

# **Multinational disposal of radioactive wastes: from taboo topic to acknowledged necessity and business opportunity**

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## ***Industrialised countries need access to geological disposal facilities***

In the early decades of nuclear power, the concept of multinational fuel-cycle facilities was topical and studies were performed on regional and international spent fuel management. Up to the 1970s, the complete back-end of the nuclear fuel cycle was internationalised directly, with the UK, France and Russia all retaining the wastes produced by reprocessing fuel from other countries. Growing opposition, particularly within the UK and France, led to commercial reprocessors being compelled by their governments to require that radioactive wastes be returned to client countries, which were then faced with the challenging task of finding their own disposal solutions for HLW and reprocessing ILW.

From the 1980s onwards, the greatest challenges, technically, economically and societally, lay in implementing geological disposal facilities (GDFs). GDFs are recognised as the only feasible and safe solution for these wastes, but they are expensive (tens of billions of EUR), especially for countries with only small nuclear power programmes to generate the funds required. Non-nuclear power countries began to find themselves in the same position, as they accumulated long-lived radioactive wastes from medicine, industry or research, since these must also be disposed of in GDFs. Most technologically advanced industrialised countries now require access to a GDF for wastes that are in storage, even though quantities may be only a few tens of cubic metres.

## ***The prospect of shared GDFs was controversial***

There are large potential economies of scale in the costs of GDFs that could benefit countries if they shared a disposal facility. Although the potential advantages of shared repositories were recognised<sup>1</sup>, the concept of one country accepting wastes for disposal from another was strongly criticised by some national waste management programmes. Claims were made that any such proposals might seriously hinder these programmes by causing alarm among the public and politicians about the possible import of 'foreign' radioactive wastes, even when this was not permitted by national laws. In Europe in particular, the concept of regional repositories became highly controversial. Some advanced programmes advocated publicly that all discussion of this 'sensitive topic' should be stopped. It was argued that the prospect of shared solutions might have negative impacts on national endeavours, for political, strategic or ethical reasons. Most worries were related to the risk of local rejection of a national GDF.

Proponents of multinational initiatives felt these concerns were over-inflated or unjustified, and were surprised at some deliberate efforts to hinder progress with shared GDF plans. Of course, some concerns were understandable, e.g. the prospect of local opposition; possible reduced political or financial support for a national solution. But proponents considered that the fear of a country being compelled against its will to accept waste from other countries was unwarranted. There are firm commitments at global and European levels to the principle that this is not permissible. The concern that effort or attention might be diverted from a national programme was realistic, but the modest resource requirements of multinational

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<sup>1</sup> C. McCombie. 1999. Multinational Repositories: A Win-Win Disposal Strategy. European Nuclear Society, TOPSEAL-99, Antwerp.

initiatives in their early phases mean that a national programme could examine both options in parallel, as in the 'dual track' approach that is now being followed by several national programmes.

### ***Security benefits and the universal need for credible solutions***

In the last five years, the conflicting perceptions of multinational disposal concepts have largely been replaced by recognition that all countries could benefit from the economic, strategic and security benefits of shared solutions for long-lived wastes. This view spread more easily as leading programmes achieved their goal of successfully siting a GDF and as security concerns grew about widely distributed nuclear materials in countries that were not in a position to implement national disposal facilities on their own in any foreseeable future.

Every country with long-lived radioactive waste will be best served by having a credible policy and management programme, and a timetable for implementing it, and this will require a mix of both national and shared multinational projects. It is, indeed, important that the most advanced purely national programmes are not hindered, since demonstration that progress is being made is valuable for all waste disposal programmes. However, only when all countries have an independent programme, or are part of a transparent and credible shared programme, will fears, rational or otherwise, about imposition of unwanted wastes on unwilling countries cease to be of concern.

The IAEA acknowledges the potential benefits of multinational disposal and, at a legal level, the EU recognizes that this approach can be valuable for Member States in meeting their obligations under European Council Directives. Directive 2011/70/EURATOM observes that *"Some Member States consider that the sharing of facilities for spent fuel and radioactive waste management, including disposal facilities, is a potentially beneficial, safe and cost-effective option when based on an agreement between Member States concerned"*.

The significant change in outlook means that there are now so many active initiatives addressing the issue of multinational disposal that coordination of these efforts has itself become a challenge.

### ***Active developments at the IAEA***

In 2004, the IAEA summarised<sup>2</sup> early work on multinational concepts, going back to the 1970s. In 2005, at the request of the Director General, a high-level expert group produced a comprehensive report<sup>3</sup> on multilateral approaches to the nuclear fuel cycle, covering enrichment, reprocessing and disposal, with external support to the study being provided by Arius. Further reports followed, addressing the viability of multinational repositories<sup>4</sup> (2011) and discussing a staged approach for partnering in the implementation of such facilities (2015). The latter report<sup>5</sup> examines not only the benefits of multinational concepts but also all risks of a technical, financial, institutional or socio-political nature. The fact that the report took around three years to be cleared at higher levels in the IAEA indicates that the topic of multinational disposal is, nevertheless, still sensitive at the Agency. Currently, the INPRO (International Project on Innovative Nuclear Reactors and Fuel Cycles) section at the IAEA is starting a project aimed at studying drivers and impediments to multinational back-end cooperation and, starting from suggestions at the 2015 IAEA General Conference, a Topical Meeting is being prepared on the subject of *"Disposal of Spent Fuel or Radioactive Waste in Another Country"*.

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<sup>2</sup> Developing multinational radioactive waste repositories: Infrastructural framework and scenarios of cooperation. IAEA-TECDOC-1413, 2004.

<sup>3</sup> Multilateral Approaches to the Nuclear Fuel Cycle. Expert Group Report to the Director General of the IAEA. IAEA, 2005.

<sup>4</sup> Viability of Sharing Facilities for the Disposal of Spent Fuel and Nuclear Waste. IAEA-TECDOC-1658, 2011.

<sup>5</sup> Framework and Challenges for Initiating Multinational Cooperation for the Development of Radioactive Waste Repositories, IAEA Nuclear Energy Series report, in press

## *Europe leads the way*

A major step forward in evaluating all aspects of shared GDFs was taken in 2005-9 through the SAPIERR project, financed by the European Commission and carried out by a consortium of specialists from fourteen EU countries. The project was comprehensive, with reports covering legal and business options, responsibilities, financial liabilities, economic aspects (including hosting benefits), security aspects and public and political attitudes.

SAPIERR showed<sup>6</sup> that, apart from the credibility imparted by having a concrete and common plan, the most obvious advantages are the economic benefits to partner countries and to the EU as a whole. Partner countries could each save billions of EUR by sharing development and disposal costs rather than each having to implement a national GDF, with over half the savings being in shared RD&D. Working together on a common concept, design and, eventually, site has tremendous economic and political benefits. For the models analysed, the saving to the EU as a whole was estimated at 15 to 25 billion EUR. If a regional facility were able to offer disposal as a commercial service to other European countries once the GDF becomes operational, the original partner countries may be able to manage their own current and future wastes with further significant cost reductions. There would also be specific economic benefits to the host country and community.

SAPIERR found that most of the challenges involved in developing a shared regional GDF are closely analogous to those of a national facility. In both national and multinational programmes, finding suitable sites remains the biggest challenge and SAPIERR was influential in formulating a possible siting strategy that is summarized in the final section of this article.

SAPIERR concluded by making proposals for a staged, adaptive implementation strategy leading to a shared European GDF. A smaller group of potential partners was formed: the European Repository Development Organisation Working Group (ERDO-WG). Governments from eight Member States have provided funding and delegated representatives since 2009. The activities of the group have involved consideration of organisational forms and financing models for a European Repository Organisation (ERO) that would initially function as a small sister to existing national organisations. Discussion documents<sup>7</sup> cover siting strategies for a shared GDF, the size and form of an ERO, outreach activities, operating guidelines and a model constitution. An important part of ERDO-WG activities has been analysing the impact on small radioactive waste programmes of European Council Directive 2011/70/EURATOM, discussed above. A key aspect of this is the need to pursue a 'dual track' approach, whereby partner countries in a sharing project also maintain a strong national programme until significant progress has been made on the shared solution.

## *Global interest is high*

Outside Europe, international entities and think-tanks are studying the potential impacts of multinational storage or disposal, in particular of spent fuel. The Arius Association, which provides the secretariat for the ERDO-WG, has worked on this topic since 2002. Arius has received significant financial support from the Sloan and Hewlett Foundations in the USA, to examine how the European model might be extended to countries in the MENA regions (Middle East and North Africa) or in Asia. Workshops focussing on common or regional waste management issues have been run in Tunisia, with participation of MENA nations, and in the UAE, with participation of Gulf Co-ordination Council countries. Some meetings have been held in cooperation with both the IAEA and the Arab Atomic Energy Agency, AAEA.

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<sup>6</sup> SAPIERR-II – Shared, Regional Repositories: Developing a practical implementation strategy. Ewoud Verhoef, Charles McCombie and Neil Chapman. 2009. In: Euradwaste '08 Seventh European Commission Conference on the Management and Disposal of Radioactive Waste. European Commission Report EUR 24040, p 519-524.

<sup>7</sup> The ERDO Model Structure and Plan and response to EC Directive 2011/70/EURATOM are available at: <http://www.erdo-wg.eu/Documents.html>

The Nuclear Threat Initiative (NTI) runs the *'Developing Spent Fuel Strategies'* project, supported by the MacArthur and Hewlett Foundations, which also looks at how multinational facilities might impact on the nuclear fuel cycle. The American Academy of Arts and Sciences (AAAS) also examines this question in its *'Global Nuclear Futures'* project. Arius has contributed to NTI and AAAS meetings in Vietnam, Indonesia and Taiwan and is also involved in a current International Framework For Nuclear Energy Cooperation (IFNEC) project, which has the objective of eliciting information and national views on the 'dual track' approach.

### ***The most recent South Australian initiative***

A new initiative of the government of South Australia is creating much interest today. A Royal Commission has been set up to assess the impacts that could result in South Australia from expanding the nuclear activities of the State beyond the extraction of uranium ore. Potential new opportunities include establishing a nuclear power programme, manufacturing and leasing nuclear fuel and becoming a provider of spent fuel, HLW and ILW storage and disposal services internationally. After producing a series of issue papers, the Royal Commission has awarded contracts for various studies, including the production of business cases for such services.

This is ground-breaking, as no government has, as yet, embarked on such a comprehensive and transparent initiative. Unlike the European partnering projects discussed above, this is a potentially commercial multinational disposal project – something that has not been countenanced for over a decade. When the Royal Commission reports in May, the reaction of political and business groups and the Australian public to the economic implications and the overall concept will be a critical barometer for multinational initiatives. If a state-sponsored multinational initiative in a country with the high global political status and credentials of Australia were to be available, it would change the worldwide paradigm of radioactive waste management forever and for everyone.

### ***Identifying disposal sites***

As observed above, as in any national programme, the successful identification of a suitable and acceptable GDF site is the ultimate requirement of multinational solutions. The siting approach advocated by Arius and by the ERDO-WG aims to find a site that is demonstrably environmentally safe and secure and would be applicable for any regional initiative worldwide.

The approach<sup>8</sup> is in multiple stages leading up to the point of licensing a GDF for operation. The initial stages most strongly differentiate multinational approaches from their national equivalents. A fundamental premise is that the siting process must be voluntary or consent-based. Stage 1 establishes the legitimacy of the process; Stage 2 establishes the waste management implementation body; Stage 3 is a period of consultation with key stakeholders. It is not until Stage 4 that siting factors are defined, including exclusion criteria, technical acceptability requirements and 'preference' factors (that are not essential, but enhance practicality, operability and economic or societal benefits). Stage 5 identifies broad, non-excluded regions, with Stage 6 calling for potentially interested communities in those regions across the partner countries. Stages 7 and 8 involve national level discussions with government and the definition of a shortlist of potentially suitable sites. Further Stages, up to Stage 20 (site evaluations, safety case production, license submissions etc.), are more typical of those employed in national programmes.

A central aspect of the approach is that, with only a need for initial, outline approval from the partner governments, it begins at community level and does not require national government decisions until it has already gained local support, involvement and approval. Potential host countries will emerge only after extensive interactions have taken place, involving interested

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<sup>8</sup> Chapman, N. A. and McCombie, C. Staged Siting Strategy. 2008. Nuclear Engineering International, 53, 26-33

communities within the country. Although the study suggested a feasible timescale of 15 to 20 years to reach a preferred site and a 'point of commitment', national experiences show considerable uncertainty in time estimates. However, with the most advanced national GDF programmes for spent fuel expected to be operational within the next 5 to 8 years and with the potential fillip that could be provided by an Australian initiative, it is possible that the long, systemic history of GDF delays may be coming to an end.

It is thus rewarding to see that the efforts put into promoting multinational concepts over the years appear finally to be showing rewards. Arius has been at the forefront of these developments since 2002 and is gratified to observe that the initial, predominant resistance, even hostility, to the concept, has turned into widespread acknowledgement of its advantages and realisation that its development will benefit many industrialised countries.

### ***Acknowledgements***

We acknowledge the encouragement and input of all those organisations and individuals who have supported Arius, ensured that the ERDO-WG came into being and helped spread the concept to other regions of the world. Multinational solutions are widely acknowledged to be essential, but making real progress can be an uphill struggle into strong headwinds!