

IMPORTANT FACTORS FOR MULTINATIONAL RADIOACTIVE WASTE REPOSITORIES

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BACKGROUND

Authorities planning and implementing nuclear energy programmes are expected to assume responsibility for the safe management and disposal of radioactive waste from their national programmes. Such a national approach is perceived as ethically correct.

The question can nevertheless be raised as to whether developing a strictly “national” approach for disposal of radioactive waste is reasonable in the case of countries with small quantities of waste and limited resources and opportunities. Continued pursuit of this “national” approach may in the latter countries lead to inappropriate use of scarce resources which, otherwise, could be used for different, equally important, social or economic purposes. In this respect, the concept of “multinational repositories” for radioactive waste would appear to make good sense for a number of reasons that could include economics, environment and non-proliferation. Several Member-States of the IAEA and part of the waste management community have already expressed their interest in such a concept.

However, such a concept involves political and public acceptance issues and therefore a consensus among countries or regions eventually concerned by the development of a multinational repository is a prerequisite for its realisation.

In this context it was deemed appropriate that the IAEA identifies and assesses the important factors to be taken into account in the process of such consensus building. In June 1998 the IAEA published a report [1] reviewing and assessing these factors and providing Member-States with a prospect for obtaining a more favourable environment for the development of a multinational repository.

This paper intends to offer large excerpts of its content and give additional prospective views on future development.

MULTINATIONAL REPOSITORY CONCEPT

The term “multinational repository” means in this paper a facility in a country (host country or host) which is used for the disposal of radioactive waste generated in several countries (partner countries or partners). Such a repository could range from near surface to geological and be managed by the host country. For obvious reasons of transportation, distance and specific interests, the concept would apply in the first place to geographically grouped countries.

This multinational disposal concept is to be distinguished from “international options” considered in earlier times, such as:

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- Disposal in polar ice caps or extraterrestrial space; and
- Disposal under the deep ocean floor.

Multinational repositories are to be considered in the light of the potential benefit to the partner countries from safety, technical and economic standpoints. The IAEA document is an attempt to assess important factors in these areas with regard the multinational concept.

FACTORS TO BE CONSIDERED

Ethical Aspects

The ethical considerations that need to be taken into account in the case of a multinational repository are the same as those applying to national repositories. The ethical considerations are embodied in the IAEA's Safety Fundamentals [2], in particular with regard to the protection of human health and the environment, with emphasis on the protection of future generations, the protection of third countries/parties beyond national borders, and the principle of avoiding undue burdens on future generations. These considerations can be reformulated with respect to multinational repositories in terms of several principles including:

- Third party countries' interests must not be prejudiced in any way by the countries participating in a multinational repository project;
- Equity must apply amongst the partner countries, that is, a fair balance must exist between the burden transferred and the compensation received through the multinational repository agreement.

Legal Aspects

If the legal and regulatory situation in countries considering a multinational repository would be similar, protective measures could be easily harmonised among the partners. Differences among partner countries concerning the licensing and control mechanisms for a repository project could anyhow be a matter of discussion to arrive at mutual agreement for regulations of the multinational repository. There are also legal international instruments that could be used as existing international conventions, e.g. the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management [3], under which they could regulate their partnership. If countries with legislation restricting the export and import of radioactive waste wish to join a multinational repository project, their legislation will have to be amended. Countries with limited use of radioisotopes, where existing regulations are inadequate for drawing up a convention of a partnership for the selection, design and operation of a multinational repository, could make use of the international instruments.

Safety Aspects

In general, with regard to the application of safety principles as established in the IAEA Safety Fundamentals for Radioactive Waste Management [2], there should be no difference between national and multinational repositories. Should a multinational disposal project be proposed, it is likely that the host country would have already adopted safety criteria (for waste conditioning, disposal, etc.) complying with international standards. Then it seems logical to apply them to the multinational repository. Where such criteria do not yet exist, they should be established by the candidate host country in collaboration with candidate partners. It

should be noted that existing agreements [3] prevent transboundary movements of radioactive waste in countries which lack the necessary infrastructure to properly manage the waste.

Environmental Aspects

Multinational repositories offer a number of potential environmental advantages. First, combining efforts can significantly reduce the number of sites, world-wide, containing radioactive materials which might pose a potential burden on future generations. Secondly, reducing the number of sites offers other environmental benefits, such as:

- Pooling multinational technical expertise in their efforts to make the safest repository possible;
- A broader choice of geological sites, suited to safely contain the particular waste type and easily demonstrate the safety;
- More funds available to obtain the best technical and material resources for a safer site;
- Potential reduction of the number of required waste conditioning facilities;
- Avoiding the proliferation of small, under-funded facilities in countries which lack the technical and financial resources to construct a state-of-the-art repository.

Technical Issues

Current and future inventories of all types of waste materials for disposal must be established before serious consideration can be given to establishing a multinational repository. Also, there should be an agreement between the host country and its partners as to waste acceptance criteria, locations of facilities for waste conditioning and interim storage (i.e. at each partner country or at centralised facilities installed on the site of the multinational repository), and quality assurance and control of waste packages to be disposed of.

Currently, all waste within or among Member-States is transported under national transport regulations, derived from internationally accepted guidelines [4]. Waste destined for a multinational repository would be subject to the same guidelines.

The characterisation and selection of a site as well as the design, construction and operation of a repository require substantial knowledge and experience in a broad range of disciplines. Some of these steps may require long term R&D. If expertise in those areas is available in the host country and partner countries, it could be combined for more efficient investigations, even with cost sharing.

Economic Aspects

Multinational repositories will offer numerous economic benefits for both the host and the partner countries. Sharing a facility with a few partners can dramatically reduce a host country's expenditures. Further, since the host country will bear the burden of permanently housing the repository, (and since some partners may be saving the costs of establishing their own centralised facility) the host country may be able to negotiate an equitable contribution by its partners towards the total development costs of the project. Partner countries may agree to pay the host country not only some or all of the costs of development, but also a profit on the operation of the site. Furthermore, multinational agreement will spread the full burden of

development costs among several partners, thereby significantly reducing these costs for individual members.

Cost Sharing and Liabilities

Cost sharing will extend over long time periods from site selection activities to site construction, operation, and post-closure monitoring and maintenance. Long-lasting financial arrangements are thus unavoidable and these can be made in several forms among which could be guarantees as to the amount and time at which certain waste streams would be available, or agreements as to the fees that could be charged for such waste. Such fees would have to be determined prior to operation of the repository. Similarly, a host country may expect cash contributions to cover overall disposal costs. These could be drawn directly from the national treasuries of partner countries or from fees assessed on waste generators who will use the multinational repository.

Liability is closely related to cost. Several factors can lead to cost increases beyond the estimates and these have to be properly identified and evaluated, e.g. usual contingencies, changing safety requirements, actual experience, advanced state-of-the-art, unforeseen events, etc. To deal with liability, two typical examples cases can be envisaged. In the first case, at the time of receiving the waste, the host country may take all responsibilities or liabilities for any possible future remediation. In the second, the host country and partner countries may conclude an agreement by which the partners accept a partly open-ended situation and assume liability for improbable but not impossible future events which might require remediation. Choosing between the two approaches (or any intermediary approach) may depend on institutional factors, half-lives of the predominant radionuclides, practical experience from other international joint ventures, etc.

Ownership of Waste and Spent Fuel

Partners involved will have to agree about the timing of the transfer of waste ownership to the host country operating the multinational repository and on the scope of such property transfer. Transfer could occur at the time when the waste is inspected in the partner's conditioning facilities before transportation, or when the conditioned waste enter the host country at the national border, or at reception in the repository of the host country. It is conceivable that the transfer could occur at a later stage after which any new and additional costs are extremely unlikely to occur. For instance, when spent fuel is held for an interim cooling period, the date of ownership transfer can be delayed.

Transfer of ownership of spent fuel might be more complicated as spent fuel can also be considered as a potential resource rather than a waste, and as the transfer involves safeguards issues. For spent fuel, it could also be mentioned that the host country would thereby provide temporary storage for a valuable resource - the plutonium - which is also considered by many countries as a large potential source of energy for future use, should humanity need it later on in 50 or more years. Depending on the ownership agreement between the participating countries, the host country would thus acquire a potentially exportable commodity

Institutional and Political Aspects

The above considerations about cost sharing, liability, safety regulations, etc. are closely linked to the institutional character of the project that involves national and multinational relations among regulatory and licensing bodies, as well as with contractual partners. Since

repository management may extend over decades or centuries, the facility may be run under an international convention or agreement. The political stability of the host and the partners is again a vital element. A repository is a long term project, extending over centuries or even much longer periods, which involves a relatively long lead time (possibly more than 20 years), several decades of operational period, and a post-closure surveillance and monitoring period. This underlines once again the importance of the continuity factor not only from a political and contractual, but also from a technical and cost sharing point of view.

Safeguards

The safeguarding of certain nuclear materials must be carried through the entire nuclear fuel cycle, up to the stage where the materials can be considered to be practically unrecoverable from an economic standpoint (e.g. less than 2.5 kgs of plutonium per cubic meter of vitrified high-level waste). Otherwise, in particular for spent fuel, safeguards must be continued even after the closure of a repository. This is of course the challenge: the need to continue safeguarding may be incompatible with the need to ensure long-term term safety through isolation and closure.

Over the last decade, the IAEA's Department of Safeguards has worked towards defining a safeguards policy on radioactive waste and spent fuel. Several Advisory Group and Consultants meetings were held, and a more ambitious "Programme for Development of Safeguards for the Final Disposal of Spent Fuel in Geologic Repositories (SAGOR)" was started in 1994 and has now been completed.

With respect to radioactive waste, it was concluded that the criteria for making determinations of 'practicably irrecoverable' should include waste material type, nuclear material composition, chemical and physical form, and waste quality (e.g. the presence or absence of fission products). The total quantity, facility specific technical parameters and the intended method of eventual disposal should also be considered. The main concern from the waste management standpoint is that any intended safeguards measures should not impair the safety of the waste management system. Another consideration is related to the additional costs associated with the need to implement safeguards measures. The Advisory Groups and Consultants concluded that spent fuel does not qualify as being practically irrecoverable at any point prior to, or following, placement in a geological formation commonly described as a 'permanent repository', and that safeguards on spent fuel should not be terminated.

As far as spent fuel is concerned, various safeguards techniques have been proposed for application at a spent fuel conditioning facility. None of the proposed techniques are likely to cause significant problems from the safety point of view. No destructive verification techniques are foreseen. However, for certain containers, special attention may be needed to ensure that markings made for safeguards purposes do not have any negative effect on their long term corrosion resistance.

For closed geological repositories, the safeguards approach must provide a credible assurance that an undeclared breaching of the integrity of a repository is detected and that continuity of knowledge of the spent fuel is not lost in case of safeguards failure. The repository should be safeguarded by a non-intrusive surveillance mechanism that would allow the repository site to be checked periodically, e.g. unannounced inspections with geophysical

equipment, satellite or aerial monitoring and seismic monitoring with remote data transmission.

Safeguards for the final disposal of spent fuel are expected to begin within the next decade. International collaboration in that field should continue beyond the successful SAGOR Programme. The IAEA must develop clear concepts, make ready the necessary equipment and formulate the applicable criteria early enough to allow the unhampered planing, design and commissioning of conditioning facilities and repositories. Therefore, if fissile materials contained in waste - and spent fuel - are considered for disposal, the multinational repository project, as well as any other national project, has to take into account specific requirements allowing for control and inspection [5].

Public Acceptance

Public acceptance is already of crucial importance for the establishment of national repositories; it will even be of greater importance for multinational repository projects with nuclear waste and spent fuel coming from several countries. Slogans such as “Dumping ground of the world...”, “Not in my backyard...” would most likely come up as soon as an international project would be mentioned. High safety standards, impeccable quality assurance on conditioning and disposal, fair cost sharing, transparency with regard to coverage of potential future costs, clear and convincing answers with regard to ethical concerns, etc. are thus essential for obtaining public acceptance for a multinational repository project.

The burden would lie first of all on the shoulders of the host country and its government. There are several things that the host government, the participating countries and the international community could do to help in gaining the required public acceptance:

- The number and nature of the participating countries would play a role in public acceptance in the host country. A strong political support by the partner countries is an absolute prerequisite for achieving public acceptance;
- While the participation of solid partners would seem necessary to ensure the technical viability and economic soundness of an international project, the involvement of governments and other public entities would strengthen public acceptance by providing an assurance of long-term continuity;
- For spent fuel disposal, the non-proliferation dimension of the repository should be emphasised in the justification and presentation of an international repository. The host country would thereby provide a safe central shelter for the plutonium contained in the spent fuel, rather than leaving it scattered in numerous facilities around the world;
- For spent fuel storage, it could also be mentioned that the host country would thereby provide temporary storage for a valuable resource - the plutonium - which is also considered by many countries as a large potential source of energy for future use, should humanity need it later on in 50 or more years. Depending on the ownership agreement between the participating countries, the host country would thus acquire a potentially exportable commodity.
- Besides participating countries, it would seem that the international community at large could also play a role in achieving greater public acceptance for international repositories. With respect to the IAEA, its Member-States could also contemplate a new assessment of the concept of the International Plutonium Storage. This idea is enshrined in the 1957 Statute of the IAEA and is applicable

to *separated* plutonium. Although evaluated at length in an international Expert Group between 1978 and 1982, the concept never materialised for all kinds of reasons. The international storage of *unseparated* plutonium, that is of spent fuel, could deserve attention with the present evolution of the fuel cycle around the world.

OUTLOOK

For a group of countries interested in launching a project of multinational repository, the task would begin with solid technical evaluations of waste characterisation, conditioning and transportation. Analyses need to be carried out related to the inventories, cost/benefit, safety and legal issues. The identification of suitable repository sites is of paramount importance, since the specific safety, environmental and political aspects associated with the proposed sites will effectively determine the fate of such an international project. No effort should here be spared to establish a strong technical and scientific basis for choosing the best location in term of safety and environmental impact.

Many political and public acceptance issues may arise in connection with the multinational project. Successful implementation of disposal programmes on the national level, good transparency of the international dimension of the project - broad adherence to international instruments such as the Non-Proliferation Treaty and the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management [3] - could significantly contribute to the acceptance of an international repository project.

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