

Radioactive waste disposal: Moving ahead

A report from the IAEA's international symposium in Hanover

With various countries around the world now actively engaged in research and development in radioactive waste disposal, the field is not lacking in experience to support the general scientific consensus that no technological barriers prevent the safe and environmentally benign disposal of radioactive wastes.

In fact, many of the 29 countries that recently took part in the IAEA's symposium on the subject in Hanover, Federal Republic of Germany, were reported to be moving ahead with a well-planned disposal programme, and in some countries, significant experience already has been accumulated.* The group of countries with active research and development (R&D) projects, it was noted, includes all those with programmes in nuclear energy.

In summarizing the week's discussions on the symposium's last day, R. Stein, from the Office of Civilian Radioactive Waste Management of the US Department of Energy, surveyed the record of experience, and emphasized that considerable challenges remain.

While the range of experience varies, "I think it is fair to say that the repository programme for each country is generally at the correct stage for each country's needs", Mr Stein said in reference to efforts directed at high-level waste disposal. He indicated, however, that expanding public and political support for the safe operation of disposal facilities promises to remain a formidable task in many countries.

Experience and challenges

In the Federal Republic of Germany (FRG), for example, the Asse mine was operated as a low-level waste disposal site for several years. A site for the disposal of low-level and intermediate-level waste has been

operated in the German Democratic Republic since 1979; and there are low-level waste burial grounds in operation in the USA. In France, the La Manche site for the disposal of low- and intermediate-level wastes has been operated successfully for more than 10 years. It is expected that this site will be filled by 1990, and plans are well advanced toward opening a second.

Before a repository for *high-level* wastes can come into operation, however, many preparatory steps must be taken. A question which must be settled early is who should be responsible for the operation of such a facility. In practice, governments tend to be heavily involved. Again taking the FRG as an example, the development and operation of disposal facilities is ultimately the responsibility of the Federal Government. Similarly, in the USA, the Federal Government has responsibility for the disposal of high-level waste and spent fuel. In both countries, however, there is a provision that the costs of disposal shall be borne by the waste generator: that is, the small incremental cost of disposal is added to the cost to the user of electricity generated by nuclear power.

In several other countries, such as Canada, Finland, the German Democratic Republic, Switzerland, Sweden, and the UK, radioactive waste disposal is the responsibility of the nuclear utilities. However, in each case, proposed disposal facilities must be reviewed and approved, or licensed, by the federal authorities. In yet other countries, the Federal Government has taken responsibility for all disposal activities.

Goals and requirements

In many countries represented at the symposium, federal law has specified dates by which disposal operations must begin. Some of these countries, such as Finland, Switzerland, and the USA, have specified steps to be taken in achieving these goals.

The IAEA has issued several guides for the disposal of radioactive wastes. These have been used as a basis for the development of criteria in many countries. It is

* International Symposium on the Siting, Design, and Construction of Underground Repositories for Radioactive Wastes, organized by the IAEA and held in Hanover, Federal Republic of Germany, from 3-7 March 1986.

This report was largely based on an overview presented at the symposium by R. Stein of the Office of Civilian Radioactive Waste Management, US Department of Energy, and on a summary report prepared by James Daglish, IAEA Division of Public Information.

The IAEA will publish the proceedings of the symposium in a few months. See the Keep abreast section for ordering information.

common practice that siting guidelines are developed to assist in site selection and in setting limits on potential radionuclide releases or on exposures from radioactive waste repositories which are reckoned to be acceptable.

However, Mr Stein acknowledged that in some countries criteria are still being developed: the USA has yet to establish a method for disposal of intermediate-level waste; Sweden has regulations and acceptance criteria for waste disposal under development; and Yugoslavia is studying issues related to regulatory requirements.

So, while much work has been done in establishing goals and requirements, more is needed — especially in the regulatory area. These requirements will be an important factor in the development of repository designs, and thus must be pursued vigorously.

Site selection

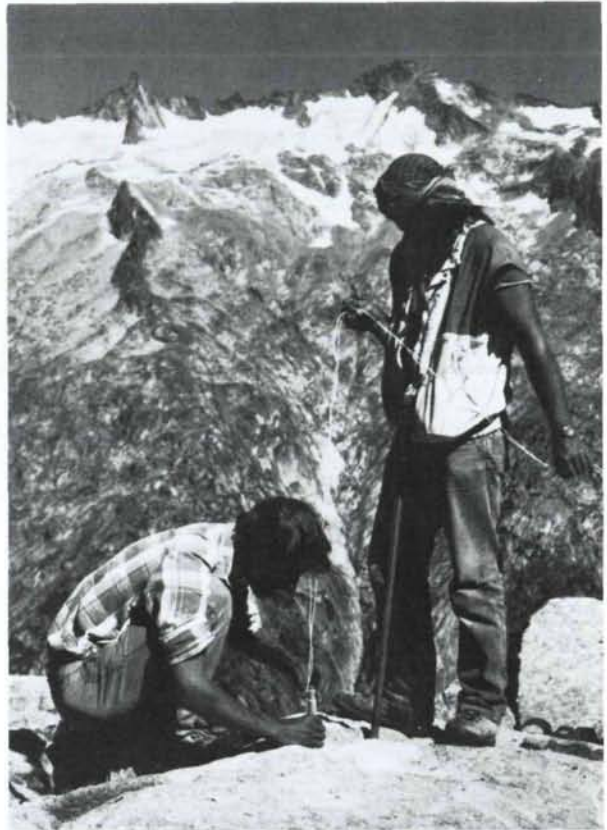
Extensive site screening efforts are under way in many countries. Some have advanced to the detailed characterization of sites intended for the construction of repositories.

Considerable efforts have focused on the immediate problem of disposal of low-level and intermediate-level wastes. For example, Belgium, Czechoslovakia, Finland, and India have selected a number of sites for detailed characterization; Switzerland and Yugoslavia have identified several sites for further screening; and Canada, Japan, and the UK have established the general environments considered suitable for low- and intermediate-level waste disposal. Selection of sites for low-level and intermediate-level waste disposal is therefore well advanced.

Significant progress has also been made in the selection of sites for high-level waste repositories. Most notably, the FRG has begun sinking shafts for the exploration and characterization of the Gorleben site. The USA is about to recommend sites for detailed characterization; shaft sinking is planned to begin in 1987. Finland has selected sites at which preliminary field studies will begin this year, and Belgium and Argentina have selected their sites for waste disposal.

Technology development

Although there are differences of detail, there is a consensus that isolation of wastes will be ensured by multiple barriers. There is also general agreement that disposal in underground repositories is to be preferred: Many countries have only recently made this important decision — for example, Yugoslavia, in relation to the disposal of low- and intermediate-level waste. The UK also has developed and assessed design concepts for the shallow burial of low- and intermediate-level wastes, and has concluded that there is no obstacle to this approach. In Finland, a study completed in 1985 showed the feasibility of high-level waste disposal in the Finnish bedrock.



Geological investigation in Switzerland. (Credit: Cédra informe)

The engineered or technological barriers to be used in waste repositories are being studied in many countries. For example, Argentina is studying the use of lead in waste canisters. Canada is evaluating several types of barrier; specifically, it is undertaking research into glass and glass-ceramic waste forms, the leachability of used fuel, and various container and backfill materials. In this field, considerable work also is being done in other countries.

Safety assessment and licensing

Thus far, there is little international experience in the licensing of radioactive waste repositories. Sweden has licensed an intermediate-level waste facility, and the German Democratic Republic its low-level waste facility. It is expected that an application will be submitted this year for a license to construct and operate the Konrad mine, in the FRG, as an intermediate-level waste repository. However, no application has yet been made for the actual operation of a high-level waste repository.

Assessing the safety of proposed facilities is, of course, an essential element in the licensing process. There has been extensive work in this area. However, there is still debate on several issues — for example, the question of how far models can be used to prove safety, and the application of probabilistic risk assessments to safety assessment.

"There is a great deal of work ahead of us in this area," said Mr Stein. "We must first achieve consensus amongst ourselves in the technical community on the appropriate approaches to safety assessment and its role in the licensing of repositories. Once the technical community agrees we are still faced with the task of assuring the members of the public communities that safety will indeed be maintained. I think you will all agree with me that this is no trivial task."

He concluded: "From my point of view, I am optimistic. I see strong progress everywhere. And of personal importance to me is to be able to describe to the public in the USA, with whom I often meet, this progress of my colleagues. I believe, in the end, this ability of all of us to describe the active work in progress, and success worldwide, on waste disposal will serve to generate confidence in the public and the political leaders that this technology will be ready to meet each nation's needs in accordance with individual timetables."

IAEA activities

The IAEA established a Technical Review Committee on Underground Disposal in 1978 to review and periodically guide the work of the Agency in this field and, in particular, to examine and make recommendations on its publications. The first phase of this integrated programme was completed with the publication of 24 documents in the Agency's Safety Series, and related technical reports, a majority of which dealt with the disposal of low- and intermediate level waste into shallow ground and rock cavities. In the second phase of the Agency's programme, which began in 1984, the emphasis is on the disposal of high-level waste in deep geological formations. The Agency is preparing technical guidance on engineering aspects of deep geological disposal, covering siting, design, construction, operation, shut-down, and closing of repositories. The Agency also is developing Safety Standards on international standards and criteria for underground disposal of high-level waste, a Code of Practice on underground disposal, and a number of other guides.

For additional reports on the subject of radioactive waste management, see articles in the *IAEA Bulletin*, Vol. 28, No. 1, Spring 1986.



Chernobyl briefing: Dr Boris Semenov, the Governor of the USSR on the IAEA Board of Governors, and Mr Oleg Khlestov, Ambassador of the Soviet Union to International Organizations in Vienna, brief reporters in Vienna. (Credit: Katholitzky)