

Multinational and Regional Disposal Initiatives: Nearing a Turning Point

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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. 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 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, a turning point may well be reached in the next few years. Section II of this paper elaborates on the add-on approach, using the topical example of Russia to

illustrate potential benefits and problems. Section III 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: RUSSIAN EXAMPLE

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. The most likely country to offer to act as host in this latter 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.

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 statements 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 Proposals

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 we have 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.

What, then, will be needed to make such a facility feasible in Russia? In our opinion, some of the key requirements that the Krasnoyarsk or any other Russian proposal will have to meet, to have any realistic chance of success and international acceptance, are:

1. **The import of spent fuel for disposal, not just storage, should be permissible.** This means that a new law will be required in the Russian Federation to allow disposal of any fuel that is not to be, or cannot be, recycled (reprocessed or regenerated). A prime reason for this requirement is that most potential users of a Russian service would not wish to receive fuel back after interim storage. One of the key attractions of an international facility is that provisions for long-term storage and disposal do not have to be made in one's own country, thus avoiding the high costs of a national repository and also reducing many of the political and societal problems entailed in siting such facilities. A second reason is that this would allow accommodation with the United

States over the fate of US-flagged fuel. The third, very topical reason is that the international community will not wish spent fuel to be returned to States where continuing control of the fissile materials it contains could present problems.

2. **The services offered should include a final disposal option (geological repository) not only for spent fuel, but also for vitrified high-level wastes and other long-lived wastes.** For the reasons given above, a country wishing to divest itself of the requirement to build a geological repository for spent fuel will equally wish not to have to build one for returned reprocessing wastes or for its other long-lived wastes. Thus, Russia should be prepared to retain high level wastes resulting from Russian reprocessing of foreign spent fuel, to accept high level wastes that customer countries may already have received from other reprocessors and also to accept other long-lived wastes from customer countries. The service provided should be complete, so that countries can use it for all their wastes that will require deep disposal.
3. **Overall acceptability of the scheme to the international community is a necessity.** This applies in particular to the European Union and the United States – the former because disposal outside the EU is not a policy presently supported and the latter because of the issues with US-flagged materials. However, all nations and groups of nations that become involved will have to present the scheme's credentials to their own public and institutions with great commitment. Acceptability will depend upon the scheme being openly executed to the highest technical standards that are being developed internationally, using the most appropriate best available technology and being subject to international monitoring, as discussed further below. It will be possible to gain enough support for export only if the provider of a disposal service can demonstrate clearly that there will be no relaxation of standards.
4. **Clear economic advantages must result, both to the users and to Russia.** The scheme will obviously need to have benefits for both implementer and user. Economically, Russia stands to benefit substantially by being able to charge appropriate rates for a valuable service not currently available anywhere else, but only if the previous requirements are met. The approach to disbursement of parts of these funds to the host communities willing to accept this international responsibility needs to be clearly set out so that users are convinced of the equity of the scheme. There can also be other, less tangible benefits to Russia. Offering a service that enhances global security and helps small countries to meet

their waste management responsibilities can bring significant political advantages. The users should be prepared to pay for avoiding the problems and unpredictable costs of running their own national disposal programmes which can take decades and might never reach a successful conclusion. This means that disposal prices will be significant in absolute terms – but, because of the economies of scale in repository implementation, they may still be less than small nuclear countries would have to pay for a national repository option.

5. **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.

As noted in point 3, above, in order to get the necessary acceptance and international support, there are additional requirements on both the international community and the proponents of the Russian scheme:

6. **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.
7. **An open and transparent project management structure.** Information on the way that the scheme is managed, along with all its significant technical, societal and economic aspects, should be available to interested parties. Both national and international public and political communications need to be given high priority and the acceptability of the project to key stakeholders nationally and locally in Russia needs to be clear. Another example of major international services being provided by one or a few countries is in the reprocessing area, where the base load customers of French and UK reprocessors joined together in formal groups that require extensive access to information – for example, on the reprocessing facilities. A similar arrangement may be appropriate for disposal.

8. **Use of the best knowledge and expertise.** Both transparency and international standards will be achieved by ensuring the direct participation of the best technical experts, selected worldwide. This should be a truly international project, generating wide enthusiasm in the global scientific and technical community. Russia could take the initiative here by establishing credible advisory groups at the immediate outset of the project, including internationally recognized experts in the disposal area.
9. **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 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

IIIA A possible approach to partnering

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 following stages can be envisioned for a partnering scenario. It is interesting that they do not differ greatly from steps taken within a federally organised state to seek a national disposal solution.

Pilot feasibility studies: A sufficient number of interested national organisations cooperate to organise and fund pilot studies (such as the SAPIERR project, described below).

A formalised development consortium and dedicated Regional Repository Project Team To progress to the more detailed level of R&D needed, a structured project team must be created, staffed and funded at the appropriate level. A development organisation would act as an interim body, evaluating feasibility in depth, with a business organisation being established later, when there is a definitive proposal and clear prospects of achieving a solution.

Siting studies leading to candidate siting areas in different partner countries: The siting study is clearly the most sensitive work area. Optimally, it should involve working in parallel on a volunteering strategy and on a technical/societal study aimed at ranking options and keeping multiple options open.

Establishment of a Business Consortium or a Joint Venture: The purpose of this organisation is to organise and fund the characterisation of sites, to finalise agreements on the key issue of compensation for host communities and countries, to select a short list of preferred sites and to interact with political and regulatory bodies in the candidate countries.

Establish a construction and operation company: This is specific to the hosting country or countries with respect to legal structures, shared liabilities, funding mechanisms, etc

Repository operation: During the decades for which the repository will operate, the relationships between the partners can be of various types. Given the nature of the facility, international oversight by the IAEA will be a necessity (and the EC for a European repository).

Closure and post-closure: At some time in the far-future, the multinational repository will be closed and possibly monitored for some long time. As with the shared benefits, agreements for sharing liabilities must be agreed long before this final stage is reached.

IIIB The SAPIERR Project

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.

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 soon 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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