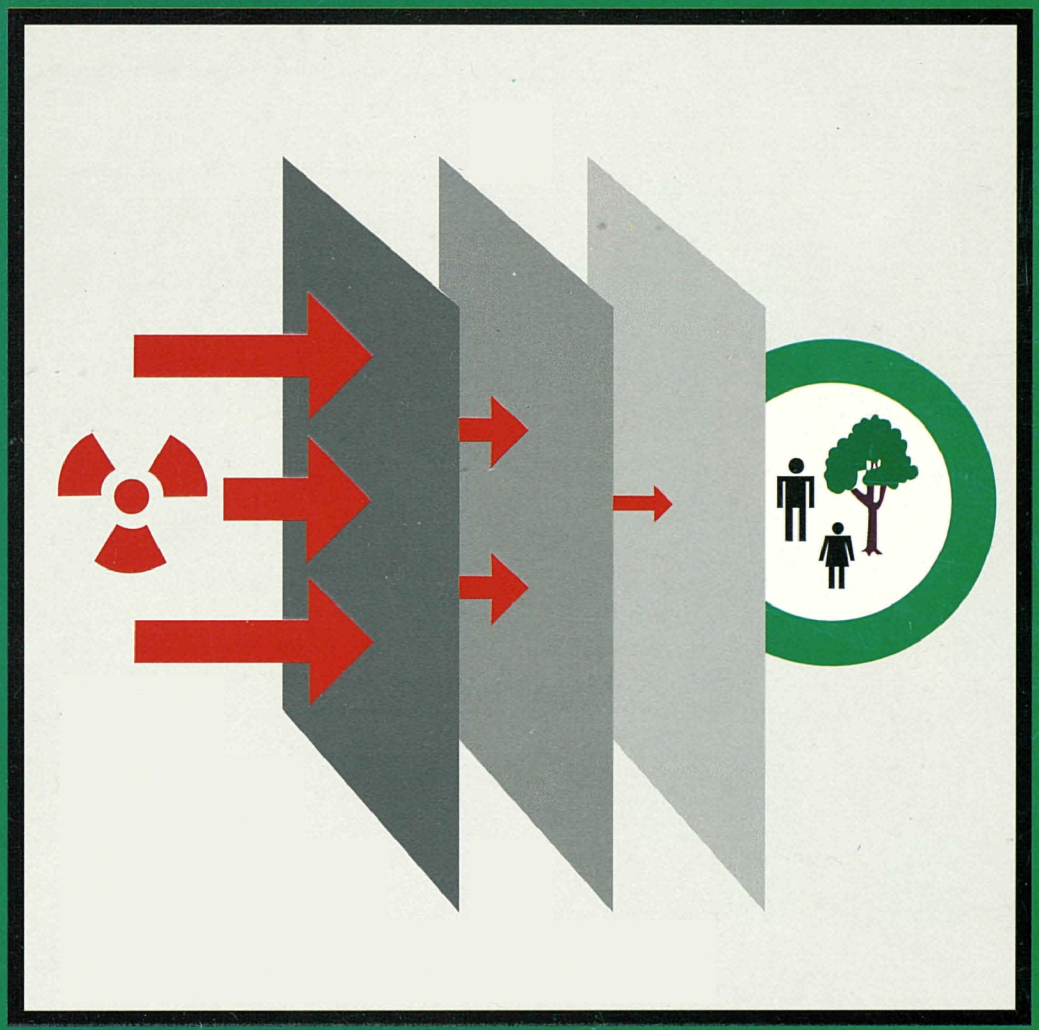
European Commission

nuclear safety and the environment

Decommissioning of nuclear installations in the European Union

Supporting document for the preparation of an EC communication on the subject of decommissioning nuclear installations in the EU



Report

EUR 18860 EN

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Decommissioning of nuclear installations in the European Union

Supporting document for the preparation of an EC communication on the subject of decommissioning nuclear installations in the EU

Compiled by

P. Vankerckhoven

DG XI/C.2

Directorate-General
Environment, Nuclear Safety and Civil Protection

1999

EUR 18860 EN

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Cataloguing data can be found at the end of this publication.

Luxembourg: Office for Official Publications of the European Communities, 1999

ISBN 92-828-5815-4

Printed in Luxembourg

PRINTED ON WHITE CHLORINE-FREE PAPER

FOREWORD

This document has been created and used as a support for an EC Communication on the subject of decommissioning nuclear installations in the EU.

A close analysis of the age of Europe's nuclear facilities reveals that the first decades of the next century will see a rapid increase in the number of such facilities being decommissioned. At present, over 110 nuclear facilities within the Union are at various stages in the decommissioning process and it is forecast that at least a further 160 facilities will need to be decommissioned over the next 15 years (with a Union of 15 Member States).
Future expansion of the Union to include the Baltic and Central European countries may contribute to a rapid increase in the number of facilities to be decommissioned (at least 50 sites).

The Communication will aim at addressing the emphasis that the European Commission has placed on co-operation between the Member States for the decommissioning and safe management of radioactive waste.

The development of common views within the EU on the decommissioning of these facilities will result in better protection of the workers, of the public and of the environment, in a more harmonious technological practice allowing a reduction of the decommissioning costs.

This supporting document has been formulated together with a Group of invited Experts on the basis of Terms of References establishing the main focus of the Communication.
It is constituted by an Introduction (Chapter 1), the Terms of References (Chapter 2) and the Supporting Positions and Observations from the Group of Experts (Chapter 3) on the various items developed from the Terms of References.

The 2 annexes are composed of a short description of the current situation in the Member States and the Central and Eastern European Countries regarding the policy and regulatory aspects linked with decommissioning activities.

This report reflects the opinion of the team of invited experts and does not necessarily reflect the views of the European Commission services. It must be considered as a valuable input to the Commission's work in the area. The Commission will carefully examine the experts recommendations and will in particular assess to what extend they can be included in its future communication on the subject.

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1. INTRODUCTION

Within the framework of chapter 3 of the EURATOM treaty, and of the subsequent Council Resolutions of 19th December 1994 on the management of radioactive waste (No.C379/1) and 15th June 1992 concerning the renewal of the Community action plan regarding radioactive waste (No.C158/3), emphasis is placed on co-operation between the Member States for the safe management of radioactive waste, collaboration with non-Community countries with regard to the future dismantling of a number of nuclear facilities and sites, and in general, on achieving a satisfactory and equal level of protection for workers, the public and the environment, at the highest safety levels that can, in practice, reasonably be achieved.

The outcome from an EC consultation indicates that there are differences and potential improvements in the approach to decommissioning by Member States and candidates for accession. Therefore, with the aim of European co-operation, harmonisation of policies, and development of common views, as emphasised by the opening and the deregulation of the electricity market within the Member States, it would be a significant benefit to have Community guidelines for the decommissioning of nuclear facilities.

The communication, in the form of guidelines, will concern every type of nuclear facility (reactors, fuel cycle facilities, particle accelerators, laboratories, nuclear research centres). [The Naturally Occurring Radioactive Materials (NORM) industry is excluded from the scope of this report.]

Such guidelines for decommissioning would encourage European co-ordination centred on the utilisation of international and national technical and scientific knowledge as well as an approach resolutely aimed at ensuring safety, ensuring environmental sustainability and minimising cost.

Co-ordination at the level of the Member States of the European Union would allow a reduction of the decommissioning costs thanks to the added value generated by an industrial harmonisation of practices and co-operation on a large scale between the involved industrial bodies.

2. TERMS OF REFERENCE AND POTENTIAL ITEMS TO BE HIGHLIGHTED IN AN EC COMMUNICATION ON THE DECOMMISSIONING OF NUCLEAR FACILITIES

The following "Terms of Reference and Potential Items to be highlighted in an EC Communication on the decommissioning of nuclear facilities" were prepared by DG XI/C in consultation with the Advisory Committee on Programme Management and have been used as guidance by the Group of Experts in the preparation of this report.

There are a large number of criteria to be considered in establishing a Community opinion on the decommissioning of nuclear facilities.

Various regulatory, technical, financial and organisational aspects are closely intertwined in preparing a guiding framework.

An analysis of the regulatory and organisational items relevant to decommissioning should be made in the form of an inventory of potential future EC and Member States actions.

The guidelines will recommend some policies for the decommissioning of nuclear facilities, and will identify the relevant common base for the legislative aspects and will help Member States to draw experience from others.

The following list summarises some of the major elements potentially forming the framework of the communication.

2.1. Policy aspects.

2.1.1. The group of experts should identify the specific aspects of the health standards protecting the public and the workers under the Directives and recommendation of the Euratom Treaty in the field of decommissioning. This involves examination of the radiation protection aspects as dosimetry, contamination control and the ALARA (ALARP) principle.

2.1.2. The group of experts should identify the responsibilities connected with decommissioning and waste management.

2.1.3. The group of experts should identify management policies for material resulting from decommissioning operations. This analysis will be performed in a context of the development of common practices of management and classification of radioactive waste.

2.1.4. The group of experts, in a context of minimisation of waste generated, will examine the rules in force within the framework of the criteria for release of materials. The EURATOM basic safety standards and recommendations will be considered.

2.1.5. The group of experts should examine potential ways for the implementation of the rules on the environmental impact assessment in National regulations. It will take into

account the Council Directive 97/11/EC of 3rd March 1997 amending Directive 85/337/EEC.

2.2. Financial aspects

2.2.1. The group of experts should consider the possible financing plans for the implementation of decommissioning operations. The fiscal aspects, the concepts of financial provisions, and the management of funds will be examined.

2.2.2. The group of experts should recommend that international co-operation with regard to decommissioning be reinforced. The synergies thus developed on a Union scale could allow decommissioning costs to be reduced.

2.3. Technical aspects

2.3.1. The group of experts will recommend that a technical approach to decommissioning is established on the concept of the time appropriate for implementation of the various stages of decommissioning, on the current development of technical and scientific knowledge developed by the European Community in its research and development programmes (from the 3rd to the 5th framework programme of Directorate-General XII), and on the social conditions, the nuclear energy perspective, and the repository situation of each country.

2.3.2. The group of experts will examine and recommend possibilities to ensure that the quantities of waste produced during decommissioning operations are minimised. To this end, processes connected with recycling and/or re-use of materials should be explored. They should consider whether the environmental and energy-related impact of recycling is beneficial. Recent progress in the fields of decontamination and the segregation of isotopes will contribute to the analysis of this objective.

2.3.3. The majority of radioactive waste volumes resulting from decommissioning operations have a very low level of activity. The Group of Experts should consider the specific case of very low-level radioactive waste. Options for storage and final disposal will be examined within the national and Community possibilities with regard to the matter.

Based on the existing national experience in the field of decommissioning, the preparation of a Community communication for decommissioning will have to integrate numerous economic, health-related and legislative parameters.

This integration will be possible in the perspective of sustainable industrial development also involving respect for the environment.

To this end, consultation of the various European socio-economic actors involved will be necessary in order to better define the terms governing a Commission recommendation.

3. SUPPORTING POSITIONS AND OBSERVATIONS FROM THE GROUP OF EXPERTS

Methodology

This chapter describes the positions taken and the observations made by the Group of Experts during three working sessions in 1998 that considered drafts of this document which is based on the Terms of Reference (see chapter 2).

Each of the subjects described in the TOR were submitted to the experts and discussed.
At the end of the working sessions on each item, the most important points of the discussion were considered and the experts reached a consensus on their positions and observations.

These points are to be used as valuable input for the establishment of the EC Communication on the subject of decommissioning nuclear installations in the EU.

The subjects were originally grouped in three categories: the "policy aspects", the "financial aspects" and the "technical aspects".

During the working sessions, it appeared necessary to complement these three categories with a fourth one describing the "Public Acceptance" issues. This category, called Social aspects, groups the multiple comments raised on this subject by the Group of Experts during the discussions.

Each section of these categories includes an introduction describing the existing situation on the subject.
This introduction is then followed by the positions and observations made by the experts on these points.

The sequence of these sections and of these categories does not reflect any particular order of priority suggested by the experts but merely represents the order in which they appear in the Terms of Reference.

3.1 Policy aspects

3.1.1 RADIATION PROTECTION AND INDUSTRIAL SAFETY

Objective

The study of this item was aimed at identifying the E.C. regulatory documents pertaining to the protection of the workers and the public against the dangers of ionising radiation, at identifying the specific requirements resulting from the decommissioning activities of nuclear facilities, and at verifying that the latter requirements are addressed into the former regulatory documents.

During the course of the working sessions, the Group of Experts recommended that the industrial safety aspects during decommissioning should also be highlighted.

Institutional basis

The guiding principles for "the protection of the health of workers and the general public against the dangers arising from ionising radiation" have been established in the Article 2b of the Euratom Treaty of 1957, leading to the Chapter 3 calling for the editing of Basic Safety Standards.

These have been worked out by the Commission and their last version published in the Council Directive 96/29/EURATOM of 13 May 1996[1].

Other important documents on radiation protection from the Commission of the European Communities that are applicable during decommissioning activities in the broadest sense are:

- Council Directive on the operational protection of outside workers[2]
- Recommended radiological protection criteria for the recycling of metals from the dismantling of nuclear installations[3]

Regarding the protection of the workers against the conventional risks incurred during decommissioning works, each Member States has in place its own legislation and rules for industrial application in all sectors of activities: civil, electrical, chemical,...

Definition of decommissioning risks

With more and more on-going decommissioning activities in the nuclear industry, it is becoming necessary to verify that the risks to the workers and to the population from those activities are addressed in the existing European documents and that no new recommendations or directives need to be worked out and published.

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[1] EURATOM 96/29, Council Directive of 13 May 1996 laying down basic safety standards for the health protection of the general public and workers against the dangers of ionising radiation. (OJ L-159 of 29/06/1996 page 1)

[2] EURATOM 90/641, Council Directive of 4 December 1990 on the operational protection of outside workers exposed to the risk of ionising radiation during their activities in controlled areas.(OJ L-349 of 13/12/90 page 21)

[3] Radiation Protection 89, Recommended radiological protection criteria for the recycling of metals from the dismantling of nuclear installations, 1998

The decommissioning works involve the following specialities[4]:

- Safe operation and maintenance of a nuclear installation under dismantling or storage conditions
- Work in a nuclear environment (cutting up, decontamination, remote handling)
- Activities involving various conventional industrial expertise
- Waste and material management
- Storage and disposal of nuclear wastes
- Disposal of toxic and hazardous wastes

As a result, the list of regulations applying to decommissioning includes the following:

- Protection of workers and public against the harmful effects of ionising radiation
- Regulations governing the transport of nuclear materials
- Rules for the protection of the environment
- Regulations for conditioning and storing wastes
- Rules for the release of materials, buildings, and land for reuse
- Safety rules applicable to work in and the surveillance and operation of nuclear installations under dismantling
- Safety rules protecting the workers against the conventional risks in an industrial environment

Although most of these activities are part of the normal operation of a nuclear facility, and that ref [4] indicates that, at the time of the report (1991), "all the existing documents on radiation protection and safety meet the needs of decommissioning", it is worthwhile verifying that the accumulated experiences of decommissioning have not induced additional nuclear or conventional risks not observed before.

The strategies for decommissioning (with a typical breakdown given below) were reviewed by the Group of Experts :

- Radiation and contamination mapping
- Material inventory and characterisation
- System preparation and conditioning
- Dismantling of the conventional part, including the equipment for electricity generation
- Decontamination
- Cutting
- Remote handling
- Dismantling of the nuclear island
- Material sorting for recycling or reutilization
- Wastes: conditioning
  transport
  disposition / storage
- Surveillance and control

[4] EUR 13642 EN, Inventory of information for the identification of guiding principles in the decommissioning of nuclear installations, A. Cregut, J. Roger, 1991.

- Safe storage for a period of time
- Deferred dismantling
- Clearance of the site for reuse

Particular attention was given to the principles of dosimetry, contamination control, and ALARA principle.

Regarding these latter items, it is interesting to note the following suggestions (related to policy items) resulting from the " 1st EAN Workshop to Improve Alara Implementation During Decommissioning ", P. Croüail, C. Lefaure, J. Croft, and interpreted as :

- Need to take into account a balanced risk approach considering radiological and conventional risks, public and occupational exposure, imposed and voluntary risks, human health and environmental hazards
- Need to encourage the use of the International System on Occupational Exposure (ISOE) to plants being decommissioned in order to have available an international data base and feedback experience exchange support
- Need to adopt a uniform system of control in Europe to demonstrate that an acceptable level of risk has been achieved when material arising from decommissioning are cleared

ALARA in connection with decommissioning

Modern radiation protection involves the use of the ALARA principle. This means that even if the incurred individual doses are below national, legally binding, dose limits, they should also be kept As Low As Reasonably Achievable (ALARA), economic and social factors being taken into account. According to the Council Directive 96/29/EURATOM, Article 6, each Member State shall ensure that ALARA is implemented. Merely issuing a regulation or changing a legal text does however not implement ALARA – it is teamwork done at the plant under the responsibility and support of the management and the supervision of the national authorities.

The practical implementation of an ALARA-programme during decommissioning of a facility comprises similar components to the ones applied during operation of the facility:

- plan the operations
- set objectives and goals, stimulate the work
- perform the work – review and implement changes if necessary
- document the work

Planning the work

When decommissioning projects are prepared, it is valuable to share the experience from other projects where similar work has been performed. Valuable experience and feedback is also obtained from major refurbishment projects at nuclear facilities[5] . To this end, it is beneficial for the utilities to use data collected and shared in the Information System on Occupational Exposure, ISOE, set up by OECD/NEA and co-sponsored by IAEA. Such

[5] 1st European ALARA Network Workshop on ALARA and Decommissioning, Saclay, France, December 1-3, 1997.

feedback experience is also regularly reported at international conferences[6] and in publications[7].

In the early planning phase, several important topics are addressed. The possible objectives of the decommissioning project are considered. Different technical solutions and possible methods for performing the decommissioning work are identified and studied. The decommissioning work is usually divided into major parts or stages and scoping estimates of the incurred doses for each stage should be made. These estimated doses are used, together with cost estimates and constraints such as:

- nationally decided decommissioning policies
- available funding
- available storage or disposal facilities
- local and regional social factors (e. g. employment issues)
- environmental considerations

to select between the viable decommissioning options and techniques in order to find the optimum solution. Specific tools (devoted software, databases, radiation detectors) to help in the assessment of doses and making the choice between different options have been developed.

A final decommissioning plan describes the final objective of the project and the identified, separated work packages within the project. The radiological status of the facility as well as the occurrence of radioactive substances must be known. The plan should describe the radiation protection programme to be used during the decommissioning work. Individual and collective doses are to be estimated for each separate work package as well as for the total project. It should be shown that the work has been optimised. The adequate competence and the education of the personnel must be addressed. In order to be acceptable, the plan must also describe the measures taken to limit radiation risks and other risks in the case of accidents (potential doses). The issue of quality assurance has to be addressed.

Some key factors

The organisation, control and follow up of radiation work to ensure that doses are kept ALARA is a management issue and should not be delegated to health physics departments alone. The involvement of the top management is important in order to improve and sustain the attitude towards, and awareness of, radiation protection issues at all levels in the organisation. The necessary technical and financial resources for this work must also be provided.

Other factors, which could have an impact on the doses to the personnel, are:

- the use of decontamination of systems to be dismantled
- appropriate plant knowledge and availability of records
- education and radiation protection knowledge of the staff (including contractors)

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[6] 1st EC/ISOE Workshop on Occupational Exposure Management at NPPs, Malmö, Sweden, September 16-18, 1998

[7] The NEA co-operative programme on decommissioning, The First Ten Years, 1985-95, OECD-publications 1996

- effective systems for exchange of information between different work teams
- good organisation of the work – avoid re-work and unnecessary exposure due to insufficient planning
- the use of mock-up systems for training of personnel and testing of equipment
- the dismantling strategy, direct or deferred

It must be realised by the decommissioning team that deferred decommissioning does not necessarily reduce the total doses incurred by the workers for specific tasks. For example, where radioactive decay allows hands-on working after a suitable deferral period, the doses incurred could potentially be higher than if the work had been done earlier by using remote techniques. Also, for Plutonium contaminated materials, the associated dose rates increase with time due to the in-growth of Americium.

Set objectives and goals

It is important that objectives and goals are set for the radiation protection work. To this end a predictive ALARA plan is helpful. It should include estimated, expected individual and collective doses together with levels of variation and action levels for the different work packages. Work of repetitive nature should regularly be reviewed and assessed. The personnel should be well informed about the set goals, the importance the management attaches to the concept of ALARA and the prospects of achieving the set goals.

Implementation phase

During the implementation phase, it is important to continuously survey and monitor incurred doses. It is therefore important to use a suitable dosimeter system and to acquire and implement recording systems, which enables continuous follow-up. Computerised dose recording systems enable large amounts of information to be handled, analysed and shared. Regularly, consideration should be given to the comparison between the estimated dose and the projected final dose upon the completion of work packages or, if feasible, during the time the work is done. This enables identification of deviations and guarantees that remedial actions can be taken as early as possible.

A questioning attitude, open and free exchange of information, willingness to report errors and deviations should be encouraged at all levels in the organisation. Co-ordination between different projects at different levels, including tracking work progress and reporting accidents and other relevant information is important. This can be organised in many ways and there is no given formula for success. Short daily meetings for sharing information between radiation protection personnel and representatives from contractors and staff is one example. Information panels, TV-monitors and handouts could also be used to spread information about objectives and evolution of results. It is important that each person feels and realises that he/she is a participant in, rather than a spectator to, the ALARA-process.

Quality control and Documentation

Audits of the ALARA programme should also be performed during decommissioning. Documentation of the performed work is important. Not only does the decommissioning project benefit from good filing and record keeping practice but it also enables other decommissioning projects to share the lessons learnt and valuable information about incurred doses, time-scales, etc.

Industrial (Classical) Safety

The conventional risks tend to increase when decommissioning, particularly dismantling, starts and hence there is a need to increase the attention paid to these safety issues.

Some of the conventional risk issues are:

- Ensuring safe access and egress is maintained, both during and after decommissioning work: dismantling can result in handrails or staircases being removed, holes being created in floors, fire escape route being blocked or removed, lighting being inadequate, overhead working, etc...
- Materials handling and lifting: care needs to be taken in handling and lifting materials and equipment so as to avoid dropped loads, falling objects and damage to plant, structures and people.
- Identification and verification of the safe isolation of plant prior to dismantling: all plant to be dismantled needs to be isolated from all hazardous sources (e.g. electricity, steam, chemicals, gases) by physical disconnection from sources, draining, flushing and marking as safe. Any plant, pipework, cabling or other equipment in an area where dismantling is to happen, but which is not to be dismantled, should be clearly marked particularly if it is for example live, operational, an essential service or could create a hazard if inadvertently dismantled.
- Identification and protection against other hazards: decommissioning or dismantling activities may create other hazards or safety issues in addition to those identified above, e.g. fire hazards from hot cutting. Careful planning and preparations are required prior to the start of all decommissioning activities to ensure that all potential hazards are identified and adequately protected against.

Positions and observations by the Group of Experts

- The Group of experts indicated that the conventional safety issues that can be encountered during decommissioning works should also be considered, in addition to the nuclear and radiation risks. The write-up of this section has been modified accordingly and the previous paragraph added, based on inputs from the experts.
- The dose limits imposed by the EURATOM BSS for the workers and the public protection are sufficient and are applicable even if the nuclear facility has changed status and /or has entered in a decommissioning phase.
- The total yearly exposure will vary according to the stages of decommissioning and to the ALARA principle. If not at the beginning, the dose received by each individual will gradually decrease due to the removal of the radiation sources and to the decontamination of the plant.
- International dosimetry tracking: the experts were of the opinion that, although each Member States has put in place national dose recording systems, the tracking of the workers dosimetry was deficient on an international scale.
  Decommissioning projects may involve international private companies sending their workers to different decommissioning sites around Europe and it will be important to record the worker's total doses from each different country. Presently, the transfer of exposure data relies on the worker's willingness to communicate their exact dosimetry information to the next employer or authority. Therefore, improvements in international dose tracking are necessary to avoid abuses.
  It is suggested that this issue be considered as an additional subject for an EC programme.

3.1.2 RESPONSIBILITIES

Present situation

The outcome from an EC consultation on decommissioning in the Member States and in the Central and Eastern European Countries and other references[8],[9],[10] indicate the variety of regulations and responsibilities among the States in charge of decommissioning projects.

Although most national regulations are similar in substance, they differ in the distribution of regulatory functions and in the administrative procedures. Individual approaches are influenced by factors such as:

- the constitutional and legal system of the State
- the distribution of authority and jurisdiction among various government agencies and departments
- the ownership, organisation and structure of the nuclear industry and
- the technical, personnel and financial resources available to the licensees

The decommissioning strategies also vary significantly depending on factors such as:

- the number and types of licensees
- whether the licensees are private or state owned
- the availability of waste storage or disposal capacity
- the future use of the site
- the availability of the necessary technology and skilled workers
- the financial resources needed to complete the task
- the type and age of the nuclear facility

Until now, the decommissioning projects have been regulated on a case-by-case basis because of the novelty of the matter and the initial build-up of experience in this field. However, the harmonisation of decommissioning practices in the Member States and the development of decommissioning specific regulations may render regulatory decisions easier, more efficient, transparent and foreseeable.

There could also be a public concern as to how individual country's decommissioning strategy was decided and why it is different from others. It is, therefore, useful to identify the causes of these variations. This information can then be reflected in future decisions and used in communicating with the public [10].

[8] EUR 15355 EN, Euradwaste series N° 7: Policies,regulations and recommendations for the decommissioning of nuclear installations in the European Community, 1994
[9] EUR 17622 EN: A review of the situation of decommissioning of nuclear installations in Europe, 1997
[10] IAEA-TECDOC-714: National policies and regulations for decommissioning nuclear facilities, 1993

Methodology used for the analysis of the decommissioning responsibilities.

The objective that was pursued by the Group of Experts in the analysis of this element was to identify the various responsibilities associated with all the decommissioning and wastes management activities on a nuclear installation, to identify the multiple possible participants who could bear part or all of these responsibilities, and to verify that the risks involved in the decommissioning activities are covered by this scheme.

Responsibilities are:

- the public
- the workers
- the environment
- the future generations
- the tax payers
- the shareholders
- the national and local authorities (governments, parliaments,...)
- the other countries (eg: in case of radioactivity releases)
- the European Institutions

The responsible groups or entities are:

- the licensing authorities
- the governments / states
- the owner of the plant / operator / licensee
- the contractors

The risks involved in the decommissioning of nuclear facilities and the management of their wastes are:

- Technical (to the public, workers, equipment, contamination, waste management...)
- Societal (environment, employment, future liability, welfare...)
- Financial (provisions, access to the funds, depreciation and interest rates, safe management of the funds,...)

Additionally, the lack of reference to nuclear decommissioning in the International Conventions of Paris, Brussels, and Vienna for damages caused by nuclear installations was reviewed: although the risks are reduced when compared with an operating nuclear installations, the liability still exists during decommissioning works.

Ref.[11] concludes, on third party liability during decommissioning projects, that although none of the Conventions expressly treat the decommissioning of nuclear installations, "the NEA steering committee interpretation (not binding) of 28 April 1987 and the decision of 20 April 1990 establish some radiological criteria helping the parties to decide whether or not the installations under decommissioning should remain subject to the Convention".

[11] Nuclear Liabilities and Decommissioning, European and International Regulations and Policies, STAR Seminar-Risley (UK)-October 7, 1998-P. Vankerckhoven

Thus (ref. [11]), for countries that have signed the Conventions, the nuclear liability may apply to nuclear installations under a decommissioning programme: the strict liability should rest upon the operator and an insurance or other financial security is still required.

Regarding environmental damage from decommissioning activities, the Paris Convention does not deal at all with this issue. Two recent changes have occurred in the last decade addressing the environmental damage issues from nuclear activities: the Lugano Convention in 1993, and the Protocol to amend the Vienna Convention in 1997. None of these protocols are yet in force, and furthermore, it is not clear that they would address decommissioning activities.
On the other hand, following a European Commission decision of 29 January 1997, a White Paper on environmental liability (general approach and not specifically nuclear oriented) is currently being prepared with the following main objectives:

- Prevention of environmental damage
- Decontamination, restoration, and reinstatement of the environment
- Strengthening the implementation of the Community environmental legislation
- Implementing the polluter pays principle
- Reducing distortions in the internal market

We can conclude that there are presently numerous gaps in the decommissioning and environmental liability regime and that this should be analysed in more details by legal experts and the contracting parties to the International Convention [11]. The EC White Paper could solve and harmonise some of the Member States approach. With the proposed enlargement of the EU and the increased number of decommissioning operations in the near future, it should be recommended that a clear legal status should be clarified in this field [11].

Positions and observations by the Group of Experts

- The Group of Experts recognises that the legal framework for decommissioning is different in each Member States, and should be treated as such: "harmonisation" of decommissioning practices need not necessarily be the objective.
- On the other hand, each Member State must ensure that the risks involved in decommissioning are covered by the national regulatory framework put in place for this important task: the Group of Experts stressed the importance that the responsibilities and the participants be clearly identified by law in each country, without imposing a uniform guideline throughout the Member States.
- In the case of transfer of responsibilities, e.g. to future generations, the Member States must verify that this transfer is feasible and that not only the responsibilities are transferred, but also the means to achieve them: technical, knowledge, financial,...
- Each Member State must ensure that the decommissioning of each of its nuclear facilities be completed to the final stage determined by their Authorities
- There is a particular responsibility for waste management: the Member States must determine clearly who is responsible for waste repositories, and that these responsibilities are fully covered in the long term.
- As already indicated in item 3.1.1., the conventional risks should be considered during decommissioning activities. Consequently, the associated responsibilities should be clearly identified.

3.1.3 DECOMMISSIONING MATERIAL MANAGEMENT POLICY

Material from decommissioning

It is considered that the material from decommissioning activities do not include material generated during the operation of the plant, i.e. do not include nuclear fuel nor operational wastes (references to the estimation of decommissioning waste quantities are given in item 3.1.4.).

Ref.[12] gives the inventory of decommissioning material arising from nuclear facilities within the European Community. The assessment has included large scale nuclear power plants, nuclear fuel facilities, and a sensitivity study of small research reactors in the EC. This inventory should be increased by the amount of material generated by non electricity producing installations like isotope producers, particles accelerators, laboratories, universities, research centres and medical installations,...

Nevertheless, the material produced by the decommissioning of those facilities should be similar in quality to the material generated by the decommissioning of large reactors, i.e. a large quantity of low and very low level waste (carbon steel, stainless steel, copper, aluminium, concrete, graphite, sodium, secondary wastes from decontamination and dismantling).

Material management policy

Among the options existing for the management of the large quantities of decommissioning material, "disposal and replacement", or "recycle and reuse" are two main ones that should be evaluated by considering cost-benefit analysis, the health, the environmental, and the socio-economic impacts, the safety of the overall process and the ALARA (P) principle.

Studies, for example ref.[13], indicate that for low radioactive and decontaminable material, "the radioactive scrap metal recycling/reuse alternative appears to have considerable advantages over disposal/replacement. Both health risks and environmental impacts are likely to be substantially lower for recycling".

Additionally, the quantity of potentially clearable scrap arising at any point in time is dependent on many factors including: decommissioning strategies, availability of a repository and its costs, decontamination techniques and their costs, scrap market, projects in progress, as well as the clearance levels for scrap metal.

However, this quantity is also depending on the clearance policy used at the time of decommissioning, and different options exist related to the adoption or not of conditional clearance criteria: the fig 3.1 and 3.2, attached, show different material management schemes where fig 3.1 [3] depicts the present E.C. recommendation on unconditional clearance of scrap

[12] EUR 18041, Recycling and reuse of radioactive material in the controlled nuclear sector, AEA Technology plc (UK) and Enresa SA, Madrid (E)
[13] OECD-NEA: Nuclear Decommissioning, Recycling and Reuse of Scrap Metals, 1996

metal while fig 3.2 [13] describes the view of the OECD/NEA task group advocating the concept of a "tiered" system including conditional release alternatives.

Evaluation by the Group of Experts

- The waste management policies outlined above were reviewed in order to reach an agreement that could be used for the communication: fig 3.1 and 3.2 were commented on and a position taken on the release alternatives. Material management can include the following options:

  - ✓ Direct reuse in the nuclear industry
  - ✓ Recycling in the nuclear industry
  - ✓ Conditional clearance
  - ✓ Unconditional clearance for recycling or direct reuse
  - ✓ Disposal as final radioactive waste of the remaining material that cannot be released or recycled

- The additional specific items that follow were also discussed by the group of experts:

  - ✓ Reinforcement of the recommendation that "even if it has been demonstrated that clearance, consistent with the radiation protection criteria, is possible, recycling within the nuclear industry might be preferable to clearance to the public domain, whenever it is economically sound to do so" [14].
  - ✓ Comment on the uniformity of release criteria among the member States, and on the consequential transboundary problems that could occur if no regulated harmonisation is in practice: legal transfer of released material from one state to another where national regulations are different. Moreover, the use of different release levels could be negatively perceived by the public.
  - ✓ Position on international disposal facilities and transfer/exchange of wastes between countries (comment on the comparison with conventional electricity generation industry where waste or effluents do transfer from one country to another).
  - ✓ Position on the legal transfer of released material from one state to another where national clearance regulations are different (e.g. clearance to the public domain do not exist)
  - ✓ Material traceability: feasibility and limits of material traceability should be evaluated in each case where traceability is required, for example in the case of conditional clearance. This is also applicable in other cases like direct reuse or recycling in the nuclear industry, where traceability limits should be established.
  - ✓ Very low level waste classification and repositories (see also item 3.3.3.).

[14] E.C. Radiation Protection 89: Recommended radiological protection criteria for the recycling of metals from the dismantling of nuclear installations, 1998.

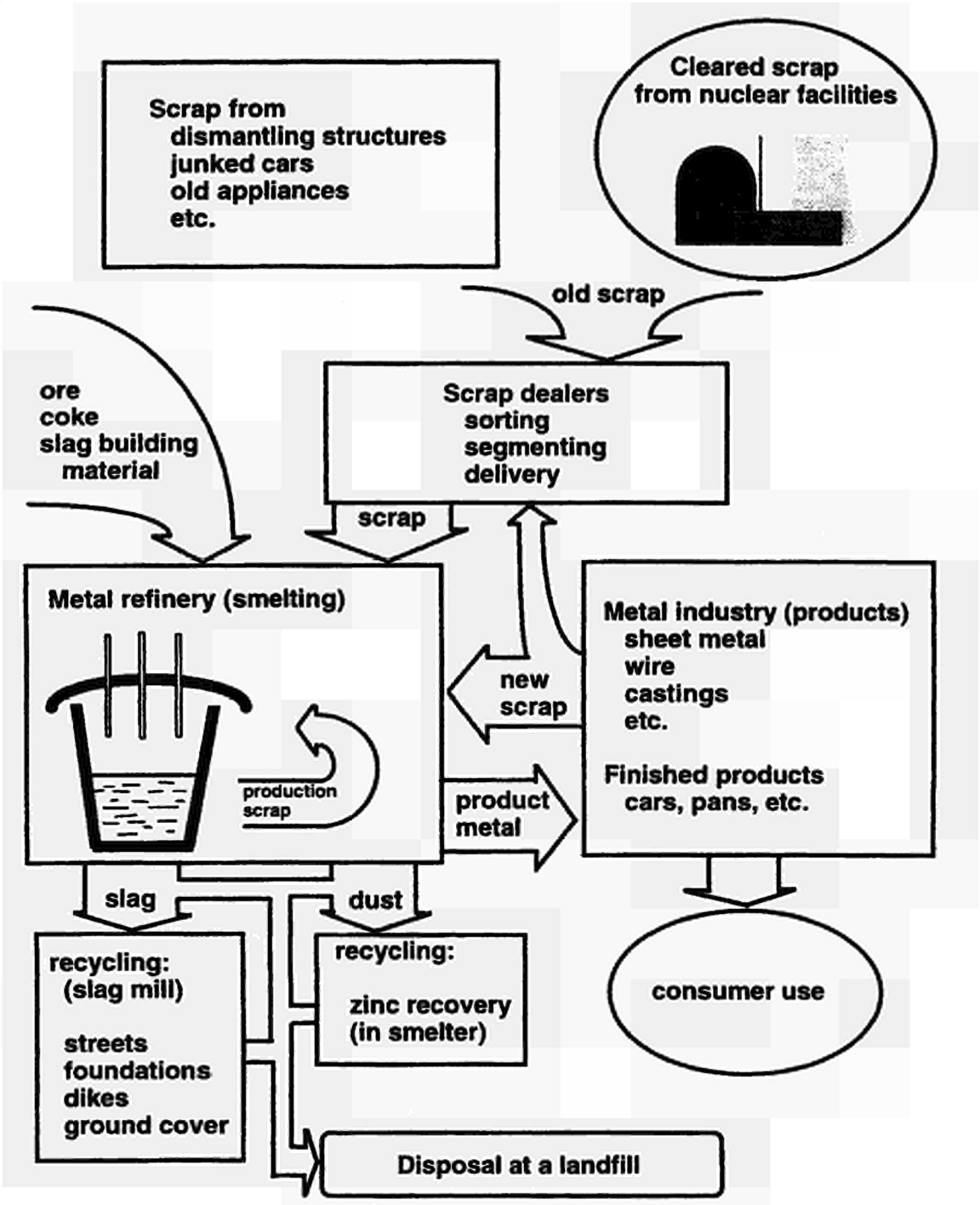

Fig 3.1: Schematic diagram of scrap metal recycling [3].

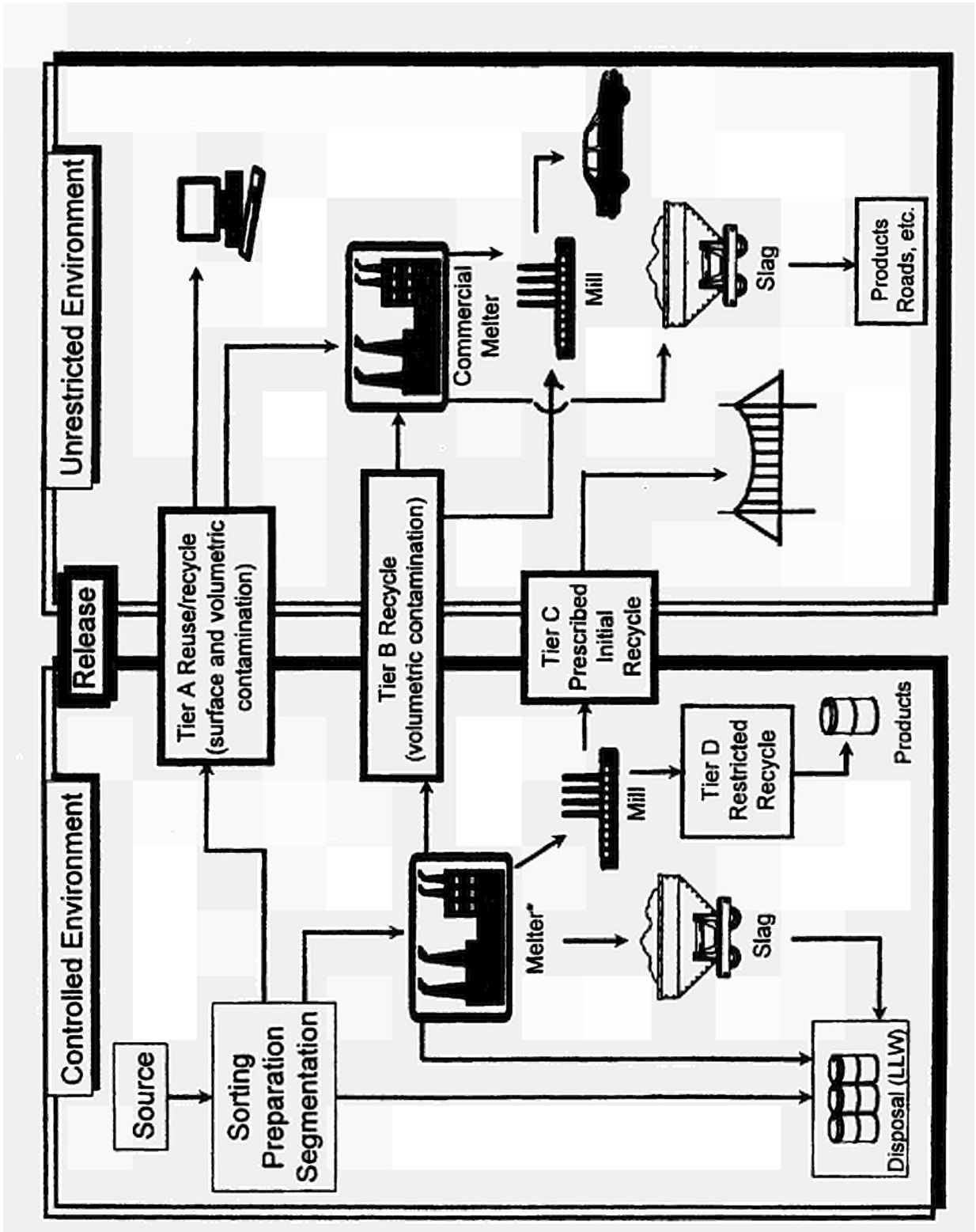

Fig 3.2: Conceptual illustration of Tier Release System [13].

Positions and observations by the Group of Experts

- The Group of Experts was of the opinion that, when viable, the option of "recycle-reuse" is preferable to the option of "disposal-replacement".
- The abolition of the borders within the E.U. makes the harmonisation of material management criteria highly desirable. To achieve this, co-operation between international organisations (IAEA, OECD-NEA, EC) is highly desirable, even if the first two organisations positions are only consultative inside the EU.
- Worldwide criteria harmonisation will also protect the EU against unexpected importation of scrap of international origins.
- This harmonisation will let material released in one Member State be accepted freely in another through transboundary shipments.
- It is important to keep open different pathways for the management of the material from decommissioning activities: fig 3.1 and 3.2 depict two different approaches for the management of these material: fig 3.2 goes beyond fig 3.1 by using 4 tiers of material management including conditional release that the EC does not consider because of traceability ("once the material is cleared no further control is possible") but only in terms of the properties of the material itself ("being metal suitable for either recycling or reuse"). These different approaches must be evaluated on a case by case basis depending on the national situation and the economics of the waste disposal prices which are different in each Member State and influence the national decision on material management. Conditional clearance must remain an open possibility.
- The OECD-NEA scheme is already in use in Germany for Tier A, B, D. Tier C is less likely, but even if total traceability is impossible, or if the material is diverted from its planned destination, the public and worker exposures have been verified to be within the acceptable limits.
- Economics also guide the selection of different specific processes, like material sorting, which in some cases is very expensive but in other cases is the best approach for sound material management similar to what is done in the conventional industry.
- Material from decommissioning must be defined: some material originating from the non-controlled area, are not expected to be contaminated and never came into the regulatory system. For the material coming from the controlled area, the typical segregation is:
  5-10 %: radioactive waste
  40-50 %: cleared after decontamination
  35-45 %: non-nuclear equipment in controlled areas, released after control
  One way of segregating the material is by zoning (used in France); clearance can be done by measurements and strict controls based on criteria, or on a case by case basis (France).
  It must be remembered that difficulties can be and have been encountered in the acceptance of cleared material by scrap dealers or commercial melters who refuse this kind of raw material for their production (public perception problem as well).
- Decommissioners should also take into account the management of hazardous material: asbestos, PCB, ...which may also be radioactive.

3.1.4 RELEASE CRITERIA

Existing rules in force

Estimation of the quantity of decommissioning waste can be found in different publications, ref. [9], [12], [15], [16].

Various international organisations, as the IAEA, the EC, have issued a number of release recommendations, i.e. exemption and clearance criteria, conditional or unconditional, based on the radiological protection principles of ICRP 60: see the list of these recommendations and guidelines in ref. [12], page 21 with the addition of the recent revision by the IAEA (Safety Series n° 115, 1996) and the EC (Directive 96/29, 1996) of their Basic Safety Standards.

Further differences in the approach to release criteria management can be illustrated by comparing the OECD-NEA task group proposal of the concept of conditional clearance (see fig 3.2) and the EC approaches (see fig 3.1): see item 3.1.3. for the discussion on conditional clearance.

In addition, each Member State has its own strategies and policies about waste management, including the material release criteria: ref. [8], [10], [17].

Ref. [13] concludes that the concept of conditional clearance levels is not fully addressed or only applies to a limited number of countries, that the release criteria incorporate conservatism that should be reduced, that the risks associated with replacement of the materials surpass recycling, and that practical data (rather than models or calculated assumptions) are now becoming available to set the base for conditional and unconditional release standards.

Harmonisation of the waste management practices and of the clearance levels among the member states would be beneficial not only in terms of equivalent levels of safety in waste management and disposal, but also in the minimisation of wastes through release and recycling: " Because of the economic value of metal, once regulatory controls have been removed, it cannot be guaranteed that the metal will remain in the country in which regulatory control was lifted. In particular, in view of achieving a single European market, it is highly undesirable that this would give rise to further controls, either at the border or at the final destination of the metal. For this reason, it is imperative that within the EU uniform criteria be applied for relinquishing regulatory control." [14].

An attachment to this section gives information on the clearance of waste from nuclear facilities in Sweden.

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[15] EUR 14950 EN: Waste management study for large volumes of very-low-level waste from decommissioning of nuclear installations, 1993

[16] EUR 16004 FR: Definition des autorisations de sortie ou clearance levels pour les bétons venant du démantèlement, 1995

[17] EUR 12570 EN: Objectives, standards and criteria for radioactive waste disposal in the European Community, 1989

The following open questions were then considered by the Group of Experts:

- Perpetuation of the use of the principles of exemption, conditional, unconditional clearance levels: "the great disparity between existing exemption levels and proposed clearance levels is a subject that warrants considerable attention" [13].
  Particular attention will be given to the acceptability of the concept of conditional release (ref. [13], page 56)
- Position on the proposal made at an IAEA meeting in Vienna, May 1997, on Exclusion, Exemption and Clearance: the "collapse" of the exemptions and clearance values into one set, based on the BSS exemption levels.[18]
- Agreement on release criteria values (related to the minimisation of wastes) and on their conservatism [13]
- The Group of Experts should review the situation of concrete release criteria
- Position on a proposal for a co-operative program and a common communication (E.C.-IAEA-OECD/NEA) on the release principles and the release criteria (release=exemption and clearance, conditional or unconditional).

Positions and observations by the Group of Experts:

- The Group of Experts recommended that the concepts of exemption, conditional, and unconditional clearance be maintained: although a disparity could be perceived between the values, they need to be maintained if we want to address the numbers of issues that the decommissioning activities encounter. The number of various concepts or criteria create confusion, therefore one needs to find the correct language to communicate them. Hence a new point /recommendation: find an adequate strategy for communication, see also chapter 3.4.1.
- The Group of Experts did not recommend any absolute values for criteria since it was not the purpose of the meeting; on the other hand, there was a consensus that absolute limits are needed, which meet national agreements.
- Industrial concrete is more and more recycled in the construction industry instead of disposed of in industrial dumps. If we want to pursue a similar process in the nuclear decommissioning industry, on going work on release criteria for contaminated concrete should be pursued.
- The Group of Experts raised the question of clearance levels and detection limits: the detectors that more and more equip the scrap dealers are of sufficient sensitivity to detect radiation below clearance levels. This issue should be considered when developing a strategy for communication to the public and to industrialists not familiar with health physics and radiation control, see also chapter 3.4.1.
- The Group of Experts stressed the importance of the proposal for co-operation and clarification on release principles and release criteria with other international organisation: it was felt of great interest to create an international working group with IAEA, OECD-NEA in order to reach consensus on these issues.

[18] Recycling of radioactive material: Criteria for release for unrestricted use, OECD/NEA Co-operative Programme on Decommissioning,S. Menon, CPD/PC/98/19-980602

ATTACHMENT TO RELEASE CRITERIA. DESCRIPTION OF A NATIONAL EXAMPLE

Clearance of wastes in Sweden

Clearance of waste from nuclear facilities is addressed in special regulations, SSI FS 1996:2, issued by the Swedish Radiation Protection Institute, SSI, on the 25 September 1996. The regulations came into force on 1 January 1997. The regulations are not applicable to equipment containing sealed sources. They are not applicable to wastes that arise at hospitals and other practices outside the nuclear fuel cycle.

Treatment of oil

After removal of water and particles, contaminated oil may be incinerated in large heating furnaces or special furnaces for destruction of chemicals provided the activity concentration of beta/gamma emitters is lower than 5 Bq/g and 0.1 Bq/g for alpha emitting nuclides. The nuclear facility shall annually report the quantities of released oil and the activity content to the Swedish Radiation Protection Institute, SSI. The total activity content in oil removed for destruction or incineration may not exceed 500 MBq/year and site.

Reuse or Disposal on municipal refuse dumps

Waste may be taken out from a nuclear facility for reuse, recycling or for disposal on municipal dump sites. The quantity of waste eligible for disposal on a municipal dump site is limited by a maximum total activity of 1 GBq/year and site. Useful part should be destroyed in such a way that they are not attractive for reuse before they are disposed of at the dump site. The limits for surface contamination and specific activity (mass concentration) have to be applied simultaneously. Nuclide-specific measurements have to be performed on waste for exemption, and the limits are:

surface contamination:		4.0 Bq/cm^2 for β/γ-emitters 0.4 Bq/cm^2 for α-emitters
specific activity:	free use, recycling:	0.5 Bq/g whereof 0.1 Bq/g for α-emitters
	municipal dump sites:	5.0 Bq/g for β/γ-emitters 0.5 Bq/g for α-emitters

All measurements should be recorded and the total quantity and the total activity cleared should be reported to SSI annually. This report should also include any clearances that have been done after receiving a special permit from SSI.

Case-by-case clearance

An example of this is sludge from sanitary sewage disposal systems on controlled areas which may be reused as fertiliser or disposed of on municipal landfills provided the total activity is less than 20 Bq/g (dry weight).

Contaminated scrap metal is recycled after melting of the material. Sometimes the treatment process has included decontamination of the scrap prior to melting. SSI has so far accepted a specific activity up to 1 Bq/g whereof maximum 0.1 Bq/g from α-emitters.

3.1.5 ENVIRONMENTAL IMPACT ASSESSMENT

Existing situation

The Council Directive 85/337/EEC of June 27, 1985 on the "assessment of the effects of certain public and private projects on the environment" advocates the need for harmonisation of the environmental effects assessment principles in the Member States to prevent unfavourable competitive conditions which could thereby affect the functioning of the common market.
This directive is general and not particularly directed toward decommissioning projects; it had to be transcribed in national legislation since July 1988.

This Directive was amended by the Directive 97/11/EC of 3 March 1997 which provides clarification into the application of the original Directive in order to ensure that it is applied in an increasingly harmonised and efficient manner.
It also introduced the transboundary context to take account of developments at international levels and makes specific reference to the dismantling or decommissioning of power stations or reactors. It contains a new annex III which indicates the relevant selection criteria determining whether a project shall be made subject to an assessment or not (screening). It still contains the annex IV (previously annex III) which specifies the type of information (scoping) to be investigated in the EIA (Environmental Impact Assessment).
E.U. Member States should bring this revised Directive into force by 14 March 1999.

A fairly similar Council Directive (COM/96/0511 – SYN 96/0304) on the "assessment of the effects of certain plans and programmes on the environment" has been proposed for application by the Member States by 31 December 1999.
This was to reinforce the systems operating within the Community for EIA of plans and programmes where transboundary consultations, due to the effect of a project from one member state to another member state, are needed, and where action is required at Community level to establish a general environmental assessment framework .

In addition to these Directives, EC Review Check List (June 1994), and guides on Screening and Scoping methodology (May 1996) have been developed and issued for assisting developers and competent authorities in their studies and decisions.

Formally, the Directives set out the broad principles of the environmental assessment system, leaving the procedural details to the Member States.

Review by the Group of Experts

The objective of the review of this item was to consider how the EIA and the methodology described in the above mentioned Directives are implemented in decommissioning projects and in the national regulations on decommissioning.
The outcome from an EC consultation and of ref.[19], [20] indicates that EIA are part of the decommissioning plans and are regulated in most of the countries inside and outside of the

[19] IAEA Safety Guide N° 105, The regulatory process for the decommissioning of nuclear facilities, 1990
[20] IAEA-TECDOC-714, National policies and regulations for decommissioning nuclear facilities, 1993

European Community for the decommissioning projects, although they focus on radiological impact assessments rather than the wider EIA covered by the Directives.

On the other hand, little information is yet available on the methodology used in the establishment of the EIA. Indeed, no reference is made in the decommissioning documentation to the EC Directives ruling the process.

The Council Directive 97/11/EC is only applicable to "nuclear power stations and other nuclear reactors including the dismantling or decommissioning of such power stations or reactors".

Positions and observations by the Group of Experts

- The Group of Experts indicated that the Directive 97/11/EC came out only in March 1997 and should be translated in national legislation in 1999. Therefore, it is too early to identify the approaches and the differences between the Member States on this matter.
- The Group of Experts insisted on the importance, in the future, of a proper feedback from the Member States on the Environmental Impact Assessments that they put in place.

Some Member States specific experiences

The following information results from a suggestion from the Group of Experts that they provide more detailed information on the EIA process carried out in each country with the aim of identifying the approaches and the main differences in Member States when performing an EIA:

UK

The position in Great Britain is that the bulk of the Directive will be implemented via regulations under town and country planning legislation. This means that EIA, when required, will be submitted by developers to local authorities for their approval. However, it is considered that the Directive's requirement related to nuclear power station decommissioning warrants a separate and different approach. Separate legislation (The Nuclear Reactors (Assessment of Environmental Effects of Decommissioning) Regulations 199-) is therefore being prepared which makes the Health and Safety Executive, who also control nuclear site licenses, the competent authority for receiving and approving environmental impact assessments related to reactor decommissioning. This means that they will be handled by a national body rather than by local authorities.

SPAIN

At the same time as it drew up the report on alternatives for dismantling of the Vandellos 1 plant, Enresa requested that the Ministry of Industry and Energy provide information on the environmental standards to be taken into account in the Plan.

- 23rd June 1995. The Ministry of Industry and Energy informed Enresa that the Decommissioning and Dismantling Plan for the Vandellos I Nuclear Power Plant would be subject to an Environmental Impact Statement, as a result of which Enresa should initiate the procedure established in the corresponding regulations.

- 5th July 1995. Enresa initiated the aforementioned procedure by sending to the Ministry of Public Works, Transport and the Environment (MOPTMA) and to the Ministry of Industry and Energy the so-called " Summary Report" on the Project. During the following months the project "Summary Report" was sent by the MOPTMA to different organisations, institutions and administrations for their opinions. The replies were communicated by the MOPTMA to Enresa to be taken into account in drawing up the Environmental Impact Study.

- 5th September 1996. Enresa submitted its Environmental Impact Study to the Ministry of the Environment.

- 14th December 1996. The Ministry of the Environment issued a Resolution by which the Environmental Impact Study was subjected to a process of public information.

- 24th February 1997. The Ministry of the Environment informed Enresa that no objections had been received in relation to the process of public information to which the Vandellos I Nuclear Power Plant Decommissioning and Dismantling Plan Environmental Impact Study had been subjected.

- 26th September 1997. The Ministry of the Environment issued the Vandellos I Nuclear Power Plant Decommissioning and Dismantling Plan Environmental Impact Statement.

According to the Environmental Study, the impacts of the dismantling project on the different elements of the environment were considered to be compatible, and the solution adopted optimum, inasmuch as the possible impacts would remain in effect only during the stage of performance of the dismantling project.

The document described the environmental implications of the project, underlining the fact that the impact on the soil would be restricted to the site itself, where demolition and landfill operations would be carried out; no significant non-radiological impact was foreseen in relation to the groundwaters, nor were direct impacts forecast on the fauna and flora, nor in relation to demographics or the land systems.

The study also pointed out that the impacts on the landscape and on land use might be considered as constituting a positive effect, since on completion of the works a significant percentage of the land occupied would be released for unrestricted use.

The Environmental Impact Study established a series of corrective measures in order to minimise as far as possible the foreseen radiological impacts, both in demolition and crushing of the concrete and in the accumulation of materials, and the use of experienced personnel for these tasks, thus avoiding unnecessary risks. It also contemplated the application of a series of measures to avoid radiological impacts off site.

Furthermore, the Vandellos I Nuclear Power Plant Decommissioning and Dismantling Plan itself foresees the establishment of surveillance programmes, depending on the radiological or conventional aspects to be monitored. Among these programmes are the Environmental Surveillance Plan (ESP) and the Environmental Radiological Surveillance Plan (ERSP).

The objective of the ESP is to verify compliance with the corrective measures during dismantling, to foresee possible impacts and to track the effectiveness of the measures applied. The aim of the ERSP is to verify compliance with the programme for the control of effluents and releases having potential radiological impact.

3.2 Financial aspects

3.2.1 FINANCING PLANS

The subject of the financing plans for the decommissioning of nuclear installations within the Member States was introduced by the EC DG XVII.
The following points are the important issues identified by the EC DG XVII during the working session:

- The Directive 96/92/EC of December 19, 1996 opens for the first time the competition in the European electricity market, not only at the production level, but also at the supply level, as so called eligible customers will have the right to freely chose between different electricity producers or suppliers. To enable this choice, the transmission and distribution network operators have to grant third party access (TPA) to their networks. Third party access for the electricity network already exist in several Member States like United Kingdom, Finland, Sweden and Spain, and by February 19, 1999, adequate national legislation will have implemented the market liberalisation of the directive in all Member States, except Ireland and Greece (benefiting from 1 and 2 year supplementary periods).
  The existing electricity transporters must allow transit of electricity without undue excessive fees to the new entrants to the market.
- Community legislation and the directive are not allowed to interfere with the ownership structure of electricity producers and transporters. However, the directive contains explicit mechanisms to ensure that the transmission system operator is independent, is offering transparent and non discriminatory conditions, and is refraining from cross-subsidisation between production, transmission and distribution. For this purpose, the directive requires vertically integrated electricity companies to separate their accounts for production, transmission and distribution as well as to establish an independent management of the transmission system operation.
- Different situations exist among the Member States for the financing of decommissioning, e.g. simple provision in the accounts allowing reinvestment of the collected funds for other than decommissioning purposes, segregation of collected funds outside the sphere of the company, or a complete State organisation and management of decommissioning by separate specialised, mostly publicly owned companies. Moreover, the amount of yearly funding required, the requirements as to when and how decommissioning has to be accomplished, and the applied calculation methods and discount rates differ substantially between Member States. This situation questions the principles quoted above and could lead to distortion and discrimination between now competing nuclear electricity producers from different Member States. Decommissioning costs are clearly seen as part of the electricity production costs. They may not be cross-subsidised from the transmission activity nor be directly subsidised via state aid. Transparency of the financing plans and a discussion about acceptable calculation methods is a first step to tackle this issue.
- In some cases a parallel to the case of stranded costs under article 24 of the directive could be seen. Any authorisation to aid the electricity producer to overcome difficulties to amortise the full costs of decommissioning must be examined under the state aid rules of the Treaty.

Positions and observations by the Group of Experts

- The decommissioning and waste management costs should be included in the price of the kWh (internalisation of costs) with the exception of historical liabilities associated, for example, with national research or defence facilities.
- Provided that financial provisions have been built up throughout the operating life of a nuclear facility, the costs per kWh should be relatively low and should not significantly influence electricity charges or lead to unfair competition between producers. If appropriate financial provisions have not been built up over time there is a potential risk that producers could choose to elect the cheapest decommissioning strategy rather than make a balanced judgement on all the relevant factors, e.g. safety and environmental issues.
- This decommissioning financing obligation could handicap the nuclear electricity generators compared to fossil fuel generators. A fairer approach could be to integrate into fossil fuel electricity prices the cost of the greenhouse effects (e.g. a CO^2 tax).
- The steps to be taken in determining financing requirements include identifying the decommissioning strategy to be applied and preparing detailed cost estimates which include appropriate risk margins. Advice is being prepared as part of the "Incosit" initiative on the elements that should be included within a decommissioning cost estimate.
- The best practice is to have full funding available at the time of final shutdown of the facility. The benefit of this approach is to ensure that money is available when decommissioning occurs and that should any decommissioning activities be deferred to a later date, that financial burdens are not imposed on future generations.
- The funding of decommissioning nuclear installations in the EU should be based on the idea of :
    - ✓ Identifying the full amount of the fund required, including the waste management and final disposal costs
    - ✓ making the fund secure and controlled by the competent authorities
    - ✓ making sure that the appropriate amount of money is available when needed
    - ✓ dedicating the fund to decommissioning, and nothing else.

3.2.2 INTERNATIONAL CO-OPERATION

Existing situation

In line with the EURATOM Treaty of 1957, Articles 2a, 2g, 2h, clear recommendations exist at European Union level for co-operation between the Member States on radioactive waste management: the Council Resolution of 19 December 1994 on radioactive waste management (94/C 379/ 01) "considers that optimum use should be made of (treatment, conditioning, storage and final disposal) facilities at national level and, where practicable and appropriate, between Member States...".
In addition, ref.[21] details the various fields of possible co-operation and recommended harmonisation between the Member States on the subject of waste management:

- Radioactive waste definition and classification, including clearance criteria
- Radioactive waste minimisation, including recycling and reutilization
- Radioactive waste transportation
- Radioactive waste treatment and storage
- Public information
- Radioactive waste management financing

This ref. [21] stressed the importance to have an open approach between the Member States in order to find integrated solutions in the treatment and storage of wastes: for example, it would be financially advantageous for countries without an electro-nuclear programme or with a reduced one to co-operate with other Member States and use others' facilities.

Such co-operation already exists within the EU in R&D programmes, reprocessing facilities and scrap metal melting facilities.

In addition to this, existing co-operation on the EC R&D programmes on waste management and decommissioning (DG XII) resulted in access to a large number of international projects and technical developments with information being available to the community and through the various EUR publications and the EC data bases (see chapter 3.3.1).

EC, IAEA and OECD/NEA started in 1997 the establishment of a standardised list of cost item definitions (Incosit) to be included in the respective data bases for decommissioning costs. This will allow further exchange of comprehensive and comparative data.

Conferences, seminars, R&D programmes, bilateral co-operation, IAEA, OECD, Unipede are examples of existing co-operation.

Nevertheless, some other important possibilities for co-operation exist that have not been fully exploited yet:

- Waste disposal in other countries facilities and waste disposal cost harmonisation
- Recycling and treatment on an international scale

[21] COM (94) 66, A Community strategy for the management of radioactive wastes, 1994

- Cost associated with the non co-operation on the above subjects (EU and international)
- Continuation and increase in the dialogue and co-operation of the European Union with international organisations such as IAEA, OECD,...
- Other forms of possible international co-operation leading to cost reductions during decommissioning projects.

Additional recommendations

- The experts stressed the importance of the exchange of information on decommissioning within the Community and recommended that the EC extends its initiatives on this subject
- The experts also expressed their strong recommendation that the EC continues its co-operation between the States by sponsoring projects and developments on decommissioning subjects
- The experts recommended that the training of engineers and technicians be developed by exchanges of staff and experts between countries inside and outside the EU. This would also be beneficial to the nuclear industry in preparation for the future enlargement of the EU.
- International co-operation should exist in the development of information strategies to the public
- Worker dosimetry tracking should be improved on an international scale to facilitate international participation in decommissioning projects.
- The experts recognised the potential technical and financial benefits of international co-operation on waste disposal and waste transfer between countries. Although there are merits in sharing highly expensive waste or fuel repositories (e.g. why impose on a small nuclear waste producing State the high costs of its own deep repository for a few cubic metres of spent fuel or waste while a neighbouring State does the same for its own use), or swapping wastes between countries to optimise treatment and disposal, it was recognised that it may not be politically acceptable to all national governments.

3.3 Technical aspects

3.3.1 TECHNICAL APPROACH TO DECOMMISSIONING

EXISTING SITUATION

The European Commission (DG XII) has, since 1979, conducted four successive five-year R&D programmes on the decommissioning of nuclear installations performed under cost-sharing contracts with organisations from the European Union. The main objective of these programmes was and is to establish a scientific and technological basis for the safe, socially acceptable and economically affordable decommissioning of obsolete nuclear installations.

Following the growing need for strategic data for the decommissioning of a rising number of redundant nuclear facilities, the scope and the funding of the programmes has increased steadily from 1979 to 1993 (FPl to FP3). As regards FP1 to FP3, dismantling and decontamination techniques (including remote controlled ones) have been developed, adapted and tested in laboratories and ongoing decommissioning projects, mainly in five selected current pilot decommissioning projects (AT1 La Hague, BR3 Mol, KGR Greifswald, KRB-A Gundremmingen and WAGR Windscale). Long-term integrity of buildings and components, as well as the identification of guiding principles and the influence of design features to facilitate dismantling have been assessed. The results are being published in EUR-project final reports, as well as in workshop, seminar and conference proceedings.

In FP3, two powerful decommissioning data-bases, "EC DB TOOL" and "EC DB COST", have been developed with specialised organisations and experts. Their aim is to take advantage of EU decommissioning experience, then to make updated and qualified information available to potential decommissioners, nuclear industry and licensing authorities. These data-bases have found growing international interest and have led to co-operation agreements with the IAEA and OECD/NEA on the definition of cost items.

Current activities carried out within DG XII "Nuclear Fission Safety" 1994-98 (FP4) programme focus on testing innovative dismantling techniques, data collection, hardware and software data base improvements and decommissioning planning. Strategic Planning Tools are being assessed (SPT) by selected experts and organisations. The main aim of the SPT is to identify basic requirements to be used in the planning of decommissioning. The SPT study is investigating currently available knowledge on decommissioning planning by means of an EU-wide capability survey. The use of the SPT would help to provide a consistency of approach and enable strategic decisions to be taken with respect to safe and cost-effective decommissioning.

Each decommissioning project needs its specific decommissioning strategy, depending on the particular situation at each site. Two main decommissioning strategies may be pointed out, namely the immediate and the deferred dismantling. The appropriate choice depends on local and national conditions (e.g. the existence and type of waste repositories) and on the political situation of the country or area where the decommissioning project is being carried out. Immediate dismantling can clear a site for new use (e.g. KGR-Greifswald) or greenfield, (e.g. KKN in Germany), and may save money; deferred dismantling may save dose uptake to workers and make dismantling work easier when no more high activity components are

present, but the cost of long-term surveillance of the site need to be considered as does the retention of essential specific knowledge to support future decommissioning activities. The EU data bases and the SPT could be suitable tools in helping to make the choice.

Positions and observations by the Group of Experts

- The EC should publicise more widely the results of its 20 years of R&D projects on decommissioning. This publication should address the practical industrial aspects of decommissioning showing the industrial maturity that has been reached and the technical problems that have been solved. It should also identify new areas for further works and research.
- There is not one decommissioning strategy, but a number of alternatives depending of the particular situation of each site: the choice between immediate and deferred dismantling is based on various factors: the existence or not of waste disposal sites, the social aspects and the local employment, the need to clear sites for further nuclear or industrial activities, the technical solutions available at the time of the shutdown, the type of reactors or facility, the level and nature of the contamination, the decay optimisation,... The situation can vary depending on the social aspects, the use of specialist subcontractors, the existence or not of decommissioning funds,...
- Technical solutions exist for the majority of the projects involving decommissioning of nuclear installations, but the EC should identify the supplementary approaches from the conventional industry that could be directly applicable or transferred to decommissioning activities.
- More investigation should be made on deferred decommissioning techniques and long term building integrity.
- It is important to work on the best decommissioning techniques allowing the decommissioning costs and the wastes produced to be reduced to a minimum.
- Within the framework of the enlargement of the EU to the Eastern countries, it will become more important to study the WWER decommissioning cases. With the exception of Lithuania, the other Central and Eastern countries nuclear reactors are mostly WWER types and their number warrant a serious investigation on existing documentation, applicable and available dismantling techniques and the need for further R&D programmes. The experts suggested the creation by the EC of a Centre of Excellence where technical exchanges between Eastern and Western specialists could take place, plant status and decommissioning programs evaluated, and practical training on real decommissioning cases performed.
- Comparison direct and deferred dismantling for the WWER reactors: pursuant to the previous paragraph, the following is a comparison between a direct dismantling and a deferred dismantling after a 30 years of safe enclosure for the WWER 440-230 reactors of the Greifswald units 1-4 type:

Comparison direct-deferred dismantling of the Greifswald NPP:

			Direct	Deferred
Cost	Mill. DEM	Total	5,110	6,077
		Only decom.	2,375	3,371
Dose commitment	manSv		17.0	20.2
Radioactive waste volumes	m^3		22,790	25,794

In order to understand these results, some specific points and general aspects of the WWER need to be considered:

WWER specific aspects

There is no containment and the buildings are generally not constructed for a long lifetime.
In the VVER 440-230 design (Greifswald Unit 1-4) the confinement is not tight.
Several auxiliary and common systems containing radioactivity are outside the confinement.

General aspects

When planning the two alternatives, it is obvious that by the deferred dismantling option three major work areas have to be added:

- Establishment of the safe enclosure
- Operation of the safe enclosure for 30 years
- Preparation of deferred dismantling (new equipment, etc...)

Finally, these adders make the project more expensive.

The increase in applied dose is due to the increased work mentioned above although partly lower doses are prevailing.

The increase in waste volumes is due to the production of secondary waste during the 30 years enclosure (air filters, water treatment). Here, one must also add that in the used calculation programme, although officially authorised for this type of cost comparison in Germany, the decrease in radioactive waste due to more released material is not taken into account, since:

- The influence of 30 years storage is not major
- The additional costs for measurement and eventually decontamination offsets the gain in reduced volume

3.3.2 MINIMISATION OF WASTES

Existing situation

Management of material from decommissioning operations, including recycling and re-use, has been discussed in the analysis of item 3.1.3., while waste minimisation and discussion on release criteria have been addressed in item 3.1.4.

Large volumes of material are produced during decommissioning activities, and the costs to dispose of this material as waste are very significant. Consequently, the minimisation of waste is important in the management of these projects: one of the significant means to reduce the amount of wastes generated by the decommissioning activities is the recycling of the material, after decontamination if necessary (or reuse, if conditions permit).

Ref. [13] describes the extensive work done by a working group under the OECD/NEA umbrella on metal recycling and re-use and its environmental related impact.
It proposes a "tiered" system for the management of radioactive scrap based on 4 basic options :

1. Re-use or melting in an unrestricted environment, following decontamination or certification
2. Controlled melting followed by metal recycling in commercial smelters and processing into consumer products
3. Controlled melting followed by designated use of the metal
4. Recycling within the nuclear industry

This approach is different from the EC which recommends unconditional clearance of scrap metal, although it proposes different release levels for direct re-use of surface contaminated metals and for metals destined for melting at a commercial smelter.

Regarding the environmental impact of the metal recycling and re-use approach, ref. [13] concludes: "A comparison of the relative merits of disposal and replacement versus recycle and re-use practices shows that recycle and re-use produces lower human health risks and environmental impacts by more than a factor of two. Moreover, disposal and replacement alternatives for radioactive scrap metal management may involve imposition of greater health and environmental impacts in less-developed countries (from ore mining and processing) than those associated with recycling in industrialised countries."

Ref[22] proposes a similar study for the management and recycling of concrete waste generated during the decommissioning of nuclear installations and can be used as a base for further environmental impact studies.

In addition to recycling and re-use methods, other techniques to be considered are:

- The minimisation of future decommissioning waste must be included in the early design of the installations (materials of the components and engineering design) and the first

[22] EUR 16004 FR, Définition des autorisations de sortie ou clearance levels pour les bétons venant du démantèlement, 1995

decommissioning plan should be compulsory with the license requirements for the building of the installations

- At the design stage: minimisation of the waste could be influenced by factors like: type of surface in contact with the radioactive fluid, quality and lifetime of equipment chosen, ...
- During operation of the facility: the emphasis on keeping all the installation in the lowest possible contamination state, for example by using "passivation" techniques and by promoting regular clean-up campaigns.
- During the decommissioning operations: proper attention being given to the choice of the adequate techniques, the sorting of the wastes, the precise control of the material contamination, the thorough treatment of the material leading only to the disposal of "ultimate" waste,...

Positions and observations by the Group of Experts

The experts agreed with the suggestion for additional technological development programmes on:

- non-metallic material recycling and environmental impact
- control and measurement techniques of difficult to access surfaces
- improvement of decontamination methods
- improvement of volume reduction techniques

The experts also made the following remarks:

- Limiting the concentration of impurities in material, at the design stage of the plant, for example rare earth's in concrete, will reduce the production of Europium by neutron activation and limit the amount of waste generated by the dismantling of the plant
- Example of actions that can be taken during the operation of the plant which could limit the spread of radioactivity are:
  - ✓ primary water chemistry control which, in the case of the BWR's, can be illustrated by the controlled addition of zinc.
  - ✓ The permanent control of the cleanliness of the plant
- At decommissioning time, the choice of adequate decommissioning techniques can be instrumental in the minimisation of wastes
- Another decommissioning strategy for waste minimisation is to let decay reduce the activity of the material. However, this technique is not always effective as, for example, the slow diffusion of tritium through the material could lead to larger quantities of wastes.
- Additional R&D programmes on waste minimisation should be carefully proposed, taking account of the research projects already developed and/or completed by the EC DG XII.

3.3.3 VERY LOW LEVEL WASTE

Existing situation

Very low-level radioactive waste from nuclear installation activities consists of a composite group of waste with a radioactivity level of some tens of Bq/g or less. The wastes are generated during operation and dismantling of nuclear installations. In the first case, they consist of technological waste (vinyl, clothing, oils, etc...) or waste from processing (filters, resins, etc...). In the second case, they predominantly consist of concrete rubble and metal scrap.

The majority will be generated by the dismantling of nuclear installations, although the amount of very low level waste generated during operation is not negligible (several hundred tons per year).

The second characteristic which emerges from this review is the diversity of waste: mineral and organic materials, liquids and solids, containing various radionuclides.

The radiological risks associated with very low level radioactive waste are recognised as being slight, though they should not be ignored. In addition, the chemical risks resulting from the presence of toxic substances (asbestos insulation for example) or chemically reactive ones should also be taken in account.

The final point to raise is the effort to undertake the radiological characterisation of this kind of waste due to the very low concentrations and the large volumes involved which require industrial scale measurements.

International organisations i.e. the IAEA, the EC, have been actively working on exemption and clearance levels, based on exposure scenarios and assessment of possible doses to the workers and to the public from released or recycled materials. These programmes especially address the very low level material since these are the vast majority of the material produced during decommissioning activities.

The VLLW situation is also characterised not only by the spread of the criteria utilised internationally (ref. [13], [15]), but also by the various material disposition philosophy among the Member States, some accepting the concept of unconditional release, some suggesting that the utilisation of release levels is difficult to manage and that one criteria will penalise unnecessarily the disposition alternatives; moreover, controlling these very large amount of materials will be difficult and expensive.

Positions and observations by the Group of Experts

- This chapter deals with Very Low Level Wastes and not Very Low Level Material, i.e. what is remaining radioactive after all attempts have been made to declassify, clear, recycle, ...
- The Very Low Level Wastes is not an existing category of wastes except in France, where a specific VLLW site is planned.

- The VLLW are of such a low activity that it is not desirable for financial reasons, to dispose of them in LLW repositories.
- Therefore, the suggestion is to avoid the disposal of the large volumes of VLLW in LLW site: alternatives are specific disposal in VLLW sites or conditional release of these materials (not wastes) and controlled recycling as input for the production of new metal, or for the construction of roads,...

ATTACHMENT TO "VERY LOW LEVEL WASTE"

VLLW policy and experience within the EU Member States

UK

The definition of VLLW in the UK is that "which can be safely disposed of with ordinary refuse (dust-bin disposal) each 0.1 m^3 of material containing less than 400 kBq of β/γ activity or single items containing less than 40 kBq of β/γ activity".

Also, some wastes at the lower end of the LLW range can be disposed of at disposal sites not dedicated to radioactive waste in a process termed "controlled burial". Although there are sound economic and radiological grounds for encouraging greater use of controlled burial, the UK Government recognises the genuine anxieties that its proposal has aroused among local residents. For that reason, it has decided not to encourage greater use of controlled burial by the nuclear industry. Nevertheless, controlled burial should continue to be available as a disposal route, particularly for small users -such as hospitals, universities, research laboratories, and non-nuclear industries- subject to the agreement of the site operators and to the necessary regulatory requirements being met.

SWEDEN

SHALLOW LAND DISPOSAL

The present legal situation and statement by the SSI board

In November 1982 the board of SSI issued a policy statement, which subsequently enabled the licensing of shallow land disposal of low-level waste from nuclear facilities in Sweden. From a radiation protection point-of-view, shallow land burial is acceptable provided that:

1. The repository is located on the site of the nuclear facility
2. The release of radionuclides into the local environment shall not significantly change the radiological impact of the area
3. Doses to individuals in a critical group are not allowed to increase from considered doses from routine operation of the facility
4. The total activity and the radionuclide composition of the repository must be known
5. The activity content in the repository must be so low that radiological control is not needed for a longer time-period than 100 years after closure.

According to the Ordinance of Nuclear Activities, SFS 1984:14, 19 §, SSI may grant a licence for the construction of shallow land disposal sites on condition that the total activity level does not exceed 10 TBq, of which no more than 10 GBq may comprise alpha-emitting substances.

Shallow land burials in operation

The Swedish Radiation Protection Institute, SSI, has to date licensed four shallow land disposal sites for waste arising from the operation of the nuclear facilities in Sweden:

at OKG nuclear power plant, NPP, – 1985, at Forsmark NPP – 1987, at Studsvik in 1987 and at Ringhals NPP in 1991. All Swedish nuclear power plants and most of the nuclear facilities are coast-located so the local recipient is the sea.

The licence conditions are:

1. The total activity in the repository shall at any time be below 100 GBq (of which the activity from α-emitters must be less than 100 MBq).
2. The specific activity of the waste packages shall be less than 300 Bq/g (for radionuclides with half life longer than 5 years);
3. The surface dose rate of every single package shall be below 0.5 mSv/h;
4. The repository must be under institutional control for at least 50 years after closure (the site must be marked on an archived map.);
5. No other environmentally hazardous wastes are allowed to be placed in the land fill.

FRANCE

The principles of very low level radioactive waste management in France:

Inadequate management practices which have been observed over the last few years have led the French Nuclear Safety Authority to instigate a policy in collaboration with nuclear industry operators and the ministerial departments concerned in order to achieve a safe, unambiguous and thorough management system for very low level radioactive waste. This management system must be integrated into the global context of exhaustive and selective management for all categories of nuclear waste.

In France, the legal provisions governing the recovery and removal of all type of waste stem from a law passed in 1975. Under this law, the generator of waste is responsible for sorting, processing, packaging and disposing of the waste. To properly assume this responsibility, the generator must also take steps to reduce their volume and toxicity. In addition, the generator must monitor and trace all the management activities concerning his waste, from generation to disposal.

Fulfilling these basic principles for very low level radioactive waste implies that any universal release threshold should be excluded, for it would mean that part of the waste would not be subject to total monitoring, which would be incompatible with the exhaustiveness and traceability sought. Besides this incompatibility, several arguments confirm that universal release thresholds are impractical: public opinion is not prepared to accept thresholds which, in its eyes, would be designed to enable industrial companies to get rid of this waste; thresholds can encourage dilution of the waste in order to reach radioactivity levels of free release; the operators of non radioactive disposal sites and residents in the vicinity would refuse such waste, regardless of any thresholds.

For the Nuclear Installations Safety Directorate, only management of the very low level waste through pathways can ensure thoroughness. Each pathway (recycling, treatment, disposal), being specific to a waste category of known characteristics (origin, radioactivity level, composition, etc...) can indeed be designed to allow proper operation and control.

The above mentioned principles are currently implemented in France in the following steps:

- the preparation of « waste studies »: these pilot studies will describe the management of

nuclear waste and will act as a reference,

- zoning of the nuclear installations: the zoning is based on the design and operating rules of the installations, it may also evolve with the events (like accident and subsequent restoration) occurring in the installations,
- identification of suitable pathways approved by the government, stricter regulatory approach.

The volume involved is significant. In total, it is estimated that all the materials generated by the existing nuclear installations will rise in France to 15 million tons by the end of the 21 st century, 250 000 tons of them will be LLW, 1 600 000 tons VLLW.

SPAIN

VLLW is not a waste category in Spain. All materials for which no further use is foreseen and which present an activity above the minimum levels defined by the Ministry of Industry after proposal of the CSN are classified as radioactive wastes. Those below the maximum activity limits for El Cabril L&ILW disposal facility will be sent there.

3.4 Social aspects.

3.4.1 PUBLIC ACCEPTANCE

The following items were segregated from each previous section:

- **Radiation protection**:
  It is of prime importance that the workers and the public be assured of the precautions taken during decommissioning activities, and be confident that no undue doses will be incurred by the public for whatever reasons and from whatever practices. Even if the existing regulations and practices used during decommissioning protects the workers and the population, it remains that the public need to be informed of those measures, and that its protection is real.
  The Group of Experts suggested that :
  - ✓ The situation of information to the public, including basic information on radiation and relative risks, be further developed. Accomplishment could be through modern communication means like CD-ROM as explained in the following paragraph. Confirmation of the compliance of the actual decommissioning activities with the regulations put in place must also be part of the information given to the public.
  - ✓ Related to the above, the information to the public needs to remain transparent, understandable and accessible.
- **Responsibilities**:
  - ✓ There could be public concern as to how individual country's decommissioning strategy was decided and why it is different from others. It is useful to identify the causes of variations, and to communicate them to the public.
  - ✓ Our legacy to the future generations can influence the decisions taken today on decommissioning strategies and stages, and should be explained to the public.
- **Material management policy**:
  The various possible strategies for material management (disposal and replacement or recycle and reuse) will have different impact on public opinion. This should be considered when deciding between the different options, e.g. recycle in the nuclear industry, recycling in the non-nuclear industry, conditional release and traceability, ...
  It must be remembered that difficulties have been encountered in the acceptance of cleared material by scrap dealers or commercial smelters who refuse this kind of raw material for their production.
- **Release criteria**: ref. [18]:" few people, except experts, understand the difference between exemption and clearance. Having two sets of values would only confuse the public".
  The Group of Experts considered:
  - ✓ The simplification of the concepts: Exclusion
    Exemption
    Clearance
    Practices – interventions
    Etc...
  - ✓ The understanding of the concepts,
  - ✓ The transparency of the processes,
  - ✓ The need to harmonise the different sets of criteria for material management

- **Environmental impact assessment**: this may assist public acceptance of decommissioning projects since it is a useful source of information and that it shows the consistency, the rigor, and the credibility of the authorities in the process.
- **Financing plans**: sound decommissioning financing will increase the public acceptance of our legacy to the future generations.
- **International co-operation**:
  Focus should be on:
  - ✓ Harmonisation of the process, strategy, and criteria within the EU is necessary to prevent public rejection of decommissioning projects and material management including transboundary shipments
  - ✓ The consistency of national regulations within the nuclear international community
  - ✓ The public information on waste and material management across borders: waste transboundary shipments, waste disposal in foreign countries, recycling on an international scale, ...
- **Technical approach to decommissioning:**
  The following issues were raised:
  - ✓ Choice between decommissioning strategies versus the responsibility of the current generation to transfer decommissioning responsibilities to future generations
  - ✓ Explanation of studies comparing the overall risk to the workers and to the population of the material replacement option versus the recycling option
- **Minimisation of wastes:**
  The Group of Experts recommended the following actions:
  - ✓ Publicise the efforts achieved for waste minimisation by recycling and reuse
  - ✓ Describe to the public that recycling in the public domain can be done rigorously
- **Very low level waste:**
  Although this paper is not directly related to the non-nuclear industry and NORM, the very low-level waste approach raises the issue of consistency between the regulatory treatments of radioactive material in the nuclear industry and in the non-nuclear industry. Any inconsistent treatment of these two types of waste would be questioned by the public and difficult to explain.

Positions and observations by the Group of Experts

- Legacy to the next generation: although it is true that each generation must take care of their problems in order not to transfer unresolved issues to the future, the experts considered that decommissioning activities can be postponed to the next generation for particular reasons (technical, decay, overall cost of the cleanup,...) if the financial and technical means to solve the problems are transferred as well.
- The responsibility for transferring any legacy to future generations lies not only with the national or private electricity producers or nuclear facility users, but also with the public who have received the benefits from the product (welfare, price stability,...).
- It would be advantageous in terms of public information to produce an EC CD-ROM describing the decommissioning programmes within the EU, the results of the R&D projects, the principles of decommissioning strategies and alternatives, ... all information to the public as described in the previous paragraph. The same can be advertised on Internet.
- The experts expressed the opinion that any decommissioning actions are per se positive environmental activities that are aimed at solving issues and reducing the risk from industrial activities to the population.

- Recognising the difficulties in explaining complex messages to the general public, professional public affairs advice should be taken in developing the means and details of how to convey appropriate messages and information to the public on decommissioning.

4. CONCLUSION

All the subjects of the Terms of Reference were reviewed and discussed by the experts during three working sessions in 1998.

The conclusions of this work can be found in the chapter 3 of this document and more particularly in the sections: "Positions and Observations by the Group of Experts" of each subject.

The Group of Experts agreed that their recommendations be taken as the basis for the EC Communication on the decommissioning of nuclear installations in the EU.

ANNEX 1

CURRENT POSITION
Member States

Belgium

The Radiological Protection Office (SPRI-DBIS) of the Ministry of Public Health and Environment, the Office of Technical Safety (SSTIN-DTVKI) of the Ministry of Employment and Labour, and the National Agency for Radioactive Waste and Enriched Fissile Material (ONDRAF-NIRAS) are involved in the development of both policy and regulations.
The licensee is legally responsible for the implementation of decommissioning. In exceptional cases ONDRAF-NIRAS can be assigned to execute the decommissioning programme. In this case, the programme is sub-contracted to its subsidiary BELGOPROCESS.
Under the current regulations, decommissioning can be controlled with an operating licence, however a Royal Decree for Decommissioning Licences is in preparation. That means that no general guidance or prescriptive approach is provided up to now by the regulatory body.
In specific cases the licences have been transferred to BELGOPROCESS. In these cases, the Agency acts in the capacity of a decommissioning authority.
There is no legal requirement for plant design to allow for decommissioning. Nevertheless, for new constructions, the regulatory body requires information concerning future decommissioning.
The release of material is regulated on a case-by-case basis according to general radiation protection regulations, the radiometric checks being agreed and supervised by the Regulator.
Since 1991, the agency ONDRAF-NIRAS is legally in charge of the collection of decommissioning related information on nuclear facilities, the evaluation and approval of decommissioning programmes which comprise cost estimates for decommissioning and financial provisioning. The necessary information is provided by the licensee to the Agency by means of decommissioning plans.
Waste processing facilities and interim stores are available for both operational and decommissioning waste, and disposal facilities are being studied.
ONDRAF-NIRAS has been assigned by law in 1997 to work out a national inventory of all nuclear installations and radioactive contaminated sites, to evaluate their decommissioning and clean-up costs, and to verify availability and sufficiency of financial provisions. In case of insufficient provisions, the Ministry of Economic Affairs may enjoin the licensee or the owner of the facility or site to take the necessary measures.

Denmark

Riso National Laboratory are involved in the development of policy and regulations, they are also responsible for the implementation of decommissioning. Regulation of

decommissioning is carried out by the Inspectorate for Nuclear Installations (TNA) under the Emergency Management Agency and the National Institute of Radiation Hygiene (SIS) under the National Health Services of Denmark.
Control of decommissioning cannot be undertaken under an operating licence. Decommissioning licences are issued by the TNA, and cannot be transferred to a decommissioning authority. No guidance or licence conditions are provided by the regulatory bodies. Plant design was not required to take account of decommissioning but it would be desirable in any future design projects.
A case-by-case system is used for decommissioning strategy although the IAEA Stages from the guidelines have been adopted. Stage 3 is not obligatory. The decay period is also decided on a case-by-case basis examples to date ranging from a few years to 20 years.
The release of materials from decommissioning operations is regulated on a case-by-case basis by SIS. Radiometric checks are accepted by the regulator, however additional checks are sometimes required.
A storage facility for radioactive waste is available but space is limited, no disposal facilities are available. Licence cost and funding requirements are not required and there are no requirements for public involvement in the process.

Finland

The Ministry of Trade and Industry are involved in setting the policy for decommissioning, the Government deal with the development of general regulations and the detailed regulations are developed by the Radiation and Nuclear Safety Authority (STUK). All three of these organisations are involved in the regulation of decommissioning. The implementation of decommissioning is dealt with by the licensees, IVO and TVO for NPP utilities and VTT for the research reactor.
In principle control of decommissioning can be by operating licence , however this may not be the approach taken. No decommissioning licences have been defined in the legislation so far, but it is the Government which issued operating licences. The regulatory body provides general and detailed licence conditions as necessary, general guidance and a prescriptive approach are provided in principle but to date this has not occurred. Plant design is required to allow for decommissioning.
The policy which has been published requires that all decommissioning plans be updated on a 5 yearly basis. There are no official definitions of the IAEA Stages of decommissioning, however achievement of the equivalent of Stage 3 is obligatory. Decommissioning plans for the two NPP's assume decay periods ranging from a few years to about 30 years.
The release of material is regulated according to Regulatory Guide YVL 8.2, however to date there is no experience of materials being released. Operational waste storage and disposal facilities exists and plans exist to expand them to include decommissioning waste. The requirement for licence cost and funding estimates is stipulated in the Nuclear Energy Law and decree.
The public involvement for constructing and operating a disposal facility is covered by two areas of legislation, the Nuclear Energy legislation requires a public hearing before the first licensing stage and the Environmental Impact Assessment (EIA) legislation requires a public hearing process on the EIA programme, the EIA process and the EIA report.

France

The governmental authorities approve specific constraints and exercise surveillance on installations where radioactive substances are processed.
The regulatory responsibilities of the governmental authorities in the area of nuclear safety are as follows:

- establishment and application of general safety rules,
- issue of licences to each installation after in-depth technical appraisal of the safety case, and
- surveillance.

The Nuclear Installations Safety Directorate (DSIN) is the governmental authority responsible for nuclear safety. It reports both to the Ministries in charge of the Environment and in charge of Industry.
DSIN processes the entire application procedures for licencing the design, construction, operation and decommissioning, etc. of Basic Nuclear Installations.
Licences are granted by ministerial decree signed by the Prime Minister.
The different phases are defined decree 63-1228 modified.
At any time, operators are responsible for the safety of their installations.
According to a classical scheme, DSIN sets out general safety objectives. Operators suggest solutions to reach those objectives and, after approval by DSIN, implement their proposed solutions. This implementation is done under the control of DSIN.
As a general rule, operators are free to choose their decommissioning strategy and the techniques to be used provided safety criteria are respected. These criteria are formulated by the nuclear safety authority, through the issuance of technical prescriptions that take into account the specific risks due to dismantling.
The dismantling operations lead to a large amount of materials and nuclear waste. According to the French regulation, an operator that owns a nuclear installation undergoing dismantling is responsible for:

- managing its material and waste exhaustively, properly and safely,
- keeping record of this management in a appropriate way.

This statement implies that each category of waste should be dealt with from production to elimination according to a pre-assessed and controlled scheme. In particular, this approach excludes the practice of any unconditional clearance levels for very low level radioactive waste because such a practice would mean the loss of waste producer responsibility.
DSIN has recently developed an approach that takes into account the above mentioned principles for waste management. This approach has been applied to the decommissioning of the EL4 reactor located in Brennilis (Britanny). Before the actual dismantling, in the authorisation decree, DSIN required the operator (CEA) to provide for approval a detailed waste management plan, called waste study, describing and justifying all the steps involved in the management of each category of waste, consequently, the operator proposed to DSIN the pathways to eliminate the waste. The approval procedure by DSIN includes an impact assessment and a public inquiry.

Germany

The Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU), the Federal States, the Reactor Safety Commission (RSK), the Commission for Radiological Protection (SSK), the Federal Office for Radiation Protection (BfS), and the Company for Industrial and Reactor Safety (GRS) are involved in the development of policy and regulations. The Regulatory Authority of the Federal States are involved in the regulation of decommissioning, with expert organisations carrying out some specialist tasks on behalf of the Authorities if required. The operator is generally the licensee responsible for the overall organisation of decommissioning activities.

Specific activities in the post-operational phase can be carried out under the operating licence, for example removal of radioactive materials and radioactive waste arising from the operational phase. All other decommissioning work must be carried out under a decommissioning licence. The Authorities of the Federal States issue decommissioning licences, with the BMU evaluating the draft application in some cases.

General guidance is provided by the authority as well as general conditions on all licences, detailed licence conditions specific to the project are defined during the licensing process. There is a requirement in the safety criteria for plant design to take account of decommissioning.

In Germany a case-by-case system is used for decommissioning strategy, the same approach is taken for the decay period to be used before decommissioning starts. Two different strategies for decommissioning have been defined (Nukem Nuklear, ENIS N° 173):

-scenario 1: preparation of safe plant enclosure (2-3 years), safe enclosure (about 30 years), complete plant demolition and release (12-14 years), and

-scenario 2: direct complete plant dismantling into "green field" and site release.

(...) In the past, due to higher radiation exposure in scenario 2, most German utilities were expected to opt for scenario 1. However, in the meantime, there is a tendency to opt for scenario 2. This is especially applied to NPPs which have been shutdown after 1990. The reason for this change is that a lot of experience with decommissioning activities has been gained during the last years in Germany. And this experience clearly contradicts the assumption that safe enclosure for several decades is a necessary condition for dose rate savings or could be cheaper or must be maintained due to assumed better dismantling techniques in the future.

The release of material is regulated by pre-conditions and the procedure for free clearance of radioactive residues in the licence for a decommissioning project, and the radiometric checks are carried out by the Regulator with support by expert organisations.

Several interim storage facilities exist in Germany and the final disposal for LAW and MAW has an operating licence until the year 2000, other final disposal facilities are undergoing the licensing procedure.

Greece

Presently in Greece there are no National Regulations or Guides addressing decommissioning. There is only a 5MW swimming pool type research reactor which will not be decommissioning for some time. The authorities which will develop the policy and regulations are the Ministry of Development and the Greek Atomic Energy Commission, whereas decommissioning will be implemented by the organisation operating the research reactor.

Italy

The National Agency for the Environmental Protection (ANPA) and the Government are involved in the development of policy and regulations. The regulation of decommissioning is carried out by ANPA, the Ministry of Trade and Industry (MICA), the Home Office, the Work Office, the Ministry of Environment, the Ministry of Health, and the Region or the Independent Province that is involved in the particular decommissioning project. ANPA, the Agency for New Technology, Energy, and the Environment (ENEA), the Public Electric Power Company ENEL, and Nuclear Fuel Fabrication (FN) are involved in the implementation of decommissioning.
Decommissioning can be controlled by operating licence, and licences are issued by MICA. Plant design is required to take account if decommissioning, and the regulatory bodies provide a prescriptive approach as well as general and detailed licence conditions.
No policy on decommissioning has been published in Italy, however the definitions of the three Stages have been decided, they are: Stage 1 - Safe storage; Stage 2 - Partial release of the site; and, Stage 3 - Unrestricted release of the site. Hence in line with the IAEA guidelines, although obligatory completion of Stage 3 has not been decided yet. The decay period used is some tens of years, decided on a case-by-case basis. There are no regulations to date on the release of materials from decommissioning operations because no decision has been taken on the "de minimis" levels. Hence no radiometric testing for release of materials is carried out.
Some temporary storage facilities are in operation but no disposal route is available as yet, waste from the NPP's is stored in situ. Licence costs and funding estimates are not required and although the Region, Province and Local Administration are involved in the process there is no requirement for a public inquiry to be held.

Netherlands

The organisations involved in the development of policy and regulations on decommissioning are the Ministry of the Environment (VROM), the Ministry of Economic Affairs (EZ) and the Ministry of Social Affairs, the same three organisations are involved in the regulation of decommissioning. The organisations involved in the implementation of decommissioning are the electricity generating companies EPZ and GKN and possibly the Radioactive Waste Operator (COVRA). Only the post-operational phase can be controlled by operating licence, the decommissioning phases must be carried out under a decommissioning licence, which

are issued by the three Ministries mentioned in the paragraph above. The decommissioning licence will be issued to the operator of the NPP to be decommissioned and will not be transferred to a decommissioning authority. The regulatory body provides detailed licence conditions and general guidance is under development. Plant design must allow for decommissioning.
A published policy on decommissioning is being developed but in addition each NPP to be decommissioning will be considered on a case-by-case basis as well. The period of decay to be used is still under discussion as part of the general policy. The IAEA Stages are not used as such, the equivalent definitions are as follows: Stage 1 - Post-operational phase; Stage 2 - Preparation for enclosure; Stage 3 - To bring the site to such a condition that further use is possible without radiological restrictions. Achievement of Stage 3 of these definitions is obligatory.
Clearance levels for the release of materials from decommissioning operations have yet to be established and procedures for the radiometric checking of materials are to be developed as part of the decommissioning plan. Storage and disposal facilities for both operating and decommissioning waste are available, run by COVRA. Licence estimates and funding estimates are required for decommissioning projects. Public involvement in the decommissioning procedure is secured through the Environmental Impact Assessment, which all decommissioning projects must have.

Portugal

No specific legislation for decommissioning has been considered yet and hence no regulations or requirements have been defined yet.. In general the Governmental organisations are involved in the development of policy and regulations concerning nuclear and radiological installations, these are the Ministry of Environment and the Ministry of Health.

Spain

The Ministry of Industry (MIE), the Nuclear Safety Council (CSN) and the Ministry of Environment (MIMA) are involved in the development of decommissioning policy and regulations. These organisations also regulate decommissioning. The organisations involved in the implementation of decommissioning are ENRESA and the former operators of the NPP at the request of the MIE.
For NPP's the so called pre-decommissioning (de-fuelling, operational waste management, system draining, etc.) can be carried out under the operating licence, however decommissioning is controlled by a separate licence. This is issued by MIE with the legally binding approval and conditions of the CSN and the MIMA (for the environmental issues). The licence is issued at the request of the decommissioning operator (ENRESA for NPP's), and it contains only general licence conditions.
Plant design is only very generically required to allow for decommissioning in the existing regulations, these are being revised and much more detailed requirements are expected in the future.
To date a case-by-case system has been used for decommissioning policy, this may change in the current revision of the regulations. Similar definitions to the IAEA guidelines are used but they are not part of the existing regulations, achievement of Stage 3 is however obligatory. The decay period expected for the Vandellos NPP is

30 years between the second and third phases. With respect to the LWR plants operated in Spain, the policy for these takes into account immediate complete dismantling down to IAEA's phase 3 (NUKEM Nuklear, ENIS N° 173).
Release of material is regulated by requirements set out in the decommissioning licence, unless otherwise defined by the regulators. The licensee's radiometric checks are checked independently by the regulator.
A disposal facility is available for LILW at EL Cabril, and spent fuel has been sent for reprocessing. Licence cost and funding estimates are calculated by ENRESA, approved by the Government and then included in the electricity bill as a fee to finance ENRESA's programme. The public participates formally in the licensing procedure, as part of this process the Environmental Impact Declaration is issued.

Sweden

The organisations involved in the development of policy and regulations on decommissioning in Sweden are the Swedish Nuclear Power Inspectorate (SKI), the Swedish Radiation Protection Institute (SSI), the Ministry of Environment, and the Boverket (National Authority for Planning of Land and Housing). The SKI, SSI, Boverket and the County Administration are involved in the regulation of decommissioning. The licensee is the only organisation involved in the implementation of decommissioning as the operator has full responsibility.
Control of decommissioning can be by operating licence but approval from the competent authorities must be obtained and the licence cannot be transferred to a decommissioning authority. No new nuclear facilities, with the exception of waste repositories and interim storage facilities, can be built so there is no requirement for plant design to take decommissioning into account. The guidance provided by the regulatory body is on a case-by-case basis and hence no general regulations have been issued so far.
Decommissioning policy has been decided on a case-by-case basis, this has included the decisions on decay periods and achievement of immediate IAEA's Stage 3 decommissioning. Similarly the definition of decommissioning phases has not been decided.
It is believed that an NPP can be dismantled immediately after shutdown without major radiological problems. It is also well accepted that appropriate dismantling tools and technologies are available right now (NUKEM Nuklear, ENIS N° 173).
The release of material is regulated according to SSI FS 1996:2, which is a general regulation for operational waste, release of materials can also be on a case-by-case basis, after application to SSI. Radiometric checks for the release of buildings are checked independently by the regulator and a third party, release of materials is accepted by the regulator but not without questions, independent checks can also be carried out if necessary.
Central interim storage for spent fuel and some "internal parts" is available, as is a storage facility for operational waste, however the storage facility for decommissioning waste is not yet available. Regular licence cost and funding estimates are required and a fee is paid by the industry against decommissioning liabilities. The requirements for public involvement in the licensing procedure have not yet been decided.

United Kingdom

The Government organisations involved in the development of policy on decommissioning are Department of Environment, Transport and the Regions, the Welsh Office, the Scottish Office, the Department of Trade and Industry, the Ministry of Defence, and the Ministry of Agriculture, Fisheries and Food. The regulations governing the decommissioning of facilities are laid down in the site licence which is issued by the Health and Safety Executive, who are also responsible for ensuring that the regulations are adhered to, waste disposal is regulated by the Environment Agency in England and Wales and the Scottish Environment Protection Agency in Scotland. The licensee is responsible for developing decommissioning strategies, plans and technology, and for the implementation of decommissioning.

The site licence covers all aspects of activities on the site, including both operation of facilities and their decommissioning, hence the operating licence does cover decommissioning operations, this is not transferred at the start of decommissioning as no *separate* decommissioning authority exists. General licence conditions are provided. Plant design does now take decommissioning into account, eg. the design work and the overall safety case for Sizewell B power station (the most modern UK power station) takes account of decommissioning.
The published policy on decommissioning is that a case-by-case system is used, the period for decay is decided on a case-by-case basis by the regulators and the licensee. The IAEA Stages are not defined nationally, each operator defines how closely his strategy corresponds to the IAEA Stages. Achievement of Stage 3 is not obligatory and the end result of a specific decommissioning project is decided on a case-by-case basis.
The release of material is regulated by statutory instruments 1986 No. 1002 and 1992 No. 647, the radiometric checks are subject to an inspection regime which includes the management system associated with its release and radiometric analyses of the material by the Regulator. The Regulator also has the power to require independent analysis of the materials by a third party.
Disposal facilities are available for LLW, and storage facilities only for ILW and HLW. It is standard practice for appropriate financial arrangements to be put in place to cover the costs of decommissioning civil nuclear plants and as such, nuclear companies must make full provision for this in their accounts.
There is presently no legal requirement for public involvement, although *this* will change when Directive 97/11/EC comes into force. However, nuclear companies do maintain contacts with their local communities and keep them informed. For example, each of the Magnox Electric sites have Local Community Liaison Councils and at Trawsfynydd they conducted a specific consultation exercise on decommissioning with the local community following the formal shutdown of the station.

ANNEX 2

CURRENT POSITION
Central and Eastern European Countries

Bulgaria

The Committee on the Use of Atomic Energy for Peaceful Purposes (CUAEPP) develops the policy and regulations for decommissioning and up to now have been involved in its regulation as well. The organisations involved in the implementation of decommissioning are the Committee of Energy, the National Electricity Company and the Nuclear Power Plant Kozloduy.
Decommissioning can be controlled by the terms of the operating licence, decommissioning licences are issued by CUAEPP and in future it is possible that a Decommissioning Authority could be set up to which the licence is transferred, this has yet to be defined. Plant design was not required to allow for decommissioning but the design allows for decommissioning without major complications. No general guidance has been developed yet but general licence conditions are given in Ordinance No 5 issued by CUAEPP in 1988 and amended in 1993. Detailed licence conditions will be provided by CUAEPP, but have not been developed yet.
There is no published policy on decommissioning as until now only preliminary studies have been developed. There are no officially published decommissioning stages but it is likely that the IAEA Stages will be adopted, achievement of Stage 3 is not obligatory however.
The release of material is regulated by Ordinance No 7 issued by CUAEPP in 1992. Waste is classified according to activity content and/or surface contamination, the waste which is below these limits is released without restrictions. Radiometric checks are reported to the regulator on a monthly basis and are reviewed by CUAEPP, periodically the CUAEPP perform independent checking of the materials prepared for release, independent checks by the specialised control organisations can also be carried out according to Bulgarian legislation.
Operational waste storage facilities were erected with the NPP and a special location has been defined for temporary storage of treated RAW. No disposal facilities are available for operational waste or for future arising of decommissioning waste, there is however a concept to establish a National repository for final RAW disposal.
There are no requirements for licence cost or funding estimates but two funds for decommissioning and radioactive waste management are being set up under the Committee of Energy. There are no requirements for public involvement in the decision making process for decommissioning nuclear facilities.

Czech Republic

The Parliament and the Government of the Czech Republic are involved in the development of policy and regulations on decommissioning. The regulation of decommissioning is undertaken by the State Office for Nuclear Safety who are also

involved in the implementation of decommissioning along with the Ministry of Industry and Trade and the Radioactive Waste Repository Agency.
Control of decommissioning can be by operating licence under the Atomic Law of the Czech Republic §9/1 (Act No 18/1997 Coll. of 24 January 1997). Decommissioning Licences are issued by the State Office for Nuclear Safety (SUJB) and can be issued to the approved operators only, there is no decommissioning authority in the Czech Republic, but the regulatory body provides both general guidance and licence conditions. Plant design must take decommissioning into account by law.
A case-by-case system is used for decommissioning rather than a published policy, with the decay period also being dependant on the character of the installation, in the case of NPP's it is assumed to be a maximum of 60 years. The IAEA decommissioning Stages are adopted without modification but achievement of Stage 3 is not obligatory.
The release of material is regulated by SUJB No 184/1997 Coll.. The licensee's radiometric checks are checked independently by both the regulator and by a third party. Waste disposal facilities are available at the near surface repository at Dukovany and at Richard.
Licence cost and funding estimates are required in the nuclear installations commissioning phase according to §13/3/ of the Atomic Law. The licensee is obliged to adequately inform the public on the assurance of both nuclear safety and radiation protection involving decommissioning activities. The SUJB must provide information on its activities to the public and any industrial activities which have an environmental impact must include the active involvement of the public.

Estonia

Estonia does not have any power producing reactors or research reactors at present and there are no plans to build any new NPP or other nuclear facilities in the near future. Two nuclear reactors were located in the Soviet Union navy training centre at Paldiski, these were partially decommissioned by the Russian authorities and the spent fuel transferred to Russia in 1994. The training centre was handed over to Estonia in 1995. ALARA Ltd was established as a governmental company in 1995 to manage the radioactive waste at Paldiski and elsewhere. ALARA holds the sole licence for radioactive waste management, issued by the Estonian Radiation Protection Centre in 1997.
The Paldiski International Expert Reference Group, PIERG, was established in 1994. The original objective of PIERG was the decommissioning of the reactors at Paldiski, this was modified in 1995 to reflect the changed circumstances, the new objective being solid waste storage and the preparation of interim storage for conditioned waste.
The regulatory authority for radiation protection, Estonian Radiation Protection Centre (ERPC) was established in 1996 and the Radiation Act came into force in May 1997. Among other tasks ERPC is responsible for preparing regulations for the application of the Radiation Act. The regulation for licensing was implemented in August 1997 and the regulation for radioactive waste management is planned for the end of 1998. There are no plans to prepare a regulation for decommissioning of nuclear installations in the near future.

Hungary

The Hungarian Atomic Energy Authority (HAEA), the Ministry of Public Welfare, the Ministry of Environmental Protection and Regional Policy and the Ministry of Interior

are involved in the development and regulations. The authorities which play the main role in issuing the licence or permission include the Nuclear Safety Directorate (NSD) of HAEA, the State Public Health and Medical Officer Services (SPHAMOS), the regional Environmental Protection Inspectorate and the building authority of the local municipality concerned. The performance of tasks related to the decommissioning of a nuclear facility is the responsibility of an organisation designated by the Government (Non-profit Agency, to be established by June 1998) based on Act CXVI on Atomic Energy.
The control of decommissioning cannot be carried out under an operating licence, it must be controlled directly under a decommissioning licence. NSD issued decommissioning licences for nuclear facilities, SPHAMOS for radioactive waste facilities. According to the definitions of the new Atomic Energy Act the radioactive waste facility in Hungary is not included as a nuclear facility. No decommissioning authority has been established. Plant design is partially required to allow for decommissioning for any new facility, mainly in terms of estimated waste arising from decommissioning. The Authorities provide both a prescriptive approach and general licence conditions for decommissioning.
At present a case-by-case system is used rather than a published policy for decommissioning, neither has a specific period of decay been defined. However, Governmental Decree No. 108/1997 connected with the Atomic Energy Act specifies three phases for the decommissioning procedure, namely final shut down, preparatory and dismantling phases, these results in a 70 years safe enclosure period for Paks NPP. The stages above are roughly similar to the IAEA Stages 1, 2 and 3, achievement of Stage 3 or equivalent is not obligatory as it depends on the decommissioning licence procedure.
Generally the release of material is regulated by decrees on exemption levels for different radioisotopes (Governmental Decree Nr 124/1997 and Ministerial Decree No 23/1997 issued by the Ministry of Public Welfare). Two decrees connected to the new Atomic Energy Act will be published soon by the Ministry of Public Welfare and the Ministry of Environmental Protection and Regional Policy which will prescribe more detail.
One final disposal LILW radioactive waste facility has been in operation since 1976 and an interim store for spent fuel has been in operation at Paks NPP site since 1997.
Licence cost and funding estimates are required but a new body, the Nuclear Financial Fund came into being on 1 January 1998 whose approach to long term provision for financial liabilities will be to include a levy on each kWh of energy produced. The amount of payment shall be determined such that it covers all the costs arising as a result of the final disposal of radioactive waste, the interim storage and final disposal of spent fuel and the decommissioning operations.
The requirements for public involvement are dealt with through the licensing process for the environmental protection impact (according to the Act LIII of 1996 on environmental protection and the Governmental Decree No 152/1996 on environmental impact evaluation).

Latvia

The main body involved in the development of policy and regulation in Latvia is the Ministry of Environmental Protection and Regional Development. The regulation of decommissioning is undertaken by the Radiation and Nuclear Safety Control Division of the Environmental State Inspectorate. The organisations involved in the implementation

of decommissioning are the Nuclear Research Centre (the operator) and the company Environmental Projects (project management).
No regulations have yet been approved on decommissioning, the proposal is to include the main decommissioning activities in the Radioactive Waste Management Regulations and licensing will be carried out under the same authorisation process as any other activity involving radiation sources. Decommissioning licences will be issued by a Commission jointly established by the Ministry of Environmental Protection and Regional Development and the Environmental State Inspectorate in the framework of the Licensing Regulations. There are no plans to establish a decommissioning authority.
At the time the research reactor was built a different legal system was in use which did not require plant design to allow for decommissioning. For decommissioning the regulatory body provides general guidance and licence conditions and also a partly prescriptive approach in that some issues will have to be negotiated with the operator, detailed licensing conditions are not provided under the Licensing Regulations but it will be managed by the supervision team.
Decommissioning policy is on a case-by-case basis as there is only one nuclear facility in Latvia. The period for decay is dependant on the country which accepts the spent fuel, if it is Russia it will be approximately 4-5 years. Achievement of Stage 3 of the IAEA guidelines is not obligatory and the definitions used for the Stages are Stage 1 - safe enclosure with minor decommissioning, Stage 2 - restricted site release, and Stage 3 - "green land".
The release of material is not yet regulated but the new Regulations will deal with this issue following the EU and IAEA guidelines. Licensee's radiometric checks are supervised by the Regulator. Facilities are available for long term storage of radioactive waste. As the facility was received close to its decommissioning phase no licence cost or funding estimates were available, however approval of the funding will be done by approval of the concept with financial estimates. Under the Licensing Regulation any licence for nuclear facilities must be examined by a public hearing procedure.

Lithuania

Lithuania have very little experience of decommissioning as no nuclear installation has yet been decommissioning or is approaching the decommissioning phase, development of legislation and regulations are therefore at a very early stage. The Ministry of Economy, the State Nuclear Power Safety Inspectorate (VATESI), and the Ministry of Environmental Protection are all involved in the development of policy and regulations on decommissioning but only VATESI is responsible for the regulation of decommissioning. To date no nuclear installations have been decommissioned so no organisations have been involved in the decommissioning of nuclear installations.
Decommissioning of nuclear installations cannot be carried out under an operating licence, the NPP operating organisation would have to obtain a separate licence for decommissioning the NPP from the Regulatory Body. Decommissioning licences are issued by VATESI, at present no decommissioning authority exists and there are no plans for one to be set up, the responsibility for decommissioning will remain with the operators of the NPP. The Regulatory Body provides only general guidance for decommissioning of nuclear facilities at present, the plant design was not required to allow for decommissioning.
The IAEA proposed Decommissioning stages are adopted as follows: Stage 1 - Removal of spent fuel from the reactor and pool; Stage 2 - Dismantling of reactor buildings; Stage

3 - Greenfield. The policy on decommissioning, the decay period and whether the achievement of Stage 3 should be obligatory have not been decided yet.
Releases of material from decommissioning are regulated by the Ministry of Environmental Protection and the licensee's radiometric checks are accepted without question. Only operational waste storage facilities are available. A safety assessment of the facility is being carried out to decide if it is acceptable as a disposal facility.
Licence cost and funding estimates are required and a decommissioning plan must be prepared 5 years in advance of the start of decommissioning an NPP, this plan must be approved by several Ministries including the local municipality in which the NPP is located.

Poland

The National Atomic Energy Agency (NAEA) are involved in both the regulation and the development of policy and regulations on decommissioning. The nuclear installation owner and operator are responsible for the implementation of decommissioning.
Decommissioning can be carried out under an operating licence, licences being issued by the President of the NAEA and can be transferred to the NAEA's Decommissioning Authority. The Regulatory Body provides only general licence conditions, however plant design is required to allow for decommissioning.
A case-by-case system is used for decommissioning of nuclear facilities with a decay period of 3 years. The application of the IAEA Guidelines is as follows: Stage 1 - Storage with surveillance; Stage 2- restricted site release; Stage 3 - Unrestricted site release. Achievement of Stage 3 is not obligatory.
The release of material is regulated by the NAEA President's Ordinance using activity levels at or below clearance levels, which are based on an annual dose to members of the public of less than 0.01 mSv. The licensee's radiometric checks are checked independently by the Regulator, the checks are carried out at random.
Temporary storage facilities are available for spent fuel and long-lived LILW, a near surface repository is available for short lived LILW. Licensing cost and funding estimates are required for all decommissioning projects and the public involvement in the decommissioning licensing procedure is via the Safety Report.

Romania

In Romania the organisation involved in the development of policy and regulations on decommissioning of nuclear installations is the National Commission for Nuclear Activities Control, they are also responsible for the regulation of decommissioning activities. The implementation of decommissioning is the task of the nuclear facilities operators.
Decommissioning is to be controlled by Operating Licence, the licence is issued by the National Commission for Nuclear Activities Control. There is no decommissioning authority but the Law does not allow the licence to be transferred to any other organisation than the operators. Plant design must take account of decommissioning and the regulatory body is planning to provide general guidance and general licence conditions.
A decommissioning policy for nuclear installations is planned to be issued in the near future, currently the decay period for radionuclides with a half-life of less than 30 years is 10 years. The provisions of the IAEA guidelines are not obligatory but adoption of these guidelines is envisaged in the near future.

According to the National Nuclear Safety Regulations the release of materials is regulated by licence. The release limits have not been established and to date limits have been used on a case-by-case basis. Limits are expected to be set when the regulations are revised. The licensee's radiometric checks are checked independently by both the regulators and a third party.
A disposal facility for operational waste is available but this facility cannot accept decommissioning waste, there is also an interim storage facility at Cernavoda NPP for LLW and MLW.
Licence costs must be paid by the licence applicant, who is required to have adequate and sufficient financial arrangements for collection, transport, treatment, conditioning and storage of radioactive waste generated from his own activities, including decommissioning.
A public hearing is required by the procedure for issuing the environmental licence.

Slovak Republic

The organisations involved in the development of policy and regulations on decommissioning are the Nuclear Regulatory Authority, the Regulatory Body under the Ministry of Health and the Ministry of Environment (EIA). Of these only the Nuclear Regulatory authority are involved with the regulation of decommissioning. SE-VYZ, a daughter organisation of NPP Bohunice, was created in 1996 for decommissioning and radwaste management.
Previously, decommissioning could be carried out by operating licence, however the planned Atomic Energy Act will change this to needing an individual licence for decommissioning operations. The decommissioning licence will be issued by the Nuclear Regulatory Authority. General guidance is provided as well as general licence conditions, detailed licence conditions are also provided for some individual projects. Currently a case-by-case system is used for decommissioning but a decommissioning policy will be published in the new Atomic Energy Act. A decay period of between 50 and 70 years is likely and this is under discussion. The IAEA Stages are used and achievement of Stage 3 is obligatory, unless the facility is to be used for another nuclear purpose.
The release of material is regulated by Act No 290/1996 and the main criteria are in accordance with IAEA/NEA guidance on exemption/clearance principles. The regulation for the radiometric checks for the release of materials is currently in preparation.
Storage facilities for radioactive waste are available for some wastes, the disposal facility is undergoing the licensing procedure. Licence cost and funding estimates are required and a decommissioning fund exists although this is being amended in the new Atomic Energy Act. Public acceptance and evaluation of the EIA (conceptual decommissioning plan) is required and the public are involved in the licensing procedure.

Slovenia

The Ministry of Environment and Physical Planning, the Slovenian Nuclear Safety Administration, the Ministry of Health and the Ministry of Economic Affairs are involved in the development of policy and regulations on decommissioning of nuclear installations. All of these organisations with the exception of the Ministry of Economic Affairs are also involved in the regulation of decommissioning, with a specific part of the Ministry of health, the Slovenian Health Inspectorate, involved. The implementation of

decommissioning is carried out by the Ministry of Economic Affairs, the Slovenian Agency for Radwaste Management and a newly established public enterprise employing the key staff from the operating company.
The decommissioning of a nuclear facility is considered as a process which is equivalent to the construction of a new facility or a facility for radioactive waste disposal. Hence it must undergo the same licensing process and approvals identical to those for siting, construction, operation and radioactive waste disposal. This means that no decommissioning work can be carried out under an operating licence, a decommissioning licence is issued by the Ministry of Environment and Physical Planning after receiving the endorsement of the Slovenian Nuclear Safety Administration. The condition for issue of the licence is the Final Safety Analysis Report after review by the appropriate Government organisations. In practice at the end of operation of a nuclear facility, a public enterprise responsible for the decommissioning is formed by the Government. The transfer of responsibilities between an operator and the public enterprise occurs when the operating licence is withdrawn from the operator.
Plant design is not required to allow for decommissioning, however, the detailed plant design is made available for the decommissioning team. The Regulatory body provides both a prescriptive approach and general licence conditions, the published policy was agreed by the Government in September 1996 and was defined in the plan for decommissioning Krsko NPP. Three possible scenarios were analysed and the immediate dismantling model was selected, the decay time in this scenario is 82 years with a total period for decommissioning of 96 years. The immediate dismantling model, once chosen, is obligatory, and, although it does not fit exactly with the IAEA Stages of decommissioning, similar activities to all three stages of the IAEA definitions are included in the immediate dismantling model.
Unrestricted release of materials is regulated by the Act on Radioactive Wastes (Off.Gaz.SFRY,40/86) which covers the record keeping, collection, storage, disposal and releases of nuclear wastes into the environment. The licensee's radiometric checks for the release of materials are checked independently by both the regulator and a third party.
Slovenia has no final repository for radioactive waste, the waste is temporarily stored in LILW storages of which there are two. By applying new conditioning methods the capacity for operational waste will be sufficient until the end of the NPP's operational life. A final disposal facility is planned which will take both operational and decommissioning waste. Spent fuel and fuel from research reactors are currently stored in pools. Research reactor fuel will be returned to the USA whilst the decision as to the future of the spent fuel has been deferred until the end of the operating life of the NPP.
The financial funds for decommissioning are provided from the state budget or in the case of Krsko NPP from a special decommissioning fund. The costs of decommissioning by the immediate dismantling model have been estimated as 740.8 million DEM.
Requirements for public involvement are specified in the Environmental Protection Act (Uradni list RS, st. 1/96) The state authority is responsible for estimating the impact on the environment and has to provide a public presentation of the project and a public hearing.

ACKNOWLEDGEMENTS

The present document is the outcome of many meetings of a working group set up under the initiative of the European Commission Directorate General XI, Environment, Nuclear Safety and Civil Protection, under the chairmanship of Mr P.Vankerckhoven of the EC DGXI unit C2 "Nuclear Safety, Regulation and Radioactive waste management.

The working group included the following members:

MM Geoffrey HOLT
Ingemar LUND
Jean-Guy NOKHAMZON
Luigi NOVIELLO
Manfred SCHRAUBEN
Hakan STERNER
Pablo ZULOAGA

The secretariat and the editorial part of the working group was ensured by Mr Claude STEINKUHLER of DDR Consult. Technical and EC internal support was received from Mr Kurt PFLUGRAD of DG XII and Mr Michael LOSCH of DG XVII.

European Commission

EUR 18860 — Decommissioning of nuclear installations in the European Union

P. Vankerckhoven

Luxembourg: Office for Official Publications of the European Communities

1999 — II, 63 pp. — 21 x 29.7 cm

Nuclear safety and the environment series

ISBN 92-828-5815-4

Price (excluding VAT) in Luxembourg: EUR 10

This document has been created and used as a support for an EC communication on the subject of decommissioning nuclear installations in the EU. A close analysis of the age of Europe's nuclear facilities reveals that the first decades of the next century will see a rapid increase in the number of such facilities being decommissioned. At present, over 110 nuclear facilities within the Union are at various stages in the decommissioning process and it is forecast that at least a further 160 facilities will need to be decommissioned over the next 15 years (with a Union of 15 Member States). Future expansion of the Union to include the Baltic and central European countries may contribute to a rapid increase in the number of facilities to be decommissioned (at least 50 sites). The development of common views within the EU on the decommissioning of these facilities will result in better protection of the workers, of the public and of the environment and in a more harmonious technological practice allowing a reduction of the decommissioning costs. This supporting document has been formulated together with a group of invited experts on the basis of terms of references establishing the main focus of the communication. It is constituted by an Introduction (Chapter 1), the terms of references (Chapter 2) and the supporting positions and observations from the Group of Experts (Chapter 3) on the various items developed from the terms of references. The two annexes are composed of a short description of the current situation in the Member States and the central and eastern European countries regarding the policy and regulatory aspects linked with decommissioning activities.

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Fax (32-2) 538 08 41
E-mail: jean.de.lannoy@infoboard.be
URL: http://www.jean-de-lannoy.be

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B-1000 Bruxelles/Brussel
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Fax (32-2) 511 01 84

DANMARK

J. H. Schultz Information A/S
Herstedvang 10-12
DK-2620 Albertslund
Tlf. (45) 43 63 23 00
Fax (45) 43 63 19 69
E-mail: schultz@schultz.dk
URL: http://www.schultz.dk

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