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COMMUNICATION FROM THE COMMISSION TO THE COUNCIL AND THE EUROPEAN PARLIAMENT

Nuclear safety in the European Union

INTRODUCTION

1. The Green Paper entitled "Towards a European strategy for security of energy supply", adopted by the Commission on 29 November 2000,[1] provided the opportunity for an open, objective and rational debate on nuclear energy to take place. On 26 June 2002, the Commission adopted the final report on the Green Paper,[2] which concluded that *"the range of choices available to the Member States has to be as wide as possible, without prejudice to their sovereignty in these matters. The nuclear option remains open to those EU Member States who would like it."*

2. Civil nuclear activities are regulated in the European Union by the EURATOM treaty, signed in 1957. This created a Supply Agency with the aim of ensuring regular and equitable supply of nuclear materials to European users and a EURATOM safeguards capability to make certain that nuclear materials were not diverted from their intended use. Some 250 inspectors are currently engaged on this task. A report in February 2002 by a group of high-level experts convened by the Commission concluded that, in order to include the entire concept of nuclear security, the possibility of enlarging the task of nuclear inspectors to include physical protection should be explored.[3] The arrangements put in place by the Treaty together with Community legislation guarantee the most effective control in the world of nuclear materials. Indeed, the complementarity between the activities of the EURATOM Supply Agency and EURATOM security control provides the framework for the global responsibility of the EU over the whole fuel cycle, from nuclear materials to waste.

   Nevertheless, the main purpose of the EURATOM treaty was to supervise the secure management of nuclear installations, including a high standard of health protection. A broad set of specific measures, distinct from those which had evolved under the auspices of the International Atomic Energy Agency, has been developed in the field of radiation protection. Paradoxically, the safety of nuclear installations has not developed in the same way, although it is supposed to provide concrete guarantees for protecting populations against ionising radiation, an area in which the Commission has, for a number of years, had undeniable technological expertise in the form of the Joint Research Centre (JRC). It is therefore appropriate to add safety standards for nuclear installations during and at the end of their working lives to the legislative corpus dealing with radiation protection, as requested by the European Council, in particular at its meeting in Laeken, and by the European Parliament in the Rübig report, adopted on 8 July 2002, on the Commission's report on the activities of the EURATOM Safeguards Office in 1999-2000.

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1 COM(2000)769, 29 November 2000: "Towards a European strategy for the security of energy supply". Office for Official Publications of the EC, 2001, ISBN 92-894-0319-5

2 COM(2002)321 final, 26 June 2002: Final report on the Green Paper "Towards a European strategy for the security of energy supply"

3 SEC(2002)658: Communication from Mrs de Palacio in agreement with Mr Kinnock "Mission of the EURATOM Security Control Office and revision of the organisation chart of DG Energy and Transport", adopted on 26 June 2002

3. The forthcoming inclusion of new member states from Central and Eastern Europe, of which the first steps are scheduled for 2004, is unprecedented in the history of the development of the European Union. The history of these countries during the twentieth century and the nature of their economic development has created a particular focus on a subject little touched upon in previous enlargements - that of the nuclear sector. As the Green Paper on security of energy supply stressed, dependence on imports to meet energy needs in the candidate countries does not differ much from that of the present EU Member States. Nevertheless, the nuclear sector will have to receive more attention in the context of an enlarged EU.

Of the candidate countries, seven have nuclear power plants a total of 22 reactors. Of particular relevance to 2004 is that five of the ten countries expected to enter the Union in 2004 have between them 19 reactors . The nature of the relationship of the candidate countries with the Russian Federation, resulting from their former dependence on the Soviet Union, and the requirement for them to adopt all elements of Community law, has brought to light a new objective need for Community intervention in the nuclear sector, regardless of choices in energy policy subsequently made by the new or existing Member States.

4. This fifth enlargement exercise has raised previously unconsidered issues about nuclear safety. Firstly,following an analysis by nuclear safety authorities, Agenda 2000 identified those reactors which should be decommissioned in the near future, as they could not be upgraded at a reasonable economic cost. Secondly, a safety analysis prompted the European Council, in co-operation with the Commission, to give clear guidance as to the improvements which would have to be made for the candidate countries to attain the high level of safety required by the Cologne Council (June 1999).

This Community evaluation exercise provided a European perspective on nuclear safety. The Laeken European Council in December 2001 internalised this perspective by asking for reports on nuclear safety to be presented on a regular basis. This would not be possible without the establishment of a Community reference framework on nuclear safety standards. Concrete actions have been undertaken by the Community in the field of nuclear safety, largely for the benefit of candidate countries. Today we are in the rather paradoxical situation where Community action on nuclear safety in third countries is internationally acknowledged while domestic action remains limited.

5. A significant number of nuclear installations in the European Union are coming towards the end of their active lives. Some Member States such as Belgium are considering whether to retain nuclear installations on their territory. Germany has taken the plunge and will permanently close its last nuclear plant in 2021. In the candidate countries, the European Union has requested the closure of eight nuclear reactorsbetween 2002 and 2009: Bohunice 1 and 2, Kozloduy 1 to 4 and Ignalina 1 and 2. These facts, independent of any energy choices made by Member States themselves, underline the need for clear provisions to be put into place in the electricity sector , in all Member States and candidate countries, in order to fund the decommissioning of power stations. These provisions will have to guarantee that these closures can be achieved according to the highest safety standards. Decommissioning nuclear power stations requires the commitment of considerable

sums of money. The sums required for complete rehabilitation of the site of a nuclear power station are in the order of 15% of the total investment cost of each reactor to be decommissioned, which can be anything from 200 million euros to more than a billion.

While Member States which have nuclear power stations have made financial provisions to ensure the availability of sufficient funds to cover the expense of decommissioning such plants, their approach to the management of these funds varies significantly from one Member State to another. In addition, the current situation involves disparities which are a hindrance to the smooth functioning of the internal market and undermine healthy competition in the electricity sector.

The European Parliament has drawn attention (in the context of the debate on the proposed directive on common rules for the internal energy market) to the adverse effects that misuse of decommissioning funds could have on competition. Sufficient funds obviously have to be available to cover decommissioning costs, but it is also necessary to ensure that those funds are used only for those activities.

Although the candidate countries have similar laws concerning the establishment of funds of this type, the funds available are in general inadequate, having been put in place only relatively recently. For the early closure of nuclear power plants, the need for funds is even more pressing. The Phare programme, along with Euratom loans, can partially subsidise and compensate for the shortfalls, but completion of the internal energy market, along with environmental considerations, will require the introduction of new rules for the enlarged EU to ensure the availability and sufficiency of funds.

6. Whatever the future of nuclear technology, whatever uses it is put to, for energy, industrial or medical purposes, and whether one is for or against its use in general, the management of radioactive waste resulting from such uses calls for radical solutions. The final report on the Green Paper shows that *"one major lesson to be drawn from the Green Paper debate is that the future of this industry depends on finding a clear and unequivocal answer to the question of the processing and transportation of radioactive waste."*[4]

There has not so far been an active policy in favour of permanent disposal of high level radioactive waste. High level radioactive waste has been building up for nearly half a century in temporary means of storage which vary from country to country, either at the power plants themselves (as irradiated nuclear fuel) or in temporary storage sites. This type of temporary, and at present indefinite, storage, sometimes above ground, raises concerns, particularly in the light of the events of 11 September 2001, as to the vulnerability to terrorist attack of such sites.

As the Green Paper on security of energy supply emphasised, the nuclear option can only be pursued if a satisfactory and transparent solution can be found to the question of the management of nuclear waste. Opinion surveys recently undertaken by the

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[4] In view of the importance of the transport of nuclear materials, the Commission expects to present a Communication on this specific subject, possibly accompanied by legislative proposals.

Commission[5] confirm this analysis and show that a clear policy for the management of nuclear waste would significantly improve public attitudes to the use of nuclear power. It is therefore necessary for the EU to ensure that Member State decisions are taken within a reasonable time and with future generations in mind.

According to most experts, permanent deep disposal is the best known solution for the long-term management of radioactive waste. Research into the technology of radioactive waste management, which has led to a reduction in long-life radioactive elements, has not yet resulted in a practicable alternative to geologicaldisposal. It must nevertheless be pursued in order to give future generations access to new technologies for the treatment of radioactive waste, such as transmutation, in the hope that in due course waste can be significantly reduced. This is why 90 million euros have been allocated to research into waste management under the sixth research framework programme (2002-2006). The Joint Research Centre, for its part, will devote in 6th Framework Programme significant efforts towards actions in the field of waste management research

7. Enlargement has also brought a new context to the continuing difficulties regarding trade in nuclear materials with the Russian Federation. Russia is an important supplier of nuclear materials (natural uranium and enrichment services). Since the beginning of the 1990s, Russia has sold onto the market more significant quantities of natural uranium and, in particular, has offered uranium enrichment services at prices below those on the world market.

This situation led to the adoption by the Euratom Supply Agency in 1992 of a policy of diversification of supply sources, in order to avoid excessive dependence on the Newly Independent States. A first attempt at an agreement on trade in nuclear materials was not successful because of the very hard line taken by the Russians in their attempt to obtain the best deal. Negotiations undertaken since under the Partnership and Co-operation Agreement (signed in Corfu on 24 June 1994) have not been successful and the issue of trade in nuclear materials has not yet been settled.[6]

In the absence of agreement between the parties, the Council and the Commission adopted a joint declaration (Declaration of Corfu[7]) stipulating that the share for European uranium enrichers should be maintained at around 80% of the European market. The principle of setting a limit was also confirmed for natural uranium.

Over the course of the Energy Dialogue ongoing between Russia and the EU since October 2000, Russian demands have become more ambitious, citing the incompatibility of measures taken within the framework of the Declaration of Corfu and World Trade Organisation rules, and creating confusion about the existence of a 30% quota for all energy products imported into the EU. Negotiations on other subjects of common interest have also been affected. Every official meeting,

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5 A survey undertaken in October-November 2001 by the Commission established that a large majority (2/3) of those polled agree that if the management of nuclear waste can be safely and satisfactorily resolved, the nuclear power option should remain open as a means of electricity production (Eurobarometer 2001 – Public Opinion in Europe on Nuclear Waste)

6 In the absence of agreement between the two parties, the PCA does not directly deal with trade in nuclear materials. Under Article 22, the parties agree to take all the necessary measures to reach agreement on trade in nuclear materials by 1 January 1997.

7 The Declaration of Corfu has not been published.

including EU-Russia summit meetings, is treated as another opportunity for the Russians to protest about restrictions and to call for a satisfactory resolution on trade in nuclear materials, which has been blocked since 1994. The EU-Russia Summit of 29 May 2002 concluded that "... *The existing situation with respect to the import of nuclear materials to the EU Member States is a matter of concern for the Russian side. We agreed, in accordance with article 22 of the PCA and in the context of EU enlargement, to reach a mutually acceptable solution.*"[8]

The operating environment for the market in nuclear materials has changed significantly since the beginning of the 1990s, in the world as a whole as well as in Europe and Russia. The nuclear disarmament agreements, and above all the prospect of enlargement including countries which have Soviet-type nuclear power stations for which Russia is practically the only fuel supplier, mean that a new long-term framework for current supply policies needs to be considered. For the European Union, this is also an appropriate time to make clear to the Russian authorities that the opening of negotiations on trade in nuclear materials should also provide a platform for concrete discussion about the safety of first-generation power stations still in operation in Russia.

8. The lack of a Community frame of reference for safety in nuclear installations, uncertainty as to the availability of financial means to ensure safe decommissioning, the lack of safe solutions to the management of nuclear waste and the mack of a framework for trade in nuclear materials with Russia provide other areas in which it is desirable to develop Community legislation.

The Commission is responding to this challenge and to its undertaking of 26 June 2002, with the adoption of the follow-up report to the Green Paper, to bring forward as soon as possible a proposal paving the way to a true Community approach to nuclear safety and allowing rapid progress towards lasting solutions to the question of the management of radioactive waste.

A A COMPREHENSIVE APPROACH TO NUCLEAR SAFETY IN THE UNION, FROM THE CONCEPTION TO THE DECOMMISSIONING OF INSTALLATIONS

1. Safety at nuclear installations: extending Community competence

1.1 Improving safety at nuclear installations: an imperative in an enlarged Union

[8] Joint Statement by V. V. Putin, President of the Russian Federation, J. M. Aznar, President of the European Council/High representative for Common Foreign and Security Policy of the EU, and R. Prodi, President of the Commission of the European Communities, Moscow, 29 May 2002, Annex 2

a) The Union has insufficient means

The Treaty establishing the European Atomic Energy Community (Euratom) contains provisions allowing the Community to regulate the use of nuclear energy by the Member States, in particular as regards nuclear safeguards and health protection.

Nuclear safeguards[9] are the responsibility of the Community pursuant to Chapter 7 of the Euratom Treaty. A team of 250 inspectors at the Euratom Safeguards Office carries out inspections in order to ensure that nuclear material is not diverted for unauthorised purposes.

The safety[10] of nuclear installations[11] is not a responsibility so explicitly established by the Euratom Treaty. When it was being negotiated in the 1950s, the nuclear industry was still in its infancy. It was therefore self-evident that nuclear power should be promoted. That is why the safety of nuclear installations is the responsibility of the nuclear operators under the supervision of their national authorities.

Pursuant to Article 2(b) of the Euratom Treaty, the Community shall, as provided in this Treaty: "*establish uniform safety standards to protect the health of workers and of the general public and ensure that they are applied.*" Chapter 3 of the Treaty, concerning health protection, contains provisions concerning basic standards with regard to protection against ionising radiation.

Chapter 3 of the Treaty has been used in the main with regard to radiation protection. Concerns about this subject had been expressed for a number of years before the Treaty was drafted, in particular as a result of the use of radioactivity in the medical sphere. Radiation protection came into being as a discipline derived from medical radiology in order to protect medical personnel using x-ray generators.

It is, however, undeniable that maintaining a high level of nuclear safety is one of the tasks assigned to the European Atomic Energy Community. Nuclear safety and radiation protection are now two closely linked concepts serving a common health protection objective. Consequently, it is now no longer possible or desirable to separate these two disciplines.

Hitherto, the Community has not made full use of its powers with regard to nuclear safety. However, the Commission has actively intervened in connection with the harmonisation of nuclear safety practices for over 25 years, in particular under the Council resolutions of 22 July 1975[12] and 18 June 1992[13] on the technological problems of nuclear safety[14]. The prospect of enlargement has highlighted the need for greater action.

Following the Chernobyl accident in 1986, which was undoubtedly the most serious accident in the history of atomic energy, and the G-7 Summit in Munich in 1992, the EU began to

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[9] Nuclear safeguards are measures concerning access to and the protection and use of nuclear material and radioactive substances. In practical terms, this concept covers physical protection and non-proliferation checks.

[10] Nuclear safety concerns the measures introduced to guarantee efficient and safe design and operation of nuclear installations.

[11] Nuclear installations is the term generally used to cover nuclear fuel cycle installations (in particular civil reactors, research reactors, reprocessing plants and enrichment plants ...).

[12] OJ No C 185 of 14 August 1975, p. 1.

[13] OJ No C 172 of 18 June 1992, p. 2.

[14] By this is meant "nuclear safety". Confusion often arises due to the translation of both the french "sûreté", "sécurité" into the english

concern itself with the safety of nuclear installations in the Central and Eastern European countries and the Republics of the former Soviet Union.

The work carried out in the Community framework in order to bring nuclear installations in the candidate countries up to a high level of safety allowed a European perspective to emerge in this context. This perspective, developed for the candidate countries, is universal and should constitute the foundations for a reference method for evaluating the safety of nuclear installations in the Member States as part of a Community approach.

The standards drawn up under the aegis of the International Atomic Energy Agency make an important contribution to improving nuclear safety, but they are not legally binding and cannot always be directly applied to the technological realities of the European nuclear industry. Moreover, the Community adoption and adaptation processes are much quicker than the intergovernmental decision-making mechanisms. This is a problem with which the European Community has already been confronted in the maritime and aviation spheres.

Protection from ionising radiation is also a concern after the end of the active life of a nuclear installation. In practice, the final shutdown of a nuclear installation marks the start of a new phase with the objective of lifting the radiological protection restrictions imposed while it was in operation. These restrictions are due to the presence of large quantities of radioactive materials in the form of structural materials, equipment, operational waste and spent fuel.

It is therefore necessary to remove these materials and to subject them to the treatment appropriate to their physical characteristics and their levels of radioactivity, in accordance with safety standards in force. All activities involved in decommissioning produce large quantities of waste. It is the ultimate disposal of radioactive wastes which accounts for the majority of the costs of decommissioning.

At national level there are legal provisions setting out a strategy for decommissioning nuclear installations. These provisions define responsibilities for the different activities involved and set up mechanisms for the provision of sufficient financial resources to deal with the expenses arising from the various activities at each phase of the decommissioning process, including the long term management of radioactive waste and spent fuel cells.

It is important to emphasise that there are significant variations between countries in the amounts of money involved, not only as a function of the size of the industry but also because of variations on the methodology for estimating the costs of decommissioning. These costs depend heavily on chosen decommissioning strategies, methods for calculating future costs and assumptions about the future avolution of financial variables. Approaches to the regulation of financial resources for decommissioning also vary significantly between Member States of the Union.

As nuclear industries are not immune from financial risk, the question of the consequences of possible non-availability of reservces must be considered. A situation where a State would have to take on the costs of decommissioning due to the insolvency of the responsible operator could not be justified to taxpayers or to other operators who had made more adequate provisions or managed them better.

Decommissioning work therefore involves major financial resources. In order to avoid risks to human health and to the environment it is necessary to guarantee, at Community level, that financial resources will be available for the completion of decommissioning work in conformity with safety standards. To this end, specific regulations must be put in place for the creation of decommissioning funds, to which the operators of nuclear installations will have to contribute throughout the active life of the installation. These regulations must guarantee the availability and adequacy of funds at the time of decommissioning operations.

b) Commission and Council evaluation of candidate countries

In the absence of a common reference system for evaluation purposes, it was necessary for the Commission and the Council to draw up an evaluation methodology. In parallel with this, the dispute between the Austrian and Czech authorities about the Temelin power station was a perfect illustration of the need for a common reference method.

Evaluation methodology

In 2000 the Commission and the Council developed a methodology based on texts and work with differing legal status. Two major elements were identified. On the one hand, the International Atomic Energy Agency's Nuclear Safety Convention and, on the other hand, what the Council described as common principles and opinions of the Union. It was stressed that there was at present within the EU a high degree of convergence as regards technical and organisational requirements.

The methodology selected to define a high level of nuclear safety to be achieved by the candidate countries consists of comparing the practices and rules and regulations in force in the candidate countries with those of the Member States. This universal methodology constitutes the foundation for a reference method for the evaluation of the safety of nuclear installations.

The evaluation was carried out by the Commission and the Council in 2001 on the basis of this methodology and made it possible to draw up recommendations which were sent by the Commission to each candidate country in July 2001. It is specified in them that they must be regarded as clarifications of the common position of the Union on the Energy Chapter (14) with regard to nuclear safety. The candidate countries were invited to accept them formally and indicate a timetable for their implementation.

Two fundamental conclusions can be drawn from this evaluation. Firstly, confirmation of the need to close the reactors which cannot reasonably achieve a high level of nuclear safety (Kozloduy 1-4 in Bulgaria, Ignalina 1-2 in Lithuania and Bohunice 1 and 2 in Slovakia). Secondly, the fact that the safety of the other reactors in the candidate countries can, subject to varying degrees of improvements, be brought to a level comparable to that which now exists within the EU for equivalent reactors.

The implementation of these recommendations has been monitored by the Commission and the Council. Work started in January 2002 concluded with a Report on the situation carried out by peer review, published in June 2002. Nevertheless, the implementation of some recommendations will be phased over several years, including beyond enlargement, and monitoring will have to be carried out in order to check compliance with the commitments entered into by these countries before their accession.

If there is no common reference framework for the monitoring of the recommendations in the post-accession period, the EU could be accused of differential treatment between the new and present Member States. For the former, the Union would have a watching brief over the safety of their nuclear installations while for the latter it would not intervene. Such a situation would not be fair.

THE SPECIAL CASE OF TEMELIN

In relation to the post-accession period, the settlement of the dispute between the Czech and Austrian authorities about the starting-up of the Temelin power station situated in the Czech Republic near the Austrian frontier, is a particularly interesting case.

The starting-up of the Temelin power station considerably worsened relations between the two countries. The Commission acted as conciliator to facilitate dialogue between the Czech and Austrian authorities. The conciliation work was formalised in the context of a protocol signed in December 2000 in Melk between the Austrian and Czech authorities, with the participation of the Commission.

Under Chapter IV of this protocol, concerning nuclear safety, the Czech Republic, Austria and the Commission embarked upon a "trialogue" on 29 subjects of concern to the Austrian authorities. The final report on the discussions carried out in the context of this process stressed that, while it was impossible to reach agreement on all the questions, the objective of what is now referred to as the Melk process, namely the facilitation of dialogue between the two States, had been achieved.

Thanks to the Commission's intervention, the Czech Republic and Austria managed to resume discussions in a less emotionally charged framework. On 29 November 2001 the two States agreed, under the mediation of the Commission, a process for the monitoring of the Melk Protocol. Monitoring will be carried out in the framework of a bilateral agreement between the two States. Under this agreement, Austria should have a watching brief over the safety of a Czech nuclear installation.

This watching brief of one State over the nuclear safety of an installation in another State is an atypical mechanism. Clearly, if there had been common safety standards, the solution would have been much simpler. These standards would have served as a reference for Austria and taken over by the Czech Republic as part of the Community *acquis*. The Commission would then have intervened as a matter of course to verify that the acquis had been suitably taken over.

Lastly it should be noted that, in parallel with this process, the safety of the Temelin power station was evaluated by the Commission and the Council in the same way as the other nuclear installations in the candidate countries. The results of this evaluation showed that this power station, subject to the implementation of the proposed recommendations, had a satisfactory level of nuclear safety.

It is therefore time for the Community fully to exercise its competences in the field of nuclear safety. It would be paradoxical for the Community to be able to intervene to evaluate safety at nuclear installations in candidate countries while action within the enlarged Union remained limited. The Community has an adapted legal base for this purpose.

1.2 The legal means to improve safety at nuclear installations

It is no longer desirable to consider nuclear safety in a purely national perspective. Only a common approach can guarantee the maintenance of a high level of nuclear safety in an enlarged EU with 28 Member States. Action by the Community in this connection must be founded on a solid legal basis in the founding texts. It is on this basis that a new approach to nuclear safety can be developed.

Since this is an area which concerns the use of nuclear energy, the legal basis is clearly to be found in the Euratom Treaty. The Treaty's provisions concerning health protection provide a general framework containing the elements of a legal basis for Community responsibilities for nuclear safety. Beyond the purely legal aspects, this competence is, moreover, recognised by the Council.

a) Community competence

To quote the preamble to the Euratom Treaty, the Member States are on the one hand *"resolved to create the conditions necessary for the development of a strong nuclear industry"* and on the other hand *"anxious to create conditions of safety necessary to eliminate hazards to the life and health of the public"*. In addition, pursuant to Article 2(b), the Community has the task of establishing *"uniform safety standards to protect the health of workers and the general public and ensure that they are applied"*.

Chapter 3 of the Treaty, concerning health protection, contains provisions concerning the basic standards with regard to protection against ionising radiation. The Treaty's founding fathers were concerned to give the Community explicit powers with regard to health protection. The latter concerns both radiation protection and nuclear safety.

Radiation protection may be defined as all measures aimed at protecting human beings and the environment against ionising radiation. Safety, on the other hand, concerns measures aimed at establishing and maintaining, in nuclear installations, effective defences against potential radiological risks in order to protect individuals, society and the environment against the damaging effects of ionising radiation emitted by these installations. These two disciplines have a common health protection objective, namely protection against ionising radiation.

The conclusions of the Advocate-General in connection with the Commission's appeal against the Council decision authorising the Community to accede to the Nuclear Safety Convention[15] are very informative. He asserts that *"given current scientific knowledge, it is neither possible nor desirable to maintain artificial boundaries between radiation protection and nuclear safety"*. He also concludes that *"the fact that Member States maintain exclusive competence with regard to the technological aspects of safety does not prevent the Community from adopting legislation laying down certain requirements with regard to safety, licensing, inspection, evaluation and application mechanisms"*.

This analysis tends to confirm the close link which exists between these two concepts. The Community's responsibilities extend beyond radiation protection in the strict sense of the term. As stressed by the Advocate-General in his abovementioned conclusions, *"an interpretation with regard to subsequent practice is particularly legitimate and potent when the drafting of the articles concerned isobsolete, and they have not been amended since then"*. The Euratom Treaty was drafted in the 1950s and, for the most part, has not been amended since. Lastly, it should be recalled that the case law of the Court of Justice has confirmedthe broad application of the radoprotection objective.

The provisions of Chapter 3 of the Euratom Treaty allow the assertion that the Community has powers with regard to the safety of nuclear installations. The basic standards mentioned in Article 30 should be supplemented in order to cover this area. To this end, Article 32 provides that the basic standards may be revised or supplemented. The drafters of the Treaty thus created a system which could evolve in order to enable the Community not only to amend its

[15] Conclusions of Advocate-General Jacobs presented on 13 December 2001, Case C-29/99.

health policy but also to extend its scope. In this regard it is worthwhile recalling that law deriving from chapter 3, Title II of the Euratom treaty, mainly Directive 96/29/Euratom[16], represents a coherent and developing package which is today comprised of about twenty provisions of various kinds, regulating among other things the medical uses of ionising radiation[17], information to be provided in radiological emergencies[18], the transport of radioactive waste and radioactive substances[19], etc..

b) Competence recognised by the Council

With the development of the European nuclear industry, convergence at Community level became necessary in order to support the Member States in their efforts to harmonise safety practices. The Council Resolution of 22 July 1975 on the technological problems of nuclear safety recognised that it was the Commission's responsibility to act as a catalyst in initiatives taken at international level with regard to nuclear safety. As a result of this resolution, the Commission set up several expert groups dealing with nuclear safety matters. These groups, in which representatives of the safety authorities of the Member States participate, have actively contributed to the harmonisation of nuclear safety practices. Following another Council Resolution dated 18 June 1992, participation in these expert groups was extended to representatives of the Central and Eastern European Countries (CEECs) and the Republics of the former Soviet Union (NIS).

Similarly, it should be recalled that the Joint Research Centre (JRC) has been a major player for many years, as far as research is concerned, in order to improve the safety of nuclear installations. Its technical expertise with regard to fuel cycle safety and reactor safety is undeniable and internationally recognised. The JRC also assists the Commission in the evaluation of tenders and the results of projects conducted in the context of the PHARE and TACIS programmes.

In a Decision dated 21 March 1994 the Council authorised the Commission to make borrowings, the proceeds of which would be assigned, in the form of loans, to the funding of projects to increase the safety and efficiency of the nuclear facilities in certain CEEC and NIS countries. Recourse to this mechanism made it possible, for example, to improve the safety of reactors 5 and 6 at the Kozloduy power station in Bulgaria. Lastly, it should be stressed that since 1990 the Community has devoted some EUR 220 million to improving the safety of the nuclear installations in the candidate countries.

As already indicated, the Cologne European Council in June 1999 asked the Commission to ensure that high safety standards are applied in Central and Eastern Europe. Following on from this request, the safety of nuclear installations in the candidate countries was evaluated by the Commission and the Council in 2001, making it possible to arrive at a European perspective with regard to nuclear safety agreed by the fifteen Member States and the Commission.

A situation where intervention by the Community with regard to nuclear safety within third countries is recognised and welcomed at international level, while its internal action remains

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[16] OJ No L 159 of 29 June 1996 p.1

[17] Directive 97/43/Euratom, OJ No L 180 of 9 July 1997 p22

[18] Euratom Decision 87/600, OJ No L 371 of 30 December 1987, p 76; and Directive 89/618, OJ No L 357 of 7 December 1989 p31

[19] Directive 92/3/Euratom, OJ No L 35 of 12 February 1992, p24; and Regulation (Euratom) n° 1493/93, OJ No L 148 pf 19 June 1993 pl

limited, cannot continue on the eve of an unprecedented enlargement at a time when nuclear safety issues are so fundamentally important. The Laeken European Council in December 2001 marked the transition from reflection conducted in the perspective of enlargement to that of a global political vision at the level of the enlarged EU. One of the conclusions of this meeting was that *"the European Council undertakes to maintain a high level of nuclear safety in the Union. It stresses the need to monitor the security and safety of nuclear power stations. It calls for regular reports from Member States' atomic energy experts, who will maintain close contacts with the Commission"*.

The conclusions of the Laeken Council apply the Cologne conclusions to within the EU, the objective of both sets of conclusions being to maintain a high level of nuclear safety. The methodology developed to evaluate the safety of the nuclear installations in the candidate countries is universal, as described by the Council, and it should be possible to use it to make a comparable evaluation within the EU.

The Commission considers that the legal and political conditions are now met to establish a Community system for the safety of nuclear installations.

2. A new approach to the safety of nuclear installations

A common approach is now essential. This will provide a binding legal framework, a single framework for control, and a single criterion for the interpretation of standards. Along the lines of the existing national systems, a Community approach to the safety of nuclear installations should comprise two aspects. On the one hand, a set of standards and, on the other, a mechanism for the verification of compliance with the standards. This will make it possible, where appropriate, to penalise failure to comply with Community standards.

2. 1. Common standards

A Community approach to the safety of nuclear installations does not necessarily entail laying down detailed technical safety standards. A system of this kind should not duplicate what exists already within the Member States.

Account should be taken of what the Member States have already established. However, it must be acknowledged that, despite increasingly marked harmonisation in this connection, nuclear safety measures remain very different from one Member State to another. This diversity of national rules and principles does not mean that a high level of nuclear safety does not exist within the EU. However, it is not guaranteed that it will be maintained. The Community approach should address this particular point.

a) Existing standards

There exists a set of principles which can constitute the basis for a legally binding Community approach. These could be formalised in the context of a Community text based in the main, initially, on elements contained in the IAEA's Nuclear Safety Convention. This Convention does not contain detailed technical rules. However, it lays down a precise legal framework constituting the basis for a nuclear safety system. All the Member States and the majority of the candidate countries (with the exception of Estonia and Malta) are parties to the Nuclear Safety Convention.

However, it should be noted that the Convention applies only to nuclear power stations. Given the development of the European nuclear industry, it would be desirable to broaden the scope to include all civil nuclear installations.

Formalising these standards in a Community text would supplement the basic standards provided for in Article 30 of the Euratom Treaty so as to cover the safety of nuclear installations. Since the Treaty entered into force, several directives have revised the standards, the last one dating from 13 May 1996 (Directive 96/29 (Euratom)[20]. However, it will not be a question of revising that directive, which lays down basic standard, but of drafting a new directive to supplement them. In concrete terms, the "basic standard" concept should cover both radiation protection and the safety of nuclear installations.

Clearly, such a Community approach to safety cannot, ultimately, be restricted simply to taking over the relevant provisions of the Convention on Nuclear Safety. However, the latter can provide a starting point on which there should be agreement since all the Member States have to implement them already, supplemented by other elements in order to assemble a legally binding set of provisions.

b) Evolving standards

Developing common standards with regard to the safety of nuclear installations entails revising them, and therefore, in accordance with Article 32 of the Euratom Treaty, a specific procedure has to be followed. Article 31 provides that basic standards are to be worked out by the Commission after obtaining the opinion of a group of persons appointed by the Scientific and Technical Committee from among scientific experts in the Member States and after consulting the Economic and Social Committee. After consulting the European Parliament, the Council, on a proposal from the Commission, establishes the basic standards, acting by a qualified majority.

In practical terms, the development of European safety standards will need to take into account the work of the International Atomic Energy Agency (IAEA) in the field of nuclear safety. The IAEA has been working in this area for many years. It will also be necessary to take into account in particular the results of the work of the Nuclear Regulators Working Group (NRWG), and especially the common positions adopted it, together with the work of the Western Nuclear Regulators Association (WENRA) with regard to harmonisation. The methodology worked out by the Commission and the Council to evaluate the safety of the nuclear installations in the candidate countries will also be an important element to be taken into consideration.

As this is an area in which there are already major national provisions, it is desirable that the Commission should be able to benefit from the experience of the Member States in order to ensure that the common standards evolve in a harmonised fashion. To this end, it must rely on the Committee envisaged in Article 31 of the Euratom Treaty.

Initially, the Community system will be based on a corpus of minimum standards. However, it will establish a legal framework comprising a mechanism allowing the standards to evolve. One of the first tasks of the Article 31 Committee will therefore be to work out a corpus of legally binding operational standards, on the basis of the abovementioned studies, which can serve as a common reference point. On the basis of these standards, verifications can be carried out within the Member States. To avoid any difference of treatment between the current Member States and the new Member States, the legal régime will need to be operational on the date of the enlargement of the Union, i.e. 1 January 2004. That date will mark the start of the practical application of this Community approach, which will subsequently evolve.

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20 OJ No L 159 of 29 June 1996, p.1.

The common standards are part of an ongoing process. It is not a question of defining a corpus of technical standards applicable to nuclear installations. The objective of the Community standards will be to ensure the maintenance of a high level of nuclear safety within the EU. It is therefore necessary that this system should rely on the expertise of the national safety authorities. The Community system is complementary to national systems.

c) Regular reports

In accordance with the Nuclear Safety Convention and the conclusions of the Laeken European Council, Member States will be obliged to transmit reports on the measures taken to meet their obligations and on the state of safety of installations under their supervision. These reports will be examined by Member States and the Commission in the framework of a "peer review" mechanism.

2.2 A system of independent verification

Establishing a system of independent verification is an essential element of the credibility and effectiveness of a Community approach to the safety of nuclear installations. Unlike the inspections conducted by the Euratom Safeguards Office, the frequency of which at a given installation may be high because of the sensitivity of nuclear material with regard to non-proliferation, the frequency of nuclear safety checks does not normally need to be as high.

The verification system will be based in the main on the technical expertise of the national safety authorities. It is not actually necessary to develop a group of Community inspectors, as is the case for the control of nuclear materials. Community control will focus on checking the wayin which safety authorities carry out their tasks, rather than carrying out on-site safety checks of nuclear installations. It will not extend to on-site checks of safety conditions at nuclear installations

Such a system should be more acceptable to the Member States. It would have the benefit, as far as the Commission is concerned, of providing nuclear safety experts not entailing major budgetary implications, or at least costing much less than a team of permanent inspectors. The system would therefore be perfectly attuned to the nature of the activities to be conducted. The Member States will be obliged to propose experts, specifying their expertise, to be called upon by the Commission for independent verifications within the Member States. Clearly, the Commission alone will be responsible for deciding what to verify and deciding on any subsequent action. At the beginning of the year the Commission will draw up a programme of verifications which it intends to conduct in the course of the year in question. Once this programme is adopted, it will contact the experts designated by the safety authorities which it intends to use, to ensure that they are available on the dates in question. Wherever possible, the Commission will endeavour not to disrupt the normal workings of the national safety authorities when requesting the secondment of the experts.

In good time in advance of the verification, the experts will receive all the documents needed to perform their tasks. A coordination meeting will be held at the Commission prior to the verification. A notification announcing the verification will be sent to the authorities of the Member State where the verification is to take place. The latter will be able to contest the composition of the team of experts authorised to conduct the verification but must provide good reasons for doing so.

On the basis of the reports following the verifications, the Commission will be able to make observations which may lead to the necessary measures being taken to ensure safety at installations. The Commission will also be obliged to publish, every two years, a report on the state of nuclear safety within the EU.

As previously mentioned, the need for protection against ionising radiation does not stop with the end of the active life of a nuclear installation. Safety concerns continue, to various degrees, during decommissioning operations.

3. Adequate financial resources to ensure safety

3.1 Ensuring the availability of funds for decommissioning

Maintaining a high level of safety in nuclear installations, during their active life as in the decommissioning phase, requires adequate resources to be available.

Decommissioning a nuclear installation is a major industrial undertaking which can take many years. The cost of decommissioning operations can be very high. To deal with these it is necessary that financial resources should be available. These will have to be provided for by the operator during the active life of the nuclear installation. It is essential that decommissioning operations can begin at once in conformity with a high level of safety.

The main concern of the general public, of national authorities and of operators is to ensure that safety and radioprotection obligations will be fulfilled on decommissioning. The availability of the financial resources necessary for decommissioning of nuclear installations must be guaranteed.

It is also essential to avoid any possibility that the decommissioning of a nuclear installation will not be able to start as planned, is not carried out according to the appropriate procedures, or is abandoned before completion due to a lack of resources.

The consequence of such a situation would be that a substantial quantity of radioactive material would not be monitored or managed in an acceptable way, with severe implications for radiological safety. Under such circumstances, one of the fundamental objectives of the Euratom Treaty would not be met. In fact, as already mentioned, the Community must, under article 2 of that Treaty, "establish uniform safety standards to protect the health of workers and of the general public and ensure that they are applied". The Community has adopted basic standards in the field of radioprotection[21] for this purpose. Chapter 3 of the Euratom Treaty therefore provides the legal base for Community action in this field.

At present, operators make use either of company resources or of contributions to externally managed funds set up by various mechanisms for this purpose.

Electricity from nuclear power is produced at nuclear plants with a long active life, on average forty years (in the absence of a political decision to turn away from nuclear power or to extend the active life of installations). Given the sums envisaged and despite the fact that they will not be used until decommissioning, the operator should take into account during the productive life of the nuclear installation not only technological, social and economic issues relating to the cost of production but also the financial viability of the project as a whole, including the decommissioning of installations.

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[21] COM 96/29 Euratom

Even if reserves are set aside to enable decommissioning to be undertaken and to ensure the management of radioactive waste and of spent fuel cells, the fundamental question is to ensure the availability of these resources in the long term, several decades hence. To this end, the creation of decommissioning funds with their own legal personality distinct from that of the operators and specifically earmarked for the decommissioning of their nuclear installations is the best option to achieve the objective of decommissioning the installations in conformity with all the necessary safety conditions. In the case where exceptional and duly justified reasons make such a separation of funds impossible, the management of funds could continue to be undertaken by the operator, provided that the availability of assets to cover the costs of decommissioning operators is guaranteed.

On the basis of regular information from Member States, to be provided every three years, the Commission will produce a periodical report on the state of the funds and will undertake, if necessary, measures to address irregularities which could compromise the completion of decommissioning.

The creation of external funds, managed on prudential principles, enables the long term availability of funds to ensure the maintenance of a high level of nuclear safety throughout the decommissioning phase to be guaranteed.

The need to harmonise the methodology for estimating future decommissioning costs has already been emphasised. It is also necessary to provide for transitional measures to enable the enterprises involved, where necessary, to minimise the impact of the transfer of significant sums of money to external funds.

The Commission has in mind a transitional periodof at least three years after the entry into force of measures taken by Member States as a consequence of Council adoption of this Directive.

3.2 The position of candidate countries

In June 1999 the Cologne Council asked the Commission to ensure the application of high safety standards in Central and Eastern Europe. On the basis of this mandate, the Commission proceeded in two stages. Firstly, it identified the reactors which should be closed. Secondly, in conjunction with the Council, it adopted a methodology for evaluating the safety of nuclear installations in the candidate countries.

As explained in the Green Paper, the future of nuclear energy remains uncertain in Europe. It depends on several factors, including the safety of reactors in the candidate countries. Accordingly, the EU has requested some of these countries to close their nuclear reactors. In return, the EU contributes towards the cost of decommissioning and offers funding.

a) The reactors concerned

Three candidate countries are concerned by the early closure of nuclear reactors: Bulgaria ((Kozloduy 1 to 4), Lithuania (Ignalina 1 and 2) and Slovakia (Bohunice 1 and 2). In June 2002, Lithuania undertook to close Ignalina 2 by 2009. The Commission is expecting Bulgaria to take a decision this year on the early closure of Kozloduy 3 and 4. The EU considers that the date for closure should be 2006, to be confirmed in the accession treaties.

International experts consider that these reactors have major design faults that cannot realistically be rectified at a reasonable cost. In addition, the report of the Western European Nuclear Regulators Association (WENRA),[22] an association bringing together representatives of the safety authorities of nine EU Member States, published in March 1999, clearly asserts that, despite all the efforts already made to improve the units concerned, they cannot reach an acceptable degree of safety by Western standards.

The Commission relied on international expertise to draft the text of Agenda 2000 which confirms the closure dates for five units and determines that final decisions will be taken for three other reactors in 2002.

b) The cost of decommissioning and how to fund it

Through the PHARE Programme, the Community has for a number of years been funding projects in the nuclear sector in the candidate countries, several of which concern activities relating to final closure, including waste treatment, fuel storage and the planning of activities.

The high cost of decommissioning

Through PHARE, the Community is the main contributor to the international decommissioning funds managed by the European Bank for Reconstruction and Development (EBRD), since in the case of the three countries concerned by the early closure of power stations, it is clear that the national funds for decommissioning will not have sufficient resources to cope with all the work needed until complete dismantling.

At its most recent meeting, on 24 and 25 October 2002, the European Council confirmed that "in view of Lithuania's confirmation that Unit 1 of the Ignalina Power Plant will be closed before 2005 and of its commitment that Unit 2 will be closed by 2009, a programme for supporting activities relating to the decommissioning of the INPP will be established". Specifically, the Council said that "The commitment appropriations foreseen for this programme will be 70 million euros for each of the years 2004 to 2006." Finally, the Council confirmed that "the European Union in solidarity with Lithuania confirms its readiness to provide adequate additional Community assistance to the decommissioning effort beyond 2006".

The Council also indicated that "to continue the pre-accession aid planned under PHARE for the decommissioning of the Bohunice Nuclear Power Plant in Slovakia, 20 million euros in commitment appropriations are foreseen for each of the years 2004 to 2006."

The Council stated that "estimated figures are to be revised as appropriate on the basis of the spending profile for the decommissioning activities of the Ignalina and Bohunice decommissioning funds. PHARE commitments are above expectations for Ignalina and below expectations for Bohunice."

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[22] Germany, Belgium, Spain, Finland, France, Italy, Netherlands, United Kingdom, Sweden.

Financial perspectives

The Commission has not entered into any commitments beyond 2006, although the most significant funding needs will appear in the following years, taking into account the abovementioned decommissioning timetables.

It is certain that the reluctance of Lithuania and Bulgaria to commit themselves to closure agreements was due to the lack of a clear financial agreement on the part of the Commission, in particular for the period 2007-2010. The Commission should therefore pay particular attention to these two countries in preparing a future financial package

B. THE MANAGEMENT OF SPENT NUCLEAR FUEL AND RADIOACTIVE WASTE

Half a century of developing nuclear energy in the world and accumulating radioactive waste has not resulted in the creation of national policies in Europe - or in the rest of the world - for permanently solving the problems created by all waste of nuclear origin. However, as the Green Paper on the security of energy supply[23] emphasised, the nuclear option can only be pursued if a satisfactory and transparent solution is found to the question of the management of nuclear waste. Opinion polls carried out recently by the Commission[24] have confirmed that the safe and reliable management of waste is an essential part of any debate on the future of nuclear energy.

The issue mainly arises for the most dangerous waste from the back-end of the fuel cycle. This waste represents 5% of the total volume of nuclear waste but contains 95% of the radioactivity. It is currently held in storage at or near the surface in temporary storage sites. This storage method, which is at present indefinite, raises concerns about the vulnerability of such sites, particularly in the light of the events of 11 September 2001.

The search continues for a solution to the problem of the disposal of waste. Different disposal possibilities have to be developed based on the most recent technological advances and guaranteeing the highest level of safety.

Based on these experiences, it can be said that deep disposal is currently the most feasible and reliable option and that the construction and operation techniques are sufficiently well-developed to be implemented. In this field, there are several underground laboratories in the European Union and Switzerland which study in detail the most promising geological layers. In Europe, Sweden and Finland have already opted for deep burial and have carried out initial feasibility investigations. Nevertheless, the disposal of waste in the sites that have been chosen cannot take place before 2015-2020. Estimates of disposal costs vary from one country to another, but they represent a small percentage of the total cost of kWh production.

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23 COM(2000) 769 of 29 November 2000: "Towards a European strategy for security of energy supply", Office for Official Publications of the European Communities, 2001, ISBN 92-894-0319-5.

24 Eurobarometer No. 56, 2001 – Europeans and Radioactive Waste (http://europa.eu.int/comm/energy/nuclear/pdf/eb56_radwaste_en.pdf).

Although deep geological disposal is a permanent solution, if more specialised technological solutions are found in the future that offer increased levels of safety at a reasonable cost, the waste can be retrieved at a later date. This is possible thanks to the basic "concentrate and confine" strategy which ensures that waste remains isolated from the environment and stable for centuries after being buried.

New technologies for the treatment of radioactive waste, enabling a reduction in long-life radioactive elements, have not yet resulted in an alternative to geological disposal but represent an important complementary strategy. At the same time as developing deep disposal sites, the development of new technologies should be pursued in order to offer future generations the possibility of having more effective methods for treating waste, such as "partitioning and transmutation" technology for example. For this reason, the sixth Euratom research framework programme for 2002-2006 has allocated part of the money available for radioactive waste to research on new technologies in paralled with research on disposal.

Regardless of the choices which will be made in the future in terms of energy policy, existing waste has to be disposed of in such a way as to ensure the long-term protection of public health and the environment.

1. The management of waste: issues still to be resolved

Nuclear energy has been exploited for civil use for five decades. The quantities of waste accumulated over this period can be described as limited in volume and the question of what to do with this waste has never been at the top of the agenda. However, the responsibility for resolving the problem of the long-term management of this waste cannot be passed on to future generations.

1.1 The current situation

The main activities which produce radioactive waste are:

- nuclear electricity generation, including back-end nuclear fuel-cycle activities and the decommissioning of nuclear facilities;
- the operation of research reactors;
- the use of radiation and radioactive materials in medicine, agriculture, industry and research;
- processing of material containing naturally-occurring radionuclides.

a) Situation in the European Union

In total, approximately 40 000 m^3 of waste is produced each year in the whole of the European Union, the majority coming from activities relating to the production of nuclear electricity.

Although the permanent disposal of short-life and low-level waste can take place using tried and tested technology, this is only practised in five Member States which have nuclear reactors (Finland, France, Spain, Sweden and the UK). In Germany, disposal operations have been undertaken in the past for this category of waste, but neither Belgium nor the

Netherlands has developed this option and these two countries are currently storing their waste in temporary centralised national depots. Similar temporary and indefinite storage is practised in the Member States that do not have a nuclear power programme.

Spent fuels and high-level/long-life waste is stored near reactors, in reprocessing plants or at any other site where the waste is produced, pending a permanent solution. No country in the world has yet implemented disposal of this waste, and the degree of progress towards this permanent solution varies considerably from country to country. In the European Union, Finland and Sweden are perhaps the most advanced, with long-established programmes for the development of deep disposal. However, even in Finland, it will be at least eight years before final authorisation is given for the development of the only site which is currently the subject of research. Belgium has been carrying out research on deep disposal for several years. In France, work is in progress to bore an access shaft to an underground laboratory. Germany has a promising site which cannot be used for the time being for political reasons. Some Member States are reassessing all their options as well as the associated decision-making processes. However, others are practising a "wait-and-see" policy.

b) The precarious storage situation in the candidate countries

In candidate countries with nuclear power stations and research reactors that were built by the Soviet Union, spent fuel management has become a crucial issue in the last decade because it is no longer possible to send this material back to Russia for reprocessing or storage under the same conditions. As a matter of urgency, these countries have had to construct temporary storage facilities for their spent fuel. Little or no progress has been made in implementing real programmes for the longer-term management of spent fuel.

Regarding less hazardous operational waste from nuclear power stations, only the Czech Republic and Slovakia have operational disposal sites. Several countries have Russian-designed repositories for non-fuel cycle radioactive waste. However, these facilities do not always meet current EU safety standards. In some cases, the waste may have to be retrieved and trasferred to other installations.

1.2 Limited Community and international provisions

The principles governing the management of all hazardous waste must guarantee a high level of public and worker safety and environmental protection. In the case of spent nuclear fuel and radioactive waste, the application of these principles must ensure that individuals, society and the environment are protected from the harmful effects of ionising radiation.

In recent years, these principles have also been the focus of action at Community level, involving research, and legislative and policy initiatives.

The approach adopted in the Community action plan[25] and the associated strategy has been to encourage harmonisation and cooperation amongst the Member States in order to ensure an equivalent and acceptable level of safety throughout the European Union. The most recent report on the situation regarding radioactive waste management in the European Union was

25 Council resolution (92/C 158/02) of 15 June 1992 on the renewal of the Community action plan in the field of radioactive waste.

published in 1999[26]. The Commission has also recently published a similar report[27] on the candidate countries.

The management of radioactive waste has been, and still is, one of the main subjects of the Community framework programmes on research into nuclear fission. A key aspect of these programmes is the support for research activities in underground research facilities, allowing the collection of fundamental data on the host rock and the experimentation on possible future disposal techniques. Advanced techniques for the chemical and nuclear separation and minimisation of long-life waste (usually collectively referred to as "partitioning and transmutation") are also important areas of research.

The basic safety standards for protecting the health of the general public and workers against the dangers of ionising radiation underpin the harmonisation of the fundamental principles of waste management, and provide a common and internationally approved level of radiation protection throughout the European Union. The most recent revision of the basic safety standards dates from 1996[28], with implementation in national law on 13 May 2000. In addition, Chapter III of Title II of the EURATOM Treaty establishes a Community system for the monitoring and control of international shipments of radioactive waste[29]. Under the environment chapter of the EC Treaty, the Environmental Impact Assessment Directive and its amendments[30][31] is also highly relevant to the radioactive waste sector.

There are also a number of international conventions that have a major role to play in establishing common practice and levels of safety in the international arena. The most important is the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management[32], which was negotiated under the aegis of the International Atomic Energy Agency (IAEA) and entered into force on 18 June 2001. The accession of the European Community and EURATOM to this Convention is currently the subject of a Commission proposal[33]. In addition, the IAEA is currently preparing a series of documents on all aspects of the safety of radioactive waste management, including recommendations regarding the safe disposal of all categories of radioactive waste.

2 TOWARDS A SAFE SOLUTION

The Commission considers that the time has come to take concrete decisions in the field of radioactive waste management, with regard to both the promoting of final disposal and stepping up research in this field in general. This does not preclude alternative solutions arising from future scientific progress.

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26 Communication from the Commission to the Council "Communication and fourth report on present situation and prospects for radioactive waste management in the European Union", COM(98) 799 of 11 January 1999.

27 Commission report EUR19154.

28 Council Directive 96/29/EURATOM of 13 May 1996.

29 Council Directive 92/3/EURATOM of 3 February 1992.

30 Council Directive 85/337/EEC of 27 June 1985.

31 Council Directive 97/11/EEC of 3 March 1997.

32 Text available from the IAEA - INFCIRC/546 (24 December 1997).

33 COM (2001) 520 final of 15 October 2001.

2.1. A choice in favour of disposal

Even though significant quantities (over 2 000 000 m3) of the least hazardous category of radioactive waste have been disposed of in the European Union in the past, not all countries currently have operational disposal sites. This category of waste, which accounts for significantly larger quantities than the more hazardous categories, presents no major technological challenges regarding its disposal but nonetheless requires close supervision while in temporary storage.

In the case of the more hazardous waste, there is a broad international consensus that deep disposal in stable geological formations is the best management option. Through a system of multiple containment barriers and a suitable choice of host rock formation, this waste can be isolated for extremely long periods of time, thus ensuring that any residual radioactivity will have insignificant levels of concentration. This strategy of deep disposal greatly reduces the risk of accidental human intrusion and is essentially passive and permanent, with no need for further human intervention or institutional control.

Nevertheless, delays in a number of Member States regarding the identification and authorisation of suitable sites, particularly in the case of deep geological repositories, are a cause for concern. During this time, the quantities of spent nuclear fuel and radioactive waste held in temporary surface storage sites continue to increase. These surface facilities require active measures such as monitoring and maintenance to ensure a permanently high level of safety and environmental protection. This is an unacceptable burden to pass on to future generations. Furthermore, following the events of 11 September 2001, the vulnerability of such surface facilities to terrorist attack has also highlighted the need to act now.

After years of doubts and procrastination, particularly in terms of political reluctance, it is high time that the Member States finally made a commitment to the implementation of a real timetable for carrying out the final disposal of all radioactive waste. In particular, the Member States of the European Union should adopt programmes for the deep disposal of high-level and long-life radioactive waste. They will therefore be obliged to take decisions on authorising the choice of disposal sites and the operation of these sites by the prescribed dates. To this end, the Commission proposes that Member States should commit themselves to a fixed timetable of national programmes for the disposal of radioactive waste in general and deep disposal of highly radioactive waste in particular. They will have to take decisions authorising the choice of disposal site (national or regional) by 2008 at the latest for highly radioactive waste and to bring the sites into operation by 2018 at the latest. For low-level, short life radioactive waste, disposal must be implemented at the latest by 2013. The Commission's expectations as regards the observation of these deadlines by member States will not prevent the implementation of other solutions which may arise from future scientific developments.

2.2 INCREASING FUNDING FOR RESEARCH

Even if geological disposal ensures the necessary isolation of waste for very long periods of time, research should nevertheless continue and be stepped up in order to optimise the technology and application methods. However, deep disposal must not lead to a reduction in the level of research in other areas of radioactive waste management, such as new technologies for minimising the quantities of such waste, from which new options might conceivably emerge in the future.

The Community framework programme has played, and will continue to play, an important role in promoting research and development in the field of radioactive waste. The sixth Euratom research framework programme for 2002-2006 has allocated EUR 90 million to research into waste management. The Joint Research Centre, for its part, is devoting a significant part of its available resources to action in the field of waste management research. Several Member States have their own research and development programmes funded either from national budgets or by the nuclear sector. Nevertheless, these programmes do not have the capacity to tackle all issues.

In accordance with the "polluter pays" principle, the operators that generate the waste should participate more intensively and more visibly in research and development. To this end, and in order to increase the level of co-operation between these programmes and the exchange of information at Community level, the Commission intends in due course to propose to the Council the creation of one or more Joint Undertakings, in line with Chapter 5 of Title II of the EURATOM Treaty, to be responsible for steering specific research programmes on waste management. These Joint Undertakings, based on a voluntary agreement with industry and the Member States, will bring together funding from the Joint Research Centre, the Member States and industry.

CONCLUSIONS

In view of the necessity of improvements in nuclear safety and the Union's undertaking to pave the way to a true Community approach in this field, the Commission has adopted drafts of coherent and complementary of measures for transmission to the Council, once the opinion of the Article 31 expert group has been received, with a view to the adoption of:

a framework Directive setting out basic obligations and general principles on safety in nuclear installations during and after their active lives in the enlarged EU, with a view to introducing, in due course, common safety standards and control mechanisms to guarantee the application of common methods and criteria throughout the enlarged Union. The Directive also requires adequate financial resources to be available for the safety requirements of nuclear installations during their working lives and on decommissioning.

a Directive on the management of radioactive waste, prioritising geological disposal of waste as the safest method of disposal in the present state of the art. It provides that Member States should adopt national programmes, according to a pre-set timetable, for the disposal of radioactive waste in general and deep disposal of highly radioactive waste in particular. Member States are required to decide on national or regional disposal sites.

In addition, the Commission is putting to the Council a draft Council decision authorising the Commission to negotiate a Euratom agreement with the Russian Federation on trade in nuclear materials. This agreement will be based on the relevant provisions of the Euratom Treaty and will have to take account of the reality of the market in the enlarged European Union and of the specific nature of the candidate countries' relations with the Russian Federation in this area. At the same time, it will have to protect the interests of European consumers and the viability of European industries, particularly the enrichment industries. The new agreement will include regular monitoring of all trade in materials, whether supplied to utilities or to enrichment industries. This decision is the subject of a separate Communication.

ANNEXES

ANNEX A: THE DECOMMISSIONING PROCESS AT NUCLEAR INSTALLATIONS

Decommissioning a nuclear installation includes all the activities, technological and regulatory, aimed at lifting all radiological restrictions applicable to the installation.

In practice, it is recognised that an installation is decommissioned when the buildings used for nuclear purposes have been demolished. There are no more radioactive materials on site, and it is possible to move to a new status. The IAEA has defined three stages in the decommissioning process which are still referred to by the nuclear sector:

- Stage 1: Remove nuclear materials and radioactive wastes produced during active life. Leakproof barriers remain in place. Access points are locked and sealed. The installation is monitored for radiological activity and is still subject to physical protection measures.
- Stage 2: The restricted zone is reduced to a minimum. All buildings and equipment are decontaminated/dismantled, apart from the reactor building and associated materials in the nuclear centres. Monitoring levels are reduced.
- Stage 3: Dismantling of the remaining structures and materials. All materials whose radioactivity is still above threshold levels are sent for definitive disposal. The site is available for alternative uses.

These three stages can be undertaken in a single continuous process or extended by quite long intervals (up to a hundred years between stages 2 and 3). A distinction is therefore made between continuous and staged decommissioning.

Reasons for choosing a particular strategy are radiological and financial, but may also take into account political considerations.

The operator of a nuclear installation is responsible for the strategy and for the provision of the necessary resources for decommissioning work and waste management. Nevertheless, these decisions will be strongly influenced by national nuclear policy, of which the objectives include the following:

- The safety of nuclear and industrial operations
- Minimisation of radioactive and conventional waste
- Safe long term management of waste products
- Minimisation of radiological and industrial risks

- Minimisation of environmental impacts
- Minimisation of socio-economic consequences

The longer certain operations are put off, the more their radiological impact will be reduced, at the same time reducing the total cost of decommissioning operations (net present value).

Assumptions about future financial variables also play a significant part in the estimation of costs, given the long delays (which can extend to several decades if not over a century) between the stages of decommissioning.

Estimates of the levels which decommissioning funds will need to reach by the time of the end of the active life of an installation will therefore be significantly affected by strategic decisions about the programming of decommissioning activities.

ANNEX B – THE SITUATION OF THE DECOMMISSIONING FUNDING SCHEMES BY MEMBER STATE

Country	Description of the Decommissioning Funding Scheme
B	▪ Each electricity company must set up a financing plan that is the subject of a special agreement with the state. ▪ The financing is covered by an **internal fund** directly managed by the utility (in the future, assets concerned could be necessarily identified in the balance sheet). ▪ The fund is fed by annual contributions. In the case of nuclear power plants, thirty years after the commissioning of the plant, these contributions, added to accrued interest, have to represent 12 per cent of investment expenditure (interest during construction excluded) currently necessary for the construction of an equivalent plant. ▪ Provisions are discounted according to a rate revised every 5 years by the Electricity and Gas Control Commission composed of representatives from Electrabel, Labour and the State. This rate was fixed at 8,6%in 1999. ▪ The nuclear utilities are discussing with the authorities about the transfer of these reserves to an external fund, kept in a separate company, Synatom, 100% owned and managed by the main utility, with a "golden share " to the Government. A three year transition period is envisaged. ▪ Synatom already manages the spent fuel and related waste. • This company would be allowed to lend money to the utility, although strictly at market rates.
	New directive implementation impact: - Resources are been collected to satisfactory level. - The new external fund to be created would comply with the Directive "externalisation" requirement, but independence, and ring-fencing from the utilities finances should be enforced. -The Belgian system under negotiation shows that they could well adapt to the Directive in a rather short period (3years).

D	▪ Electricity companies assume the responsibility of all aspects of the decommissioning, including costs. They take their own initiative concerning burdens and dues, based on estimated costs and the expected operational life-span of the installations. ▪ Provisions are made according to the decommissioning cost evaluated in nominal terms. Since 1999 they have been discounted at a real discount rate of 5,5%.The provision period is 25 years. • There are no constraints on assets allocation corresponding to these provisions. Management principles are specific to each utility in accordance with Landers fiscal authorities. • The licensees build up financial reserves to be prepared for the follow-up costs connected with the operation of a nuclear power plant such as the decommissioning and dismantling of the installations, and the treatment and disposal of radioactive material including spent fuel elements. These reserves are tax-free. So far, reserves amounting to **€35 Billion**_are set aside, of which about 45 % are earmarked for decommissioning and dismantling and about 55 % for waste management. Due to the changes in taxation that came into force in 1999, part of these reserves will have to be dissolved. This is mainly because the reserves now are subject to yield interest of 5.5 % until the time of probable use. The means to be provided to cover decommissioning and waste management costs are thus composed of the sums annually set aside as well as an interest of 5.5 %.
	New directive implementation impact: The costs of decommissioning seems higher than in other Member States. ▪ The transition period need be sufficiently long, although impact will vary depending on the possibility to transfer fixed assets to the new funds.

E	▪ The responsibility of the decommissioning operations and the management of the waste (including final disposal) is handed over to the state owned company ENRESA ▪ The future decommissioning costs are analysed and subject to an annual review presented in the framework of the general Plan for radioactive wastes, that is then submitted to the government. ▪ Cost are appraised in real terms and discounted at a 2,5% real rate. ▪ To face future expenditures, ENRESA manage a fund fed by a tax on electricity sales which represents an average value of 3 Euro/MWh both for decommissioning and end fuel cycle burdens. ▪ The calculation method of the proportional part relies on the following principle: yearly incomes are proportional to the electricity output for each plant. The burden is calculated by dividing the total estimated and discounted expenditures by the overall discounted electricity generation.
	New directive implementation impact: No/minor impact. The Spanish model fits in the present Directive proposal.
FI	▪ According to the law costs of nuclear waste management (including decommissioning costs) are responsibility of electricity companies. Necessary funds for future investments linked to wastes management have to be collected to set up the National Fund for nuclear waste management. ▪ Dismantling costs must be financed during the first 25 year of plant operation. ▪ This fund is managed by the Ministry of Industry and Business through the State Management Fund (VYR). ▪ At present the Fund's capital is mainly contributed by Fortum and TVO. ▪ These contributors are entitled to borrow money from the Fund against securities. At a time these loans may be at most 75% of the confirmed fund holding of the loan-taker. The State has a right to borrow the sum not borrowed by the contributors at the same percentage of interest. • Furthermore, the nuclear operators must propose securities, under the form of non nuclear assets, to cover their liabilities which are not covered by the assets of the fund. • Every year, company Fortum (ex-IVO) and Teollisuuden Voima (TVO) have to draw up a provisional cost assessment for the burdens until the end of the current year. Costs are appraised in nominal terms following the current cost level, without discounting.

	New directive implementation impact: The Finnish model basically complies with the Directive. Lending money back to operators might present the problem of the separation of financial risks, but securities in place seem should be enough guarantee.
F	▪ Electricity de France (EDF) assume the responsibility for all aspects of the decommissioning, including financing. EDF has its own initiative concerning burdens and dues, based on estimated costs and the expected operational life-span of the installations. ▪ Provisions are calculated for each reactor in nominal term during 30 years on the basis of the decommissioning expenses. Provisions are re-evaluated each year by taking into account the both effect of inflation and , if necessary, real escalation of decommissioning costs. The approach is conservative because the provisions are not discounted. ▪ In accordance with the fiscal authorities ,these provisions are not taxable and there is obligation to manage part of the funds according to rules approved by the state by deposit them in a separate, but not outsourced, account. ▪ The provisioned amounts have been used in recent years to start the decommissioning of the oldest NPP .These funds were partly used as investment in new assets and also contributed to diminishing the company liabilities (debts). ▪ EDF makes an accounting provision for NPP decommissioning costs by taking a percentage on each kWh sold. The amount of the accounting provision appears in EDF's accounts. EDF is fully responsible for the fund management. ▪ Decommissioning costs are based on an average decommissioning cost (258.86 euros 98 per installed kW) fixed by the ministry of industry. This cost is updated each year using the retail price index of the GDP. The total cost of decommissioning French NPP amounts to 16.2 billions of euros 98 (about 15%of investment). ▪ Another specific fund exists to finance storage and processing of nuclear waste. It represents 16.6 billions of euros 98.

	New directive implementation impact: Although EDF has recently started the creation of an internal fund managed by agents, it is small and certainly does not comply with the requirements of externalisation raised by the Directive. The migration to the external funds model will require big financial movements, whereas present accounted for liabilities are not easily convertible in tangible funds overnight. A transitional period of around 3 years may be necessary in this case.
I	A specific state managed Fund is made up of a levy on the price of the electricity, added to former resources accumulated by ENEA and already transferred to the Fund . A state owned company, SOGIN manages the Fund and is responsible for the dismantling works. So the dismantling burdens are not the responsibility of ENEL (ex-operator) or ENEA (Search and development committee for nuclear and substitution energies) anymore The National agency that will manage the waste and the final repository will receive the corresponding share of the fund.
	New directive implementation impact: The external Fund in place complies would comply with the Directive. But all plants are shutdown. Directive would in practice not apply to Italy
NL	▪ Provisions are made by the operators but the responsibility is decentralised. ▪ The company COVRA is responsible for the waste management strategy and receives yearly a sum from utilities. ▪ The utilities set aside provisions for decommissioning in their accounts, by taking from the price of the kwh. ▪ One plant (Dodewaard) is ready for dismantling
	New directive implementation impact: Only the Borssele plant could be affected by the Directive (if not closing earlier) total decommissioning and waste management is already calculated. Part of the provisions already transferred to the waste agency COVRA. The impact is quite limited.

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- According to Swedish legislation, costs related to the end fuel cycle, including the decommissioning of nuclear plants, are the responsibility of reactor owners.
- A due is retained on the electricity production from nuclear origin, during the first 25 years of operation. These dues are handed over to the state and gathered as funds in the Bank of Sweden, the Nuclear Waste Fund, one fund for each reactor owner. They are calculated on the basis of a 4% return rate until 2020 and 2,5% after.
- The money can be used by the utilities and the Swedish Nuclear Fuel and Waste Management Company (SKB-AB), created by the utilities, for the ongoing activities as the work progresses. The Nuclear Power Inspectorate (SKI) has responsibility for ensuring that the money has been properly used. At the end of 1998 a total of more than 23,000 MSEK had been accumulated in the funds.
- Each year the public authorities determine the level of this due for each plant. The decision of public authorities relies on SKN proposals. The fee has for some years now been between 0.01 and 0.02 SEK/kWh.
- The legislation requires the reactor's owner to proceed each year with a calculation of whole operations costs related to the irradiated fuel, radioactive wastes (including final disposal) and decommissioning. These calculations are used as a basis for the dues proposal. They are drawn up by the Swedish Company of Fuel and Nuclear Wastes management (SKB) and presented to the SKN in an annual report.
- In the latest cost calculation, the total undiscounted future costs were 50 BnSEK, in 2002 money values. The total cost for decommissioning of 12 reactors has been estimated to 17,000 MSEK.
- By elaborating on its proposal for its contribution, SKN takes into account all pertinent factors, such as aggregated costs, the expected reactors life span and interest on provisions put into funds.

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New directive implementation impact:

No/minor impact. The Swedish model fits in the present Directive proposal.

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UK	▪ In the United Kingdom, electricity companies assume the responsibility for all aspects of the decommissioning, including financing. ▪ Provisions are re invested by the operators in their financial or fixed assets. ▪ British Energy has set up an external fund to cover dismantling expenditures, including stages two and three, including the dismantling waste. Expenditures related to reactor unloading after the plant shut down (stage one) and expenditures related to final disposal of spent fuel realted waste are not covered by the funds but directly provisioned to the balance-sheet of British Energy. ▪ The fund is worth 0.4 £bn (2001) and receives 18 £million a year for the nine BE stations ▪ BNFL created a fund in 1994, that was cancelled in1997 to return to a provision system. ▪ Expenditures are based on the estimated disbursement schedule and discounted. The rate was 3% in 1999 ▪ British Energy bases these expenditures on the " safe store " strategy that consists of doing the minimum essentials at the time of the plant shut down and then to wait for the decrease of the radioactivity for at least a century. ▪ The ultimate stage of the dismantling would begin 80 years for the stage threen for an AGR plant type and 20 years for Sizewell B. ▪ Actuaries retain an anticipated profitability rate of 3,5 % in nominal per year, after tax for assets invested in the British Energy Funds. ▪ It is the differential between the rate of discount of the debt and the profitability rate of assets, that contributes, with the evolution of the assets market value and the evolution of dismantling costs, to define the net revalorization amount of the debt, that is counted as a financial burden in British Energy balance. ▪ The duration of the period of reserve constitution corresponds to the amortisation period of the plants
	New directive implementation impact: The external fund is already operational in the case of BE and independently managed. The question remains on the coverage of the cost of final disposal of the spent fuel related waste, which are not accounted for in the fund. The Magnox reactors, belonging to Magnox Electric (BNFL) will be dismantled on a very long timeframe. The funding will be provided by the state on top of the provisions (insufficient) to be accumulated through operation revenues.

ANNEX C – DECOMMISSIONING PROJECTS IN THE EU

(Updated April 2002)

AUSTRIA				
NAME	**TYPE**	**Oper. Period**	**STAGE**	**COMMENTS**
No decommissioning activities in Austria				
BELGIUM				
NAME	**TYPE**	**Oper. Period**	**STAGE**	**COMMENTS**
BR3 MOL	PWR	1962-87	-3	Small reactor plant
EUROCHEMIC (Dessel)	-	1965-80	-3	Reprocessing plant
DENMARK				
NAME	**TYPE**	**Oper. Period**	**STAGE**	**COMMENTS**
DR-2	DR	1959-1975	2	Building re-used
Hot cells		1964-1990	2	Building re-used
FINLAND				
NAME	**TYPE**	**Oper. Period**	**STAGE**	**COMMENTS**
No decommissioning activities in Finland				
FRANCE				
NAME	**TYPE**	**Oper. Period**	**STAGE**	**COMMENTS**
G1 MARCOULE	GCR	1956-68	3*	Small power reactor
G2 MARCOULE	GCR	1959-80	-2	Small power reactor
G3 MARCOULE	GCR	1960-84	-2	Small power reactor

CHINON-A1	GCR	1963-73	1,a	Small power reactor
CHINON-A2	GCR	1965-85	-2	Large power reactor
CHINON-A3	GCR	1966-90	-2	Large power reactor
CHOOZ A	PWR	1967-91	-2	Large power reactor
St LAURENT A1	GCR	1969-90	-2	Large power reactor
St LAURENT A2	GCR	1971-92	-2	Large power reactor
EL 4 Monts d'Arrée	HWR	1969-90	-3*	Small power reactor
EL 2 SACLAY	HWR	1952-65	3*	Small power reactor
EL 3 SACLAY	HWR	1957-79	3*	Small power reactor
PEGASE Cadarache	PWR	1963-74	3,b	Small power reactor
RAPSODIE Cadarache	FBR	1967-83	-2	Small power reactor
TRITON Fontenay	PR	1959-82	3	Small power reactor
MELUSINE Grenoble	PR	1958-88	-2	Small power reactor
MINERVE Saclay	LW-PR	1954-76	3*	Small power reactor
ZOE Fontenay	HW	1948-75	3,a	Small power reactor
NEREIDE Fontenay	LW-PR	1959-82	3	Small power reactor
PEGGY Cadarache	GCR	1961-75	3	Small power reactor
CESAR Cadarache	-	1964-74	3	Critical Assembly
MARIUS Cadarache	-	1960-83	3	Critical Assembly
ELAN II B La Hague	-	1970-73	-2	Source fabrication plant
ELAN II A La Hague	-	1968-70	3*	Pilot plant for Elan II B
AT 1 La Hague	-	1969-79	3*	Fuel reprocessing plant
PIVER Marcoule	-	1966-80	3,c	Waste vitrification plant
ATTILA	-	1968-75	-1*	Dry processing pilot cell
RM 2	-	1964-85	-2*	Radiometallurgy lab,13 cells
BUILDING 19 Fontenay	-	1957-84	3*	Plutonium metallurgy
SUPERPHENIX	FBR	1986-98	-1	Large power reactor

GERMANY				
NAME	**TYPE**	**Oper. Period**	**STAGE**	**COMMENTS**
HDR Grosswelzheim	BWR	1970-71	-3	Large power reactor
KKN Niederaichbach	HWR	1973-74	-3	Large power reactor
KRB A Gundremmingen	BWR	1967-77	-3	Large power reactor
KWL Lingen	BWR	1968-77	2	Large power reactor
MZFR Karlsruhe	HWR	1966-84	-3	Large power reactor
VAK Kahl	BWR	1962-85	-3	Large power reactor
AVR Jülich	HTR	1969-88	-1	Large power reactor
THTR 300 Hamm-Uentrop	HTR	1987-88	-1	Large power reactor
KKR Rheinsberg	PWR	1966-90	-3	Large power reactor
KGR 1 Greifswald	PWR	1974-90	-3	Large power reactor
KGR 2 Greifswald	PWR	1975-90	-3	Large power reactor
KGR 3 Greifswald	PWR	1978-90	-3	Large power reactor
KGR 4 Greifswald	PWR	1979-90	-3	Large power reactor
KGR 5 Greifswald	PWR	1989-90	-3	Large power reactor
KNK-II Karslruhe	FBR	1979-91	-2	Large power reactor
KWW Wurgassen	PWR	1975-94	0	Large power reactor
Otto-Hahn ship reactor	PWR	1968-79	3	Small reactor plant
FR-2 Karlsruhe	HWR	1961-86	2	Small reactor plant
FRJ-1 Merlin Jülich	PR	1962-85	-2	Small reactor plant
RFR Rossendorf	PR	1957-91	-3	Small reactor plant
FRN TRIGA III Neuherberg	TRIGA	1972-82	2	Small reactor plant
FRF-2 Frankfurt	TRIGA	1977-83	2	Small reactor plant
FRG-2 Geesthacht	PR	1963-95	-3	Small reactor plant
Nukem Hanau	-	1962-88	-3	Fuel fabrication plant
WAK Karlsruhe	-	1971-90	-3	Reprocessing plant
HOBEG Hanau	-	1962-88	-3	Fuel fabrication plant

Siemens Brennelementwerk Hanau	-	1968-91	0	Uranium/MOX fuel fabrication plant
SNEAK				Fast critical assembly
SNR	FBR			Small power reactor

GREECE

NAME	TYPE	Oper. Period	STAGE	COMMENTS
No decommissioning activities in Greece				

IRELAND

NAME	TYPE	Oper. Period	STAGE	COMMENTS
No decommissioning activities in Ireland				

ITALY

NAME	TYPE	Oper. Period	STAGE	COMMENTS
GARIGLIANO	BWR	1964-78	-2	Large power reactor
LATINA	GCR	1963-86	-2	Large power reactor
CAORSO	BWR	1978-86	-1	Large power reactor
TRINO	PWR	1964-87	-1	Large power reactor
AVOGADRO Compes	PR	1959-71	2,b	Small reactor plant
ISPRA-1 (EU)	HWR	1958-74	-2	Small reactor plant
Galileo Galilei,Cisam,Pisa	PR	1963-80	2	Small reactor plant
ESSOR Ispra (EU)	HWR	1967-83	-2	Small reactor plant

LUXEMBOURG

NAME	TYPE	Oper. Period	STAGE	COMMENTS
No decommissioning activities in Luxembourg				

NETHERLANDS				
NAME	**TYPE**	**Oper. Period**	**STAGE**	**COMMENTS**
DODEWAARD	BWR	1968-1997	0	Small power reactor
PORTUGAL				
NAME	**TYPE**	**Oper. Period**	**STAGE**	**COMMENTS**
No decommissioning activities in Portugal				
SPAIN				
NAME	**TYPE**	**Oper. Period**	**STAGE**	**COMMENTS**
VANDELLOS 1	GCR	1972-89	-2	Large power reactor
JEN-1 Madrid	PR	1958-87	1	Small reactor plant
ARB1 Bilbao	Arg	1962-74	1	Small reactor plant
ARGOS Barcelona	Arg	1963-77	-3	Small reactor plant
CORAL Madrid	FBR	1968-88	3	Small reactor plant
SWEDEN				
NAME	**TYPE**	**Oper. Period**	**STAGE**	**COMMENTS**
AGESTA	HWR	1964-74	1	Small power reactor
R1 Stockholm	GR	1954-70	3	Zero power research reactor
KRITZ Studsvik	PWR	1959-75	3	Zero power research reactor
Alpha-lab Studsvik	Laboratory	1960-75	3	Other installations
UNITED KINGDOM				
NAME	**TYPE**	**Oper. Period**	**STAGE**	**COMMENTS**
DFR Dounreay	FBR	1963-77	-1	Large power reactor

PFR Dounreay	FBR	1975-94	-1	Large power reactor
WAGR Windscale	AGR	1962-81	-3	Large power reactor
SGHWR Winfrith	HWR	1968-90	-1	Large power reactor
BERKELEY 1	GCR	1961-89	-2	Large power reactor
BERKELEY 2	GCR	1961-88	-2	Large power reactor
HINKLEY POINT A	GCR	1965-2000	-1	Large power reactor
HUNTERSTON A1	GCR	1964-90	-2	Large power reactor
HUNTERSTON A2	GCR	1964-89	-2	Large power reactor
TRAWSFYNYDD 1	GCR	1965-93	-2	Large power reactor
TRAWSFYNYDD 2	GCR	1965-93	-2	Large power reactor
WINDSCALE Pile 1	GR	1950-57	-2,d,e	Small reactor plant
WINDSCALE Pile 2	GR	1951-58	-2,e	Small reactor plant
Merlin Aldermaston	PR	1959-62	1	Small reactor plant
BEPO Harwell	GR	1948-68	2	Small reactor plant
DMTR Dounreay	HWR	1958-69	1	Small reactor plant
DRAGON Winfrith	HTR	1965-76	1	Small reactor plant
ZEBRA	-	1967-82	2	Fast critical assembly
DIDO Harwell	HWR	1956-90	-1	Small reactor plant
PLUTO Harwell	HWR	1956-90	-1	Small reactor plant
GLEEP	GR	1947-90	2	Small reactor plant
NESTOR	Arg	1961-95	1	Small reactor plant
B212 Caesium plant (S)	-	1956-58	-3	Other installation
B206 Solvent recovery (S)	-	1952-63	-3	Other installation
B29 Fuel storage (S)	-	1952-64	-1	Other installation
B205 Fuel reprocessing (S)	-	1957-68	-3	Other installation
B204 Fuel reprocessing (S)	-	1952-73	-3	Other installation
B207 Uranium purification, (S)	-	1952-73	-3	Other installation
Co-precipitation plant (S)	-	1969-76	?	Other installation
Uranium enrichment plant(C)	-	1953-82	-3	Other installation

B100-103 U recovery (S)	-	1952-85	3,f	Other installation
B209 Pu finishing plant (S)	-	1953-86	-3	Other installation
B203 Pu recovery plant (S)	-	1956-86	-3	Other installation
B30 fuel storage pond (S)	-	1960-86	-2	Other installation
B277 fast reactor fuel prod(S)	-	1970-88	-3	Other installation
B205 Pu corridors (S)	-	1964-88	-3	Other installation

Description of terms:

REACTOR TYPES

GCR Gas-cooled reactor

HWR Heavy Water moderated reactor

PWR Pressurised water reactor

PR Pool type reactor

FBR Fast-breeder reactor

BWR Boiling water reactor

HTR High temperature reactor

Arg Argonaut type reactor

AGR Advance gas-cooled reactor

GR Air-cooled graphite reactor

DECOMMISSIONING STAGES

0 Decommissioning announced

1 Decommissioned to stage 1

2 Decommissioned to stage 2

3 Decommissioned to stage 3

3* Decommissioned to stage 3 without civil engineering

-x Decommissioning in progress upwards stage x

COMPLEMENTARY INFORMATION

a Partly converted into a museum

B Converted into a spent fuel facility

C Equipment dismantled, building to be reused

Be re-used for...

D Contains damaged fuel elements

E Chimney being partially dismantled

F Used as radioactive waste store

S Sellafield (UK)

C Capenhurst (UK)