Comments by Neil Craik on
NWMO "Understanding the Choices" August 2004

Subject; **Retrievability** of the used fuel for future energy use.

NWMO documentation does not give sufficient attention to ensuring that whatever Storage Method (s) is recommended, retrievability of the used fuel shall be a design requirement ensuring that the large amount of energy left in the used fuel can be obtained by future generations. It only says on page 28; "Some Participants suggested that any method that closes the door (is conclusive) on the potential to retrieve wastes for possible treatment or use should not be considered."

In Appendix 5/Glossary, "Retrievability" is not described. It means the ability to remove baskets containing the used fuel, from a cask, vault or silo stored either at reactor site, centralized storage or deep geological disposal.

There is no mention of the huge amount of energy potential left in the "Used" fuel and no attempt seems to have been made by the NWMO to quantify this potential energy.

Even the NWMO Background Paper (Reference **A**) does not really state the huge amount of the potential energy in the "used " fuel, and so could be interpreted as not a firm recommendation for future reprocessing of this fuel. The technical complexity of this Background Paper also obfuscates the benefits of reprocessing.

**Recommendation by Neil Craik**; It is recommended that the NWMO use the following simple statement to justify retrievability

***The potential energy from recycled Used CANDU fuel is 70 times the energy obtained from the fuel before first discharged from the CANDU reactor.***

This estimate of potential energy which was derived from the paper by John K. Sutherland, Reference **B**, was mentioned by Neil Craik during the Dialogue in Fredericton, 2004 April 03, and recorded by a Facilitator on a discussion chart.

However this estimate is not included in the DPRA Final Report June 2, 2004, which otherwise has a good report on the support for the future use of used nuclear fuel as a potential source for energy production (page12; second and third paragraph).

The emphasis on this support seems to have been lost in the NWMO "Understanding the Choices" August 2004 and does not appear as input to the objectives Hierarchy and Ten Questions.

For References see page 2

References

Reference **A**; Paper on NWMO website

**6-4 Status of Nuclear Fuel Reprocessing, Partitioning and Transmutation**
**by David Jackson, David Jackson & Associates, ON CAN**

Page 6 "It is clear from Table 1 that much fissionable material remains in the (used) fuel. The total plutonium-239 and uranium-235 content is 0.5% of the (used) fuel, compared to the starting content to 0.7% uranium-235. Therefore, an incentive to for reprocessing the fuel would be to remove the unused uranium-235 and plutonium-235 for recycling in fresh fuel."

Comments by Neil Craik

(1) This suggests that (0.7-0.5)/0.7 = 30% of the fissionable material is used, leaving only 70% fissionable material for future energy use. This may not appear to be sufficient to make retrieveability worthwhile in the long term.
(2) However it should be explained that this is only one recycle and that such recycles could be repeated many times to achieve 70 times the energy obtained from the fuel before first discharged from the CANDU reactor as stated in the paper below.
(3) It is recognized that such reprocessing will consume some energy However this reprocessing energy would be comparable to the energy already used to mine and manufacture new CANDU fuel,

Reference **B**; Paper on energypulse.net website

**Paper on Nuclear Waste Management Part 11**

**by John K. Sutherland**

Note that the author has a number of articles published on this web site, so look under 'more articles by author'.

Extract

"If fully utilized, each kilogram of uranium could produce 3.5 million kWh of electricity rather than about 50,000 to 250,000+ kWh(e) as at present (about 7,800 MWdays (thermal)/tonne (CANDU) to about 45,000+ MWdays(th)/tonne - PWR)."

Conclusions by Neil Craik

(1) Ratio kWh(e)/Mwdays/tonne is about the same: 6.4 for CANDU, 5.5 for PWR.

(2) Potential energy from recycled Used CANDU fuel is 3.5m/50,000 = 70 times the energy obtained from the fuel before first discharged from the CANDU reactor.

NGC, 30 Nov 2004.