



## CPUBLIC SECTOR'S RESEARCH PROGRAMME ON SPENT FUEL MANAGEMENT IN FINLAND SUPPORTING THE AUTHORITIES

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### Abstract

A multiphase research program launched in 1989 to support Finnish authorities in their activities concerning spent fuel management is reviewed. The Finnish program for spent fuel management has so far managed to keep its original time schedule at least partly due to clearly defined responsibilities between the nuclear energy producing industry and the authorities. It appears that the public sector's research programme has been successful in its supporting role, because authorities have had good possibilities to adjust the emphasis and volume of the research programme from the very beginning.

### 1. CONTEXT

The Nuclear Energy Act and Decree provide a distinct framework for the implementation and research of nuclear waste management in Finland. According to the legislation, the producers of nuclear waste are responsible for all measures needed for the management of the waste, and for the arising costs. The authorities supervise nuclear waste management and issue regulations for this purpose. The objectives and timetables for the implementation of nuclear waste management as well as for the related research and planning are defined in a policy decision issued by the Council of State in 1983, see Table 1. Subsequently authorities have made decisions on the more detailed principles and requirements that power companies have to comply with in nuclear waste management. The Nuclear Energy Act was amended at the end of 1994 and it stipulates now that all radioactive wastes produced in Finland must be processed and disposed of in Finland.

TABLE 1. TIME SCHEDULE OF FINNISH SPENT NUCLEAR FUEL DISPOSAL.

Time period	Work	Comment
1983 - 1985	Screening research of areas covering the entire country	as planned
1986 - 1992	Preliminary site investigations	as planned
1993 - 2000	Detailed site investigations	as planned
2000	Selection of final disposal site	Decision-in-Principle process in progress
2000 - 2010	Investigation shaft and complementary investigations	planned
2010 - 2020	Construction of the encapsulation and final disposal facility	planned
2020	Beginning of final disposal	planned

There are three main actors in the Finnish nuclear waste management programme, each with different responsibilities. In order to fulfil the responsibility to take care of their spent nuclear fuel in Finland after the amended Nuclear Energy Act, the nuclear energy producing companies Teollisuuden Voima and Fortum (then Imatran Voima) formed a jointly owned company Posiva. The company started its operation in 1996, and its mission is to plan and implement the disposal of spent nuclear fuel generated in Finland. The overall leadership and control in nuclear energy matters in Finland belongs to the Ministry of Trade and Industry (KTM). The ministry prepares the relevant national legislation and international agreements as well as monitors compliance with them. Radiation and Nuclear Safety Authority (STUK) is responsible for the supervision of nuclear and radiation safety. STUK has prepared the national general safety requirements issued as the decision of the Council of State in March 1999. They cover the operational phase of the encapsulation and disposal facility as well as the post-closure safety of spent fuel disposal. The preparation of more detailed guidance on the assessment of long-term safety of the spent fuel repository is underway.

In May 1999 Posiva submitted its application for a Decision-in-Principle to establish a spent fuel disposal facility in Olkiluoto area in the Eurajoki municipality. The application was supported among other things by an Environmental Impact Assessment (EIA). The Nuclear Energy Act gives an absolute veto right for the proposed host community of the spent fuel repository, and also STUK must give a positive statement. Therefore, for a positive Decision-in-Principle three conditions must be fulfilled: (1) the statements by both the community and STUK are positive, (2) the Council of State supports the decision, and finally (3) the Parliament endorses the decision. The practical implementation of the spent fuel facility further requires that Posiva applies for a Construction licence from the Council of State, and Operation licence from the Council of State. Both applications must be backed by a detailed safety analysis. To insure that the financial liability is covered, the power companies must annually present cost estimates, based on their latest technical plans, for the future management of nuclear wastes, including decommissioning of NPPs. They are obliged to set aside annually an amount of money stipulated by KTM to the State Nuclear Waste Management Fund. For uncovered costs, the power companies must furnish securities. Currently, the existing liabilities are covered by the Fund, i.e. the Fund covers the future management of currently existing nuclear waste.

In their supervisory role, the authorities set safety requirements for nuclear waste management, assess the power companies' plans against the objectives and safety requirements set, evaluate the scope of annual research programmes of the power companies, and review the cost estimates drawn up by the power companies to ensure sufficient financial preparedness. In carrying out these quite demanding tasks the authorities need the support from an independent public sector's research programme on nuclear waste management.

## 2. SCOPE OF PUBLIC SECTOR'S RESEARCH PROGRAMME

The main objective of the Public Sector's Nuclear Waste Management Research Programme (JYT) has been to provide the authorities with expertise and research results relevant for the safety of nuclear waste management to support the various activities of the authorities. The main emphasis in this multidisciplinary research has been paid to the final disposal of spent fuel. The first phase of the research programme was conducted in 1989-1993 [1], the second phase in 1994-1996 [2], and the current third phase JYT2001 in 1997-2001.

The first phase of the research programme was traditional technology and natural science oriented research, but during the second phase sociopolitical and societal issues became also part of the programme. In the on-going third phase, these issues have become quite central themes. This is understandable, because the implementation of a technical plan to handle spent fuel requires that the plan is accepted also outside the circle of nuclear waste experts. Practical decision making about spent fuel management has proved to be difficult in many countries, at least partly because there are also other arguments involved than technological and scientific. The current research areas of the research programme are shown schematically in Fig. 1.

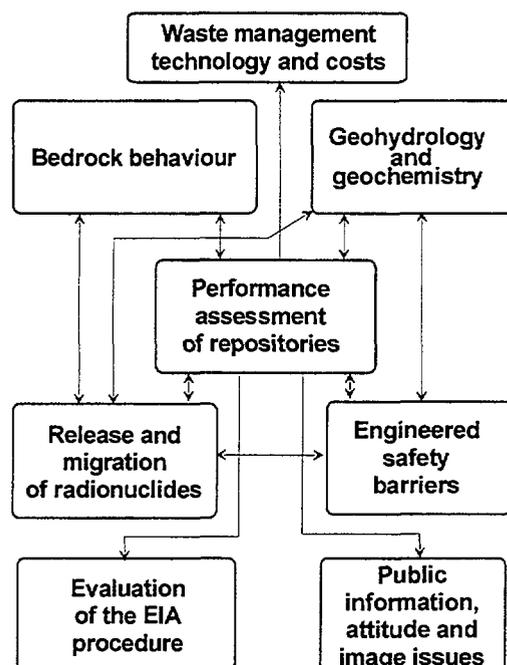


FIG. 1. The research areas of the third phase of the Public Sector's Nuclear Waste Management Research Programme (JYT2001).

Posiva's research programme has been essentially based on repeated safety assessments of the proposed disposal concept supported by site investigations and other safety related research. In contrast, because of the small amount of resources available in Finland, the public sector's research programme does not aim to do independent full-scale performance assessments of spent fuel repository. Rather, emphasis has been placed on studies to reduce uncertainties associated with the basic principles and main phenomena related to the geological disposal of spent fuel, and to be able to model these factors more accurately and reliably for safety assessment purposes. The second primary objective of public sector's research has been to develop and introduce new methods for research and analysis. Thus, Posiva can also benefit from the results obtained in the public sector's research programme.

As examples of the "idea incubator" role of the research programme, we give two different topics from the 'Release and migration of radionuclides' block in Fig. 1. The natural analogue studies at the Palmottu U deposit in southern Finland were in the beginning purely domestic in situ migration research. Later, Palmottu became a major EU Project, and is being concluded in 1999 (see [3]). Another example is the development of a non-destructive method to characterise rock matrix in terms of diffusion properties [4]. This He-gas based method was started as a pre-study in the public sector's research programme.

In the 'Waste management technology and cost' block shown in Fig. 1, the public sector's research programme has an important role in providing expertise to give annual statements to KTM concerning the adequacy of the funds collected to the State Nuclear Waste Management Fund. Furthermore, in the Environmental Impact Assessment (EIA) procedure pertinent projects of the public sector's research programme provided substantial support to KTM in the follow-up of the EIA procedure. Furthermore, the projects gave statements on the substance of the EIA report by Posiva. Especially during the third phase of the public sector's research programme (JYT2001) state-of-the-art reviews of selected topics have been encouraged by the authorities. The last major reviews covered bedrock stability [5] and the prospects of coupled modelling [6].

### 3. CONTROL OF THE PROGRAMME

The public sector's research programme has been organised so as to be of maximal use to the authorities. There is a Steering Group with representatives from independent expert organisations, and the authorities. The Steering Group reviews the submitted project proposals on annual basis and makes recommendations concerning the prioritisation of research topics and their respective funding. The research projects are divided into two Co-operation Groups: one for technological and natural science projects (topmost 6 blocks in Fig. 1) and the other for sociopolitical and social science projects (lowermost 2 blocks in Fig. 1). STUK has special contact persons for each research project in the technological and natural science projects' Co-operation Group. It can thus be seen that the authorities in general, and STUK in particular, have good control also of the substance of the research. In the second Co-operation Group, besides authorities and other experts, the representatives of the candidate site communities (four candidates during the detailed site investigation phase) have been able to express their views on the emphasis of the research.

### 4. CONCLUSIONS

The Finnish spent nuclear fuel disposal plan has so far managed to keep the time schedule set as early as in 1983. The reasons to this are the clearly defined division of responsibilities between the main actors in the field, and an obvious commitment to keep the time schedule set. Furthermore, the importance of active dialogue between the implementer and the local public as well as between the authorities and the community representatives has been recognised already in the beginning of the site selection process. In this overall context the role of the Public Sector's Nuclear Waste Management Programme, started in 1989, has been to support authorities in their work.

### References

- [1] Vuori, S. (ed.) Publicly financed nuclear waste management research programme. Annual reports 1990, 1991, 1993. (Ministry of Trade and Industry, Energy Department Reviews B:101, B:121, B147.)
- [2] Vuori, S. (ed.) 1997. Publicly administrated nuclear waste management research programme 1994-1996. Final report. 204 p. (Ministry of Trade and Industry Finland, Studies and reports 22/1997.)
- [3] Blomqvist, R., Kaija, J., Lampinen, P., Paananen, M., Ruskeeniemi, T., Korkealaakso, J., Pitkänen, P., Ludvigson, J.-E., Smellie, J., Koskinen, L., Floria, E., Turrero, M.J., Galarza, G., Jakobsson, K., Laaksoharju, M., Casanova, J., Grundfelt, B. & Hernan, P., 1998. The Palmottu natural analogue project – Phase I: Hydrogeological evaluation of the site. 98 p + 1 Appendix (European Commission, nuclear science and technology series EUR 18202.)
- [4] Väätäinen, K., Timonen, J. & Hautojärvi, A. 1993. Development of a gas method for migration studies in fractured and porous media. In: Interrante, C.G. & Pabalan, R.T. (eds.) Scientific Basis for Nuclear Waste Management XVI. Pittsburgh PA: Materials Research Society, Pp. 851-856. (Mat. Res. Soc. Symp. Proc. Vol. 294.)
- [5] Kuivamäki, A., Vuorela, P. & Paananen, M. 1999. Indications of post-glacial and recent bedrock movements in Finland and Russian Karelia. Geological Survey of Finland, Nuclear Waste Disposal Research, 92 p. + 5 app. (Report YST-99.)
- [6] Rasilainen, K., Luukkonen, A., Niemi, A., Olin, M. & Pöllä, J. 1999. The feasibility of modelling coupled processes in safety analysis of spent nuclear fuel disposal, 83 p. + app. 4 p. (VTT Research Notes 1973)