

# Internationalising the Back-End of the Nuclear Fuel Cycle

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**Abstract** – *The past five years have seen a continual growth in the interest of many national waste management programmes – especially those of small countries – in the concept of multinational or regional disposal facilities. What has often been seen as largely a concept with a European focus is now being considered in other regions, such as Central and South America. The prime drivers were originally the economic and political problems that might be lessened by being shared between countries facing the same challenges. The potential safety and safeguards benefits were also recognised at an early stage. Increasingly, however, – in particular after the terrorist attacks in the USA in 2001 and in connection with nuclear proliferation concerns – attention has focused also on the security advantages that could result. The most recent manifestation of this is the Global Nuclear Energy Partnership (GNEP) promoted currently by the US Government.*

*In its publications in this area and in recent statements of representatives of the IAEA, two potential routes to achieving international disposal have been described. One of these is the inclusion of disposal within a broader scheme of internationalised fuel-cycle services provision. The other, which does not require global strategic developments and agreements, is the partnering scenario, in which a number of most probably small countries agree to look for a common disposal solution involving one or two shared repositories. These should be sited in locations to be decided by the multinational participants in the same democratic, consensual approach that has been used by potential siting communities in the more successful national programmes. In both potential disposal approaches to multinational disposal, a turning point may well be reached in the next few years. The status and prospects for both are described in the paper.*

## I. INTRODUCTION

The past five years have seen a continual growth in the interest of many national waste management programmes – especially those of small countries – in the concept of multinational or regional disposal facilities. What has often been seen as largely a concept with a European focus is now being considered in other regions, such as Central and South America. The prime drivers were originally the economic and political problems that might be lessened by being shared between countries facing the same challenges. The potential safety and safeguards benefits were also recognised at this early stage. Increasingly – in particular after the terrorist attacks in the USA in 2001 and in connection with nuclear proliferation concerns – attention focused on the security advantages that could result. . The most recent manifestation of this is the Global Nuclear Energy Partnership (GNEP) promoted currently by the US Government. The IAEA, recently honoured with the Nobel Prize for its efforts to reduce nuclear risks, has not neglected to point out that these can also be important at the "back-end of the back-end" of the nuclear fuel cycle, i.e. not only in enrichment and reprocessing but also in storage and disposal, in particular of spent fuel.

In its publications in this area [1] and in recent statements of representatives of the IAEA, two potential routes to achieving international disposal have been described. One of these is the inclusion of disposal within a broader scheme of internationalised fuel-cycle services provision. The other, which does not require global strategic developments and agreements, is the partnering scenario, in which a number of most probably small countries agree to look for a common disposal solution involving one or two shared repositories. These should be sited in locations to be decided by the multinational participants in the same democratic, consensual approach that has been used by potential siting communities in the more successful national programmes.

The common major challenge in both these approaches to initiating multinational repositories is, of course, to find host countries. Too often, however, the current absence of clear volunteers to host waste repositories is asserted to mean that the international concept is not credible. This ignores the fact that, in all national disposal programmes, final identification of a disposal site is also a step that is taken only after a long preparatory process. Premature attempts to name sites before consensus has been reached on the fact that there is a common need to be fulfilled and on the proper process

to be followed have proven to be the cause of various well-documented failures.

In both potential disposal approaches to multinational disposal, significant progress is being made. This paper elaborates on the add-on approach, using the topical examples of Russia and the USA to illustrate potential benefits and problems. It then examines the partnering scenario, using experience gained in the SAPIERR project of the EC to indicate possible ways ahead.

## II. THE ADD-ON OPTION

### IIA New interest in Fuel Cycle Centres

A single country, or a network of countries with appropriate facilities working together, by providing extended fuel-cycle services to countries adhering to the NPT and wishing to use nuclear power, could limit the spread of those sensitive technologies that are allowed under the Treaty, namely enrichment, reprocessing and storage/disposal of fuel [2]. Crucial pre-requisites would be security of supply of services to all co-operating users (as emphasised by the Multilateral Approaches Group established by the IAEA [3] and close international monitoring by the IAEA. The whole concept has been raised again very recently by IAEA Director General, Mohammed ElBaradei [4, 5]. It is very topical because of the concerns with nations such as Iran expanding their nuclear capabilities to include fuel enrichment.

Although emphasis is on the front end of the fuel cycle, where most security concerns arise, back-end services would also be offered as part of this suite of provisions, either by countries establishing new, dedicated multinational storage and disposal facilities to fit into the scheme or by countries with existing facilities that could be extended for international use.

Within this international fuel cycle scheme, the fuel leasing component is certainly the closest to being an accepted practice. This is almost the practice followed by the former USSR with its satellite States. More recent global concerns about security have led to it being the universally preferred solution, if nuclear power plants are to be operated in countries such as Iran and North Korea. Recent proposals from the US Government have indicated its support for such a scheme. Should it come to pass, the gate will be opened for other large nuclear fuel suppliers to improve the attractiveness of their fuel services, while at the same time enhancing global security. Potential network partners in internationalising the fuel-cycle would all have to be NPT signatories and could clearly include the major suppliers of uranium or of fuel cycle services or of power reactors, i.e. the list includes countries such as Argentina, Australia, Canada, France, Japan, Russia, the UK and the USA.

### IIB Russian and USA Proposals

The most likely country to offer to act as host in this add-on scenario is recognised to be the Russian Federation. Support has been expressed at Government level. The law currently allows import of spent fuel for storage or for reprocessing with return of residues. However, there is solid support for expanding this service to include final acceptance of fuel or even high level radioactive wastes (and, it is acknowledged, also strong opposition). Moreover, once a first move is made, it is not impossible that competition could even arise. Supporters of hosting an international repository have spoken up in Kazakhstan and China in the past and recently again in Australia.

The central point of these suggestions is the proposal to utilise the Krasnoyarsk facility as an international store, and possibly a final repository, for spent fuel [6], although Krasnokamensk has also been suggested as a host site [7]. Under existing national legislation, Russia could import spent fuel for:

- long-term storage, with eventual return to the sender;
- storage, with regeneration of light water reactor fuel for re-use in new generation reactors, perhaps in Russia (thus possibly entailing no return requirement to the sender);
- storage, with reprocessing and return of some of the ensuing wastes to the sender.

All of these options are economically attractive for Russia since they provide either income from provision of services or fuel for the future, or both. However, at present, the law does not allow import for eventual disposal.

As has been recently pointed out [8], this would have to be changed and a number of other conditions would have to be fulfilled if a range of important international stakeholders are to be comfortable with what is offered and the conditions attached. There are complex political, societal and security issues at stake, as well as just the technical aspects of developing engineered facilities.

The recent GNEP proposal from the USA is primarily aimed at making the nuclear fuel cycle more secure. This should be achieved by restricting sensitive the processes of enrichment and reprocessing to a restricted number of trustworthy countries (or existing weapon States) that should then provide services to other countries wishing to use nuclear power for peaceful purposes. For this to be attractive to these customer countries, there must be sufficient incentives and the supply of services must be guaranteed. One incentive would be to have no HLW or spent fuel to be managed long-term and intimately disposed. This requires the fuel suppliers to take back the spent fuel – probably under a leasing arrangement – or for a third party, trustworthy country to offer storage and

disposal services. Proposals to host an “international nuclear waste dump” have, not unexpectedly, led to public and political opposition. However, offering a global service that enhances world security, and is for the host country both safe and profitable, maybe more acceptable.

Several pre-conditions must, nevertheless be assured. These include:

1. **There must be guarantees of long-term availability of the facilities for user countries.** The facilities, or others like them, need to be available over the period that wastes will be generated by a user country in order that all wastes for deep geological disposal can be exported – otherwise their national problems are not solved. This is a point taken very seriously by some of the Central and Eastern European countries that began a nuclear power programme under the assumption that spent fuel would be returned to the USSR, only to find this option later blocked.
2. **International support and recognition is essential.** The major nuclear nations and international agencies and associations (IAEA, OECD-NEA, WNA) should acknowledge that Russia wishes to provide a valuable international service that will enhance the global security and safety environment because all technical aspects of the project will be developed to the highest international standards. These organisations can help promote appropriate groups that cooperate to establish and guard the rights of the various parties to any waste transfer agreements.
3. **Active involvement of the IAEA** in establishing the project (and, later, in an oversight monitoring role), thus underwriting its overall credibility. The fact that the UN/IAEA must play a role in overseeing international fuel cycle initiatives in general is recognized widely and is a key issue in current discussions on supply of fuel by Russia to Iran.

A fundamental point is that purely unilateral initiatives (whether this be in Russia, the USA or elsewhere) will very probably not succeed – a proper multinational approach is absolutely essential. The time is now ripe for initiating such an approach by bringing the key players together in a free and open discussion to develop plans for how a specific project can be established – a project that addresses each requirement head-on. Although recent heightened security concerns worldwide have increased the urgency of making progress in this area. Progress is needed most urgently in controlling the technologies that easily provide fissile materials (enrichment and reprocessing). There is no very urgent need to move to implementation of an international repository; this process takes many years, even in a national context – however, the way must be prepared.

The immediate objective should be to produce an agreed set of requirements that an international repository must fulfil, a project plan that could lead over several years to the implementation of such a repository and a set of recommendations for specific actions by national and international organisations so that the first steps can be taken towards this implementation.

### III. THE PARTNERING APPROACH: SAPIERR EXAMPLE

The second option for implementing multinational repositories - partnering by smaller countries - has been particularly supported by the European Union through its promotion of the potential benefits of regional solution, i.e. facilities shared by contiguous or close Member States. For the “partnering” scenario, in which a group of usually smaller countries cooperate to move towards shared disposal facilities, exploratory studies have been performed most recently by the Arius Association, which also co-manages the European Commission SAPIERR project on regional repositories [9].

The Support Action: Pilot Initiative for European Regional Repositories (SAPIERR) project, finished at the end of 2005, after 2 years of work involving organisations from 14 different countries, is described in a companion paper at this conference. Currently (end of 2005) efforts are underway to initiate a follow-on SAPIERR-2 project (Strategic Action Plan for Implementation of European Regional Repositories – Stage 2). This would establish a dedicated multinational organisation that would develop the shared repository option in a staged process similar to that favoured by national programmes.

From the work to date in the SAPIERR project, the following top level conclusions can be drawn [10]:

- The potential benefits of multinational, regional repositories are recognized widely throughout the EU, as evidenced by the participation in SAPIERR of numerous organisations from 14 different countries in Europe.
- The most obvious benefits are in the economic area where shared repositories would lead to substantial reduction in expenditures throughout the Community. Even with the current rough estimates of disposal costs, it is apparent that savings of several billion Euros could be achieved or that the total costs may be reduced by about half.
- Many or most of the problems faced by regional repository initiatives are common to those to be tackled by national disposal programmes. In particular the task of siting the facility is, in both cases, challenging. Time must be allowed not only

for technical preparations but also for achieving the necessary degree of public and political consensus.

- If shared regional repositories are to be implemented, efforts must be increased already now. The optimal dates for implementation of shared facilities are around 2030 for an encapsulation plant and 2035 for the repository operation. Experience in national programmes show that the implied 3 decade lead time has been often necessary. If earlier implementation is the goal (as suggested in first drafts of the EC Waste Directive) then correspondingly greater efforts are required.
- Before greatly enlarging the scale of the work on regional repositories, a structured framework should be established. This can, in principle, be done by cooperation of individual Member States in the EU. However, start-up funding, organisational support and guidance by the Commission would greatly ease this process and bring forward the date at which a self-sufficient, joint undertaking type of organisation could be established.
- The EU countries with small nuclear power programmes, or only radioactive wastes from other sources, should continue their efforts within the EU to establish the shared regional repository concept as being no less valid, important or urgent than the purely national disposal projects being pursued in some Member States.

The partnering scenario sketched above is one of many possible variants. At the heart of a successful project lies the siting issue. However, this is a difficult problem even in national programmes – but this has not prevented local communities in some countries agreeing to host repositories. The MNA group of the IAEA [3] also recommends an initial cooperation phase, with participating countries working on a “Siteless Pilot Project” – which is, of course, the precise course taken by the European SAPIERR project.

The SAPIERR pilot study will be followed up by a SAPIERR-2 project that looks in more detail at the following topics: Multinational legal and business structures; Legal liabilities; Economics (costs, benefits); Safety and Security: Public and political attitudes. The objective is to develop in 2 -3 years a strategy and project plan for a regional repository programme.

#### IV CONCLUSIONS

Over the past 5 or so years, the advantages of – or even the necessity for – implementation of one or more multinational repositories has been recognized by an

increasing number of organizations. These include not only the waste management bodies in countries that do not have the means to implement national geological disposal or that appreciate the potential economies of scale. They include also international bodies which clearly see the safety and security benefits, as evidenced by numerous statements of the IAEA and the EC. The security aspects are most topical today because of increased concern over terrorism and over non-proliferation (real or latent) by States. Although these concerns are most immediate at the front end of the fuel cycle, the possible measures to alleviate them (international fuel supply or fuel leasing) lead unavoidably to discussion of the back end. Major national programmes such as that in the USA, which are considering directly supporting international efforts in this area [11], should ensure that the disposal issues are treated along with the front end aspects.

This brief overview of the possible approaches to multinational repositories indicates clearly that on both roads that could lead to a more rational use of such repositories, turning points lie close. Recent developments make ever more credible both scenarios – “add-on” involving foreign waste acceptance by a large nuclear programme and “partnering” involving cooperation of small national programmes. The taboo against multinational disposal is long since broken; projects run in cooperation between willing partners will run harmoniously in parallel with the national programmes that will most likely lead to the first safe and secure deep geological repositories for HLW and spent fuel.

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#### REFERENCES

- [1] IAEA (2004) *Developing and implementing multinational repositories: Infrastructural framework and scenarios of co-operation*, TECDOC 1413
- [2] Choi J.S., Isaacs T.H, *Toward a New Nuclear Regime*, Proceedings of ICAPP 2003, May 2003
- [3] IAEA (2005a) *Multilateral Approaches to the Nuclear Fuel Cycle*: Expert Group Report submitted to the Director General of the International Atomic Energy Agency, 22 February 2005
- [4] El Baradei M. (2003): *Towards a Safer World*, The Economist, 16<sup>th</sup> October 2003
- [5] El Baradei Nobel Lecture, Dec 2005, [http://www.iaea.org/NewsCenter/Statements/2005/eb\\_sp2005n020.html](http://www.iaea.org/NewsCenter/Statements/2005/eb_sp2005n020.html)

- [6] Rybalchenko I., Lebedev ., Safutin V., Shafrova N., *Russian Possibility of Using Russian Infrastructure for Solving Global Problems*, IHLWM Conference Las Vegas, May 2006
- [7] Laverov N.P., Velichkin V.I., Petrov V.A. (2004) *International Repository Project In Russia*, WM'04 Conference - 29 February - 4 March 2004, Tucson, Arizona
- [8] Chapman N., McCombie C., *What Will It Take To Develop An International Repository In Russia?*, Safety Barrier No 3-4, 2005, Radon Press Moscow
- [9] SAPIERR (2005) [www.sapierr.net](http://www.sapierr.net)
- [10] Chapman N., McCombie C., Stefula V., *Possible Options and Scenarios of Regional Disposal and Future RTD Recommendations conclusions* [www.sapierr.net](http://www.sapierr.net)
- [11] <http://www.gnep.energy.gov/>
- [12] McCombie C. and Chapman N, *Multinational and Regional Disposal Initiatives: Nearing a Turning Point*, Paper at 2006 International High-Level radioactive Waste Meeting, Las Vegas, May 2006