Advanced Concepts for Waste Management and for Nuclear Energy Production in the EURATOM Fifth Framework Programme

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The Fifth Framework Programme (FP5) (1998-2002) of the European Atomic Energy Community (EURATOM) has two specific programmes on nuclear energy, one for indirect research and training actions managed by the Research Directorate General (DG) and the other for direct actions under the responsibility of the Joint Research Centre of the European Commission (EC). This first programme includes a key action on controlled thermonuclear fusion, a key action on nuclear fission, research and technological development (RTD) activities of a generic nature on radiological sciences, support for research infrastructure, training and accompanying measures. The key action on nuclear fission and the RTD activities of a generic nature have a total budget of 191 millions €. They are implemented through targeted calls for proposals with fixed deadlines. All information concerning the nuclear fission programme is available on the CORDIS website (www.cordis.lu/fp5-euratom).

The key action on nuclear fission comprises four areas: (i) operational safety of existing installations; (ii) safety of the fuel cycle; (iii) safety and efficiency of future systems and (iv) radiation protection.

The area of "safety of the fuel cycle" includes three sub-areas: waste and spent fuel management and disposal, partitioning and transmutation (P&T) and decommissioning of nuclear installations. The main objective of the research activities on P&T is to provide a basis for evaluating the practicability, on an industrial scale, of partitioning and transmutation for reducing the amount of long lived radionuclides for disposal. The selected projects in this area cover advanced partitioning methods and issues related to transmutation in accelerator driven systems (ADS): technological support, fuel, basic studies and preliminary design studies. Three projects deal with partitioning. The first on pyrometallurgical processing assesses salt/metal extraction and electrorefining for the separation of actinides and lanthanides, while the two others develop aqueous processes for the chemical separation of minor actinides from high level waste. Concerning the technological support for transmutation, three projects address (i) experimental work on neutron/proton irradiation damage of a spallation target, (ii) corrosion of structural materials by lead alloys used as a spallation target and as a coolant for an ADS and thermal hydraulic experiments with liquid lead alloys and (iii) the development and validation of expertise for the design and operation of a heavy liquid metal spallation target producing a high neutron flux. Fuel issues for ADS are dealt with in three projects: (i) nitride fuel fabrication and irradiation; (ii) thorium-based fuel fabrication and irradiation; (iii) study of the feasibility of irradiation of innovative actinide-based oxide fuels for transmutation. Three projects are related to basic studies for transmutation: one on the experimental investigation and code interpretation of sub-critical neutronics and two on nuclear data, one in the low energy range encompassing the resonance regions required for transmutation, and the other at medium and high energy required for the

ADS engineering design including the spallation target. Finally, preliminary design studies of an European experimental ADS are aiming at addressing the critical points of the whole system (i.e. accelerator, spallation target unit, reactor housing the sub-critical core).

The objective of "safety and efficiency of future systems" is to investigate and evaluate new or revisited concepts (both reactors and alternative fuel cycles) for nuclear energy that offer potential longer term benefits in terms of cost, safety, waste management, use of fissile material, less risk of diversion and sustainability. In the medium-term increasing competitiveness is the main priority, whereas in the long-term the main priority is to develop a sustainable energy system. The majority of the research projects selected for funding in this area are related to High Temperature Gas-cooled Reactors (HTR). They address: (i) fuel fabrication and irradiation issues; (ii) the validation of existing core physics codes, the study of basic fuel designs, the analysis of specific waste and the disposal behaviour of spent fuel; (iii) the setting up of a material property database on reactor pressure vessel, high temperature areas (internal structure and turbines) and graphite structures; (iv) key components and systems such as the helium turbine, the recuperator heat exchanger, the magnetic bearings and the leak-tightness rotating seal; (v) safety approach and licensing issues; (vi) co-ordination and networking. Four projects are exploring in light of the present technology available the potential benefits of other reactor concepts and other applications of nuclear energy such as (i) high performance light water reactor (HPLWR), (ii) gas-cooled fast neutron reactors, (iii) molten salt reactors and (iv) sea water desalination with innovative nuclear reactors. A last project has the objective of investigating the fabrication and irradiation behaviour of thorium based fuel. Finally, a network is being established to propose a R&D strategy to keep the option of nuclear fission energy open in the 21st century in Europe.

The Commission is aiming at the adoption of the new Framework Programmes (2002-2006) and their specific programmes by both the Council and the European Parliament by June 2002.