

**LOG OF RESPONSES TO CONSULTATION ON  
FULL DRAFT OF CoRWM's INTERIM STORAGE REPORT,  
FEBRUARY – MARCH 2009**

**INTRODUCTION**

On 2 February 2009 CoRWM invited comments (via e-bulletin 30, CoRWM document 2553) on a full draft of its proposed March 2009 report to Government on interim storage of higher activity wastes and the management of spent fuels, plutonium and uranium (CoRWM doc. 2500, 2<sup>nd</sup> full draft report, dated 2 February 2009). 6 responses were received. These were from:

- National Nuclear Laboratory
- Sellafield Ltd
- Dr Rachel Western
- Environment Agency
- NDA
- HSE

In addition, CoRWM commissioned 3 independent reviews of the outline report from members of the HSE's Nuclear Safety Advisory Committee (now disbanded).

All the comments received are summarised in Table 1 below, with a note of how they were taken into account in producing the final draft of the report. The comments are shown in full in Annex A.

General comments on CoRWM's interim storage tasks for 2008/09 are summarised in three documents:

- 2302 - comments on CoRWM's draft programme for 2008/9, March 2008
- 2457 - log of responses to invitation to comment on interim storage, September 2008
- 2488 - report of public and stakeholder workshop, 30 October 2008.

Comments on an outline of the interim storage report (CoRWM doc. 2500, outline, dated 19 December 2008) are in:

- 2540 – log of responses to consultation on outline of CoRWM's interim storage report, December 2008 – January 2009.

Other comments on the full draft of the interim storage report (CoRWM doc. 2500, second full draft, dated 2 February 2009) are in:

- 2563 - report of stakeholder workshop on the draft interim storage report, 19 February 2009.

**TABLE 1 SUMMARY OF COMMENTS AND ACTIONS TAKEN IN PRODUCING FINAL DRAFT OF INTERIM STORAGE REPORT**

Commentator and date	Issues (or numbered sections) they commented on	CoRWM response - how comments were acted on
<p>1. National Nuclear Laboratory 27 February 2009</p>	<p><b>Summary:</b> support for recommendations; importance of research re developing a stable waste form and to long-term product stability  <b>2. Conditioning &amp;c:</b> support comments on need for criteria to define waste package failure  <b>4. Spent fuels:</b> need for R&amp;D to support transfer of experience from Hanford, USA to treatment of Magnox fuel  <b>5. Plutonium &amp;c:</b> work done on immobilisation options; work done on potential to recycle plutonium into new-build fuel</p>	<ul style="list-style-type: none"> <li>• Noted.</li> <li>• Noted.</li> <li>• Text changed to emphasise that R&amp;D needed.</li> <li>• Noted but this section is about NDA work, not about work that NNL did for NDA.</li> </ul>
<p>2. Sellafield Ltd 2 March 2009</p>	<p>General: distinguish between risk and hazard reduction; check some references</p> <p><b>Summary:</b> clarify what are assets and what wastes; better grouping of recommendations; possible role of public &amp; stakeholder engagement</p> <p><b>1. Introduction:</b> spent fuels &amp;c management driven by storage needs, no presumption of disposal  <b>2. Conditioning &amp;c:</b> amount of ILW that can be packaged without conditioning  <b>3. Storage &amp; transport:</b> extending design lives of Vitrified Product Store &amp; future ILW stores; “mini-store” concept and alternatives; contingent vs. alternative strategies for waste storage; Lifetime Plan as reference for comments on ILW storage  <b>4. Spent fuels:</b> drying of Magnox &amp; AGR fuel; reprocessing &amp; interim storage of AGR fuel; fuel in Sellafield legacy ponds not yet waste; drafting comments  <b>5. Plutonium &amp;c:</b> clarify NDA remit in relation to considering recycling Pu in UK thermal / fast reactors</p>	<ul style="list-style-type: none"> <li>• Checked and changes made where necessary.</li> <li>• Distinction made between wastes and materials that may be declared to be wastes.</li> <li>• Not appropriate to make the point here.</li> <li>• Text reworded to address concern.</li> <li>• Factual corrections made. Do not agree with statement about alternative strategies – contingent strategies are intended to cover all possibilities.</li> <li>• Changes made to address most concerns.</li> <li>• For NDA to clarify.</li> </ul>

Commentator and date	Issues (or numbered sections) they commented on	CoRWM response - how comments were acted on
<p>3. Dr Rachel Western</p> <p>2 March 2009</p>	<ul style="list-style-type: none"> <li>• NDA's method of operation; not taking holistic approach to waste management, increasing rather than reducing hazard</li> <li>• security not given priority</li> <li>• passive safety not optimised</li> <li>• need for dry storage for spent fuel, and chemical pre-treatment as part of the conditioning process</li> <li>• hazard from HLW facilities at Sellafield, including consequences of a terrorist attack, technical problems with the evaporation, vitrification and storage facilities, need for extra HLW storage / treatment plants, threat presented by separated plutonium, separated plutonium and uranium stockpiles increasingly seen as liabilities, failure of reprocessing as a waste management technique and benefits of ending reprocessing</li> <li>• other / supporting information, including history and origins of the Sellafield site, operations and funding problems of the nuclear industry, complex chemistry of radioactive waste, problems facing geological disposal including expansive fracturing, leaching and gas generation, implications for R&amp;D costs</li> </ul>	<ul style="list-style-type: none"> <li>• Comments are mainly about the policy of reprocessing Magnox and AGR fuel. It is not in CoRWM's remit to scrutinise or advise on this.</li> <li>• Noted for other CoRWM reports.</li> </ul>
<p>4. Environment Agency</p> <p>3 March 2009</p>	<ul style="list-style-type: none"> <li>• General: include more on legacy wastes and storage of raw wastes in general; more information for public; securer NDA funding; national integrated waste strategy</li> </ul> <p><b>Summary:</b> role of regulators, Govt &amp;c</p> <p><b>2. Conditioning &amp;c:</b> conditioning of Sellafield PCM; polymers &amp; ceramic waste forms; treatment of operational wastes incl. SIXEP &amp; AGR fuel; pond sludge buffer storage; regulatory involvement including LoC reviews; waste product quality and 500-year container life; progress on immobilisation; monitoring ILW packages &amp; store conditions; co-ordinating R&amp;D; document layout comments</p> <p><b>3. Storage &amp; transport:</b> contingency planning; strategy affecting</p>	<ul style="list-style-type: none"> <li>• Text added to explain why no details on legacy and other raw wastes. NDA funding is for another CoRWM report.</li> <li>• Changed to meet concerns.</li> <li>• Changes made to meet most concerns but some points too detailed for this report.</li> </ul>

Commentator and date	Issues (or numbered sections) they commented on	CoRWM response - how comments were acted on
	<p>sites' operational decisions; fuel ponds; legacy raw waste at Harwell, Dounreay &amp; with MoD; 50-100yr storage: transferring legacy wastes to new buffer facilities and ensuring regulatory compliance; environmental conditions in some long-term stores; keeping records; waste package longevity incl. validating modelling data; good practice in public engagement; regulators' role in co-ordination; scenario planning including delayed disposal</p> <p><b>4. Spent fuels:</b> strategic approach; reprocessing and decision on asset/waste; robustness to external factors e.g. Euratom; Magnox fuel strategy incl. corroded fuel; options for non-contracted fuel e.g. dry for direct disposal; need for consultation on any long-term consolidated store; Sellafield AGR fuel; DFR fuel treatment at Sellafield; Strategic Action Planning to develop options for exotic fuels</p> <p><b>5. Plutonium &amp;c:</b> storage in ageing facilities; need for Govt lead on Pu/U status as asset or waste; implications of large U inventory for a geological disposal facility</p>	<ul style="list-style-type: none"> <li>Some changes and additions made but no further details on legacy wastes added (see above).</li> <li>Comments noted. Do not agree that a strategic action planning approach is the most appropriate.</li> <li>Text added on decision priorities and volume of U waste.</li> </ul>
<p>5. Nuclear Decommissioning Authority</p> <p>4 March 2009</p>	<ul style="list-style-type: none"> <li>General: be clearer on what is meant by strategic co-ordination.</li> </ul> <p><b>Summary:</b> examples of co-ordination with MoD, BE &amp;c; NDA strategy development will help identify public info. needs; be more specific about where / why PSE is inadequate; ref OCNS</p> <ol style="list-style-type: none"> <li><b>Introduction:</b> suggestions for other definitions e.g. of waste, storage.</li> <li><b>Conditioning &amp;c:</b> comments/corrections on Sellafield HLW; waste arisings &amp; conditioned ILW; 4m box container; conditioning to immobilise activity; risks involved in storing raw wastes e.g. at Sellafield legacy plants; data on using cement, or alternatives, in immobilisation; regulation incl. RWMC, joint guidance, LoC and safety case reviews, status of the waste packages in the post-closure safety assessment for ILW, R&amp;D and package specifications; constraints to a strategic</li> </ol>	<ul style="list-style-type: none"> <li>Some text added.</li> <li>Examples show that co-ordination is not occurring at the right level, because it does not involve strategy "owners".</li> <li>Definitions are consistent with Govt documents and regulatory guidance (new GRAs).</li> <li>Changes made to accommodate factual comments only. Note that NDA comment on regulatory guidance is based on out of date information.</li> </ul>

Commentator and date	Issues (or numbered sections) they commented on	CoRWM response - how comments were acted on
	<p>approach to conditioning methods; practicality of UK-wide checks on R&amp;D and its findings.</p> <p>3. <b>Storage &amp; transport:</b> 2110 date not matching lifetime plans; volumes of final site clearance ILW e.g. graphite; disposal beginning before 2075 although VPS HLW only emplaced from 2075 onwards; R&amp;D strategy, priorities &amp; generic/plant-specific work; inclusion of BE material in disposal plans; HAW movements; package transport &amp; regulation; other comments / corrections;</p> <p>4. <b>Spent fuels:</b> wording on decisions on reprocessing AGR fuel; status of DFR fuel strategy; MoD fuels; other comments including extent to which NDA comments on outline document have been addressed</p> <p>5. <b>Plutonium &amp;c:</b> BE materials held at Sellafield.</p> <p>6. <b>Conclusions &amp;c:</b> further detail on NDA, BE, MoD strategy co-ordination.</p>	<ul style="list-style-type: none"> <li>• Changes made to accommodate factual comments only.</li> <li>• Changes made to accommodate factual comments only. NDA comments on outline ignored where they conflicted with information from BE, who own the fuels in question.</li> <li>• Comment is about what will be done in future, text is about current situation.</li> <li>• See above – comments show that more high-level strategic co-ordination is needed.</li> </ul>
6. A N Other 18 February 2009	<p><b>2. Conditioning &amp;c:</b> minor editorial comments</p> <p><b>5. Plutonium &amp;c:</b> more detail needed on “asset” v “waste”</p> <ul style="list-style-type: none"> <li>• References, glossary, acronyms: minor corrections</li> </ul>	<ul style="list-style-type: none"> <li>• Editorial points dealt with. Do not agree about urgency for decision on asset v waste.</li> </ul>
7. Peter Manning  7 February 2009	<ul style="list-style-type: none"> <li>• General: would like to see more conclusions and recommendations</li> </ul> <p><b>2. Conditioning &amp;c:</b> regulators’ duty to help progress conditioning; need for independent check on credibility of TBUrDs/plans; comment/recommend on slow progress, on conditioning</p> <p><b>3. Storage &amp; transport:</b> safestore v demolition and regulators’ view; keeping control systems &amp; software operable</p> <p><b>4.</b> More conclusions needed (and in Section 5)</p> <p><b>6. Conclusions/recommendations:</b> needed on progress</p>	<ul style="list-style-type: none"> <li>• Decision take to have few high-level recommendations because report is to Government.</li> <li>• Not appropriate to make comments on regulators’ duties; text added on need to make faster progress with conditioning.</li> <li>• Text changed or additions made to address points.</li> <li>• Text added.</li> </ul>

Commentator and date	Issues (or numbered sections) they commented on	CoRWM response - how comments were acted on
	including impact of deferring decisions, “controlling mind”, funding, programme review, safety, regulators / LoC, organisations, remediation, grouting, safestore, MOP8, AGR & PWR fuel, exotics, Pu & U, tails conversion, ground contamination, skills	<ul style="list-style-type: none"> <li>• Not appropriate to make these sorts of detailed conclusions in a report to Government. Also some of these issues are outside CoRWM’s remit.</li> </ul>
<p>8. HSE Nuclear Installations Inspectorate</p> <p>9 March 2009</p>	<ul style="list-style-type: none"> <li>• General: some options SLCs considering are not firm strategies; delayed decommissioning, &amp; SLC statements on store longevity, not yet undergone detailed regulatory examination; may need more on raw wastes; store environmental conditions and inspection; drafting comments/corrections e.g. on regulators’ role</li> <li><b>3. Storage &amp; transport:</b> raw waste storage not the only way to allow radioactive decay; need for detailed regulatory scrutiny of “safestore” and mini-store; BE proposals for ion exchange resins; progress with LoC reviews; variable adequacy of inspection arrangements; mention liquid waste stores; containers’ role in preventing spread of contamination; storage part of an overall management system; need to explore contingencies e.g. inability to implement dry storage / safestore; MoD fuel transport; who leads in co-ordination</li> <li><b>4. Spent fuels:</b> need for regulatory approval before options implementable; R&amp;D to substantiate dry storage</li> </ul>	<ul style="list-style-type: none"> <li>• Changes made to address concerns.</li> <li>• Changes made to address concerns.</li> <li>• Changes made to address concerns.</li> </ul>

**ANNEX A**

**RESPONSE FORMS**

## Personal Details

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Email address: gdb1@nnl.co.uk	Tel. no.: 01925 832985
Postal address: Room 260 National Nuclear Laboratory Hinton House Risley Warrington Cheshire WA3 6AS	
Are you responding as an individual or on behalf of an organisation or constituency? On behalf of the National Nuclear Laboratory	
Do you wish your name (or that of your organisation) to be omitted when responses or summaries of responses are published? No	

## Comments on Draft CoRWM report on Interim Storage of Higher Activity Wastes and Management of Spent Fuels, Plutonium and Uranium (CoRWM document 2500, 2<sup>nd</sup> full draft, dated 2 February 2009)

### General Comments on the Draft Report

*Please enter here your general comments on the draft report.*

The National Nuclear Laboratory supports the recommendations made in this report and would particularly welcome the development of a national strategy for research on the conditioning, packaging and storage of higher activity wastes and the management of plutonium, uranium and spent fuels.

One of the key objectives of research associated with waste treatment is to develop a stable wasteform that will be compatible with the geological disposal concept. Therefore we note that research underpinning the treatment of these materials cannot be considered in isolation from any plans for subsequent disposal. The requirement to demonstrate product stability during storage for a period of several hundred years means that research in support of waste management will inevitably need to address some of the same issues of product evolution that are relevant to behaviour in a disposal environment .

## Specific Comments on the Draft Report

Section	Comments
Executive Summary	
1. Introduction and Background	
2. Conditioning and Packaging of Higher Activity Wastes	<p>We support the statements made regarding the development of criteria to define waste package failure. There are a wide range of possible interpretations and clarification will no doubt be useful in discussions with stakeholders.</p>
3. Storage and Transport of Higher Activity Wastes	
4. Management of Spent Fuels	<p>A statement is made to the effect that <i>“Drying of metal fuel has been shown to be viable at Hanford in the US and to work well, even for highly corroded fuel.”</i> It should be noted that the Hanford fuel was clad in zircaloy with a smooth surface finish. Substantial R&amp;D would be required to support the transfer of this experience to the UK. Metal fuel from the Magnox reactors is clad in Magnox (a magnesium alloy) which typically has large fins which result in a much higher surface area. This Magnox fuel cladding is considerably more reactive than zircaloy and is susceptible to corrosion in the presence of moisture. Carbonaceous deposits are often found on Magnox fuel. The combination of these factors means that Magnox fuel may be much more difficult to dry and that the fuel cladding will be significantly less tolerant of any residual moisture.</p>
5. Management of Plutonium, Uranium and Thorium	<p>The report contains a discussion of potential immobilisation options. The options referred to are the use of <i>“cement composites, glass composites and ceramic composites made via hot isostatic pressing.”</i> The research on immobilisation in glasses and ceramics concentrated on the incorporation of plutonium into the structure of the materials and not on the use of composites. Similarly the cementation research looked at simple encapsulation in a cement grout. The research into immobilisation in ceramics investigated a wide variety of ceramic formulations and explored two main fabrication routes. One was hot isostatic pressing and the other was cold pressing, followed by sintering.</p> <p>The brief discussion on the potential to recycle plutonium into fuel states that NDA has not considered the option of recycling plutonium.</p>

<i>Section</i>	<i>Comments</i>
	However NDA commissioned NNL to carry out an evaluation of the potential for the plutonium stockpile to be recycled into fuel. This evaluation determined how much of the stockpile could be used in existing UK reactors. It also determined the suitability of the various elements of the stockpile for use in new build PWRs. NNL would be happy to supply references for publications in this area, if required.
6. Overall Conclusions and Proposed Recommendations	
7. References	
8. Glossary and Acronyms	

## Personal Details

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Postal address: Sellafield Site Sellafield, Seascale Cumbria CA20 1PG	
Are you responding as an individual or on behalf of an organisation or constituency? On behalf of an organisation	
Do you wish your name (or that of your organisation) to be omitted when responses or summaries of responses are published? No	

## Comments on Draft CoRWM report on Interim Storage of Higher Activity Wastes and Management of Spent Fuels, Plutonium and Uranium (CoRWM document 2500, 2<sup>nd</sup> full draft, dated 2 February 2009)

### General Comments on the Draft Report

*Please enter here your general comments on the draft report.*

A much improved version of the report over the outline version made available in December 2008.

One general comment is the use of the terms 'hazard reduction' and 'risk' - a clearer distinction needs to be made between the two in the document as it is the latter that is used for prioritisation. The Original Dry Silo at Sellafield is a good example; removing the waste from the silo and re-storing it in boxes does nothing to change the hazard of the inventory but a great deal to reduce the risk.

### Specific Comments on the Draft Report

Section	Comments
Executive Summary	First paragraph - Remit: The remit for CoRWM identified here needs to be clearly expressed and clear distinctions made for all radioactive materials, namely what is currently waste and what is currently a zero value asset. This paragraph needs to be expanded to include that; "CoRWM's terms of reference (or remit) require it to

Section	Comments
	<p><i>provide independent scrutiny and advice to Government on the long-term management, including storage and disposal, of radioactive wastes. It also includes materials from past and current nuclear power and defence programmes that may be declared to be wastes in future. These materials are mostly spent nuclear fuels of various sorts, plutonium and uranium”</i> (extract from CoRWM website). Currently, waste owners place a zero asset value on these radioactive materials meaning that they are neither classed as a waste nor a commercial asset.</p> <p>Second Box: The second recommendation here could easily be subsumed into the first recommendation as they both entail recommending that more information be made available - including security of storage and transport of radioactive wastes and materials.</p> <p>Second Box: The third recommendation needs to make clear distinctions on the role of Public and Stakeholder Engagement in the process. Suggested text could be “.....sufficient stakeholder participation in establishing the principles and setting the framework within which decisions can be made on the conditioning.....” This would recognise the impracticality of providing general stakeholders with sufficient information and (more importantly) technical understanding of the issues to actually participate in decision making in an informed manner. They can and should be consulted as a means of establishing principles, criteria and rankings.</p>
1. Introduction and Background	<p>Section 1.3, 4<sup>th</sup> Paragraph (Page 9):</p> <p>Although we do not disagree with this statement, it needs to be made clear that the management of higher activity wastes is driven by the requirements for long term storage and disposal, whereas the long term management of spent fuels, plutonium and uranium is currently only driven by long term storage until such time as they are required and would only change if UK national policy dictates so.</p>
2. Conditioning and Packaging of Higher Activity Wastes	<p>Section 2.3, Paragraph 1 (Page 13):</p> <p>We believe it is misleading to state that “much” of the ILW arising in future may be able to be packaged without conditioning. Although it may be possible, it would require changes to the disposal criteria (not to be underestimated) and may not be of such a high proportion of the total ILW when Sellafield decommissioning waste is taken into account.</p>
3. Storage and Transport of Higher Activity Wastes	<p>Section 3.2.2, 1<sup>st</sup> Paragraph (Page 20):</p> <p>Extended operational life of VPS - amend wording to identify that, although the design life of the existing VPS is currently 50 years, Sellafield will look to extend the</p>

Section	Comments
	<p>operational life by a programme of refurbishment and replacement of plant and equipment, subject to the usual safety case reviews.</p> <p>Section 3.2.2, 2<sup>nd</sup> Paragraph (Page 20):</p> <p>The first part of this paragraph should be re-written to state future Sellafield ILW stores are planned that have a design life of 50 years but which will be constructed using civil design codes that are good for at least 100 years. Initial assessments have indicated that the design life of these stores could therefore be extended to 100 years, subject to the usual regular safety case reviews. Store operational equipment has an initial 50 year design life which could be extended with refurbishment or replacement.</p> <p>The second part of this paragraph is equally applicable to all UK stores, not just those at Sellafield, and should therefore be included as part of Section 3.2.1.</p> <p>Section 3.3.1, 2<sup>nd</sup> paragraph: As far as Sellafield are aware the “mini-store” concept would only suit small waste volumes and would be inappropriate for the large waste volumes we have at Sellafield; the massive concrete structures referred to are the most cost effective storage method. Also, we are aware that this concept doesn’t store waste in a final product form for disposal and that additional conditioning of such waste would be required. However, Sellafield are looking at alternative containers to optimise waste treatment, packaging and storage.</p> <p>Section 3.3.2, 3<sup>rd</sup> and 5<sup>th</sup> paragraph (Page 23):</p> <p>Reference is made to “Plan C” as being a <u>contingent</u> strategy for waste storage if geological disposal never occurred. We believe this terminology is incorrect as a quite different <u>alternative</u> strategy would have to be developed if the end point were not disposal - you would effectively default to the Scottish position. Sellafield undertook some work on such an alternative scenario a few years ago but this has not been taken any further forward.</p> <p>Section 3.9.1, Paragraph 3 (Page 27):</p> <p>Is the information in this section based on LTP2007 data? Other options at Sellafield include ‘fit for purpose’ ILW stores containing standard packages but with reduced shielding commensurate with the waste forms stored. This Class 2 store is identified in the latest Sellafield Lifetime Plan.</p>
4. Management of Spent Fuels	<p>Section 4.1, 4<sup>th</sup> Paragraph (Page 29):</p> <p>To comply with Sellafield’s remit the following bullets need to be amended</p> <p>Bullet 1:  “Geological disposal” should read “Interim storage”</p>

Section	Comments
	<p>Bullet 2: Add “with interim storage pending a decision on disposal”</p> <p>Bullet 3: Bullet should be amended to identify “drying the fuel and placing it in high integrity canisters for interim storage”.</p> <p>Section 4.1, 6<sup>th</sup> Paragraph (Page 29): Again, the inference is that a safety case is being made to show that dried Magnox fuel is a suitable waste form for disposal. This is <u>not</u> the case. The work being undertaken is only to determine a safety case for the drying of Magnox fuel and its interim storage at Sellafield, <u>not</u> its disposability.</p> <p>Section 4.2, 4<sup>th</sup> Paragraph (Page 30): The near term management of AGR Fuel has always included a combination of Reprocessing and Interim Storage. The relative proportions are dictated by the closure date of Thorp as dictated by the Sellafield Lifetime Plan.</p> <p>Section 4.2, 5<sup>th</sup> Paragraph (Page 30) The inference here is that drying of AGR Fuel is more difficult than drying of Magnox fuel. Suggest that the first sentence be amended to identify that dry storage is being considered as part of the reference strategy and as an alternative option.</p> <p>The statement “The difficult step is the drying of the fuel” should be removed and replaced with “The AGR fuel will require drying on removal from the storage ponds. Some R&amp;D will be required to underpin this operation, building on the extensive work conducted by SNL in the 1990’s. Although unlike SNL, the Sellafield proposal would be to continue to remove the graphite sleeves and stainless components for more efficient packing. Although considered an easier proposal than drying Magnox fuel, there are some outstanding issues that require addressing for example “how dry the fuel needs to be to avoid corrosion of its cladding during storage.”</p> <p>Again, use is made of the phrase ‘contingent strategy’ whereas what we are looking at is an alternative strategy.</p> <p>Section 4.2, 5<sup>th</sup> Paragraph (Page 30): It should be made clear that the fuel in the legacy ponds at Sellafield has not yet been declared as waste. This decision will be a UK one, not just an NDA one as it also involves DGTREN (EC Directorate General for Transport and Energy, formerly Euratom).</p>
5. Management of Plutonium, Uranium and Thorium	<p>Section 5.1, Paragraph 3 (Page 34): Would it be the NDA’s position to consider the option of recycling plutonium in UK reactors, for either thermal or fast reactors? Clarification required.</p>

<i>Section</i>	<i>Comments</i>
6. Overall Conclusions and Proposed Recommendations	No further comments
7. References	Need to double-check the cross references between this section and in the body of the document. We found a couple of discrepancies.
8. Glossary and Acronyms	No further comments

**Other Comments**

*Please enter here any other comments on CoRWM's work on the topics covered in this report*

No other comments

**Response to the  
CoRWM 2 Storage Consultation  
Dr Rachel Western BA (Oxon) PhD**

**2<sup>nd</sup> March 2009**

**Introduction**

In 2006 in its response to CoRWM 1's July 2006 report, the Government wrote that the NDA:

*"will ensure that a **holistic** view is taken through the complete waste management chain, ensuring that both long and short term issues are addressed in a fully coordinated and integrated manner."*<sup>1</sup>

*"In response to CoRWM's more specific points the **security** of all stores is of paramount importance ... This includes, but is not limited to, the vulnerability of the waste form and the degree of protection provided against attack."*<sup>2</sup>

*"Government and regulators agree that wastes should be made **passively safe** as soon as practicable. This is consistent with the need to avoid any requirement for future repackaging and the attendant double handling of wastes."*<sup>3</sup> (Emphasis Added)

This response to the CoRWM 2 consultation on storage comprises my January 2009 response to the NDA (2009-2012) Business Plan (see Annex B) in order to show that:

- i) the NDA [and CoRWM 2] is not taking a holistic approach to waste management
- ii) security is not given priority
- iii) passive safety is not optimised.

The reason for all of these problems with the waste management approach is that the Post War waste management technique 'plutonium separation' (reprocessing) is still used for the treatment of the majority of the spent nuclear fuel rods.

Spent nuclear fuel rods contain a high concentration of fission products. Following the plutonium separation operation these end up in a concentrated nitric acid solution. It was believed that this nitric acid solution could readily be turned into glass blocks (vitrified) however this has not turned out to be the case.

Thus it can clearly be seen that the requirement to minimise the threat to security is not being complied with because:

Quite apart from the production of a separated plutonium stream – which is the raw material for nuclear weapons; the concentrated fission product stream is converted from a solid to a liquid. This means that it is readily dispersible and therefore does not meet the criterion either of 'minimal threat to security' or optimised passive safety.

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<sup>1</sup> NDA – Draft Storage doc (Jan 2009) p7

<sup>2</sup> NDA – Draft Storage doc (Jan 2009) p7

<sup>3</sup> NDA – Draft Storage doc (Jan 2009) p7

In my NDA Business Plan response (see Annex B) – I make reference to CoRWM documents on the regulator preference for purpose built dry stores for Magnox fuel – which could be preceded by in-reactor storage; and also the NDA statement that it ‘was clear that dry storage facilities at Sellafield would be required for AGR fuel’.

Not only would the dry storage of spent fuel reduce the terrorist threat presented by nuclear waste – it would also significantly reduce the costs, the doses and the waste volumes and discharges associated with spent fuel management.

Given that it is now accepted dry storage is preferred by the regulators – and is accepted as an option by the NDA – then in order to optimise savings and also minimise dose and waste impacts dry stores for both AGR fuel and Magnox fuel should be constructed as a matter of priority.

In addition to this recommendation, following the publication of the August 2008 EA Longevity report <sup>4</sup> which indicated the problem of ‘Expansive Fracturing’ within waste packages – which had already gone through the ‘Letter of Compliance’ process it is clear that a much greater emphasis be given to **chemical treatment** in order to reduce its ‘reactivity’. This is particularly important for magnesium/aluminium alloy (Magnox) and also uranium metal.

It should be recognised that we do not presently know enough to ensure the safety of radioactive waste; it is quite clear that two steps need to be taken that would considerably reduce the detriment associated with radioactive waste.

- i) Adoption of Dry of Spent Nuclear Fuel
- ii) Adoption of ‘Chemical Pre-Treatment’ as a necessary step in the packaging and conditioning process.

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<sup>4</sup> <sup>4</sup> “*The longevity of intermediate-level radioactive waste packages for geological disposal: A review*” Environment Agency – Nuclear Waste Advisory Team (NWAT) Author - P K Abraitis: August 2008

## Personal Details

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## Comments on Draft CoRWM report on Interim Storage of Higher Activity Wastes and Management of Spent Fuels, Plutonium and Uranium (CoRWM document 2500, 2<sup>nd</sup> full draft, dated 2 February 2009)

### General Comments on the Draft Report

#### *Overall comments*

We welcome the CoRWM report. We are very supportive of the work of the Committee and with our partners the HSE have provided information, advice and views on higher activity wastes, spent fuels and materials to assist the Committee in their work. The report is a very useful public summary of the status of storage and highlights the main issues and challenges for nuclear site operators.

#### *Historical context*

The last independent review<sup>5</sup> of higher activity waste storage undertaken by Government advisors was published in 2002. We suggest that it would be useful for CoRWM to revisit this earlier report, as we think it asks some pertinent questions that could equally apply today. For example the RWMAC/NuSAC report states:

“While a long-term management solution is being decided and implemented, ILW has to be managed in the interim, and there must be a clear interim management policy statement to cover this. Here, the Committees perceive a policy deficit, with relevant parts of the July 1995 Cm 2919 White Paper policy statement now being clearly in need of updating. Any such policy statement should, in RWMAC’s and NuSAC’s view, **reflect the need to begin to carry forward treatment of some of the older legacy wastes held on the UK’s nuclear sites more vigorously than has been the case in the past.** Equally, there is also a need to balance treatment to make the waste safe in the shorter term with the need to ensure that it can also be appropriately managed over the long term.” [Our emphasis in bold, reinforcing

<sup>5</sup> RWMAC/NuSAC, 2002. CURRENT ARRANGEMENTS AND REQUIREMENTS FOR THE CONDITIONING, PACKAGING AND STORAGE OF INTERMEDIATE LEVEL RADIOACTIVE WASTE. Report of a joint study by the Radioactive Waste Management Advisory Committee and the Nuclear Safety Advisory Committee

our main point with respect to legacy waste storage below].

#### *International context*

CoRWM might wish to mention the UK Government's recent submission to the IAEA Joint Convention<sup>6</sup>. and put the UK's fuel storage and waste management in context<sup>7</sup> with that in other states.

#### *Storage of legacy wastes*

On a similar basis to the Nuclear Decommissioning Authority's (NDA) draft report on Higher Activity Waste storage,<sup>8</sup> the CoRWM draft report highlights the safety and environmental detriment represented by the storage of legacy wastes in ageing facilities. It would be helpful if CoRWM's report described the significant environmental risks represented by these facilities in a way that allowed the wider public to understand their importance. The remediation of the higher hazard facilities is an urgent and important task and is quite rightly the first priority of the NDA.

Currently it appears that the remediation of these major hazards and environmental risks may not meet agreed statutory milestones set out by the HSE/NII. Much progress has been made but significant challenges and technical uncertainties will need to be overcome, to improve confidence in the delivery of significant reduction in environmental risks. Both the NDA and the CoRWM reports focus on the packaged waste storage facilities, and this seems to be a significant limitation. Whilst we welcome the discussion of the issues for packaged waste storage, including the more detailed consideration in the NDA report, we have recommended that more detailed scrutiny of the legacy raw waste remediation programmes should feature within the NDA programme for 2009/10. We suggest that CoRWM should explore opportunities for closer working with NDA to ensure the Committee is able to draw appropriately on the resources of the NDA when scrutinising the arrangements for legacy facilities.

#### *Transparent information*

We agree with the Committee's views about the quality of information in the public domain and support their recommendation. In view of the significant issues with raw waste storage, it is surprising that information in the public domain is uneven and limited. Some of the reasons relate to security considerations but we think these could be addressed by careful attention to managing the risks. The information<sup>9</sup> made available by the US Department of Energy, where there are similar security considerations, suggests that much more could be done. We have asked nuclear site operators and NDA to place improved information in the public domain, to inform stakeholder participation in option studies. Some good progress has already been made. For example, summary information on the key issues with Sellafield's Legacy Ponds and Silos have been placed in the public domain by Sellafield Ltd<sup>10</sup> - although this information was published in 2005 and could now be updated.

#### *Funding of NDA*

We remain concerned that the NDA's funding remains subject to 3-year Comprehensive Spending Review decisions by Government: In our view, the NDA's funding needs to be placed on a more secure, strategic, footing. We are working with the NDA to develop their new strategy for clean up of the nuclear legacy. This report is a useful input into that strategy development and should help the NDA to develop longer-term strategic objectives that may receive assured (ring-fenced) funding in the future. This is important if the UK is to make

<sup>6</sup> <http://www-ns.iaea.org/conventions/waste-jointconvention.htm>

<sup>7</sup> The International Atomic Energy Agency (IAEA) will be reviewing new submissions (made in 2008) in May 2009.

<sup>8</sup> <http://www.nda.gov.uk/documents/upload/Draft-UK-Radioactive-Waste-Storage-Review-Report-January-2009-version2.pdf>

<sup>9</sup> [http://www.em.doe.gov/pdfs/NDAA%20Report-\(01-15-09\)a.pdf](http://www.em.doe.gov/pdfs/NDAA%20Report-(01-15-09)a.pdf)

<sup>10</sup> <http://www.sellafieldsites.com/UserFiles/File/publications/stakeholder%20consultations/Stakeholder-Consultation-Note-V8.pdf>

timely progress with cleaning up its significant nuclear legacy, and not transfer the burden to future generations.

*Coordination, strategy development and public stakeholder engagement*

We agree with the Committee's draft recommendations. We are currently working with the NDA on their strategy development process, and we consider that there would be significant opportunities – and potential benefits for UK taxpayers - if a “National Integrated Waste Strategy” were developed, incorporating radioactive wastes that are not owned by NDA. Moreover we think it would be beneficial to link the development of such a strategy with the development of a UK fuels and materials strategy - as the fuel and materials are the sources of much of the nuclear waste. Although there might be public and stakeholder concerns about extending the NDA strategy development work to wastes that are currently outside the NDA's core Energy Act responsibilities, we think these could be managed. There is precedent, as Government has requested that NDA take the lead on LLW strategy for the UK: this work is progressing well and offers a model that could be built on..

**Specific Comments on the Draft Report**

Section	Comments
Executive Summary	<p>Page 4 last para</p> <p>Regulators enforce the <b>majority</b> of the legislation that implements Government Policy for radioactive waste rather than enforcing Government Policy. For example the regulators are not responsible for ensuring the principle of “Justification”. This is a responsibility of Government. A rolling summary of Government policy for radioactive waste is provided on the Defra web site<sup>11</sup>. This summary includes spent fuel and materials that may become waste in the future and highlights statutory guidance to the Environment Agencies on nuclear waste.</p> <p>Responsibility for radioactive waste management lies with the producers and owners of the waste.</p> <ul style="list-style-type: none"> <li>• The Government decides on matters of overall policy</li> <li>• The regulators regulate in accordance with legal requirements and ensure that Government policy is implemented</li> <li>• The producers and owners of the waste must manage the waste in ways that meet the legal and policy requirements.</li> </ul>
1. Introduction and Background	No comments
2. Conditioning and Packaging of Higher Activity Wastes	<p>2.1 We suggest the table should be transferred to an annex, and that there should be a summary table in the main text providing a clearer description of the current status at the various sites</p> <p>2.2 - Progress in Conditioning and Packaging ILW</p> <p>It is useful that attention is drawn at the start of this section to the fact</p>

<sup>11</sup> <http://www.defra.gov.uk/environment/radioactivity/waste/rwpg/pdf/rwpg-rolling-summary.pdf>

Section	Comments
	<p>that a minority of the current UK inventory have been packaged for disposal.</p> <p>“All of the conditioned ILW at Sellafield is in cement-based matrices [Defra &amp; NDA, 2008a].” We would point out that treatment of “plutonium contaminated materials (PCM)” is different from the other three ILW packaging plants at Sellafield - the waste is not intimately grouted like the other ILW streams listed, but instead has a grout annulus around super-compacted 200l drums (‘pucks’). There are several potential issues with this particular waste form type, e.g. re-expansion of the pucks, leading to cracking of the grout annulus. We understand that trials of lesser-force compaction are to be undertaken, to help address this issue.</p> <p>Para beginning, “<i>However, other conditioning materials...</i>” in addition to the example of ‘thermal treatment’ we recommend that CoRWM cite the potential use of polymers and ceramic waste forms as other examples (as these would seem to be in more highly-developed state).</p> <p>2.3 Some operational higher activity wastes are not promptly treated – for example, higher activity wastes arising from the Sellafield’s Site Ion Exchange Plant (SIXEP) have been stored for many years without clear plans for their treatment. Another example is the graphite sleeves from AGR fuel.</p> <p>The original dry silo is not the only exception – there are plans for the interim buffer storage of large volumes (many hundreds of cubic metres) of pond sludge</p> <p>It is wrong to say that the Higher Active Waste Strategy Group is coordinating future work. This is a new NDA industry group, in which regulators are also involved. Its current role is to support NDA strategy development.</p> <p>2.4 The Regulatory Framework for Waste Conditioning and Packaging</p> <p>We suggest the following sentence should replace the sentence below.</p> <p>Suggested sentence:  <i>“The regulators request the submission of selected, specific, RWMCs for scrutiny. The submissions are assessed from the perspectives of safety and the environment by the HSE and the relevant environment agency respectively (the EA or SEPA). This selective regulatory scrutiny is in addition to the arrangements which site operators must have in place to ensure compliance with site licence and authorisation conditions.”</i></p> <p>CoRWM sentence  <i>“The RWMCs for major waste streams have to be submitted to regulators. The submissions are assessed separately by HSE and the relevant environment agency (the EA or SEPA).”</i></p>

Section	Comments
	<p>We are glad that the Committee has flagged the new regulatory guidance on RWMCs and the future role of the Regulators. Although these new arrangements have been covered by guidance since December 2005, the regulators have received relatively few developed RWMCs for scrutiny. We are continuing to work with nuclear site operators to improve these arrangements.</p> <p>There is an error in the references “NDA, EA &amp; SEPA, 2007” – should be HSE not NDA.</p> <p>2.5 The NDA Letter of Compliance Process</p> <p><i>“The regulators require waste producers to show that waste packages are disposable as part of their preparation of their safety case for waste conditioning and packaging (see Section 2.4).”</i></p> <p>Suggest adding “The regulators also expect waste producers to demonstrate that they are actively managing issues that could detract from waste product quality during package production, and issues (that have either been identified by monitoring or modelling) that could arise during long term storage”</p> <p><i>“There are concerns that it is difficult to achieve a 500 year container life and difficult to demonstrate that it has been achieved [CoRWM docs 2386, 2389, 2397]”</i> We suggest referencing the Environment Agency longevity report “EA, 2008a” which is already in the reference list.</p> <p><i>“RWMD told CoRWM that the industry had focused on the most difficult types of ILW first, hence the apparently slow rate of progress. It did not believe that the LoC process itself was delaying the immobilisation of wastes [CoRWM doc. 2459].”</i></p> <p>We think that another contributory factor may be that the industry focused on operational wastes from Magnox and Thorp reprocessing during the 1990s, because of regulatory pressures.</p> <p><i>“There is a system for reviewing LoCs issued to date [CoRWM doc 2459; NDA, 2008j]. The reviews take into account changes in package specifications, advances in knowledge, and evidence from inspection of stored packages. As yet very few LoCs have been subject to review. The intention in future is to carry out reviews on a ten year cycle, to coincide with sites’ periodic safety reviews [CoRWM doc. 2459].”</i></p> <p>This is an area that requires more careful consideration. We are aware that progress on outstanding issues with some Letters of Compliance (LoC) have in some instances been extremely slow. This does not necessarily invalidate the LoC process but may detract from the continuing validity of a specific LoC. We consider that a more frequent and regular review process is essential. In particular, the changing requirements for extended on-site storage suggest that a much earlier schedule of programmed review should be agreed with regulators. It is important the LoC process is seen to be proactive and responsive – bringing about prompt improvements to waste packaging where these</p>

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	<p>are considered necessary to ensure disposability and minimise the risk that packages would need to be reworked.</p> <p>CoRWM may wish to cite the Environment Agency’s reviews of the LoC process in 2005 and 2008. “Review of Nirex’s Letter of Compliance Process NWAT/Nirex/05/001 November 2005” and “RWMD Response to NWAT Queries for LoC Process Topic Day”, NDA 2008 Technical Note 9239586</p> <p>Overall, we consider that the LoC process is relatively mature: it has significant strengths, and some limitations that are being addressed. We endorse the NDA’s strategic role of maintaining an overview of the LoC process via their higher activity waste strategy overview group.</p> <p>2.6 Dealing with Failed and Out of Specification Packages</p> <p>Last para <i>“The EA has carried out research on ways to choose between these types of remedial action, using approaches based on minimising environmental impact [EA, 2005]. The NDA has investigated over packing [CoRWM, 2459; NDA, 2008j].</i></p> <p>CoRWM may wish to be aware that the Environment Agency has recently commissioned further research on approaches to assuring the disposability of radioactive waste packages. Also we understand that NDA are taking forward work on waste package monitoring and environmental conditions in ILW stores within their generic research portfolio.</p> <p>2.7 Waste Conditioning and Packaging R&amp;D</p> <p><i>“We found that the NDA has made considerable progress in co-ordinating R&amp;D on waste conditioning and packaging. Its NWRF, which involves all its SLCs, and other waste producers, is an appropriate mechanism for determining the topics on which R&amp;D is required. “</i></p> <p>We have been supporting the NWRF but would be careful not to overstate the success of this forum to date. We agree with recent NDA initiatives to improve clarity about NWRF’s role and focus. Its success depends on support for coordination of important issues that are now being led by Site Licence Contractors (SLCs). There is a need to improve transparency of coordination between NDA corporate research (led by NDA Strategy Directorate) and NDA Radioactive Waste Management Directorate (RWMD) research.</p> <p>2.8 Conclusions on Waste Conditioning and Packaging</p> <p>The second paragraph discusses adequacy of LoC process – it could usefully mention the RWMAC/NuSAC 2002 review findings (referred to earlier) and the challenges we have raised on the LoC process in 2005 and again recently in our LoC ‘topic day’ in 2008 (references above).</p>
3. Storage and Transport of	Please see our general point, above, about legacy wastes.

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Higher Activity Wastes	<p>In general we agree with the points made about contingency planning in the UK's waste management programme. "Plan A" in England &amp; Wales (and Northern Ireland) is geological disposal, "Plan B" by default is continuing interim storage. It would be useful if contingency planning included alternative scenario-based considerations.</p> <p>The link between UK's/NDA's strategic work and operational decisions on the sites needs to be clear, and carefully managed, to make sure that a strategic steer doesn't improperly affect operational decisions for which the relevant site licence company must be accountable.</p> <p>Specific comments</p> <p>3.1.1. Significant volumes of legacy wastes have also accumulated in operating fuel ponds due to poor operation of those facilities. Some of the more hazardous facilities were not cleaned up after operations ceased due to the significant accumulations of higher activity wastes and issues with accumulation of corroding fuel. Generally fuel ponds represent a clean up challenge across the NDA estate although the main problems are at Sellafield.</p> <p>Although large volumes of raw plutonium contaminated waste have been consolidated within modern engineered stores at Sellafield, there are other significant similar legacy raw waste accumulations at UKAEA Harwell and Dounreay, and with the Ministry of Defence.</p> <p>We think it understates the problems of legacy waste storage to place these facilities in the "50 to 100y" context. Some facilities require prompt remediation and represent significant safety and environmental management challenges. According to current plans, and because of time-critical risks, some of these legacy wastes will be transferred to new interim buffer facilities.</p> <p>All major remediation activities are also subject to authorisation under the Radioactive Substances Act 1993. Plans will need to be consistent with the Best Practicable Environmental Option and each facility will need to demonstrate they are using Best Practicable Means to minimise discharges and disposals of radioactive waste to the environment. We shall expect operators of these facilities to make an environmental case that is consistent and integrated with the nuclear safety case required under health and safety legislation .</p> <p>3.1.3 long term stores</p> <p>Table 2 – it would be useful to provide the capacity of the current stores at each site and the future planned capacity</p> <p>3.4</p> <p>We are aware of significant limitations on the control of environmental conditions within long term stores on some sites. This means that some packages may be subject to unnecessary or accelerated external</p>

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	<p>degradation mechanisms that could be avoided by engineered improvements, improved quality assurance, or transfer of packages to stores with modern standard designs and quality assured operation. We think it important to provide “defence in depth” and to ensure appropriate protection for the waste packages so that they are robust for transport and future disposal. There is a need to avoid, where practicable, the future reworking of packages.</p> <p>The <u>necessary</u> information about packaged wastes will need to be recorded and maintained over a long period. There remains significant work to ensure that waste record retention is consistent with best practice. Current limitations with retention of duplicate records remains a significant issue. Loss of information about waste packages could make it very difficult to establish disposability of the affected packages.</p> <p>These is also a need for improved assurances about waste package longevity in the storage environment, including appropriate validation of modelling data during the storage period (e.g. through experimental work on simulated waste forms, or periodic non destructive testing on stored finished packages). This work is underway and focussed on the packages with the highest uncertainty. However we also aware that it can be difficult to design an appropriate monitoring programme because of limitations with quality assurance arrangements, package characterisation and inspection facilities.</p> <p>3.8 We agree with CoRWM’s view about the need for greater public and stakeholder engagement (PSE) on higher activity waste decisions. For example the Sellafield SLC has decided (2007) to encapsulate a significant proportion of the UK higher activity waste inventory within a product form that is of relatively high volume<sup>12</sup>. The regulators and NDA have been closely involved in this decision-making and were persuaded (considering the safety and environmental risks represented by the current storage arrangements) that it represented the best practicable environmental option. There could have been significant advantages in wider PSE on this decision, in view of the implications for the eventual disposal facility. But there are also good examples of local PSE e.g. by UKAEA Harwell</p> <p>3.9.2. We do not think it would be appropriate for the Environment Agency to play a significant role in waste storage coordination between organisations. The role appears to fit well with the current roles and responsibilities of the NDA, although new legislation or a direction from Government might be needed.</p> <p>We have mentioned the need to undertake scenario planning for long term storage, because of the uncertainties with the disposal timetable. In the USA, it now seems unlikely that fuel and waste disposals would commence by 2020 in the single nominated US site (Yucca Mountain). This suggests that clear alternative scenarios need to be explored in the context of delayed or restricted disposal requirements. Again we</p>

<sup>12</sup> The design contains a second skin and a void that allows for potential expansion of the cement waste form

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	<p>think that the NDA is best placed to undertake this analysis (and consider all UK disposals) as part of its strategy development process for its higher activity wastes, fuels and materials.</p>
<p>4. Management of Spent Fuels</p>	<p>We agree with the need for a UK strategic approach on management of spent fuel extending beyond the NDA-owned spent fuel. We would expect the NDA to play a leading role in delivering this.</p> <p>Linked to the Government's consideration of Plutonium and Uranium management is Government's lead on spent fuel reprocessing and in what circumstances spent fuel should be managed as a waste. We would expect the Government's view on this to be informed by the strategic development work being undertaken by the NDA.</p> <p>Robustness of spent fuel management plans to external factors (e.g. Euratom Safeguards requirements) needs to be considered.</p> <p>4.1 We support the lead that NDA is taking on Magnox fuel strategy and the development of contingent strategies. The contingent strategies may become viable alternatives to the baseline strategy. For Magnox fuel, the currently-recognised issue of corroded legacy fuel (around 400Te) will need an alternative solution: this might also provide a way of managing some of the more difficult "operational" Magnox fuel, or provide a contingency if significant issues arose with the current, ageing, reprocessing infrastructure or downstream waste treatment plants. Direct encapsulation of this fuel as a waste raises issues about the long-term integrity and disposability of the wasteform. The option of drying is one of a number of options that are being considered.</p> <p>4.2 NDA have more options than "store" or "reprocess" to consider for the fuel that is not contracted – as the report later points out NDA could decide to dry the fuel for direct disposal.</p> <p>We agree that NDA should consult public and stakeholders on consolidated long term storage of fuel (if this is considered as an option) before deciding the location of such a consolidated store.</p> <p>The issue of appropriate management of AGR fuel at Sellafield is currently an area of close regulatory scrutiny.</p> <p>4.4 We understand that NDA have a preference for treatment of DFR fuel at Sellafield but the decision will depend on PSE and the availability of appropriate facilities at Sellafield once the more problematic in-reactor fuel is removed. (The timescales remain uncertain, because this is a difficult decommissioning task).</p> <p>Long-term management options for exotic fuels (or fuels that are special that because they shall need new treatment routes established) need to be developed using a Strategic Action Planning approach, so that the necessary short- and medium-term R&amp;D and new facility development is done in time to enable longer-term decisions at appropriate times. We support the work being undertaken by the NDA</p>

Section	Comments
	waste strategy team.
5. Management of Plutonium, Uranium and Thorium	<p>The current storage of Plutonium (Pu) is mainly in ageing stores that have relatively high safety and environmental detriment scores. The transfer to a more modern consolidated store is a high priority but will not be achieved for many years.</p> <p>The need for a Government lead on whether publicly-owned Pu and Uranium (U) should be re-used or managed as a waste, or at least to define <u>when</u> such a decision would be taken, is becoming more pressing in terms of the future NDA strategy development process.</p> <p>The size of the UK's U inventory is very significant: we understand it would give around 100 000 cubic metres of conditioned and packaged waste. NDA will need to address the implications of this inventory for the geological disposal facility .</p>
6. Overall Conclusions and Proposed Recommendations	We agree with the overall conclusions and proposals. We also support the specific recommendation about strong regulatory involvement in strategic coordination.
7. References	
8. Glossary and Acronyms	

### Other Comments

*Please enter here any other comments on CoRWM's work on the topics covered in this report*

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Are you responding as an individual or on behalf of an organisation or constituency? On behalf of NDA	
Do you wish your name (or that of your organisation) to be omitted when responses or summaries of responses are published? No	

## Comments on Draft CoRWM report on Interim Storage of Higher Activity Wastes and Management of Spent Fuels, Plutonium and Uranium (CoRWM document 2500, 2<sup>nd</sup> full draft, dated 2 February 2009)

### General Comments on the Draft Report

*Please enter here your general comments on the draft report.*

The value of coordinated strategies is recognised. It would be worthwhile defining what is meant by strategic coordination, and more explicitly recognising that strategies can operate at various levels. It is appropriate to have high level strategies that apply UK-wide covering some of the topics of this report, but equally valid for organisations to have different lower level strategies, so long as Government Policy and the law are being adhered to.

### Specific Comments on the Draft Report

Section	Comments
Executive Summary	<p>Page 4, Scope of report, last line – change to “For R&amp;D, only ...” to avoid ambiguity.</p> <p>Page 4, Strategic Co-ordination – define the level at which this strategic co-ordination would apply. This will provide the necessary context for later text, which is ambiguous or potentially contradictory.</p> <p>Page 4, Strategic Co-ordination, paragraph 2 - BE work</p>

Section	Comments
	<p>related to their existing nuclear liabilities is coordinated with the NDA which has a dedicated team to discharge the NDA's responsibilities as set out in a letter of direction from BERR. NDA has a formal responsibility with BE via the Nuclear Liabilities Funding Agreement, one of a suite of contracts established between Government and BE to effect a solvent restructuring of the Company In 2003. This is discharged via the above-mentioned letter of direction.</p> <p>Page 4, Strategic Co-ordination, paragraph 2 - MoD recognise the benefit of aligning their strategies with the NDA. This will be undertaken at overall strategy as well as topic strategy level.</p> <p>Page 4, Strategic Co-ordination, paragraph 2 – can be read as critical of the NDA that there is thought to be insufficient coordination, i.e. “The only co-ordination mechanism that the NDA has ...” Would be better worded “The NDA has ....”. Also suggest rewording along the lines “strategies are appropriately co-ordinated”, rather than “are co-ordinated with those of the NDA”.</p> <p>Page 5, paragraph 1 – is it really appropriate to have a “prioritised R&amp;D strategy for the UK as a whole”. This goes beyond strategic coordination and appears impractical and unnecessary.</p> <p>Page 5, Boxed item – should there really be “UK-wide strategies” for all aspects, rather than appropriately coordinated strategies. This to some extent depends upon the definition of strategic coordination, but different bodies may well, legitimately adopt different lower level strategies, while conforming with Policy. This line of argument is consistent with the text in Section 3.9.2. Prioritisation would also need to have appropriate regard for social and economic factors.</p> <p>Page 5, Public and Stakeholder Engagement – it should be recognised that the NDA strategy development work has and will help provide the types of information being identified as being required. Such information will have also been promulgated in the past through the NSG and related activities.</p> <p>Page 5, Public and Stakeholder Engagement, paragraph 3 and page 6, Boxed Item, PSE recommendation – this could be seen to be rather a sweeping recommendation based on an apparently small sample set (see Section 3.8). It is noted that where joint NDA and BE sites exist, the local SSG covers both stations. Perhaps the</p>

Section	Comments
	<p>recommendation could be focussed onto all organisation involved in the issue?</p> <p>We recommend that this CoRWM report should reference the OCNS document “Finding a Balance”, which provides guidance on the sensitivity of nuclear and related information and its disclosure:  <a href="http://www.berr.gov.uk/files/file23308.pdf">http://www.berr.gov.uk/files/file23308.pdf</a></p>
1. Introduction and Background	<p>Section 1.1, final paragraph – change to “from potential future nuclear power stations”.</p> <p>Section 1.2 Higher activity radioactive waste definition – suggest the definition in the MRWS White Paper is referred to. This will raise the question of Scottish Government Policy, i.e. this report also covers those higher activity wastes managed under the Scottish Executive’s policy, but the MRWS White Paper definition does not.</p> <p>Section 1.2, Storage definition – stating that the time when a geological disposal facility is open does not constitute storage is likely to be confusing for many readers. Wastes will clearly be stored during this time. This report concerns interim storage (as a precursor to geological disposal), and so discussion of disposal is not required in this context.</p> <p>Section 1.3 – provide a reference for the Scottish Government position.</p> <p>Section 1.3 – penultimate paragraph, last sentence – delete “the” from “the other organisations that have”, as the listed organisations are probably not exhaustive.</p>
2. Conditioning and Packaging of Higher Activity Wastes	<p>Section 2.1.1, paragraph 1 – the last sentence should be amended to “HLW only arises at Sellafield from reprocessing spent fuels from commercial reactor operations”.</p> <p>Section 2.2, paragraph 1 – the citation of the ‘less than 10%’ value could be taken out of context as this relates to total predicted arisings. It would be appropriate to also express the quantity of conditioned wastes as fraction of the amount of ILW that exists at present.</p> <p>Section 2.2, paragraph 3 – please note that there are currently no manufactured waste packages based on the 4m box container. In addition to the quoted 500 litre</p>

Section	Comments
	<p>drums and 3m<sup>3</sup> box containers, thus far wastes have been packaged using 3m<sup>3</sup> drums, WAGR boxes and Type 1803 drums.</p> <p>Section 2.3, paragraph 1 – it should be made clear that the primary aim of conditioning is to immobilise <u>activity</u> (over a suitable timescale and taking account of the evolution of the waste). The form of some wastes may provide sufficient immobilisation without the need for further conditioning (for example bulk items of activated steel).</p> <p>Section 2.3, paragraph 2 – balancing commentary on the risks associated with the storage of raw wastes should be provided, with some of the Sellafield legacy plants providing good examples.</p> <p>Section 2.3, paragraph 3 – the last sentence should refer to optimisation of safety, rather than maximising safety.</p> <p>Section 2.3, paragraph 5 – it should be noted that the use of cements for the immobilisation of wastes is supported by an extensive and mature R&amp;D base that helps provide confidence in the assessment of proposals based on cementation. Alternative technologies may be less well-supported, placing greater demands for additional R&amp;D to justify endorsement. This limited evidential base is potentially a strategic issue.</p> <p>Section 2.3, paragraph 7 – please note that the Higher Activity Wastes Strategy Group is strategically focused and will concentrate on those projects that are addressing national issues.</p> <p>Section 2.4, paragraph 1 – the RWMC is potentially an important means of demonstrating optimisation of safety across the whole life-cycle of a waste. It should be noted that it allows the risks in different phases of that life-cycle to be weighed and balanced.</p> <p>Section 2.4, paragraph 2 – there are six modules associated with the Joint Guidance. Module IIC (Option Selection) has been omitted from the list.</p> <p>Section 2.5, paragraph 3 – it should be recognised that it is not a ‘given’ that proposals will obtain an LoC. In some circumstances the waste producer may be encouraged to pursue an alternative approach.</p> <p>Section 2.5, paragraph 3 – the description of the staged LoC process is not strictly accurate. The second (interim) stage is a submission of supporting R&amp;D to justify the process. The third (final) stage is not necessarily <i>‘the</i></p>

Section	Comments
	<p><i>most detailed</i>', but is intended to be based on proof that a plant operates in the manner intended (for example through evidence from commissioning). It should be noted that this staged process is offered to waste producers to mirror a staged approval process and is not compulsory.</p> <p>Section 2.5, paragraph 6 – this paragraph gives a misleading impression – see NDA response to CoRWM questions on the LoC process). It is correct to assert that the existing generic post-closure safety assessment for ILW does not explicitly take credit for features of the packages. Nonetheless, it is essential that the waste packages are consistent with the underpinning assumptions of that assessment to make that assessment valid. Consequently, the GWPS includes criteria that are derived from or informed by post-closure requirements. These include criteria for heat evolution, thermal conductivity, voidage, minimisation of non-aqueous liquids, and compatibility with the chemistry of the disposal concept upon which the GWPS is based.</p> <p>Section 2.5, paragraph 7 – the proposed 'mini-stores' are not 'very large' containers. They are similar in size to the standard 3m<sup>3</sup> boxes and are smaller than WAGR boxes.</p> <p>Section 2.5, paragraph 9 – the periodic review of LoC is not necessarily intended to coincide with periodic reviews of safety cases. Instead the proposed periodicity (ten yearly) has been based on that adopted for the safety cases, and there could be other triggers for a periodic review.</p> <p>Section 2.7, paragraph 2 – given the diversity of UK ILW, the opportunities for a strategic approach to developing conditioning methods is restricted. Emphasis should be placed on the dissemination of good practice and supporting evidence, together with improving the technological readiness of appropriate alternative conditioning methods.</p> <p>Section 2.7, paragraph 2 – RWMD package specifications require that all R&amp;D is performed under a suitable management system in order for it to be accepted under the LoC process. To support this, a programme of audits is undertaken.</p> <p>Section 2.8, paragraph 1 – the practicality and need for "UK-wide processes for checking how R&amp;D is carried-out and that its results are being put to practical use" is questioned (linked to comments on the Executive Summary). Those carrying out or commissioning research should have appropriate controls in place, and</p>

Section	Comments
	this will be undertaken within the regulatory regime.
3. Storage and Transport of Higher Activity Wastes	<p data-bbox="639 338 1394 533">Section 3.2.1, page 20, first bullet point – the 2110 date does not align to the NDA lifetime plans. Current assumptions for planning purposes include for repository availability well beyond this date. Might be worthwhile referring to the NDA's site export integrated schedule for ILW.</p> <p data-bbox="639 591 1394 757">Section 3.2.1, page 20, main paragraph – please note the large volumes of final site clearance ILW, where the NDA is starting to explore alternative treatment routes. The key waste stream is the bulk reactor graphite from Magnox and BE decommissioning.</p> <p data-bbox="639 808 1394 974">Section 3.2.2, page 20 – the Vitrified Product Store had an original design life of 50 years and started operating in 1990. The current NDA plan assumes that HLW would be transferred to the GDF from 2075 – it does not assume that geological disposal can't begin before 2075.</p> <p data-bbox="639 1025 1394 1422">Section 3.3.2, page 22, paragraph 2 – the NDA's Higher Activity Wastes Strategy Group is strategically focussed with representatives from the Regulators, NDA (including RWMD), BE, MoD, and SLCs. This Group reports into the NDA's Strategy Management System (SMS). Co-ordination at the technical level is being managed via the NDA's Research Board on Nuclear Decommissioning and Waste Clean Up. The NWRF reports the key issues to this Research Board. It is also questioned whether separate waste producing organisations and individual sites should, or would, have common priorities as is recommended.</p> <p data-bbox="639 1473 1394 1541">Section 3.3.2, paragraph 4 onwards – why is the discussion restricted to ILW?</p> <p data-bbox="639 1592 1394 1861">Section 3.3 – page 23 – paragraph 2 – BE is already included in planning for ILW disposal and long term waste and fuel management through their Baseline Decommissioning Plans (one for each site) and their Un-contracted Liabilities Discharge Plan (UCLDP), all of which are reviewed by the NDA and are aligned with the guidance given by the NDA to its SLCs in developing their LTPs.</p> <p data-bbox="639 1912 1394 2011">Section 3.6 – page 26 – first sentence. Please check this statement, as the second sentence infers there are no movements of HAW.</p>

Section	Comments
	<p>Section 3.6, paragraph 3 – this ends rather abruptly, and is another risk management issue. Appropriate measures need to be put in place to facilitate future transport of packages. This is considered as part of the LoC assessment. Furthermore, regulatory change can occur in any discipline, hence the value of a periodic review process.</p> <p>Section 3.7 – separate comment will be provided on the R&amp;D report, however, this text could be misleading. There will be a great deal of R&amp;D supporting storage activities, but that R&amp;D will have not been undertaken for specific plant.</p> <p>Section 3.9, page 27, paragraph 7 – strategies are being developed for the individual components.</p>
4. Management of Spent Fuels	<p>Section 4.1, 3<sup>rd</sup> bullet – amend to “drying the fuel, placing it in canisters for dry storage, then appropriate treatment, e.g. overpacking followed by geological disposal”.</p> <p>Section 4.2, paragraph 2 and 3 – comment has previously been made on the statement that it is at NDA’s discretion as to whether the fuel is stored or reprocessed. This is not accurate and other parties would be involved in such decisions.</p> <p>Section 4.2 and 4.3 – a number of detailed comments have previously been made on earlier text that do not seem to have been addressed.</p> <p>Section 4.4, page 31, paragraph 1 – the current reference strategy is to treat as waste - detailed plans for individual streams are still to be worked up so this may change in the future.</p> <p>Section 4.4, page 31, paragraph 4 – a preference for considering DFR fuel as part of the MOP and reprocessing at Sellafield has been expressed. Final viability of the strategy needs to be established before a final change would take place.</p> <p>Section 4.4, page 32, paragraph 6 – delete the 2<sup>nd</sup> and 4<sup>th</sup> sentences for accuracy.</p> <p>Section 4.5, page 32, paragraph 5 – word change “reference” to “preferred”, and replace the last sentence</p>

<i>Section</i>	<i>Comments</i>
	for "Work is required to integrate MoD strategies, Sellafield LifeTime Plan and the contractual position in relation to submarine fuel".
5. Management of Plutonium, Uranium and Thorium	Section 5.4, page 36, paragraph 3 – BE materials held at Sellafield are being integrated into NDA strategy planning through better alignment of BE's UCLDP and the Sellafield LTP (currently they are disconnected). This will happen once NDA receive and approve the next Sellafield LTP as this will provide the baseline and benchmark for BE to follow and will save them effort.
6. Overall Conclusions and Proposed Recommendations	<p>Section 6.1, page 36, paragraph 1 – as noted earlier in the comments the NDA has now set up the Higher Activity Wastes Strategy Group, and in addition the Spent Fuels and Nuclear Materials Forum.</p> <p>Section 6.1, page 36, paragraph 2 – co-ordination mechanisms exist also within BE who field representative to various NDA fora.</p> <p>Page 37 - SDDG has an interest in MoD and BE nuclear liabilities and the development of strategies to improve processes and minimise costs.</p>
7. References	<p>Reference to finding a balance (OCNS):</p> <p><a href="http://www.berr.gov.uk/files/file23308.pdf">http://www.berr.gov.uk/files/file23308.pdf</a></p>
8. Glossary and Acronyms	

## Personal Details

Name: A N Other	Organisation: -
Email address:	Tel. no.
Postal address:	
Are you responding as an individual or on behalf of an organisation or constituency? Individual	
Do you wish your name (or that of your organisation) to be omitted when responses or summaries of responses are published? Yes please	

## Comments on Draft CoRWM report on Interim Storage of Higher Activity Wastes and Management of Spent Fuels, Plutonium and Uranium (CoRWM document 2500, 2<sup>nd</sup> full draft, dated 2 February 2009)

### General Comments on the Draft Report

*Please enter here your general comments on the draft report.*

I am not repeating, in the main, comments made and recorded in the Workshop discussions on Feb 19<sup>th</sup> as these hopefully will have already been picked up.

I have not repeated comments made on the first draft as these have largely been addressed.

I have made editorial and detailed comments on an annotated second draft of the report already submitted.

### Specific Comments on the Draft Report

<i>Section</i>	<i>Comments</i>
Executive Summary	This is relevant and comprehensive. The overall conclusions and recommendations are clearly stated. The separation of 'technical' and 'PSE' recommendations is appropriate.
1. Introduction and Background	This sets the scene for the report and is well constructed and comprehensive.
2. Conditioning and Packaging of Higher Activity Wastes	This part of the report covers inventory, processing, packaging, regulation and LoC, out of specification

<i>Section</i>	<i>Comments</i>
	products and signals the related parts of the (to be consolidated) R&D report. The technical content is sound and the conclusions drawn are well thought out and presented. I have identified a few minor editorial comments which have been communicated separately.
3. Storage and Transport of Higher Activity Wastes	This part of the report covers existing storage facilities and current and anticipated future plans on a site by site basis. The robustness of plans is examined as are safety and transport aspects. The technical content is sound and the conclusions drawn are well thought out and presented
4. Management of Spent Fuels	This part of the report covers Magnox, AGR, PWR and exotic fuels The reporting is clear and appropriate.
5. Management of Plutonium, Uranium and Thorium	Plutonium, Uranium and Thorium aspects are covered in this section. The question of 'asset or waste' could be more fully addressed. Other than minor stylistic comments I find nothing to criticise.
6. Overall Conclusions and Proposed Recommendations	These mirror the conclusions and recommendations drawn in the previous four sections and no new material is introduced. The findings are clear and I have neither technical nor style comments to make.
7. References	I have drawn minor errors in the reports listing to the attention of the authors.
8. Glossary and Acronyms	I have noted a couple of omissions in the listing and drawn these to the attention of the authors.

### **Other Comments**

*Please enter here any other comments on CoRWM's work on the topics covered in this report*

I was very pleased to have been approached to provide technical scrutiny at an early stage in the compilation of this report. It is clear that the comments I made earlier have been considered and, in the main, addressed. The final report will be technically sound with well thought out Conclusions and Recommendations. Thanks again.

## Personal Details

Name: Peter Manning	Organisation: NuSAC RG6
Email address:peter@petermanning.co.uk	Tel. no.:01946 841381
Postal address: Glenholme Beckermet Cumbria CA21 2XP	
Are you responding as an individual or on behalf of an organisation or constituency? Individual	
Do you wish your name (or that of your organisation) to be omitted when responses or summaries of responses are published? No	

## Comments on Draft CoRWM report on Interim Storage of Higher Activity Wastes and Management of Spent Fuels, Plutonium and Uranium (CoRWM document 2500, 2<sup>nd</sup> full draft, dated 2 February 2009)

### General Comments on the Draft Report

*Please enter here your general comments on the draft report.*

I think the authors have done a very good job in collecting together the factual information and references. There is just a bit more that I would like to see included. It is presented in a logical manner.

For me, however, the style needs to be tidied up. In particular

- 1- in several places, it is not clear-cut as to whether CoRWM is stating fact or its opinion
- 2- The text generates a number of topics which work up to a conclusion, but these then seem to get lost, and do not appear in the overall conclusions or executive summary.
- 3- A number of these conclusions are worthy of recommendations
- 4- I would like to see more opinion from CoRWM in a number of areas, to build on the factual material gathered.
- 5- In the sections entitled 'conclusions', many of the statements are really summaries of facts presented earlier, and are not actually conclusions.

Overall, I think that the considerable work undertaken could provide more conclusions and recommendations, even if some were at a lower level of importance. The report would then be more significant.

## Specific Comments on the Draft Report

Section	Comments
Executive Summary	<p>I would like to see several more conclusions and recommendations. They would follow from the body of the report (see later).</p> <p>There is an extra aspect to the problem of involving people who are not in the industry. It is not just a case of presenting material in a digestible form. Many of the topics in the industry are inter-related and require on-the-ground knowledge, so an outsider has a herculean task of assimilating all the relevant info to make an informed judgement. Consequently, even when such people are involved, they may not be able to fully contribute. I have been in this situation.</p>
1. Introduction and Background	OK
2. Conditioning and Packaging of Higher Activity Wastes	<p>Table 1. I think the right hand column is packages of <b>conditioned</b> waste. Need to clarify.</p> <p>2.4. I think that the regulators have a duty to help to make progress- not just to insert additional demands (like produce an RWMC). I would like to see this brought out as a conclusion/ recommendation.</p> <p>2.7/2.8 There could be reference to the TBuRDs. There is no overall independent check on the credibility of plans, the appropriateness of R&amp;D, the timescale to deliver, the priorities, the likelihood of a positive result, etc. This warrants a conclusion/recommendation.</p> <p>The limited or failed progress of recent years is glossed over. It could be used to strengthen the argument.</p> <p>No recommendations on Waste Packaging?</p>
3. Storage and Transport of Higher Activity Wastes	<p>3.2.1 For years, NII argued strongly against the Safestore approach- rather, they wanted demolition asap. This should be brought out and a CoRWM conclusion on the appropriateness of safestore inserted.</p> <p>3.2.2 Mention the key problem of maintaining control systems and software operable.</p> <p>3.9.1 None of the 4 'conclusions' is an actual conclusion. To me, they are summaries of fact. So what does CORWM itself conclude about the topic? What is recommended?</p>

Section	Comments
4. Management of Spent Fuels	4.5 Again, 'conclusions' 1, 2, 4 and 5 are hardly conclusions. What is the CORWM view? Recommendations?
5. Management of Plutonium, Uranium and Thorium	Again, short on conclusions/recommendations re the current status- and work needed.
6. Overall Conclusions and Proposed Recommendations	<p>I suggest that CoRWM considers whether it wants to make a conclusion and recommendation(s) in at least the following areas:-</p> <ol style="list-style-type: none"> <li>1- Impact of the long delays in providing a repository</li> <li>2- Impact of the 'controlling mind' factor and who is accountable</li> <li>3- Adequacy of funding, and competition with daily demands</li> <li>4- Adequacy of progress in many areas</li> <li>5- Suitability of programmes</li> <li>6- Role of regulator in making progress</li> <li>7- Improvements to NWRF and HA wastes strategy group</li> <li>8- Adequacy of alternatives to cement grouting</li> <li>9- Improvements needed to LOC process?</li> <li>10- Arrangements to remove and examine packages/remediate.</li> <li>11- Scrutiny of future programmes/R&amp;D, etc</li> <li>12- Impact of deferring decisions e.g. the RCF, LoCs, Regulatory Consents, etc</li> <li>13- Support for safestore</li> <li>14- Adequacy of safety of current storage arrangements</li> <li>15- The last line of 3.7 needs to be clarified and brought to conclusions/recommendations</li> <li>16- The adequacy of the MOP 8 contingency approach</li> <li>17- The adequacy of the arrangements for AGR fuel storage.</li> <li>18- The adequacy of PWR fuel storage arrangements</li> <li>19- What should be done with exotic fuels</li> <li>20- The adequacy of the U and Pu storage</li> <li>21- The adequacy of the Pu strategy</li> <li>22- The status of the tails conversion strategy</li> <li>23- The adequacy of the uranium strategy</li> <li>24- Ground contamination (Arisings/treatments/disposal, etc. At least log that there is an issue which is inter-related with whatever view is taken of the ultimate state of a site)</li> <li>25- The availability of essential skills</li> </ol> <p>Nearly all of these topics are mentioned in the body of the</p>

Section	Comments
	report, but either conclusions or recommendations are not worked up; or they are not transferred to the conclusions and recommendations sections.
7. References	OK
8. Glossary and Acronyms	OK

### Other Comments

*Please enter here any other comments on CoRWM's work on the topics covered in this report*

The way that the output from CoRWM's R&D report is fed into this one needs clarity.

The existing recommendations are very high-level. Having gone to the considerable trouble of unearthing the basic material, you could extract more value from it. I think that the discussion needs to be extended in some areas; then the conclusions and recommendations could be systematically documented. I realise that this would give more detail, and issues of lesser significance, but I think that it would be really worthwhile.

## **Response from NII**

### **GENERAL COMMENTS**

1. In places the report gives the impression that certain options being considered by SLCs are firm strategies, whereas in practice these are not fully underpinned and have not been agreed by the regulators. Some examples are given in the detailed comments.
2. The report states that delaying decommissioning, particularly for reactors, will avoid the need for interim stores as waste can be sent directly to the GDF. It should be noted that the deferral strategy has not been through the NDA SMS procedure and ND has not assessed a safety case for reactor safestore.
3. We agree with the overall conclusion concerning joined up waste strategies or the UK overall, and not just for the NDA sites.
4. The report would benefit from a brief explanation of why raw waste is not covered in any detail.
5. The report should stress that the statements on store longevity (which are based on the NDA UK storage review report) are the views of the SLCs, that these have not yet been underpinned by detailed studies, and hence longevity has not yet been considered by the regulators.
6. The report could put more emphasis on store environmental conditions and inspection provisions.

### **DETAILED COMMENTS**

1. Page 4 last para. The regulators enforce relevant legislation, but do not directly enforce government policy.
2. Page 21 para 3.2.7 The report should make it clear that the arrangements for the management of ion exchange resins described in this section are BE proposals which do not yet have regulatory agreement.
3. Page 35 3rd para. Insert "hazardous" before hydrogen fluoride.
4. Page 29. Section 4 on fuels raises several issues associated with the various management options. This section should make it clear that the chosen option cannot be implemented until the regulators are satisfied with the safety case.
5. Page 12 para 1. The fact that there is no safety case yet developed for safestore should be mentioned.
6. Page 13 para 6. The statement is worded such that it infers that only storage as raw waste produces radioactive decay.
7. Page 14 para 2. It is suggested that the last sentence is reworded as follows: "...the current plan is to retrieval the wastes and restore as raw waste. This will enable characterisation and sorting to be carried out to reduce the significant unknowns associated with the current store and the materials within. Once this has been achieved a disposal method can be identified."

8. Page 17 para 4. Penultimate sentence should be amended to: "...best use of its resources for the good of the UK."
9. Page 17 para 5. The conclusions could include a statement on the need for a timely completion of the LoC reviews.
10. Page 18 para 2 The second sentence should read "Examples of the latter legacy waste..."
11. Page 18 para 6. A statement needs to be added that the deferral of decommissioning depends on a satisfactory safety case.
12. Page 19 Section 3.1.3. The statement that NDA has provided "full" information in its report is potentially misleading. The general comment on store longevity applies here.
13. Page 19 Section 3.1.3 The section should point out that the adequacy of inspection arrangements is variable and some do not meet modern standards.
14. Page 19 Table 2. Clarification should be included that these are solid waste stores (noting that the definition of HAW includes liquid wastes).
15. Page 20. Para 3. The phrase "...control contamination spread..." should be amended to "minimise contamination spread..." The report could also mention that the main safeguard against the spread of contamination is the containment of activity within the container.
16. Page 21 Para 4. This section should make it clear that much more work is required to prove the acceptability of the mini-store concept and that there are a number of significant regulatory issues which have not yet been resolved.
17. Page 22 Section 3.3.1 We agree that storage should be considered as a system taking account of the waste form, container, store, etc. This is in accordance with international good practice and had been reflected in NII guidance for a number of years.
18. Page 22 3rd para. This section appears to prejudge the acceptability of mini-stores for application in the UK.
19. Page 23 para 1. As well as contingencies concerning the GDF availability, contingencies may need to be explored in other areas such as inability to implement safestore or dry storage.
20. Page 24 para 5. This should be reworded as follows: "Regulators have highlighted that more attention should be paid to controlling the store atmosphere."
21. Page 26, Section 3.6. There are important issues raised in this section which merit inclusion in the conclusions section. In addition the statements on fuel transport in the first paragraph omit MoD fuel.
22. Page 26, para 6. This could point out that there is not yet a detailed programme for the development of the strategy, but it is under production.
23. Page 28 para 3. We agree that there is a need for coordination between the various waste producers, however we do not agree that this coordination role should be led by the regulators.
24. Page 29 para 2 3rd line. Change "storing" to "holding."

25. Page 29 para 6. This should stress that significant R&D is required to substantiate the drying option for application in the UK.

26. Page 29 paras 5 and 6. This should stress that significant R&D will be required to substantiate dry storage.

## Annex B – Appendix to Dr Rachel Western’s Response to CoRWM Consultation

### Dr Rachel Western’s Response to NDA Draft Business Plan 2009/12

*Dr Western is a Nuclear Researcher for Friends of the Earth, West Cumbria and North Lakes, and also a member of ‘Nuclear Waste Advisory Associates’.*

*Her academic background is in the science and policy issues associated with nuclear waste management; and she has worked for the nuclear waste agency (Nirex), and also for Friends of the Earth (HQ).*

#### THE DEFINITION OF DECOMMISSIONING

**“DISMANTLING A CLOSED DOWN NUCLEAR FACILITY AND REMOVAL OF ITS CONTENTS, BOTH RADIOACTIVE AND NON-RADIOACTIVE, IS KNOWN AS DECOMMISSIONING. THE KEY OBJECTIVE IN DECOMMISSIONING A NUCLEAR FACILITY IS PROGRESSIVELY TO REMOVE THE HAZARD WITHIN AN OVERALL FRAMEWORK THAT ENSURES THE SAFETY OF WORKERS AND THE PUBLIC, AND PROTECTS THE ENVIRONMENT.” [PARA 3.15 (PAGE 26)] (EMPHASIS ADDED)**

#### SOURCE:

**“MANAGING RADIOACTIVE WASTE SAFELY - PROPOSALS FOR DEVELOPING A POLICY FOR MANAGING SOLID RADIOACTIVE WASTE IN THE UK”**

SEPTEMBER 2001 (DEFRA)

This is the DEFRA Consultation document that initiated the ‘MRWS Process’

thus,

*“In this paper, the UK Government and the Devolved Administrations for Scotland, Wales and Northern Ireland are launching a national debate which will lead up to that decision, and beyond it. The aim is to develop, and implement, a UK nuclear waste management programme which **inspires public support and confidence.**” [para 4 (page 7)] (Emphasis Added)*

#### **Introduction**

In January 2009, eight years on from DEFRA’s (September 2001) launch of the ‘Managing Radioactive Waste Safely (MRWS) Process’, the Government’s radioactive waste management programme is in crisis. The body responsible for the programme: ‘*The Nuclear Decommissioning Authority*’ (the NDA) – actually chemically treats the radioactive waste nuclear fuel that is removed from nuclear reactors, such that the hazard that it presents is drastically increased. Not only does this present a risk to the general public – it also results in quite unnecessary demands on the Public Purse.

The primary objective set out in the NDA’s (2009 – 2010) Draft Business Plan is as follows:

*“to deliver value for money through:*

*a reduction of the risk associated with high hazards and ensuring radioactive waste continues to be put in a passively safe form”*<sup>13</sup>

This is the direct reverse of how the NDA actually functions. The situation is of such concern to the regulators, that they have pointed out that the NDA’s main site (Sellafield) is effectively breaking the Law.<sup>14</sup>

Although in the Business Plan, an objective of achieving savings of £240 million over three years is set out,<sup>15</sup> it is not at all clear how this can be achieved.

For example on 22<sup>nd</sup> January 2009, the NII stated that:

*“The NII has [indeed] written to the NDA [on 26 September 2008] regarding delays in funding decisions for key strategic projects involving the future replacement of Sellafield Highly Active Storage Tanks and associated evaporators, and requesting urgent explanations, justifications and plans for recovery of the situation.”*<sup>16</sup>

The NII go on to say that :

*“[t]he NDA has since provided the funding necessary to allow the relevant projects to progress at the necessary pace”*

However, it is hard to see how this can be the case given that the July 2008 NII Newsletter (pp 15 – 17) indicates that of the order of five additional HLW storage/treatment units are required. Each individual unit has a cost of the order of several hundred millions pounds.<sup>17</sup>

### **The Military Origins of the Sellafield Site**

The techniques applied to spent fuel waste management at the Sellafield site have changed little since the military origins of the site. Sellafield was first set up immediately following the Second World War to provide plutonium for nuclear weapons. In order to achieve this a chemical extraction process was developed.

Thus at Sellafield spent nuclear fuel rods are dissolved in hot nitric acid and then subjected to a ‘solvent extraction’ process to separate the uranium and the plutonium, and concentrate the intensely radioactive ‘fission products’ in the nitric acid.

When the decision to subject nuclear fuel rods from the non-military nuclear power stations was made it was confidently argued that the fission product stream could readily be turned into glass (vitrified) – and also that the plutonium and uranium product streams would prove to be a valuable resource.

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<sup>13</sup> NDA Draft Business Plan (2009-2012) page 8

<sup>14</sup> Sellafield Quarterly Report for 1 July 2008 – 30 September 2008

<http://www.hse.gov.uk/nuclear/llc/2008/sellafield3.htm>

<sup>15</sup> NDA Draft Business Plan (2009 – 2012) [Published November 2008] page 26

<sup>16</sup> Letter from Mike Weightman (HM Chief Inspector of Nuclear Installations and Director, Nuclear Directorate – Health and Safety Executive) to Dr Rachel Western (22<sup>nd</sup> January 2009)

<sup>17</sup> “MULTI-MILLION POUND BILL FOR SELLAFIELD” BY ALAN IRVING (WHITEHAVEN NEWS) WEDNESDAY, 08 OCTOBER 2008

<http://www.whitehaven-news.co.uk/news/1.251885>

However, in fact it has proven to be very difficult to achieve the vitrification of the nitric acid/HLW stream, and also – rather than bringing in funds, the reprocessed uranium and separated plutonium stocks are going to require funds in order to develop a long term approach to their management.

### **THE PRESENT CRISIS**

The nuclear industry is presently facing a financial and safety crisis. In Autumn 2008 the Nuclear Installations Inspectorate reported <sup>18</sup> that:

*“Funding continues to impacting [sic] on the delivery of projects on the [Sellafield] site and NII is keen to ensure major hazard and risk reduction projects are progressed in a timely manner. ...*

*we have recently written to Sellafield Ltd stating that protracted delays are unacceptable and that failure to meet the requirements of the Specifications is **an offence under law.**”* <sup>19</sup> (Emphasis added)

### **Funding Problems**

On the 8<sup>th</sup> October 2008 the Whitehaven News reported:

*“Both the NII and the Environment Agency have expressed concern that funding shortfalls” for the operation of Sellafield could undermine regulatory standards.*

*Evaporator D has been described as “politically sensitive” at a time of escalating costs.”* <sup>20</sup>

This funding issue was referred to extensively in the July 2008 issue of the Nuclear Installations Inspectorate Newsletter. For example:

*“Funding constraints are restricting the licensee’s ability to deliver major projects and safety improvements on the site”* (page 11)

*“Sellafield Limited has now shared the content of Lifetime Plan 2008 (LTP08) with us and it does indicate a significant shortfall in funding between the costs of the in-year programme of work identified by the licensee for the Sellafield site and the level of funding available from NDA.”* (page 12)

Despite this short-fall in funding for safety projects – the NDA are actually projecting to achieve savings over the next three years. <sup>21</sup>

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<sup>18</sup> (The most recent on the web – as of 15<sup>th</sup> January 2008)

<sup>19</sup> Sellafield Quarterly Report for 1 July 2008 – 30 September 2008  
<http://www.hse.gov.uk/nuclear/llc/2008/sellafield3.htm>

<sup>20</sup> *MULTI-MILLION POUND BILL FOR SELLAFIELD BY ALAN IRVING, WHITEHAVEN NEWS, WEDNESDAY, 08 OCTOBER 2008* [HTTP://WWW.WHITEHAVEN-NEWS.CO.UK/NEWS/1.251885](http://www.whitehaven-news.co.uk/news/1.251885)

<sup>21</sup> NDA Draft Business Plan 2009 – 2012 (page 26)  
<http://www.nda.gov.uk/documents/loader.cfm?url=/commonspot/security/getfile.cfm&pageid=25403>

## The Hazard Presented by Liquid High Level Wastes

A significant contribution to the hazard presented by the Sellafield site arises from the liquid wastes – thus in a June 2006 an NDA (Nuclear Decommissioning Authority) document on ‘Radiological Hazard Potential’, the NDA Engineering Directorate<sup>22</sup> wrote:

*“Materials which are liquids or gases could all escape if all storage protection was removed”* (page 6)

In the year 2000, British Nuclear Fuels (BNFL) estimated that the likelihood of a plane crashing into the liquid high level waste tanks on the Sellafield site was:

one in 100 million a year.<sup>23</sup>

In the following year, the 9/11 plane crash took place – and thus BNFL’s one in a 100 million estimate of a plane crash is demonstrably far too low. However, given that BNFL had argued that the risk of such a plane crash was so low, they had not designed the tanks that hold the liquid high level wastes to be able to withstand aircraft impact.<sup>24</sup>

Thus – if there were to be a 9/11 at Sellafield the radioactive contents of the tanks would be released.

Some idea of the possible implications of such an event may be obtained from the evidence which Gordon Thompson, (an American nuclear expert) submitted to the House of Commons Defence Select Committee in January 2002 – just four months after 9/11.

His evidence was entitled: <sup>25</sup>

*“Civilian Nuclear Facilities as Weapons for an Enemy”*

and it stated that:

*“At present, the [liquid high level waste] tanks contain about 1,550 cubic metres of liquid HLW. The radioactive isotopes in this liquid include:*

*about **8 million** TBq (2,400 kilograms) of caesium-137*

*For comparison,*

*the 1986 Chernobyl reactor accident released to the atmosphere about **90,000** TBq (27 kilograms) of caesium-137, representing 40 percent of the inventory of caesium-137 in the reactor core. Most of the offsite radiation exposure from the Chernobyl accident can be attributed to caesium-137, which has a half-life of 30 years. (page 2)*

(a TBq is a unit of radioactivity)

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<sup>22</sup> Nuclear Decommissioning Authority “The “Radiological Hazard Potential” - Helping to make sense of cleaning up the UK’s nuclear sites” [Engineering Directorate Document No: EGR003 Revision: Rev 1] 13th June 2006

<sup>23</sup> ‘Assessing the risk of terrorist attacks on nuclear facilities’ Parliamentary Office of Science and Technology Report - Report 222, July 2004 (page 79)

<sup>24</sup> POST (2004) page 79.

<sup>25</sup> [http://www.irss-usa.org/pages/documents/UKDefCttee01\\_02\\_000.pdf](http://www.irss-usa.org/pages/documents/UKDefCttee01_02_000.pdf), p2

Separately, estimates have been made of the impact of such an incident. These estimates vary – but some commentators have reported that following such an attack on the Liquid High Level Waste tanks it may be necessary to evacuate between areas as far apart as Glasgow and Liverpool.<sup>26</sup>

In terms of the number of possible fatalities, some indication may be given by the STOA Report,<sup>27</sup> (August 2001). On page 38, this report considers a possible ‘atmospheric release’ from the Sellafield liquid high level waste tanks of ‘3.5 million TBq of caesium-137’. It calculates that this could result in a ‘collective dose’ over the affected population of 47 million person Sv.<sup>28</sup>

According to the Health Protection Agency, the International Commission of Radiological Protection (the ICRP) has recommended an overall total cancer risk coefficient of 5% per Sievert.<sup>29-30</sup>

Thus, the number of fatalities that may be expected from such a release would be:

$$47,000,000 \times 0.05 = 2,350,000$$

or - approximately two million fatalities.

### **Technical Problems with the HLW Treatment Facilities**

There are three main facets of the high level waste treatment facilities on the Sellafield complex.:

- the Evaporators,
- the Storage Tanks, and
- the Vitrification Lines.

The July 2008 edition of the Nuclear Installations Inspectorate Newsletter (which is the most recent that is on the web<sup>31</sup>) indicates that there are problems associated with each of these three aspects of the high level liquid waste treatment facilities

#### The Evaporators

Sellafield already has three evaporators (A, B and C). In addition to the planned Evaporator D “*Sellafield Limited is also considering the need for further evaporative capacity (Evaporator E)*” (page 17)

#### The Storage Tanks

“*Recent HAST [Highly Active Storage Tanks] cooling coil failure rates and, specifically, the location of recent failed coils has led to uncertainties over the*

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<sup>26</sup> POST (2004) page 81

<sup>27</sup> “STOA Study Project” on the “Possible Toxic Effects from the Nuclear Reprocessing Plants at Sellafield (UK) and Cap de la Hague (France)” Mycle Schneider et al  
Commissioned by the European Parliament, Directory General for Research  
Scientific and Technological Option Assessment (STOA) Programme  
Contract No EP/IV/A/STOA/2000/17/0 - Final Report - August 2001

<sup>28</sup> Sv – stands for ‘Sievert’ – which is the unit used for the health effects of radiation,

<sup>29</sup> E-mail from Shelly Mobbs (Health Protection Agency) to Rachel Western - 26 Nov 2008

<sup>30</sup> see also e-mail from Ian Fairlie (Consultant on Radioactivity in the Environment) to Rachel Western - 24<sup>th</sup> January 2009

<sup>31</sup> <http://www.hse.gov.uk/nuclear/newsletters.htm> states that - the November (2008) Newsletter is to be published “soon” – previously it was stated that this Newsletter would be published in January 2009.

*ability of the newer HASTs to continue to service the needs of the HAL stocks strategy.*

***“Replacement HASTs should be progressed with the utmost urgency. We are currently awaiting the submission of Sellafield Limited’s document on their strategy for the safe storage of HAL [High Active Liquor]”*** (Emphasis Added) (page 16)

### Vitrification Lines

*“Currently (end of May 2008) all three vitrification lines are shut down. Line 1 suffered a plant malfunction in February 2008 which resulted in the need to undertake significant repair work: planned work will be undertaken coincidentally with the result that Line 1 is expected to return to HAL feed in late summer 2008. Lines 2 and 3 have operated fairly consistently in recent weeks though both are currently undergoing outages. WVP also suffered a shut down of operations caused by the loss of site steam supplies.”* (page 17)

From this information it is possible to estimate that approximately five new ‘HLW treatment units’ are required . (Evaporator D + E, Tanks (plural), plus the need for additional vitrification facilities – given the technical problems with the current facilities.)

Given that Evaporator D is expected to cost of the order of several hundred million pounds, it is possible that an additional £1 billion needs to be spent at Sellafield to address the liquid HLW problem.

Given the possible implications of a serious incident release from the Sellafield Liquid HLW tanks it is imperative that the money is found to address these problems. Furthermore, reprocessing should be terminated – in order to prevent the creation of additional HLW liquor.

### **The Threat Presented by Separated Plutonium**

Spent fuel rods can only be handled remotely, due to the very intense radiation field, which makes its diversion or theft a rather unrealistic scenario.<sup>32</sup> However separated plutonium can be handled without radiation shielding – which means that expensive measures are required to ensure that it is not stolen by anyone who may wish us harm.

Although plutonium is dangerous if taken into the body by inhalation or ingestion it does not require remote handling.

Despite the fact that there is no economic value for the separated plutonium (rather it has an associated cost) the UK has built up stocks of 100 tonnes.<sup>33</sup> Although this plutonium originates from ‘civil’ nuclear power stations – rather than reactors specifically designed to create military plutonium – there is no question of the fact that it could be used to make a weapon.<sup>34</sup> Frank Barnaby, writing for the Oxford Research Group, cites a figure of 13 kilograms, as the amount of ‘reactor-grade’ plutonium required to make a nuclear weapon.<sup>35</sup>

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<sup>32</sup> “Global Fissile Material Report 2007” International Panel on Fissile Material, page 117

<sup>33</sup> “Uranium and Plutonium: Macro-Economic Study” NDA Final Report (June 2007) page 2

<sup>34</sup> “Managing Plutonium in Britain: Current Options” – Oxford Research Group ‘Current Decisions Report’ Number 21 (September 1998) pp 9-11 “Will Mixed-Oxide (MOX) Fuel Make it Easier to Acquire Nuclear Weapons?” Frank Barnaby

<sup>35</sup>[See above (PP 10,11) – Frank Barnaby cites: ” Reactor-Grade Plutonium’s Explosive Properties” Mark, J. Carson. - Nuclear Control Institute., Washington D C (August 1990)]

Given that there are 1000 kilograms in 1 tonne, 100 tonnes of plutonium is sufficient for approximately

7,500 (weapons)

### **Uranium and Plutonium Stockpiles now Recognised as a Liability**

At the initiation of the both the Magnox and also the AGR reprocessing projects (B205 and THORP) it was felt that the uranium and plutonium products would prove to be financial assets; however, as is shown below – this has not proven to be the case.

#### Reprocessed Uranium

In addition to the plutonium product, another waste stream that arises from reprocessing is 'RepU' – or reprocessed uranium. Historically, it was argued that this product would be reused to manufacture nuclear fuel rods. However, CoRWM stated in its January 2009 draft document on research into radioactive waste management options, that the NDA currently has research and development in progress concerning the 'immobilisation' options for separated uranium.<sup>36</sup>

This indicates that the nuclear industry no longer see reprocessed uranium as a valuable resource – rather they see it as a liability.

#### Separated Plutonium

The NDA reported to CoRWM in August 2008 that plutonium is a liability because whichever management option is adopted it will cost money.<sup>37, 38</sup> One option being mooted for the management of the separated plutonium stocks is that it should be used to manufacture nuclear fuel rods.

Such plutonium-based fuel rods are known as 'mixed oxide' fuels or 'MOX'. This is because such fuel rods are based on mixing plutonium oxide with uranium oxide. However, the present 'Sellafield MOX Plant' (SMP) works to a capacity of just 2-3 % of its design capacity.<sup>39</sup>

The NDA have reported that the market for MOX is limited. A rationale for MOX use may be to 'reduce the plutonium liability'. It is important to note that the NDA go on to say (in a meeting with CoRWM) that 'an incentive to users might be needed'.<sup>40</sup> Thus it may be seen that – as is the case with reprocessed uranium, the plutonium product of reprocessing is a liability, rather than a resource with a value.

In December 2008, the NDA sent a document to Government concerning plutonium.<sup>41</sup> However, the regulators were concerned that 'safety and security were not addressed enough'<sup>42</sup> in the document. Furthermore, the regulators did not see why the NDA plutonium document had to go to Government so soon – especially if it did not take sufficient account of stakeholders views.<sup>43</sup>

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<sup>36</sup> CoRWM [1] page 28 (para 5.8)

<sup>37</sup> CoRWM [3] page 2 (para 11)

<sup>38,38</sup> Plutonium is also a liability in the sense that pursuing any management option would entail risks – such as worker dose. CoRWM [3] page (para 11)

<sup>39</sup> CoRWM [3] page 3 (para 13)

<sup>40</sup> CoRWM [3] page 3 (para 13)

<sup>41</sup> CoRWM [2] page 5 (para 25)

<sup>42</sup> CoRWM [2] page 5 (para 26)

<sup>43</sup> CoRWM [2] page 5 (para 27)

CoRWM stated in January 2009 that two years more research was required before a decision could be made between the different plutonium options.<sup>44</sup>

### **Failure of Reprocessing as a Waste Management Technique**

It is often argued that reprocessing should continue as it is the optimal waste management approach for spent fuel. However, apart from the fact that reprocessing actually serves to increase the difficulties associated with radioactive waste; the reprocessing facilities (B205 for Magnox and 'THORP' for AGR fuel) have exhibited severe technical limitations. As a result – for both fuel types - it is envisaged that a 'dry storage' route will need to be adopted

#### Magnox Spent Fuel

The NDA claim<sup>45</sup> that Magnox reprocessing is the only 'proven' technology for the management of Magnox fuels. However, this statement does not address the fact that reprocessing only serves as an interim approach – generating wastes streams (in particular liquid HLW + plutonium) that have proven to be very problematic to deal with – and which currently present a number of unresolved issues.

The Environment Agency have pointed out that the cessation of Magnox reprocessing would be good for the environment because of the reduction of discharges that would result.<sup>46</sup> In particular, the Environment Agency have pointed out that the continued operation of the Magnox reprocessing facilities has implications for the UK Discharge Strategy.<sup>47</sup>

At present, considerable effort and resource is being put into keeping the Magnox reprocessing facilities in operation.<sup>48</sup> Even with this expenditure the regulators have pointed out that it will not be possible to reprocess the entire Magnox fuel inventory (due to the advanced corrosion of fuel in the 'Legacy Ponds').<sup>49</sup>

As an alternative to Magnox reprocessing – the regulators would consider an interim option of 'in-reactor' storage – prior to the development of purpose built dry storage facilities.<sup>50</sup>

#### AGR Fuel

The NII reported to CoRWM in December 2008 that the AGR position was 'less satisfactory' than Magnox.<sup>51</sup> Contingency strategies were needed and one of them would almost certainly involve dry storage.<sup>52</sup> Similarly, the NDA reported to CoRWM in August 2008 that 'it was clear that dry storage facilities would have to be developed at Sellafield.'<sup>53</sup>

The Environment Agency reported to CoRWM in December 2008 that the regulators had been pressing for an oxide fuel strategy 'for years'.<sup>54</sup> The AGR inventory is divided into a proportion that is contracted for reprocessing, and the remainder that the NDA can manage 'as they see fit'.<sup>55</sup>

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<sup>44</sup> CoRWM [1] page 27 (para 5.7)

<sup>45</sup> CoRWM [3] (See 'CoRWM Reference List at Back of Document – for full details of the CoRWM References) – page 3 (para 16)

<sup>46</sup> CoRWM [2 ] – page 2 (para 11)

<sup>47</sup> CoRWM [2] – page 2 (para 8)

<sup>48</sup> CoRWM [1] – page 22 (para 5.6.1)

<sup>49</sup> CoRWM [2] – page 2 (para 12)

<sup>50</sup> CoRWM [2] page 2 (para 9)

<sup>51</sup> CoRWM [2] page 3 (para 15)

<sup>52</sup> CoRWM [2] page 3 (para 15)

<sup>53</sup> CoRWM [3] page 3 (para 17)

<sup>54</sup> CoRWM [2] page 3 (para 16)

<sup>55</sup> CoRWM [1] – page 24 (para 5.6.2)

## **Benefits of a Cessation of Reprocessing**

If reprocessing were to cease:

- it would also prevent further conversion of spent fuel rods into the particularly hazardous radioactive waste streams 'Liquid HLW' and the raw nuclear weapons material separated plutonium
- the aerial and liquid radioactive waste discharges that arise as a result of reprocessing would cease.
- the additional creation of the bulk ILW and LLW streams (both solid and liquid) created by reprocessing would also come to an end.

## **Conclusion**

It has been shown in this paper that the Nuclear Decommissioning Authority is failing in its remit. ie

***Rather than serving to reduce the hazard associated with nuclear waste***

–

***instead the NDA treats the wastes in such a way that the hazard is increased***

Ironically – given that the NDA is supposed to be business minded – its approach to radioactive waste management only serves to increase the associated costs.

This paper has outlined a number of problematic areas facing the NDA where high costs seem certain to arise.

Appendix Two, (which is concerned with the reliability of the NDA's calculation of the risks that would be associated with radioactive waste burial ) sets out additional areas where high levels of future expense seems likely.

In terms of a detailed commentary on the Draft Business Plan – this has not been possible as the figures are not sufficiently apportioned.

However – the document does allow one to conclude that the NDA does not have the self – awareness to be cognizant of its actual working practices – and their implication for hazard and cost.

Nor does it seem to have any sense of responsibility to the taxpayer to avoid unnecessary costs.

## CoRWM References

### **CoRWM [1] on Storage and Management Research – Draft doc (Jan 2009)**

CoRWM 'Working Group C' – "*Report on Research and Development for Conditioning, Packaging and Interim Storage of Radioactive Wastes and the Management of Spent Fuels, Plutonium and Uranium*" DRAFT  
Document Number: 2389 (19<sup>th</sup> January 2009)

### **CoRWM [2] (NII + EA) – [Re: SF + Pu + U Management] (Dec 2008)**

CoRWM Meeting with HSE and the Environment Agency on Management of Spent Fuels, Plutonium and Uranium  
Document Number 2520 (9<sup>th</sup> December 2008)

### **CoRWM [3] NDA - [Re: SF + Pu + U Management] – (Aug 2008)**

CoRWM - Meeting with NDA – Re: Management of Plutonium, Uranium & Spent Fuels  
Document Number: 2418 (8<sup>th</sup> August 2008)

## APPENDIX ONE

### The Complexity of the Chemistry of Radioactive Waste

Within a nuclear reactor uranium is exposed to small particles called 'neutrons'. As a result:

- it may either take up the neutron and turn into the nuclear weapons material plutonium,
- or split in two and form 'fission products'.

In addition to these two processes the materials used to build the reactor can also take up neutrons (and form radioactive 'activation products')

The result of these three processes is that atomic nuclei are synthesised that possess more neutrons than are found in the natural form. As a result they are unstable and release 'radioactivity' (alpha, beta or gamma rays). Such radioactivity can cause genetic damage. which may result in a fatality.

The initial fission products comprise the chemical elements zinc to dysprosium, in addition there are heavy elements of the 'actinide' series (such as plutonium and neptunium). Of course the radionuclides (radioactive atoms) do not exist in isolation – they will be bonded to other chemical element to form a large variety of chemical compounds.

The Sellafield nuclear complex was constructed in the immediate post-war period in order to extract plutonium from spent nuclear fuel rods. It achieves this using a solvent extraction process where a combination of water based and oil based solvents are used.

Due to the large number of cycles that the process undergoes there are a very large number of waste streams (including solid, liquid and gaseous forms) produced. Within these the various radioactive elements are dispersed in an extremely large number of ways.

## APPENDIX TWO

### Problems Facing the Burial Plan

There are many problems facing the proposed waste burial programme. This document looks at just three; the 'Expansive Fracturing' problem, the Leaching problem, and the Gas problem.

#### Expansive Fracturing

Due to the need to hold wastes in a solid form the nuclear industry began a waste cementation programme. However the programme was rushed into, with an inadequate analysis of the best approach to take. This has led to the cementing up of metals that are due to expand due to the chemical reaction conditions. It has been estimated that in 150 years there may be '*expansive fracturing*'.<sup>56</sup> 17,000 waste drums are affected. The radioactivity in the drums will be dangerous for periods of hundred of thousands of years – and the fact that the nuclear industry's approach to containing the wastes has been shown to be flawed in such a fundamental way is of concern.

#### The Leaching Problem

In addition to this problem, in March 2007, British Nuclear Group pointed to the need to investigate:

*"low-leach wasteforms"*<sup>57</sup>

... noting that 'leach-rate' might become a key criterion for the assessment of whether burial would be safe. The term 'leach-rate' refers to the capacity of a solid to release contaminants as water soaks through it. British Nuclear Group reported that a key out-product of its research programme was a study of potential alternatives to current materials used to solidify the wastes to include: leachability, and the extent of the scope for chemical reaction with the radionuclides. This issue remains unresolved.

#### The Gas Issue

In addition to the release of radioactivity from a disposal facility via the contamination of the water supply system, it is possible that extremely high levels of radioactivity may be released in the form of contaminated gas.

Specifically, in November 2005, Nirex (now incorporated into the NDA) published their so-called '*Viability*' report. On page 57 of this report there is a 'Risk/Time' curve that presents the possibility of a peak 'Risk of Contracting a Fatal Cancer due to the Presence of a Disposal Facility' as potentially reaching a level as high as 'one in a thousand' (which is one thousand times greater the proposed 'one in a million' target that is generally quoted). This potential peak risk would occur within about fifty years of closure of the disposal facility (again this is a much different figure that the one million years that has been generally assumed).

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<sup>56</sup> "*The longevity of intermediate-level radioactive waste packages for geological disposal: A review*" [NWAT Report: NWAT/Nirex/06/003] Author: P K Abraitis [August 2008]page 25

<sup>57</sup> Extract Taken from British Nuclear Group March 2007 Sellafield R&D document Sellafield 2007/08 Lifetime Plan Technology Baselines and Underpinning Research & Development Site Introduction (35.0.09) Version 1 (March 2007) (pp 294 - 295)  
<http://www.sellafieldsites.com/UserFiles/File/publications/profiles/Unrestricted%20TBURD.pdf>

Clearly, these figures are unacceptable. Nirex stated:

*“If, through further work, the calculated rates and quantities of carbon-14 containing methane generated were not to be significantly reduced, compared with those used in the scoping calculation presented here, it could be necessary to establish **siting criteria** that would ensure that significant gaseous release to the biosphere would be unlikely.”*

.....

*“...further work is planned which **may include the identification of specific siting requirements**”*

(Emphasis Added)

(Source: Nirex ‘Viability Report’ November 2005 – Nirex Report N-122)

Clearly, if methane were to be a problem, the ‘site-selection’ criteria – would need to be:

- **Would Not Allow the Escape of Gas**

However, in contrast, the Section within the ‘Viability Report’ which addresses the ‘Gas Issue’ starts off with the Statement:

*“Post-closure performance assessments [Risk/Time Predictions] have consistently shown that **there would be no significant risk from overpressurisation due to gas generation for a repository in a hard fractured host rock** and no flammability hazard at the surface is expected to arise from gas generation.”* (page 55) (Emphasis Added)

Nirex was set up in 1982. In 1985/86 they carried out an initial review of their plans to bury nuclear waste. This immediately indicated the significance of the amount of hydrogen that would be produced by the underground corrosion of steel <sup>58</sup> – the issue being that due to the amount of steel that would be involved the quantity of hydrogen gas would be likely to be extremely large. This factor demanded that a gas release pathway had to be included in order to avoid an undue pressure build-up.

Thus, when the issue of hydrogen gas production is considered – the necessary site-selection criteria must be:

- **Would allow the escape of Gas**

It has not yet been worked out how a burial facility can at the same time an undue pressure build-up through the release of one type of gas, whilst at the same time avoiding a very high radioactivity dose through the retention of another type of gas.

The November 2008 Environment Agency report referred to this problem as follows:

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<sup>58</sup> Cooper MJ, Hodgkinson (ed) (1987). The Nirex Safety Assessment Research Programme: Annual Report for 1986/87. NSS/R101 Nirex. (page 113)

*“During site screening / selection the need to demonstrate that the geosphere will **retard or disperse** gas needs to be considered more than perhaps in the past.”*<sup>59</sup>  
(emphasis added)

The June 2008 White Paper ‘*Implementing Geological Disposal*’<sup>60</sup> makes no reference to the dilemma created by the gas issue. This indicates that the Nuclear Industry and the Geological Community simply have not factored it into their thinking. This means that their present ‘site –selection’ programme that is underway is going ahead despite the fact that neither the geological, or nuclear community know what sort of site would be appropriate for nuclear waste burial.

## **Conclusion**

It may be seen that, in addition to the additional financial pressures that will inevitably face the NDA, due the fact that the Sellafield site is in crisis, research costs for the long term burial programme are also certain to spiral out of control.

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<sup>59</sup> <sup>59</sup> Gas generation and migration from a deep geological repository for radioactive waste  
A review of Nirex/NDA’s work (Issue 1, November 2008.)

[http://publications.environment-agency.gov.uk/pdf/GEHO1108BOZN-E-E.pdf?lang=\\_e](http://publications.environment-agency.gov.uk/pdf/GEHO1108BOZN-E-E.pdf?lang=_e) (page 79)

<sup>60</sup> DEFRA (2008). Managing Radioactive Waste Safely: A Framework for Implementing Geological Disposal. June.

<http://www.defra.gov.uk/environment/radioactivity/mrws/index.htm> (page 74-75)