

INTERNATIONAL R&D: ENRESA'S PARTICIPATION IN THE EUROPEAN UNION'S 5TH FRAMEWORK PROGRAM

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ENRESA has always considered international collaboration as an essential part of its R&D Program, and exchanging the information and experience acquired in the field of radioactive waste management is one of its top priorities.

The EU's 5th Framework Program is an ideal platform for undertaking joint actions that will result in solutions for problems that would otherwise be unfeasible for an organization to achieve on its own.

ENRESA's participation focuses on the following two courses of action:

- Cost sharing actions.
- Concerted actions.

The first call for proposals in the area of "Fuel Cycle Safety", which ended in October 1999, resulted in 23 projects.

The total cost finally approved by the Commission for these 23 projects was 109,600 euros (18,227 Mptas.). Of this amount, the Spanish groups funded by ENRESA are going to execute jobs worth 9,600 euros (1,592 Mptas.). Of this amount, ENRESA will provide 7,794 euros (1,297 Mptas.), or approximately 8.5%, and the returns that ENRESA will receive will be 4,540 euros (755 Mptas.), which means 47% funding by the EU.

INTERNATIONAL COLLABORATION IN R&D

One of the main features that differentiates R&D in radioactive waste management from R&D in other areas is that it is developed on the basis of close, successful international collaboration.

The reason for this situation primarily lies in the complexities of definitive high-level waste management and also in the need to refine and unify safe, viable, acceptable solutions based on international consensus.

Since in this field the development of solutions takes priority over any economic gain deriving from them, the different countries that must internally address very similar problems have chosen to join forces to develop and verify these solutions, which each country must then adapt to its own conditions. International collaboration thus makes it possible to share costs and, even more importantly, to take utmost advantage of the scientific capabilities of the different countries, with the resulting synergies and transfer and joint use of know-how.

Another important aspect resulting

from international collaboration is verifying that the activities on which ENRESA is working are in line with international developments and, even more importantly, that the developments produced by Spanish researchers can be contrasted by international groups. In this way, we can verify the strength of our developments and identify possible ways to improve them.

Based on these premises, ENRESA has always considered international collaboration as an important activity, and as a result it takes part in numerous international projects within the framework of the EU. These are complemented by bilateral agreements with agencies similar to ENRESA. These agreements provide for the exchange of information and experiences and, if necessary, the development of joint projects.

ENRESA currently has cooperation agreements with France, Sweden, United Kingdom, USA, Japan, Switzerland, the Czech Republic, Croatia, Argentina, Cuba and Mexico. It is also actively involved in projects promoted by the EU, the IAEA and the AEA-OECD.

In this context, one of the cornerstones of ENRESA's international collaboration policy is its participation in the European Union's Framework Programs, with the financial gains and scientific repercussions that these represent.

Radioactive Waste R&D in the 5th Framework Program

The structure and objectives of the EU's 5th Framework Program (1999-2003) have been changed substantially compared to previous programs, and it has been designed to solve specific problems and better address the socio-economic changes occurring in the Union. To do so, it focuses on a limited number of goals and areas that combine technological, industrial, economic, social and cultural aspects.

The basic criteria governing this program are as follows:

- Added value and the principle of subsidization in order to ensure the European availability of critical masses in research and innovation that are required for addressing present and future problems.
- Social goals such as the quality of life and protecting employment and the

THE UE 5th FRAMEWORK PROGRAM

THEMATIC PROGRAMS	HORIZONTAL PROGRAMS
• Quality of life and live resource management. • Friendly information society. • Competitiveness and sustainable growth. • Energy, environment and sustainable development.	• Confirming the international role of Community Research. • Promoting innovation and fostering the small-and mid-size enterprise. • Developing the human potential of research and basic socio-economic knowledge.

environment in order to broaden the expectations of European Union citizens.

- Economic, scientific and technological development in order to contribute to harmonization and sustainable development of the European Union as a whole.

The 5th Framework Program includes seven "Specific Programs", of which four are "Thematic Programs" and three are "Horizontal Programs".

TABLE 1

R&D PLAN AREA	EU PROJECT ACRONYM	COST OF SPANISH PARTICIPATION (EUROS)	EXPECTED RETURNS (EUROS)	SPANISH PARTICIPANTS
Basic Technologies	ACTAF BORIS BIOCLIM	219996 140410 232490	109998 70205 116244	CIEMAT, UPC-DIT, QuantiSci, UPC-DITCIEMAT, UPM, ENRESA
Separation and Transmutation	CALIXPART MUSE N-TOF-ADS PARTNEW* PYROREP TECLA	172550 292372 646329 280000 454512 850000	118220 146185 374064 140000 227256 425000	CIEMAT, UAM CIEMAT CIEMAT, CSIC, UPC, U. SANTIAGO, U. SEVILLE, UPM CIEMAT CIEMAT CIEMAT
Definitive Storage	BENCNHPAR-DECOVALEX III CROP EB* ECOCLAY-II FEBEX-II* MODEX-REP PROTOTYPE CONTAINER CORROSION	122093 64015 606976 304862 3012798 144000 341407 370000	61047 64015 250073 201386 1221522 72000 165262 139000	ENRESA ENRESA AITEMIN, UPC, ENRESA CSIC, UAM, ENRESA AITEMIN, UPC, CIEMATCSIC, UPM, UDC, ENRESA ENRESA ENRESA, UPC, AITEMIN ENRESA, INASMET
Safety Assessment	BENIPA* SPIN	433631 214783	183859 107392	ENRESA ENRESA
Installation Support	INTERLABS TND DACAPO FASSET	222379 26634 138772 279675	111190 26634 69386 139837	CIEMAT, ENRESA ENRESA CIEMAT CIEMAT
	TOTAL	9570684	4539776**	

* Projects coordinated by ENRESA ** 3786 EUROS of the returns go directly to ENRESA

The main features of these projects are those described in the center table.

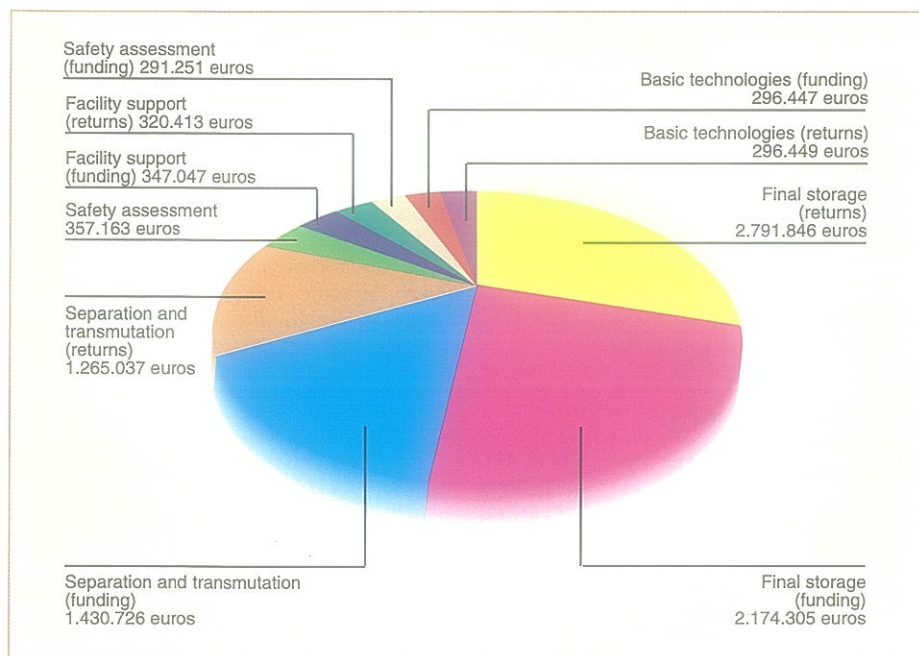


Figure 1. Enresa's participation in the EU's 5th Framework Program.

One of the essential features of this program is integrated problem solving. This integration is supported at three levels: through Key Actions in the

Thematic Programs, *Integration of Objectives* in the Thematic and Horizontal Programs, and *Integration of Thematic Processes*.

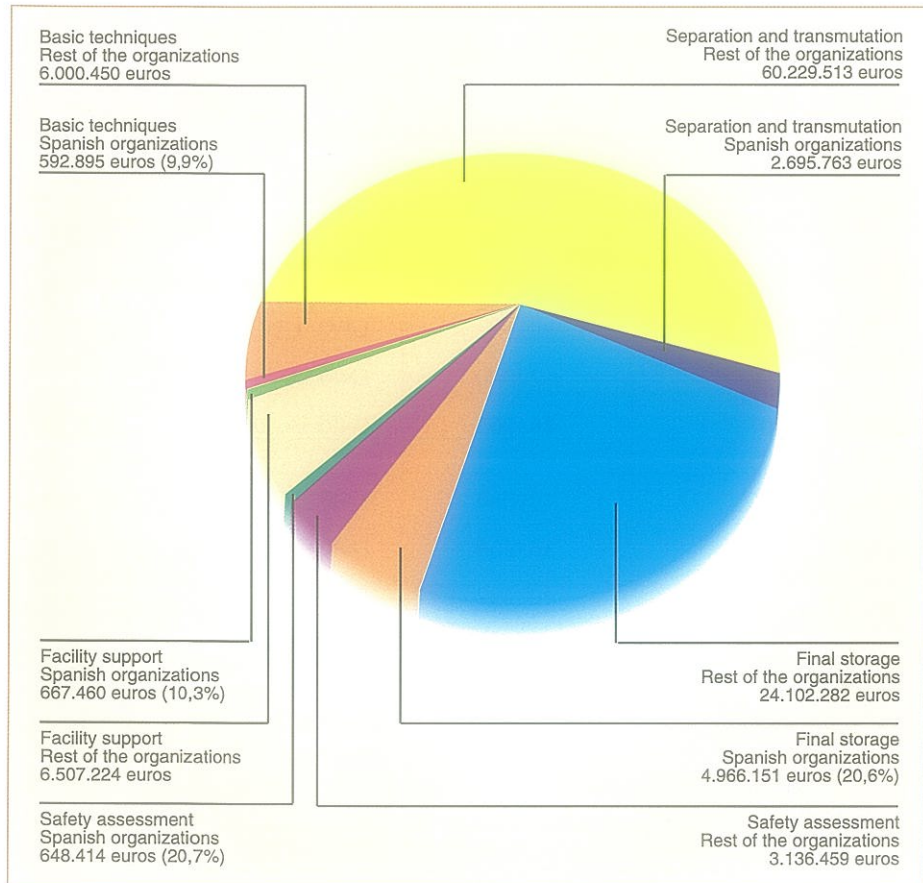


Figure 2. Participation of Spanish organizations in the EU's 5th Framework Program.

R&D activities in the area of radioactive waste are included as part of the EURATOM 5th Framework Program, and its organization and management are an integral part of the Thematic program for Energy, Environment and Sustainable Development.

The EURATOM 5th Framework Program includes 4 key actions: Nuclear Fusion, Nuclear Fission, Generic Research in Radiological Sciences, and Support of Research Infrastructures. The key action of Nuclear Fission includes lines of research in Operational Safety, Fuel Cycle Safety, Safety and Efficiency of Future Systems, and Radiological Protection. Radwaste R&D is basically part of Fuel Cycle Safety, which is broken down into "Waste and Spent Fuel Management and Storage", "Separation and Transmutation", and "Nuclear Power Facility Dismantling". However, some projects are included in the area of radiological protection.

ENRESA'S PARTICIPATION

ENRESA has been systematically taking part in these programs, and its participation has increased as its support infrastructure has improved.

On analyzing in detail the 5th Framework Program and ENRESA's R&D Plan 1999-2003, it can be seen that both are very similar in terms of the objectives pursued in many of the areas. This means that many of the internal projects initially planned by ENRESA in its program can later cover proposals of the European Union program.

Thus, ENRESA and its collaborating research organizations made a significant effort to promote and/or take part in those proposals in which the R&D Plan and 5th Framework Program directives overlap. The result was 35 proposals with a differing degree of participation for the first call for proposals in the area of "Fuel Cycle Safety", the deadline for which was October 1999.

After evaluating these proposals, the Commission accepted 23 of them for contract negotiation. Of the remaining proposals, one was approved but is on a waiting list, and 5 of them are of interest to the Commission provided that some aspects – primarily costs – are modified, and thus they could be successfully submitted to the second call (October 2000 – January 2001).

These 23 projects cover activities in the 5 major areas of ENRESA's R&D Plan: 3 projects are included in "Basic

Table 2.
Characteristics of the Research Projects in which ENRESA and its Collaborating Organizations Take Part.

Basic Technologies

Actaf

Determine the mechanisms that govern the interaction of radionuclides with different materials, in accordance with their physical-chemical and radio-chemical properties.

Boris

Estimate the processes of radionuclide migration in the geosphere by using information generated during environmental reclamation of the areas of Tomsk and Krasnoyarsk (former Soviet Union), where waste from irradiated fuel reprocessing was injected in depth.

Bioclim

Characterize paleoclimatic evolution and the parameters that govern it on a regional and local scale, to establish the bases for reconstructing long-term paleoclimatic change and its effect on the study of radionuclide behavior in a repository.

Safety Assessment

Benipa

The purpose of this project is to analyze how different countries have considered engineered clay barriers in their safety assessments. Analyze the different storage concepts and relevant safety processes considered, as well as the codes and models used and verified by applying them to certain processes.

Spin

This European projects addresses the search for safety indicators to complement the now classic ones of dose and risk. It includes identification of possible indicators, their evaluation in practical cases, compilation of reference data on the selected indicators, and their evaluation in accordance with their utility and application.

Separation and Transmutation

Calixpart

This project addresses the refinement of hydro-metallurgic separation techniques for long-lived isotopes contained in irradiated fuel. The aim is to synthesize organic molecules (calixarenes) capable of forming complexes with the actinides and lanthanides, and separate them from the rest. The radionuclides separated in this way could be transmuted in ADS systems.

Muse

The purpose of this project is to define experimental subcritical configurations of interest and analyze them experimentally, as well as to develop new specific techniques for supporting subcritical system operation and for integrating parameters used to obtain calculation routes for predicting neutron behavior in an ADS.

N-tof (ads-th)

Identification of neutron cross sections will help to optimize ADS system efficiency, through localization of high levels of accuracy and coverage for most isotopes.

Partnew

The primary aim is to design an extraction process for the Am (III) and Cm (III) found in the HAR and the HAC that result from recycling of irradiated fuel.

Pyrorep

This project addresses the refinement of actinide separation techniques through fuel dissolution in molten salts, from which the actinides would subsequently be separated by electrolysis for later transmutation.

Tecla

The main purpose of this project is to improve the performances of ADS processes by obtaining a better understanding of the technologies, materials and thermohydraulic systems of the materials, lead alloys, used in the ADS system.

Facility Support

Interlab

Maintenance of the European network of low- and intermediate-level waste characterization laboratories through the comparative analysis of certain waste currents. The aim is to standardize as much as possible the analytical techniques, their range of application and their precision and accuracy characteristics, so that in the future the results obtained in this network's laboratories will be comparable.

TND

The purpose of this project is to create a European dismantling information network that integrates and combines the data generated in different dismantling projects, the technologies used, the ranges of application, the production data of different types of waste and the decontamination techniques, and to promote technician training in this area and

support the activities of the different agencies and the Commission in this field.

Dacapo

This project is intended to develop automatic destructive analysis equipment for radionuclides that are not g-emitters in low- and intermediate-level waste. This equipment, supported by stand-alone robotic systems, will strengthen radiation a and b isolation systems and will be applied to packages containing non-standard waste.

Fasset

The purpose of this project is to establish a common framework in the EU for studies of environmental impact owing to radioactivity on the non-human biotic medium. The aim is to identify the generic organisms of different European ecosystems, develop dose-response level studies, identify critical systems of internal or external exposure, and identify the critical effects and danger levels for biological communities.

Final Storage

Benchpar-Decovalex iii

Decovalex is an international forum created by the Swedish Nuclear Safety Agency (SKI) to evaluate numeric thermo-hydromechanical codes used for modeling and simulating the geological barrier. The EU has included a part of this exercise, named BENCHPAR and focused on how these models can be simplified and how the medium's thermo-hydromechanical properties should be included, in the integrated safety assessments of repositories. This project uses the data generated by project Febex.

EB

This includes the design, placement and behavior in the presence of hydration of the engineered clay barrier, combining the use of bentonite blocks and pellets. It will be developed in the underground laboratory of Mont Terri and applied to the concept of storage in clay.

Febex ii

The purpose of this project is to verify the viability of manufacturing, installing and monitoring an engineered clay barrier system, to identify the thermo-hydromechanical and geochemical processes that take place, and to quantify and model the transport of radionuclides through the clay barrier in an experiment based on actual dimensions, temperatures and geological conditions. This experiment, the continuation of Febex, will

Table 2. (Continuation)

be performed at full scale in the underground laboratory of Grimsel (Switzerland) and on a mock-up in Ciemat's facilities.

Prototype

The characteristics of this project are similar to project Febex, but following the conceptual storage model of SKB (Sweden) and placing greater emphasis on monitoring the clay barrier's chemical and geochemical parameters. Underground laboratory of Äspö (Sweden).

Crop

The purpose of this project is to establish

methodological guidelines for the design and construction of repositories through analysis of projects carried out to date in underground laboratories, and by exchanging information on concrete experiences and comparing the results obtained to previous predictions.

Ecoclay ii

To analyze the long-term behavior of clay barriers in contact with hyper-alkaline solutions (very high pH) resulting from alterations of concrete containment or support systems. This is a study of material compatibility and the long-term effects.

Modex-rep

This is the first EU project in the new underground French laboratory of Del'Est. The purpose is to analyze the hydraulic and mechanical behavior of the geological barrier during excavation of the lab's access well.

Container Corrosion

Lab testing of metal materials likely to be used in engineered barrier components will help establish approximate ranges of long-term corrosion behavior of these materials under storage conditions.

Technologies", 6 projects in "Separation and Transmutation", 8 projects in "Definitive Storage", 2 projects in "Safety Assessment", and 4 projects in "Installation Support", as shown in Table 1.

These 23 projects ensure a presence in the underground laboratories of Äspö (Sweden), Grimsel (Switzerland) and Mt. Terri (Switzerland), as well as

collaboration with the five major European nuclear research centers such as the ITU and FzK in Karlsruhe (Germany) and the CEA (France).

The total cost of these 23 projects approved by the Commission is 109,547 euros (18,227 Mptas.). Of this amount, the Spanish groups associated with ENRESA are going to execute jobs worth 9,571 euros (1,592 Mptas.), with returns of 4,539 euros (755 Mptas.), which means that EU funding is 47%. ENRESA will receive 3786 euros (630 Mptas.) in this 1st communication.

ENRESA takes part directly in 13 of these 23 projects, which means that ENRESA is a signatory of the contract with the EU. Of these 13 projects, 3 are coordinated by ENRESA: Febex, Benipa and EB, and in the 10 remaining ones ENRESA is indirectly involved, i.e., by funding the group or Spanish group share.

Table 1 and figures 1 and 2 contain the most significant economic data.

In the area of Basic Technologies (Fuel, Radiochemistry and Biosphere), the Spanish groups perform 1% of all activities; the figure is 2% in Separation and Transmutation, 5% in definitive storage, 1% in safety assessment, and 1% in installation support. These figures indicate the great success that Spanish research has achieved in radioactive waste management.

Participation of Spanish Organizations Co-funded by ENRESA

This share is focused on 10 organizations, including ENRESA itself, and they are as follows: AITEMIN, ENRESA, CIEMAT, CSIC, INASMET, Autonomous University of Madrid, University of La Coruña, Polytechnic University of Catalonia, Polytechnic University of Madrid, University of Santiago de Compostela, and University of Seville.

The total cost of the Spanish

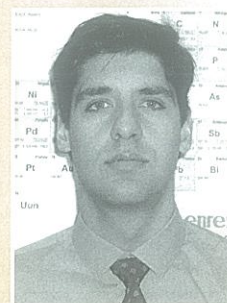
organizations' participation in the above-mentioned projects is 9,571 euros. Of these, CIEMAT will execute 36%, AITEMIN 20%, UPC 7%, CSIC 5%, INASMET 3%, and the rest of the organizations between 1% and 2%. ENRESA will directly execute 22% of the planned activities.

THE PROJECTS

Table 2 describes the main features of the approved projects, which are grouped together based on ENRESA's R&D Plan.



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Antonio CORTÉS RUIZ has a Bachelor's degree in Geological Sciences (Geological Engineering) from the University of Granada, and a Master's in Environmental Business Management and Engineering and a Diploma in Project Management from the School of Industrial Organization/Polytechnic University of Madrid. From 1999 to 1993, he worked for the University of Granada in the Agricultural Chemistry Department. In 1993, he joined ENRESA's Department of Research & Development Coordination, where he is responsible for national and international projects that are part of the European Union's Framework Programs. In 1997 and 1998, he was a member of the International Atomic Energy Agency's (IAEA) scientific advisory missions to Argentina and Romania.