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SAPIERR II

Strategic Action Plan for Implementation of European Regional Repositories: Stage 2

Work Package 2

Responsibilities and Financial Liabilities

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Contents

1 Introduction

Soon after the peaceful use of nuclear energy began to spread in the 1960s and 70s there were proposals for multinational solutions to providing fuel cycle services to power plant operators (IAEA, 2004). However, for the final steps in the cycle, the management and disposal of spent fuel or radioactive wastes, it was only reprocessing services that were actually implemented multinationally. These were provided by countries such as France, the UK and Russia. These countries originally also provided a disposal service since they did not return any reprocessing wastes to their customers. With time, however, a waste return clause was included in new reprocessing contracts – mainly as a reaction to public and political pressures in the reprocessing countries.

Interest revived in the late 1990s, driven both by the high costs of geological repository programmes and also by the security concerns associated with the prospect of fissile material being widely distributed across the world. Although several initiatives were proposed, none led to success, partly because the proposed approaches were judged to be premature and too commercial. Accordingly, in 2002, the not-for-profit organisation, ARIUS (Association for Regional and International Underground Storage), was established to help partner organisations from various countries explore the possibilities of shared disposal facilities. The current growing world-wide interest in initiating or expanding nuclear power programmes also emphasises the need for all countries to have a credible disposal strategy. For many, especially new or small programmes multinational cooperation leading to shared facilities could be an attractive option.

In Europe the Parliament and the EC have both expressed support for concepts that could lead to regional shared facilities being implemented in the EU. The EC has funded two projects that can form the first steps of a staged process towards the implementation of shared regional or international storage and disposal facilities. In the period 2003 to 2005, the EC funded the project SAPIERR I (Support Action: Pilot Initiative for European Regional Repositories), a project devoted to pilot studies on the feasibility of shared regional storage facilities and geological repositories, for use by European countries. The SAPIERR I project looked at the basic technical and economic feasibility of implementing regional, multinational geological repositories in Europe. The studies [Stefula 2006, Boutellier and McCombie 2004, Chapman et al. 2005] indicated that shared regional repositories are feasible and that a first step could be to establish a structured framework for the future work on regional repositories.

The present SAPIERR II project (Strategic Action Plan for Implementation of Regional European Repositories) examines in more detail specific issues that directly influence the practicability and acceptability of such facilities. If these are to become a reality a dedicated organisation will be required that can work towards the goal on the extended timescales that national disposal programmes have shown to be necessary. Specific terminology is introduced in the SAPIERR II project to describe the organisations that may eventually be formed for performing the work leading to implementation of a regional repository in Europe. The terms introduced are a European Development Organisation (EDO) and a European Repository Organisation (ERO). The definitions of EDO and ERO are as follows:

- **EDO (European Development Organisation):** the initiating, non-profit organisation for a shared geological disposal facilities project. Its objective is to establish the systems, structures and agreements and carry out all the work necessary for putting in place a shared waste management solution and geological repository (or repositories). This work would continue through the investigation of potential sites and up to the point of license application to begin the construction of a repository. It is assumed that

this takes about 10+ years. At this point the EDO may decide to transform into or separately establish the ERO.

- **ERO (European Repository Organisation):** the implementing organisation for waste disposal. The ERO would be the license holder for the repository and responsible for all subsequent operational activities in a host country that has agreed to dispose of wastes from other European countries. The form for the ERO will be chosen at a future date by the members of the EDO, assuming that they come to the conclusion that the EDO organisation needs to be altered. The choice will also be strongly influenced by the preferences of the country or countries that have been identified as repository hosts. The ERO could be either non-profit or commercial in structure.

The goal of SAPIERR II (2006-2008) is to develop possible practical implementation strategies and organisational structures that will enable a formalised, structured European Development Organisation (EDO) to be established after 2008 for working on shared EU radioactive waste storage and disposal activities. The tasks in the SAPIERR II project are listed below. Each task translates into a Work Package , as follows:

1. Preparation of a management study on the **legal and business options** for establishing a European Development Organisation (EDO).

2. A study on the **legal liability issues** of international waste transfer within Europe.

3. A study of the potential **economic implications** of European regional storage facilities and repositories.

4. Outline examination of the **safety and security impacts** of implementing one or two regional stores or repositories relative to a large number of national facilities.

5. A review of **public and political attitudes** in Europe towards the concept of shared regional repositories.

6. Development of a **Strategy and a Project Plan** for the work of the EDO.

7. **Management and dissemination** of information.

1.1 Objectives of this Report

The intention of this report is to look at the organisational structures suggested for an EDO in Work Package 1, place these into various scenarios of how an EDO might interact with a host country and other major stakeholders and then to:

- identify the kinds of responsibilities to be borne throughout the long development process (legal, financial, ethical, etc.);

- identify the various bodies that together must bear the responsibilities and carry the financial liabilities associated with a multinational or regional repository programme;

- propose an option or options for the allocation of responsibilities and financial liability;

- discuss which aspects are peculiar to multinational projects and which are also common to national waste management programmes.

In doing this, there is a close link with the financing models for an EDO that are developed in Work Package 3 and the reader should consider the report on economic aspects in parallel with the present report.

The intention is to review the actions which may have to be taken during and after the operation of a multinational disposal facility, to consider who shares responsibility for such actions and to look at how responsibilities can best be allocated to ensure that they will be fulfilled in a way which protects future generations from burdens, be it physical or financial.

Some of the issues involved concern legalistic points of title to wastes, contracts at different national and international levels etc. However, this report does not attempt a formal legalistic analysis but concentrates rather on matters of principle (e.g. intergenerational equity) and practicality (e.g. which organisation is most fitted for any specific task).

In developing the suggestions made at the end of this report we provide examples of cases where liabilities are being or have been shared between countries cooperating in multinational nuclear projects (e.g. reprocessing, return of spent fuel, etc.) and discuss which aspects are peculiar to multinational projects and which are common also to national waste management programmes.

1.2 Terminology Used in this Study

A discussion on nuclear liabilities took place at the Radioactive Waste Management Committee of the NEA in 2003 [NEA 2003]. It was agreed that, in accordance with the ethical principle of intergenerational fairness, costs for safely managing nuclear wastes should be borne, in the first place, by the generations that created those wastes. This is also required by the general principle of sustainable development, as most concisely expressed in the Brundtland Report [WCED 1987] - "*development that meets the needs of the present without compromising the ability of future generations to meet their own needs*".

Accordingly, it must be assured that funding is available for safe repository operation, decommissioning nuclear facilities, remediating sites, and managing the wastes.
The NEA report points out that *"a liability on future generations would exist if these funds were to prove to be insufficient. A liability can have several originating causes, e.g., underestimation of the actual costs by the operator or the owner of the nuclear installation or by the holder or the owner of the radioactive materials; negligence; transfer of ownership of the nuclear installation or the nuclear site without transfer of the corresponding provisions; a reduction in the operating time; bankruptcy; ignorance; etc. The word liability can also be used to indicate a responsibility, both financial and non-financial, that an entity, such as a government, may have."*

The responsibilities and liabilities must be identified, quantified where possible and managed by ensuring that an appropriate framework is established. The provision of sufficient funds is linked, ultimately, to the safety of the public and therefore financial and non-financial liabilities are both involved. This link is recognised in the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste concerning the safety of the management of irradiated nuclear fuel and radioactive waste, which states in article 22 that "*each Contracting Party shall take the appropriate steps to ensure that adequate financial resources are available to support the safety of facilities for spent fuel and radioactive waste*

management during their operating lifetime and for decommissioning." This link is also made by the European Commission, and it is at the basis of a recent proposed directive on establishing decommissioning funds.

The discussion at the NEA session and the papers presented there focus on the national frameworks that have been established to assure that waste management funds are accumulated in individual countries. The main features of the systems established in a variety of OECD countries are summarised in Appendix 3. In the present report, another level of complexity is introduced when one considers liabilities and responsibilities associated with the operation, closure and long-term safety of a multi-national repository that contains spent fuel and HLW from a number of participating countries. The questions raised are then, not only what financial liabilities arise and how much funding must be set aside, but also who bears the responsibilities for ensuring safety at all times and for providing sufficient funds for all eventualities both pre- and post-closure.

The NEA discussion forms a useful starting point for the present study. In the following text we distinguish between responsibilities and liabilities as follows:

Organisational **responsibilities** for:

- ownership of wastes;
- ensuring that disposal takes place safely;
- managing specific elements of the disposal programme

Financial **liability** for:

- ensuring that the costs of disposal are met;
- any economic consequences of waste management activities.

For the larger disposal programmes represented in the EDRAM organisation, some of these issues have been addressed at a national level [EDRAM 2005]. Specifically in connection with financing, the European Commission has also published national overviews [EC 1999].

2 Organisations Involved in a European Regional Repository Project

In this section we identify the various types of organisations that will be involved (or could possibly be involved) in central roles in a European regional repository project. These are indicated in the diagram below. Note that, in this diagram, the links shown are certainly not the only routes for communication between organisations and one of the tasks of the EDO will be to establish a comprehensive communications strategy for all stakeholders.

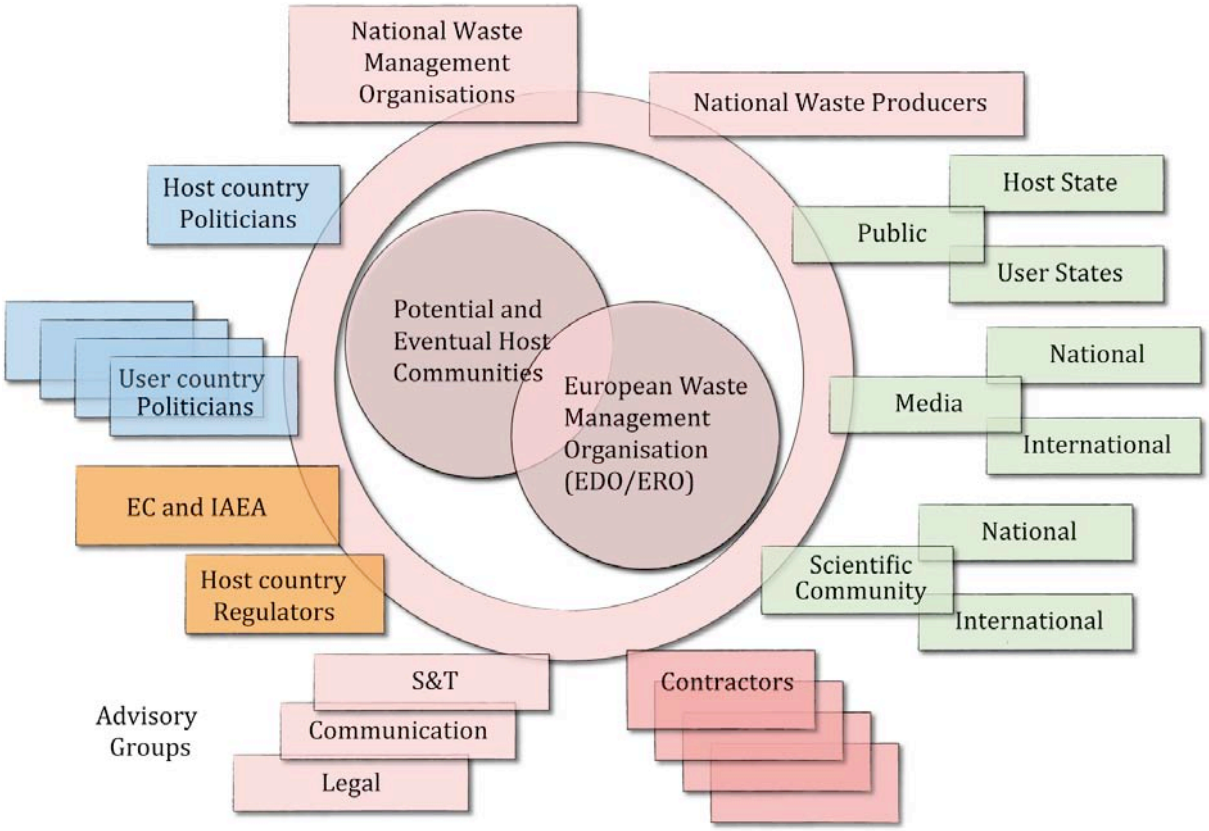

Figure 1: Interfaces to be managed by an EDO (and ERO)

2.1 National Waste Management Organisations

The initial owners of radioactive wastes before waste disposal activities are commenced are clearly those organisations responsible for the nuclear activities that produce the material. However, responsibility for national waste disposal strategies and operations varies from country to country. Most often, a national Waste Management Organisation (WMO) is established, by the waste producers or by the government. The chief focus of the present study is on long-lived wastes, i.e. spent nuclear fuel, HLW from reprocessing and other long-lived materials. The spent fuel clearly belongs to the reactor operator in current nuclear programmes. In some cases of the long-term storage of spent fuel, its ownership is shifted to the storage facility operator. Concepts being discussed for fuel leasing [Ruchkin and Loginov 2006, USDOE 2007] imply, however, that the ownership might stay with the fuel supplier.

This resembles relationships between East European countries operating WWER reactors and Soviet Union/Russian Federation until politico-economical changes at the end of eighties put an end to the practice. For HLW, the original owner is normally the organisation that sent the fuel for reprocessing. In early reprocessing contracts, the ownership transferred to the reprocessor, but currently the commercial reprocessors in France, the UK and Russia all have clauses specifying return of wastes. In some countries ownership of long-lived wastes, other than those from nuclear power plants, is assumed after its centralized collection by the government directly or by a special organisation under government supervision.

2.2 The repository implementer (EDO/ERO)

Work Package 1 of the project considered various forms that a European implementing agency could take. The model that we use in the current report is one in which:

- During the initial period of work, an organisation (the EDO: European Development Organisation) is established in the general form of a co-operative or association (various legal forms are discussed in Work Package 1 and their positive and negative features compared). The EDO carries out all necessary work up to initial repository siting (identification of the host country, siting approach and siting options) and all other preparatory work to move towards implementation.
- After a period of several years, when concrete implementation plans are in place, it is assumed that the EDO may establish a new organisation (the ERO: European Repository Organisation), which will implement disposal. The ERO could be structured as either a commercial or a non-profit organisation.
- From the viewpoint of financial liabilities and responsibilities, it is expected that the EDO would be established by international agreement and have the responsibility of initiating the implementation phase. Financial liabilities for members of the EDO would be restricted to agreeing a budget and the allocation of costs to members, providing the agreed funds and ensuring proper management of the budget. Responsibilities would only be to ensure that the members' aims are met.

Once the ERO is established, then the simplest mechanism would be that it takes ownership of wastes as they are transferred to it by national agencies and becomes financially liable for all aspects of implementation activities. However, various aspects of these liabilities might be shared with the host country government or with partner countries that use the repository, as discussed later. *This report is principally concerned with the responsibilities and liabilities of the ERO.*

2.3 The host country government, regulator and local community

It is inconceivable that foreign radioactive wastes could be imported to a country without the explicit consent of the host country government. In fact, as pointed out in Appendix 2, several countries already have legislation or a national policy directly specifying such a requirement. It is equally inconceivable that the government would agree to such imports without consulting with its national nuclear regulator. In practice, some European governments might consult more widely, as the UK has done on the question of waste exchange, for example. The degree of involvement of the local host community will depend on the practices of the host country, just as is currently the case for national repository siting. The tendency today, however, is to move towards a situation where acceptance of the local community is a pre-requisite, or even where volunteering is the chosen siting approach. This may be more

problematic for multinational facilities, but the challenges of convincingly demonstrating safety and of offering an acceptable package of benefits are basically the same in both cases.

2.4 Governments, regulators and populations of partner countries

It is to be expected that governments of partner countries will also have to agree to export of wastes. In most European countries, this is legally possible, although there are exceptions such as in France or Finland. It is also to be expected, however, that the exporting countries may demand a level of safety in the receiving country equivalent to that which would be required in the sending country. In Switzerland, for example, this is already built into the Nuclear Law [Swiss Parliament 2003]. To check whether this condition is satisfied, the exporting country may well request a safety assessment by its own regulators. One result of this could be that the standards set for a multinational repository, because they have to accommodate the requirements of all partners, are more restrictive than those in individual national facilities. Some countries in Europe may also consult their population on the question of exporting radioactive wastes. According to the polling done in various countries [EC 2002], the majority in most countries seems to prefer a national repository solution to the option of exporting. These polls, however, are taken in the absence of a current credible shared repository option in a willing host country. Should this be implemented, then opinion may well change.

2.5 International organisations

Responsibilities can also be allocated above government levels, to international or supra-national organisations such as the United Nations or the European Union. For the particular case of radioactive materials, the IAEA and the EC both already have supranational responsibilities in the safeguards and transport areas. It is possible that either could assume responsibilities or even ownership of materials in a closed repository, especially of wastes containing fissile materials which must be controlled for the sake of global security. In any case, both organisations would certainly exercise an oversight function over any regional radioactive waste disposal facility implemented in Europe.

In practice, the IAEA and the EC both already own and operate technical facilities in Europe. The Joint Research Centre of the EC has its Directorate General and Institutional and Scientific Relations Directorate in Brussels, while the seven different institutes are found on five separate sites in Belgium, Germany, Italy, the Netherlands and Spain. Laboratories of the IAEA are located at Seibersdorf in Austria and in Monaco. A further EC entity at the site of a regional repository is not inconceivable.

3 Responsibilities and liabilities in a disposal programme

A deep geological repository will go through a series of phases during its long development history. These cover times into the very far future since the long-lived wastes foreseen for geological disposal remain potentially hazardous for tens or hundreds of thousands of years. The phases considered here, when discussing liabilities and responsibilities of various stakeholders, are:

> **Planning, siting and design**: decisions with far reaching safety and financial implications are already taken at this early stage. For both national and multinational facilities, the stakeholders legitimised to participate in these decisions must be identified.
>
> **Construction through to closure**: this is the period of most intense activity at and around the site and also the phase of highest impact on local populations. Expenditures are high; accidents may occur; the long-term performance of the facility can be affected by operational procedures. Hence competent management is needed, as well as adequate controls, – responsibilities for both of these functions must be allocated.
>
> **Active control and passive institutional control**: here specific measures are taken on a continuing basis to minimise the probability of repository disruption and to maximise the probability of detecting any malfunction. **I**n the later phases, although at most passive information archiving activities remain, consideration must still be given to responsibilities for unforeseen developments (e.g. remedial actions or decisions to retrieve for other reasons).

Throughout these phases, responsibilities for decisions and actions must be clearly allocated if conflicts are to be avoided. It is worthwhile repeating that, while the present study is concerned with multinational, regional facilities, the problems faced are to a large extent common also to national repositories. The following sections discuss the key areas of responsibility that must be addressed and highlights the special features of a multinational approach.

Ultimately, at some future time, all responsibility for buried wastes will revert to a national government, or to a supra-national organisation. An obvious complication results from potential disposal of wastes in a multinational repository. Does the ultimate responsibility which unavoidably falls on a national government then extend for the host government to all of the wastes which have been imported? Rather than accept such a situation, it is conceivable that the host government might insist on State Treaties which continue to share responsibilities for the unlikely event of retrieval out into the indefinite future. It is equally conceivable that the partner countries' governments would be quite prepared to accept this shared responsibility. Given that no respectable country would allow its wastes to be exported to location judged to be less safe than that of a national disposal project, shared responsibility for a common international facility may well be more attractive than full responsibility for a national repository. This sharing could be under bilateral or multilateral agreements, but the probability that supra-national organisations would be directly involved is high.

3.1 Ownership of land

Several options are possible for the title to the land while the repository is implemented and operated and for the very long time period following closure. In some national legislations

(the USA and Slovakia, for instance), state ownership of repository land is explicitly stated as a condition for siting. In other cases, the implementer can be the owner during active operation, but special arrangements may be needed for the post closure phase. Because no time pressure in the most cases, these arrangements are often not yet explicitly and clearly solved even within national frames. A particular point that differs from country to country is the depth below the surface to which ownership rights extend. In some cases this is unrestricted; sometimes the land owner has to demonstrate legitimate interests to a given depth; sometimes the national or regional government has rights to exploitable resources at depth. The ownership question is directly linked to the issue of financial liabilities associated with the activities at the site.

Option 1: Title to the land is held by the repository implementer and reverts to the Government on closure (possibly after an extended monitoring period);

Option 2: Title to the land is held by the repository implementer; after closure the land can be released for further use and transferred to other owners, but the host Government must maintain records and institutional controls;

Option 3: The host Government holds title to the land from inception and grants rights to the repository implementer;

Option 4: The host Government cedes ownership or leases the land to an international organisation for the duration of operations. In the long term, ownership must revert to the national government.

3.2 Ownership of wastes

There are complex legal issues connected with ownership of radioactive wastes from their time of production to their final disposal. The initial ownership, as described in section 2.1 above, is with the producer of the wastes, but other arrangements must be made as the material moves towards final disposal. These differ from country to country. In some cases, the situation is clear, at least in principle. For example in the USA, it is foreseen that the Government will take title to spent fuel from utilities and with this title goes all future responsibilities. This can work where the Government is also the repository implementer. The situation is more complex when a third party is the implementer – for example a dedicated waste management organisation outside the Government. The possibilities then are that the original waste owners retain joint responsibility for future events or that a private body takes over the wastes and also the responsibilities.

Ownership issues can be complex during the operational period of the repository; but they become more so in the post-closure period. The Government of the host country must be involved in some way because of the ultimate responsibility which it will bear. In a multinational project, the countries that export wastes to a shared repository may transfer ownership at the outset, or may retain ownership for some time afterwards. The arguments most commonly made for retaining ownership are that liabilities for any unforeseen remediation activities are then also shared. With the current increased emphasis on reprocessing spent fuel, however, the material in the repository may ultimately be seen as a valuable asset whose ownership must be defined. The issues of transfer of title and of long-term responsibilities will almost certainly become the subject of supra-national arrangements governed by intergovernmental treaties and agreements.

An interesting point is whether ownership of the material disposed of in a repository is coupled directly to ownership of the land itself. Land includes fixtures to the land. If an item

is intended to remain in the land indefinitely and considerable expense has been incurred to install it, it will be a fixture although it may be easily removed. The waste material will be encased in overpacks at a disposal site at a depth of hundreds of metres. At closure all physical human access to the canisters will be closed off. It will take thousands of years for the canisters to decay. The canisters may be treated as fixtures, and thus become part of the land when embedded in the earth. By the application of common law principles, it could be argued that title to the material, when embedded in the earth, passes to the owner of the land. However, in some countries, the rights to minerals and other resources lying below the surface rest with the government, not the landowner.

3.3 Transport to the repository

Responsibilities for radioactive and/or nuclear materials during their transport are regulated in detail by international regulations based on the corresponding IAEA standards and no unprecedented requirements would be necessary for movements to a shared European disposal facility. Experience of the system has been gained during many national and international transports of all types of radioactive wastes.

3.4 Repository implementation and operation

3.4.1 Siting

Responsibilities for defining and for implementing a repository siting strategy are allocated differently in different national waste disposal programmes. Commonly a general approach is laid down at government level, but the level of detail varies. The broadest approach is that the government simply requires that an acceptable case can be made that a repository at a site chosen by the implementer will be safe (as judged against the relevant regulatory criteria). This was the original strategy used, for example, in Sweden, Finland, and Switzerland. As the implementation programmes in many countries encountered increasing problems with public acceptance, more specific requirements were set in many countries – both technical and societal. For example, geological and environmental criteria were written into legislation or regulations in France, Japan, USA, and Switzerland. In the non-technical area, requirements on public consultation and involvement were also introduced directly by government officials or proposed by their advisory groups (e.g. AkEnd in Germany, EKRA in Switzerland, CoRWM in the UK).Examples of crucial overarching requirements of this type are the need for the implementer to allow scope for interveners, to look for volunteer communities, to provide siting alternatives, etc.. The resulting situation today is that some governments have assumed complete siting responsibility, either directly or through a governmental waste management organisation; some have exerted great influence on the siting activities of a nominally independent implementer; and some have a more hands off approach – without however relinquishing the ultimate responsibility for approving a proposed site in a licensing process.

In a multi-national programme, siting will obviously be yet more sensitive than in the national case. The greatest responsibilities at government level will clearly lie with the government of the host country. Since the siting strategy can greatly affect the duration and costs of the siting programme, however, a consensus will have to be achieved with all partner countries that are co-financing the enterprise. Over-dimensioned technical programmes or over-generous benefits packages that lead to unacceptably high costs will not be acceptable. On the other hand, all partner countries will have a vested interest in ensuring that the funding levels for the siting process are adequate to guarantee that it will lead to a safe site.

Agreeing a siting strategy with costs and timescales will be one of the greatest challenges facing the EDO.

3.4.2 Licensing

A regional repository will clearly have to be licensed according to the legal requirements of the host country. This means that a nuclear regulatory structure must be in place and that sufficient know-how and resources must be available. Should this be a problem in a potential European host state, then support may be provided from the partner countries or else, on a commercial basis, from other European countries with advanced disposal programmes. In the broader environmental area, the EC has set out many of the requirements for environmental assessment, both at the strategic environmental assessment level and for major projects, and these would clearly have to be satisfied. Environmental impact assessment processes contain in themselves international aspects: applying the Convention on Environmental Impact Assessment in a Transboundary Context [Espoo 1991] and its augmentation by the Protocol on Strategic Environmental Assessment [Kiev 2003]. One complexity that arises for a multinational project is that, as mentioned above, the regulators of the partnership countries may also have to approve the project. Indeed, it is very likely that even wider reviews of licensing/safety documentation, including the environmental and/or nuclear safety assessment of the site, may be required to be performed, either by an international body like the EC or IAEA, or by an expert group established by these organisations. Another complexity, treated further in the following section, is that the host country regulators have less access to the pre-disposal treatment and packaging stages that also influence the overall repository safety.

3.4.3 Verification of waste characteristics before acceptance

Already in national disposal programmes the specification of waste acceptance requirements and the process of verifying that these are satisfied are much debated issues. The task of confirming by direct measurements on finished waste packages that these fulfil all requirements is difficult, time consuming and expensive. Accordingly, the tendency is to establish a waste characterization strategy as an optimal compromise between two options: qualification of the production process itself or checking all packages individually [IAEA 2007]. This is possible only if there is good contact between repository operators, regulators and waste producers and mostly means that the former must have access to the premises of the latter. Arrangements of this sort are feasible also for multinational repository projects, but are obviously more complex and potentially sensitive. If there is any sort of shared responsibility between partners for malfunctioning of the repository, then the issue of waste quality assurance becomes yet more complex. The authorities of the partner countries may demand that they also are assured that all requirements are met.

3.4.4 Safe Operation

Requirements for safe operation are laid down internationally (e.g. in the Joint Convention of the IAEA) and nationally by regulators who also monitor compliance. Although the safe operation of the repository is clearly primarily the responsibility of the host state, the above point concerning shared liabilities for malfunctions is relevant also here. If the partner states transfer all rights and responsibilities to the host at the time of shipping wastes, then this is no longer a legal issue. Even in this case, however, a residual moral responsibility remains with the partner state. Public sentiment in most European countries will not allow transfer of wastes to a foreign host where safety is questionable. This raises the question of how the partner states can be assured over the lifetime of the repository that operations are being safely carried out. This is allied to the topics of monitoring the repository performance

throughout its operation and afterwards, as well as to the still rather controversial topic of retrievability of disposed material from a repository.

3.4.5 Pre-closure Inspection, Post-Closure Monitoring

As a model programme in SAPIERR II it is assumed that either:

- the repository is closed directly upon emplacement of the last waste packages, with the site subsequently being monitored for as long as needed or required by the host population, or;

- the repository remains open after completion of waste emplacement for continued inspection of the wastes for some defined prior to closure (and subsequent monitoring).

A recent view on the desirability of early closure was given by the UK Government in its 2007 Consultation document [DEFRA 2007]

"The UK Government acknowledges that there is a divergence of views on this subject, but on balance considers that CoRWM's conclusion was correct, i.e. that "leaving a repository open, for centuries after waste has been emplaced, increases the risks disproportionately to any gains". Closure at the earliest opportunity provides greater safety, greater security from terrorist attack, and minimises the burdens of cost, effort and worker radiation dose transferred to future generations. The UK Government also notes, however, as has CoRWM, that it is likely to be at least a century until final closure is possible, which the UK Government believes provides sufficient flexibility for further research to be undertaken to achieve public confidence and approval and to provide for key decisions to be taken in future. The decision about whether or not to keep a geological disposal facility (or vaults within it) open for an extended period of time can be made at a later date. In the meantime the design and construction can be carried out in such a way that the option of extended retrievability is not excluded."

Establishment of any post-closure monitoring concept is the prime responsibility of the repository implementer. However, the implementer will possibly be constrained by conditions set by the regulator in order to reflect government policy, which may, in turn, reflect public opinion on the type and duration of monitoring that is needed. The execution of monitoring programmes throughout the first phases in repository life is also largely an implementer responsibility, although the regulator will certainly maintain independent oversight. For multinational or regional facilities, it is conceivable that regulators also in partner countries will have to be consulted or at least informed about all monitoring activities.

3.4.6 Retrievability

The issue of retrievability in connection with disposal of radioactive waste has been discussed in waste disposal programmes worldwide, even though it may seem, at first sight, inconsistent with the basic aim of permanent removal of the wastes from the human environment. Waste Management Organisations originally paid little attention to the issue of retrievability since they were confident that such measures would never be needed. Recently, public opinion in several countries has favoured maintaining the capability either to retrieve wastes or to inspect them in situ (or both) for a long period after emplacement, effectively lengthening the pre-closure period in some national strategies. This approach places the principle of "maximising future freedom of choice" with the principle of "minimising burdens on future generations" and has led to extensive debate in many countries. The policy with respect to retrievability

varies widely from country to country and it is not possible today to say which approach might be taken by an EDO/ERO.

From the viewpoint of identifying responsibilities and liabilities, a few generic 'retrieval scenarios' can be considered that might affect a shared, regional repository:

1. Retrievability is stipulated as a condition for repository construction and operation by the host community or country. Clearly, it is important to establish early in the life of the EDO what the host's position will be with respect to retrievability, as this could affect the open period of the repository and hence the overall costs. It seems inevitable that the financial and management responsibility for maintaining the repository in an accessible condition for as long as eventually required will fall to the ERO and its partners.

2. The extremely unlikely situation where retrieval becomes necessary, before or after closure, from the viewpoint of environmental damage being caused, or potentially likely to be caused, by a malfunctioning repository. In this unlikely event, the decision to retrieve will be enforced by the national regulator of the host country, if the implementer does not itself react immediately. If we assume that waste would be retrieved only in the event of severe breakdown in performance of the repository during the operational or inspection period, the liabilities are covered by the events identified as 'malfunctions' in Section 3.4.3. If inadequate safety is the reason for retrieval, then clearly the implementer would be expected to perform directly or indirectly the work of recovery, reconditioning (if needed) and arranging an alternative disposition for the wastes. Retrieval long after closure, when the ERO may no longer exist, would seemingly become the liability of the host nation, unless the original EDO agreements had stipulated a continuing responsibility of the partner countries (and/or the establishment of a protected, long-term contingency fund that could be used in this situation).

3. Retrieval to recover useful materials (fissile materials or radionuclides) or a wish to implement a better technology. A decision to retrieve for either of these reasons could, in principle, be made by the ERO or at governmental level in the host country (e.g. after closure of the repository and the disbandment of the ERO). Partner nations of a regional repository may be directly interested in, or involved in, any decision on retrieval during the operational period, as retrieval to recover valuable materials raises questions about their ownership. This issue is complicated and is discussed in Section 3.2. Clearly, it is important that the EDO strategy tackles this matter at the outset when it is being established. Where fissile materials are concerned, supra-national consent to retrieve should also be a pre-requisite.

3.5 Financing

3.5.1 Up to construction and start of operation

The costs through the preparatory stages may be distributed amongst participants in various ways, depending upon the organisational structures chosen for the EDO (see Work Package 1 and Work Package 3). If a cooperative or an association structure is chosen, this implies equal voting rights in the organisation, but not necessarily equal funding levels. In a national example, the costs of the cooperative NAGRA are borne by the Swiss utilities in proportion to the thermal power of their reactors. This is a surrogate for the waste volumes that will later be produced. Mechanisms are then foreseen for adjusting payments at the time of

implementation to account for actual waste volumes. Another type of example is the Association ARIUS, in which voting rights are equal, but funding is negotiated between members.

The partners in the regional repository project need to agree on how the necessary funding will be raised. They will also have to agree on the cost items in the implementing organisation's budget. One particularly sensitive issue involved here concerns the benefits packages that may be provided to host nations and host communities. This issue is discussed at length in the report on Work Package 3 of the SAPIERR II project.

3.5.2 During operation

This also depends on the organisational structure chosen for the ERO and is discussed in more detail in the Work Package 3 report. In principle, the running costs of the repository and the accumulation of funds for closure and long term monitoring can be financed by income from partners who pay a fee to dispose of their wastes. A problem can arise with this system – and also with any national repository catering for independent users – is that incentives may be needed to persuade the users to move their materials out of their interim stores and into the repository. This is because the continuing outlay for maintaining existing stores are less than the costs that arise for transport and for emplacement of the wastes in the repository. If there is no shortage of storage capacity, this situation can arise even if the partners have already contributed to the capital costs of the repository. One mechanism that can avoid this problem is to have partner countries reserve space in the shared repository and compel them to pay for this space, even if it is not being used. In any case, successful technical and commercial operation of a shared repository can only be achieved if partners are constrained to define in advance their proposed shipments and to adhere to agreed schedules.

3.5.3 Post closure

Specific post-closure funding arrangements have been made only in very few countries as yet. In this section, we discuss the basic principles involved and also the additional aspects introduced when the repository in question is a region or multinational facility rather than a purely national one.

Relative to the substantial costs of any repository project, the funding needed on a continuing basis for monitoring activities is small and may, for example, be provided by the interest yielded by a dedicated fund. The implementer can be compelled to establish at closure a dedicated fund which is large enough to generate sufficient interest for an effectively indefinite monitoring programme. The governments of future generations can then at any time take a political decision to terminate the monitoring and use the funds for other purposes, if they so wish. Public acceptance at the outset of disposal operations, however, may well be enhanced if dedicated funds were protected by legislation from being diverted for some (long) specified time period.

Financing of retrieval, is more problematic. Retrieval costs can be high – comparable to repository construction costs. Moreover, if retrieval is not to allow re-use of the materials, further actions (new siting, new waste treatments) can also be very expensive. The probability of retrieval being necessary for safety reasons, on the other hand, must be agreed by all to be very small before geologic disposal is allowed to take place. Nevertheless, the small remaining risk lasts for an extremely long time. How does one factor these considerations into a concept for allocating future financial responsibilities?

In principle, one could establish a dedicated fund also for retrieval. The resources needed depend strongly on the agreed time before retrieval becomes credible. If this is long, say hundreds of years, modest funding suffices. This option may well be justifiable because robust designs for a repository can give high confidence that early failure is extremely unlikely. If sufficient funding to allow retrieval is, nevertheless, to be available at any time from day one following closure, then the cost of disposal rises considerably. Setting aside so much funding to cover such an unlikely event may not be the best use of society's resources. The chances of such a sum being left untouched by a long succession of future governments can also be debated.

Various arrangements are conceivable for ensuring that funding is available for monitoring or inspection actions in the future.

- A post-completion activity fund is established as a special purpose trust fund, charged to secure the repository implementer's obligations, and administered by the implementer alone from inception.

- A post-closure activity fund is established as a special purpose trust fund, charged to secure the repository implementer's obligations, with administration of the fund passing from the repository implementer to the host country Government only on repository closure (perhaps including a first period of "confidence monitoring").

- A post-completion activity fund is established as a special purpose trust fund, charged to secure the repository implementer's obligations, and administered by the host Government from the beginning of repository operations.

In a multinational arrangement, the partner nations, who will obviously also have to contribute to any fund that is set up, may expect to have oversight possibilities to ensure that accumulated funds are not misused

Typically, the fund would have a trustee and a manager. A trust deed would govern the rights and obligations of the trustee, the manager and the repository implementer. The trustee would be an independent person, preferably a trustee who is approved as a trustee under the Law. All funds in the trust fund would be under the control of the trustee who would only be able to disburse the funds for the post closure activities. A manager would administer the fund. The manager would invest the funds and make recommend to the trustee when and how funds are to be applied for the objects of the trust.

3.6 Public communication and involvement

The importance of communication and of binding the national public and local communities into repository implementation plans has been brought home forcibly to many national WMOs by the delays and failures that are observed to have resulted from ignoring these issues. In the national case, almost invariably all players in the repository programme tend to be active in this area. The implementers have learned the importance of a continuous, two-way flow of information at all levels. The governments have learned that the chances of success are considerably higher when they too emphasise the need for repositories, the mechanisms to ensure safety and oversight, and the rights of the public to be participants.

For a multi-national EDO/ERO, full, open communication will be a complex but absolutely crucial task. As expanded on in Work Package 1, close liaison will be needed to all national waste management organisations, regulators and governments of partner countries. In the critical siting activities, when contacts to local communities are of paramount importance,

nationals and locals from the countries and communities in question should be directly involved. This is yet another powerful lesson that can be learned by analogy with some national waste programmes in which bad relations have resulted from sending only staff from headquarters in the capital city to interact with local (and often remote) communities.

4 Scenario for allocation of responsibilities

As discussed in Section 2.2, the scenario envisaged for establishment of the implementing organisation involves two stages: EDO followed by ERO. Here we discuss how responsibilities might be allocated once the ERO is established, as either a commercial or a non-profit organisation.

4.1 Repository operation by a commercial ERO

This is an option that has been used in various countries for low level waste repositories, but not for spent fuel/HLW facilities. A general model is:

- A designated repository company will build and operate a repository.
- Users pay for the disposal service provided, either as wastes are delivered or up-front by reserving space in the repository. Special terms would likely be available to the founder countries that establish the EDO and the ERO. Specific terms are likely to be considered for disposing of the wastes of the host country itself.
- The ERO income is sufficient to cover all construction, operation and closure costs; to pay any compensation and taxes due, and to generate a fair profit for the company
- A fund will be established for the longer term needs.
- A long term monitoring regime will be established.
- The repository company will either terminate after closure or be absorbed by the national Government.
- For a national repository, the net consequences are that in the long term any liability falls on the national Government to the extent that funding is not available. In a multinational arrangement, the liabilities may be spread across partner countries in the ways mentioned earlier.

From the point of view of a commercial ERO charged with operating a multinational repository, the most straight forward situation would be as follows:

- The company takes title to the fuel and waste on its delivery.
- Customers have no liability post-disposal; their liabilities finish on delivery of the fuel and payment of contracted price.
- A small percentage (perhaps around ~2%) of revenue goes to a decommissioning and closure fund.
- A fixed repository closure date is set; the company closes down post repository closure – possibly after a restricted monitoring period.
- An organisation is set up for long-term monitoring post-closure.
- The post-closure fund is passed to Government, along with all liabilities.

- Post-closure costs in excess of the Fund to be met by Government.

This situation is simple and easy to manage for the ERO. It may, however, leave the host country government or the ERO feeling that it is carrying too much risk. Some options to relieve this are:

- The ERO obtains undertakings from customers (or their governments) to underwrite any remediation work during the operational lifetime, if the problems are due to the characteristics of the wastes delivered or if they were really unforeseeable (e.g. natural catastrophes)

- The ERO provides a fund which will grow in value at 100 years post-closure to a large size agreed to cover any 'maximum credible event'; the host government obtains undertakings from customers (or their governments) to underwrite any essential post-closure work not covered by the fund.

- Responsibilities remain shared amongst national Governments for some future period. Although it may seem unlikely at first sight that Governments of participating countries would accept such shared responsibility, the alternative may be 100% responsibility for a national facility that is less flexibly sited and must be implemented with fewer resources.

4.2 Repository operation by a non-profit ERO

A joint venture ERO between a number of countries that are sharing a disposal facility located in one of them is a conceivable scenario. Sharing of responsibilities and liabilities in the operational phase could then be more likely. Post-closure, the questions of sharing liabilities between the host government and the partners are as in the above cases. As discussed in Work Package 1, there are examples of facilities being run by national companies as a service for multinational customers, international consortia or supranational bodies. In all such cases, the issue of liabilities must be addressed.

5 Conclusions

The responsibilities and liabilities associated with implementing a regional, multinational repository are in many aspects similar or identical to those for national programmes. The national challenges that apply equally to a multinational programme include:

- Creating a structured framework defining the roles of all relevant entities – regulators, implementers, national governments, local communities, supranational organisations, etc.
- Implementing a facility that is safe and secure during the operational and post-operational phases
- Gaining sufficient political and public acceptance at all necessary levels for the siting
- Securing financing for construction of the repository and allocating the costs in a fair way to all repository users
- Ensuring adequate flow of funds throughout the operational period and proper oversight of the funding arrangements
- Establishing mechanisms to ensure that segregated funds are available for post-closure requirements
- Developing institutional control and knowledge preservation measures for the very long time period – a task that requires close cooperation with the host Government.

The parallels to multinational projects are particularly close for national repositories that serve a number of independent waste owners (e.g. different nuclear power utilities). Additional challenges for such shared repositories arise for the following reasons:

- Complex procedures may be needed for assuring that waste packages transported from varied sources meet the acceptance requirement at the repository
- Fair mechanisms for sharing development, capital and operating costs must be agreed. These must allow for subsequent expansion of the partner organisations should further nuclear power companies be established
- Arrangements (practical and financial) must be made for the acceptance at a deep repository of long-lived wastes produced outside the nuclear fuel cycle, e.g. from medicine, industry and research.
- Users must be obligated to transfer their stored wastes to the repository on agreed schedules in order that the repository operations can be optimised

For multinational repositories, the challenges are, of course, greater. Further issues are:

- Supranational bodies such as the EC and the IAEA must play a more direct role
- Regulators from a number of nations may have to be informed and even to approve the repository project
- Political and public acceptance may be harder to achieve, in particular in the repository host country

- Legal mechanisms to ensure that all users have sufficient assets to cover potential future liabilities may be weaker than in the national case

Despite these added difficulties, there are no fundamental reasons why assurance can not be provided that a multinational repository can meet all its responsibilities and liabilities. As pointed out, the basic problems and approaches to their solutions are all transferable from national disposal programmes. There are various examples of long-term, jointly funded, major multinational projects that have been run successfully. Direct support will be necessary from supranational bodies - in the specific case of a potential European Regional Repository from the EC and also from the IAEA. Given the recognised environmental, safety and economic advantages of shared repositories, and the increasing pressure to provide safe disposal routes to the numerous countries expanding or introducing nuclear power, this international support for shared facilities is likely to continue.

When a group of potential participants in a formalised EDO is established, then explicit negotiations on legal responsibilities and liabilities will be an immediate top priority. These negotiations will require participation of technical, legal and financial experts from the partnering organisations.

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Appendix 1: Recent relevant EU legislation

Legislation environment of international transfer of radioactive waste and spent fuel was discussed in detail in the study elaborated within the SAPIERR project. Therefore, only new legislation documents issued since 2006 two years are analyzed below.

A1.1 Council Directive on supervision and control of shipments of radioactive waste and spent fuel

This Direction (2006/117/EURATOM of 20 November 2006) supersedes the former Council Directive 92/3/Euratom of 3 February 1992 regarding the supervision and control of transfers of radioactive waste between Member States or coming in and out of the EU. The new Directive lays down a Community system of supervision and control of transboundary shipments of radioactive waste and spent fuel, so as to guarantee an adequate protection of the population. Explicit including of spent fuel into the directive scope represents one of the major changes.

The Directive shall not apply:

- to shipments of disused sources to a supplier or manufacturer of radioactive sources or to a recognized installation,
- to shipments of radioactive materials recovered, through reprocessing, for further use,
- to transboundary shipments of waste that contains only naturally occurring radioactive material which does not arise from practices.

The Directive lays down some fully new articles. First of them (Article 3) concerned with the transboundary shipments of spent fuel for reprocessing, stating that those shipments and exports shall be supervised and controlled in accordance with the procedures laid down in the Directive. It also explicitly lays down the Member States right to safely return to the country of origin:

> *"shipments of radioactive waste and spent fuel which fall under the scope of this Directive but which were not duly authorised in accordance with this directive; and radioactively contaminated waste or material containing a radioactive source where this material has not been declared as radioactive waste by the country of origin*."

Provisions regarding the shipments to third parties outside the European Union have potentially great significance for the new member states from East Europe. According to these, the authorities of the state of origin shall not authorize shipments to third countries that do not have the administrative and technical capacity and regulatory structure to manage the radioactive waste or spent fuel safely, as stated in the Joint Convention.

Member States are required to bring into force the laws, regulations and administrative provisions necessary to comply with this Directive before 25 December 2008.

A1.2 Commission Recommendation on management of financial resources for decommissioning of nuclear installations, spent fuel and radioactive waste

This Recommendation (2006/851/Euratom of 24 October 2006) proposes measures to ensure that adequate financial resources are available at the scheduled time for all decommissioning activities of nuclear installations and for the management of spent fuel and radioactive waste. The text of the Recommendation does not make fully clear if it considers spent fuel and radioactive waste management as a part of decommissioning, or considers only spent fuel and radioactive waste arising during decommissioning or management of spent fuel and radioactive waste in general. Nevertheless, the Recommendation gives an initial basis for harmonization of nuclear energy back-end funding mechanisms, both external (at the state level) and internal (at the level of facility operator).

A1.3 Council Regulation Establishing an Instrument for Nuclear Safety Cooperation

The general objective of the Regulation (EURATOM No 300/2007 of 19 February 2007) is to establish and finance Community measures to support the promotion of a high level of nuclear safety, radiation protection and the application of efficient and effective safeguards of nuclear material in third countries. Since export of spent fuel to the Russian Federation is still being practiced by some countries like Bulgaria and is an option considered by politicians or decision makers in some other East European States (e.g. Hungary, Slovak Republic), the Regulation has the potential to significantly influence the financing scheme of a third party offering disposal services. According to Article 2 of the Regulation, the Commission should promote an effective nuclear safety culture at all levels, in particular through…. "*support for the safe transport, treatment and disposal of spent nuclear fuel and radioactive waste*". The Regulation also supports "measures to promote international cooperation (including in the framework of relevant international organizations, notably IAEA) in the above fields, including the implementation and monitoring of international Conventions and Treaties, exchange of information and training and research". It establishes altogether ten forms of Community financing: from financing of particular projects and programmes, through financial grants to contribution to various forms of funds. The Regulation introduces various options for co-financing and establishing institutional, organizational and administrative frameworks for implementation of given measures. It entered into on publication in the Official Journal and shall apply until 31 December, 2013.

A1.4 European Directive on the Radioactive Waste and Spent Fuel Management

The SAPIERR-I legal report contained an annex giving a detailed history of the development of the "nuclear package" first proposed by the EC in 2003. The first nuclear package was rejected by the governments of the Czech Republic, Finland, France, Germany, Hungary, Lithuania, Sweden and the United Kingdom primarily because they did not wish their national responsibility for nuclear safety to be compromised. Their opposition prevented the package from being adopted and in September 2004 the Commission tabled a revised version. Member States opposed to the original package remained hostile to the Commission's proposals and did not accept the revised version, whereupon the Council adopted a non-binding Action Plan. This calls on Member States to work more closely in order to "strengthen transparency and co-operation". Building on this Action Plan, the Council's Atomic Questions Group (AQG) set up the ad hoc Working Party on Nuclear Safety (WPNS) tasked with breaking the deadlock on the nuclear package. The WPNS set up subgroups which were charged with delivering reports on achievements reached or foreseen with regard to harmonised safety approaches in the context of the Joint Convention, WENRA, the IAEA work on Safety Standards, the OECD/NEA work and the EC and Euratom on consensus documents. These reports were intended to provide a basis for the consultation process foreseen in the Council

conclusions of June 2004. The WPNS groups reported at the end of 2006 [EC 2006, EC 2006a]. The reports, based on extensive questionnaires, give good summaries of the positions taken on many nuclear waste policy issues in Member States, but they do not make any proposals for moving ahead with the Waste Directive.

Appendix 2: Legal commitments in EU countries

Deliverable No. 2 of the former SAPIERR-I project summarized the legal positions in European States. For ease of reference, the following tables given in SAPIERR-I are updated and reproduced in this Appendix:

- membership of the countries or organisations within countries in the international bodies – table A2.1
- international conventions and treaties have been ratified / signed by the countries – table A2.2
- Regulatory / licensing authorities and implementing bodies – table A2.3
- Export, import, transfer of RAW/SNF, attitude towards international repository – table A2.4.

The SAPIERR-I report concluded that the framework of most of countries is commonly based on the recommendations of the IAEA Safety Standards documents. These standards have been taken over into much of the EU legislation and also are embodied in the IAEA Joint Convention. This convention, which has been signed by all of the 14 countries represented in SAPIERR-I has also been a strong driver for establishing the necessary framework for safe waste management.

Practically all of countries also have an organised regulatory framework for radioactive waste disposal. Many – but not all – of the regulatory bodies have experience in the licensing of waste management facilities for disposal of LLW. Of course, none of the regulators has licensed a deep geological repository for HLW or spent fuel, since no country in or out of SAPIERR has yet implemented such a facility. The greatest unity of regulatory approaches has been achieved in the area of radioactive transport. Here the mature and well-tested international transport regulations of the IAEA provide a solid basis. The success in this area could provide a valuable lesson in the less developed area of geological disposal regulations.

Table A2-1: Membership of countries in international organizations or initiatives

Countries	IAEA	OECD-NEA	EU	EDRAM	ARIUS	Ljubljana Initiative	ITC
SAPIERR Countries							
Austria	Yes	Yes	Yes	No	No	Yes	No
Belgium	Yes	Yes	Yes	Yes ONDRAF	(Yes, ONDRAF to 31.6.)	No	Yes, SCK•CEN
Bulgaria	Yes	No	Yes	No	Yes, Kozloduy NPP	Yes	No
Croatia	Yes	No	No, applicant	No	No	Yes	No
Czech Republic	Yes	Yes	Yes	No	No	Yes	Yes, RAWRA (SURAO)
Hungary	Yes	Yes	Yes	No	Yes, PURAM	Yes	Yes, PURAM
Italy	Yes	Yes	Yes	No	Yes, ENEA	No	Yes, Univ. of Rome
Latvia	Yes	No	Yes	No	Yes, Radiation Safety Centre	No	No
Lithuania	Yes	No	Yes	No	No	No	No
Netherlands	Yes	Yes	Yes	No	Yes, COVRA	No	No
Romania	Yes	No	Yes	No	No	No	No
Slovakia	Yes	Yes	Yes	No	No	Yes	No
Slovenia	Yes	No	Yes	No	Yes, ARAO	Yes	Yes, ARAO
Switzerland	Yes	Yes	No, bilateral agreements	Yes, NAGRA	Yes, Colenco for utilities	No	Yes, NAGRA, ARIUS
Other EU Countries							
Finland	Yes	Yes	Yes	Yes, POSIVA Oy			Yes, Univ.Helsinki
France	Yes	Yes	Yes	Yes, ANDRA			
Germany	Yes	Yes	Yes	Yes, BfS and DBE			Yes, BfS
Spain	Yes	Yes	Yes	Yes, ENRESA			Yes, Univ. Valencia Univ. Catalunya
Sweden	Yes	Yes	Yes	Yes, SKB			Yes, SKB, SKI, SSI
United Kingdom	Yes	Yes	Yes	Yes, Nirex			Yes, Univ. of Leeds

Table A2-2: Ratification/adoption of international conventions and treaties

Countries	Joint Convention	Convention on Physical Protection of Nuclear Material	Treaty on Non-Proliferation of Nuclear Weapons, NPT	OS PAR Convention [1])	Espoo Convention [1])
SAPIERR countries					
Austria	Yes	Yes	Yes	No	Yes
Belgium	Yes	Yes	Yes	Yes	Yes
Bulgaria	Yes	Yes (withdrawal)	Yes	No	Yes
Croatia	Yes	Yes	Yes (deposit)	No	Yes (accession)
Czech Republic	Yes	Yes	Yes (deposit)	No	Yes
Hungary	Yes	Yes (withdrawal)	Yes	No	Yes
Italy	Yes (signed)	Yes	Yes	No	Yes
Latvia	Yes	Yes	Yes (deposit)	No	Yes (accession)
Lithuania	Yes	Yes	Yes (deposit)	No	Yes
Netherlands	Yes	Yes	Yes	Yes	Yes (acceptance)
Romania	Yes	Yes	Yes	No	Yes
Slovakia	Yes	Yes	Yes (deposit)	No	Yes
Slovenia	Yes	Yes	Yes (deposit)	No	Yes (accession)
Switzerland	Yes	Yes	Yes	Yes	Yes (accession)
Other EU Countries					
Finland	Yes	Yes	Yes	Yes	Yes
France	Yes	Yes	Yes (deposit)	Yes	Yes
Germany	Yes	Yes	Yes	Yes	Yes
Spain	Yes	Yes	Yes (deposit)	Yes	Yes
Sweden	Yes	Yes	Yes	Yes	Yes
United Kingdom	Yes	Yes	Yes	Yes	Yes

[1]) The EC has also signed and ratified the OSPAR Convention and the Espoo convention.

Table A2-3: List of the regulators and implementing bodies for disposal of radioactive waste

Country	Regulatory Authority	Implementing Organisation
SAPIERR countries		
Austria	Federal State	Federal Minister for Agriculture, Forestry, Environment and Water Management
Belgium	Federal Agency for Nuclear Control (FANC)	ONDRAF/NIRAS
Bulgaria	Nuclear Regulating Agency (NRA)	Radioactive Waste Management Organisation (WMO)
Croatia	State Institute for Nuclear Safety) for nuclear safety issues and State Office for Radiation Protection for radiation protection issues	None
Czech Republic	State Office for Nuclear Safety (SUJB)	RAWRA (SURAO)
Hungary	HAEA Atomic Energy Authority (SNF) and Ministry of Health, Social and Family Affairs + SPHMOS (RAW)	PURAM
Italy	Ministry for Productive Activities and APAT	to be defined
Latvia	Radiation Safety Centre and Ministry of Environment	RAPA
Lithuania	VATESI	RATA
Netherlands	Ministry of Housing Spatial Planning and Environment plus Ministry of Social Affairs and Employment plus Ministry of Economic Affairs	COVRA
Romania	CNCAN	ANDRAD
Slovakia	Nuclear Regulatory Authority (UJDSR) for nuclear safety issues and Public Health Authority (UVZ SR) for radiation protection issues	No national agency responsible for waste disposal. JAVYS fulfils its role until its establishing.
Slovenia	Nuclear Safety Administration (SNSA)	ARAO
Switzerland	HSK (SUVA and BAG for small RAW producers)	NAGRA
Other EU Countries		
Finland	Radiation and Nuclear Safety Authority (STUK)	POSIVA
France	General Directorate for Radiation Protection and Nuclear Safety	ANDRA
Germany	Federal Ministry of Environment, Nature Conservation and Nuclear Safety and Federal States	BfS with delegation to DBE
Spain	Nuclear Safety Council (CSN)	ENRESA
Sweden	Swedish Nuclear Power Inspectorate (SKI) and Swedish Radiation Protection Authority (SSI)	SKB
United Kingdom	Environmental Agency in England/Wales The Scottish Environmental Protection Agency (SEPA) in Scotland	NDA

Table A2-4: Export, import, transfer of RAW / SNF[1], attitude towards international repository

Country	Disposal Policy for HLW/SNF, Attitude towards international repository; actual transfers	Import of foreign RAW for disposal permitted?	Export of RAW permitted ?
SAPIERR I Countries			
Austria	Anti-nuclear policy; preference for no repositories Early negotiations with intent to export Zwentendorf NPP fuel	No	Yes (conditions)
Belgium	Dual track; 1st priority national Provides disposal service for LLW from Luxembourg Previously accepted SNF for reprocessing with no waste return	Yes (conditions)	Yes (conditions)
Bulgaria	Return of SNF to Russia	No	Yes
Croatia	No official policy Currently owns spent fuel from Krysko NPP in Slovenia	No	open
Czech Republic	Dual track; 1st priority national	No	Yes (conditions)
Hungary	Dual track; 1st priority national Formerly exported SNF to Russia	No	Yes
Italy	Long term storage; export not excluded Previously exported SNF for reprocessing with no waste return Efforts to send LLW to USA	No	Yes
Latvia	Dual track	No	Yes (conditions)
Lithuania	Dual track	No	Yes (conditions)
Netherlands	Dual track; if national option, then after many decades Previously exported SNF for reprocessing with no waste return	Yes (conditions)	Yes (conditions)
Romania	No official policy	No	Yes (conditions)
Slovakia	“Triple” track: national, international, return to Russia Formerly exported SNF to Russia	No	Yes (conditions)
Slovenia	Dual track; if national option, then after many decades	Yes (conditions)	Yes (conditions)
Switzerland	Dual track; 1st priority national Previously exported SNF for reprocessing with no waste return	Yes (conditions)	Yes (conditions)
Other EU Countries			
Finland	National only	No	No

[1] This table does not include the many cases in which countries with research reactors running on fuel supplied by another country (usually the USA or Russia) have returned the spent fuel to the supplier

Country	Disposal Policy for HLW/SNF, Attitude towards international repository; actual transfers	Import of foreign RAW for disposal permitted?	Export of RAW permitted ?
	Previously returned SNF to Russia		
France	National only Previously accepted SNF for reprocessing with no waste return	No	Yes (conditions)
Germany	National only Previously exported SNF for reprocessing with no waste return SNF accepted from Germany under one time swap arrangement	Yes (conditions)	Yes (conditions)
Spain	No official policy Has exported long lived wastes to USA	Yes (conditions)	Yes (conditions)
Sweden	National only Previously exported SNF for reprocessing with no waste return Swap with Germany	Yes (small quantities, conditions)	Yes (conditions)
United Kingdom	No official policy Previously accepted SNF for reprocessing with no waste return Operates substitution policy for reprocessing wastes	Left open	Left open

The various attitudes towards shared disposal concepts are often reflected in the policies and in the legal / regulatory framework of the countries. Many countries currently ban import of wastes for disposal (e.g. Austria, Croatia, Czech Republic, Hungary, Latvia, and Lithuania). Very few legally ban export; Finland is an exception. A few explicitly acknowledge the possibility of import or export and some have no formal position. Accordingly implementation of a regional repository would almost certainly necessitate changes in a number of national legal systems. A few countries (e.g. Switzerland) have already formulated rather detailed conditions under which import or export of wastes might be permissible.

At an international level, organisations such as the EC and the IAEA have officially given support to the concept of regional repositories. The NEA has remained silent. Reservations or opposition have been expressed only by some major programmes seeking a national solution. It seems clear that more real international support for shared disposal facilities could help build acceptance for the concept.

Appendix 3: Financial liabilities in specific European countries

A3.1 Austria

Centralized collection, treatment, and conditioning of all radioactive waste for safe interim storage in order to minimise the burden for future generations is a basis of Austrian waste management policy. Although the problem of final disposal is not yet solved, adequate financial means are being established to support any future final disposal strategy. According to the Joint Agreement between the Republic of Austria, the Community of Seibersdorf and the Nuclear Engineering Seibersdorf GmbH (NES) the necessary financial resources for the infrastructure and equipment of the Austrian waste management facility are guaranteed by the Austrian State. The ultimate responsibility of the Austrian Federal State for the final disposal of all radioactive waste in interim storage now and in the future at Nuclear Engineering Seibersdorf GmbH (NES) ensures the availability of sufficient financial resources for the decommissioning of nuclear facilities and the final disposal of radioactive waste.

Treatment of radioactive waste is financed according to the polluter-pays-principle by the relevant license holder, the holder of the waste (especially that arising from recycling of scrap), and the authorities detecting and confiscating radioactive material or receiving orphan sources. When the radioactive waste is delivered to Nuclear Engineering Seibersdorf GmbH (NES) for treatment and interim storage, a charge ("Vorsorgeentgelt") taking into account a risk premium ("Risikozuschlag") has to be paid. This charge comprises the estimated costs for interim storage, pre-disposal treatment and transport to the final repository as well as for disposal and long term management of the final repository. The final disposal fee is calculated using cost estimates based on costs of existing foreign repositories. However, should the collected funds, in spite of the state-of-the art estimations, prove at a later period of time to be insufficient to pay for the real costs of final disposal, the Austrian Federation covers the difference. The contributions of the producers go into a special separated fund administered by Austrian national authorities, which is exclusively dedicated for financing the later final disposal in an appropriate repository.

A3.2 Belgium

Because it wishes to avoid the occurrence of new nuclear liabilities, the Belgian legislator, by virtue of article 9 of the programme law of 12.12.97, charged the ONDRAF/NIRAS (Belgian Agency for Radioactive Waste and Enriched Fissile Materials) with collecting all the elements that are necessary in order to examine to which degree the decommissioning and remediation costs can be actually covered when the time comes.

The Royal Decree defines the mission and competences of ONDRAF/NIRAS and states with respect to waste management financing:

- All the costs related to the activities of ONDRAF/NIRAS will be charged to those who benefit from the performed services ("polluter pays principle"),

- Those charges, evaluated at cost price, will be distributed among the beneficiaries of the services in accordance with objective criteria set by the Board of ONDRAF /NIRAS,

- ONDRAF/NIRAS may, following agreement by the Minister of Economic Affairs, manage a fund in order to finance long term duties, in particular the disposal of the waste. This fund is fed by contributions from the waste producers, according to rules approved by the Minister of Economic Affairs.

- The financial arrangements, for the waste management, for the "regular" waste producers will be fixed in an agreement to be concluded between ONDRAF/NIRAS and the producer.

- The contribution to waste management costs for "occasional" producers is decided upon by the Board of ONDRAF/NIRAS.

ONDRAF/NIRAS has established a financing mechanism based on fees per volume unit of waste delivered, in order to ensure complete financing of all the operations to be performed. The acceptance of the waste and the transfer of property imply also the transfer of financial means from the waste producer to ONDRAF/NIRAS for the short and long term management of the waste (storage and disposal). For storage and disposal operations the fees are paid into the "long-term fund", which is interest bearing. ONDRAF/NIRAS has the responsibility for managing the fund. Each accounting year the financial performance of the fund is reassessed.

The Belgian financing approach uses two part tariffs, specific to each waste category, which are charged to the waste producer for waste delivered to ONDRAF/NIRAS. The tariffs are based on the following principles:

A distinction is made between "fixed costs", independent (within certain limits) of the quantities emplaced, and "variable costs", proportional to the quantities expected to be emplaced in the future.

The fixed costs are charged to producers according to committed volumes. In the case of storage and disposal payments, producers receive in return "reservations of capacity". Each producer makes a binding minimum commitment to cover its share, regardless of the future fluctuations of its programme. This commitment takes the form of an irrevocable guarantee on behalf of the producer.

Variable costs are charged to producers according to volumes delivered and accepted. The aim of the calculation of these fees is to ensure that costs are covered to a confidence level of at least 90%. To help to achieve this, a global uncertainty factor, assigned to the fixed and variable costs of each operation, is derived by the combination of basic uncertainties.

The contract stipulates in detail the precise requirements of the producer regarding waste management, such as waste types, quantities and operations to be performed. In exchange, ONDRAF/NIRAS quotes a price valid for a minimum time period of 10 years (or 5 years for treatment and conditioning). To take into account the time value of money and the opportunity cost of capital, the fees escalate each year, beyond inflation, by a constant risk-free interest rate of 2% (real terms). The parts of the payments which relate to fixed costs are offset against the guaranteed sum and hence the size of the producer's guarantee reduces with time. Should the producer exceed the originally planned volume, the guaranteed sum is increased accordingly (and other producers' guarantees are correspondingly decreased), taking account of interest at 2%. At the end of the contractually agreed period, the waste producer may decide to renew or to terminate the relationship with ONDRAF/NIRAS. Under the latter option, the waste producer then pays in full its outstanding share of the fixed costs, i.e. that part of the guaranteed sum which remains unpaid.

The quoted fees are paid by the producers whenever the property of wastes is transferred to ONDRAF/NIRAS. The tariffs to be applied are fixed by contractual arrangements; they are specific for each waste category and the fees paid are proportional to the volume of the wastes transferred to ONDRAF/NIRAS. The amount of the fees to be paid is then deducted of the producer's provisions and transferred to the so-called "long-term fund" managed by ONDRAF/NIRAS.

The fund for spent fuel management is charged (together with decommissioning fund) to the consumer in the selling price of electricity. The funds are collected from the consumers by the electricity company and transferred to SYNATOM (100% daughter of ELECTRABEL established to manage the funds; the State owns a golden share providing the right of veto). A Surveillance Committee has been created as a legal entity entrusted with control of the settlement and the management of the funds entrusted to SYNATOM. The Committee activities include the methodology of the settlement of the funds, the investment policy, and the refunding of the invested funds.

The head of ONDRAF has made some interesting observations on remaining difficulties even in the well organised Belgian framework (NEA 2003):

Determination of the financial responsible(s). Is the financially responsible entity the operator of the site, the owner of the installations, the owner of the site on which the installations are present, the lessee of the installations or the manager stipulated in a contract concluded between the parties? The division of the obligations amongst the owners and the operators must be carefully defined in formal agreements.

Availability of the financial means built up. The financial means built into accounting provisions recorded in the annual accounts of the companies, are generally rebuilt up in the operation of these companies. This may threaten their availability in the long term taking the uncertainties of economic life into account.

Sufficiency of the financial means. Covering the nuclear costs using a financing mechanism presupposes that this mechanism is maintained for the entire, originally planned duration of operations of the installations concerned. The risks of an early shutdown of the installations or an insufficiency of the mechanisms raise the issue of the solidarity between the actors in the nuclear sector and the solidarity with the State.

Uncertainty regarding real costs. The calculation of the real costs is linked to a number of uncertainties that relate to the work hypotheses used, specifically in relation to the planned management scenarios, and with the development of the laws, standards and techniques. These uncertainties are partially covered by a margin that is included in the calculation of the provisions. Once this reserve is depleted, the State is the sole guarantee for long-term financing for making the radioactive substances safe.

Fiscal deductibility of the provisions. The non-fiscal deductibility of the nuclear provisions, with the exception of the provisions built up by the nuclear power states, is a disincentive for many financial managers to invest provisions.

Many of these are relevant also for multinational projects.

A3.3 Bulgaria

In 2004, Government of Bulgaria adopted the Strategy of Spent Fuel and Radioactive Waste Management. The Strategy foresees some short-term measures for assurance of the spent fuel

management activities in 2005-2010. One of these is, based on the presently valid contract, regular implementation of two transfers of spent fuel to Russia annually. Another is the accumulation of financial assets in the Nuclear Facilities Decommissioning Fund in order to cover expenses for the spent nuclear fuel management.

The Bulgarian strategy recognizes that, in the medium-term, it will be impossible to realize the direct disposal of spent fuel in the country. It defines "complete transfer of the spent fuel from Kozloduy NPP for technological storage and processing outside of the country" as the most acceptable alternative. The high-level waste will be accepted back and stored in the dry-storage facility. Meanwhile, activities leading to development of high-activity waste disposal have been started. These include:

- Construction of the first stage of spent fuel dry storage facility (container type) – activities financed by European Bank for Reconstruction and Development in the framework of the forced decommissioning of Kozloduy 1 and 2 blocks
- Implementation of denser storage of spent fuel in existing wet storage facilities
- In case the two annual shipments to Russia are impossible, the corresponding unused funds should be transferred to the Nuclear Decommissioning Fund.

It is foreseen that the Kozloduy NPP site will be completely free of spent fuel by year 2040. All these formulations show that the strategy retains considerable ambiguity. It is a good illustration of a common situation in the post-Soviet block countries – a conflict between the wishes to continue historical practices involving transfer of spent fuel eastward and the political, social, technical and economical realities of the present day.

The financing of spent fuel and radioactive waste management is provided by the operator of producing power plants during their operational life. For financing radioactive waste and spent fuel management in the post-operational period of Bulgarian NPPs, or after the transfer of waste to the state company "Radioactive Waste, two independent funds were established: "Radioactive Waste Management Fund" and "Nuclear Facilities Decommissioning Fund". The first fund should predominantly cover the costs of the "Radioactive Waste" company; the management of spent fuel is financed from the second one. The management of spent fuel from the research reactor is financed from the state budget.

A3.4 Czech Republic

The Atomic Act states that "*An owner of radioactive waste or in the event other natural or legal person managing the assets of an owner in such a manner that radioactive waste is generated (hereinafter referred to as an "generator") shall bear all costs associated with its management, from its origination to its disposal, including monitoring of radioactive waste repositories after their closure, and including the necessary research and development activities*". The costs of activities associated with disposal of RAW and SF are paid from the nuclear account, a financial source created by generators of RAW and SF in compliance with the Atomic Act, and this nuclear account, as a part of the state financial assets and liabilities, is managed by the Ministry of Finance. A basic principle for the calculation of payments is the duty of generators to cover all costs related to the safe disposal their radioactive waste. The methodology is based on the simulation of cash flows related to the operation of the radioactive waste disposal system and the amount and characteristics of radioactive waste or spent fuel. Rate of payments and payments are defined and approved by Governmental Decree. It should be noted that Czech legislation strongly differentiates between the funding of radioactive waste and spent fuel disposal on one hand and decommissioning of nuclear

facilities on the other. For financing of decommissioning, the holders of licenses have a statutory duty to create financial reserves and deposit financial means on segregated, dedicated bank accounts.

The nuclear account should cover activities of the Radioactive Waste Repository Authority RAWRA (SURAO). RAWRA also controls the creation of financial reserves for decommissioning and their accumulation on segregated accounts annually.

A3.5 Hungary

The following details are taken from reference (NEA 2003). The Minister supervising the Hungarian Atomic Energy Authority (Minister of internal affairs, at the present) disposes of the Central Nuclear Financial Fund (hereinafter Fund), while the Hungarian Atomic Energy Authority is responsible for its management. The Fund was established on 1st January 1998 and is a separate state fund pursuant to Act on Public Finance, exclusively earmarked for financing the construction and operation of disposal facilities for the final disposal of radioactive waste, as well as for the interim storage and final disposal of spent fuel, and the decommissioning of nuclear facilities.

A long-term plan (lasting up to the decommissioning of the various nuclear facilities), a medium-term plan (for five years), and an annual work schedule on the use of the Fund are prepared by the Public Agency for Radioactive Waste Management, PURAM. The long- and medium-term plans are reviewed annually and revised as required. The long- and medium-term plans and the annual work schedule are approved by the Minister supervising the Hungarian Atomic Energy Authority. The payments into the Fund are defined in accordance with these plans. The annual payments into the Fund by Paks Nuclear Power Plant are proposed by the Minister supervising the Hungarian Atomic Energy Authority, in the course of the preparation of the Act on the Central Budget. The calculations are performed in accordance with the calculation algorithms given in the "Rules of development of the long-term plans and relevant estimations in relation to activities to be financed from the Central Nuclear Financial Fund" approved in 2000 by Special Committee of the Hungarian Atomic Energy Commission. Payments are based upon submittals prepared by the Public Agency for Radioactive Waste Management and approved by the Hungarian Atomic Energy Authority and by the Hungarian Energy Office. Payments by Paks Nuclear Power Plant are taken into account when the price of electric energy is being determined.

The institutes disposing radioactive waste in the Radioactive Waste Treatment and Disposal Facility are also liable to contribute to the Fund in accordance with the official price list contained in a ministerial decree. For nuclear installations financed from the central national budget (research reactor and training reactor), the sources required to cover the payment into the Fund are provided by the central budget, when they arise.

The rate of payments into the Fund shall be specified in such a way as to provide appropriate sources for all costs of radioactive waste and spent fuel management and the decommissioning of nuclear facilities. These sources also provide coverage for public control and information activities as well as for the operational expenses of the existing repository.

In order to ensure that the Fund maintains its value, the Government contributes to the Fund a sum that is calculated on the average assets of the Fund in the previous year using the average base interest rate of the central bank in the previous year. This practice was interrupted for 2001-2002, but restored again in 2003.

A3.6 Italy

The early shut down of Italian nuclear power plants had direct consequences. It removed the possibility to set aside from operational revenues all the necessary financial resources for decommissioning. Management of radioactive waste and spent fuel remain a part of decommissioning from financial point of view. Besides the standard decommissioning activities, the following activities are also financed within the scope of decommissioning:

- On-site storage of fuel;
- Volume reduction (e.g. compaction) for radioactive waste materials;
- Packaging of historic/operational waste, e.g. sludge, ion-exchange resins;
- Disposal of radioactive waste.

The corresponding funds have been transferred to SOGIN S.p.A. which is responsible for performing decommissioning and waste treatment activities for all nuclear installations (including ENEA ones). For this purpose, SOGIN has been also charged to produce plans and cost estimations. The cost estimation includes a contingency depending on the specific activity and on the time of expenditure, together with the management costs of the SOGIN. SOGIN has to submit to the National Authority for Electricity and Gas an updated report on the technical and economic plans of the global decommissioning project. The yearly reports have also to contain an update of the decommissioning plan and cost estimate. The levy on kWh, paid from the final users, is adjusted every 3 years on the basis of the contents of the yearly reports. In this way, possible additional costs due to changes of strategies and the activities needed for safety reasons can be endorsed by the National Authority for Electricity and Gas. Efficiency criteria related to the program management and to the progress of activities are taken into account in performing such adjustments.

At present, cost for the long term/final disposal of HLW resulting from the reprocessing of spent fuel has not been evaluated. Regarding the waste treatment capabilities, the adaptation of the already existing waste treatment and storage facilities to the new needs are taken into account.

A3.7 Latvia

Disposal of institutional radioactive waste is performed by the State Hazardous Waste Management Agency (BAPA/RATA). It is also an operator of the Salaspils research facility equipped, among others, with research reactor. Waste producers pay for disposal (in the Baldone repository) or storage (for wastes that are not acceptable in Baldone for safety reasons) of their waste according the list of prices.

A3.8 Lithuania

The financing system for management of radioactive waste and spent fuel is varied in Lithuania. Management of operational radioactive waste and spent fuel, control of existing facilities and storage at the Ignalina NPP are included in the production expenditures of the enterprise.

New management facilities, which are or will be built by the Ignalina NPP decommissioning programme, such as a solid radioactive waste management and storage facility, spent nuclear fuel storage, landfill and near surface disposal facilities, are being financed by the Ignalina International Decommissioning Support Fund and co-financed by the State Enterprise

Ignalina NPP Decommissioning Fund. State Enterprise Ignalina NPP Decommissioning Fund is accumulated in the special Treasury Account from 6 % of yearly Ignalina NPP revenue received from sold electricity. Ignalina International Decommissioning Support Fund is accumulated by the contributions of donor countries and one of the contributors is European Community. It supports decommissioning of INNP according to the commitments that were set of the Treaty of Accession to the European Union[2]. The European Bank for Reconstruction and Development is an administrator of the fund, while the governing body is the Donors' Assembly.

Institutional waste producers pay for their waste collection, transportation, treatment, storage and disposal services according to a contract with the Lithuanian waste management agency, RATA. The fees of the services were approved by order of the minister of economy.

RATA performs control and monitoring of the only existing closed radioactive waste disposal facility in Maišiagala, which was inherited from Soviet times. These activities are resourced from the State Budget of the Republic of Lithuania through the Ministry of Economy.

Analysis of possibilities of constructing a regional geological repository by joint efforts of several countries is a part of Lithuanian Program of assessment of possibilities of the disposal of spent fuel and long-lived radioactive waste (2003-2007). The Program is implemented by the Radioactive Waste Management Agency (RATA). It is financed from the budget of the Republic of Lithuania, the Decommissioning Fund of the Ignalina Nuclear Power Plant, the funds of bilateral cooperation projects, and other resources.

A3.9 Netherlands

COVRA, the Central Organisation for Radioactive Waste, is the only organization in the Netherlands that is qualified to process radioactive waste. It operates so as to cover its costs and the polluter pays all these costs. As COVRA takes over full title and there is no retrospective adjustment of fees paid, all present and future costs have to be covered by the payment of waste fees by the polluter beforehand. Waste fees are paid per volume and type of waste. There is no difference in the financing scheme between large and small producers.

As direct disposal is currently impossible for the small nuclear program of the Netherlands, a capital growth fund has been established for disposal of the long-lived waste. This money is drawn from the fee paid at transfer of the waste to COVRA. All waste producers contribute to the fund, even if they produce only short-lived, low-level waste. During the long period of interim storage the fund has to grow to the desired level. The development, construction, operation, and closure of a national geological repository, the cost of the reference solution, is estimated at € 1.3 billion. Adequacy of the fund is analyzed periodically (i.e. every 5 years). Contributions to the fund are calculated per unit volume (m^3) of conditioned waste, a hundred years of storage time and real interest rate of 3%. The contributions of HLW and LILW are different. Of the required € 1.3 billion two-thirds are charged to the HLW and one-third to the LILW. The money is put in safe investments (e.g. government bonds), which have to be approved of by the Minister of Economic Affairs. Finally, the state acts as back-up for all waste fee calculations.

For small volumes of low and intermediate level waste (LILW) from many, different producers, standardized routes and prices per unit of waste are used. The fee to be paid for full transfer of LILW is mainly related to the treatment needed, to the resulting volume of the

[2] Similar funds have been established for two further countries, where the EC required the shut down of NPPs as their accession condition: Bulgaria and Slovakia. The scopes of activities covered by these funds differ from country to country.

conditioned waste to be stored and to the final radiation level of the conditioned package. No direct account is taken of the activity content of the waste. Waste fees are increased each year to compensate for inflation, unless specific reasons exist to increase costs. Fees paid by waste producers to COVRA include all direct costs of transport, conditioning and storage and also all financial provisions for the costs of future storage and disposal. For a 100-litre drum with solid waste, a fee between € 500 and € 2000 is charged, depending on the resulting end volume. For small end volumes, about 32% of this fee is related to handling and conditioning of the waste, about 29% to the storage, 36% is not directly production related (overhead), 1% is for future maintenance costs and 2% is contributed to the capital growth fund for geological disposal. For waste that does not meet the acceptance criteria, e.g. because of its large dimensions or need for special treatment, special prices apply. For the nuclear power stations that themselves condition their liquid waste (spent ion exchange resins and concentrates from evaporators), the fee for waste transferred to COVRA varies between 10000 and 20000 €/m3.

COVRA has to operate cost-effectively. For some small quantities of waste which require high investments (e.g. animal carcasses), full cost coverage can result in unreasonable waste fees. In order to manage also these wastes at reasonable prices, COVRA has received an interest free loan of € 18 million from the government. High prices based on full cost coverage could create incentives to dispose of the waste via alternative, illegal ways and thus increase the government costs of monitoring and supervision.

A few industrial, research and nuclear producers generate larger volumes of waste. The waste fees for these producers are based on individual contracts. Typically the contract entails that all investments are directly borne by the waste producers (building, fund for future costs); COVRA becomes owner of the building(s) and/or other infrastructure. In addition, the producer pay for operating cost in the form of a fee upon transfer of the waste to COVRA. Concretely, the users of the COVRA's HLW and spent fuel storage facility (HABOG) have directly financed its construction according to the percentage of the volume reserved per producer. The operational costs of HABOG are borne by the users of HABOG: 5 nuclear facilities, which generate SF and HLW (the so-called basis clients). Some of these basis clients pay the operational costs as an annual contribution; others made a down payment by which they paid off all future waste management costs. The waste generators of the latter category are discharged of any responsibility for the management of radioactive waste, once it is transferred to COVRA.

The financial scheme for SF from nuclear power plants is somewhat more complicated. The difference is that after storage at the reactor pools, spent fuel (SF) is exported abroad for reprocessing. Contracts with AREVA and BNFL involve reprocessing and storage before and after, with return of equivalent HLW.

A3.10 Romania

According to Romanian Law, the authorization for any facility is granted only if the applicant has prepared financial arrangements for safe management of its own radioactive wastes and for decommissioning of its installation. In practice, this means the financing of both predisposal and disposal waste management steps. Predisposal activities regarding radioactive waste and spent fuel are financed within the internal economic activities of facility operators. For the costs associated to the long term management, i.e. disposal of spent fuel and radioactive waste management including here also decommissioning costs, SNN/CNE PROD (owner and operator of the Cernavoda NPP) shall pay a financial contribution to the Fund for Radioactive Waste Management and Decommissioning (after implementation of corresponding legislation).

The funds for management of spent nuclear fuel of Romanian research reactors and of institutional radioactive waste are assured by:

- A special fund created by the Ministry of Education and Research (i.e. from the state budget) designated to support the operation of nuclear facilities of national interest, which concretely means the VVR-S research reactor in Marguele,
- Funds for the spent fuel and radioactive waste originating at SCN Pitesti (Triga type research reactor) are provided by the Ministry of Economy and Trade,
- Economic contracts with radioactive waste producers from all over the Romanian territory.

After implementation of legislation on the Fund for Radioactive Waste Management and Decommissioning, the financing of activities will be regulated according to this.

A3.11 Slovak Republic

Financing of all activities related to the "back-end of the peaceful use of nuclear energy" is realized through the State Nuclear Fund. Corresponding legislation specifies the activities can be financed, besides decommissioning of nuclear facilities:

- management of spent fuel and radioactive waste after the shut-down of nuclear facilities (management of operational waste is not financed from the Fund),
- management of orphaned nuclear materials and radioactive wastes,
- purchasing land for siting of the spent fuel and (decommissioning) radioactive waste repositories,
- searching for localities, geological investigation, preparation, designing, construction, commissioning, operation, closing and institutional control of the spent fuel and (decommissioning) waste repositories, including the corresponding research and development.

The National Fund is a juridical person reporting to the Ministry of Economy. The budget, as well as the financing of particular projects and activities, is approved by the Board of Governors which is a statutory body of the Fund.

Currently, there is only one "consumer" of the Funds financial resources - the state-owned JAVYS company (Nuclear Decommissioning Company), which is currently responsible for realisation of activities financed from the fund. The funding process should be based on the national strategy for the back-end of nuclear energy (currently under Governmental approval) and on annual applications for financial covering of specific activities. They shall be consistent with the approved strategy.

JAVYS is currently also responsible for the final steps of management of institutional waste. The process is based on individual contracts with the waste producers from medicine, research and industrial areas.

Slovakia has not yet established the national agency responsible for disposal of radioactive waste and spent fuel. According to the legislation, it shall be established by 2012. Assignment of responsibilities to the new agency is still under discussion, recent international studies proposed institutional arrangement analogous to the Belgian model:

- A national agency proposing the conceptual solutions and responsible for disposal of radioactive waste and spent fuel – analogue of ONDRAF/NIRAS

- The rest of JAVYS – analogous to Belgoprocess and of other companies implement specific radioactive waste and spent fuel management activities.

A3.12 Slovenia and Croatia

The Nuclear Power Plant Krško is jointly owned by Slovenia and Croatia. The electricity production is equally shared between the two countries and both parties participate in management of the NPP. By the contract on NPP ownership and exploitation, signed between the two Governments in 2003, the decommissioning and the disposal of spent fuel (SF) as well as low and intermediate level waste (LILW) is under the responsibility of both parties, and the financial resources for covering these liabilities should be equally provided. Both countries are liable to establish the fund and collect the financial resources for the decommissioning and waste disposal.

Regarding the Slovenian part of such obligation, the Krško NPP covers the operating expenses with the income of the sale of electricity. Expenses for RAW and SNF treatment, conditioning and storage are regarded as part of the production costs. The financial resources for these activities are ensured during the operational period of the NPP. Besides of these costs, the owner of the Krško NPP is, since 1995, obliged by the legislation (Act on the Fund for the Financing of the Decommissioning of the Krško NPP and the Disposal of RW from the Krško NPP) to assure the financial resources for decommissioning and final disposal of RAW and SNF too. The Fund is a legal entity mandated to collect the financial resource for the decommissioning of NPP and the disposal of radioactive waste and SNF. All activities of Slovenian radioactive waste management agency, ARAO, the state public services, covering treatment & conditioning and disposal of radioactive waste and SF arising from NPP, are financed from this special earmarked fund.

The research reactor is owned by the Republic of Slovenia, so the final financial responsibility for its decommissioning and SNF/RAW management lies with the state budget. Small producers are liable to pay for waste management services to ARAO according to the tariff system, approved by the Government.

The establishment of a Croatian fund analogous to above-mentioned is still pending. The Act on Ionising Radiation Protection and Safety of Ionising Radiation Sources defines that the holder of the authorisation must provide for and bear the costs of disposal of radioactive waste as well as of spent sealed radioactive sources and ionizing radiation sources not intended for further use. In the event that the costs of disposal at the moment of enforcement are not recoverable from the party obligated to bear such costs, the funds for covering the costs of enforcement by a third person shall be provided from the state budget of the Republic of Croatia. Upon recovering the costs from the party, the funds shall be restored to the state budget.

No practical arrangements on joint disposal of the spent fuel and radioactive waste between Slovenia and Croatia have been agreed so far. More details are in Appendix 6.2.

A3.13 Switzerland

To ensure sufficient financial resources for the decommissioning of nuclear installations and the final management of SNF and RAW two funds have been established. Both are independent legal entities administered by a Management Commission appointed by the

Federal Department (Ministry) of Environment, Transport, Energy and Communication (UVEK)

- Decommissioning Fund (Stilllegungsfonds): funds to cover costs for decommissioning of NPPs and other nuclear facilities and the disposal of decommissioning waste. The decommissioning costs include expenditures for shut-down and demolition of nuclear facilities and the marginal costs of disposal of the waste resulting thereof, assuming that the basic disposal costs are covered by the Waste Management Fund describes below. The amount of the contributions is calculated according to the expected costs of the tasks to be covered by the fund, separately for each NPP. The yearly contributions of the operators are calculated in such a way that, by the end of operation of the NPP, the necessary costs are accumulated.

- Waste Management Fund (Entsorgungsfonds): accumulates final resources to cover the costs arising after shut-down of the NPPs for the final management (disposal) of RAW. Included are all costs arising for disposal of RAW and SNF after shut-down of the NPPs, such as research, preparatory measurements, projecting, construction and operation of disposal facilities, their closure and monitoring.

The annual contributions to be paid to the funds by the NPP operators are based on cost estimates, derived from specific decommissioning and disposal projects submitted by the operators and reviewed by the nuclear safety authorities separately for each NPP. The projects, cost estimates and annual contributions are periodically updated (every five years). In December 2005, the accumulated funds of the Decommissioning Fund amount to CHF 1'252 million. The accumulated funds of the Waste Management funds amount to CHF 2'762 million. The total cost estimate for decommissioning is CHF 1.9 billion and for waste management 12.1 billion.

Current expenditures related to SNF reprocessing and storage of SNF and RAW as well as to research and development, planning, geological investigations and eventually construction and operation of disposal facilities are continuously paid for by the NPP operators.

Appendix 4: Ownership issues in specific European countries

Although details on ownership of wastes at different times throughout their lifecycle are difficult to find, some illustrative examples from EU Member States are given here.

A4.1 Austria

According to the Radiation Protection Act 16 the producers of radioactive waste are responsible for its safe management including disposal. They must take care that the radioactive waste is brought into a form suitable for transport, storage and disposal (conditioning), to store it pending disposal, and eventually to dispose it at their own costs.

A4.2 Belgium

ONDRAF/NIRAS takes over the ownership of wastes after their acceptance from waste producers.

A4.3 Bulgaria

Ownership of radioactive wastes is transferred to the State company "Radioactive Waste" at the time when this company undertakes the management of them. Regarding the spent fuel, it is unclear from available documents, if the Russian company performing the acceptance of Bulgarian spent fuel according with the bi-lateral agreement will be "only" responsible for the management of them or take over also the ownership of spent fuel. Bulgarian strategy of spent fuel management is based on the transfer to Russia (twice annually) for "processing and technological storage", i.e. with later return of corresponding high-level waste. The strategy does not specify when this return will be take place nor who will be the owner of returned waste and/or responsible for its management.

A4.4 Czech Republic

During pre-disposal steps of radioactive waste and spent fuel management, they are owned by responsible organization – the generator and/or holder of license for particular management step. On acceptance of waste for disposal, the ownership is transferred to the RAWRA. According to the Atomic Act, *"A licence issued by the State Office for Nuclear Safety is required for radioactive waste management to the extent and in the manner established in an implementing legal regulation. A contractual transfer of rights to manage radioactive waste or of its ownership must be stipulated in writing*".

A4.5 Hungary

Hungarian legal regulations allocate clearly the responsibility for managing radioactive waste and spent fuel in all stages of radioactive waste management, but the ownership is not explicitly dealt with.

A4.6 Italy

Since the political decision on closing Italian nuclear programme, two main organisations remain involved in the back-end of fuel cycle and in the radioactive waste management:

- The National Agency for New Technology, Energy and the Environment (ENEA) (formerly Nuclear Energy Research Agency (CNEN)) which was responsible for the

operation of experimental fuel cycle installations. ENEA also becomes owner of institutional radioactive waste (except disused radium sources) and take care of its final disposal.

- SOGIN (Società Gestione Impianti Nucleari) S.p.A., whose shareholder is the Ministry of Economy and Finance, with strategic and operational aims given by the Ministry of Productive Activities. The primary mission of SOGIN S.p.A. is to cover the decommissioning of all Italian nuclear installations and the safe management of the spent fuel and radioactive waste.

Both these companies own the NUCLECO company which carries out the ENEA tasks in the management of institutional radioactive waste. Generally, all spent fuel from closed NPPs is owned by SOGIN, also in cases when spent fuel is stored externally, in "away from reactor" facilities.

A4.7 Latvia

The waste producer is the owner of waste, but the final owner is the State – when waste is accepted by the BAPA/RATA.

A4.8 Lithuania

Nuclear and radioactive materials belong to the State and/or to legal persons having licences. In practice, RATA takes over the ownership of wastes after their acceptance for further management steps, mostly in facilities at the Ignalina NPP.

A4.9 Netherlands

Once the waste producer has handed over its waste to the authorized body, all waste management activities fall under the 'responsibility/liability of state'. The state fulfils this responsibility by appointing COVRA and, as such, it delegates its liability to COVRA which has statutory obligations to treat and condition, store, dispose the waste, and also to manage the financing. The responsibility/liability for the waste is coupled to its physical control. COVRA, the Central Organisation for Radioactive Waste, is the only organisation in the Netherlands that is qualified to process radioactive waste. Any company in the Netherlands, licensed to work with radioactive materials under the Nuclear energy act is bound by law to tender all of its radioactive – both arising in nuclear facilities and institutional – waste to COVRA.

Once the transfer of the waste has been accomplished, the producer is exempted from further responsibility/liability for the waste. Until the transfer, the license holder/waste producer holds responsibility/liability for the waste. With only a few exceptions (e.g. reprocessing waste from France), COVRA collects and transports all radioactive waste, and is thus responsible/liable for the waste during alls steps of its management, except processes at the place of its arising.

A4.10 Romania

Since Romania operates a disposal facility for institutional waste (Baita-Bihor) only; all spent fuel and radioactive waste produced at nuclear facilities are still under the responsibility/ownership of their producers. The repository is operated by the research institute IFIN-HH (Marguele), but after establishing ANDRAD (the national agency responsible for development and operation of disposal facilities), the ownership of the Baita-Bihor repository has been transferred to ANDRAD (with IFIN-HH remaining in the position

of a contractual repository operator). In fact, the final institutional arrangement of the radioactive waste and spent fuel ownership during and after its disposal is still being set up.

A4.11 Slovak Republic

Slovak legislation does not consider the ownership of radioactive waste and spent fuel. It knows only the term "holder of the license (authorization, permission, approval…) for the management of radioactive waste and/or spent fuel". All transfers of radioactive waste and spent fuel are performed between the "license holders". It could mean implicitly (but purely legislatively not fully accurately), that the license holder owns the spent fuel and radioactive waste in the scope of his particular license.

A4.12 Slovenia and Croatia

Slovenian legislation does not use the term "ownership" of radioactive waste and/or spent fuel. It speaks about "responsibilities". According to the Act on Ionising Radiation Protection and Nuclear Safety, the acceptance, the collection, transportation, pre-treatment, storing prior to disposal and the disposal of radioactive waste and spent fuel is a mandatory state public service. This mandatory state public service is performed by ARAO – Agency for Radwaste Management. Nevertheless, the legislation also allows that for a limited period of time the treatment and storage of radioactive waste and spent fuel at the waste generator if it is licensed for these activities by the competent Ministry. This is the case with the NPP Krško.

Regarding Slovenian fuel cycle wastes, the final closure and disposal of mine and milling tailing is under the responsibility of the facility operator; later ARAO will conduct the monitoring and stewardship of the disposal sites (two sites) as a state public service. This transfer of responsibilities is expected in 2008 or 2009.

Slovenian small producers are liable to deliver the waste for storing and future disposal to ARAO. As a state public service ARAO is responsible for collection, transport, storage, treatment and conditioning as well as future disposal of institutional waste. By accepting the waste from small producers, ARAO takes over the full responsibility for the waste (including the disposal and financial risks associated with future disposal).

Regarding the situation in Croatia, the responsibilities for waste management are only briefly mentioned in the legislation. The holder of the authorization must provide for and bear the costs of disposal of radioactive waste as well as of spent sealed radioactive sources and ionising radiation sources not intended for further use. The Act on Ionizing Radiation Protection and Safety of Ionising Radiation Sources defines that the disposal of radioactive waste and orphan sources shall be provided by the State Office for Radiation Protection, but no task related to the disposal of radioactive waste is delivered to this office at the same time.

No other organization has been given a clear mandate for the disposal of radioactive waste. APO – the Croatian Agency for Hazardous Waste is according to the Agreement on the ownership and exploitation of the NPP responsible for preparation of Decommissioning and Waste Disposal plan for NPP Krško including the cost estimates for future liabilities which should be the basis for collecting the financial resources in the fund. In the past, APO was also involved in the site selection for Croatian LILW repository, but it still does not have legislative mandate for the disposal of radioactive waste or spent nuclear fuel.

A4.13 Switzerland

Waste from nuclear power plants belongs to the operating utilities, which formed a national waste management cooperative to plan their disposal. Institutional waste from small users is collected (for a fee) by the Paul Scherrer Institute, acting as an agent for the Government. Ownership passes to the Government on collection of the wastes.

Appendix 5: Import, export and transportation issues in specific European countries

In addition to the country-specific requirements noted in the following sections, all States that have signed up to the IAEA Joint Convention on radioactive Wastes and Spent Fuel have accepted certain restrictions, such as the prohibition on transporting waste to a destination south of latitude 60^0 south.

A5.1 Austria

According to §3 of Constitutional Law No. 149 on a nuclear-free Austria, transportation of fissionable material on Austrian territory is prohibited in general. Exceptions are made if international duties demand this, and for transports for the purpose of peaceful use except for production of energy by nuclear fission and disposal of wastes from this. These basic rules follow the consequence that import of radioactive waste is prohibited in general. Export of radioactive waste is permitted under certain conditions; transfer of radioactive waste through Austrian territory is only possible if foreseen in an international treaty signed by Austria.

Every transport of radioactive waste is subject to the conditions set in Council Directive 92/3/Euratom. Austria has implemented this Council Directive in its national legislation by adoption of the Ordinance on the Transfer of Radioactive Wastes of 1997. All actions in connection with transport of radioactive waste out of, into or through Austrian territory are regulated by the Ordinance on the Transfer of Radioactive Waste as well as international and European transport regulations (RID, ADR, ADN etc.).

A5.2 Belgium

There are a few transboundary shipments of irradiated fuel and waste. Licenses have been granted for:

- Transfer of irradiated fuel from the Dutch nuclear power plant of Borsele to COGEMA La Hague in France;
- Export of the irradiated MTR fuel assemblies of reactor BR2 from Mol to La Hague;
- Import of vitrified high-level radioactive waste from COGEMA La Hague to Belgoprocess Dessel. This waste is the result of the reprocessing of irradiated fuel of the nuclear plants of Doel 1-2 and Tihange 1 which was transferred previously from Belgium to France;
- Import of waste, generated either through the decontamination of materials (e.g. pumps) or as a consequence of melting of radioactively contaminated metal;
- Import of used sources from Luxemburg within the framework of the existing convention between Luxemburg and Belgium.

A5.3 Bulgaria

Import and transportation of RAW generated outside of the Republic of Bulgaria into Bulgarian territory is prohibited (Act on the Safe Use of Nuclear Energy). An exception is made for re-import of used sealed sources manufactured in the Republic of Bulgaria and for RAW generated by reprocessing of materials as a service to the Republic of Bulgaria.

Export is carried out by shipping spent nuclear fuel for reprocessing to Russia. The shipment passes through the territories of Romania and Ukraine.

A5.4 Czech Republic

Import of radioactive waste into the territory of the Czech Republic is prohibited, with the exception of the re-import of ionizing radiation sources produced in the Czech Republic or radioactive waste originated from materials exported from the Czech Republic for the purpose of their processing or reprocessing having been approved by the SUBJ, the State Office for Nuclear safety.

- In general , it is prohibited to transport radioactive waste to a state which, in the option of the competent authority of the country of radioactive waste origin, does not have special legal or, according to accessible information, technical or administrative resources to manage the radioactive waste safely.

A5.5 Hungary

Import and/or export of radioactive waste and spent fuel is not prohibited in Hungary, in general. It is subject to a license issued by HAEA, according to the Governmental Decrees on the licensing of nuclear exports and imports, and on the licensing of shipments of radioactive waste across the national border. Licenses for import of radioactive waste can be granted only if the technical, legal or administrative resources for the safe management of the waste are assured.

In the past, from 1989 to1998, management of Hungarian spent fuel was based on the option of exporting the spent fuel to the Soviet Union, later to Russia. However, in the 1990's, contrary to the terms of the original agreement though in accordance with international practice, the responsible Russian authorities wished to have Hungary take back the residual radioactive waste and other by-products created during reprocessing. Contrary to Bulgaria, export from Paks NPP was interrupted after 1998.

The last Hungarian Joint Convention Report spoke on the need for elaboration of a strategy for the fuel cycle back-end. In the course of the elaboration of the strategy it decided to examine various possibilities, including the shipment of spent fuel abroad. In principle, this seems to be a possible option, due to the protocol on conditions concerning the reshipment to the Russian Federation of Russian-made spent fuel assemblies (2004). Export to Russia has also remained as an option for the spent fuel from Hungarian research and training reactors.

A5.6 Italy

The National Operator entitled to perform spent fuel, radioactive waste and decommissioning activities is SOGIN (Società Gestione Impianti Nucleari), a company whose shareholder is the Ministry of Economy and Finance, while the strategic and operational aims are given by the Ministry of Productive Activities. The present national policy on spent fuel management issued by the Government (Directive by the Ministry of Productive Activities on March 28th, 2006) calls for the shipment abroad of the residual spent fuel still present on the national territory for reprocessing in foreign facilities. Part of that of Trino and Garigliano NPPs, as well as all the spent fuel of Latina NPP were sent abroad under services agreements for reprocessing, including provisions for return to Italy of corresponding nuclear material and conditioned radioactive waste. All the remaining spent fuel, also fuel originated by the operation of research reactors is still wet stored in the plant of origin or in "Away from Reactor" facilities. Also the fuel of two experimental reprocessing facilities shut down several

years ago is currently wet stored at the facility site. Almost all the wastes generated by the operation of nuclear installations are also stored at the sites of origin.

According to the national regulations, a licence to export spent fuel or radioactive waste from Italy cannot be granted if the destination is:

- south of latitude 60° south;
- a State party to the Fourth ACP-EEC Convention which is not member of the European Union;
- a State which, in the opinion of the Italian competent authority, does not have the technical, legal or administrative resources to manage the spent fuel or the radioactive waste safely.

The international regulations for transport of dangerous goods, including class 7 (radioactive material) are applied for trans-boundary movement of spent fuel and radioactive waste to protect persons, property and the environment from the effects of radiation during their transport. Those materials are not categorized as such by the international Regulations but on the basis of their radioactive and fissile properties. Therefore all the requirements stated in the modal regulations that are based on the IAEA Regulations for the Safe Transport of Radioactive Material, are applied for the shipments of spent fuel and radioactive waste. Italy also follows the administrative procedures set forth in the European Union Directive 92/3/Euratom implemented into the national regulatory framework by the Radiation Protection Act for transboundary movement of radioactive waste. For trans-boundary movement of spent fuel, a case by case licensing procedure is applied

National experience of trans-boundary movements of spent fuel and radioactive waste is related to the reprocessing of spent fuel in UK and the treatment of radioactive waste arising from nuclear fuel cycle and from medical or industrial activities. The last shipment to UK took place in 2005 as closure of the service agreements signed in the past. In 2007, SOGIN signed an agreement with AREVA for reprocessing of a further 235t of spent fuel – with return to Italy of the resulting HLW.

A5.7 Latvia

Import of radioactive waste into the Republic of Latvia from other countries is prohibited, except in cases:

- where such waste originated as a result of the treatment of radioactive waste exported from the Republic of Latvia and is being transported back into the country;
- where it is impossible to segregate the radioactive waste which, during the treatment process abroad, originated from the radioactive waste which was imported from the Republic of Latvia; in such case an equivalent amount of other radioactive waste can be imported into the country.

A5.8 Lithuania

According to provisions of the Law on the Management of Radioactive Waste of the Republic of Lithuania, it is prohibited to import radioactive waste and spent nuclear fuels into Lithuania, except in cases when radioactive waste is transported in transit or radioactive waste and spent nuclear fuel is returned to Lithuania as the country of origin. Radioactive waste may be transported only to such states that have the administrative and technical capacity to

receive it, as well as the regulatory and other structures, needed to manage radioactive waste in accordance with the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management. It is ensured that radioactive waste and spent nuclear fuel is exported and transported in transit only after notification of the country of destination, and having received the approval of that country according to established order. It is foreseen in the legal acts of the country, that consignors of radioactive waste and spent nuclear fuel shall take back the waste, if the shipment cannot be finished or if the conditions for the shipment are not fulfilled.

A5.9 Netherlands

It is forbidden by law to import, export and transit radioactive wastes without a license. Internal transport (within the Netherlands) only requires notification. Conditions for a transport license are a nuclear insurance and a compliance with legislative requirements for transport (IAEA Safety Standard series No. TS-R-1 and/or the ADR).

Export of waste for processing is allowed, but resulting wastes have to be returned to the Netherlands and transferred to COVRA. Import of foreign waste is not allowed. Dutch waste is defined as waste from organizations with a license under the Dutch Nuclear energy act. In principle, it is possible that a licensee imports foreign radioactive materials and has these processed at COVRA as radioactive waste.

License applications for a transboundary shipment of radioactive waste should be made to the regulatory body still using the standard document laid down in EC Decision 93/552 Euratom. Spent fuel destined for reprocessing is not considered as radioactive waste and consequently, does not fall under the scope of the Directive 92/3. However, with a view to the large quantities of radioactive material involved in such transports, regulatory control is exercised anyway. A license based on the international transport regulations is required, covering aspects such as import or export from the country, package approval certificates and physical protection measures. The new Euratom Directive 2006/117 has to be implemented before December 25, 2008.

A5.10 Romania

According to the principal nuclear law, import, export, and transit of radioactive materials, including spent fuel and radioactive waste, must be authorized by the regulatory authority (CNCAN). The import of radioactive waste (including of spent fuel, as Romania considers spent fuel to be radioactive waste) is prohibited. The only exception is when the import follows directly from the processing outside Romanian territory, of a previously authorized export of radioactive waste (including spent fuel), on the basis of the provisions of international agreements or of contracts concluded with commercial partners.

According to the “Romanian Norms for Transport of Radioactive Material – Authorization Procedures”, the international shipment of radioactive materials can be performed only if the carrier gets a transport authorization issued by CNCAN, and the carrier or consignor gets a shipment authorization issued by CNCAN for that particular shipment. Supplementary, for the shipment of radioactive waste, the “Norms for International Shipments of Radioactive Wastes Involving Romanian Territory” are also applicable. These norms transpose the Council Directive 92/3/EURATOM on shipment of radioactive waste between Member States and into and out of the Community. By the conditions stated in the authorization, CNCAN asks to be notified before the entry on Romanian territory of radioactive materials, including radioactive waste. For spent fuel transport, special requirements for notification are in place as escort and emergency planning special arrangements are required. Transit or export

operations can be conducted only if the licensee has all the authorizations from the countries involved, including of the country of destination.

A5.11 Slovak Republic

Importation of radioactive waste is prohibited, except in cases where the procedures of movement of radioactive waste between the Member States and to and from European Union meet provisions established by § 16 of the Atomic Act (fully implementing the Council Directive No. 92/3/EURATOM) and except for importation of radioactive wastes approved by the Nuclear Regulatory Authority:

a) which have arisen through reprocessing and conditioning of radioactive materials exported for this purpose and their re-import was approved by the NRA in advance,

b) for purposes of their treatment or conditioning on the Slovak Republic territory, if the re-export of material with aliquot activity was stipulated and permitted by the NRA.

Neither RAW shipments across Slovak territory, nor RAW imports or exports have been carried out since the Atomic Act came into force. The last shipment of spent fuel to the Russian Federation (last portion of spent fuel from NPP A-1 – shut down in 1978) took place around 2000. Details of the bi-lateral agreement, particularly regarding the return of equivalent radioactive waste after its reprocessing or shipment "without return", are currently unknown.

A5.12 Slovenia and Croatia

In the Republic of Slovenia, the export, import and transfer of radioactive waste and spent fuel are allowed but are subject to licensing by the Slovenian Nuclear Safety Administration (SNSA). Corresponding requirements comprise mainly the consent of the competent authorities in the destination country and countries of transit to guarantee that the RW/SNF is handled according to the regulations, especially with regard to radiation and nuclear safety and an insurance stipulated by the customs regulations and a warranty guaranteeing payment of expenses occurring in case of refusal of shipment in destination country or in case of lack of assurance that the imported RAW or SNF are handled pursuant to the legislative provisions.

Export of SNF was happened: the SNF from research reactor was shipped back to the USA in 1999.

Export of radioactive waste is mentioned in the Croatian legislation only implicitly: the term "storage of radioactive waste and spent sealed radioactive sources" is described as the activity of placing the radioactive waste and/or spent sealed sources in warehouses prior to or following conditioning or treatment, or prior to release from supervision, restitution to the manufacturer, export or landfill, that is, safekeeping in such a way so as to ensure its isolation with the intention of carrying out the activity in the future. From this formulation it can be concluded that the export of radioactive waste is not prohibited. At the same time, the import, processing, storage and disposal of radioactive waste not originating in the Republic of Croatia are prohibited.

A5.13 Switzerland

Transports of RAW and SNF within the territory of Switzerland have to comply with the rules of the Ordinance on Transportation of Dangerous Goods on Roads. In addition, the prescriptions of ADR, RID and ICAO have to be met.

In principle, RAW generated in Switzerland must be disposed of domestically. However, export, import and transit of RAW for disposal are allowed as an exception under certain conditions. The import, export and transit of radioactive materials are subject to an authorisation by the Federal Government issued under the Nuclear Energy Law and/or the Law on Radiation Protection and their executing Ordinances.

Export for disposal abroad is prohibited unless:

- such export is the object of an agreement between Switzerland and the country of disposal
- the safety requirements of the state of destination are sufficient
- a repository in that state exists
- the requirements of Art. 27 of the Joint Convention are met.

Export of RAW and SNF for reprocessing, treatment or research is possible (but subject to authorisation).

The conditions governing potential import of radioactive waste as an exception are defined in the Nuclear Energy Law and are symmetric with the export conditions given in the bullet points above. This means that Switzerland must have, in an international Convention, approved the import of the radioactive waste, that it has a suitable disposal facility, in line with current international science and technology, that the transit states have approved the transit and that the receiver has formally agreed with the sender, in agreement with the state of origin of the waste, that the sender will take it back if necessary.

De facto, no license could be issued at present for import of SNF or RAW to Switzerland, since the licenses of the Swiss facilities rule out treatment or storage of SNF and RAW not arising from Swiss facilities (with the exception of import of small quantities for research).

Appendix 6: Example case studies of bilateral arrangements

In the past, there have been numerous examples of radioactive materials being transferred for disposal in a country where they were not produced. Many such cases are documented in Reference IAEA 2004. Most prominent, perhaps, were the contracts between the reprocessing companies in France, the UK and Russia and their respective customers around the world. The early versions of these contacts implied that all the HLW arising from the process would remain in the reprocessing country. Current contracts, however, specify return of wastes. In this appendix, a more detailed description is given of the past complex interactions between Russia and one of its partners, Hungary, on the problematic issue of waste acceptance. In addition, the Appendix lays out the waste disposal challenges that arise when countries share ownership of a nuclear power plant. The example given is that of Slovenia and Croatia. The shared ownership issue may well become more general in future, given the current proposals for joint ownership of power plants by the Baltic Countries and the Gulf States.

A6.1 Return of Hungarian spent fuel to Russia[3]

The history of Hungarian spent fuel management can serve an illustrative example of earlier approaches of decision makers in the Former Soviet Union satellite countries in Eastern Europe and of decision makers of Russia. It is of interest since both sides have been interested in the possibility of re-establishing the former practice. Russian incentives are good business opportunities and also a wish from a safeguards angle to have Eastern European spent fuel under centralized control. Interest in the post-Soviet countries is based largely on the assumption that management and disposal of spent fuel abroad will ease the corresponding financial and societal problems at home.

It is useful to review the history of the Russian-Hungarian collaboration in nuclear power exploitation. The construction of the Paks nuclear power plant began in 1966, immediately after an agreement on joint construction between Hungary and Russia had been signed. The first power unit at Paks was based on the Soviet nuclear VVER-440 reactor and was launched in 1983. Currently, four units, with a total capacity of 1760 megawatts, operate at the plant. In 1994, Hungary and Russia, as parties to the international agreement of 1966 on joint construction of the Paks nuclear power plant, adopted a protocol to the agreement. Russia, continuing in the role of the former USSR, was to receive spent nuclear fuel from Hungary in the form of fuel assemblies and ship fresh nuclear fuel to Paks. How the spent fuel would be handled—via reprocessing or storage—was not stipulated in the agreement or the later protocol.

By then, legislation “On Environmental Protection”, which banned the import of radioactive waste and any other foreign radioactive materials into Russia, had come into force. The handling of radioactive waste as per the 1996 protocol conflicted with the proposed legislation. In July 1995, the Russian government issued a decree on the import of spent nuclear fuel for the purposes of reprocessing, stipulating the return of radioactive waste and materials obtained from reprocessing to the country of origin. The decree’s requirements should be applied to all inter-governmental agreements on the import of foreign spent nuclear fuel to Russian reprocessing plants.

[3] See: http://www.bellona.org/english_import_area/international/russia/envirorights/33021

In practice, radioactive waste has never been shipped back to Hungary—either before or after the decree was enacted. Russia's acceptance of the imported radioactive waste without return is the only attractive part of any agreement; Eastern European countries could just as easily have sent their spent fuel to France or Great Britain for reprocessing, firstly, because these countries are on average closer, and, secondly, because collaboration within the EU was always encouraged by EU policy makers. But both France and Great Britain insist on the mandatory return of radioactive waste from reprocessed fuel to the exporting country and their prices are much higher than Russia's prices. Therefore, Hungary preferred to export its spent fuel to Russia.

In a 1996 letter to the Russian government, Hungary requested a "transitional period" while the Hungarian government deliberated the construction of a radioactive waste repository on its own territory. The Hungarian Minister of Industry and Trade asked the Russian government to accept Hungarian spent fuel and to hold on to the reprocessed radioactive waste during this "transitional period". While this request was being considered in Moscow, former Chelyabinsk Region Governor Pavel Sumin offered up to the Russian Government his region—where Mayak, Russia's only working spent fuel reprocessing facility is located—as a home for Hungary's radioactive waste. An appeal sent to the government made it plain that, without the Hungarian contract, reprocessing at Mayak would grind to a halt.

Following these events, the Russian Government commissioned various research and regulatory agencies to develop a plan for Hungarian spent nuclear fuel imports that would provide for non-return of the radioactive by-products of reprocessing. Three executive bodies worked on the project: Minatom, GosKomEkologia, (Russsia's State Environmental Committee) and GosAtomNadzor (GAN – Russsia's Federal Nuclear and Radiation Safety Inspection). Heads of these executive bodies signed a one-page document titled "Resolution on the Organization of Spent Nuclear Fuel Imports in Limited Amounts from the Paks Nuclear Power Plant Constructed in Hungary Jointly with the USSR."

In the document, the agency heads "assuming the consent of the head of the Chelyabinsk Regional Administration, in good will" accepted the Hungarian Government's request, and it was decided that, *"as an exception,"* Russia would receive Hungarian spent fuel without returning radioactive waste and other reprocessing by-products to Hungary. This resolution was signed by: Russia's Minister of Atomic Energy Vladimir Mikhailov, Head of the State Environmental Committee Vladimir Danilov-Danilyan, and GAN Chairman Yury Vishnevsky. The resolution was subsequently approved by Governmental Decree No. 1483-r of October 15, 1998 and signed off on by former Prime Minister Yevgeny Primakov. The decree was published in the "Compiled Laws of the Russian Federation," but the original resolution signed by the three agency heads and ministers stipulating Hungarian spent nuclear fuel import procedures and terms has not been published.

With the legal grounds for Hungarian spent nuclear fuel imports clarified, a train with nuclear materials and radioactive substances left Mayak for Hungary. In the opposite direction, approximately 30 tonnes of spent fuel was sent from Paks to Mayak, which was 10 percent of the entire spent fuel volume of the plant at this time. The war in Yugoslavia frustrated the next train shipments and the imports had to be halted. When the Balkan conflict was over, Russia planned on more spent fuel imports to Mayak from Paks. However, two Russian environmental NGOs—Pravosoznanie (Legal Consciousness) and Dvizheniy za Yadernuyu Bezopasnost (Movement for Nuclear Safety)—had in the meantime managed to get hold of the original resolution signed by the agency heads and ministers and found that a number of the document's resolutions were in direct conflict with legislation. They brought suit against the validity of the October 15, 1998 decree in the Russian Supreme Court. According the

opinion of NGOs, the resolution violated a number of civil rights guaranteed by the Russian Constitution and laws of the Russian Federation, including:

- The right to a safe environment and credible information on the environmental condition as per article 42 of the Constitution;
- The right to health protection from environmental hazards caused by industrial or other activities as well as from accidents, catastrophes and natural disasters as per Article 11 of the Law of the Russian Soviet Socialistic Republic (RSFSR) "On Environmental Protection"; as per Provision 3, Article 50 of the law "On Environmental Protection" of the former RSFSR, the import to Russia of foreign radioactive waste and materials for storage, burial, or disposal—as well as the launching by Russia of such material into space—was strictly forbidden.
- The right to a safe environmental climate with no effect on humans as per Article 8 of the Federal Law "On Sanitary and Epidemiologic Safety," and,
- The right to radiation safety as per Article 22 of the federal law "On Radiation Safety."

The law "On Ecological Impact Studies" outlining the procedures of state environmental impact studies, which are mandatory because of the hazardous effects to humans caused by spent nuclear fuel and the environment, was also violated.

After a number of Supreme Court hearings on this case, it turned out that neither the Government's decree nor the resolution in question had been examined by experts, despite the fact that such expert examination is mandatory. It also became known that the most of the spent fuel contracted to be moved to Mayak still remained in Hungary. The court, therefore, had to decide whether or not the 370 tonnes of spent nuclear fuel remaining in Hungary would be imported as per the Primakov Decree of October 15, 1998.

Some Russian Government representatives stated that the imports of Hungarian SNF were beyond the control of current Russian law, since the liabilities on the storage of radioactive waste from reprocessed SNF in Russia were stipulated in the original 1994 international agreement between Hungary and the USSR to jointly build the Paks plant. Government representatives alluded to a Russian Constitutional provision stipulating the priority of international law over national legislation. Government lawyers even insisted on the necessary ecological impact studies and tried to append a conclusion by Russia's Ministry of Natural Resources to the case. They also claimed that the authors of the Hungarian exception resolution had included in the resolution's preamble an "entirely irrelevant" formulation, which read: "The international agreement of December 28, 1966 on the joint construction of the Paks nuclear power plant and the Protocol of April 1, 1994 fail to clearly stipulate liabilities regarding the final imports of SNF in Russia without further return of radioactive waste and reprocessed products." This single phrase contradicted the Government's argument that Russia's liability, inherited from the collapse the USSR to keep radioactive waste from reprocessed Hungarian spent fuel in Russia, was based in international agreements.

On February 26, 2002 Russia's Supreme Court declared the Government's Decree of October 15, 1998 numbered 1483-rd invalid and non-applicable. The Government tried to appeal the case with the Appeal Review Collegium of the Supreme Court on May 21, 2002. In addition to the reasons presented at the previous hearing in the Supreme Court, Government counsel added allegations of procedural irregularities during the appeal process. The court found against the appeal, and the decision has remained unchanged and in force ever since.

According to the chief engineer of the Mayak plant who had participated in the court hearing, approximately 30 tonnes of Hungarian spent fuel were imported into Russia and reprocessed.

The return of the radioactive waste to Hungary is impossible as it cannot be extracted from the rest waste accumulated at the Mayak plant. Aside from extraction problems, there is no proper infrastructure—no containers for radioactive waste and no special transportation for radioactive waste shipments.

Some lessons can be drawn from the interactions between Russia and Hungary. These lessons are reinforced by similar experiences during Russia's dealings with other East European States, and also by the contractual arrangements made originally between Western European countries and commercial reprocessors in France and Germany. The main points are that:

- Sensible arrangements made between willing partners concerning transfer of radioactive wastes for disposal can be overturned by political or legal developments in the country accepting the wastes.
- The perceptions of the benefits and drawbacks of such arrangements can alter with time. Plutonium and uranium recovered from reprocessing fuel may change from an economic asset to a disposal liability. The benefits of enhanced safety and security may no longer be judged to outweigh the societal problems involved in importing wastes.
- For this reason, any contracts or agreements made on waste transfers should be legally tight and should be consented to by all relevant bodies.
- More importantly, a diversity of disposal service providers is an important goal of any small country exporting its wastes. This can guard against the danger of services being withdrawn or of prices suddenly being unjustifiably increased.

A6.2 Slovenia-Croatia[4]

The multinational disposal concept is an option of topical interest also for Slovenia and Croatia. The interest is not limited only to the expected economic advantage of a regional or multinational repository. In Slovenian-Croatian case the multinational concept is important because of another aspect – i.e. the shared responsibility of both countries for the waste from the NPP.

The construction of the Nuclear Power Plant Krško, being located in Slovenia near the Slovenian-Croatian border, was a joint investment by Slovenia and Croatia, two republics of the former Yugoslavia. The plant was completed in 1981 and the commercial operation started early in 1983. The obligations and rights of both investors during the construction and operation were specified in two bilateral contracts signed in 1974 and 1982. These contracts were fairly detailed on construction, operation and exploitation of the nuclear power plant (NPP), but they said very little about future nuclear liabilities. The electricity production was equally shared between the two countries and both parties participated in management of the NPP.

In 1991, after Slovenia and Croatia became two independent countries, the agreement on the ownership and exploitation of the NPP Krško was re-negotiated and a new contract signed in 2003. By the new contract the decommissioning and the disposal of spent fuel (SF) as well as low and intermediate level waste (LILW) is the responsibility of both parties, and the financial resources for covering these liabilities should be equally provided. Regardless of

[4] Irena Mele, Multinational/Regional Repository – an Illusion or Solution?, Proceedings of the International Conference "Nuclear Energy for New Europe 2006", Portorož, Slovenia, 2006
Irena Mele, Does Dual Ownership of Waste Imply a Regional Disposal Approach?, WM'06 Conference, February 26- March 2, 2006, Tucson, Arizona

shared ownership of waste, the agreement opts for a single disposal solution for LILW as well as for SF, but the details are left open.

More clear elaboration of these responsibilities is given in the programme of the decommissioning and disposal of radioactive waste from the NPP which was jointly prepared by the Slovenian and Croatian waste management organisations in 2004. By the Joint Decommissioning and Waste Disposal Programme for NPP Krško, the preferred solution for the waste is one repository for LILW from both countries and one geological repository for the entire spent fuel inventory. In fact, the Joint Programme proposes two shared facilities for the waste inventory from the two neighbouring countries. According to the IAEA terminology these two repositories may also be regarded as multinational repositories, or more precisely, as regional repositories. Furthermore, if the proposed joint disposal solution is compared to the scenarios for multinational repositories, parallels can easily be drawn with the "cooperation scenario", in which Slovenia and Croatia agreed to jointly develop and implement the disposal solution in one of the two countries.

However, the hosting country for the repository remains undefined. In the existing version of the Joint Programme, the repositories for LILW as well as for the SF are developed for generic sites. Decision on the hosting country is left to future discussions and negotiations between the two parties. According to the Joint Programme, the LILW repository should be in operation by 2018 and the geological repository for SF and high level waste by 2065.

LILW REPOSITORY IN SLOVENIA

In spite of these agreed intentions for shared disposal facilities, the siting and construction of the LILW repository in Slovenia is not being conducted as a joint project. Slovenia, following the requirements of the 2002 Nuclear Act, needs to provide the repository operation by 2013 and is at present making great efforts to successfully conclude the siting of a repository. The project is conducted as a national project. Croatia is not taking part in this project and the question of whether it will join the construction of the LILW repository in Slovenia remains open. So far no explicit initiative to clarify this issue has been given from any site. If in the future the cooperation of the two countries on this project will be readdressed, there are in principle two possibilities for jointly continuing the project:

- If Slovenia is agreed as a hosting country for the LILW repository, different time schedules of the Slovenian national LILW disposal programme and joint disposal programme and other plans for the shared repository may be adjusted to the Slovenian plans. Further development of a regional repository may follow the »cooperation scenario«, if financial arrangements for implementation would include also the previous Slovenian investments into the development and siting of a national repository.
- If Slovenia is not agreed as the host country, or if the agreement is not achieved in time, Slovenia would implement a national repository; however, an option of »add-on scenario« for development of a regional repository may also be considered. The Slovenian national repository may be upgraded into a regional repository at some later stage, if finally successfully negotiated between the two countries. The agreement should include a decision on future long-term liabilities as well as adequate consideration of the fact that this option does not lead towards the real "regional" repository, but instead the repository remains a national facility with waste inventory from both countries.

Both options have many variations which depend on adjustments and fine tuning during the negotiations between the partners. However, if none of these joint options will be accepted by the end of the NPP operational period, each party is liable to take one half of LILW and one half of SF and provide its own disposal solution. But it is important to note that possibilities

for shared disposal facilities exist and that options suggested by multinational scenarios may be helpful in further addressing the joint solution.

JOINT OR NATIONAL DISPOSAL SOLUTION

Important aspects and conditions identified as essential for implementation of the regional repository may also have an impact on Slovenian-Croatian disposal projects and therefore need to be carefully examined. Financial arrangements, legal and institutional requirements and socio-political aspects are very likely to play the decisive role in implementing the joint disposal solution, and will certainly require thorough consideration in the future.

Financial arrangements have partly been addressed in the contract on shared ownership of the nuclear power plant, but at a very general level. In case of a joint disposal solution, both parties are liable to cover the cost of its implementation. The two Funds should equally finance all activities related to the disposal of LILW and SF, previously approved by the Inter-governmental commission. These financial arrangements may be sufficient for the initial stage and preparatory phase, but at the latest time when the hosting country becomes known they will certainly have to be upgraded and details specified, taking into account the asymmetric situation of the hosting and partner country. Decisions will have to be made on revenues allocation, on the involvement of private organisations in the development and construction of the repository and - most importantly - on the securing of financing. Careful consideration will also be needed for financial arrangements regarding the siting project for a repository and, in particular, public involvement in the siting process and incentives to local communities. Sharing of financial risks of increased costs, extra expenses due to delays in construction or obtaining licences, unexpected additional work etc. will also have to be clarified. No such mechanism has been included in the present contract on shared ownership of the NPP.

Regarding the legal aspect, an important question that will have to be addressed in the future is the ownership of waste and its transfer from partner country to the host country. This may prove to be complicated in the case of spent fuel. Although at present SF is considered as waste in both countries this may change in the future, and SF may be recognized as a resource. Clear agreement will be needed for liabilities extending far into the future and a decision will have to be taken on whether to share liabilities also in the future or to transfer them to the hosting country. In the case of a shared repository for spent fuel, an agreement on safeguard will also be needed. Since the spent fuel is of United States origin, the clarification regarding the consent rights may also be required.

Transport and transboundary movement of waste and SF seem not to be a problem. Export and import of waste are conditionally allowed in both countries and - as Slovenia and Croatia are two neighbouring countries - no third country will be involved in the transboundary movement.

There are also other issues important from the perspective of long-term waste management, which have so far been ignored by both partners. The question of possible NPP lifetime extension is more and more frequently discussed in both countries but its influence on the disposal plans has so far not been addressed. Another delicate issue is that of the radioactive waste not originating from the nuclear power plant; although in limited quantities, both countries have such wastes. But the existing plans for a joint solution are developed exclusively for the NPP, therefore limited only to waste from the NPP. In case of a shared repository the disposal of non-energy wastes remains open.

Above all, however, the implementation of a regional repository will require sufficient political and public support in both countries. The relations between the countries are charged

with emotions and some unresolved issues from the past, which are impeding real progress towards a joint solution.

In case of a complete failure of negotiations between the partners and no agreement being reached on a shared repository, the Slovenian LILW repository - if successfully constructed - will remain a national repository, intended for 50 % of LILW inventory from NPP as well as for LILW from other nuclear applications. Croatia is liable for its own waste. According to the provisions of the contract on shared ownership of the NPP Krško, the Croatian part of the waste needs to be removed from the site and transferred to Croatia by 2025 at the latest.