became incarnated in the process itself. When federal Energy Minister Jake Epp first proposed a generic environmental assessment of the AECL concept of geological "disposal" of irradiated nuclear fuel, Lucien Bouchard was Minister of the Environment in Ottawa. Minister Epp demanded an assessment process on irradiated nuclear fuel management that explicitly forbade any examination or commentary upon the question of whether the production of irradiated nuclear fuel should be reduced or stopped altogether. Minister Bouchard objected to this, saying that the option of "reduction at source" is an important aspect of any toxic waste management strategy.

Minister Epp proposed a compromise. If the environmental assessment were allowed to proceed along the restricted lines that he had insisted upon, then the government of Canada would organize another "parallel" set of public hearings to examine the role of nuclear energy in the context of an overall energy strategy for Canada. This compromise was accepted by Minister Bouchard.

During the first phase of the public hearings held by the Seaborn Panel, the question of the role of nuclear energy was raised repeatedly by members of the public. The Panel Chairman, Blair Seaborn, patiently explained (as a matter of public record) that there would be parallel hearings on the role of nuclear energy in Canada and that the public would have ample opportunity to discuss those issues there.

When it later became apparent that the Government of Canada had reneged on its promise to hold public hearing on the role of nuclear energy, Mr. Seaborn publicly apologized for having unwittingly misled people in earlier sessions. He expressed his own sense of frustration over the bad faith shown by the government.

Later, when the Seaborn Panel had concluded its ten-year environmental assessment of the geologic disposal concept, it unanimously recommended that a Nuclear Fuel Waste Agency be created, which would be completely independent of the nuclear industry, and whose Board of Directors would represent important stakeholders, including aboriginal people.

The Seaborn Panel found that AECL's geologic disposal concept did not fully satisfy the criteria for safety, and that it completely failed the test of public acceptability. The principal uncertainties about geologic disposal center on these facts:

- that geology is not a predictive science;
- that science has no way of assessing an infinite time horizon;
- that undisturbed geologic strata must be disturbed to be useful;
- that excavations can't be restored to the same integrity as undisturbed rock;
- that mathematical models are often not

empirically verifiable;
- that failure of containment, if and when detected, cannot be corrected;
- that irradiated fuel is thermally and chemically active as well as radioactive.

Nevertheless the Panel felt that more work should be done on the problem, and on the geologic disposal option, but that the inherent conflict of interest embodied in the nuclear industry must at all costs be avoided in the Nuclear Fuel Waste Agency. The Seaborn Panel also recommended that the findings of the NFWA should be reviewed periodically and publicly by the federal Parliament.

The Chrétien government did not accept these recommendations of the Seaborn Panel. It passed a law, the Nuclear Fuel Waste Act, which created the present SGDN as a creature of the nuclear industry, whose Board of Directors consists of Ontario Power Generation, NB Power Corporation, and Hydro-Québec -- the very utilities that are creating the irradiated nuclear fuel in the first place.

Moreover the SGDN reports not to parliament but to the federal cabinet, which then decides on the appropriate course of action. There is no assurance of any further democratic debate.

The famous conflict of interest, mentioned above, is manifested by the fact that SGDN is "not allowed" to address the question of whether or not Canada should or should not continue to produce irradiated nuclear fuel, even though that is evidently a question of central importance. The SGDN concerns itself almost exclusively with the three options mentioned in the law itself: permanent geologic disposal, centralized monitored storage, or on-site storage at the reactors that have produced the irradiated nuclear fuel in the first place.

Evidently, however, none of these options makes complete sense as a "solution" to the problem if we are to continue producing irradiated nuclear fuel indefinitely.

First of all, on-site storage is simply status quo -- it is not a solution, especially if irradiated nuclear fuel continues to be produced so that the amount at the

surface simply grows larger and larger as time goes by.

Secondly, centralized storage does not offer much of a solution if the irradiated fuel continues to be produced, because it just adds one more site to the several existing sites (at the reactors) where the irradiated fuel is being produced. And since the irradiated fuel cannot be moved away from the reactor site for a decade or so after it has been produced, the inventory of fresh irradiated fuel at each reactor site will remain very substantial at all times.

Similar comments apply to the geologic disposal option, with the added observation that as long as irradiated nuclear fuel continues to be produced on an on-going basis, nobody is going to want to seal up the geologic repository because there's always more that must be added to what's already there.

It is a sad commentary that the government of Canada is afraid to ask the question, "should we continue to produce irradiated nuclear fuel in Canada?" Hopefully, the Government of Quebec is not afraid to ask the corresponding question as it pertains to Quebec: "should Québec continue to produce irradiated nuclear fuel?"

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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.

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.

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.

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.

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.

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.

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.

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.

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.

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.

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).

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.

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.

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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OCTOBER 2004

Sources:

Nuclear Fuel Waste Act
NRCan Power Point Presentation (Dr. Peter Brown, Feb. 24, 2004)
NWMO Discussion Document: Asking the Right Questions

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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 a comprehensive public dialogue process is conducted with Inuit 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 dialogue with 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 dialogue 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.

[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."

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Consultation with the Inuit Land Claims Organizations:

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

Reasons and objectives of the consultation:

- The design and execution of a culturally specific dialogue 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 dialogues 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.

INFORMATION KIT
FOR THE
NATIONAL INUIT-SPECIFIC DIALOGUE
ON THE
LONG-TERM MANAGEMENT OF NUCLEAR FUEL WASTE IN CANADA

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INUIT TAPIRIIT KANATAMI

Sources:

Nuclear Fuel Waste Act
NRCan Power Point Presentation (Dr. Peter Brown, Feb. 24, 2004)
NWMO Discussion Document: Asking the Right Questions
AFN Fact Sheet
http://www.nucleartourist.com/world/canada.htm

1.0 BACKGROUND

Commercial production of nuclear power began in Canada when Atomic Energy of Canada Ltd. (AECL) opened the Douglas Point nuclear generating station in 1968. Additional nuclear generating stations were built throughout the 1970's, 80's and 90's. As of 2003, there were 22 licensed CANDU (Canadian Deuterium Uranium) reactors in Canada, that as part of their operations, produce highly radioactive used nuclear fuel waste.

2.0 WHAT IS USED NUCLEAR FUEL WASTE?

Nuclear fuel waste is the used uranium fuel from nuclear reactors, which is used to produce energy. This Nuclear Fuel Waste is contained within irradiated fuel bundles (please see the picture below), which weigh approximately 20 kg each.

NRCan Power Point Presentation
(Dr. Peter Brown, Feb. 24, 2004)

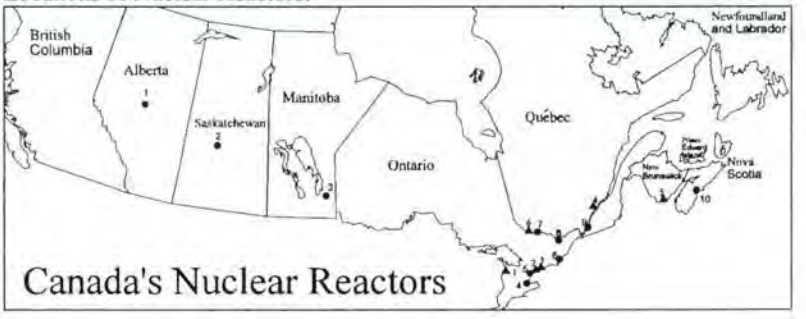
These bundles, she added, are also used in research reactors in universities and in hospitals for making isotopes for medical procedures. The finished bundles are removed from the reactors by robot due to the high levels of heat and radiation. With the hazards of spent fuel continuing for thousands of years, and continuing use of nuclear fuel, the waste will increase many times over. Long term plans for disposal are required for good stewardship.

Because of its radioactivity and toxic properties, nuclear fuel waste is dangerous to human and environmental health.

3.0 WHERE IS USED NUCLEAR FUEL WASTE CURRENTLY STORED?

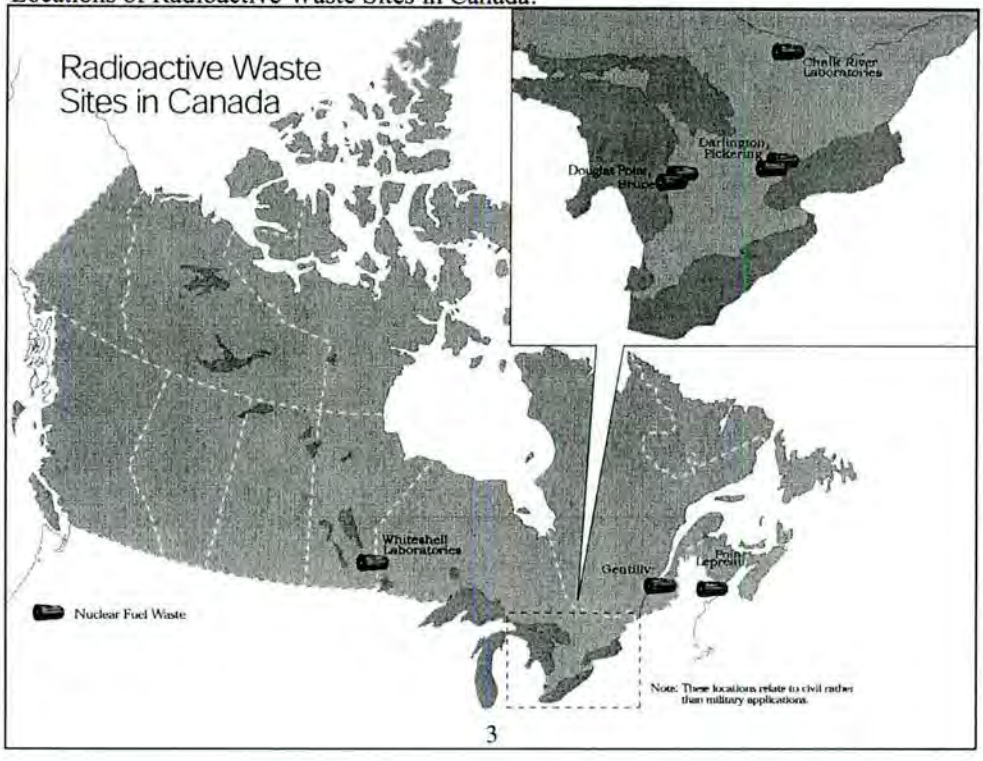
For the most part, used nuclear fuel waste is currently stored on-site at nuclear generating facilities, either in wet or dry storage. Some waste is also stored at the Chalk River and Whiteshell Laboratories.

Locations of Nuclear Reactors:



On the map, circles represent research reactors; triangles represent commercial facilities (http://www.nucleartourist.com/world/canada.htm).

Locations of Radioactive Waste Sites in Canada:



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4.0 WHO PRODUCES NUCLEAR FUEL WASTE?

Nuclear fuel waste is produced by nuclear generating facilities that have been operating since the mid- to late 1970's. Ontario Power Generation is responsible for approximately 90% of the waste, New Brunswick Power for 4%, Hydro-Québec for 4%, and Atomic Energy of Canada Ltd. for 2%. Other waste owners (i.e. universities) produce much smaller quantities of nuclear fuel waste.

5.0 HOW MUCH NUCLEAR FUEL WASTE IS THERE IN CANADA?

As of 2002, approximately 1.7 million used nuclear fuel bundles (approximately 40,000 metric tones) have been produced (enough to fill three hockey rinks). At current rates of nuclear power production, 3.6 million used fuel bundles will be produced by 2033.

6.0 HOW LONG DOES NUCLEAR FUEL WASTE REMAIN DANGEROUS?

The radioactivity of substances is measured in half-lives, or the amount of time for the material to lose half of its radioactivity. Waste by-products such as uranium have half-lives as long as 710,000 years.

7.0 MANAGING NUCLEAR FUEL WASTE IN CANADA

The management of nuclear fuel waste in Canada has been a lengthy process and the focus of much debate. A brief overview of the history of nuclear fuel waste management is provided below.

1977 – The Hare Commission, contracted by Energy, Mines and Resources Canada, released a report favouring the use of deep geological burial in igneous rock for the management of nuclear fuel waste.

1988 – The Minister of Energy, Mines and Resource Canada referred the concept of deep geological disposal to the Minister of Environment for review.

1989 – The Seaborn Panel was established to review the concept of deep geological disposal.

1996 – Prior to completion of the Seaborn Panel's work, the Government of Canada released its "Policy Framework for Radioactive Waste Management" where they identified that industry should be responsible for the management of their wastes.

1998 – The Seaborn Panel released its report, concluding that "While the safety of the AECL concept has been adequately demonstrated from a technical perspective, from a social perspective it has not." A key aspect of their report was that it recommended any proposed waste management organization must be at arms length from industry to have credibility.

1998 – The Government released its response to the Seaborn Panel's findings, recommending that industry be responsible for management of its waste.

2002 – The Nuclear Fuel Waste Act was passed, requiring the producers of nuclear fuel waste to form a waste management organization (Nuclear Waste Management Organization [NWMO]) to provide recommendations on the long-term management of nuclear fuel waste by November 15, 2005. The Government is responsible for reviewing and approving key NWMO activities.

8.0 THE NUCLEAR FUEL WASTE ACT

The Nuclear Fuel Waste Act (NFWA) came into force on November 15, 2002. This Act is a key to the implementation of the 1996 Policy Framework for Radioactive Waste. Natural Resources Canada is overseeing the NFWA. Important elements of the Act include the following:

- The establishment of the Nuclear Fuel Waste Management Organization (NWMO) is to implement the long-term management of nuclear fuel waste. The major owners of nuclear fuel will establish this organization to deal with the management, finances and operations around nuclear fuel waste.
- The NWMO is required to study the following 3 methods of managing nuclear fuel waste: deep geological disposal in the Canadian Shield, storage at nuclear reactor sites and centralized storage, either above or below ground. Other management options may be considered, at the discretion of the NWMO.

- Major owners of nuclear fuel waste must pay into trust funds to finance the long-term management of nuclear fuel waste.
- The NWMO must consult with the general public, and in particular Aboriginal peoples, on each of the proposed approaches.
- Within three years of the Act, the NWMO must submit a study which includes a detailed technical description of each proposed approach, specifying an economic region for its implementation.
- The Governor in Council (Prime Minister) has the authority to make a decision on the choice of approach for the long-term management of nuclear fuel waste in Canada, to be implemented by the NWMO.
- Each approach must include plans for how the NWMO will minimize effects on a community's way of life.
- The Act requires the NWMO to establish an Advisory Council, who will provide written comments on the study of the proposed approaches.

9.0 INUIT AND NUCLEAR FUEL WASTE

No Inuit communities are currently located close to a nuclear power plant. Some, such as Inuit living in Nunavik (northern Québec), and those residing in Nunatsiavut (Labrador), hold traditional territory in areas that could be considered for the Long-Term storage of Nuclear Fuel Waste. The Labrador Inuit Association (LIA) is, however, opposed to the storage of Nuclear Fuel Wastes in Nunatsiavut and adjacent areas of northern Québec and Labrador.

Depending on the method of management chosen, there is a potential for Inuit communities to be affected. Consideration must also be given to those communities along potential transport routes, should Nuclear Fuel Waste require transportation from the nuclear reactor sites where it is produced to their intended storage facilities.

10.0 THE SEABORN PANEL

The Seaborn Panel was appointed by the Federal Government in 1989 to assess the options regarding the Long-Term Management of Nuclear Fuel Waste in the Canadian Shield.

Some of the concerns expressed by Aboriginal representatives that were present at that time included the following.

- They did not have the opportunity to study the proposal for nuclear fuel waste disposal in the Canadian Shield;
- The proposals do not incorporate Traditional Knowledge;
- The proposals conflict with their deeply held beliefs.

The Seaborn Panel released its final report in 1998, concluding that while the safety of deep geological disposal was demonstrated, the concept did not have the broad public support needed to move forward. One of the Seaborn Panel recommendations was to initiate an Aboriginal participation process. The proposed Nuclear Fuel Waste Act (Bill C-27) was reviewed by two Committees before it became law in 2002.

11.0 RECENT DEVELOPMENTS

The Nuclear Fuel Waste Act came into force in November 2002. In this act, a provision for consultations with the general public and "in particular Aboriginal peoples, on each of the proposed approaches" was included.

12.0 NEXT STEPS

Now that the Nuclear Fuel Waste Act has become law, the Inuit Tapiriit Kanatami (ITK) will begin to play a new role with regards to the Inuit engagement around the Long-Term Management of Nuclear Fuel Waste. Natural Resources Canada and the Nuclear Waste Management Organization have provided funding to ITK to facilitate a three year dialogue on the Long-Term Management of Nuclear Fuel Waste in Canada. Other organizations, including the Assembly of First Nations (AFN), the Métis National Council (MNC) have also received funding for the purpose of conducting these dialogues or consultations.

For more information on the ITK directed dialogue process, please contact ITK's National Coordinator on the Inuit-Specific Dialogue on the Long-Term Management of Nuclear Fuel Waste in Canada at:

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13.0 PROPOSED DISPOSAL/STORAGE METHODS

13.1 Key Terms:

13.1.1 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

13.1.2 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.

13.1.3 Treatment:

Processes applied to used nuclear fuel that changes 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.

13.1.4 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.

13.2 Outline of 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.

13.2.1 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, which 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.

Deleted: <sp>

13.2.2 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.

13.2.3 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.

1re session, 37e législature,
49-50 Elizabeth II, 2001

Chambre des communes du Canada

PROJET DE LOI C-27

Loi concernant la gestion à long terme des déchets de combustible nucléaire

Sa Majesté, sur l'avis et avec le consentement du Sénat et de la Chambre des communes du Canada, édicte :

TITRE ABRéGé

1. *Loi sur les déchets de combustible nucléaire.*

Titre abrégé

DéFINITIONS

2. Les définitions qui suivent s'appliquent à la présente loi.

Définitions

« déchets nucléaires » Les grappes de combustible irradié retirées des réacteurs à fission nucléaire, à vocation commerciale ou de recherche.

« déchets nucléaires »
``*nuclear fuel waste*"

« gestion » S'agissant des déchets nucléaires, la gestion à long terme de ceux-ci par entreposage ou évacuation, y compris leur manutention, transport, traitement et conditionnement à ces fins.

« gestion »
``*managemen t*"

« ministre » Le ministre des Ressources naturelles ou le membre du Conseil privé de la Reine pour le Canada chargé par le gouverneur en conseil de l'application de la présente loi.

« ministre »
``*Minister*"

« région économique » Région définie par Statistique Canada dans son *Guide de l'Enquête sur la population active* paru le 31 janvier 2000.

« région économique »
``*economic region*"

« société de gestion » La société responsable de la gestion des déchets nucléaires constituée en application de l'article 6.

« société de gestion »
``*waste management organization*"

« sociétés d'énergie nucléaire »

« sociétés d'énergie nucléaire »
``*nuclear energy corporation*"

a) Ontario Power Generation Inc., Hydro-Québec, la Société d'énergie du Nouveau-Brunswick ainsi que toute autre entité propriétaire de déchets nucléaires provenant de la production d'électricité au moyen d'un réacteur nucléaire commercial;

b) le successeur ou cessionnaire éventuel des sociétés visées à l'alinéa *a*);

c) le cessionnaire éventuel d'Énergie atomique du Canada limitée (ci-après appelée Énergie atomique du Canada), personne morale constituée ou acquise aux termes du paragraphe 10(2) de la *Loi sur le contrôle de l'énergie atomique*, chapitre A-19 des Statuts revisés du Canada de 1970.

« taux de base » Taux d'intérêt auquel les banques accordent des prêts commerciaux à court terme à leurs clients de premier ordre et qui est fixé et publié par la Banque du Canada pour le mois.

« taux de base »
``*prime rate*"

OBJET

3. La présente loi vise à encadrer la prise de décision, par le gouverneur en conseil, sur proposition de la société de gestion, concernant la gestion des déchets nucléaires, dans une perspective globale, intégrée et efficiente de la question au Canada.

Gestion globale, intégrée et efficiente

CHAMP D'APPLICATION

4. La présente loi lie Sa Majesté du chef du Canada ou d'une province.

Obligation de Sa Majesté

5. La présente loi ne s'applique aux sociétés d'énergie nucléaire et à Énergie atomique du Canada que si elles sont propriétaires de déchets nucléaires.

Condition d'application

SOCIéTé DE GESTION DES DéCHETS NUCLéAIRES

6. (1) Il incombe aux sociétés d'énergie nucléaire de constituer une société de gestion - sans but lucratif pour l'application de la présente loi - ayant pour mission de formuler des propositions de gestion des déchets nucléaires à l'intention du gouvernement du Canada et de mettre en oeuvre celle éventuellement retenue sous le régime de la présente loi.

Constitution et mandat

(2) Toute société d'énergie nucléaire est tenue de faire partie de la société de gestion.

Adhésion obligatoire

(3) La société de gestion n'est pas mandataire de Sa Majesté du chef du Canada.

Pas mandataire de Sa Majesté

7. La société de gestion est tenue d'offrir à Énergie atomique du Canada et à tout propriétaire de déchets nucléaires produits au Canada qui ne fait pas partie de la société - sans discrimination et à prix raisonnable compte tenu de ce qu'il lui en coûte pour gérer les déchets nucléaires des propriétaires qui en font partie - les services de gestion de déchets nucléaires prévus dans la proposition retenue par le gouverneur en conseil.

Obligation envers autres propriétaires de déchets

8. (1) La société de gestion s'adjoint un comité consultatif qui a pour fonction d'étudier l'exposé des propositions de gestion et les rapports visés à l'article 18, et de lui faire part de ses observations écrites à ce sujet.

Comité consultatif

(2) Les membres du comité sont nommés par l'organe dirigeant de la société de gestion de façon à assurer la représentation, dans la mesure du possible :

Compétence et représentation

a) d'un large éventail de disciplines scientifiques et techniques se rapportant à la gestion de déchets nucléaires;

b) d'une expertise en affaires publiques appliquées au domaine de l'énergie nucléaire et, au besoin, d'autres sciences sociales connexes;

c) de l'administration publique ou de l'organisation autochtone dont la région économique est visée par la proposition retenue par le gouverneur en conseil.

FINANCEMENT

9. (1) Les sociétés d'énergie nucléaire et Énergie atomique du Canada instituent au Canada, individuellement ou conjointement, un fonds en fiducie auprès d'une institution financière constituée en personne morale ou formée sous le régime d'une loi fédérale ou provinciale, et à l'égard de laquelle elles ne détiennent pas, directement ou indirectement, la propriété effective de plus de dix pour cent de l'ensemble des actions en circulation d'une même catégorie.

Fonds en fiducie

(2) L'institution financière intéressée tient les documents afférents au fonds au Canada.

Documents afférents au fonds

10. (1) Les entités ci-après versent, directement ou par intermédiaire, dans leur fonds en fiducie, au plus tard dix jours après la date d'entrée en vigueur de la présente loi, les sommes suivantes :

Quote-part initiale

a) Ontario Power Generation Inc., 500 000 000 $;

b) Hydro-Québec, 20 000 000 $;

c) la Société d'énergie du Nouveau-Brunswick, 20 000 000 $;

d) Énergie atomique du Canada, 10 000 000 $.

(2) Elles sont tenues à la même obligation pour les années suivantes - la date d'exigibilité étant la date anniversaire de l'entrée en vigueur de la présente loi - à raison des sommes suivantes :

Quotes-parts annuelles

a) Ontario Power Generation Inc., 100 000 000 $;

b) Hydro-Québec, 4 000 000 $;

c) la Société d'énergie du Nouveau-Brunswick, 4 000 000 $;

d) Énergie atomique du Canada, 2 000 000 $.

(3) Le paragraphe (2) cesse de s'appliquer dès que le ministre agrée, conformément au paragraphe 16(3), les quotes-parts proposées par la société de gestion.

Péremption

(4) Des intérêts calculés quotidiennement au taux de base majoré de deux pour cent courent sur tout versement en souffrance.

Intérêts

(5) La quote-part et tous les intérêts courus doivent être déposés au plus tard trente jours après la date de la décision du gouverneur en conseil concernant la gestion des déchets nucléaires.

Date limite pour verser les fonds

11. (1) Seule la société de gestion peut retirer de l'argent d'un fonds en fiducie.

Pouvoir exclusif de la société

(2) Les fonds détenus en fiducie ne peuvent servir qu'au financement de la mise en oeuvre de la proposition retenue par le gouverneur en conseil, notamment pour prévenir ou atténuer, le cas échéant, ses répercussions socioéconomiques notables sur le mode de vie d'une collectivité, ou sur ses aspirations sociales, culturelles ou économiques.

Affectation unique

(3) Le premier retrait de fonds ne peut servir qu'au financement d'une activité de construction ou d'entreposage autorisée, après la décision du gouverneur en conseil, au titre de l'article 24 de la *Loi sur la sûreté et la réglementation nucléaires*.

Premier retrait

(4) S'il constate une dérogation aux paragraphes (2) ou (3), le ministre peut subordonner tout retrait éventuel à son agrément préalable.

Agrément préalable du ministre

EXPOSé DES PROPOSITIONS DE LA SOCIéTé DE GESTION

12. (1) Au plus tard trois ans après la date d'entrée en vigueur de la présente loi, la société de gestion remet au ministre un exposé de ses propositions de gestion des déchets nucléaires accompagné des observations de son comité consultatif. Elle indique dans l'exposé la proposition qui a sa préférence.

Trois ans pour faire des propositions

(2) Chacune des méthodes ci-après doit faire l'objet d'au moins une proposition :

Méthodes de gestion obligatoires

a) l'évacuation en couches géologiques profondes dans le Bouclier canadien décrite par Énergie atomique du Canada dans son *Étude d'impact sur l'environnement concernant le concept du stockage permanent des déchets de combustible nucléaire du Canada*, compte tenu des observations dont cette étude a fait l'objet dans le *Rapport de la Commission d'évaluation environnementale du concept de gestion et de stockage des déchets de combustible nucléaire* publié en février 1998;

b) l'entreposage à l'emplacement des réacteurs nucléaires;

c) l'entreposage centralisé en surface ou souterrain.

(3) Chaque proposition comporte les précisions techniques voulues et indique la région économique retenue pour sa mise en oeuvre.

Description technique et région retenue

(4) Chaque proposition fait état des avantages, risques et coûts comparatifs compte tenu de la région économique retenue et des considérations morales, sociales et économiques sous-jacentes.

Présentation comparative

(5) Chaque proposition énumère les services de gestion des déchets nucléaires qu'il incombe à la société de gestion d'offrir aux termes de l'article 7.

Liste de services

(6) Chaque proposition comporte un plan de mise en oeuvre prévoyant notamment les activités nécessaires à cette fin, un échéancier, un programme de consultations publiques et les moyens qu'entend prendre la société de gestion pour prévenir ou atténuer, le cas échéant, ses répercussions socioéconomiques notables sur le mode de vie d'une collectivité, ou sur ses aspirations sociales, culturelles ou économiques.

Mise en oeuvre

(7) Chaque proposition fait l'objet de consultations auprès du grand public - notamment les peuples autochtones - et la société de gestion joint à l'exposé un résumé des observations ainsi recueillies.

Consultation

13. (1) Chacune des propositions de l'exposé comporte, hypothèses et motifs à l'appui, une formule de calcul du financement annuel de sa mise en oeuvre établie à partir des renseignements suivants :

Financement des propositions

a) le coût total estimatif de la gestion des déchets nucléaires compte tenu d'événements - naturels ou autres - qui ont une probabilité de survenance raisonnable;

b) le taux de rendement estimatif des fonds en fiducie;

c) la durée de vie utile des réacteurs de chaque société d'énergie nucléaire et d'Énergie atomique du Canada;

d) les recettes estimatives provenant de la prestation de services de gestion auprès des propriétaires de déchets nucléaires autres que les sociétés d'énergie nucléaire et Énergie atomique du Canada.

(2) L'exposé prévoit pour chaque proposition la répartition motivée du coût total estimatif de la gestion des déchets nucléaires entre les sociétés d'énergie nucléaire et Énergie atomique du Canada.

Projection de la répartition des coûts

(3) L'exposé indique la forme et le montant des garanties financières fournies par les sociétés d'énergie nucléaire et Énergie atomique du Canada aux termes de la *Loi sur la sûreté et la réglementation nucléaires* et se rapportant à la gestion de déchets nucléaires.

Garanties financières

14. (1) Le ministre peut procéder aux consultations qu'il juge nécessaires auprès du grand public sur les propositions figurant dans l'exposé.

Option de consulter pour le ministre

(2) S'il juge les renseignements fournis dans l'exposé non conformes sur un point important aux exigences prévues aux articles 12 et 13, le ministre ordonne à la société de gestion de revoir les passages en cause dans le délai qu'il fixe.

Renvoi à la société

National Inuit Specific Dialogue on the Long-Term Management of Nuclear Fuel Waste

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 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.

Intent of the legislation (continued):

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.

Background:

In discussions with Nuclear Waste Management Organization (NWMO) and NRCan 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.

At that time it was indicated by us that it is essential that a comprehensive public dialogue process is conducted with Inuit in order to develop long-term management approach options, which are to be submitted by the NWMO on November 15, 2005.

Background (continued):

This proposed dialogue, which we have now initiated, 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.

Reasons and objectives of the consultation:

- The design and execution of a culturally specific dialogue 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;

Reasons and objectives of the dialogue (continued):

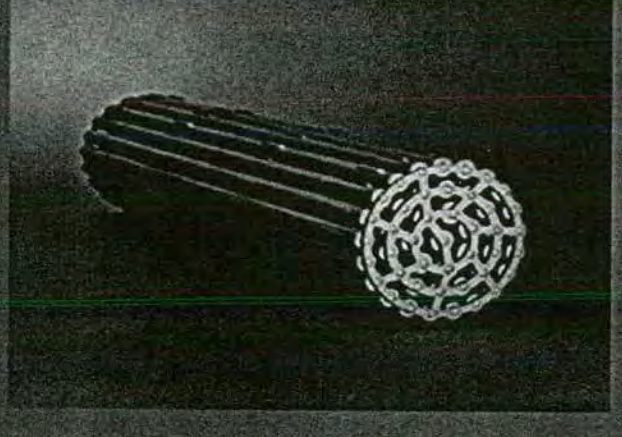
- To provide the Minister with the views and opinions of Inuit peoples in advance of the recommendation to the Governor-in-Council on the approach for the long-term management of nuclear fuel waste;
- To assist in developing capacity for Inuit peoples at an organizational level, as well as allowing Inuit 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 dialogues 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.

What is Nuclear Fuel Waste?

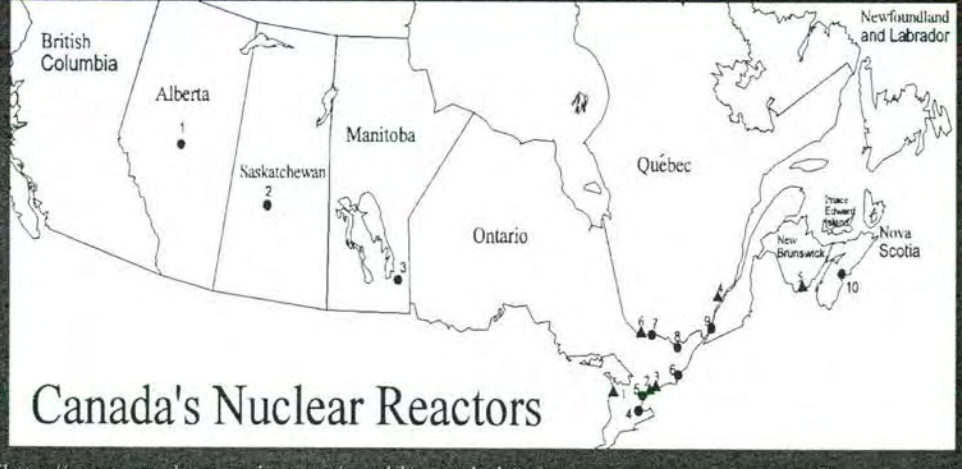
- Nuclear Fuel Waste is the used uranium fuel from nuclear reactors, which is used to produce energy. This Nuclear Fuel Waste is contained within irradiated fuel bundles, which weigh approximately 20 kg each.
- Because of its radioactivity and toxic properties, nuclear fuel waste is dangerous to human and environmental health.



Where is used Nuclear Fuel Waste currently stored?

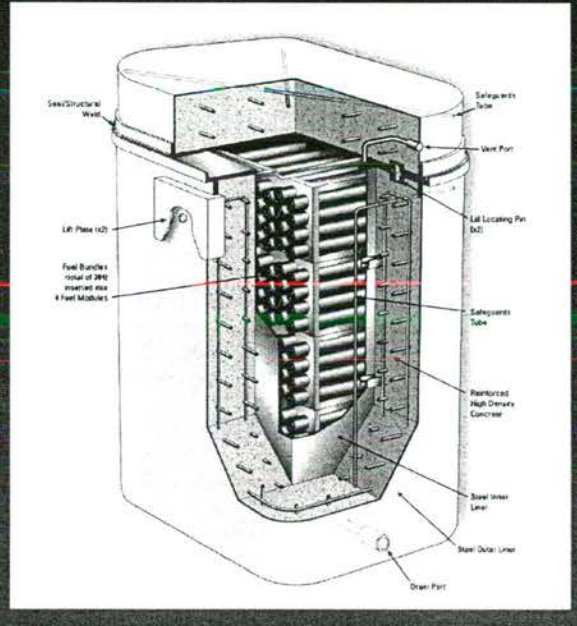
For the most part, used nuclear fuel waste is currently stored on-site at nuclear generating facilities, either in wet or dry storage. Some waste is also stored at the Chalk River and Whiteshell Laboratories.

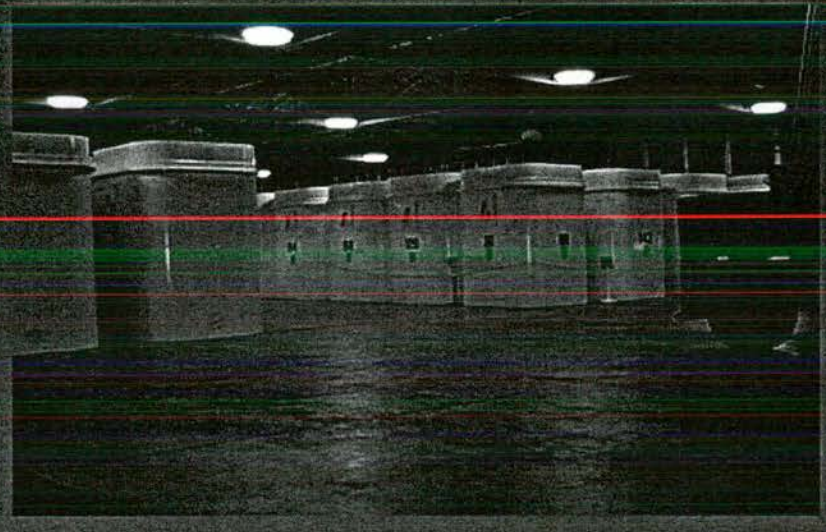
On the map, circles represent research reactors; triangles represent commercial facilities



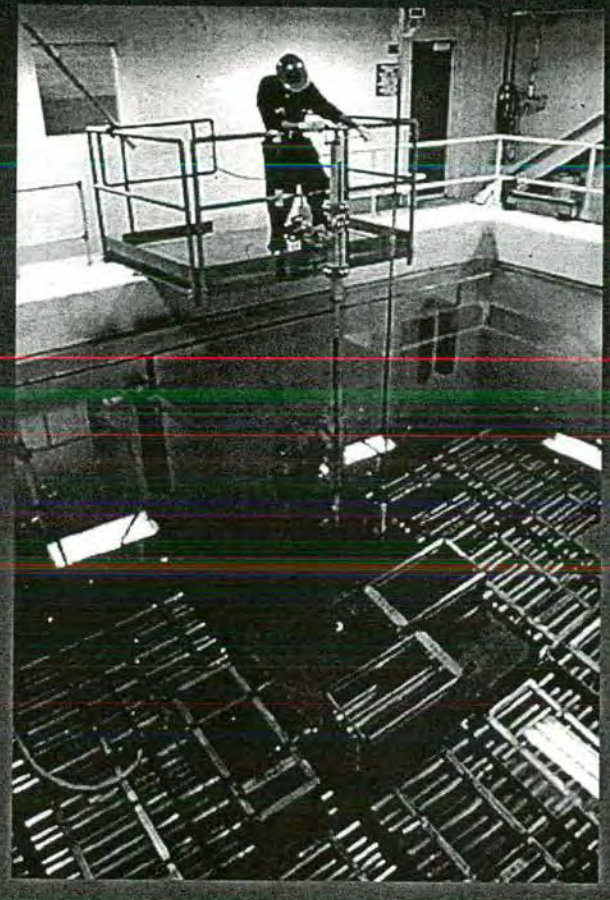
(http://www.nucleartourist.com/world/canada.htm).

Dry Storage


Safeguards Tube
Vent Port
Lid Locating Pin (x2)
Lift Plate (x2)
Fuel Bundles
Safeguards Tube
Reinforced High Density Concrete
Steel Inner Liner
Drain Port



Wet Storage

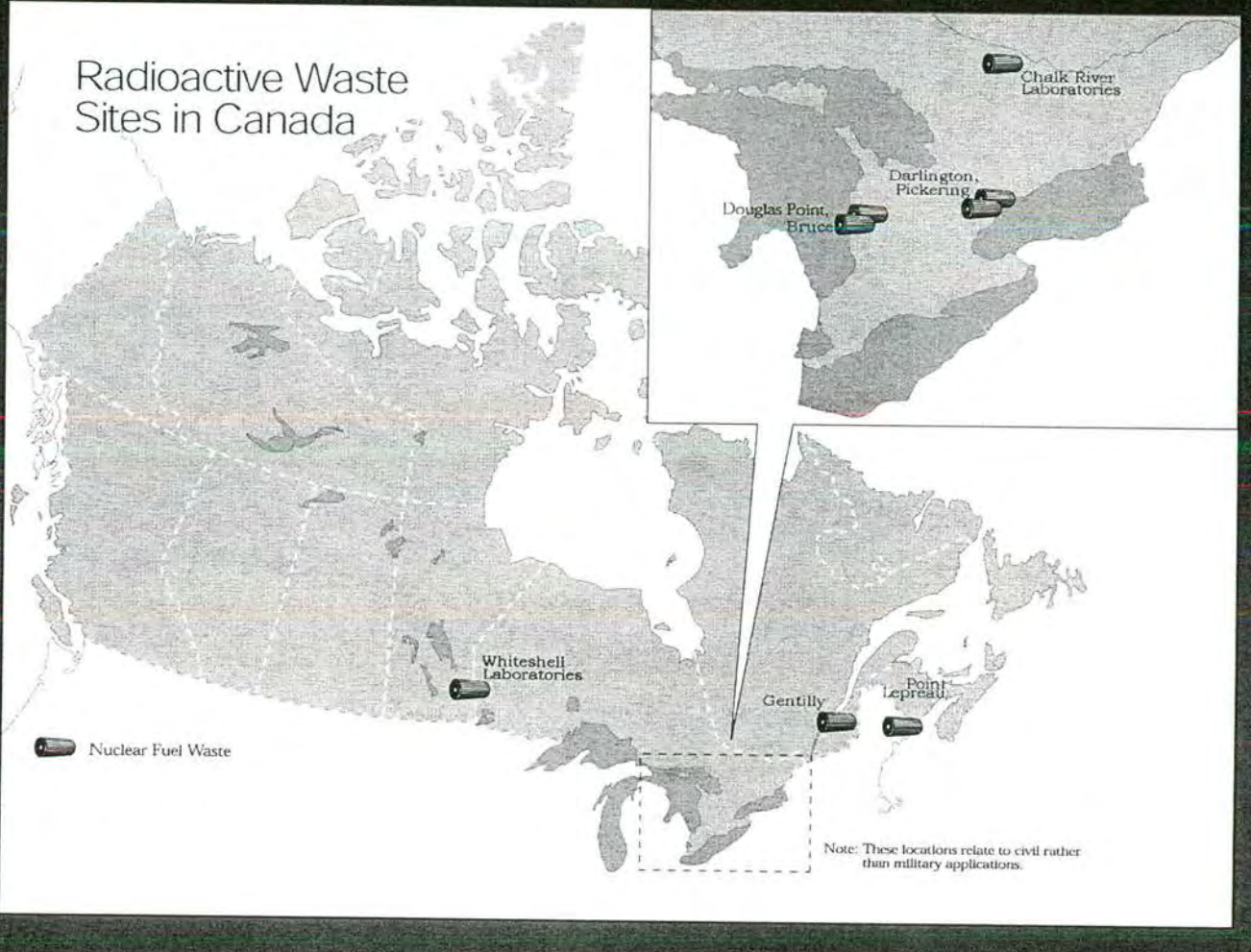


Used nuclear fuel initially very hot and highly radioactive

Stored in water pools in reactor buildings for cooling and shielding

Water pool capacity 15 to 20 years of reactor production

Locations of Radioactive Waste Sites in Canada:3



Who produces Nuclear Fuel Waste?

Nuclear Fuel Waste is produced by nuclear generating facilities that have been operating since the mid- to late 1970's.

Ontario Power Generation is responsible for approximately 90% of the waste, New Brunswick Power for 4%, Hydro-Québec for 4%, and Atomic Energy of Canada Ltd. for 2%. Other waste owners (i.e. universities) produce much smaller quantities of Nuclear Fuel Waste.

How much Nuclear Fuel Waste is there in Canada?

As of 2002, approximately 1.7 million used nuclear fuel bundles (approximately 40,000 metric tones - enough to fill three hockey rinks) have been produced.

How long does Nuclear Fuel Waste remain dangerous?

The radioactivity of substances is measured in half lives, or the amount of time for the material to lose half of its radioactivity.

Waste by-products such as uranium have half-lives as long as 710,000 years.

Inuit and Nuclear Fuel Waste

No Inuit communities are currently located close to a nuclear power plant. Some, such as Inuit living in Nunavut, Nunavik (northern Québec), those residing in Nunatsiavut (Labrador), hold traditional territory in areas that could be considered as potential sites for the deep geological disposal management method that has been outlined by the NWMO.

Outline of 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).

Deep Geological Disposal

- Disposal is a method of isolating Nuclear Fuel Waste from humanity and the environment. It is conclusive and without the intention of retrieval or reuse.
- Deep geological disposal involves burying the Nuclear Fuel Waste deep underground.

Deep Geological Disposal (continued):

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.

Centralized Storage

Storage is a method of maintaining Nuclear Fuel Waste 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.

Reactor-Site Extended Storage

Both above and below-ground storage alternatives are in use today.

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.

Summary of approaches:

At-Reactor Storage

Advantages:

No transportation of used nuclear fuel would be required, as the used fuel would remain next to where it is generated. Each of these sites already houses nuclear installations, so there is nuclear expertise on site and in the existing communities.

At-Reactor Storage

Limitations:

The key disadvantage is the need for continuing administrative controls and operations for the thousands of years the used nuclear fuel remains hazardous.

At-reactor storage means continued management at a number of sites, each of which has, as its primary focus, the production of power, not the long-term management of used nuclear fuel. These reactor sites were selected for their suitability for reactor operation, not for the very long-term storage of used nuclear fuel. The used nuclear fuel will remain hazardous well beyond the almost certain shutdown and ultimate abandonment of the nuclear reactor sites.

Centralized Storage

Advantages:

Centralized storage, either above-ground or shallow below-ground, would allow for the site selection solely on the basis of used nuclear fuel management. If done well, siting can be achieved with community participation.

Centralized Storage

Limitations:

Centralized storage has the key disadvantage of requiring effective and continuing administrative controls and operations, including the required funding, for thousands of years. Further requirements include:

- Identification and development of a site with potentially contentious community involvement;
- Transportation of the used nuclear fuel to the site would be required with its attendant risks and costs.

ᓄᓕᒃᓴᓂᕐᓂᖅ ᖃᓄᐃᓕᓚᖅᑐᑦᑐᖅᓯᒪᔪᓂᒃ ᐱᓕᕆᔨ ᐊᑯᓂᐅᔪᖅᑯᓂ ᐊᐅᓚᑕᐅᔪᓐᓇᖅᓂᖅᓂᒃ ᓄᑕᖅᑐᑎᒃᓴᔪᖅᓂᖅᓂᒃ ᐅᑕᖅᓯᔪᓐᓇᖅᑐᓄᑦ ᐊᖅᑕᕐᕕᖅ ᖃᓄᖅᑕᒥᒃ ᐱᓕᕆᔨᑦᑕᐅᔪᑦ

ᐃᓄᐃᑦ ᑭᓱᑕᒥᒃ ᑲᒪᒋᐊᕐᓂᖅ ᑕᒪᑐᐊᕐᓗᒍ ᐊᑯᓂᐅᔪᖅᑯᓂ ᐊᐅᓚᑕᐅᔪᓐᓇᖅᓂᖅᓂᒃ ᓄᑕᖅᑐᑎᒃᓴᔪᖅᓂᖅᓂᒃ ᐅᑕᖅᓯᔪᓐᓇᖅᑐᓄᑦ ᐊᖅᑕᕆᔨᓂᒃ ᖃᓄᖅᑕᒥᒃ - ᐃᓄᐃᑦ ᑕᐱᓵᑦ ᖃᓄᑕᒥ ᐅᑐᐱᓕ 2004

<u>ᐱᓕᕆᐊᔪᑦ:</u> ᓄᑕᖅᑐᑎᒃ ᐅᑕᖅᓯᔪᓐᓇᖅᑐᑦ ᐊᖅᑕᐊᓂᒃ ᐱᖁᔭᖅᔪᐊᖅᑯᖅ
ᓂᓇᒥ ᐊᑐᐃᓐᓇᓕᒫᔪᖅᑯᑦ ᖃᓄᒥ ᖁᓕᑕᐅᔪᖅᑯᑦ ᐅᖁᐅᓯᖅᓴᓕᒫᓕᕆᔨᖅᓂᒃ
ᓴᖅᑭᔭᖅᑎᑕᐅᔪᑦ (ᑐᖅᑕᖅ ᐱᑕ >ᓕᐅᓐ, ᐃᓕᐊᓕ 24, 2004)
ᓄᑕᖅᑐᑎᒃ ᐅᑕᖅᓯᔪᓐᓇᖅᑐᓂᒃ ᐊᖅᑕᐊᓕᕆᓚᓂᕐᒧᑦ ᑲᑐᔪᖅᑎᑎᖅᓯᒪᓂᖅ
ᐅᖁᖅᑎᑎᕐᑕᐅᔪᑦ ᑎᑎᕋᖅᓯᒪᔪᖅᓂᒃ: ᐊᐱᓚᔪᑦ ᓇᒪᔭᑐᓂᒃ ᐊᐱᖏᓂᒃ

ᐃᓄᐃᑦ ᑕᐱᕇᑦ ᑲᓇᑕᒥ
INUIT TAPIRIIT KANATAMI

ᖃᓄᖅᑑᕈᑕᐅᔪᖅ ᒪᓕᒐᓕᐊᕆᓯᒪᔪᖅ (ᐱᓪᓗᒍ ᓱᕈᖅᑰᑎᕈᔪᖕᒋᓐᓂᒃ ᐆᑕᖅᓯᔪᓐᓇᖅᑐᓄᑦ ᐊᒃᑕᕆᐊᓕᑦ ᐱᖁᔭᕐᔪᐊᖓ ᐊᒻᒪ ᐃᓂᖓ 12 (7) ᐱᖁᔭᓕᐊᕆᔭᐅᕙᓪᓕᐊᔪᖅ C - 27:

ᑕᐃᑲᓂ ᓄᕕᐱᕆ 15, 2002, ᑖᓐᓇ ᓱᕈᖅᑰᑎᕈᔪᖕᒋᓐᓂᒃ ᐆᑕᖅᓯᔪᓐᓇᖅᑐᓄᑦ ᐊᒃᑕᕆᐊᓕᑦ ᐱᖁᔭᕐᔪᐊᖓᓄᑦ ᐊᑐᖅᑕᐅᓯᓚᐅᖅᑐᖅ. ᑖᓐᓇ ᓱᕈᖅᑰᑎᕈᔪᖕᒋᓐᓂᒃ ᐆᑕᖅᓯᔪᓐᓇᖅᑐᓄᑦ ᐊᒃᑕᕆᐊᓕᑦ ᐱᖁᔭᕐᔪᐊᖓ ᓇᓗᓇᐃᖅᓯᓯᒪᕗᖅ ᐊᖏᔪᒥᒃ ᑲᔪᓯᑦᑎᐊᖅᓯᒪᓪᓗᓂ ᒐᕿᒃᑯᓂᑦ ᑲᓇᑕᒥ ᐱᔭᒃᓴᕆᓂᐊᕐᒪᔾᔪᒃ ᐱᓪᓗᒍ ᐊᑯᓂᐅᔪᒃᑯᑦ ᐊᐅᓚᑕᐅᔭᓇᖅᓂᖏᑦ ᓱᕈᖅᑰᑎᕈᔪᖕᒋᓐᓂᒃ ᐆᑕᖅᓯᔪᓐᓇᖅᑐᓄᑦ ᐊᒃᑕᕆᐊᓕᕐ, ᐊᒻᒪ ᐋᕿᒃᓯᓗᑎᒃ ᐱᕙᓪᓕᐊᑎᑦᑎᔾᔪᑕᐅᓂᐊᖅᑐᓂᒃ, ᓴᓇᓯᒪᓂᕆᓂᐊᖅᑕᖏᓐᓂᒃ ᐊᒻᒪ ᐃᓯᒪᒃᓴᖅᓯᐊᕆᔭᕆᐊᖅᑐᓂᒃ ᑲᔪᓯᑦᑎᐊᑎᓐᓂᐊᕐᓗᒍ ᐊᐅᓚᔾᔭᒃᑕᐅᒥᐊᖅᑐᖅ ᑕᒪᓐᓇ ᐱᖁᔭᕐᔪᐊᖅ. ᓱᕈᖅᑰᑎᕈᔪᖕᒋᓐᓂᒃ ᐆᑕᖅᓯᔪᓐᓇᖅᑐᓄᑦ ᐊᒃᑕᕆᐊᓕᑦ ᐱᖁᔭᕐᔪᐊᖓ ᓴᕿᑕᐅᓚᐅᖅᑐᖅ ᑐᖓᕕᔾᔪᑎᖃᖅᓗᓂ ᐅᓄᖅᑐᓂᒃ ᕿᒥᕈᐊᖅᑎᖅᑲᓚᐅᖅᓗᑎᒃ ᐃᓄᓕᒫᓂᒃ ᐊᒻᒪ ᑎᒍᒥᐊᕐᑎᐅᔪᓂᒃ, ᐃᓚᒋᔭᐅᓗᑎᒃ ᐅᓄᖅᑐᖅ ᐊᑐᐊᒐᑦ ᑐᓴᕐᑎᑦᑎᔾᔪᑕᐅᔪᓂᑦ ᑳᒃᑯᓐᓇᖓᑦ ᒐᕿᒃᑯᓂ ᑲᓇᑕᒥ 1996 ᐊᒻᒪ 1998. 1998 ᑲᓇᑕᒥ ᒐᕿᒃᑯᑦ ᑭᐆᓯᓚᐅᖅᑐᑦ ᑕᒪᑐᒧᖓ ᓲᐳᐊᓐ ᑭᒥᕈᐊᕐᑎᖓᓄᑦ, ᒐᕿᒃᑯᑦ ᐅᖃᓚᐅᖅᑐᑦ ᑕᐃᒪᒎᖅ ᑕᒪᓐᓇ ᐱᓕᕆᐊᕆᔭᐅᔪᓐᓇᖅᑐᖅ ᐃᓚᐅᑎᓪᓗᒋᑦ ᐃᖏᕋᕙᓪᓕᐊᓂᖓ ᑲᓇᑕᒥ ᓄᓇᖃᖄᖅᓯᒪᔪᑦ ᑐᑭᓯᓂᐊᕐᒪᑕ ᐊᒻᒪ ᖃᐅᔨᓴᕐᓗᒋᑦ ᓱᕈᖅᑰᑎᕈᔪᖕᒋᓐᓂᒃ ᐆᑕᖅᓯᔪᓐᓇᖅᑐᓄᑦ ᐊᒃᑕᕆᐊᓕᑦ ᐱᔾᔪᑎᓂᒃ. ᒐᕿᒃᑯᑦ ᐅᖃᓚᐅᖅᑐᑦ ᑕᐃᒪᒎᖅ, ᐊᖏᓛᖑᓗᓂ, ᐃᖏᕋᕙᓪᓕᐊᓂᖓ ᓴᓇᔭᐅᓯᒪᓂᐊᖅᑐᖅ ᐊᒻᒪ ᐱᓕᕆᐊᖑᓗᓂ ᓄᓇᖃᖄᖅᓯᒪᔪᓂᑦ ᑕᐃᒪᓗ ᓈᒪᖕᓂᐊᕐᒪᑕ ᐱᓕᕆᔾᔪᓯᕆᕙᒃᑕᖏᓐᓄᑦ. ᑕᐃᒪᖓᓐᓂᑦ 1998, ᒐᕿᒃᑯᖏᑦ ᑲᓇᑕᒥ ᐅᖃᖅᑎᕆᖅᑕᖅᓯᒪᔪᑦ ᑭᒐᖅᑐᖅᑎᖏᓐᓂᒃ ᓄᓇᖃᖄᖅᓯᒪᔪᑦ ᑲᑐᔾᔨᖅᑎᒌᑦ ᐱᓪᓗᒍ ᖃᓄᖅ ᕿᒥᕈᐊᖅᑕᐅᔪᒪᖔᒪᖔᑕ.

<u>ᖃᓄᐃᓕᖓᓚᐅᕈᓯᖓ:</u>

ᐅᖃᖅᑎᕆᒍᑕᐅᔪᑦ ᑳᒃᑯᐊᓗ ᓱᕈᖅᑰᑎᑦ ᐆᑕᖅᓯᔪᓐᓇᖅᑐᓄᑦ ᐊᒃᑕᑯᓕᕆᓂᕐᒧᑦ ᑲᑐᔾᔨᖅᑎᒌᖕᒋᓐᓂᖕᒐᖅᑐᑦ ᑭᒐᖅᑐᖅᑏᑦ, ᐃᓄᐃᑦ ᑕᐱᕇᑦ ᑲᓇᑕᒥ ᐃᖅᑲᓇᐃᔭᕐᑎᖏᑦ ᓇᓗᓇᐃᑦᑎᐊᓚᐅᖅᑕᖓᑦ ᑐᖓᕕᓪᓚᕆᖓ ᐱᒻᒪᕆᐅᔪᖅ ᓄᓇᖃᖄᖅᓯᒪᔪᓄᑦ, ᐊᒻᒪ ᐅᖃᐅᓯᖃᓗᐊᖑᐊᖅᓗᑎᒃ, ᐃᓄᐃᑦ ᐃᓚᐅᓂᖓᑦ ᐱᕙᓪᓕᐊᑎᑦᑎᓂᖓᓂ ᐊᐅᓚᑦᑎᔾᔪᑕᐅᔭᓇᖅᑐᓂᒃ ᓂᕈᐊᖅᑕᐅᓯᒪᔭᓇᖅᑐᓄᑦ ᑕᒪᒃᑯᐊ ᑕᐃᒪᓐᓇᐅᖁᔭᐅᔪᑦ ᑳᒃᑯᓐᓇᖓᑦ ᓱᕈᖅᑰᑎᕈᔪᖕᒋᓐᓂᒃ ᐆᑕᖅᓯᔪᓐᓇᖅᑐᓄᑦ ᐊᒃᑕᕆᐊᓕᑦ ᐱᖁᔭᕐᔪᐊᖓ. ᐱᒻᒪᕆᐅᕗᖅ ᑕᒪᓐᓇ ᑐᑭᓯᐅᒪᔭᐅᑦᑎᐊᕐᓗᓂ ᐃᓄᖕᓄᑦ ᑐᑭᓯᖃᑎᒋᑦᑎᐊᖅᓗᑎᒃ ᐃᖏᕋᑎᑕᐅᓗᓂ ᐃᓄᖕᓂᑦ ᓄᐃᑦᑎᓂᐊᕐᒪᑕ ᐊᑯᓂᐅᓕᖓᓂᐊᖅᑐᒥᒃ ᐊᐅᓚᑦᑎᔾᔪᑕᐅᔭᓇᖅᑐᒥᒃ, ᓇᓕᐊᒃᓗ ᑐᓐᓂᖁᑕᐅᓇᔭᕐᓂᖓ ᑳᒃᑯᓐᓇᖓᑦ ᓱᕈᖅᑰᑎᑦ ᐆᑕᖅᓯᔪᓐᓇᖅᑐᓄᑦ ᐊᒃᑕᑯᓕᕆᓂᕐᒧᑦ ᑲᑐᔾᔨᖅᑎᒌᖕᒋᓐᓂᑦ ᓄᕕᐱᕆ 15, 2005. ᐊᒻᒪᓗᑦᑕᐅᖅ ᐱᒻᒪᕆᐅᕗᖅ ᑕᒪᓐᓇ ᕿᒥᕈᐊᖅᑎᒌᖕᓂᖅ ᐊᑑᑎᖃᓪᒪᕆᖕᒪᑦ, ᑐᑭᖃᑦᑎᐊᖅᓗᓂ, ᐊᒻᒪᓗ ᐱᖁᓯᑐᖃᕐᒧᑦ ᓈᒻᒪᒃᓗᓂ ᑕᒪᓐᓇ ᑕᑯᓯᒪᓂᐊᖅᓗᒍ

ᐃᓄᖃᖕᖏᑦᑐᒦᒻᒪᑕ ᐃᓄᑭᑦᑐᓂ, ᐊᒻᒪ ᐅᖃᐅᓯᖃᑎᒋᓇᓂᒋᑦ ᐃᓄᐃᑦ ᓄᓇᓕᖕᒋᑦ ᑖᒃᑯᐊ ᕿᒥᕈᐊᖃᑎᒋᔭᐅᔭᕆᐊᓕᑦ ᑕᒪᓐᓇ ᐃᖕᒋᕋᕙᓪᓕᐊᓂᓗᒃᑖᖕᒐᓄᑦ.

ᑭᖑᓂᑦᑎᓂᓕ, ᐃᓄᐃᑦ ᐱᔪᒪᓐᖏᖃᑦᑕᖅᓯᒪᖕᒪᑕ ᑕᒪᑐᒥᖓ ᐊᑯᓂᐅᔪᒃᑯᑦ ᐊᐅᓚᑕᐅᔪᓐᓇᖅᓂᖏᑦ ᓱᕈᖅᑰᑎᕈᔪᖕᒋᓐᓂᒃ ᐆᑕᖅᓯᔪᓐᓇᖅᑐᓄᑦ ᐊᒃᑕᓇᓕᑦ ᑲᓇᑕ ᐅᑭᐅᖅᑕᖅᑐᖕᒐᓄᑦ. ᐱᔭᐅᔪᒪᓯᒪᓪᓗᓂ ᓯᓕ, ᑕᒪᓐᓇᐅᓚᐅᕐᑎᓪᓗᒍ, ᕿᒥᕈᐊᖅᑎᒧᑦ ᐊᒻᒪ ᐃᓕᓐᓂᐊᕐᑎᓪᓗᒋᑦ ᐃᓄᐃᑦ ᑕᒪᓐᓇ ᐱᔾᔪᑕᐅᓂᖕᒐᓂᒃ ᑕᑯᒥᐊᕐᑎᐊᒃᓂᖅᓗᒍ/ᓇᓗᓇᐃᕐᑎᐊᓇᐊᒃᓂᖅᓗᒍ/ᕿᓂᕐᑎᐊᒃᓂᖅᑐᒋᑦ ᐃᓄᐃᑦ ᑕᐅᑦᑐᖕᒋᑦ ᑲᑐᑎᔭᐅᑦᑎᐊᕐᓗᑎᒃ. ᑐᑭᓯᔭᐅᑦᑎᐊᕈᒪᓇᔭᖅᑐᕐᓕ ᐃᓄᖕᓄᑦ, ᐅᓇ ᐆᒃᑑᑎᒥᓗᒍ, ᐊᑦᑕᖅᓇᐅᑎᔪᓐᓇᖅᑐᑦ ᓄᒃᑕᖅᑕᐅᓂᖕᒐᓄᑦ ᐊᕐᑯᑎᖕᒋᑦ ᐃᓗᐊᓐᖏᔾᔪᑎᑦ ᐱᓯᒪᔪᓂᒃ ᐊᑯᓂᐅᔪᒃᑯᑦ ᐊᐅᓚᑕᐅᔪᓐᓇᖅᓂᖏᑦ ᓱᕈᖅᑰᑎᕈᔪᖕᒋᓐᓂᒃ ᐆᑕᖅᓯᔪᓐᓇᖅᑐᓄᑦ ᐊᒃᑕᓇᓕᑦ.

ᑕᒪᓐᓇ ᐱᑦᑐᒍ, ᐃᓄᐃᑦ ᑕᐱᓃᑦ ᑲᓇᑕᒥ ᑐᒃᓯᕋᖅᓯᒪᔫᑦ ᐊᕐᕌᒍᓄᑦ ᐱᖓᓱᓄᑦ ᐱᕙᓪᓕᐊᑎᑕᐅᕐᑯᑦᓗᒍ ᑐᑭᓯᖃᑎᒌᑦᑎᐊᕋᓱᐊᕐᓂᖅ ᑖᒃᑯᓐᓄᖓ ᑲᓇᑕᒥᐅᓄᑦ ᐃᓄᖕᓄᑦ ᐱᑦᑐᒍ ᑕᒪᓐᓇ ᐊᑯᓂᐅᔪᒃᑯᑦ ᐊᐅᓚᑕᐅᔪᓐᓇᖅᓂᖏᑦ ᓱᕈᖅᑰᑎᕈᔪᖕᒋᓐᓂᒃ ᐆᑕᖅᓯᔪᓐᓇᖅᑐᓄᑦ ᐊᒃᑕᓇᓕᑦ ᐊᒻᒪ ᐊᒃᑕᕐᕕᒃ, ᑕᐃᒪᓕ ᑎᓕᔭᐅᓯᒪᔪᖅ ᐅᖃᖅᓯᒪᔪᖅ ᐃᓂᖓ 12 (7) ᐱᕐᑯᔭᓕᐊᓇᔭᐅᕙᓪᓕᐊᔪᖅ C-27.[1] ᐅᓇ ᐊᕐᕌᒍᓄᑦ ᐅᓄᖅᑐᓄᑦ ᐱᕙᓪᓕᐊᑎᑕᐅᓯᒪᓗᓂ ᓄᐃᑎᑦᑎᓂᐊᖅᑐᖅ ᑐᑭᓯᑎᑦᑎᑎᐊᕈᓐᓇᖅᑐᓂᒃ ᐅᓂᒃᑳᓕᐊᓇᓯᒪᔪᓂᒃ ᓇᓗᓇᐃᔭᕐᑎᐊᖅᓯᒪᔪᓂᒃ ᑲᓇᑕᒥᐅᑦ ᐃᓄᐃᑦ ᐃᓕᖅᑯᓯᖃᖅᑎᖏᓐᓂᖕᒋᑦ, ᐃᓅᓯᖕᒋᑦ, ᐊᕙᑎᖓᑦ ᐊᒻᒪ ᒪᑭᑕᓇᓱᐊᕈᑎᑦ ᐃᓱᒪᒋᔭᐅᓯᒪᔭᓇᐊᖃᖅᑐᑦ ᐱᑦᑐᒍ ᑐᕐᑯᖅᓯᓯᒪᓂᐊᕐᓗᓂ ᓱᕈᖅᑰᑎᕈᔪᖕᒋᓐᓂᒃ ᐆᑕᖅᓯᔪᓐᓇᖅᑐᓄᑦ ᐊᒃᑕᓇᓕᑦ, ᑭᐅᓇᓱᒻᒧᒍ ᑕᐃᒪᓐᓇᐅᔪᓐᓇᕐᒪᖔᑦ ᑕᐃᒪᓐᓇᐅᔪᓐᓇᖕᒋᒻᒪᖕᖓᑦᑑᓐᓃᑦ ᓱᕈᖅᑰᑎᕈᔪᖕᒋᓐᓂᒃ ᐆᑕᖅᓯᔪᓐᓇᖅᑐᓄᑦ ᐊᒃᑕᓇᓕᑦ ᑐᕐᑯᖅᓯᒪᓗᓂ ᐃᓄᐃᑦ ᓄᓇᖕᒋᓐᓂ ᑕᒪᓐᓇ ᓈᒻᒥᔭᐅᓇᔭᕐᒪᖔᑦ, ᐊᒻᒪ ᓈᒻᒥᔭᐅᒍᓂ, ᖃᓄᖅ ᐋᕿᒃᓯᒪᔪᒪᓗᔭᕐᐸᑦ ᑐᕐᑯᖅᓯᓯᒪᕝᕕᐅᓂᐊᖅᑐᒥᒃ.

ᐅᓇ ᑐᑭᓯᖃᑎᒌᓚᓯᐊᕐᓂᖅ ᐊᔪᖏᑎᑦᑎᓂᐊᖅᑐᖅ ᐃᓄᖕᓂᒃ ᐅᖃᕈᔭᕐᒥᖕᓂᒃ ᓂᑦᑎᕈᓐᓇᖅᓗᑎᒃ ᐱᐅᓯᑐᖃᕐᒥᖕᓄᑦ ᐱᓯᒪᔪᓂᒃ ᑕᒪᓐᓇ ᓴᕿᑕᐅᓗᓂ ᑐᑭᓯᓇᖅᓯᑎᑦᑎᑎᐊᖅᓯᒪᔪᖅ ᐅᓂᒃᑳᓕᐊᓇᓯᒪᓗᒍ ᑕᒪᓐᓇ ᑕᒪᖅᓯᒪᓐᖏᑦᑎᐊᖅᑐᒥᒃ ᓴᕿᔮᕐᑎᑦᑎᐊᕐᓗᓂ ᑲᓇᑕᒥᐅᑦ ᐃᓄᖕᒋᓐᓂᒃ ᐃᓯᒫᓗᑎᓯᖕᒋᓐᓂᒃ ᐊᐱᕐᑯᑕᐅᔪᓄᑦ ᐱᓯᒪᔪᖅ ᑖᒃᑯᓂ ᐃᓂᖓ 12 (7) ᐱᕐᑯᔭᓕᐊᓇᔭᐅᕙᓪᓕᐊᔪᖅ C-27.

[1] ᐃᓂᖓ 12 (7) ᐱᕐᑯᔭᓕᐊᓇᔭᐅᕙᓪᓕᐊᔪᖅ C-27:, ᐱᕐᑯᔭᕐᔪᐊᖅ ᐃᒃᐱᒍᓱᑦᑎᐊᖅᑐᖅ ᐊᑯᓂᐅᔪᒃᑯᑦ ᐊᐅᓚᑕᐅᔪᓐᓇᖅᓂᖏᑦ ᓱᕈᖅᑰᑎᕈᔪᖕᒋᓐᓂᒃ ᐆᑕᖅᓯᔪᓐᓇᖅᑐᓄᑦ ᐊᒃᑕᓇᓕᑦ, ᐅᖃᖅᓯᒪᖕᒪᑦ ᐃᒪᓐᓇ, "ᐊᒃᑕᓇᓕᖕᓄᑦ ᐊᐅᓚᑦᑎᕚᐅᔪᑦ ᑲᑐᔾᔨᖃᕐᕕᖕᒋᑦ ᑭᒡᒐᖅᑐᕐᑎᖃᕐᓂᐊᖅᑐᖅ ᐃᓄᓕᒫᓂᑦ, ᐱᑐᐊᖅᑐᒥᒃ ᓄᓇᖅᑲᖅᑳᖅᓯᒪᔪᑦ, ᑕᒪᒃᑯᓐᓇᖓ ᐊᑐᓂ ᑐᒃᓯᕋᖅᑕᐅᔪᓂᒃ ᐱᒋᐊᕐᕕᐅᓗᑎᒃ."

ᐃᓄᐃᑦ ᑕᐱᕇᑦ ᑲᓇᑕᒥ
INUIT TAPIRIIT KANATAMI

ᕿᒥᕈᐊᖃᑎᒌᖕᓂᖅ ᐃᓄᐃᑦ ᓄᓇᑖᕈᑎᖏᓐᓂᑦ ᑲᑐᔾᔩᖃᑎᒌᖕᒋᑦ:

ᐃᓄᐃᑦ ᑕᐱᕇᑦ ᑲᓇᑕᒥ ᑐᑭᓯᖃᑎᒌᑦᑎᐊᕋᓯᖕᓂᐊᖅᑐᑦ ᑲᔪᓯᓐᓇᖅᓂᐊᕐᓗᒍ ᐃᓄᐃᑦ ᓄᓇᑖᕈᑎᖏᓐᓄᑦ ᐊᐅᓚᑦᓯᔩᐅᔪᑦ ᐊᒻᒪ ᐱᔭᓇᐊᑭᓪᓕᑎᖃᑦᑕᕐᓗᒋᑦ ᐱᕈᕐᐸᓪᓕᐊᓂᐊᖅᑐᑦ ᑭᐆᔪᑎᑦ ᑕᒪᑐᒧᖓ ᑐᑭᓯᖃᑎᒌᒐᓱᐊᕈᑎᓂᑦ ᐊᐱᕐᑯᑎᓂᑦ. ᐃᓄᐃᑦ ᑕᐱᕇᑦ ᑲᓇᑕᒥ ᐅᖃᓪᓚᔾᔮᖕᖏᑦᑐᖅ ᓂᓪᓕᕈᑎᔾᔮᖕᖏᑦᑕᖕᒋᑦ ᐊᒻᒪ ᐅᖃᓪᓗᒍᓇᕋᑎᒃ ᑖᒃᑯᓐᓄᖓ ᐊᕕᒃᑐᖅᓯᒪᔪᓂ ᑎᒥᐅᔪᓄᑦ ᑭᓯᐊᓂ ᑐᑭᓯᖃᑎᒌᒐᓱᐊᕐᓂᖕᒐᑦ ᐊᒻᒪ ᑕᐅᑦᑐᙵᔪᐅᔪᑦ ᐱᕙᓪᓕᐊᑎᑕᐅᓂᖕᒋ ᐃᓱᓕᑉᐸᑦ.

ᐱᔾᔪᑎᖏᑦ ᐊᒻᒪ ᑐᕌᓇᕙᓪᓕᐊᓂᐊᖅᑕᖏᑦ ᑐᑭᓯᖃᑎᒌᒐᓱᐊᓕᕈᑎᒃ:

- ᓴᓇᓯᒪᓂᐊᕐᓂᖓ ᐊᒻᒪ ᐊᑐᖅᑕᐅᓂᐊᕐᓂᖓ ᐱᐅᓯᑐᖅᑲᕐᒧᑦ ᐱᓯᒪᓗᑎᒃ ᑐᑭᓯᖃᑎᒌᒐᓱᐊᕐᓂᖅ ᐱᓕᕆᑎᑦᑎᔾᔭᑕᐅᔭᖅ ᐃᓄᐃᑦ ᑕᐱᕇᑦ ᑲᓇᑕᒥ ᑕᒪᑐᒧᖓ ᐊᑯᓂᐅᔭᒃᑯᑦ ᐊᐅᓚᑕᐅᔭᓐᓇᖅᓂᖏᑦ ᓱᕈᖅᑰᑎᕈᔭᖏᓐᓂᒃ ᐆᑕᖅᓯᔭᓐᓇᖅᑐᓄᑦ ᐊᒃᑕᖅᓂᖅ ᑲᓇᑕᒥ.
- ᑐᓴᒐᒃᓴᓂᒃ ᖃᐅᔨᒪᔭᐅᕆᐊᖃᖅᑐᓂᒃ ᑐᓂᓯᓯᒪᓗᑎᒃ, ᖃᓄᑐᐃᓐᓇᖅ ᐊᒻᒪ ᐱᕕᖃᕐᑎᑕᐅᓗᑎᒃ ᐃᓄᐃᑦ ᑐᑭᓯᖃᑎᒌᒐᓯᖕᓂᐊᕐᒪᑕ ᐃᒻᒥᖕᓄᑦ ᐊᒻᒪ ᐅᖃᐅᓯᒃᓴᑎᒃ ᑐᓴᖅᑕᐅᑎᓪᓗᒋᑦ ᐊᒻᒪ ᑕᐅᑦᑐᙵᔪᕐᑎᒃ ᑖᒃᑯᐊ ᐱᓪᓗᒋᑦ ᑲᓇᑕᒥ ᒐᕙᒪᒃᑯᑦ;
- ᑐᓂᓯᓯᒪᓗᑎᒃ ᐅᓄᖅᑐᓂᒃ ᐅᓂᒃᑳᓕᐊᕆᓯᒪᔭᓂᒃ, ᐊᒻᒪ ᐱᓗᐊᖅᑐᒥᒃ ᑕᒪᒃᑯᐊ ᑭᖑᓪᓕᕐᕚᖅᓯᐅᑎᑦ ᐅᓂᒃᑳᑦ, ᑖᒃᑯᓐᓄᖓ ᓄᓇᒥ ᐊᑐᐃᓐᓇᓕᕆᔪᒃᑯᑦ ᑲᓇᑕᒥ, ᑕᒪᒃᑯᐊᓗ ᑐᓴᕐᑎᑦᑎᔾᔭᑕᐅᓗᑎᒃ ᒥᓂᔅᑕᒧᑦ, ᑖᒃᑯᐊ ᓇᓗᓇᐃᖅᓯᔾᔪᑦ ᑕᐅᑦᑐᖏᓐᓂᒃ ᐊᒻᒪ ᐅᖃᐅᓯᒃᓴᖏᓐᓂᒃ ᐃᓄᐃᑦ ᑕᐱᕇᑦ ᑲᓇᑕᒥ ᑭᒡᒐᖅᑐᖅᑎᒋᔭᖏᑦ ᐱᓪᓗᒍ ᐊᑯᓂᐅᔭᒃᑯᑦ ᐊᐅᓚᑕᐅᔭᓐᓇᖅᓂᖏᑦ ᓱᕈᖅᑰᑎᕈᔭᖏᓐᓂᒃ ᐆᑕᖅᓯᔭᓐᓇᖅᑐᓄᑦ ᐊᒃᑕᕐᕕᒃ ᑲᓇᑕᒥ. ᑕᐃᒪᓕ, ᓄᐃᑦᑎᓗᑎᒃ ᑎᒥᒥᒃ ᖃᐅᔨᒪᓂᐊᖅᑐᓂᒃ ᐱᓪᓗᒍ ᑕᐅᑦᑐᙵᔪᓂᒃ ᐊᒻᒪ ᐅᖃᐅᓯᒃᓴᖏᓐᓂᒃ ᓄᓇᖅᑲᖅᑳᖅᓯᒪᔪᑦ ᑕᒪᑐᒧᖓ ᓱᕈᖅᑰᑎᕈᔭᖏᓐᓂᒃ ᐆᑕᖅᓯᔭᓐᓇᖅᑐᓄᑦ ᐊᒃᑕᕐᕕᖏᓐᓂᒃ;
- ᑐᓂᓗᒍ ᒥᓂᔅᑕ ᑕᐅᑦᑐᙵᔭᖏᓐᓂᒃ ᐊᒻᒪ ᐅᖃᐅᓯᒃᓴᖏᓐᓂᒃ ᐃᓄᐃᑦ ᐊᑐᓕᕐᑎᑦᑎᓚᐅᓐᖏᓐᓂᖓᓂ ᑖᒃᑯᓐᓄᖓ ᑭᒡᒐᖅᑐᕐᑎᒻᒪᕆᐅᔪᑦ ᑲᑎᒪᔩᖏᓐᓄᑦ ᐊᑐᖅᑕᐅᒥᐊᕈᑕᐅᔭᓐᓇᖅᑐᓂᒃ ᑕᒪᓐᓇ ᐊᑯᓂᐅᔭᒃᑯᑦ ᐊᐅᓚᑕᐅᔭᓐᓇᖅᓂᖏᑦ ᓱᕈᖅᑰᑎᕈᔭᖏᓐᓂᒃ ᐆᑕᖅᓯᔭᓐᓇᖅᑐᓄᑦ ᐊᒃᑕᕐᕕᓕᕆᓂᖅ;
- ᐃᑲᔪᕐᓗᒋᑦ ᓴᕿᑦᑎᓇᓯᐊᕐᑎᓪᓗᒋᑦ ᐃᓗᓕᓇᔭᓐᓇᖅᑕᖏᓐᓂᒃ ᐃᓄᐃᑦ ᑕᐅᓐᓇ ᐊᐅᓚᑦᑎᓂᖕᒐᒍᑦ, ᐊᒻᒪ ᐊᔭᖏᑎᓪᓗᒋᑦ ᐃᓄᐃᑦ ᖃᐅᔨᒪᓕᕈᓐᓇᖅᑕᖏᓐᓂᒃ ᑕᒪᒃᑯᓐᓄᖓ ᐊᐅᓚᑕᐅᔭᓐᓇᖅᓂᖏᑦ ᓱᕈᖅᑰᑎᕈᔭᖏᓐᓂᒃ ᐆᑕᖅᓯᔭᓐᓇᖅᑐᓄᑦ ᐊᒃᑕᕐᕕᓕᕆᓂᖅ;
- ᓄᐃᑦᑎᓗᑎᒃ ᑐᓴᐅᑎᓕᕆᔾᔪᑎᒥᓂᐊᖅᑕᖏᓐᓂᒃ ᐊᕙᑖᓂᑦ ᐃᓄᐃᑦ ᐊᒻᒪᓗ ᑲᓇᑕᒥ ᒐᕙᒪᒃᑯᑦ ᐱᓪᓗᒍ ᑕᒪᓐᓇ ᐱᔾᔪᑎᒋᔭᐅᔪᓄᑦ ᐊᑯᓂᐅᔭᒃᑯᑦ ᐊᐅᓚᑕᐅᔭᓐᓇᖅᓂᖏᑦ ᓱᕈᖅᑰᑎᕈᔭᖏᓐᓂᒃ ᐆᑕᖅᓯᔭᓐᓇᖅᑐᓄᑦ.

ᖃᓄᓇᑦᑑᔭᓐᓇᖅᓂᖓ/ᑕᑯᓐᓇᖅᓂᐊᖅᑕᖓ:

ᑐᑭᓯᖃᑎᒌᒐᓱᖕᓂᖏᑦ ᐱᓯᒪᓪᓚᕆᒃᑑᓗᒋᑦ ᐊᒻᒪ ᑕᒪᒃᑯᓐᓇᖓᑐᐊᖅ ᐱᓯᒪᔪᓄᑦ ᐊᑯᓂᐅᔪᒃᑯᑦ ᐊᐅᓚᑕᐅᔪᓐᓇᖅᓂᖏᑦ ᓱᕈᖅᑑᑎᕈᔪᖏᓐᓂᒃ ᐆᑕᖅᓯᔪᓐᓇᖅᑐᓄᑦ ᐊᒃᑕᕐᕕᒃ ᑲᓇᑕᒥ ᐊᒻᒪ ᓴᓇᓯᒪᓂᖏ ᐊᒻᒪ ᐱᕙᓪᓕᐊᓂᖏᑦ ᓴᕿᑕᐅᓯᒪᑦᑎᐊᖅᓗᑎᒃ ᓱᕈᖅᑑᑎᕈᔪᖏᓐᓂᒃ ᐆᑕᖅᓯᔪᓐᓇᖅᑐᓄᑦ ᐊᒃᑕᓇᐊᓕᑦ ᐱᕐᑯᔾᔭᐊᖓᓂ. ᐱᔾᔭᑎᑦ ᐅᖃᖃᑎᒌᒍᑎᒃᓴᑦ ᐅᑯᓂᖓ ᐃᓚᖃᖅᑐᑦ:

- ᐱᓯᒪᔪᓄᑦ ᐊᑯᓂᐅᔪᒃᑯᑦ ᐊᐅᓚᑕᐅᔪᓐᓇᖅᓂᖏᑦ ᓱᕈᖅᑑᑎᕈᔪᖏᓐᓂᒃ ᐆᑕᖅᓯᔪᓐᓇᖅᑐᓄᑦ ᐊᒃᑕᕐᕕᒃ ᑲᓇᑕᒥ ᐃᓚᒋᔭᐅᓗᑎᒃ ᐅᖃᐅᓯᒃᓴᐃᑦ ᓇᓗᓇᐃᔭᕐᑎᐊᖅᓯᒪᔪᑦ ᐃᓗᐊᓂ ᓱᕈᖅᑑᑎᕈᔪᖏᓐᓂᒃ ᐆᑕᖅᓯᔪᓐᓇᖅᑐᓄᑦ ᐊᒃᑕᓇᐊᓕᑦ ᐱᕐᑯᔾᔭᐊᖓᓄᑦ, ᐊᒻᒪ ᐊᓯᖏᑦ ᑐᒃᓯᕋᐅᑕᐅᔪᑦ ᓱᕈᖅᑑᑎᑦ ᐆᑕᖅᓯᔪᓐᓇᖅᑐᓄᑦ ᐊᒃᑕᑯᓕᕆᓂᕐᒧᑦ ᑲᑐᔾᔨᖅᑎᒌᖏ;
- ᐱᐅᓯᑐᖃᕐᓄᑦ ᓄᓇᖅᑲᖅᑳᖅᓯᒪᔪᑦ ᖃᐅᔨᒪᔪᖃᖏᑦ ᐱᓪᓗᒍ ᓱᕈᖅᑑᑎᑦ ᐆᑕᖅᓯᔪᓐᓇᖅᑐᓄᑦ ᐊᒃᑕᑯᓕᕆᓂᕐᒧᑦ ᐊᐅᓚᑦᑎᓂᖅ; ᑐᖓᕕᖓᑦ ᐊᑐᖅᑕᐅᓕᕈᑎᒃ ᐃᓄᐃᑦ ᖃᐅᔨᒪᔪᖃᖏᓐᓄᑦ ᐊᒻᒪ ᐱᓂᐊᒐᖏᑦ ᑕᐃᒪᓐᓇᐃᓕᐅᕈᒥᒃ;
- ᓄᓇᖅᑲᖅᑳᖅᓯᒪᔪᑦ, ᐊᖏᕈᑏᑦ ᐊᒻᒪᓗ ᐊᓯᖏᑦ ᐱᔭᓐᓇᐅᑎᑦ ᐱᓪᓗᒍ ᑕᒪᓐᓇ ᓱᕈᖅᑑᑎᑦ ᐆᑕᖅᓯᔪᓐᓇᖅᑐᓄᑦ ᐊᒃᑕᑯᓕᕆᓂᕐᒧᑦ ᐊᐅᓚᑦᑎᓂᕐᒧᑦ;
- ᐊᓯᖏᑦ ᑕᒪᑐᒧᖓ ᓈᒻᒪᒃᑐᑦ ᐅᖃᐅᓯᒃᓴᐃᑦ ᓄᐃᑉᐸᓪᓕᐊᓂᐊᖅᑐᑦ, ᑖᒃᑯᐊᓗ ᐊᖏᖅᓯᒪᔭᖏᑦ ᒥᓂᔅᑕᐅ.

ᑐᓴᖅᓴᐃᒃᑯᑦ
ᑲᓇᑕ ᐃᓄᖅᓄᑦ ᑐᖓᔪᓂᒃᑯᖅ ᐅᖃᖅᑎᑎᒋᔭᐅᓂᒃᑯᑦ
ᓯᕗᓂᖅᓴᒥ ᐅᑦᖁᖅᑐᓪᓗᑦ ᓯᑭᖅᓚᖅᑐᖓᓕᑦ ᐊᖏᑕᖅᑕᐅᓂᖓᓕᑦ
ᖃᒪᑭᕐᐅᓂᓚᓂᐊᖅᑕᖓᓕᑦ ᑲᓇᑕ

ᐃᓄᐃᑦ ᑕᐱᓵᑦ ᑲᓇᑕ
INUIT TAPIRIIT KANATAMI

ᐱᖁᐅᐸᑦ:

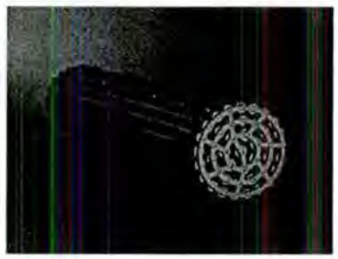
ᐅᑦᖁᖅᑐᓪᓗᓂᒃ ᐊᑦᑕᖅᓯᐅᓕᖅᑭᑦ ᒪᓕᒃᖅ
NRCan Power Point Presentation (Dr. Peter Brown, Feb. 24, 2004)
NWMO Discussion Document: Asking the Right Questions
AFN Fact Sheet
http://www.nucleartourist.com/world/canada.htm

1.0 ᐱᓕᕆᐊᒍᓯᒪᔪᑦ

ᓂᐅᕿᑎᒃᓴᓕᐊᖑᕙᓕᓚᐅᖅᑐᑦ ᐆᑖᕐᓇᖅᑐᓖᑦ ᐆᒻᒪᖅᑰᑏᑦ ᑲᓇᑕᒥ ᐊᑖᒥᒃ ᐃᓄᔾ ᑲᓇᑕᒥ ᓕᒥᑎᑦ ᒪᒃᐱᖅᓯᓚᐅᖅᑎᓪᓗᒍ ᑕᒡᓚᔅ ᐳᐃᓐ ᐆᑖᕐᓇᖅᑐᓕᖕᓂᒃ ᐆᒻᒪᖅᑯᑎᓕᕆᔾᔪᓂᒃ 1968-ᖑᑎᓪᓗᒍ. ᐊᓯᖏᑦ ᐆᑖᕐᓇᖅᑐᓖᑦ ᐆᒻᒪᖅᑰᑏᑦ ᓴᖅᑭᑕᐅᖄᑦᑕᓕᓚᐅᖅᑐᑦ 1970-ᖏᓐᓂ, 80-ᖏᓐᓂ ᐊᒻᒪᓗ 90-ᖏᓐᓂ. 2003-ᒥ 22-ᖑᓕᓚᐅᖅᑐᑦ ᐱᔪᓐᓇᐅᑎᖃᕐᕕᒋᔭᐅᑎᒃ ᐆᒻᒪᖅᑯᑎᓕᕆᔩᑦ ᑲᓇᑕᒥ, ᐆᒻᒪᖅᑯᓯᐅᕐᓂᕐᒥᒃᑎᒍᑦᓗ ᓴᙱᔪᒻᒪᕆᖕᓂᒃ ᐆᑖᕐᓇᖅᑐᓂᒃ ᐊᑦᑕᒃᓴᖄᖅᐸᒃᐳᑎᒃ.

2.0 ᑭᓲᕙ ᐊᑐᖅᑕᐅᓯᒪᔪᑦ ᐆᑖᕐᓇᖅᑐᓕᖕᓂᒃ ᐊᒃᑕᒃᓴᐃᑦ?

ᐆᑖᕐᓇᖅᑐᓖᑦ ᐊᑦᑕᒃᓴᐃᑦ ᐊᑐᖅᑕᐅᓯᒪᔪᑦ ᓄᖑᓯᐃᑦᑐᓂᒃ ᐅᖅᓱᐊᓗᒃ, ᐆᒻᒪᖅᑯᓯᐊᓇᔾᔭᐅᓯᒪᔪᓂᑦ. ᑖᓐᓇ ᐆᑖᕐᓇᖅᑐᖅ ᐊᑦᑕᒃᓴᖅ ᑲᑎᙵᑎᑕᐅᕙᒃᑐᑦ (ᐊᔾᔨᙳᐊᖅ ᑕᒪᑐᒪ ᐊᑖᓃᑦᑐᖅ ᑕᑯᓗᒍ), ᐅᖄᒪᐃᓐᓂᖄᕈᒃᐳᑎᒡᓗ 20 ᑭᓗᒍᕐᒫᓂᒥᒃ ᐊᑐᓂ.



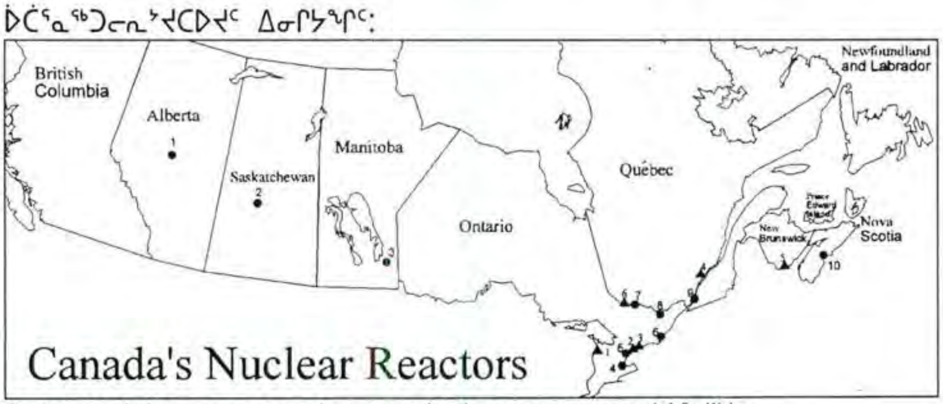
ᑖᒃᑯᐊ ᑲᑎᙵᔪᑦ, ᐅᖄᐅᑕᐅᓚᐅᖅᑐᑦ, ᐊᑐᖅᑕᐅᕙᖕᒥᔪᑦ ᓯᓚᑦᑐᓴᕐᕕᒡᔪᐊᓂ ᐋᓐᓂᐊᕕᖕᓂᓗ ᖃᐅᔨᓴᖅᑐᓄᑦ ᐊᒻᒪᓗ ᐃᓅᓕᓴᐅᑎᒃᓴᓕᐅᕐᓯᒃᑐᓄᑦ. ᐊᑐᖅᑕᐅᕌᓂᒃᓯᒪᔪᑦ ᐲᖅᑕᐅᕙᒃᑐᑦ ᐆᒻᒪᖅᑯᑎᓕᐅᕿᑎᖏᓐᓂᒃ ᖃᕐᓴᐅᔭᓄᑦ ᐊᐅᓚᑕᐅᔪᓂᒃ ᐊᑐᖅᐳᑎᒃ ᐆᓇᓗᐊᕐᓂᖓᓄᑦ ᐊᒻᒪᓗ ᐆᑖᕐᓂᖓᓄᑦ. ᐆᑖᕐᓇᖅᑐᑦ ᐊᑦᑕᕐᓇᕐᓂᖏᑦ ᑕᐅᓴᑦ ᐅᑭᐅᑦ ᐅᖓᑎᖏᓐᓄᑦ ᐊᑦᑕᕐᓇᐃᓐᓇᕈᓐᓇᖅᑐᑦ, ᐊᒻᒪᓗ ᐆᑖᕐᓇᖅᑐᓖᑦ ᐱᑕᖃᐃᓐᓇᕐᓂᖏᓐᓄᑦ, ᐊᑦᑕᒃᓴᑦ ᐊᖏᓕᕙᓪᓕᐊᔪᓐᓇᖅᑐᑦ. ᓯᕗᓂᒃᓴᒧᑦ ᐸᕐᓇᒃᓯᒪᔭᕆᐊᖃᖅᐸᒃᑐᑦ ᐊᑦᑕᖅᑕᐅᑦᑎᐊᕆᐊᖃᕐᓂᖏᑦ.

ᐆᑖᕐᓇᕐᓂᖓᓄᑦ ᐊᒻᒪᓗ ᐊᑦᑕᕐᓇᕐᓂᖓᓄᑦ, ᐆᑖᕐᓇᖅᑐᓖᑦ ᐊᑦᑕᒃᓴᐃᑦ ᐃᓄᖕᓄᑦ ᐊᒻᒪᓗ ᐊᕙᑎᐅᔪᒧᑦ ᐊᑦᑕᕐᓇᖅᑐᑦ.

3.0 ᒫᓐᓇ ᓇᒧᑦ ᑐᖅᑯᖅᑕᐅᕙᒃᐸᑦ ᐊᑐᖅᑕᐅᓯᒪᔪᑦ ᐆᑖᕐᓇᖅᑐᓕᖕᓂᒃ ᐊᒃᑕᒃᓴᐃᑦ?

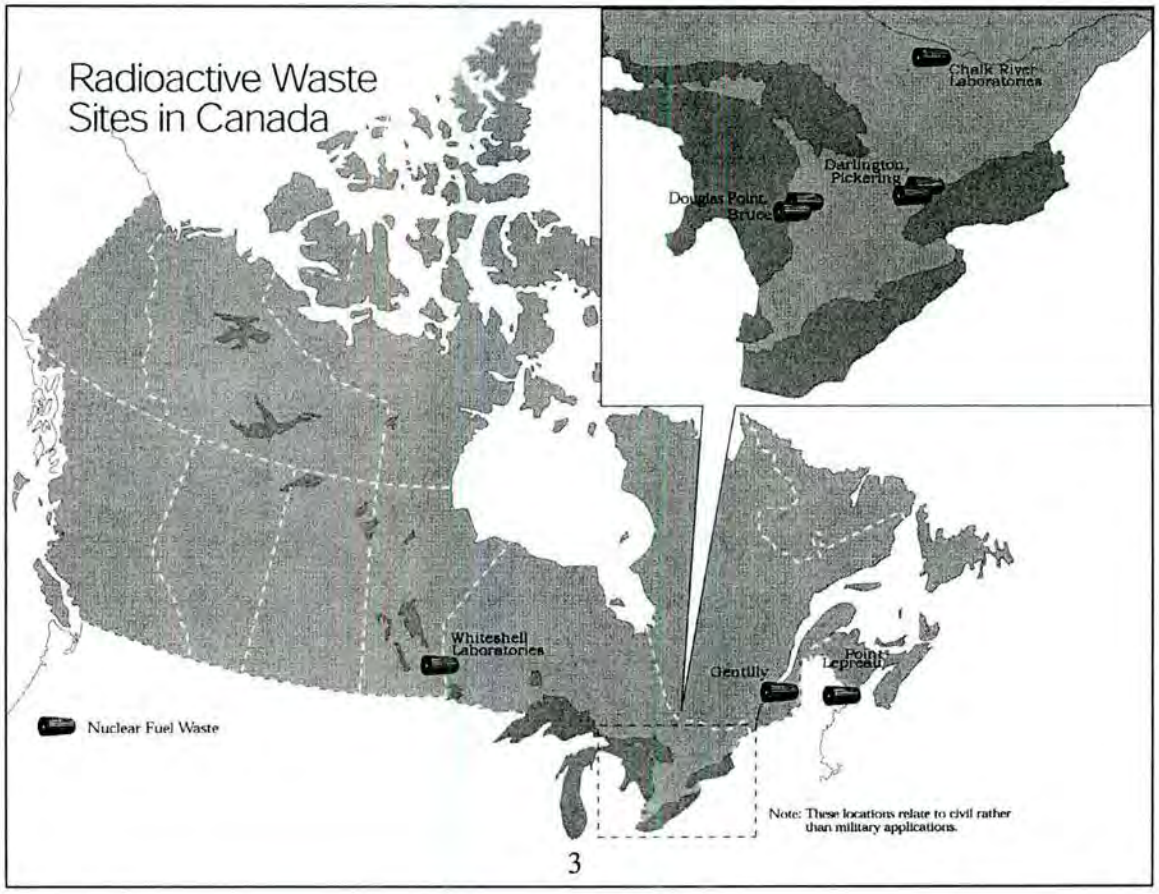
ᑕᒪᐃᓐᓂᒃᓴᒃ, ᐊᑐᖅᓯᒪᔪᑦ ᐆᑖᕐᓇᖅᑐᑦ ᐊᑦᑕᒃᓴᐃᑦ ᐊᑐᖅᑕᐅᕝᕕᒋᔭᖏᓐᓂ ᐆᒻᒪᖅᑯᑎᓕᕆᕕᖕᓂ ᑐᖅᑯᖅᑕᐅᓯᒪᕙᒃᑐᑦ, ᐸᓂᖅᑐᒦᑎᑕᐅᓪᓗᑎᒡᓘᓐᓃᑦ ᑭᐊᒃᑐᒦᑎᑕᐅᓪᓗᑎᒡᓘᓐᓃᑦ. ᐃᓚᖏᓪᓗ ᐊᑦᑕᒃᓴᐃᑦ ᓵᒃ ᑰᖓᓂ ᐊᒻᒪᓗ ᐅᐊᐃᑦ ᓯᐅᓪ ᖃᐅᔨᓴᕝᕕᖓᒥ ᑐᖅᑯᖅᑕᐅᓯᒪᕙᒃᑐᑦ.

ᐆᑖᕐᓇᖅᑐᓕᓐᓂᒃ ᔪᑕᐅᔪᑦ ᐃᓂᒋᔭᖏᑦ:



On the map, circles represent research reactors; triangles represent commercial facilities (http://www.nucleartourist.com/world/canada.htm).

ᐅᑦᓇᑐᖏᖅᑐᑦ ᐊᑦᑕᓚᖏᖅᑐᑦ ᐃᓂᒋᔭᖓᑦ ᑲᓇᑕᒥ:



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4.0 ᑭᒃᑯᑦ ᓴᓇᓕᒃᑯᑦ ᐅᑦᓱᖏᑐᒃᓯᓂᒃ ᐊᒃᑕᓚᒃᓴᓂᒃ?

ᐅᑦᓱᖏᑐᓪᓗᑦ ᐊᑦᑕᓚᒃᓴᐃᑦ ᐱᑕᖏᖅᑯᓕᑦ ᐅᓴᒪᖏᑐᓕᕐᑎᑐᑦᓂᒃ 1970-ᖓᑎᓂ ᓴᖏᑭᑕᓕᕐᑎᒃᓭᒪᔪᓂᑦ. ᐊᓐᑎᐅᓕᕐᒥ ᐅᓴᒪᖏᑐᓕᓕᒃᑯᑦ ᐅᑦᓱᖏᑐᑐᒃᓯᓂᒃ ᐊᑦᑕᓚᒃᓴᐅᑦᑐᑐᒃᓂᒃ 90-ᓴᓴᖓᓂᓪᓗᑎᓂᒃ ᐊᑦᑕᓚᒃᓴᖏᖅᑯᑦᑕᒃᑯᑦ, ᓂᐅᕐᖏᓐᓇᐃᒥ ᐅᓴᒪᖏᑐᓕᓕᒃᑯᑦ 4-ᓴᓐᓂᒃ, ᑯᔪᐃᒥ ᐅᓴᒪᖏᑐᓕᓕᒃᑯᑦ 4-ᓴᓐᓂᒃ ᐊᓴᒐᓗ ᐊᑦᑕᒥᒃ ᐅᓴᒪᖏᑐᓕᓕᒃᑯᑦ ᑲᓇᑕᒥ 2-ᓴᓐᓂᒃ. ᐊᓯᖓᑦ ᐊᑦᑕᓚᒃᓴᖏᖅᑯᑦᑕᒃᑯᑦ (ᓯᑦᓗ ᓯᓇᓪᑐᑐᓴᖏᐃᑦ) ᒥᑭᓂᒃᖏᓴᓴᓕᓪᓚᖓᓂᒃ ᐊᑦᑕᓚᒃᓴᓪᓕᖏᖅᑯᑦᑕᒃᑯᑦ.

5.0 ᖃᓄᑎᒥ ᐅᑦᓱᓇᒃᑐᓪᓗᒃᓂᒃ ᐊᑦᑕᓚᒃᓴᓂᒃ ᐱᑕᖏᖅᑯᓕ ᑲᓇᑕᒥ?

2002-ᒥᓂᑦ, 1.7 ᒥᓪᐊᓂᖓᔪᓪᓗᐊᖏᖅᑐᑦ ᐊᑐᖏᖅᑕᐅᓯᒪᔪᑦ ᐅᑦᓱᖏᑐᓪᓗᑦ ᐊᑎᖏᓯᖏᖅᑕᐅᓯᒪᔪᑦ (40,000 ᒥᑐᓗᒃ ᑕᓂᓪᓗᐊᖏᖅᔪᓪᓗᑎᒃ) ᐊᑐᓚᒃᓴᖓᓂᖏᖅᑎᑕᐅᓪᓗᑎᒃᑐᑦ (ᐱᖓᓚᓯᓂᒃ ᕿᐊᑭᕐᕕᐊᓂᓪᓗᐊᓂᒃ ᑕᑕᑎᔨᓂᓪᓗᐊᖏᖅᑐᖏᖅ). ᐃᓂᓂ ᑕᐃᒪᐃᑎᓪᓗᔪ 3.6-ᒥᓪᐊᓂᓪᓗᐊᓂᒃ ᐊᑐᓚᒃᓴᓪᓕᖏᓪᓚᕐᕿᖏᖅᑐᑦ 2033-ᒧᑦ ᑎᑭᓪᓗᔪ.

6.0 ᖃᓄᖅ ᐊᑯᓂᐅᑎᒋᔭᖅ ᐆᑖᕐᓇᖅᑐᓖᑦ ᐊᑦᑕᓗᒃᓴᐃᑦ ᐊᑦᑕᕐᓇᖅᐸᒃᐸᑦ?

ᐆᑖᕐᓇᖅᑐᑦ ᐆᒃᑐᕋᖅᑕᐅᕙᒃᑐᑦ ᐆᑖᕐᓇᖅᑐᖃᕈᓐᓇᕐᓂᖏᑦᑕ ᐊᕙᑦᓗᐊᖏᓐᓂᒃ, ᐅᕙᓘᓐᓃᑦ ᐆᑖᕐᓇᖅᑐᖃᕈᓐᓇᕐᓂᖓᑕ ᓇᑉᐸᖓᓂᒃ. ᓄᖑᓯᐃᑦᑐᓂᙵᖅᑐᑦ ᐊᑦᑕᕐᓇᖅᑐᖃᕈᓐᓇᕐᓂᖓᑕ ᓇᑉᐸᖓ 710,000 ᐊᕐᕌᒍᓄᑦ ᑎᑭᐅᑎᔪᓐᓇᖅᑐᑦ.

7.0 ᐊᐅᓚᑦᑎᓂᖅ ᐆᑖᕐᓇᖅᑐᓕᖕᓂᒃ ᐊᑦᑕᓗᒃᓴᓂᒃ ᑲᓇᑕᒥ

ᐆᑖᕐᓇᖅᑐᖃᖅᑐᑦ ᐊᑦᑕᓗᒃᓴᐃᑦ ᐊᐅᓚᑕᐅᓂᖏᑦ ᑲᓇᑕᒥ ᐊᑯᓂᐊᓘᔭᓐᓇᖅᐸᒃᑐᑦ ᐊᒻᒪᓗ ᐅᖃᖃᑎᒌᒍᑕᐅᕐᔪᐊᖃᑦᑕᖅᓯᒪᓪᓗᓂ. ᐆᑖᕐᓇᖅᑐᓖᑦ ᐊᑦᑕᓗᒃᓴᐃᑦ ᐊᐅᓚᑕᐅᓂᖏᑦ ᐃᒪᓐᓇ ᐱᓕᕆᐊᖑᖃᑦᑕᖅᓯᒪᔪᑦ:

1977 – Hᐃᐅ ᑲᒥᓴᓐ, ᐊᖏᖃᑎᒌᒍᑎᖃᖅᓱᑎᒃ ᐆᒻᒪᖅᑯᑎᓕᕆᔩᒃᑯᓐᓂᒃ, ᐅᔭᕋᖕᓂᐊᖅᑎᓂᒃ, ᐊᒻᒪᓗ ᑲᓇᑕᒥ ᐊᑐᓚᒃᓴᓕᕆᔨᓂ, ᑎᑎᕋᖅᓯᒪᔪᓂᒃ ᓴᖅᑭᑦᑎᓚᐅᖅᑐᑦ ᓈᒻᒪᒃᓴᕐᓂᕋᖅᓱᑎᒃ ᐆᑖᕐᓇᖅᑐᓖᑦ ᐊᑦᑕᓗᒃᓴᐃᑦ ᓄᓇᒧᑦ ᐃᓗᑐᔪᒻᒪᕆᖕᒧᑦ ᓴᐳᔾᔨᖅᑕᕐᓂᐊᕐᓂᖏᓐᓂᒃ ᑐᐊᒪᖕᓂ.

1988 – ᒥᓂᔅᑕᐅᔭᖅ ᐆᒪᖅᑯᑎᓕᕆᔩᒃᑯᓐᓂᒃ, ᐅᔭᕋᖕᓂᐊᖅᑎᓂᒃ, ᐊᒻᒪᓗ ᑲᓇᑕᒥ ᐊᑐᓚᒃᓴᓕᕆᔨᓂ ᓄᓇᒧᑦ ᓴᐳᔾᔨᑎᑦᑎᖅᑕᑦᑕᖁᔨᓯᒪᓂᕐᒧᑦ ᑎᑎᕋᖅᓯᒪᔪᓂᒃ ᑐᓂᓯᓚᐅᖅᑐᖅ ᐊᕙᑎᓕᕆᓂᕐᒧᑦ ᒥᓂᔅᑕᐅᔭᒧᑦ.

1989 – ᓯᐳᐊᓐ ᑲᑎᒪᔩᑦ ᓴᖅᑭᑕᐅᓚᐅᖅᑐᑦ ᕿᒥᕐᕈᖁᔭᐅᓪᓗᑎᒃ ᑕᒪᑐᒥᖓ ᓄᓇᒧᑦ ᓴᐳᓯᖅᑕᕐᓂᐊᕐᓂᕐᒥᒃ.

1996 – ᓰᐳᐊᓐ ᑲᑎᒪᔨᖏᑕ ᐱᓕᕆᐊᕆᔭᖏᑦ ᐱᔮᕆᖅᑕᐅᓚᐅᕋᑎᒃ, ᑲᓇᑕᐅᑉ ᒐᕙᒪᖓ ᓴᖅᑭᑎᓚᐅᖅᓯᒪᔪᖅ "ᒪᓕᒐᒃᓴᓕᐊᓂᒃ ᐆᑖᕐᓇᖅᑐᖃᑦᑐᑦ ᐊᑦᑕᓗᒃᓴᐃᑦ ᐊᐅᓚᑕᐅᓂᖏᓐᓄᑦ" ᓇᓗᓇᐃᖅᓯᓪᓗᑎᓪᓗ ᐱᓕᕆᕝᕕᐅᔪᑦ ᓇᖕᒥᓂᖅ ᑲᒪᔪᓐᓇᕐᓂᐊᕐᓂᖏᓐᓂᒃ ᐊᑦᑕᓗᒃᓴᓐᓄᔭᒥᖕᓂᒃ.

1998 – ᓰᐳᐊᓐ ᑲᑎᒪᔩᑦ ᓴᖅᑭᑎᓚᐅᖅᑐᑦ ᑎᑎᕋᖅᑕᒥᖕᓂᒃ, ᐅᖃᖅᓱᑎᒃ "ᐊᑦᑕᕐᓇᖅᑎᑦᑎᑦᑕᐃᓕᓂᕐᒧᑦ ᐱᓕᕆᐊᖑᔪᑦ ᓇᓗᓇᐃᔭᖅᑕᐅᓯᒪᑦᑎᐊᕋᓗᐊᖅᑎᓪᓗᒍ, ᐃᓄᓕᕆᓂᕐᒧᑦ ᑐᕌᖓᔪᓂᒃ ᓇᓗᓇᐃᔭᖅᓯᒪᑦᑎᐊᖏᓐᓂᖓᓂᒃ." ᑎᑎᕋᖅᑕᖏᓐᓂ ᐱᖁᔨᕗᖕᒑᕈᑎᓕᐅᓚᐅᖅᑐᑦ ᐊᑦᑕᓗᒃᓴᐃᑦ ᐊᐅᓚᑕᐅᓂᖏᓐᓄᑦ ᑲᑐᔾᔨᖃᑎᒌᑦ ᐱᓕᕆᕝᕕᐅᔪᓄᑦ ᖃᓂᑦᑕᓇᐊᖅᑲᕐᓂᐊᕐᓂᖏᓐᓂᒃ ᑲᒪᑦᑎᐊᕐᓂᐊᕈᑎᒃ.

1998 – ᒐᕙᒪᒃᑯᑦ ᑭᐅᓕᓚᐅᖅᑐᑦ ᓰᐳᐊᓐ ᑲᑎᒪᔨᖏᓐᓄᑦ ᑎᑎᕋᐅᑕᐅᓚᐅᖅᑐᓂᒃ, ᐅᖃᖅᓱᑎᓪᓗ ᐱᓕᕆᔩᑦ ᑲᒪᔪᓐᓇᕐᓂᐊᕐᓂᖏᓐᓂᒃ ᐊᑦᑕᓗᒃᓴᓕᐊᒥᖕᓂᒃ.

2002 – ᐆᑖᕐᓇᖅᑐᓕᖕᓄᑦ ᐊᑦᑕᓗᒃᓴᓄᑦ ᒪᓕᒐᖅ ᑲᔪᓯᑎᑕᐅᓚᐅᖅᑐᖅ, ᐅᖃᖅᓯᒪᓪᓗᓂ ᐊᑐᖅᑕᐅᔭᓇᐊᓕᖕᓂᒃ ᐆᑖᕐᓇᖅᑐᓕᖕᓂᒃ ᐊᑦᑕᖅᓯᓂᐊᖅᑐᓄᑦ ᑲᑐᔾᔨᖃᑎᒌᖅᑲᖅᑯᐃᓪᓗᑎᒃ ᐱᖁᔨᕗᖕᒑᕈᑎᓕᐅᕐᓂᐊᖅᑐᓂᒃ ᓯᕗᓂᒃᓴᒧᑦ ᐆᑖᕐᓇᖅᑐᓖᑦ ᐊᑦᑕᖅᑕᐅᕙᖕᓂᐊᕐᓂᖏᑦᑕ ᐊᐅᓚᑕᐅᔾᔪᑎᒃᓴᓂᒃ ᔫᓚᐃ 15, 2005-ᖑᓚᐅᖏᓐᓂᖓᓂ. ᒐᕙᒪᒃᑯᑦ ᑲᒪᔪᓐᓇᕐᓂᐊᖅᑐᑦ ᕿᒥᕐᕈᓪᓗᑎᒃ ᐊᖏᕈᑎᖃᕐᓗᑎᓪᓗ ᑖᒃᑯᓇᙵᑦ ᐱᓕᕆᐊᖑᔪᓂᒃ.

8.0 ᐆᑖᕐᓇᖅᑐᓕᖕᓂᒃ ᐊᑦᑕᓗᒃᓴᓕᕆᓂᕐᒧᑦ ᒪᓕᒐᖅ

ᐆᑖᕐᓇᖅᑐᓕᖕᓂᒃ ᐊᑦᑕᓗᒃᓴᓕᕆᓂᕐᒧᑦ ᒪᓕᒐᖅ ᐱᙳᖅᑎᑕᐅᓚᐅᖅᑐᖅ ᔫᓚᐃ 15, 2002-ᖑᑎᓪᓗᒍ. ᑖᓐᓇ ᒪᓕᒐᖅ ᐱᒋᐊᖅᑎᑦᑎᔾᔭᑕᐅᓕᓚᐅᖅᑐᖅ 1996-ᒥ ᒪᓕᒐᒃᓴᓕᐊᖑᓚᐅᖅᓄᑦ ᐆᑖᕐᓇᖅᑐᓯᕐᓂᒃ ᐊᑦᑕᕐᓂᕐᒧᑦ. ᑲᓇᑕᒥ ᓄᓇᒥᙵᖅᑐᓂᒃ ᐊᑐᓚᒃᓴᓕᕆᔩᒃᑯᑦ ᑕᒪᑐᒥᖓ ᑲᒪᔨᐅᑎᑕᐅᔭᑦ. ᒪᓕᒐᐅᑉ ᐱᒻᒪᕆᐅᓂᖏᑦ ᐅᑯᐊᖑᕗᑦ:

- ᐋᖅᑭᑦᑎᓚᐅᖅᐳᑦ ᐆᑖᕐᓇᖅᑐᓕᖕᓂᒃ ᐊᑦᑕᕐᓂᕐᒧᑦ ᐊᐅᓚᑦᑎᓂᕐᒧᑦ ᑲᑐᔾᔨᖃᑎᒌᒥᒃ, ᐱᒋᐊᖅᑎᑦᑎᓂᐊᕐᓗᑎᒃ ᐆᑖᕐᓇᖅᑐᓖᑦ ᐊᑦᑕᓗᒃᓴᐃᑦ ᑲᒪᒋᔭᐅᔭᓇᐊᕐᓂᖏᓐᓂᒃ. ᓇᖕᒥᓂᖃᖅᑎᐅᔪᑦ ᐆᒪᖅᑯᑎᓕᕆᔩᓂᒃ ᑖᔅᓯᒪᖕ ᑲᑐᔾᔨᖃᑎᒌᖑᔪᒥᒃ ᐱᒋᐊᖅᑎᑦᑎᓂᐊᖅᑐᑦ ᐊᐅᓚᑦᑎᓂᐊᕐᓗᑎᒃ, ᑮᓇᐅᔭᓕᕆᔨᐅᓂᐊᕐᓗᑎᒃ ᐊᒻᒪᓗ ᐃᖏᕐᕋᓂᖕᒪᓂᒃ ᑲᒪᓂᐊᕐᓗᑎᒃ.

- ᐆᑖᕐᓇᖅᑐᓕᖕᓂᒃ ᐊᑦᑕᕐᓂᕐᒧᑦ ᐊᐅᓚᑦᑎᓂᕐᒧᑦ ᑲᑐᔾᔨᖃᑎᒌᑦ ᖃᐅᔨᓴᖃᑦᑕᕆᐊᖃᖅᑐᑦ ᐅᑯᓂᖓ ᐱᖓᓱᓂᒃ ᐊᐅᓚᑦᑎᔾᔪᑕᐅᔪᓂᒃ ᐊᑦᑕᓇᒃᓴᓕᕆᓂᕐᒧᑦ: ᑲᓇᑕᒥ ᓄᓇᕗᖅᑲᐃᓂᖅ, ᑐᖅᑯᖅᓯᓂᖅ ᐆᑖᕐᓇᖅᑐᓂᒃ ᐆᒻᒪᖅᑯᑎᓕᕆᓂᖅᐱᖕᓂ ᐊᒻᒪᓗ ᑲᒪᒋᔭᐅᔪᒥ ᑐᖅᑯᖅᓯᓂᕐᒥᒃ. ᐊᓯᖏᑦ ᑲᒪᔾᔪᑕᐅᔪᓇᖅᑐᑦ ᐃᓱᒪᒋᔭᐅᔪᓐᓇᕐᒥᔪᑦ ᑲᑐᔾᔨᖃᑎᒌᖑᔪᒧᑦ ᐊᖏᕈᑕᐅᓂᐊᕐᓗᑎᒃ.
- ᓇᖕᒥᓂᖃᖅᑎᐅᔪᑦ ᐆᑖᕐᓇᖅᑐᓕᖕᓂᒃ ᐊᑦᑕᕆᐊᓕᖕᓂᒃ ᐊᑭᓖᔭᕆᐊᖃᖅᑐᑦ ᑮᓇᐅᔾᔪᑕᐅᓂᐊᖅᑐᓂᒃ ᐊᑦᑕᓇᒃᓴᐃᑦ ᑲᒪᒋᔭᐅᓂᖓᓄᑦ.
- ᐆᑖᕐᓇᖅᑐᓕᖕᓂᒃ ᐊᑦᑕᕐᓂᕐᒧᑦ ᐊᐅᓚᑦᑎᓂᕐᒧᑦ ᑲᑐᔾᔨᖃᑎᒌᑦ ᐅᖃᖅᑎᖃᖃᑦᑕᕆᐊᖃᖅᑐᑦ ᐃᓄᖕᓂᒃ, ᐱᓗᐊᖅᑐᒥᒃ ᓄᓇᖃᖅᑳᖅᓯᒪᔪᓂᒃ, ᓴᖅᑭᑦᑎᓂᐊᕿᖕᒐᒥᒃ ᐱᓕᕆᐊᒃᓴᕆᓂᐊᖅᑕᒥᖕᓂᒃ.
- ᒪᓕᒡᓗ ᓴᖅᑭᑕᐅᓚᐅᖅᑎᓪᓗᒍ ᐊᕐᕌᒍᑦ ᐱᖓᓱᑦ ᐊᓂᒍᖏᓐᓂᖏᓐᓂ, ᐆᑖᕐᓇᖅᑐᓕᖕᓂᒃ ᐊᑦᑕᕐᓂᕐᒧᑦ ᐊᐅᓚᑦᑎᓂᕐᒧᑦ ᑲᑐᔾᔨᖃᑎᒌᑦ ᖃᐅᔨᓴᕈᑕᐅᓯᒪᔪᓂᒃ ᓇᓗᓇᐃᔭᖅᓯᒪᑦᑎᐊᖅᑐᓂᒃ ᓴᖅᑭᑎᔭᕆᐊᖃᕐᓂᐊᖅᑐᑦ, ᓇᓗᓇᐃᖅᓯᓗᑎᒡᓗ ᓇᓕᐊᖓ ᓄᓇᓕᖅᑎᖏᓐᓂ ᐱᓕᕆᐊᖃᕐᒪᖔᕐᒥᒃ.
- ᐊᖓᔪᖅᑲᐅᔪᖅ ᑲᑎᒪᔩᓂ (ᑲᓇᑕᐅᑉ ᐊᖓᔪᖅᑳᖓ) ᐃᓱᒪᓕᐅᖅᑎᐅᔪᓐᓇᖅᑐᖅ ᓇᓕᐊᖕᓂᒃ ᐱᓕᕆᐊᒃᓴᓂᐊᕐᒪᖔᖏᓐᓂᒃ ᓯᕗᓂᒃᓴᒧᑦ ᐊᐅᓚᑦᑎᔾᔪᑕᐅᓂᐊᖅᑐᓂᒃ ᐆᑖᕐᓇᖅᑐᓂᒃ ᐊᑦᑕᕆᐊᓕᖕᓂᒃ ᑲᓇᑕᒥ, ᑲᒪᒋᔭᐅᓂᐊᕐᓗᑎᒃ ᐆᑖᕐᓇᖅᑐᓕᖕᓂᒃ ᐊᑦᑕᕐᓂᕐᒧᑦ ᐊᐅᓚᑦᑎᓂᕐᒧᑦ ᑲᑐᔾᔨᖃᑎᒌᓄᑦ.
- ᑕᒪᕐᒥᒃ ᐊᑐᓚᒃᓴᓕᐊᖑᔪᑦ ᑎᑎᕋᖅᓯᒪᔭᕆᐊᖃᖅᑐᑦ ᖃᓄᖅ ᐆᑖᕐᓇᖅᑐᓕᖕᓂᒃ ᐊᑦᑕᕐᓂᕐᒧᑦ ᐊᐅᓚᑦᑎᓂᕐᒧᑦ ᑲᑐᔾᔨᖃᑎᒌᖑᔪᑦ ᓄᓇᓕᖕᒥᐅᓂᒃ ᐊᒃᑐᐊᖏᓕᐅᕈᑎᖃᓕᖅᑎᑦᑎᖏᓐᓂᖅᐸᐅᔪᓐᓇᕐᒪᖔᖏᓐᓂᒃ.
- ᒪᓕᒡᓗ ᐆᑖᕐᓇᖅᑐᓕᖕᓂᒃ ᐊᑦᑕᕐᓂᕐᒧᑦ ᐊᐅᓚᑦᑎᓂᕐᒧᑦ ᑲᑐᔾᔨᖃᑎᒌᖕᓂᒃ ᑎᓕᓯᒪᔪᖅ ᐅᖃᐅᔾᔭᐃᓃᒃᓴᓂᒃ ᑲᑎᒪᔩᖃᓕᐊᕐᓂᐊᖏᓐᓂᒃ, ᑎᑎᕋᖃᑦᑕᕐᓂᐊᖅᑐᓂᒃ ᖃᐅᔨᓴᕐᑕᐅᓯᒪᓕᖅᑐᓂᒃ ᐱᓕᕆᐊᒃᓴᐅᓂᐊᖅᑐᓄᑦ.

9.0 ᐃᓄᐃᑦ ᐊᒻᒪᓗ ᐆᑖᕐᓇᖅᑐᓖᑦ ᐊᑦᑕᓇᒃᓴᐃᑦ

ᒦᓇ ᐃᓄᐃᑦ ᓄᓇᓕᖏᑦ ᖃᓂᒋᔭᐅᖕᒋᑦᑐᑦ ᐆᑖᕐᓇᖅᑐᓕᖕᓂᒃ ᐆᒻᒪᖅᑯᑎᓕᕆᓂᒃ. ᐃᓚᖏᑦ, ᔫᕐᓗ ᐃᓄᐃᑦ ᓄᓇᕕᖕᒥᐅᑕᐃᑦ, ᐊᒻᒪᓗ ᐃᓄᐃᑦ ᓄᓇᑦᓯᐊᕙᒻᒥᐅᑕᐃᑦ (ᓛᐸᑐᐊᕆᒥ), ᓄᓇᖁᑎᖃᖅᑐᑦ ᐆᑖᕐᓇᖅᑐᓕᖕᓂᒃ ᐊᑦᑕᓇᒃᓴᓂᒃ ᑐᖅᑯᕐᕕᐅᑐᐃᓐᓇᕆᐊᖃᖅᑐᓂᒃ. ᓛᐸᑐᐊᕆᒥ ᐃᓄᐃᑦ ᑲᑐᔾᔨᖃᑎᖏᑦ, ᐊᖏᕈᑎᖃᖅᓯᒪᖕᒋᑦᑐᑦ ᓄᓇᑦᓯᐊᕙᒻᒥ ᓄᓇᓂᓗ ᖃᓂᒋᔭᖏᓐᓃᑦᑐᓂᒃ ᐆᑖᕐᓇᖅᑐᓕᖕᓂᒃ ᐊᑦᑕᓇᒃᓴᓂᒃ ᑐᖅᑯᐃᔭᒪᓯᒪᔭᓂᒃ.

ᖃᓄᐃᑦᑐᓂᒃ ᐊᐅᓚᑦᑎᔾᔭᑎᖃᕐᓂᐊᕐᓂᖏᑦ ᒪᓕᒃᓗᒋᑦ, ᐃᓚᖏᑦ ᐃᓄᐃᑦ ᓄᓇᓕᖏᑦ ᐊᒃᑐᖅᑕᐅᓯᒪᓂᖃᑐᐃᓐᓇᕆᐊᖃᖅᑐᑦ. ᐃᓱᒪᒋᔭᐅᔪᓐᓇᕐᒪᑕ ᖃᕋᔭᕐᒥᐅᑦ ᓄᓇᖐᑦ ᐊᖅᑯᓯᓂᕐᒦᑦᑐᑦ ᐊᒃᑕᖅᑕᐅᕝᕕᖓᓄᑦ, ᐊᑦᑕᓇᒃᓴᐃᑦ ᐆᒻᒪᖅᑯᑎᖃᕐᕕᖕᓂᑦ ᓅᑕᐅᓇᓱᕐᓂᖅᐸᑕ ᑐᖅᑯᖅᑕᐅᓯᒪᕝᕕᒋᓂᐊᖅᑕᖏᓐᓄᑦ.

10.0 ᓯᐳᐊᓐ ᑲᑎᒪᔩᑦ

ᓯᐳᐊᓐ ᑲᑎᒪᔩᑦ ᑎᒃᑯᐊᖅᑕᐅᓚᐅᖅᑐᑦ ᑲᓇᑕᐅᑉ ᒐᕙᒪᖓᓄᑦ 1989-ᒥ ᓴᖅᑭᑎᕐᑯᔭᐅᓪᓗᑎᒃ ᖃᓄᖅ ᐊᔾᔨᒋᖕᒋᑦᑐᓂᒃ ᑲᒪᒋᔭᐅᔭᓇᕐᒪᖔᖏᑦ ᐆᑖᕐᓇᖅᑐᓖᑦ ᐊᑦᑕᓇᒃᓴᐃᑦ ᑲᓇᑕᒥ.

ᐃᓚᖏᑦ ᐃᓱᒫᓗᒋᔭᐅᓚᐅᖅᑐᑦ ᓄᓇᖃᖅᑳᖅᓯᒪᔪᓂᒃ ᑲᑎᒪᔨᐅᖃᑕᐅᔪᓂᒃ ᑲᑎᒪᔭᖅᑐᖅᓯᒪᖃᑕᐅᓚᐅᖅᑐᓂᒃ ᐅᑯᐊᖑᒐᑦ.

- ᕿᒥᕐᕈᕋᕐᕿᕈᓇᖅᑎᑕᐅᓚᐅᕐᒥᒪᑕ ᑎᑎᕋᖅᓯᒪᔪᓂᒃ ᐆᑖᕐᓇᖅᑐᓕᖕᓂᒃ ᐊᒃᑕᓇᓕᖕᓂᒃ ᐊᒃᑕᖅᓯᔾᔪᑕᐅᖃᑦᑕᕐᓂᐊᖅᑐᓂᒃ ᑲᓇᑕᒥ ᐱᓕᕆᐊᖃᕈᒪᖕᒪᖔᖏᓐᓂᒃ;
- ᑎᑎᕋᖅᑕᐅᓯᒪᔪᑦ ᐱᖅᑯᓯᕆᔭᐅᔪᓂᒃ ᐊᑐᕐᓂᖅᓯᒪᓚᐅᕐᒥᒪᑕ;
- ᑎᑎᕋᖅᑕᐅᓯᒪᔪᑦ ᐅᒃᐱᕆᔭᖕᒋᓐᓂᒃ ᐊᑐᕐᓂᖅᓯᒪᓚᐅᕐᒥᒪᑕ.

ᓯᐳᐊᓐ ᑲᑎᒪᔩᑦ ᓴᖅᑭᑎᓚᐅᖅᑐᑦ ᐱᓕᕆᐊᖑᓯᒪᔪᓂᒃ ᐅᓂᒃᑳᖅᓯᒪᔪᓂᒃ 1998-ᒥ, ᐅᖃᖅᓯᒪᓪᓗᓂ ᓄᓇᒧᑦ ᓴᐅᓯᖃᑦᑕᕐᓂᖅ ᐊᑦᑕᕐᓇᖕᒋᑲᓗᐊᖅᑎᓪᓗᒍ, ᑕᒪᓐᓇ ᐃᓄᓕᒫᓄᑦ ᐃᑲᔪᖅᓯᖅᑕᐅᖕᒋᓗᐊᕐᓂᖓᓄᑦ ᑲᔪᓯᑎᑕᐅᔪᓐᓇᕐᒥᒪᑦ. ᓯᐳᐊᓐ ᑲᑎᒪᔩᑦ ᐱᕈᔾᔭᖖᒋᕈᑎᓕᐊᕆᓚᐅᖅᑕᖏᑦ ᐃᓚᖓ ᐅᖃᖅᓯᒪᓚᐅᖅᑐᖅ ᓄᓇᖃᖅᑳᖅᓯᒪᔪᓂᒃ ᐃᓚᓕᐅᔾᔨᓯᒪᓱᕆᐊᖃᕐᓂᖏᓐᓂᒃ. ᐆᑖᕐᓇᖅᑐᓕᖕᓂᒃ ᐊᒃᑕᕐᓂᕐᒧᑦ ᒪᓕᒡᓗ ᒪᕐᕈᖕᓄᒃ ᑲᑎᒪᔨᖕᓄᒃ ᕿᒥᕐᕈᔭᐅᓚᐅᖅᑐᖅ ᐱᕐᕈᓴᖕᒍᖅᑎᑕᐅᓚᐅᖅᑲᓂ 2002-ᒥ.

11.0 ᒫᓐᓇᔫᖅ ᐱᓕᕆᐊᖑᓯᒪᓕᖅᑐᑦ

ᐆᑖᕐᓇᖅᑐᓕᖕᓂᒃ ᐊᒃᑕᕐᓂᕐᒧᑦ ᒪᓕᒐᖅ ᐱᒋᐊᖅᑎᑕᐅᓚᐅᖅᑐᖅ ᓄᕕᐱᓚ 2002-ᒥ. ᑖᓐᓇ ᒪᓕᒐᖅ, ᐅᖃᖅᓯᒪᔪᖅ ᐃᓄᐃᑦ ᐅᖃᖅᑎᒋᔭᐅᔭᓗᐊᖅᑲᕐᓂᖏᓐᓂᒃ "ᐱᔪᐊᖅᑐᒥᒃ ᓄᓇᖃᖅᑳᖅᓯᒪᔪᑦ, ᑕᒪᐃᓐᓂᒃ ᐊᑐᕈᓐᓇᓕᐊᖑᔪᓂᒃ ᕿᒥᕐᕈᑎᑕᐅᔪᑎᒃ".

12.0 ᖃᓄᐃᓕᐅᕈᑕᐅᓂᐊᓕᖅᑐᑦ

ᐆᑖᕐᓇᖅᑐᓕᖕᓂᒃ ᐊᒃᑕᕐᓂᕐᒧᑦ ᒪᓕᒐᖅ ᐱᖁᔭᙳᖅᑎᑕᐅᓯᒪᓕᕐᒪᑦ, ᐃᓄᐃᑦ ᑕᐱᕇᑦ ᑲᓇᑕᒥ ᐱᓕᕆᖃᑕᐅᓂᐊᓕᖅᑐᑦ ᑲᒪᖃᑕᐅᔪᑎᒃ ᖃᓄᖅ ᐆᑖᕐᓇᖅᑑᑦ ᐊᒃᑕᓚᒃᓴᐃᑦ ᐊᐅᓚᑕᐅᓂᐊᕐᒪᖔᖕᖏᓐᓂᒃ. ᑲᓇᑕᒥ ᓄᓇᒥᓐᖔᖅᑐᓂᒃ ᐊᑐᓚᒃᓴᓂᒃ ᐱᓕᕆᔾᔪᑦ ᐊᒻᒪᓗ ᐆᑖᕐᓇᖅᑐᓕᖕᓂᒃ ᐊᒃᑕᓚᒃᓴᓂᒃ ᐊᐅᓪᓚᑎᓂᕐᒧᑦ ᑲᑐᔾᔨᖃᑎᒌᑦ ᐃᓄᐃᑦ ᑕᐱᕇᒃᑯᓐᓂᒃ ᖄᓇᐅᔭᓂᒃ ᑐᓂᓯᓯᒪᓕᖅᑑᒃ ᐊᑐᖅᑕᐅᓂᐊᕐᓗᑎᒃ ᐊᖑᑯᓄᑦ ᐱᙵᓱᓄᑦ ᐅᖃᖅᑎᒌᒃᑎᑦᑎᓂᕐᒧᑦ ᖃᓄᖅ ᐆᑖᕐᓇᖅᑑᑦ ᐊᒃᑕᓚᒃᓴᐃᑦ ᑲᒪᒋᔭᐅᓂᐊᕐᒪᖔᖕᖏᓐᓂᒃ ᑲᓇᑕᒥ. ᐊᓯᖏᑦ ᑲᑐᔾᔨᖃᑎᒌᖑᔪᑦ, ᐃᓚᒋᔭᐅᓪᓗᓂ ᐊᓪᓚᐃᑦ ᑲᑎᒪᔨᖏᑦ, ᐊᒻᒪᓗ ᐊᓪᓚᐅᔮᖓᔪᑦ ᑲᑎᒪᔨᖏᑦ ᖄᓇᐅᔭᖅᑖᖅᑎᑕᐅᓯᒪᖕᒥᔫᒃ ᑕᐃᒪᓐᓇᑦᑕᐅᖅ ᐅᖃᖅᑎᒌᒃᑎᑦᑎᓂᕐᒧᑦ ᐊᑐᖅᑕᐅᓂᐊᕐᓗᑎᒃ.

ᑐᑭᓯᐊᒃᑲᓐᓂᕈᒪᒍᕕᑦ ᐃᓄᐃᑦ ᑕᐱᕇᑦ ᑲᓇᑕᒥ ᐅᖃᖅᑎᒌᒃᑎᑦᑎᓂᓕᓂᐊᖅᑕᖏᓐᓂᒃ, ᑐᑭᓯᐊᕈᓐᓴᖅᑐᑎᑦ ᐃᓄᖕᓄᑦ ᑐᕌᖓᔪᓂᒃ ᐆᑖᕐᓇᖅᑐᓕᖕᓂᒃ ᐊᒃᑕᓚᒃᓴᐃᑦ ᐊᐅᓚᑕᐅᓂᖏᓐᓂᒃ ᑲᓇᑕᒥ ᐅᖃᖅᑎᒌᒃᑎᑦᑎᓂᕐᒧᑦ ᑲᒪᔨᒧᑦ ᐅᕙᓂ

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13.0 ᐊᒃᑕᕐᓂᕐᒧᑦ/ᑐᖅᑯᐃᓂᕐᒧᑦ ᐊᑐᒐᒃᓴᓕᐊᖑᓯᒪᔪᑦ

13.1 ᐅᖃᐅᓯᖅᑕᐃᑦ:

13.1.1 ᐊᒃᑕᕐᓂᖅ:

ᐊᑐᖅᑕᐅᓯᒪᔪᑦ ᐆᑖᕐᓇᖅᑐᓖᑦ ᐆᒻᒪᖅᑯᑕᐅᓯᒪᔪᑦ ᐃᓄᖕᓄᑦ ᐊᕙᑎᒋᔭᖕᒐᓐᓄᓪᓗ ᐊᒃᑐᐊᑦᑕᐃᓕᑎᑕᐅᓂᖕᒐ; ᐅᑎᖅᑕᐃᓕᑎᑕᐅᓯᒪᔭᓇᐊᖃᖅᑐᖅ ᐊᑐᒃᑲᓐᓂᒐᒃᓴᐅᖕᒋᓪᓗᓂᓗ. ᐊᒃᑕᐃᔭᓐᓇᖅᑐᑦ ᓄᓇᒧᑦ ᖃᒧᖕᒐᒃᑲᓪᓚᒃ ᓴᐅᔭᐅᓗᑎᒃ, ᐃᒪᐅᑉ ᐃᖅᑲᖕᒐᓂᑑᓐᓃᑦ, ᓂᓚᖕᓂ, ᓯᓚᐃᓐᓇᕐᒥ ᐅᕝᕙᓘᓐᓃᑦ ᑎᓯᓕᐊᖑᓯᒪᔪᓂ. ᓄᓇᕐᔪᐊᕐᒥ ᐊᒃᑕᕐᑲᑦᑕᖅᑐᑦ ᓄᓇᒧᐊᖅᓯᒐᔪᖕᓂᖅᐸᐅᑉᐳᑦ ᔫᕐᓗ ᖃᖅᑲᐅᑉ ᐃᓗᐊᓄᐊᖅᑕᐅᓪᓗᑎᒃ (ᐊᒥᐊᓕᒃᑲᒥᐅᑦ ᑕᐃᒪᐃᑉᐸᒃᐳᑦ), ᐅᕝᕙᓘᓐᓃᑦ ᓄᓇᒧᑦ ᓴᐅᔭᐅᓗᑎᒃ ᖃᐃᖅᓯᒐᖅᑐᓂ (ᓯᐃᑕᓐᒥᐅᑦ ᕙᓐᓚᓐᒥᐅᓪᓗ ᑕᐃᒪᐃᑉᐸᒃᐳᑦ). ᐊᒻᒪᓗ 'ᐋᖅᑭᒃᓱᖅᑕᐅᓯᒪᔪᓂ ᐊᑲᐅᙱᓕᐅᕈᑕᐅᕙᒃᑐᑦ' ᑐᖅᑯᖅᓯᔾᔪᑎᓕᐊᖑᕙᒃᑐᑦ ᐊᒻᒪᓗ ᐊᓯᖏᑦ, ᐃᓯᒪᒋᔭᓇᐊᖃᖅᐸᖕᒪᑕ ᖃᓄᖅ ᐃᑎᑎᒋᓂᐊᕐᒪᖔ ᓴᐅᔭᐅᓂᖔ (Hᐊᓐᓇᓕᖕᒋᓐᓂ ᐃᑎᓂᖃᓪᓗᐊᕐᓗᓂ) ᐊᒻᒪᓗ ᑕᒪᓐᓇ ᓄᓇᖓ ᖃᐅᔨᒪᔭᐅᕐᑎᐊᓇᐊᖃᕐᓗᓂ ᐆᑖᕐᓇᖅᑐᑦ ᓴᖅᑭᐸᐸᓪᓕᐊᑐᐃᓐᓇᓇᐊᖃᕐᒪᑕ ᑕᐪᐸᖕᒐᑦ ᐊᒃᑕᖅᑕᐅᓯᒪᔪᒥᑦ. ᓄᓇᒧᑦ ᐊᒃᑕᕐᓂᖅ ᐃᓄᖕᓄᑦ ᐊᕙᑎᖕᒐᓐᓄᓪᓗ ᓯᕿᐃᓯᒪᖕᒋᓐᓂᖅᐸᐅᔭᓐᓇᖅᑐᖅ ᑐᖅᑯᖅᑕᐅᕖᑦ ᓯᕐᑐᐃᓐᓇᓇᐊᖃᕐᓂᖕᒋᓐᓄᑦ. ᐊᒃᑕᕐᓂᐊᕐᓗᑎᒃ ᐆᑖᕐᓇᖅᑐᓂᒃ ᓅᑎᔭᓇᐊᖃᕐᔭᖅᑐᑦ ᑕᕝᕙᓂ ᓄᓇᒥᖕᓂ ᐅᕝᕙᓘᓐᓃᑦ ᓄᓇᕐᔪᐊᕐᒥᐅᓄᑦ ᐊᒃᑕᖅᑕᐅᕕᐅᕙᒃᑐᒧᑦ ᐃᒪᐅᑉ ᐃᖅᑲᖕᒐᓄᑦ.

13.1.2 ᑐᖅᑯᐃᓂᖅ:

ᐆᑖᕐᓇᖅᑐᓕᖕᓂᒃ ᐆᒻᒪᖅᑯᑎᓂᒃ ᑐᖅᑯᖅᓯᓯᒪᓂᖅ ᑲᒪᒋᔭᐅᔭᓇᕐᓂᐊᕐᓗᓂ, ᐊᑐᖅᑕᐅᔭᓇᕐᓂᐊᕐᓗᓂᓗ. ᑐᖅᑯᖅᑕᐅᓯᒪᕝᕕᑦ ᑲᒪᒋᔭᐅᕙᒃᐳᑦ ᐆᑖᕐᓇᖅᑐᓂᒃ ᐊᑦᑕᕐᓇᖅᑐᖃᖕᒋᒃᑲᓗᐊᕐᒪᖔᖕᒋᓐᓂᒃ. ᐊᑐᖅᑕᐅᓯᒪᔪᑦ ᐆᑖᕐᓇᖅᑐᓖᑦ ᑐᖅᑯᖅᑕᐅᓯᒪᕙᒃᐳᑦ ᑐᖅᑯᖅᓯᔾᔪᑎᓕᐊᖑᔪᓂᒃ (ᕿᒨᓗᑎᒡᓘᓐᓃᑦ, ᐊᓯᖏᓪᓘᓐᓃᑦ ᑐᖅᑯᖅᓯᔾᔪᑎᓕᐊᑦ) ᐅᕝᕙᓘᓐᓃᑦ ᓄᓇᐅᑉ ᐃᓗᐊᓂ ᑐᖅᑯᖅᓯᕕᓕᐅᕐᓗᑎᒃ. ᐃᓕᖕᒋᑦ ᓄᓇᐃᑦ ᔫᕐᓗ ᓯᐃᑕᓐᒥ, ᓄᓇᐅᑉ ᐃᓗᐊᓂ ᑐᖅᑯᖅᓯᕕᓕᐅᖅᐸᒃᐳᑦ. ᐃᓕᖕᒋᑦ ᑐᖅᑯᖅᑕᐅᕝᕖᑦ ᐊᔾᔨᒋᒃᐸᙱᑦᑐᑦ ᖃᓄᖅ ᐊᑯᓂᐅᑎᒋᔪᒥᒃ ᑐᖅᑯᖅᓯᓯᒪᓂᐊᕐᓂᖕᒋᑦ ᑐᖅᑯᖅᓯᕖᑦ ᐅᓄᕐᓂᖕᒋᑦ ᐊᒻᒪᓗ ᓴᓇᔭᐅᓯᒪᓂᖕᒋᑦ ᒪᓕᒡᓗᒋᑦ (ᐃᓕᖕᒋᑦ ᑐᖅᑯᖅᑕᐅᓂᐊᖅᑐᑦ ᐊᓯᖏᓐᓂᒃ ᑐᖅᑯᖅᑕᐅᓯᒪᕝᕖᒃᓴᖏᓐᓄᑦ ᐃᓕᔭᐅᔭᓇᐊᖅᑐᐃᓐᓇᓇᐊᖃᕐᒪᑕ). ᑐᖅᑯᖅᓯᓯᒪᕝᕕᑦ ᑲᒪᒋᔭᐅᕐᑎᐊᓇᐊᖅᑐᑦ; ᐃᓕᖕᒋᑦ ᐊᓯᖏᓐᓄᑦ ᐴᖅᑲᖅᑕᐅᒃᑲᓐᓂᓇᐊᖅᑐᐃᓐᓇᓇᐊᖃᕐᒪᑕ ᐊᒻᒪᓗ ᓈᑕᐅᔭᓇᐊᖅᑐᐃᓐᓇᓇᐊᖃᕐᒪᑕ ᑐᖅᑯᖅᑕᐅᓯᒪᕝᕖᑦ ᑕᕝᕙᓂ ᐆᒻᒪᖅᑯᑎᓕᓇᕝᕕᖕᒥ ᐱᑕᖃᙱᑉᐸᑕ.

13.1.3 ᑲᒪᒋᔭᐅᓂᖓ:

ᐆᑖᕐᓇᖅᑐᓖᑦ ᐆᒻᒪᖅᑯᑏᑦ ᐊᑐᖅᑕᐅᓪᓗᑎᒃ ᐊᓯᙳᖅᐸᖕᓂᖓ. ᑖᒃᑯᐊ ᒫᓇ ᐃᒪᓐᓇ ᑲᒪᒋᔭᐅᕙᒃᐳᑦ, ᐊᑐᖅᑕᐅᓯᒪᔪᑦ ᐆᑖᕐᓇᖅᑐᓖᑦ ᐆᒻᒪᖅᑯᑏᑦ ᒥᑭᓐᓂᖅᓴᐅᑎᑕᐅᓇᓱᒃᓗᑎᒃ ᐊᒻᒪᓗ ᐊᕕᒃᑐᖅᑕᐅᓯᒪᓪᓗᑎᒃ ᐊᑐᓂᓗ ᑲᒪᒋᔭᐅᔭᓇᐊᕐᓗᑎᒃ (ᐊᑐᒃᑲᓐᓂᕐᓂᖅ, ᐊᕕᒃᑐᐃᓂᖅ ᐊᒻᒪᓗ ᑲᒪᒋᔭᖅᑲᕐᓂᖅ). ᐃᓕᖕᒋᑦ ᓄᓇᐃᑦ ᖃᐅᔨᓴᒃᑲᓐᓂᕈᑎᒃᓴᓂᒃ ᐱᓕᕆᐊᖃᖅᐸᒃᐳᑦ ᑕᒪᒃᑯᓐᓂᖓ ᑲᒪᔾᔭᑎᒋᓂᐊᖅᑕᒥᖕᓂᒃ. ᑕᕝᕙᓂ ᐃᓕᓕᐅᑎᔭᐅᓯᒪᖕᒥᔭᖅ ᐆᑖᕐᓇᖅᑐᑦ ᐊᑦᑕᕐᓇᕐᓂᖓᓂᒃ ᐊᖅᐸᖅᓯᑎᑦᑎᓇᓯᐊᕐᓂᖅ (ᓯᐊᒻᒪᒃᑎᑦᑎᓂᒃᑯᑦ). ᖃᔾᔨᓐᓇᐃᑦ ᓄᓇᐃᑦ ᑕᒪᑐᒥᖓ ᖃᐅᔨᓴᕿᑎᖅᑲᖅᓯᒪᓕᖅᑐᑦ, ᑕᒪᓐᓇ ᓯᓕ ᐱᓕᕆᐊᖑᒃᑲᓐᓂᕆᐊᖅᑐᒻᒪᕆᐅᔪᖅ. ᑲᒪᒋᔭᖅᑲᕐᓂᐊᕐᓗᑎᒃ ᐃᓚᐅᕿᑎᓂᒃ ᐊᒻᒪᓗ ᐊᐅᓚᑕᐅᓂᕆᓂᐊᖅᑕᖑᓐᓂᒃ ᑲᒪᔭᕆᐊᖅᐸᒃᐳᑦ, ᓇᓂᓯᓇᓯᒡᓗᑎᒃ ᐊᑐᖅᑕᐅᔭᓐᓇᖅᑐᓂᒃ ᐊᒻᒪᓗ ᐊᕕᒃᑐᐃᓗᑎᒃ ᑲᒪᒋᔭᖅᑲᖅᓗᑎᒡᓗ, ᐆᑖᕐᓇᖅᑐᓂᒃ ᐊᑦᑕᕐᓇᖅᑐᓂᒡᓗ ᐊᑦᑕᒪᒃᓴᓂᒃ. ᐃᓕᖕᒋᓐᓂ ᑲᒪᒋᔭᐅᔪᓂᒃ ᐆᑖᕐᓇᖅᑐᓖᑦ ᐆᒻᒪᖅᑯᑎᒃᓴᐃᑦ ᓈᑕᐅᔭᓇᐊᖅᑐᐃᓐᓇᓇᐊᖅᑐᑦ ᑕᐃᒪᐃᑦᑐᓕᓇᕝᕕᓕᓇᖕᒧᑦ, ᐊᒻᒪᓗ ᐊᑐᒐᒃᓴᓕᐊᖑᓯᒪᔪᑦ ᐊᒃᑕᒐᒃᓴᓕᐊᖑᓯᒪᔪᓪᓗ ᓈᑕᐅᔭᓇᐊᖅᑐᐃᓐᓇᐊᖃᓪᓗᑎᒃ.

13.1.4 ᐊᑐᒃᑲᓐᓂᕈᓐᓇᖅᑐᓂᒃ ᐱᓕᕆᐊᖃᕐᓂᖅ:

ᐊᑐᒃᑲᓐᓂᕈᓐᓇᖅᑐᓂᒃ ᐱᓕᕆᐊᖃᕐᓂᖅ X ᐃᓯᒪᒋᑐᐊᕐᑐᒍ ᐃᓄᐃᑦ ᓄᓇᒥᑐ ᐆᒪᔪᑦ ᖃᓄᐃᙱᑦᑎᐊᓗᐊᖃᕐᓂᖏᑦ ᐅᖃᐅᑕᐅᓚᐅᖅᓯᒪᔪᖅ 1987-ᒥ ᑎᑎᕋᖅᑕᐅᓚᐅᖅᑐᓂᒃ ᓄᓇᕐᔪᐊᒥ ᑲᑎᒪᔨᐅᔪᓄᑦ ᐅᕙᑎᓕᓗᓂᕐᒧᑦ ᐊᒻᒪ ᐱᓕᕆᐊᖃᖅᐸᓪᓕᐊᓂᕐᒧᑦ (ᐅᕿᓐᓚᓐ ᑲᒥᔅᓴᓐᒧᑦ). ᑖᓐᓇ ᐊᑐᖅᑕᐅᕙᒃᑐᖅ ᐃᓯᒪᓕᐅᖅᑎᐅᔪᓄᑦ ᐃᓯᒪᒋᔭᖃᖅᕈᑎᒃ ᒪᑭᒪᓇᓯᐊᕈᑎᓄᑦ, ᐊᕙᑎᒧᑦ ᐃᓄᖕᓄᓪᓗ ᐊᑐᖅᑕᐅᖏᓐᓇᕈᓐᓇᖅᑐᓂᒃ.

ᐊᑐᒃᑲᓐᓂᕈᓐᓇᖅᑐᓂᒃ ᐱᓕᕆᐊᖃᕐᓂᐊᕐᑐᓂ ᐃᓯᒪᓕᐅᕆᐊᖃᖅᐸᒃᐳᑦ ᐃᓄᐃᑦ ᓄᓇᒥᑐ ᐆᒪᔪᑦ ᑲᒪᒋᔭᐅᑦᑎᐊᕐᑐᑎᒃ ᐅᕝᕙᓗᓐᓂᑦ ᐊᑲᐅᓯᕚᓪᓕᖅᑎᑕᐅᓂᒃ. ᑲᒪᒋᔭᖃᕐᓂᖅ ᐱᐅᓯᕚᓪᓕᖅᑎᑦᑎᓂᕐᓗᓐᓂᑦ ᐊᓯᙳᓐᓂᒃ ᖁᔭᓈᖅᓯᓯᒪᓗᓂ ᓈᒻᒪᙱᒻᒪᓇᒃᑐᖅ ᐊᑐᖅᑕᐅᒃᑲᓐᓂᕈᓐᓇᖅᑐᓂᒃ ᐱᓕᕆᐊᖃᕐᓂᕐᒧᑦ, ᐊᑕᐅᓯᑐᐊᕐᒥᒃ ᐃᓯᒪᒋᔭᖃᓯᖕᓂᐊᕐᑐᓂ ᐊᓯᙳᓐᓂᒃ ᖁᔭᓈᖅᓯᓯᒪᓗᓂ ᐃᓅᓯᕐᒧᑦ ᓈᒻᒪᙱᒻᒪᑦ.

ᐱᓕᕆᐊᖃᕐᓂᐊᕐᑐᓂ ᐃᓯᒪᒋᔭᐅᔭᕆᐊᖃᖅᑲᔭᖅᑐᑦ, ᐱᓕᕆᐊᖑᔭᕆᐊᖃᖅᑲᔭᖅᑐᓪᓗ ᖃᐅᔨᓴᕐᓂᐅᓂᐊᖅᑐᓄᑦ ᐅᑯᐊᖑᔪᑦ:

- ᑭᖑᓪᓕᒃᓴᓄᑦ ᓈᒻᒪᒃᑐᓂᒃ ᕿᒪᐃᓂᖅ;
- ᐃᓯᒪᓕᐅᕐᓂᖅ ᑕᒪᐃᓐᓂᒃ ᐃᓯᒪᒋᔭᖅᓯᒪᓗᓂ;
- ᑮᓇᐅᔭᓕᐊᓂᒃ ᐊᑐᕐᓗᓂ ᑐᓐᓂᖅᑯᓯᐊᕐᓂᑐᐃᓐᓇᐅᖏᑦᑐᖅ; ᐊᒻᒪ
- ᓇᓕᒧᒌᑦᑎᐊᖅᑐᒥᒃ ᐃᓯᒪᒋᔭᖅᓂᖅ ᐃᓄᖕᓂᒃ, ᐊᕙᑎᒥᒃ ᐊᒻᒪ ᒪᑭᒪᓇᓯᐊᕈᑎᓂᒃ.

13.2 ᑎᑎᕋᐅᑕᐅᓯᒪᔪᑦ ᐊᒃᑕᕐᓂᕐᒥᒃ/ᑐᖅᑯᐃᓂᕐᒥᒃ:

2002-ᖑᑎᓪᓗᒍ ᐆᑖᕐᓇᖅᑐᓕᖕᓂᒃ ᐊᒃᑕᕐᓂᕐᒧᑦ ᒪᓕᒐᖅ ᐅᖃᖅᓯᒪᓚᐅᖅᑐᖅ ᐆᑖᕐᓇᖅᑐᓕᖕᓂᒃ ᐊᒃᑕᒐᒃᓴᓂᒃ ᐊᐅᓚᑦᑎᓂᕐᒧᑦ ᑲᑐᔾᔨᖃᑎᒌᑦ ᕿᒥᕐᕈᔭᓇᐊᖃᕐᓂᖏᓐᓂᒃ ᖃᓄᖅ ᐆᑖᕐᓇᖅᑐᓖᑦ ᐆᒻᒪᖅᑯᑏᑦ ᐊᐅᓚᑕᐅᓂᐊᕐᓂᖏᓐᓂᒃ:

- ᓄᓇᒧᑦ ᓴᐅᓯᓂᖅ ᑲᓇᑕᐅᑉ ᓄᓇᖓᓂ;
- ᑐᖅᑯᖅᓯᓯᒪᓂᖅ ᐆᒻᒪᖅᑯᑎᖃᖅᐱᐅᔪᒥ; ᐊᒻᒪ
- ᑐᖅᑯᖅᓯᓯᒪᕝᕚᑦ (ᓄᓇᒥ ᓄᓇᐅᑉ ᐃᑐᐊᓂᓘᓐᓃᑦ).

ᑖᒃᑯᐊ ᐱᖁᓯᑦ ᐊᑐᒐᒃᓴᐃᑦ ᑕᕝᕙᐅᒐᓗᐊᖅᑎᓪᓗᒋᑦ, ᐊᓯᖏᑦ ᐱᓕᕆᐊᓕᔭᐅᖃᑦᑕᖅᓯᒪᓕᖅᑐᑦ, ᒐᕙᒪᒃᑯᓐᓂᑦ, ᐱᓕᕆᕝᕕᖕᓂᑦ ᐊᒻᒪ ᖃᐅᔨᓴᖅᑎᓂᑦ. ᐆᑖᕐᓇᖅᑐᓕᖕᓂᒃ ᐊᒃᑕᒐᒃᓴᓂᒃ ᐊᐅᓚᑦᑎᓂᕐᒧᑦ ᑲᑐᔾᔨᖃᑎᒌᑦ ᖃᐅᔨᓴᓇᐊᖃᕐᓂᖓ ᓇᓕᐊᖑᓂᑐᐃᓐᓇᖅ, ᑕᒪᐃᓐᓂᒡᓗᓐᓃᑦ ᑖᒃᑯᓂᖓ ᐊᑐᒐᒃᓴᓂᒃ ᐊᒻᒪ ᑭᖑᓂᕐᒥ ᐊᑐᖅᑕᐅᓯᒪᙱᑦᑐᓂᒃ ᕿᒥᕐᕈᔪᓐᓇᕐᓂᖃᖅᓯᒪᓪᓗᑎᒃ.

13.2.1 ᓄᓇᒧᑦ ᓴᐅᑐᒋᑦ ᐊᒃᑕᕐᓂᖅ

ᐊᒃᑕᖅᓯᕙᒃᑐᑦ ᐆᑖᕐᓇᖅᑐᓕᕐᓂᒃ ᐊᑦᑕᒐᒃᓴᓂᒃ ᐃᓄᖕᓄᑦ ᐊᒻᒪ ᐊᕙᑎᐅᔪᒧᑦ ᓯᑭᑭᑕᐅᔭᙱᑦᑐᒧᑦ. ᐊᒃᑕᖅᑕᐅᔪᑦ ᓴᖅᑭᑕᐅᒃᑲᓐᓂᖅᐸᙱᑦᑐᑦ ᐊᑐᒃᑲᓐᓂᒐᒃᓴᐅᓇᑎᒡᓗ.

ᓄᓇᒧᑦ ᐊᒃᑕᖅᐸᒃᐳᑦ ᓴᐅᓪᓗᒋᑦ ᐃᑎᔪᐊᓗᖕᒥ. ᑕᒪᓐᓇ ᓄᓇᓄᑦ ᐅᓄᕐᓂᖅᓴᓄᑦ ᐊᑐᖅᑕᐅᕙᒃᑐᖅ ᐱᑐᐊᖅᑐᒥ ᓄᓇᓂ ᐊᖏᓂᖅᓴᐅᔪᓂᒃ ᐆᒻᒪᖅᑯᑎᓕᓇᕙᒃᑐᓂᒃ. ᓅᑕᔪᓇᐊᖃᖅᐸᒃᐳᑦ ᑕᕝᕙᙵᑦ ᐆᒻᒪᖅᑯᓯᐅᕐᕕᖕᒥᑦ ᓴᐅᔭᐅᕕᒋᓂᐊᖅᑕᒥᖕᓄᑦ (ᓇᒥᑐᐃᓐᓇᖅ ᓂᑭᐊᓄᔭᐅᔪᒥ).

ᐊᒃᓯᑭᕐᓇᐅᑕᐅᓚᔪᖕᓂᖅᐸᐅᔪᖅ ᐊᒃᑎᓇᓂᐊᕐᑐᓂ ᐆᑖᕐᓇᖅᑐᑦ ᓅᑐᓐᓇᕐᓂᖏᓐᓂᒃ ᐊᒻᒪ ᐊᑦᑕᕐᓇᖅᑐᓂᒃ ᑖᒃᑯᓄᖓ ᐆᑖᕐᓇᖅᑐᓄᑦ ᑲᑎᑦᑎᑦᑕᐃᓕᓂᖅ. ᐃᓯᒫᓗᑕᐅᓂᖅᐸᐅᕙᒃᑐᖅ ᓄᓇᐅᑉ ᐃᑐᐊᒎᑦ ᐃᒪᐅᑉ ᐊᐅᓚᓂᖓ.

ᑖᒃᑯᐊ ᐊᑦᑕᕐᓇᖅᑐᑦ 1 ᒦᑕᑐᐃᓐᓇᐅᒐᓗᐊᕐᒥᒃ ᓅᑉᐸᓪᓕᐊᕙᒃᐸᑕ - ᑖᒃᑯᐊ ᐊᑦᑕᕐᓇᖅᑐᑦ ᐊᐅᓚᓂᖃᕈᓐᓇᕐᒪᑕ 5 ᑭᓚᒥᑐᓂᒃ ᐊᕐᖂᑦ 5,000ᓂᒃ, ᑖᒃᑯᐊ ᐊᑦᑕᕐᓇᖅᑐᓂᒃ ᐊᒃᑐᖅᓯᓐᓂᖅᐸᑕ.

ᐊᒃᑎᓇᓂᖅ (ᓇᓄᓇᐃᖅᑕᐅᓯᒪᔪᖅ ᒪᓕᒐᓕᐊᖑᓯᒪᔪᓂ), ᑲᒪᒋᔭᐅᓯᒪᔪᖅ ᐅᓄᖅᑐᓂᒃ ᓄᖅᑲᐅᑎᖅᑲᖅᑎᑕᐅᓪᓗᑎᒃ ᓅᓐᓂᖏᑦ ᑲᒪᒋᔭᐅᓇᓱᒃᓗᑎᒃ, ᐅᑯᐊᖑᕗᑦ:

- ᑐᖅᑯᖅᑕᐅᓯᒪᕝᕕᖓ, ᒪᕐᕉᔭᕐᒥᒃ ᓴᓇᔭᐅᓯᒪᔪᖅ ᓯᐊᒻᒪᒃᓯᑦᑕᐃᓕᔾᔪᑕᐅᓪᓗᓂ ᐃᓗᓕᖏᓐᓂᒃ;
- ᔫᑲᓗᐃ ᑐᖅᑯᐃᕝᕕᒃ ᓵᖅᓯᕕᐅᓯᒪᕙᒃᓱᓂ ᑐᖅᑯᒐᒃᓴᓕᐊᖑᓯᒪᔪᓂᒃ;
- ᐊᒃᑕᒐᒃᓴᖃᕕᐅᔪᖅ ᓱᖁᒃᐸᓪᓕᐊᔭᙱᑎᑕᐅᒋᐊᖅᓱᓂ, ᐃᒥᒡᒋᕈᓐᓇᙱᑎᑕᐅᒋᐊᖅᓱᓂ;
- ᐅᓄᖅᑐᓂᒃ ᑐᓗᖅᑕᕈᑕᐅᔪᓐᓇᖅᑐᓂᒃ ᑖᓐᓇ ᑐᖅᑯᖅᓯᒪᕝᕕᒃ ᐊᕙᓗᓴᐅᓯᒪᓪᓗᓂ; ᐊᒻᒪᓗ
- ᓄᓇᒥᒃ ᓂᕈᐊᓚᖅᑲᖅᐸᒃᓗᑎᒃ ᐊᑯᓂᐅᔪᒥᒃ ᐃᓂᒋᔭᐅᓗᓂ ᓈᓇᖕᒋᑦᑐᒦᑎᑕᐅᒋᐊᖅᓗᑎᒃ.

ᐊᑦᑕᕐᓇᖅᑐᑦ ᐊᓂᓐᓂᖅᐸᑕ ᑕᕝᕙᖕᒐᑦ ᑐᖅᑯᖅᑕᐅᓯᒪᕝᕕᒋᔭᒥᖕᓂᒃ, ᓅᑉᐸᓪᓕᐊᓂᖅᑲᖅᔭᖅᑐᑦ ᑖᓐᓇ ᓄᓇ ᐃᓂᒋᔭᖓ ᖃᓄᐃᓕᖓᓂᖓ, ᖃᐃᖅᓯᒐᖓ ᐊᒻᒪᓗ ᓄᓇᐅᑉ ᐃᓗᐊᒍᑦ ᐃᒪᐅᑉ ᐃᖕᒋᕐᖁᒥᖓ ᒪᓕᒃᓗᒍ. ᐅᓄᖅᑐᓂᒃ ᐊᔾᔨᒌᙱᑦᑐᓂᒃ ᐅᔭᕋᖅᑲᖅᑐᖅ ᓈᓇᓗᐊᙱᑦᑐᓂᒃ, ᔫᔅᓗ ᑎᓯᔪᓂ ᐅᔭᖅᑲᓂ, ᑕᓄᐅᓕᖓᓂ ᐅᔭᖅᑲᓂ, ᕿᑯᒃᓴᓂᒃ ᐊᒻᒪᓗ ᓄᓇᐅᑉ ᐊᐅᒪᕕᓂᖕᖓᓂ ᐊᒻᒪᓗ ᑕᒪᓐᓇ ᓄᓇ ᐃᒪᖃᓗᐊᙱᑉᐸᑦ ᓴᐅᓯᕝᕕᐅᔭᓇᐊᖓ ᓈᒻᒪᒍᓐᓴᖅᑐᖅ.

ᑲᓇᑕᒥ, ᐅᔭᖅᑲᑦ ᑎᓯᔪᑦ ᑲᓇᑕᐅᑉ ᓄᓇᖓᓂ ᖃᐅᔨᓴᖅᑕᐅᓯᒪᓕᖅᑐᑦ. ᔫᒪᓂᒥ, ᓴᐅᓯᕕᐅᔪᓐᓇᖅᑐᑦ ᐅᔭᖅᑲᑦ ᑕᓄᐅᓖᑦ ᐊᑐᖅᑕᐅᕙᒃᑐᑦ. ᓯᐃᑦᓯᓚᒥ ᖃᐅᔨᓴᕐᓂᖅᓯᒪᓪᓗᑎᒃ ᕿᑯᓕᐊᓗᒃᓴᓂᒃ, ᐊᒻᒪᓗ ᐊᒥᐊᓕᑲᒥ ᒐᕙᒪᖓ ᐊᖏᕈᑎᖅᓯᒪᓪᓗᑎᒃ ᔪᑲ ᖃᖅᑲᒥ ᓴᐅᓯᖃᑦᑕᕐᓂᐊᕐᓂᕐᒥᒃ ᐊᑐᕐᓗᑎᒃ ᓄᓇᐅᑉ ᐊᐅᒪᕕᓂᖕᖓᓂᒃ ᓴᐅᓯᕝᕕᒋᔭᖕᖓᓂ.

ᐱᓕᕆᕝᕖᑦ ᐱᓕᕆᐊᖃᖅᐸᓪᓕᐊᖏᓐᓇᖅᑐᑦ ᐃᓱᒫᓗᑕᐅᔪᓂᒃ ᓄᓇᒧᑦ ᓴᐅᓯᖃᑦᑕᕐᓂᕐᒥᒃ ᑲᓇᑕᒥ. ᐊᑕᐅᓯᖅ ᐱᓕᕆᐊᖑᔪᖅ ᐱᔪᒪᓯᒪᔪᖅ 324-ᓂᒃ ᑐᖅᑯᖅᓯᔪᓐᓇᖅᑯᐱᓪᓗᓂ ᓴᕕᖁᔭᖑᒧᑦ ᑐᑦᑯᐃᕕᖑᒧᑦ ᐊᕙᓗᓴᐅᓯᒪᓗᓂ ᑳᐳᒧᑦ ᓴᕕᖁᔭᖑᒧᑦ. ᑖᓐᓇ ᑐᖅᑯᖅᓯᓯᒪᕝᕕᒃ ᔫᖅᑕᐅᓯᒪᓇᔭᖅᑐᖅ ᐃᒻᒥᓂᒃ ᒪᑐᔪᓐᓇᖅᑐᒧᑦ ᕿᑯᕐᒧᑦ, ᑖᓐᓇᓗ ᑐᖅᑯᖅᑕᐅᒃᑲᓐᓂᖅᓯᒪᓗᓂ, ᓱᕋᔭᐃᖅᑕᐅᓯᒪᓗᓂ ᐊᒻᒪᓗ ᓴᐅᓴᐅᓯᒪᓗᓂ. ᑖᓐᓇ ᑐᖅᑯᖅᓯᓯᒪᕝᕕᒃ ᓴᐅᓴᐅᓇᔭᖅᑐᖅ ᓄᓇᐅᑉ ᐃᓗᐊᓄᑦ ᐃᑎᓂᖃᕐᓗᓂ 500-ᓗ 1000-ᓗ ᒦᑐᓂᒃ ᑲᓇᑕᐅᑉ ᓄᓇᖓᓂ. ᐊᔾᔨᖑᐊᖅ 4.2 ᓇᓄᓇᐃᖅᓯᓯᒪᔪᖅ ᑲᓇᑕᐅᑉ ᓄᓇᖓᓂᒃ ᐱᓕᕆᕝᕕᐅᕙᒃᑐᒥᒃ.

ᐆᒃᑐᕋᐅᑕᐅᓯᒪᔪᑦ ᐅᖃᖅᓯᒪᔪᑦ ᓴᐅᓴᐅᔪᑦ ᐃᑎᓂᖓ, ᐅᔭᕋᖓ ᐊᒻᒪᓗ ᓄᓇᐅᑉ ᐃᓗᐊᒍᑦ ᐃᒪᐅᑉ ᐊᐅᓚᓂᖓ ᑖᒃᑯᐊ ᑕᒪᕐᒥᒃ ᐊᑐᕐᓗᒋᑦ, ᐆᑖᕐᓇᖅᑐᑦ ᐊᒻᒪᓗ ᐊᑦᑕᕐᓇᖅᑐᑦ ᓅᑉᐸᓪᓕᐊᔭᓇᕐᒪᑕ. ᑐᖅᑯᖅᑕᐅᓯᒪᔪᑦ ᐃᓂᒋᔭᖓ ᖃᓄᑐᐃᓐᓇᖅ ᐱᔭᐅᒐᓗᐊᕈᓂ ᓴᐅᓴᐅᓯᒪᔪᑦ ᓱᕐᕋᒐᔭᙱᑦᑐᑦ (ᔫᔅᓗ ᐊᓄᕐᕚᕐᕋᓗᐊᖅᐸᑦ, ᐅᔪᒃᓴᓪᓚᒃᑲᓗᐊᖅᐸᑦ, ᓯᓚᐃᓐᓇᕐᒥᖕᒪᖅᑐᒥᒃ ᑲᑦᕕᐅᒐᓗᐊᖅᐸᑦ, ᖁᐊᕋᓗᐊᖅᐸᑦ ᐊᒻᒪᓗ ᓯᓚᐅᑉ ᐆᓇᕐᓂᖓ ᐊᔾᔨᕋᓗᐊᖅᐸᑦ).

ᐱᒋᐊᓕᖅᓱᑎᒃ, ᓄᓇᒧᑦ ᓴᐅᓯᓂᖅ ᐊᒃᑕᒐᒃᓴᓕᓐᓇᔪᑦ ᐊᒃᑕᐃᕙᓚᐅᓇᕗᑦ ᓴᓂᑐᐃᓐᓇᕐᓂᒃ ᐊᒻᒪᓗ ᓴᐅᔭᑎᒃ ᐅᓕᒃᓯᒪᑦᑎᐊᖅᓱᓂᔾᔪᒃ. ᐅᓪᓗᒥ, ᑭᓱᐊᓂ, ᐃᓕᖕᒋᑦ ᓄᓇᐃᑦ "ᐊᓯᖕᒋᓐᓂᒃ" ᐃᓱᒪᒋᔭᖃᓕᖅᑐᑦ ᓴᐅᓂᐊᖅᑕᑎᒃ ᒪᑐᔭᐅᓂᐊᕐᓂᖓ ᐊᕐᖂᓄᑦ ᐊᒥᓱᓄᑦ ᐅᑕᖅᑭᔭᓇᐊᖃᖅᓗᑎᒃ. ᓛᓐᓇᒃᑯᑦ ᑕᐃᒪᐃᓕᖓᓂᖓ ᒪᓕᒃᓱᒍ ᐆᒻᒪᖅᑯᑎᒃᓴᐃᑦ ᐱᔭᐅᒃᑲᓐᓂᕈᓐᓇᖅᑐᑦ, ᑕᒪᓐᓇ ᑕᐃᒪᐃᓐᓂᖓ ᐱᐅᒋᔭᐅᓪᓗᓂ. ᑖᓐᓇ ᐊᑐᖅᑕᐅᓂᖓ ᖃᐅᔨᓴᕈᑕᐅᒃᑲᓐᓂᕈᓐᓇᖅᓱᓂ ᐊᒻᒪᓗ ᐊᐅᓚᑕᐅᓂᖓ ᐊᓯᔾᔨᖅᑕᐅᔪᓐᓇᖅᓱᓂ. ᐊᒻᒪᑦᑕᐅᖅ, ᖃᐅᔨᓴᖅᐸᓪᓕᐊᓂᒃᑯᑦ ᑐᑭᓯᔪᓐᓇᖅᑐᑦ ᖃᓄᖅ ᑖᒃᑯᐊ ᐊᑐᕐᓂᖅᑎᕆᖕᒪᖔᑕ ᐊᒻᒪᓗ ᐃᖕᒋᕐᖁᓂᖅᑎᕆᖕᒪᖔᑕ.

ᑖᒃᑯᓄᖓ ᐱᓕᕆᐊᖑᔪᖅ ᐊᒻᒪᓗ ᐊᓯᖕᒋᓐᓂᒃ ᐱᓕᕆᐊᖑᔪᑦ ᑕᐃᔭᐅᓚᐅᖅᐸᒃᑐᑦ "ᒪᑐᓰᕙᓕᓂᕐᒥᒃ" ᐊᒻᒪᓗ "ᒪᑐᓯᓇᕖᕐᓂᕐᒥᒃ" ᓂᕈᐊᓚᖅᑎᑦᑎᓂᐅᓂᖅᑕᐅᓪᓗᓂ. "ᒪᑐᓯᖕᒋᓪᓗᑎᒃ" ᓂᕈᐊᓚᖅᑲᕈᓐᓇᕐᒥᔪᑦ, ᑖᓐᓇ ᑲᒪᒋᔭᐅᔪᒥᒃ ᑐᖅᑯᖅᓯᕕᐅᓇᔭᖅᑐᖅ ᑕᕝᕙᓂᓗ ᓇᓄᓇᐃᔭᖅᑕᐅᓯᒪᓪᓗᓂ ᑕᒪᓐᓇ.

13.2.2 ᑲᒪᒋᔭᐅᔪᒥ ᑐᖅᑯᖅᓯᓂᖅ

ᑐᖅᑯᖅᓯᕕᖕᓂ ᑲᒪᒋᔭᖃᖅᐸᒃᑐᑦ ᐊᑐᖅᓯᒪᔪᓂᒃ ᐅᑖᕐᓇᖅᑐᓕᖕᓂᒃ ᐆᒪᖅᑯᑕᐅᔪᓂᒃ, ᑲᒪᒋᔭᐅᓪᓗᓂ ᐃᓂᒋᔭᖕᖓ ᐊᐅᓚᑕᐅᑎᐊᖅᑐᓂ, ᐅᑎᖅᑎᑦᓴᐅᓪᓗᑎᒃ ᓯᕗᓂᒃᓴᒧᑦ ᐊᑐᖑᒃᓴᐅᓂᐊᕐᓗᑎᒃ. ᐊᑯᓂᐅᔪᒥᒃ ᑐᖅᑯᖅᑕᐅᓯᒪᓂᐊᖅᑐᑦ ᑐᖅᑯᖅᓯᒪᕚᕕᖕᒥ ᓈᑕᐅᔪᓇᐊᖃᖅᐸᒃᐳᑦ ᑖᒃᑯᐊ ᐆᒪᖅᑯᑎᒃᓴᐃᑦ. ᑖᒃᑯᐊ ᑐᖅᑯᖅᓯᓯᒪᕚᑦ ᓄᓇᒦᑦᑐᓇᖅᑐᑦ ᓄᓇᐅᑉ ᐃᓗᐊᓃᑦᑐᓇᖅᓱᑎᓪᓗ.

ᑐᖅᑯᖅᓯᓯᒪᕚᑦ ᓄᓇᒥ ᓴᓇᔪᓯᒪ.ᕙᒃᑐᑦ ᐊᔾᔨᒌᙱᑦᑐᓂᒃ ᖃᓄᑎᒋ ᐊᑐᖅᑕᐅᓂᖓᓂᐊᖅᑕᖏᑦ ᒪᓕᒃᓱᒋᑦ. 'ᒫᓇᒃᑯᑦ' ᐊᑐᖅᑕᐅᓂᐊᖅᑐᑦ ᑐᖅᑯᖅᓯᓯᒪᕚᑦ ᓴᓇᔪᕙᒃᐳᑦ ᐊᕐᕌᒍᑦ 100 ᐊᓂᒍᖅᐸᑕ ᐊᓯᔾᔨᕆᐊᖃᖅᓯᒪᓪᓗᑎᒃ, ᓴᓇᔪᓯᒪᓂᖓ ᑭᓯᓐᓗ ᐊᑐᕐᓂᖏᑦ ᒪᓕᒡᓗᒋᑦ. ᐊᓯᖏᓐᓂᒃ ᓴᓇᔭᓇᕐᒥᔭᑦ ᐊᕐᕌᒍᓄᑦ ᐅᓄᕐᓂᖅᓴᓕᒫᖓᓄᑦ ᑐᖅᑯᖅᓯᓯᒪᕕᐅᔭᓐᓇᕐᔪᖅᑐᓂᒃ.

ᓄᓇᐅᑉ ᐃᓗᐊᓂ ᑐᖅᑯᖅᓯᓯᒪᕚᑦ ᐃᑎᓗᐊᖅᑐᒦᙱᔾᔪᑎᒃ ᐅᕙᓘᓐᓃᑦ ᓄᓇᐅᑉ ᐃᓗᐊᓄᑦ ᔫᕐᓇᕐᑐᑦ ᐃᓚᖏᑦ 10-ᒦᑕᓂᒃ ᐃᑎᓂᖅᑲᖅᔪᑎᒃ. ᑕᐃᒪᐃᑉᐸᒃᑐᑦ ᐅᐸᒐᕐᓂᙱᓐᓂᖅᓴᐅᑎᑕᐅᑎᐊᖅᔪᑎᒃ ᓄᓇᒦᑦᑐᓂᒃ ᐆᒪᖅᑯᑎᒃᓴᓂᒡᓗ ᐱᕕᐅᔭᓇᕐᓗᑎᒃ. ᑖᒃᑯᐊ ᑐᖅᑯᖅᓯᓯᒪᕚᑦ ᑲᒪᒋᔭᐅᖏᓐᓇᕆᐊᖃᕈᓐᓃᖅᑐᑦ ᐊᒻᒪᓗ ᓯᕗᓂᒃᓴᑦᑎᓐᓂ ᑲᒪᔨᐅᓇᔭᖅᑐᑦ ᐊᐅᓚᑦᑎᔭᓇᑦᑎᐊᕆᐊᖃᕈᓐᓃᖅᔪᑎᒃ ᐱᓕᕆᐊᒃᓴᐅᔭᓂᒃ.

ᑕᒫᓂ ᑲᓇᑕᒥ, ᐱᓕᕆᔨᐅᔭᖅ ᖃᐅᔨᓴᕐᓂᕐᒥᒃ ᐱᔮᖅᓯᓯᒪᓕᖅᑐᑦ ᑐᖅᑯᖅᑕᐅᕙᒃᓴᓂᒃ. ᓄᓇᒦᑦᑐᓂᒃ ᑐᖅᑯᖅᓯᓯᒪᕕᓕᐅᖅᓯᒪᔪᑦ ᑳᓐᓂᒃ ᐊᒻᒪᓗ ᓴᕕᖅᔭᕐᓂᒃ ᐃᓪᓗᐊᓗᖕᓂᒃ; ᐊᒻᒪᓗ ᓄᓇᒦᑦᑐᓂᒃ ᑐᖅᑯᖅᓯᓯᒪᕕᖕᓂᒃ. ᓄᓇᐅᑉ ᐃᓗᐊᓃᑦᑐᑦ ᑐᖅᑯᖅᓯᓯᒪᕚᑦ ᓴᐅᓯᓯᒪᓪᓗᑎᒃ ᑐᖅᑯᖅᓯᒪᔪᓂᒃ; ᑳᓐ, ᓴᕕᖅᔭᑦ ᐊᒻᒪᓗ ᖃᐃᖅᓯᒐᓂ.

13.2.3 ᐆᒪᖅᑯᑎᓕᕆᕕᐅᔪᒥ ᑐᖅᑯᖅᓯᓂᖅ

ᑕᒪᕐᒥᒃ ᓄᓇᒥ ᓄᓇᐅᓪᓗ ᐃᓗᐊᓂ ᑐᖅᑯᖅᓯᓯᒪᕚᑦ ᐅᓪᓗᒥ ᐊᑐᖅᑕᐅᕙᒃᑐᑦ. ᐊᓯᖏᑦ ᑐᖅᑯᖅᓯᕕᐅᔭᓇᖅᑐᑦ ᓵᖅᑭᑕᐅᔭᓇᖅᑐᑦ ᐋᖅᑭᒃᓯᐃᑐᐊᕈᑎᒃ ᖃᓄᐃᓕᖓᓂᖓᓂᐊᖅᑕᖑᓇᓂᒃ ᐊᒻᒪᓗ ᐊᑭᒋᓂᐊᖅᑕᖑᓇᓂᒃ ᐆᒪᖅᑯᑎᓕᕆᕕᐅᔭᓂ ᑐᖅᑯᖅᓯᓯᒪᕚᑦ. ᑕᒪᕐᒥᒃ ᑐᖅᑯᖅᓯᓯᒪᕚᑦ ᐊᔾᔨᙳᙱᓐᓂᖅᑲᖅᑐᐃᓐᓇᐅᔭᑦ, ᐊᒻᒪᓗ ᖃᓄᐃᓐᓂᐅᔭᑦ ᐃᓱᒪᒋᔭᐅᔭᖓᐊᖅᓯᒪᓪᓗᑎᒃ ᐋᖅᑭᒃᓱᖅᑕᐅᓯᒪᓂᖑᓄᑦ, ᓴᓇᔭᐅᓂᖑᓄᑦ, ᐊᐅᓚᑕᐅᓂᖑᓄᑦ ᐱᓕᕆᐊᖑᓂᖑᓄᓪᓗ. ᐊᔾᔨᙳᙱᓐᓂᐅᔭᑦ ᐊᔾᔨᙳᐊᕐᒥ ᑕᑯᔭᓇᖅᑕᑦ 4.1-ᒥ ᓇᓗᓇᐃᖅᓯᒪᓪᓗᓂ ᑭᓯᑦ ᐊᔾᔨᐅᙱᑦᑐᑦ ᑲᓇᑕᒥ ᐃᓱᒪᒋᔭᐅᓂᖅᑲᖅᓯᒪᖕᒪᖔᖏᓐᓂᒃ.

ᓄᓇᒦᑦᑐᑦ ᑐᖅᑯᖅᓯᕚᑦ ᐱᑕᖃᖅᓯᒪᓕᖅᑐᖅ ᐊᕐᕿᒍᓚᖓᓄᑦ. ᑭᓯᐊᓂ, ᓄᓇᐅᑉ ᐃᓗᐊᓂ ᑐᖅᑯᖅᓯᕚᑦ ᒫᓇᒧᑦ ᓵᖅᑭᑕᐅᓯᒪᓗᐊᙱᑦᑐᑦ X ᑐᖅᑯᖅᓯᕚᑦ ᐅᓄᕐᓂᖅᓴᐃᑦ ᓄᓇᒥᓪᒪᑕ. ᖃᐅᔨᒪᔭᐅᓂᖅᐸᐅᔭᖅ ᓄᓇᐅᑉ ᐃᓗᐊᓃᑦᑐᖅ ᑐᖅᑯᖅᓯᓯᒪᕕᒃ ᑕᐃᔭᐅᔭᖅ ᑲᓛᕐᒥᒃ ᓯᐃᑕᓐᒥ, ᐊᑐᖅᓯᒪᔪᑦ ᐅᑖᕐᓇᖅᑑᑦ ᐆᒪᖅᑯᑎᒃᓴᐃᑦ ᑐᖅᑯᖅᑕᐅᓯᒪᓪᓗᑎᒃ ᓄᓇᐅᑉ ᐃᓗᐊᓂ 30 ᒦᑕᓂᒃ ᐃᑎᓂᖅᑲᖅᑐᒥ; ᑖᓐᓇ ᑲᒪᒋᔭᐅᓪᓗᓂ ᑐᖅᑯᖅᓯᓯᒪᕕᐅᔪᖅ, ᐆᒪᖅᑯᑎᓕᕆᕕᖕᒥ ᑐᖅᑯᖅᓯᕕᐅᙱᔾᔪᓂ. ᑯᕌᖓᒥ ᒦᓇ ᖃᐅᔨᓴᖅᐸᓪᓕᐊᔪᑦ 'ᓯᕗᓂᒃᓴᒥ ᐊᑐᖅᑕᐅᔭᓇᕐᓂᐊᖅᑐᓂᒃ ᑐᖅᑯᖅᓯᕕᖕᓂ', ᓄᓇᐅᑉ ᐃᓗᐊᓃᑦᑐᓂᒃ ᔩᕐᓗ ᑲᓛᑎᑐᑦ, ᐅᕙᓘᓐᓃᑦ ᐃᑎᓂᖅᓴᒦᓪᓗᑎᒃ ᖃᖅᑲᕐᓃᓪᓗᑎᒃ.

ᐊᑐᖅᓯᒪᔪᓂᒃ ᐅᑖᕐᓇᖅᑐᓕᖕᓂᒃ ᐆᒪᖅᑯᑎᒃᓴᓂᒃ ᑐᖅᑯᖅᓯᓂᖅ ᐆᒪᖅᑯᑎᓕᕆᕕᐅᔪᒥ ᐱᐅᓂᖅᑲᖅᐳᖅ ᐆᒪᖅᑯᑎᒃᓴᐃᑦ ᓈᑕᐅᔪᓇᐊᖅᑲᖏᓐᓂᖏᓐᓄᑦ ᐊᓯᖑᓄᑦ ᑐᖅᑯᖅᓯᓯᒪᕕᖑᒧᑦ. ᐊᒻᒪᓗ ᐱᓕᕆᕕᐅᔭᑦ ᐅᓄᕐᓂᖏᓐᓄᑦ ᐊᖏᓗᐊᖅᑐᒥᒃ ᐱᓕᕆᕕᒃᑲᖅᑲᖏᔭᑕᐅᓪᓗᓂ.