

## **PROGRESS TOWARDS INTERNATIONAL REPOSITORIES**

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### **ABSTRACT**

The nuclear fuel cycle is designed to be very international, with some specialist activities (e.g. fuel fabrication, reprocessing, etc.) being confined to a few countries. Nevertheless, political and public opposition has in the past been faced by proposals to internationalise the back-end of the cycle, in particular waste disposal. Attitudes, however, have been changing recently and there is now more acceptance of the general concept of shared repositories and of specific proposals such as that of Pangea. However, as for national facilities, progress towards implementation of shared repositories will be gradual. Moreover, the best vehicle for promoting the concept may not be a commercial type of organisation. Consequently the Pangea project team are currently establishing a widely based Association for this purpose.

### **A BRIEF LOOK BACK**

At the birth of nuclear technologies, there was no thought that these should be deployed by each nation independently of others. In particular, the nuclear fuel cycle was designed to be very international. Countries introducing nuclear power certainly did not assume that they must themselves cover all necessary activities nationally. Uranium producers sought markets world-wide. Various countries offered services for enriching uranium and fabricating fuel. France, the UK and Russia all accepted spent fuel from other countries for reprocessing. For the wastes also, there was no drive for purely national solutions. The original reprocessing contracts included transfer of waste liabilities. As early as 1975, the IAEA was proposing regional fuel cycle centres, where all aspects of the fuel cycle – including disposal - could be addressed in shared multinational projects.

With time, as opposition to nuclear power and apprehension over radioactive wastes both grew, there were movements to prevent any country becoming "the nuclear dustbin of the world". The companies offering reprocessing services (BNFL and Cogema) introduced return of waste clauses. Russia stopped taking back spent fuel from Former Soviet Union countries. Some countries, e.g. Sweden and France, legislated against import and/or export of wastes by their national waste disposal programmes. The grounds were partly to lessen opposition to national siting plans and partly to ensure that waste owners prepared responsibly for disposal rather than passively awaiting foreign options. Nevertheless, the suitability of the regional repository concept, in particular for small countries, continued to be recognised and the IAEA, for example, ran working groups on clarifying the institutional and legal boundary conditions (IAEA, 1998)

During the 80s and 90s, the emphasis was firmly on national programmes, which were endeavouring to demonstrate that the concept of geological disposal was feasible. Considerable amounts of field and laboratory work have provided data for numerous national safety assessment studies, which have all begun to converge in their conclusions. The results, for a wide range of types of long-lived wastes and for a wide variety of disposal concepts, consistently indicate that acceptable safety performance can be achieved by deep geological repositories. If properly implemented, these facilities will have negligible radiological consequences for people now, or in the future. This work has been driven ahead principally by a limited number of dynamic national programmes. Although there have been useful international efforts to harmonise approaches and provide international benchmarks, these have tended to track, rather than to lead geological disposal developments. This 'era' has clearly been successful, as we are now entering the phase where several national programmes are within a decade of achieving a repository. The main challenges are recognized as being societal rather than technical (NRC 2001) and the big issue is always the choice of a specific repository site.

These positive developments have clearly been valuable, but they have also had the effect of leaving many smaller nuclear programmes in a rather problematic position. They could follow what the larger national programmes were doing, attend meetings and run limited research programmes – but repository implementation requires a different scale of investment. Some small nuclear programmes, such as that of Switzerland, whilst pursuing active national disposal projects, explicitly kept open the option of disposal in an international framework. However, there were little or no specific efforts initiated to ensure that disposal provisions could be internationally available and that the wider future of nuclear power could consequently be properly fostered internationally.

## **THE NEXT FEW YEARS**

Over the past few years, as we enter a new era, the international issue has begun to assume a higher profile, for various reasons.

- The escalating cost estimates for geological repositories have emphasised the needs of small programmes for shared facilities.
- Some national programmes (e.g. those in Scandinavia) are in the sensitive stage of siting HLW or spent fuel repositories and, despite the national laws, potential import of wastes has been used as an argument by opponents.
- In some countries, e.g. the UK, Canada, Spain, siting programmes have faltered, been shelved or failed and all potential options for safe long-term management are being considered again.
- Some countries, in particular Russia and some other members of the FSU, are considering import of spent fuel as a commercial enterprise.
- A number of initiatives have consciously promoted the advantages of international disposal: most prominent have been the Non-Proliferation Trust (NPT), a private U.S.-based organization focusing on storage and disposal in Russia of surplus materials from weapons dismantling and the Pangea Project, an international organization proposing commercial repositories for conventional spent fuel, ex-weapons materials and other long-lived wastes in specially chosen geological settings.
- Growing acceptance of the reality of the climate change threat has led to increased interest in nuclear power and consequently in the availability of environmentally correct backend solutions for all user countries, no matter how small their nuclear programme.
- Recently, terrorist activities – especially those in the USA - have deepened the appreciation of many parties for the necessity of safeguarding securely all spent fuel and other materials around the world – including those from small countries which may never have a national deep repository.

Pangea has emphasised in its work that geological disposal is the best approach to ensuring environmental safety and to guaranteeing nuclear (Pellaud and McCombie 2000). Pangea has emphasised that there are sound ethical, safety, environmental and economic arguments for promoting the concepts of international or regional repositories shared by a number of smaller programmes (McCombie 1999). These arguments have been supported by organisations such as the IAEA (Pellaud et al 1999), the US Academies of Science (NRC, 2001) and the CSIS (CSIS 2000). The understandable concerns of active national programmes have been to a large extent allayed and the case has been put (McCombie et al 2001) for national and multinational concepts being mutually supportive rather than competitive.

## **PANGAEA OBJECTIVES**

Pangea has developed a convincing technical case that international repositories can provide additional safety, security and economic optimisation. However, the most challenging tasks facing Pangea have been – and are still – concerned with societal aspects rather than technical or economic issues. The initial challenge in this respect has been to establish a credible grouping of public supporters for the project. The original very commercial Pangea approach, based on ownership by companies pursuing the implementation of an international repository as a business investment, has been problematic. The timescales involved are simply too long for satisfying normal commercial investment guidelines. The concept currently being pursued is that of a "self-help", co-operative

organisation comprised of waste owners and also of other organisations whose strategic future could be strongly affected by the availability of international disposal options. This approach appears to be more appealing to waste management organisations and to most other potential stakeholders.

Amongst these stakeholders, the most important are of course the potential host countries which would have to willingly accept spent fuel and other radioactive materials from third parties. We believe that host countries are more likely to be found if there is wide recognition that they would be providing a valuable or even necessary global environmental service. In principle, almost any country could act as host; the necessary geological conditions for repositories are widely available, if an appropriate engineered barrier system is developed to suit the geology. Pangea's original concepts, however, highlighted the fact that some regions of the world are particularly suitable in a technical sense. The intention of Pangea was always to consider a number of potential siting regions of the world, technically suitable for its 'high-isolation' repository concept, which was developed because it combined exceptional demonstrability of performance and safety with optimum economics (Miller et al, 1999). The scientific justification for the regions identified for this concept has been publicly documented (Black & Chapman, 2001). The initial region chosen for more detailed study was the desert basins of West Australia. The scientific work performed (Apted et al 2001) reinforces the view that such areas would be technically very suitable for siting safe repositories. In future studies, it is hoped that similar regions in other countries can be evaluated, in agreement with national authorities.

In addition, Pangea intends to look at more conventional repository concepts for potential regional repositories in areas other than those with the arid environments on which the high-isolation concept is predicated. In parallel with these scientific and technical studies, it will be necessary to examine in depth the legal and societal issues associated with the transfer of long-lived wastes to another country. The pioneering studies of the IAEA in this area form a good basis from which to start. Pangea has already begun by looking at the public safety issues involved in shipping spent fuel long distances by sea and land (Tunaboylu et al, 2001). More work is foreseen on broad issues crucial to international disposal concepts, such as transfer of liabilities, optimisation of costs, etc.

The most immediate task facing Pangea at present is the restructuring of the project in the form of a broadly based Pangea International Association. This will replace the current commercial company, Pangea Resources International, which will suspend active operations. The declared mission of the new association is "to promote, in the field of nuclear waste management, regional and international cooperation initiatives that will contribute to environmental, safety, security and economic optimisation by sharing facilities for storage and disposal of radioactive materials and wastes". At the time of writing, organisations from 7 different countries are preparing to join the new structure, which should be finalised in the first quarter of 2002. Further participants will be sought and the Association will maintain links to national programmes and international organisations while progressing the types of studies mentioned above.

## REFERENCES

Apted M, Miller I, Smith P (2001). "The high Isolation Safety Concept. A Preliminary Evaluation of Performance, safety and design factors", Pangea Technical Report PTR-01-04, Pangea Resources International, Baden, Switzerland, 2001.

Black, J H, Chapman, N A (2001). "Siting a High Isolation Radioactive Waste Repository", Technical Approach to Identification of Potentially Suitable Regions Worldwide. Pangea Technical Report PTR-01-01, Pangea Resources International, Baden, Switzerland, 2001.

CSIS, (2000). "Managing the Global Nuclear Materials Threat – A Report of the CSIS Project on Global Nuclear Materials Management", Project Chair: Sam Nunn, Project Director: Robert Ebel, CSIS (2000)

IAEA (1998). "Technical, Institutional And Economic Factors Important For Developing A Multinational Radioactive Waste", TECDOC 1021, IAEA, Vienna, 1998.  
IAEA 1997.

WM'02 Conference, February 24-28, 2002 Tucson, AZ

McCombie, C., (1999). "Multinational Repositories – a win-win strategy", In Proceedings of European Nuclear Society Topseal '99 Conference, Antwerp, Belgium, 1999.

McCombie C, Chapman N, Kurzeme M and Stoll R (2001). "International Repositories: An Essential Complement to National Facilities", LBNL Workshop on Geological Solutions in Waste Disposal, 2001.

Miller I, Black J, McCombie C, Pentz D, Zuidema P (1999). "High-Isolation Sites for Radioactive Waste Disposal: A fresh look at the challenge of locating safe sites for radioactive repositories", Proc. of WM99 Conference, Tucson, 1999.

NRC (2001). "Disposition of High-Level Waste and Spent Nuclear Fuel", National Research Council, National Academy Press, Washington, 2001.

Pellaud B, Bonne A, Raynal M and Han KW (1999). "Important Factors For Multinational Radioactive Waste Repositories", Proceedings of WM 99 Conference, Tucson, 1999.

Pellaud, B. and McCombie, C. (2000). "International Repositories for Radioactive Waste and Spent Nuclear Fuel", Proceedings of the INMM Annual Meeting, New Orleans, LA, 2000.

Tunaboylu K, Playfair A, and Nandakumar M (2001). "Waste Transport and Public Safety", Pangea Technical Report PTR-01-03, Pangea Resources International, Baden, Switzerland, 2001.