Publishable Executive Summary

The Integrated Project known as ESDRED (Engineering Studies and Demonstrations of Repository Designs) is a joint research effort by major national radioactive waste management agencies (or subsidiaries of those agencies) and by research organisations, representing nine European countries. ESDRED is co-ordinated by the French national radioactive waste management agency (ANDRA) and is part of the European Union's 6th Euratom Framework Programme for Nuclear Research and Training. The five year Project has a total budget of EURO 18.7 million, of which 7.3 million is from the EU's Framework Programme.

The 13 partners (Contractors) in this project are:

Radioactive Waste Management agencies:
ANDRA, France
ENRESA, Spain
NAGRA, Switzerland
NIREX, United Kingdom
ONDRAF/NIRAS, Belgium
POSIVA, Finland
SKB, Sweden

Technological R&D organisations:
AITEMIN, Spain
CSIC, Spain
DBE TECHNOLOGY, Germany
ESV EURIDICE EIG, Belgium
GRS, Germany
NRG, the Netherlands

ESDRED is focused on technology and has three main objectives. The first is to demonstrate, at an industrial scale, the technical feasibility of some very specific activities related to the construction, operation and closure of a deep geological repository for high level radioactive waste. The work is organised inside four (4) Technical Modules and essentially involves the conception, design, fabrication and demonstration of equipment or products for which relevant proven industrial counterparts (mainly in the nuclear and mining industry) do not exist today. At all times this work is to be carried out within the framework of compliance regarding the requirements for operational safety, long term safety, retrievability and monitoring.

Each of the four technical Modules involves from 3 to 7 Contractors and as many as 6 different national disposal concepts may be represented. The programmes within these Modules are provided below:

Module # 1: **Buffer Construction Technologies** for horizontal disposal concepts

Module # 2: **Waste Canister Transfer and Emplacement Technology** for horizontal and vertical disposal concepts

Module # 3: **Heavy Load Emplacement Technology** for horizontal disposal concepts

Module # 4: **Temporary Sealing (using low pH cement) Technology** for construction of sealing plugs and for rock support using shotcrete techniques

A second and equally important objective is to promote a shared European vision in the field of radioactive waste disposal technology. This is accomplished through the INTEGRATION process, which is one of the key objectives that identify Euratom's 6th Framework Programme. Among other things integration involves working together within Work Packages and/or Modules; sharing information; comparing one another's input data and functional requirements for consistency; ensuring that, where possible, fabricated components are compatible; and coordination of demonstration activities.

The third objective involving communication and training is deemed to be sufficiently important to merit a separate Module. Among other things it involves the dissemination of knowledge by way of press releases, pamphlets, technical articles and presentations, videos and eventually an international event. Training, with a focus on New Member States, is to be accomplished via workshops, courses and possibly some secondments.

A general project schedule is shown in **Figure 1** below:

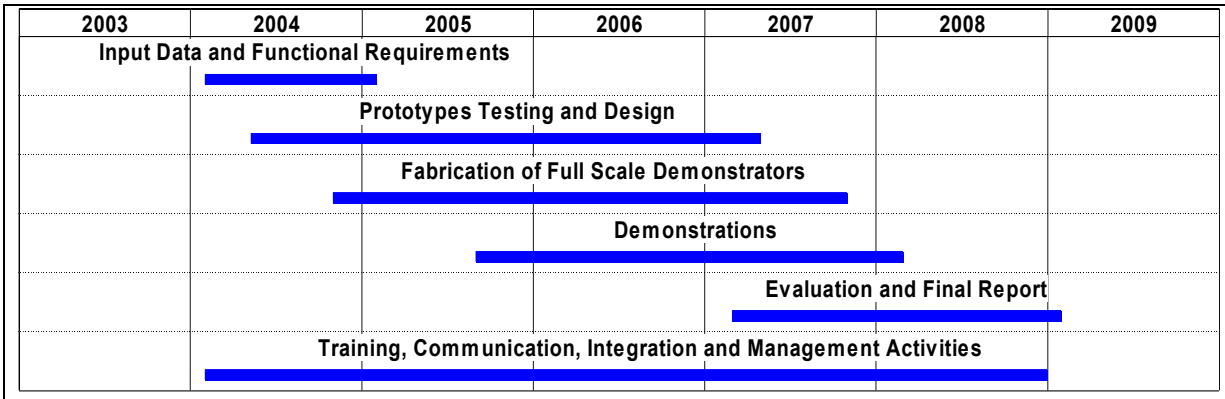

Figure 1: General Schedule of the ESDRED Project

The first year of the project, which terminated at the end of January 2005, can be characterized as a success given that all major objectives for the year were achieved. In particular each of the 4 Technical Modules produced a first deliverable dealing with "Input Data and Functional Requirements". This document is intended to be the foundation on which the rest of the Module work can build. Secondly an Experts Committee was recruited, debated and finally appointed for the five year term of the project. They have begun to work. Although this was not a contractual requirement DBE, O/N and SKB, acting as Module Leaders, voluntarily submitted their "Input Data and Functional Requirements" reports (IDFR), noted above, to members of the ESDRED Experts Committee for review. Management tools were developed early in the program as needed. ESDRED was publicized extensively via Press Releases, Project Pamphlets, Technical Journals, Presentations and in particular via its own Web Site. Finally, Integration seems to have caught on with improved communication and cooperation between the 13 partners.

THE TECHNICAL WORK ACCOMPLISHED DURING THE FIRST YEAR INCLUDES:

Module 1: (Buffer Construction Technology)
In addition to the IDFR report, bids were solicited for the design, fabrication and testing of bentonite buffer rings. A contract, including the probable utilization of the most powerful press available in Western Europe today, is imminent. The basic design and laboratory testing of buffer configurations, to be used for surface and in situ demonstrations (planned for 2005) of seals constructed in vertical bore holes, was completed; and there were two internal workshops on non-intrusive monitoring.

Module 2: (Waste Canister Transfer and Emplacement Technology)
In addition to the IDFR report, tenders have been prepared and bids have been received for the design, fabrication and testing of pushing robots to be used for the emplacement of spent fuel and vitrified waste canisters. The conceptual and basic design of the equipment intended for the industrial demonstration of the horizontal (2007 in situ underground) and vertical (2008 in a surface facility) emplacement concepts has begun. Finally a compilation of data describing the various National/ESDRED repository concepts, as they relate to reversibility/retrievability, is underway. This will result in a desk study deliverable.

Module 3: (Heavy Load Emplacement Technology)
Notwithstanding the completion of the IDFR reports, this is the Module with the most visible sign of progress as shown in the Figures 2 and 3 below. Bertin Technologies, a French firm, has successfully completed the design, fabrication and testing of a 1/3 scale prototype air cushion device for the emplacement of heavy loads up to 43 tons. Experiences gained here are being incorporated into the design and fabrication of a similar full scale industrial demonstrator to be tested in 2006. ANDRA and SKB worked in close cooperation during the preparation of a list of invited bidders and in the preparation of the tender documents for the industrial demonstrators. Both agencies have now awarded contracts for this work (to 2 separate firms) and Bertin will be a sub-contractor in both cases.

Figure 2: Prototype Test of the Air Cushion Principle Applied to Small Diameter Canister

Figure 3: Sealing Plug Construction Site – Full face bored demonstration drift at Äspö

Module 4: (Temporary Sealing Technology)
In addition to producing the IDFR report this Module has made a lot of progress in the laboratory work needed to be able to design the demonstration work which is to follow in the next 2 years. First a methodology for the determination of pH in cements has been developed. An important Milestone was achieved upon the completion of the characterization and formulation of low pH cements and of shotcrete suitable for the construction of sealing plugs. The design for the in situ construction of a plug at Äspö is well underway and should take place late 2005 or early 2006. Although this is outside the scope of ESDRED the excavation of the 15m long drift, where the construction of the sealing plug will take place, has already been completed. See Figure 3 above.

COMMUNICATION, TRAINING, AND INTEGRATION PROGRESS DURING YEAR 1:

Much progress was also made in the area of communication. Significant training is of course not possible until there has first been more progress within the Technical Modules. Integration is really spread across all of the Technical Modules where the progress is often somewhat subtle and hard to quantify. Notable achievements include:

Module 5: (Training & Communication)
Shortly after the Kick-off Meeting a Press Release was prepared and distributed in 7 languages. This was followed by a Project Presentation Leaflet and similar material for special interest groups. An article summarizing the ESDRED project was also prepared and published in the Nuclear Engineering International journal. All of the above is available on the ESDRED web site (www.esdred.info) which has been set up and which includes links to the web sites of all 13 Contractors.

Deliverables related to the 5 year Training and Communication Action Plan have been submitted to the Commission. The Confidence building objective was addressed by having a strong presence at all COWAM 2, Work Package 4 (Long Term Governance) meetings. This included one informal and one formal presentation.

Module 6: (Integration)
This challenging Module is the responsibility of the ESDRED Project Coordinator also known as the IPC or Integrated Project Coordinator. A comprehensive document combining elements from each of the first deliverables (IDFR) prepared by the four Technical Modules, has been prepared and submitted to the EC as well as to the Experts Committee for review and for a formal report. The Expert's review is underway. Over the course of the year there were four (4) meetings, attended by all ESDRED participants, to discuss the topic and to ensure that, going forward, the best possible integration would be achieved.

CONCLUSION:
There have not been any significant problems during the first year of the project and none are foreseen going forward. It is worth noting that given the novel applications of existing technologies, which themselves at times require further development to be useful, the list of suitable bidders for the work can sometimes be very limited and that does create a problem. At the same time ESDRED is seen to be an important catalyst for encouraging both the firms and the technological developments they are working on.

Coordination

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