

RADIOACTIVE WASTE MANAGEMENT - A PRIORITY THEMATIC AREA WITHIN THE EURATOM 6TH FRAMEWORK PROGRAMME (2002-2006)

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ABSTRACT

The European Union's Sixth Framework Programme for Research and Technological Development and the specific EURATOM Framework Programme for Research and Training in Nuclear Energy (2002-2006) –EURATOM FP6 – are the major building blocks for the European Commission to strengthen the foundations of the European Research Area, an open market for knowledge and science in Europe.

The absence of a broadly agreed approach for radioactive waste management and disposal in the European Union caused the European Commission to raise the issue to a priority key area of research and development within EURATOM FP6. The sub-programme is aimed at looking to a widely agreed approach to waste disposal and will explore also the technical and economic potential of concepts for nuclear energy generation able to make better use of fissile material and generate less waste. To achieve these goals, participating research institutions are invited to invest in durable and structured partnerships by implementing “new instruments” for projects - Integrated Projects and Network of Excellence.

In 2002 the European Commission consulted the research community on its readiness to prepare actions that use these “new instruments” for research topics in the priority area “management of radioactive waste” to assist in preparation of the work programme 2002-2006 of the EURATOM FP6. In parallel and under the last call for proposals of EURATOM FP5 the Commission launched two topic-related “Thematic Networks” that are bringing European research forces together and will create potential interest for future development within FP6.

INTRODUCTION

The Treaty of March 1957 establishing the European Atomic Energy Community (EURATOM) has entrusted the Commission of the European Communities (the ‘Commission’) to promote and facilitate nuclear research in the Member States and to complement it by carrying out a Community research and training programme.

The Council of the European Union (the ‘Council’) having regard to the Treaty and acting on a proposal made by the Commission adopted on September 30, 2002 the Specific Programme implementing the EURATOM Sixth Framework Programme (‘FP6’) for nuclear research and training activities during the period 2002-2006 [1]. EURATOM FP6 has been structured so as to contribute to strengthening the **European Research Area** (‘ERA’) an initiative launched at the Lisbon European Council in March 2000 to redefine the European research policy landscape and create a genuine ‘internal market’ in research.

The ERA concept has developed with the realisation that research in Europe suffers from several weaknesses among which the fragmented nature of activities and dispersal of resources do not favour the development of a European dimension to research, training and innovation. Against this background, the objective of the ERA initiative is to create the conditions for the free movement of knowledge, researchers and technology, with the aim of increasing co-operation, stimulating competition and achieving a better allocation of resources. This would lead to a restructuring of the European research fabric, in particular by improving the European dimension of research at national level that accounts for most of the activities carried out and financed in Europe. The economic target of such an objective is to increase the research funding up to 3% of the GDP by 2010 so as to turn the European Union into the world's most competitive and dynamic knowledge-based economy.

A NEW APPROACH FOR IMPLEMENTING FP6

The Sixth Framework Programme is a major building block designed for structuring research in Europe and developing closer partnership among EU Member States and with associated countries. To facilitate synergy between researchers, the Commission's efforts in 2002 were to propose to the Member States, newly Associated States and other Associated Countries an innovative approach for building and co-operating in research.

Two of the key features of the FP6 implementation are: (a) the introduction of more effective methods for implementing EC-funded research, notably through *new instruments* such as *Integrated Projects* (IPs) and *Networks of Excellence* (NoE) [2] and (b) an evaluation of how Member States deem these instruments appropriate to address priority research topics of FP6.

a) The new instruments

An **Integrated Project** is seen as contributing to strengthening European competitiveness and help solve major societal problems, by mobilising a critical mass of research and development resources and skills existing in Europe. It is designed to generate knowledge required to implement the priority thematic areas. It is an instrument to support objective-driven research where the primary deliverable is knowledge.

A **Network of Excellence** is seen as contributing to strengthening European scientific and technological excellence through a better integration of research capacities across Europe. It is designed to tackle the fragmentation of European research, where the main deliverable should be a durable structuring and shaping of the way that research is carried out in the topic of the network.

NoE and IPs instruments are both characterised by their capacity to mobilise the critical mass of expertise needed to achieve ambitious objectives. They are also characterised by the structuring and integrating effects that they will have on the fabric of the European research. The introduction of a training component makes these instruments particularly attractive for co-operation.

b) Community interests for using the new instruments

In March 2002 an invitation to submit **Expressions of Interest** (EoI) was launched by the Commission to consult the research community on its readiness to prepare actions using the new instruments for research topics within the priority thematic areas as they are defined in the 2002-2006 FP. The exercise was designed so as to assist the Commission Services in the preparation of the FP6 Work Programme and in defining the scope of the first calls for proposals. An overall assessment of EoI for the priority thematic area "Management of Radioactive Waste" was conducted with external experts in June-July 2002 and results were published on the Commission CORDIS Web site in September 2002 [3].

The results of the assessment cover the two research topics of the area:

- Geological disposal and
- Partitioning and Transmutation and other concepts to produce less waste.

From the 103 EoI assessed, a total of 26 proposals were deemed to be suitable for the new instruments (4 NoE and 22 IPs). They were considered to cover well the objectives and aims of the priority thematic area. All of them are relevant and have the ambition of developing a sound technical basis for the demonstration of the safety of the geological disposal or for the reduction of the waste hazards. 34 EoI were not sufficiently developed or mature for implementation in FP6 and/or were more suitable for 'traditional' instruments (i.e. Specific targeted research projects (STREP) and Co-ordination Actions (CA)). 43 submitted EoI addressed other activities in the field of "Other activities in the field of nuclear technologies and safety of the EURATOM FP" or were out of scope.

Finally in 2002, from 11 to 13 November the European Commission held a major Conference in Brussels (Belgium) on "*European Research 2002 at the crossroads: The European Research Area and the Framework Programme*" [4] to mark the launch of the 6th Framework Programme. The Conference was a major forum for presenting to the European scientific community the objectives and priorities of FP6 and explaining the rules and procedures for participation. It was clearly stated at this conference that "past framework programmes have been designed and implemented with the main objective of funding specific research projects. With FP 6 this will change as it aims at creating a 'European Research Area' in terms of an internal market for knowledge and sciences via a four-year, € 17.5 billion funding scheme starting January 1st, 2003".

OBJECTIVES AND WORK PROGRAMME of FP6

The work programme adopted by the Commission was made official with the first call for proposals that was published in the Official Journal of the European Communities on 17 December 2002 [5].

The EURATOM programme itself comprises three main lines of activities, which are (i) the Priority Thematic areas of research; (ii) Other activities in the field of nuclear technologies and safety and (iii) Nuclear activities in the Joint Research Centre (JRC). The financial envelope for the EURATOM FP6 for the period 2003-2006 is € 1,230 million (out of € 17,5 billion for FP6) and the related indicative breakdown by line of activities is given below.

- (i) Priority Thematic Areas of Research 890 M€
 - Controlled Thermonuclear Fusion 750 M€
 - **Management of Radioactive Waste** 90 M€
 - * Research on geological disposal
 - * Partitioning and Transmutation and other concepts to produce less waste in nuclear energy generation
 - Radiation Protection 50 M€
- (ii) Other activities in the field of nuclear technologies and safety 50 M€
 - Innovative concepts
 - Education & training
 - Safety of existing installations
- (iii) Nuclear activities in the Joint Research Centre (JRC) 290 M€
 - Nuclear safety and security
 - Measurements and reference materials

Research on "**Geological disposal**" will aim at establishing a sound scientific and technical basis for demonstrating the safety of disposal of spent fuel and long-lived radioactive waste in geological formations. Research will also aim at underpinning the development of a common European view on main issues related to the management and disposal of radioactive waste:

- Improvement of fundamental knowledge of key processes
- Development and testing of disposal technologies in Underground Research Laboratories
- New and improved tools for performance and safety assessment and
- Improving governance processes of waste disposal.

The objectives of "**Partitioning and Transmutation**" (P&T) are to determine practical ways of reducing the amount and/or hazard of the long-term component of the radioactive waste to be disposed of in geological repositories by P&T and to evaluate their practicability on an industrial scale. The research will focus on:

- the assessment of the overall concept of P&T versus waste management
- investigation of experimental pyro-chemical processes for partitioning
- basic studies on transmutation data and preliminary design of an experimental Accelerator-Driven System (ADS).

Further information on objectives and work programme of EURATOM FP6 **priority thematic area "Management of Radioactive Waste"** can be obtained from the CORDIS Web site: <http://www.cordis.lu/fp6/waste.htm>

EXPERIENCING A TRANSITIONAL PHASE– FROM FP5 TO FP6

Important steps towards the implementation of ERA and to structure research activities have been already made with actions taken on the occasion of the last call for proposals in the Fifth Framework Programme (1998-2002). The Commission is at present completing the Fifth EURATOM Framework Programme (FP5) for research and training activities in the field of 'Nuclear Energy' for the period 1998-2002 [6]. The programme is structured along three lines:

- Two key actions: - Controlled Thermonuclear Fusion and
- Nuclear Fission
- Generic Research on Radiological Sciences and
- Support for Research Infrastructure

a) Nuclear Fission - Management of radioactive waste

Within the key action "Nuclear Fission", this research is mainly devoted to the disposal of high-level and long-lived radioactive waste and spent nuclear fuel and is characterised by a move from fundamental research to the stage of demonstration and implementation of the concept of deep disposal of radioactive waste. The research contributes to the problem solving approach to demonstrate the availability of practical solutions to the outstanding scientific and technical problems and public concern on the issue. The specific objectives to address are: (i) developing methods for comparison of different waste management strategies, (ii) demonstration of the technical feasibility of geological disposal, (iii) improvement of the scientific basis for the safety assessment and (iv) establishment of better methods for achieving public confidence and trust. The research sub-area 'Geological Disposal' covers 43 projects and the related financial contribution from the Community for the projects is about € 29 million.

Two new projects were launched in November 2002 which are of potential interest for future development within FP6 in the geological disposal priority topic.

- The Thematic Network **NET.EXCEL**¹ that brings together radioactive waste management organisations from seven Member States (Belgium, France, Germany, Finland, Spain, Sweden, United Kingdom) and Switzerland to analyse the status of the research and technologic development for disposal of high-level radioactive waste and spent fuel in the three geological rock formations: clay, salt and crystalline rock. The network will identify key topical issues and contribute to form a solid basis for the reflection of end users in the disposal area. The project is running for 15 months until January 2004. The results should build the basis for establishing priorities and co-ordination of future European RTD work for radioactive waste management.
- The Thematic Network **ACTINET**² aims at preparing a Europe-wide network structure for advanced research on "Actinide Sciences" for the further development of the nuclear fuel cycle, including the safe disposal of nuclear waste. The research includes studies on basic properties of nuclear fuels and waste for transmutation and long-term evolution as well as studies of the chemistry and physics studies of actinides in solution and solid phases and in geological environments. The network consists of three core institutions from Germany and France, the Commission Joint Research Centre and associated laboratories from Germany, France, the United Kingdom and Switzerland. The project is running for 24 months until October 2004.

¹ NET-EXCEL: Network for Centres of Excellence in Nuclear Waste Management and Disposal.

² ACTINET: Establishment of a Network of Excellence in Actinide Science

As regards the research activities devoted to "Repository demonstration technology" it should be mentioned that the 2nd international EC seminar of the CLUSTER³ URL forum, was held in Mol, Belgium, in September 2001 with the view to disseminate results from the 14 projects performed in the Underground Research Laboratories (URL's) in Europe. Proceedings of the seminar were published by the Commission in 2002 [7].

In this context, it is worth mentioning that the Thematic Network CROP⁴, an international activity, aims at comparing and evaluating results from investigations of engineered barriers considering design and construction aspects, instruments and experimental procedures, assessment of the function of engineered barrier systems. CROP Thematic Network also aims at assessing models of the important coupled processes in engineered barriers with the view of drawing recommendations for future repository concept development. Sharing experience among main operators of URLs in Europe, the USA and Canada is of added value for technical/economic development of concepts of future repositories for radioactive waste.

In the framework of the EC CLUSTER forum the Commission announced at the end of 2002, the joint EC and European Interest Group (EIG) EURIDICE International Conference on "Impact of the Excavation Damaged Zone (EDZ) on the Performance of Radioactive Waste Geological Repositories". This conference will be hosted by the Commission in Luxembourg from 03 to 05 November 2003 and is sponsored by seven European waste management organisations.

With the completion of EURATOM FP5 the Commission will organise EURADWASTE'04 from 29-31 March 2004 in Luxembourg, a major European Conference on "Radioactive Waste Management and Disposal" to inform the research community on European Commission policy development, socio-political aspects and results of the FP5 research programme. Information can be found on <http://www.cordis.lu/fp6-euratom/events.htm>.

b) Nuclear Fission - Partitioning and Transmutation

With regards to the area of 'Partitioning and Transmutation' the research will provide a basis for evaluating the practicability, on an industrial scale, of partitioning and transmutation for reducing the amount of long-lived radionuclides to be disposed.

The research sub-area covers 14 projects and the related financial contribution from the Community is € 28 Millions for 1998-2002.

A Thematic Network on (A)dvanced (O)ptions for (P)artitioning and (T)ransmutation (ADOPT) is co-ordinating the FP5 R&D activities on P&T. The research projects address various scientific and technical aspects of P&T, which have been grouped in five clusters [8]:

- One on partitioning, investigating efficient hydro-metallurgical and pyro-chemical processes, and
- Four on transmutation, consisting of the clusters on:

³ CLUSTER: Club of Underground Storage, TESting and Research facilities for radioactive waste disposal

⁴ CROP: Cluster Repository Project

- Preliminary design studies for an experimental ADS (Accelerator-Driven System)
- Basic studies (nuclear data for transmutation and ADS engineering design)
- Technological support (material studies: corrosion and behaviour under irradiation)
- Fuel studies (uranium-free nitride fuel, thorium-plutonium oxide fuel innovative actinide-based oxide fuels).

Research activities on P&T are in full operation and all the important aspects are covered by the R&D projects to fulfil the objectives of FP5.

Results of FP5 projects on P&T and ADS development will be presented in an international workshop to be held in Mol, Belgium, from September 16 – 19, 2003.

Further information on the projects under **FP5 key area ‘Nuclear Fission’** can be obtained from the CORDIS Web site: <http://www.cordis.lu/fp5-EURATOM/src/projects.htm> or in the Commission publication on “Nuclear Fission and Radiation Protection - Projects selected for funding 1999-2002” [9]. An updated edition of the document will be issued by the Commission in March 2003.

CONCLUSIONS

Much scientific and technical progress have been achieved in Europe towards the safe management of radioactive waste and disposal due to extensive work carried out at national levels and through European co-operative initiatives that have developed under the successive EURATOM Framework Programmes.

Despite the efforts made to demonstrate the feasibility of the geological disposal concept for high level waste management there is still a lack of public confidence that delays the decisions to start the construction of repositories in Europe. The new approach adopted by the Commission in implementing the EURATOM 6th Framework Programme will contribute towards a more effective use of European skills and know-how and thus allow the development of common views and basis for decisions to overcome public scepticism in this area.

Consequently the management of radioactive waste has been made one of the key priority areas of EURATOM FP6 that is aimed at looking to a widely agreed approach to waste management. It will, in particular, explore the technical and economic potentials of concepts able to make better use of fissile material and generate less waste. The interest for developing techniques in Partitioning and Transmutation (P&T) of radioactive waste is reflected by the increased efforts that the Commission commits in the 6th Framework Programme.

The recent launching within EURATOM FP5 of the NET.EXCEL thematic network on geological disposal is an example of measures taken by the Commission to bring European forces together and develop a common interest for future research on this specific topic within the EURATOM FP6.

REFERENCES

- [1] Council Decision adopting a specific programme (EURATOM) for research and training on nuclear energy (2002-2006); Official Journal of the European Communities L 294/74 of 29.10.2002 http://europa.eu.int/comm/research/fp6/documents_en.html
- [2] Introduction to the instruments available for implementing the FP6 priority thematic areas, EC-DG RTD/B/2, fifth version of November, 2002, <http://www.cordis.lu/rtd2002/fp-activities/instruments.htm>
- [3] Report on the analysis of Expressions of Interest 2002, Call identifier EOI.FP6.2002, Nuclear Energy Research and Training Programme, Priority Thematic Area 2.2: Management of Radioactive Waste, <http://www.cordis.lu/fp6/eoi-analysis.htm>
- [4] European Research 2002 – The European Research Area and the Framework Programme, Conference, Brussels, BE, 11-13, November 2002, <http://europa.eu.int/comm/research/conferences/2002>.
- [5] Calls for proposals for indirect actions under the specific programme (EURATOM) for research training on nuclear energy (2002-2006); Official journal of the European Communities C315/78.
- [6] Council Decision of 25 January 1999 adopting a research and training programme (EURATOM) in the field of nuclear energy (1998-2002); Official Journal of the European Communities, L64 of 12.03.1999.
- [7] Proceedings of the 2nd CLUSTER URL's seminar held in Mol, BE, on 27 and 28 September 2001, Nuclear Science and Technology, 178 p., 2002, EUR 19954 EN.
- [8] Hugon, M, Bhatnagar, V and Martin Bermejo, J (2001). Advanced Concept for Waste Management and Nuclear Energy Production in the EURATOM 5th Framework Programme, Proceedings of the International Conference on 'Back end of the Fuel Cycle: from Research to Solutions', GLOBAL 2001, September 09-13, 2001, Paris, France.
- [9] Nuclear Fission and Radiation Protection projects selected for funding 1999-2001, Nuclear Science and Technology, 62 p., 2002, EUR 19955 EN.