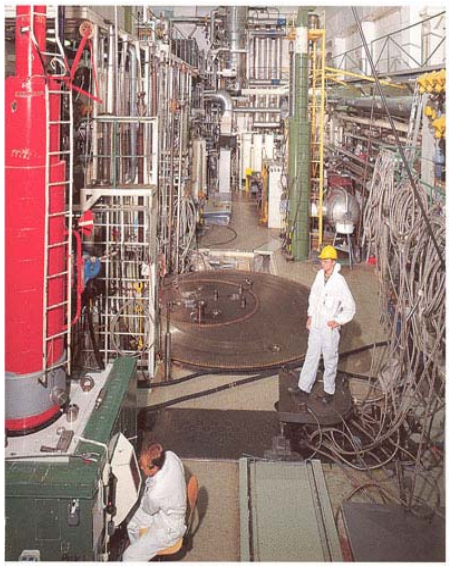
HALDEN REACTOR PROJECT

This pamphlet gives a short overview of the activities at the OECD Halden Reactor Project, an international research project operated by the Norwegian Institutt for energiteknikk.

Institutt for energiteknikk

- The Norwegian Institute for energy technology (IFE) is the second largest research institute in Norway. IFE's five areas of research are nuclear technology and physics, nuclear safety and reliability, petroleum, energy and environment and – safe interaction between man, technology and organisation (MTO).
- IFE is located at Kjeller just outside Norway's capital Oslo and at Halden on the south eastern boarder to Sweden.
- IFE has ca 550 employees equally divided between Kjeller and Halden. The 2002 turnover was 60 Million Euros. Over the last years the average result has been 3% of the turnover.



OECD HALDEN REACTOR PROJECT

- As part of it's research business, IFE is leading a major nuclear research program known as the OECD Halden Reactor Project (HRP) aiming to improve safety in operating nuclear plants. HRP includes the participation of 20 member countries and collaboration with more than 100 nuclear organisations worldwide.

- The programmes at the Halden Project address nuclear fuel issues, material performance and man-machine systems research and development and are composed to answer the needs of member organisations and the nuclear community at large.

- The organisations participating in the Halden Project are actively guiding the Project's research programmes. They represent a complete cross section of the nuclear industry, including national research organisations, reactor and fuel vendors, utility companies and the licensing and regulatory interests.

- The joint programme started already in 1958 and is renewed every third year. The programme renewal involves extensive reviews and discussions with Project participants on priorities, programme issues to be addressed and technical means to achieve the programme objectives.

- The large circle of participants, with the consequent cost sharing among many parties, has enabled to utilise the overall infrastructure to the maximum possible extent. The Halden Project is committed to continue this endeavour by responding efficiently to technical requirements emerging in the nuclear community, by maintaining its facilities in good order and by continuing to adhere to a highly competitive cost structure.

- In addition to the joint programme work, a number of organisations in the participating countries execute their own development work in collaboration with the Project. These bilateral or multi-lateral arrangements constitute an important complement to the joint programme and normally address issues of commercial interest to a participant organisation or group of organisations.

- The programme results are systematically reported in Work Reports and in Conferences organised by the Project. Special workshops with participation of experts are frequently arranged for in-depth assessments of specific issues, especially when new programme issues are to be established.

- Secondees can be assigned to the Project from member organisations. More than 300 scientists have worked at the Project for a period of one to three years. Nowadays this arrangement is mainly offered to young scientists, reflecting a new educational role of the Project.

- Norway, the host country, has always been strongly supportive of the Halden Project and is expected to do so in the future. The Norwegian contribution covers 30% of the joint programme funding.

- At the centre of the Halden Project's activities is the Halden Boiling Water Reactor (HBWR). With its spacious and accessible core, the HBWR is an ideal test bed for experimental assemblies of varied design and complexity requiring large numbers of instrument leads. In addition, the availability of in-core instrumentation and the operational flexibility afforded by the HBWR have greatly aided process control development.

- The Halden Reactor has evolved considerably from its initial goal, which was to demonstrate the heavy water concept with a modest thermocouple and turbine flow test. The reactor facilities have been progressively updated and, through a series of innovative techniques, the system has now become one of the worlds most versatile test reactors.

- Continuous developments over several years now permits: the re-instrumentation and re-irradiation of commercial fuel, the provision of prototypic LWR neutronic and thermal hydraulic conditions in dedicated assemblies and loops, and the inclusion of MOX fuel within the experimental programme.

- The present day complement of experimental assemblies' range in complexity from rudimentary, non-instrumented rod bundles to some of the most integrated and complex in-reactor tests ever designed. In the fuel and materials area, tests done in the HBWR are representative of actual commercial reactor conditions.

- HRP/IFE has built and operated the so-called Halden Man-Machine Laboratory (Hammlab) for a number of years. Hammlab is now regarded as a reference facility for human factor studies and for advises on control room engineering. It has provided the basis for studies on the performance of control room operators in complex and automated environments. Advances in technology and increased need for access to research simulators, led to the decision to establish an upgraded version Hammlab. It mainly addresses needs of the nuclear and the oil/gas industry. A French PWR, a Swedish BWR and a westernised VVER simulator as well as an off-shore oil production simulator is now available.

- Other major human factors activities are the design of human computer interfaces, test and evaluation of computerised operator support systems, human error analysis, and the development of technical bases for guidelines formulation.

- HRP/IFE has considerable experience in the development of graphical interfaces and the application of Virtual Reality (VR) technology. A VR Laboratory was established in 1996. VR has proven to be an excellent tool for rapid, interactive, high quality design of control rooms. Tools to assist in verification and validation of such designs have been developed as well as tools for maintenance training.

- Computerised Operation Support Systems (COSSs) are developed and evaluated at HRP for assisting operation and maintenance workers in fault detection, diagnosis and planning of operations. These systems cover: Alarm handling, Signal Validation, Transient detection, Computerised procedures, Graphic interfaces and Core Surveillance.

- HRP/IFE has in-depth experience with simulator development and utilisation. This experience stems from applications in the nuclear industry. IFE has since 1985 built and delivered large training simulators for the off-shore oil industry.

- The man-machine systems activities benefit from regular confrontations with real-life requirements practical implementation in power plants and in the process industry. This continuous scrutiny levied by all participants of the Project's experimental results and conclusions is particularly beneficial in preventing the insularity that often characterises research projects.