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NUCLEAR WASTE MANAGEMENT ORGANIZATION
SOCIÉTÉ DE GESTION DES DÉCHETS NUCLÉAIRES

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NWMO BACKGROUND PAPERS
6. TECHNICAL METHODS

6-4 STATUS OF NUCLEAR FUEL REPROCESSING, PARTITIONING AND TRANSMUTATION

EXECUTIVE SUMMARY

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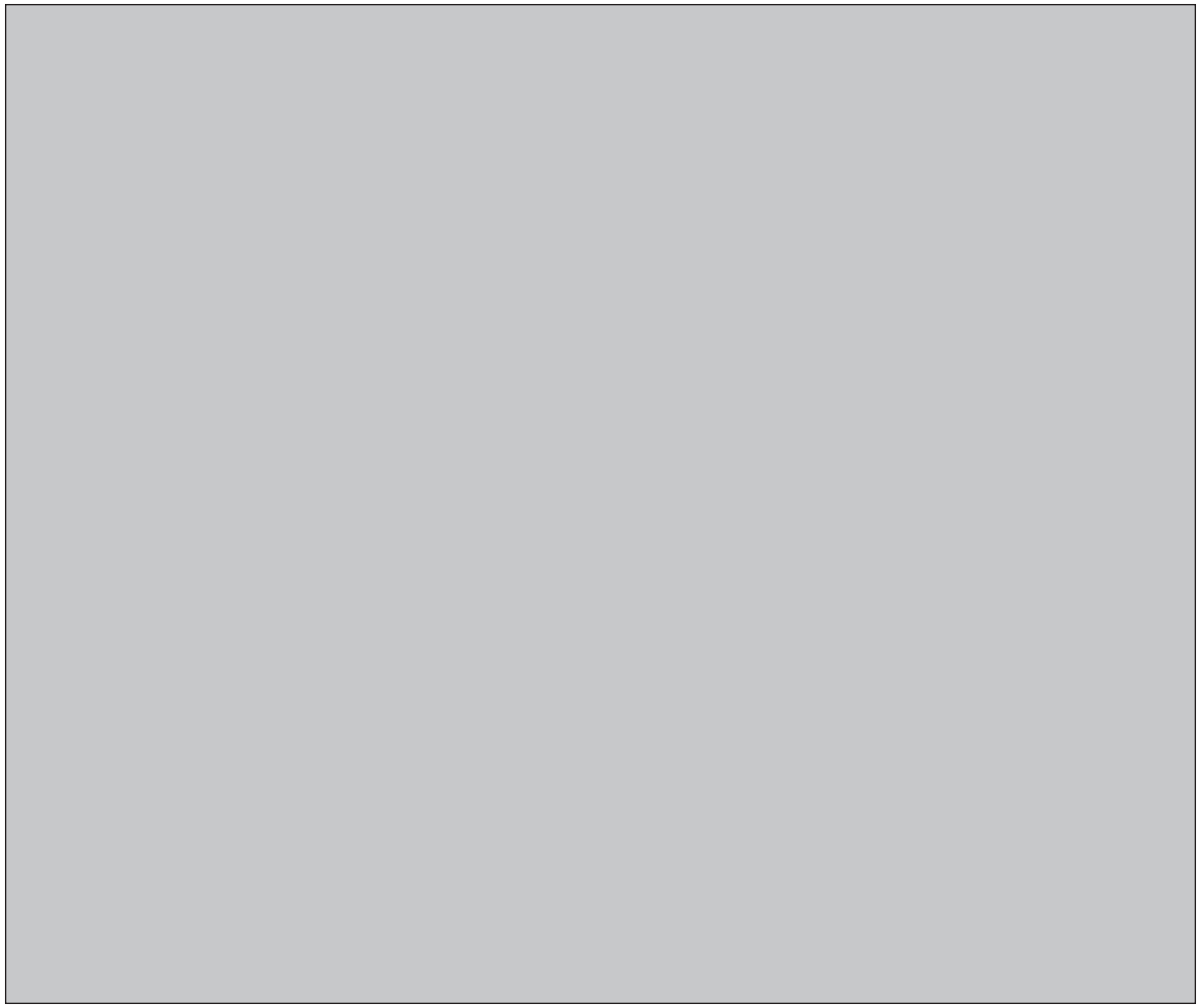

Executive Summary

Many countries have long-term nuclear power strategies based on the future need for the conservation of uranium resources and the deployment of fast reactors. Recycling of fuel is an integral part of these strategies and in many cases the domestic reprocessing capability is based on the prior development of related expertise for weapons purposes. Reprocessing of civilian nuclear fuel is done commercially on a large scale. Much the same technology, the Purex process, is used in all of the world's reprocessing plants.

Reprocessing enables the partitioning, or separation, of the spent fuel into its components: uranium, plutonium, minor actinides (MA) and fission products. The plutonium can be recycled for consumption as mixed oxide (MOX) fuel in conventional power or fast reactor fuel. However, the usage of plutonium for these purposes is still small and today most of it is stockpiled at the reprocessing plants. Fissionable uranium taken from the fuel can also be recycled as reactor fuel but, because of the low cost of uranium, is only done in Russia.

The fission products and the MA are now embedded in molten glass for long-term burial in a geological facility. The chemical form of some isotopes can be altered to decrease their mobility and radiotoxicity in conditioning processes. Hence, although reprocessing can reduce the volume and improve the form of these wastes prior to geological storage, a repository is still needed.

Transmutation is aimed at destroying the radioactive isotopes, primarily the long-lived fission products and the MA, by neutron bombardment. It requires research on improved partitioning and the development of subcritical accelerator driven systems. Even if today's research programs are successful, it will be many decades before these technologies can be deployed for practical purposes. Thus, transmutation offers the potential for the ultimate mitigation of fuel waste but only in the long-term.

Up to now, Canadian reactors have exclusively used a once through fuel cycle in which the fuel is removed from the reactor and stored at the reactor sites pending decisions on a long-term option for its disposition. Many more advanced fuel cycles are available for CANDU reactors that are primarily aimed at the optimum use of uranium. Several of these fuel cycles have a requirement for reprocessing. If in the future there was a decision to reprocess CANDU fuel either for reasons of uranium conservation, or more likely to reduce the volume and radiotoxicity of the fuel, a brief survey of the current status indicates there would be no purely technical obstacle to domestic reprocessing.