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Editorial

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Editorial

At present Canada has approximately 1,500 tonnes of high-level nuclear wastes on hand, produced from the generation of electricity by nuclear power plants. Volumes of wastes presently are not large, but are growing. These wastes consist mostly of spent fuel rods from CANDU reactors, and they are located almost entirely in Ontario, where they are in temporary storage in water-filled bays at the reactor sites. The amount of irradiated fuel produced is approximately 130 tonnes per year per 1,000 megawatts of generated electric power (Aitken *et al.*, 1977). Canada's present installed electric power generating capacity from CANDU reactors is approximately 4,500 megawatts. In Ontario, nuclear power now makes up 20 per cent of the province's electrical generating capacity.

Canada, and especially Ontario, is placing heavy reliance on CANDU reactors for future supplies of electricity; CANDU plants under construction or planned indicate that total Canadian electric power generation by reactors may reach 21,000 megawatts by 1990. Estimates to the year 2000 suggest much larger amounts of nuclear power generation.

The long-term question of waste storage or ultimate disposal - which together constitute radioactive waste management - has not been solved. Indeed, expenditures and thus research efforts to date in arriving at waste management procedures have been miniscule when compared with expenditures on reactor development and on CANDU sales abroad. Responsibility for the management of radioactive wastes rests with Atomic Energy of Canada Ltd. (AECL), which is also the major proponent of nuclear power generation.

It is against this backdrop that the Department of Energy, Mines and Resources (EMR) commissioned a study, results of which are now available in a document commonly known as the 'Hare Report' after one of its authors, F. K. Hare (Aitken *et al.*, 1977). The time available to the three-man committee who produced the report was less than four months, far too little for a thorough review of the problem. Nevertheless the report has some good points: the spirit in which it was issued, to encourage discussion and comments from all interested individuals and groups, and conclusions on the urgency of the problem, on the need for a major commitment of people and money to research, and a call for a much more open approach by AECL and other government agencies toward the scientific community and the public at large. The report takes an optimistic view that the problem can be solved, providing there is an ongoing commitment to research and development.

Major geological conclusions of the Hare report are that there are good prospects for the safe, permanent disposal of reactor wastes and irradiated fuel; that underground disposal is most promising, with igneous rocks preferred; and that unforseen groundwater movement into a repository may result in radionuclide transport outward, but at rates slower than groundwater movement.

These are optimistic conclusions, but they are based on judgements rather than on hard facts. Not surprisingly these conclusions have been questioned by a number of groups appearing before the House of Commons Standing Committee on National Resources and Public Works (see references). Because the research has not been done, we do not *know* what the prospects for safe, permanent disposal are, no matter how optimistic we may be; nor do we know that plutonic igneous rocks represent the best underground repository option. What are the properties of these rocks at depths of about 1000 metres, considered as a suitable depth for mined repositories? Are fractures present, and if so, how extensive are they? How much water can pass through? What is the sorption capacity of fracture surfaces, or of igneous rocks in general? What is the thermal response of these rocks under sustained thermal loading at several hundred degrees Celsius? These questions also apply to other igneous rocks, salt or shale, all possible candidates as host rocks for repositories. They are challenging and exciting questions to try to answer, and they provide unique opportunities to achieve new understanding of natural geologic systems under a wide range of conditions. So often in the earth sciences we are looking backward to try to answer the queston "what happened?" in a natural rock-water system. With underground storage or disposal of hot radioactive wastes, the question becomes "what will happen?" - with the added complication

that the time interval involved is hundreds to tens of thousands of years, the time during which the wastes are hazardous. We face this question whether the political decision to reprocess wastes is taken or not, and whether new CANDU reactor developments proceed quickly, slowly or are postponed until the waste problem is dealt with. Reactor wastes are on hand now, and are increasing in volume yearly, with today's nuclear power generating capacity.

What to do next? It seems clear that we are at the 'evaluation of concept' stage, and far from the selection of an actual repository site or sites. Some of the furor at Madoc, Ontario last year resulted from confusion over just what was planned – what should have been planned, given the uncertainties noted above, was evaluation of a particular rock type (syenite), *not* repository site selection. Secrecy, combined with growing public opposition to nuclear power, appear to have fuelled the outraged public reaction at Madoc.

At present EMR advises AECL on the geological aspects of radioactive waste management, and together these agencies are expected to proceed toward solving the waste management problem. The disadvantages of this approach are that only government scientists are continuously involved, and the work is easily carried out in secrecy, and thus not subject to the checks and balances inherent in peer review by the scientific community. Indeed the agencies performing the research, or at least what has been accomplished under the very limited funding to date, are also advising on the research program and assessing its quality. The few people with demonstrated competence and first-hand experience in the field who are not AECL-EMR members are involved by chance if at all.

There are indications that a different approach is being considered in government radioactive waste management circles, an approach that is working well in Sweden, a nation also faced with the problem of selection and evaluation of sites for high-level waste disposal. This approach starts with the establishment of a technical advisory panel made up of people largely from industry and the universities. Such a panel can help ensure that the research is done, that it is well formulated, funded and reviewed by the scientific community, that all expertise both in and out of government is involved, and that the program is open to public scrutiny and assessment.

It is to be hoped that the forthcoming Canadian Geoscience Council Forum entitled "Disposal of High-Level Radioactive Waste: The Canadian Geoscience Program" to be held at the GSA-GAC-MAC meeting in Toronto in October will support such an approach. Nothing less than a high priority and first quality research on the radioactive waste management problem will do, given the nature of the problem and the public perception of it.

References

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