

Role of the host communities in final disposal of spent nuclear fuel in Finland and Sweden

Mika Kari^{a,*}, Matti Kojo^a, Markku Lehtonen^b

^a Tampere University, Faculty of Management and Business, P.O. Box 1001, FI-33014 Tampere University, Finland

^b Universitat Pompeu Fabra, Ramon Trias Fargas, 25-27, 08005, Barcelona, Spain

ARTICLE INFO

Keywords:

Final disposal
Spent nuclear fuel
Nuclear waste
Partnership
Communities
Municipalities
Finland
Sweden

ABSTRACT

Finland and Sweden are the countries with the most advanced plans for final disposal of spent nuclear fuel (SNF). Both countries have also been evoked as good examples in the use of a 'partnering' approach, designed to achieve both a licensable site supported by the community and a balance between fair representation and competent participation. While both are consensus-driven high-trust societies, with similar technological concept for SNF disposal, and whose licensing processes have advanced at a fairly similar pace, their nuclear waste policies also differ from each other in certain key aspects. One difference concerns the role of the communities in siting and licensing of the repositories. The paper examines 1) the background for this differentiation, 2) how local final disposal organizations in the host communities, Eurajoki and Östhammar, took shape and evolved, and 3) how differences between the organizations illustrate the divergence between the Finnish and Swedish approaches to stakeholder engagement. While the Swedish approach can be characterized as 'involved partnership' – which shapes the operating environment for the implementer and authorities by challenging and even modifying policies and actions – the Finnish case could be described as a 'bystander partnership' characterized by trust in safety authorities, with community economics as the primary concern.

1. Introduction

Top-down, non-consultative 'Decide Announce and Defend (DAD)' siting approaches seeking to impose radioactive waste facilities on communities failed and were rejected by especially local publics in various countries during the 1980s and 1990s (Blowers and Sundqvist, 2010). These failures led for example the OECD's Nuclear Energy Agency (NEA) to conclude that, to enable decision-making regarding nuclear waste management (NWM), changes in the decision-making environment and in public perceptions required approaches entailing thorough public examination and stakeholder involvement. Moreover, practitioners acknowledged that their own role in the process as well as problem definitions had evolved. (NEA 2004.) As technocratic management was deemed counterproductive, it gave way to more communicative and participative governance, as part of the subsequent 'participatory turn'. However, the new approach did not simply replace the old one, but instead created hybrid systems, reshaped actor relationships and modified the boundaries and levels of participation

(Bergmans et al., 2008).

The NEA (2010) has advocated the partnership approach as an effective way of achieving fair representation, competent participation, and community support to ensure a licensable site. It has argued that key elements of the partnership approach have been incorporated by most OECD countries and increasingly also worldwide. According to the NEA (2010), the key components of a partnership approach are: voluntarism, formal or informal right of veto by the affected community, collaboration with local stakeholders, and the provision of community benefits packages, thus placing local community firmly at the center of the siting process. Both Finland (NEA, 2004; NEA, 2010) and Sweden (NEA, 2010) have been considered as examples of countries where partnering has been implemented.

Finland and Sweden are global forerunners as the countries with the most advanced plans for final disposal of spent nuclear fuel (SNF). In Finland, the repository is already under construction, as the government issued the construction license in 2015. Moreover, the nuclear power company, Fennovoima, launched a site selection process for its possible

* Corresponding author.

E-mail addresses: mika.kari@tuni.fi (M. Kari), matti.kojo@tuni.fi (M. Kojo), markku.lehtonen@upf.edu (M. Lehtonen).

own repository in 2016 (Vilhunen et al., 2019). In Sweden, the main public hearings as part of the construction license process¹ took place in 2017 and 2018. The nuclear waste management company, SKB, submitted additional documentation required by the Land and Environment Court in 2019, and in October 2020 the local municipal council gave its approval to the siting of the repository. The government decision is still pending. Thus, in both countries the host municipalities have expressed their approval for the repository, and have chosen not to exercise their right of veto.

In view of the experience in these two Nordic countries, partnership arguably appears as rather successful, despite some criticism (Johansson, 2008; Hokkanen, 2007). The Swedish National Council for Nuclear Waste (SOU, 2004; cf. SOU, 2014) has also stressed the role of the municipalities as one of the three main actors in final disposal, along with the state and the industry. The municipal right of self-determination concerning the siting of industries and land use in these countries means that the opinion of the municipalities is decisive in siting decisions. Furthermore, already in 1994, Lidskog (1994) suggested that the municipality – interconnecting the civil society, the state and the economy – can become central actor in waste management. In Finland, the right of veto held by the host community has been seen as a success factor, but municipalities are not seen – neither in discourse nor in policy practice – as active players in NWM (Varjoranta and Paltemaa, 2015).

The purpose of this paper is to compare the role of the local communities as actors in SNF management by examining the repository projects in Eurajoki and Östhammar, the hosts for the final disposal of SNF in Finland and Sweden. A comparative approach is fruitful because although the social and political structures in both Sweden and Finland follow a Nordic welfare society model, partnerships have been pursued and nurtured in distinct ways in these two countries (Litmanen et al., 2017). Focus on long-term changes, in turn, helps to describe and partly explain successive changes in the municipal approaches. Moreover, highlighting the differences helps to better understand the smooth advancement of these SNF disposal projects. The aim is to contribute to scholarship on partnerships in the field of radioactive waste management, particularly to the understanding of the evolving role and activities of host municipalities.

The structure of the article is as follows: Section 2 focuses on the development of the partnership approach internationally. Section 3 describes data and research methods. Section 4 describes the siting strategies and Section 5 the institutional arrangements of partnership in Finland and Sweden, so as to provide a background for the two case studies analyzed in Section 6. Section 7 concludes that the Swedish case can be characterized as an ‘involved partnership’, whereas the Finnish case represents a ‘bystander partnership’.

2. Practices of partnership

In the late 1990s it was becoming clear to the NWM community that the hitherto largely neglected societal dimension of waste management warranted increasing attention, especially in view of the difficulties encountered. The NEA set up the Forum on Stakeholder Confidence (FSC) in 2000 to address the issues in the area of public participation and stakeholder confidence. Recounting its key findings in 2004, FSC reported that stakeholder involvement had become central and that the general trend towards a more participatory democracy² required more dialogue also in NWM. In particular, local development and the needs

and views of the affected communities should be taken into account to achieve a licensable site with community support (Kari, 2020). Partnership approaches, especially in Belgium but also in Finland and Canada, were highlighted as good examples and an effective means of balancing between fair representation and competent participation (Bergmans et al., 2008; NEA, 2010). Also the UK Committee on Radioactive Waste Management (CoRWM) and the European Commission funded COWAM2 research project advocated local partnership in 2006 as a model for NWM (NEA, 2010; NDA, 2007). More recently, also the UK Policy Paper (UK Government, 2018) and the Final Report of RESET (Reset Steering Committee, 2018) have emphasized the need for partnerships.³

Originally, the ‘partnership approach’ for NWM was developed as a methodology that would allow the Belgian radioactive waste agency ONDRAF/NIRAS and a potential host community for low-level radioactive waste to engage in negotiations with each other. Social acceptance had become a prerequisite for the feasibility of a disposal solution, as public opposition and governmental decisions had compelled ONDRAF/NIRAS to change its NWM strategy and adopt a voluntary siting process. Behind the approach was idea of collective decision-making in democracy as negotiation – and that stakeholders themselves, rather than NWM experts and authorities, should have the opportunity to define their own interests. Involving different parties in the decision-making process was considered as the best way of taking the interests of all parties into account (Bergmans et al., 2006). Bergmans (2008) has defined the partnership approach as a “semi-voluntary approach to identify a suitable site, based on site-specific repository design and local participation in decision-making through the joint development of an integrated repository project”, and highlighted certain key features characterising the approach: availability of resources and time, relative independence of a local partnership, co-design and co-ownership, and stepwise decision-making.

The FSC, in turn, employed partnering as an umbrella term for certain types of engagement practices. Based on an analysis of the evolution and practices of partnering in 13 countries, the NEA (2010) outlined the partnership approach as a collaborative working relationship between the implementer and the affected communities, while other institutions could also play a role. Partnership was seen to support active involvement and joint problem solving, instead of passive acceptance, and redistribute power through negotiation, empowering the local community. A partnership would provide continuity and a non-adversarial manner to address arising issues, and could emit a credible judgment and deflate tensions. While the NEA concluded that the composition, intensity and formality of partnerships could vary greatly, it nevertheless identified certain main components. These included voluntarism, the right of veto, collaboration in facility design and implementation, and benefit packages. Typically, partnership arrangements also included conditions for continued participation and measures for empowerment of local communities (NEA, 2010.). Later, the NEA (2013) further elaborated its definition of the partnership approach, describing it as “a formal or informal arrangement between the radioactive waste management implementer and representatives of the local community to work together to assess technical and socio-economic issues”, and noted that the regulator can be part of the partnership or is usually at least aware of it, due to partnership-related requests (e.g. for regulator’s briefings for community).

Initially, partnerships were envisaged as a means to promote participation and trust, after an era dominated by top-down approaches. Early partnerships were essentially local information and/or monitoring committees, and local liaison committees typically with little influence

¹ Sweden has two track licensing process where one application is submitted under the Nuclear activities act and another under the Environmental code (Litmanen et al., 2017).

² The evolving conditions and criteria for the perceived legitimacy of public policies placed participatory decision-making higher on the political agenda in the OECD but also in other parts of the world (NEA, 2004).

³ The so-called Social licence to operate (SLO) represents another increasingly popular tool for companies to manage their relations with the local communities. While seldom applied in the nuclear sector, SLO nevertheless appears in the IAEA Nuclear Communicator’s Toolbox. (Lehtonen et al., 2020).

on the decisions. Later, the NEA (2010) concluded, however, that at the level of partnership, power should be reapportioned through negotiations and the parties involved should “agree to share planning and decision-making responsibilities through such structures as joint policy boards, planning committees and mechanisms for resolving impasses”. The shift from informing to partnering, from token involvement to influence, has been paralleled by other shifts: the communities’ role shifted from passive to active, from resigned acceptance to collaboration and voluntary involvement; the need for, and legitimacy of, community empowerment measures and socio-economic benefits has been increasingly recognized; and the new frames for collaboration emphasize mutual learning, added value and sustainable development (NEA, 2010). The NEA considers that “[c]o-framing the issues for consultation, evaluation or decision helps to achieve quality and legitimacy, especially in contentious situations” (NEA, 2015). A partnership enables pertinent issues and concerns to be raised and addressed, fosters understanding and learning, and helps produce added value to community (NEA, 2010; NEA, 2013).

3. Methods and data

The analysis adopts a comparative case study approach with special attention to changes over time. The cases of Eurajoki and Östhammar were selected for analysis, because of the forerunner role of Finland and Sweden in final disposal of SNF.

Our comparative analysis draws on diverse types of data, mainly produced by the municipal authorities. By analysing documents published by the municipal authorities, we were able to trace the development of the municipal approach in the two cases. Also previous research regarding the topic was consulted. Moreover, our case study approach is tailored to analyzing both the national context (i.e. institutional arrangements and site selection strategies) and the local level municipal approaches and practices. The thorough descriptions of the cases are characterized by a holistic and process-oriented focus in Section 6. As often in case studies, the boundary between the case and the context is blurred, as the case is not only shaped but its context, but constantly shapes this very context (Laine et al., 2007). For example, the activities of the host municipalities have influenced the site selection strategies and institutional arrangements.

For Eurajoki, the material consisted of relevant municipal documentation and the minutes of three liaison committees. (1) The liaison committee between Eurajoki municipality and the nuclear utility Teollisuuden Voima (TVO), established already in the late 1970s. The main task of the committee was to offer an arena for discussing practical questions related to the activities of shared interest to both parties. (2) A more focused, joint committee between TVO and Eurajoki was established towards the end of the 1980s, when the preliminary site characterizations began. It served as an arena for discussion and information exchange on issues related to bedrock investigations. In the late 1990s, issues related to the Environmental Impact Assessment (EIA) of the repository project were also discussed. Later, Posiva replaced TVO on this committee. (3) The Vuojoki working party, established in 1998, dedicated to discussion on further cooperation between Eurajoki and Posiva (Kojo, 2009; NEA, 2010). In 2013, the separate liaison committees between Eurajoki and TVO and Eurajoki and Posiva were merged. Unfortunately, despite repeated requests, TVO did not provide us with copies of the minutes of this new group. This data gap was filled by examining the minutes of the municipal board meetings and by interviewing, in June 2018, the local government chairperson who was also a member of the liaison committee.

In the case of Östhammar, the source material consisted of the annual activity reports of the municipality’s final disposal organization, from 1997 to 2018. We analyzed the reports from (1) the Reference group (Referensgruppen) 1997–2003, (2) the Preparatory and Reference group (Beredningsgruppen, Referensgruppen) 2004–2005, (3) the municipality’s work on SKB’s site investigation 2006, (4) the Final disposal project

(Slutförvarsprojekt) 2007–2009, (5) the Review organization (Granskningsorganisation) 2010–2013 and (6) the Final disposal organization (Slutförvarsorganisation) 2014–2018. In addition, reports produced by the SKB and the Swedish Government Inquiries series (Statens offentliga utredningar, SOU) reports, were consulted.

4. Flexible site selection strategies

4.1. Sweden – voluntarism as a principle

Repository siting in Sweden started with a systematic geo-scientific research program at the beginning of the 1980s. Escalating protests and opposition forced SKB to discontinue the test drillings in 1985 (SOU, 2007; Elam et al., 2010).

As Elam and Sundqvist (2007) have documented, after the suspension of field studies, SKB postulated in 1986 that besides geology also “other factors of importance to society can be weighed in”. In 1989, SKB declared that other factors could be “accorded greater importance in the siting”, and finally in 1992 concluded that the selection of candidate sites should at the first stage not be based on geological considerations at all, but on pre-studies in municipalities that express “an interest” (Elam and Sundqvist, 2007; SKB 1986; SKB 1989; SKB 1992). Hence, at the end of 1992, SKB was ready to turn the tables on the opposition, by sending a letter to every municipality in the country, inviting volunteers for feasibility studies (Elam and Sundqvist, 2007; SOU 2007).

SKB’s decision changed municipalities’ standing in the process. In this new situation, both the implementer and the municipality were strategic actors negotiating their interests (Sundqvist, 2002). The municipality had an opportunity to voice its interests, give its input to the process and stood to gain prosperity, while the implementer surrendered some control over the process but gained legitimacy for its aspirations and a chance to conduct investigations (cf. Elam and Sundqvist, 2007). However, the opportunity interested only a few remote municipalities (Vedung and Olofson, 1997) and SKB again had to come up with a back-up plan.

At the same time, siting of the central temporary storage facility for long-lived radioactive waste (CLAB) in Oskarshamn and of the repository for short-lived radioactive waste (SFR) in Östhammar had not posed any significant problems. SKB therefore considered that “[o]pportunities in municipalities that already have nuclear activity should also be explored [translation by the authors]” (SKB, 1994) and that “it is of interest to conduct feasibility studies in municipalities with existing nuclear activities” (SKB, 1995). The nuclear communities considered as the most promising were informed of SKB’s interest, confirmed via a letter in May 1995. As a result of a series of disappointments, SKB found itself at the negotiation table with experienced community stakeholders that now saw “a strategic opportunity to re-negotiate their established relationship with SKB” (Elam and Sundqvist, 2007). Thanks to the change in its siting strategy, SKB was able, finally, to carry out feasibility studies in eight municipalities in 1992–2000. Oskarshamn and Östhammar, the hosts of CLAB and SFR, agreed to participate in site investigations, which started in 2002 (Sundqvist, 2002). SKB announced Östhammar as the host community for the repository in 2009.

4.2. Finland – a semi-voluntary approach

In Finland, the state-owned Imatran Voima (IVO) transported the SNF produced by its two nuclear reactors to the Soviet Union and Russia until 1996. The privately owned TVO, in turn, began to consider direct disposal of SNF in Finland once it turned out that international reprocessing or final disposal options were not readily and cost effectively available. A working group set up by the Ministry of Trade and Industry concluded that if an international contract could not be achieved by 1983, investigations for a domestic option should be started. After having screened geology in the entire country (excluding the Åland Islands) in 1983–1985, TVO submitted to the authorities a list of 102

potential areas. While others were selected via a systematic elimination process, Olkiluoto in Eurajoki, as the host of TVO's nuclear power plant (NPP), was added to the list based on a separate review. After initial screening by the authorities, the number of areas was reduced to 85. TVO informed in writing all municipalities hosting potential areas and proposed discussions on potential bedrock investigations (Kojo, 2009, 166–170; Nikula et al., 2012, 140–149.).

The initial idea was that TVO would choose 5–10 areas for preliminary site characterization by the end of 1985. However, at the end of 1985, the Ministry of Trade and Industry requested an overall assessment of the investigation areas and required the company to report all research data. TVO provided the required information on all 102 areas in December 1985, and the information was then reviewed by STUK (Nikula et al., 2012, 147–148.). According to Nikula et al. (2012, 147), the Ministry ordered TVO to choose the investigation sites one by one. This is what the company did in 1986, when it announced the first site, in the municipality of Ikaalinen. However, because of local resistance and media attention spurred by the Chernobyl accident, the investigations stopped before having even properly started. Formally, TVO needed the permission of the landowner only for the site investigations, but after the failure, the company realized that local political support was needed. According to Nikula et al. (2012, 149–150), the municipality's favorable stance influenced TVO's decisions, alongside landownership and geological conditions. TVO wanted to initiate discussions with the municipalities, but did not request their formal consent for investigations. Therefore, although the proposed municipality has a right of veto in the Decision-in-Principle phase, the strategy can be called semi-voluntary, as compared to the Swedish practice of asking municipalities to volunteer for site investigation.

Wiser from the experience gained in Ikaalinen, TVO named five sites for preliminary site characterization in April 1987. In 1993, after eliminating two of the sites because of geological uncertainties, it started detailed site characterizations at three sites (Nikula et al., 2012, 150–153). Additionally, after the amendment of the Finnish Nuclear Energy Act in 1994, which banned the export and import of nuclear waste and put an end to IVO's SNF transports to Russia, also Loviisa, the host community of IVO's NPP, was brought in to the siting process as a special case, in a similar manner as Eurajoki had entered in the 'race' earlier. The detailed site investigations began in Loviisa in 1997 (Posiva, 1999).

In 1999 Posiva concluded that the main differences between the sites arose from the fact that, as nuclear communities, Eurajoki and Loviisa would be more willing and prepared than the other two candidates to host final disposal facility. Final disposal would induce less fear and anxiety, there would be less image problems and the majority of the residents would be willing to accept the facility. The residents had a more positive attitude towards final disposal on the whole, and the facility would generate less commotion, as nuclear operations were already important for these communities (Posiva, 1999) (See Table 1).

5. Institutional arrangements of the partnership approaches

5.1. Sweden – resources for municipalities' own review and information activities

The institutional arrangements of Swedish partnership approach, influenced in many ways by the activities of the Oskarshamn municipality, had five characteristics relevant for our analysis. First, the municipalities can apply for funding from nuclear waste fund to review SKB's work and inform citizens. The financing act was amended in 1995. Second, the municipality has a veto right. The Minister of the Environment has assured that the government will not consider overruling the municipal veto, and that the veto right would not be forfeited by allowing SKB to conduct investigations. Third, a National Coordinator on Nuclear Waste was appointed to coordinate information, contacts between the various actors, and efforts of the concerned municipalities.

Table 1
Comparison of siting approaches between Finland and Sweden.

	Finland	Sweden
Main government decisions on geological disposal of SNF	1983 Decision on objectives and timetable of NWM; 1994 Amendment of the Finnish Nuclear Energy Act bans the export and import of nuclear waste and terminates IVO's SNF transports to Russia 2000 Decision-in-Principle (DiP) on final geological disposal 2015 Construction license	1977 The Stipulation Act sets the demonstration of an 'absolutely safe' reprocessing or final disposal method as a precondition for any new NPP licenses 1984 The Nuclear Activities Act 1988 The Radiation Protection Act 1995 Amendment of Financing Act establishes Nuclear Waste Fund 1998 The Environmental Code
Main changes in the site selection strategy	First, a systematic geo-scientific research program; since the early 1990s move towards a more 'pragmatic' strategy	First, a systematic geo-scientific research program; since 1992, voluntarism as the key principle
Main site selection stages	1983–1985 Screening study of the entire Finland (excl. Åland Islands) 1987–1992 Preliminary site characterization 1993–2000 Detailed site characterizations 1999 Posiva announces the site	1977–1985 Typological surveys 1985 Discontinuation of the test drillings 1992–2000 Feasibility studies 2002–2008 Site investigations 2009 SKB announces the site
Voluntary enrollment in site investigations	No, formal consent from municipalities for investigations was not sought, but informal political negotiations took place	Yes, SKB sent an invitation to participate to every municipality in 1992
Local veto right on siting of the repository	Yes, formal municipal approval needed before the government can issue a Decision-in-Principle	Yes, formal municipal approval needed before the government can grant permissibility
Funding for municipalities for review and communication activities	No	Yes, from the Nuclear Waste Fund since 1996
Community benefit measures for the host municipality	Higher rate of property tax on nuclear facilities; Vuojoki Agreement between Eurajoki, TVO and Posiva	Agreement on an 'Added Value Program' between Oskarshamn, Östhammar and nuclear utilities
Local approval	2000 Eurajoki accepts on the condition that only SNF produced in Finland would be disposed of in the facility	2020 Östhammar gives its approval to the repository

Fourth, the importance of environmental legislation was enhanced and the status of the EIA groups was made official. The regional government, together with SKB, was to organize consultations between all the major parties. The county-led EIA groups included representatives from the candidate communities, SKB, the regulatory authorities and the aforementioned national coordinator (Elam and Sundqvist, 2007; Sundqvist, 2002.). From this improved position communities were able to impose far-reaching demands on SKB (cf. SOU, 1999), which leads to our fifth point: Östhammar and Oskarshamn could demand compensations and influence their allocation. The two municipalities announced that they would reject the final repository unless some form of compensation would be offered also to the municipality that would lose the 'race' for the repository. The agreement on the Added Value Programme, with a total value of EUR 160–216 million, guaranteeing that the 'loser' would

receive the majority (75%) of the compensation, was concluded between SKB and the municipalities in 2009 (Frostenson, 2010).

5.2. Finland – veto right on site selection and tax revenue as an economic incentive

The institutional cornerstone of the Finnish partnership approach is the veto right that the Nuclear Energy Act of 1987 guarantees for the proposed host municipality. The increased property tax on nuclear facilities constitutes a significant economic incentive. Unlike in Sweden, the Finnish municipalities have not been particularly eager to build their own competence concerning final disposal of SNF in general and on repository safety in particular, although safety has been the top concern of the residents (Kari et al., 2010). Knowledge management and evaluation were raised as an issue in Finland, but the candidate municipalities did not implement concrete measures to improve awareness and local decision-making. However, in the late 1990s the municipality of Loviisa requested that municipalities be provided funding to enable them to review Posiva’s plans. No funding was granted, but the representatives of the four candidate municipalities were invited to the co-operation group for the social science studies under the Public Sector’s Research Program on Nuclear Waste Management JYT2001 (see Rasilainen, 2002).

Alongside the absence of funding for the municipalities to conduct independent reviews and assessments, three other reasons for the weak interest of the municipalities in competence-building can be identified. First, NWM has been perceived as a “purely technical” issue, leaving little room for consideration of social aspects. Second, public trust in the Finnish Radiation and Safety Authority (STUK) has been exceptionally high (Kari et al., 2010; Vilhunen et al., 2019). Third, safety issues were excluded from the EIA process, which was the main forum for public discussion and participation during the site selection process in the late 1990s (Posiva, 1999). Although local opposing groups raised some concerns and introduced alternative technical concepts (Rosenberg, 1999), the safety issue was depoliticized at the local level, and the task of reviewing Posiva’s safety assessment was delegated to STUK.

6. Municipality approaches to final disposal in Eurajoki and Östhammar

6.1. Östhammar, Sweden

6.1.1. Preliminary study and site investigation phases

In Östhammar, competence building started in 1995 with a modest and straightforward organization (see Fig. 1).

The Reference group, comprised of representatives of all political parties in the municipal council, was established in order to follow, review and assess SKB’s preliminary study, to provide information to citizens, and to receive and further disseminate information from citizens. To assist the Reference group, consisting seven members and a secretary, a working group of four civil servants was formed. The Reference group participated in various study visits and seminars and

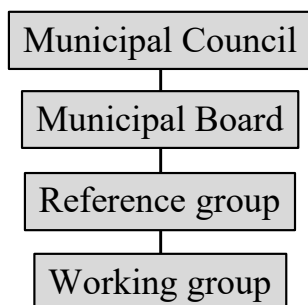


Fig. 1. Organization during the preliminary study phase.

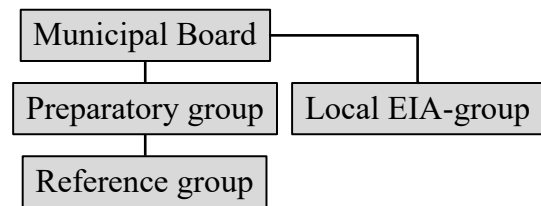


Fig. 2. Organization during most of the site investigation phase.

commissioned a regional university to review SKB’s work. The Reference group also participated in the county-led EIA-group. The Reference group’s work resulted in a number of questions and proposals for additions and corrections, which were included, together with SKB’s responses, in the end report of Östhammar’s preliminary study, in 2000 (SKB, 2000). Once SKB had supplemented its research accordingly, the municipality agreed to the site investigations on certain conditions. In the contract with SKB, the municipality stipulated e.g. unlimited access to investigation results, demanded to be kept up to date about the progress of the investigation, and required that Reference group’s ideas and views had to be given due attention. The municipality also demanded that the investigations be summarised, and progress information submitted to the local residents in an understandable fashion (Elam and Sundqvist 2007.).

The new extended final disposal organization operated directly under the municipal board, as it was considered essential to keep the board well informed at this stage (see Fig. 2).

The former Reference group was renamed as the Preparatory group and complemented by a representative from the neighboring municipality of Tierp. The new Reference group, reporting to the Preparatory group (in advisory capacity), consisted of representatives of all political parties in the municipal council, local NGOs, and from the neighboring municipalities, Tierp and Älvkarleby (two from each municipality). A local EIA-group was created, in particular to follow SKB’s EIA work. The task of the Preparatory and Reference groups was to disseminate information on the possible impacts of final disposal on citizens and the environment, monitor developments from municipality’s point of view and, on the municipal board’s discretion, review and assess reports submitted.

In 2006, the municipality estimated that the need for information and dialogue would increase as the siting decision would draw closer, and the organization was amended again (see Fig. 3).

The main purpose of the Preparatory and Reference groups was defined as ensuring that the municipality’s representatives receive sufficient training and knowledge concerning the work of the SKB and the authorities. The Reference group would also serve as a link to the public.

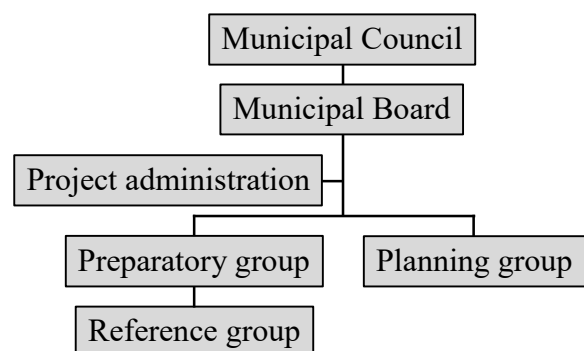


Fig. 3. Organization during the latter part of the site investigation phase.

The local EIA group was renamed as the Planning group, in order to highlight the planning that lay ahead, and to enable early intervention on matters affecting the municipality.

In addition to reviewing and commenting increasing amount of reports (e.g. using specially appointed working groups) and attending EIA consultations, the municipality participated in various seminars, projects and other competence-building activities. Östhammar also still counted on help from the regional university and experts to review SKB's work (Nyberg, 2011). While the municipality communicated directly with SKB and authorities (Nyberg, 2011), also the EIA consultations resulted in a number of questions, which were reported together with SKB's responses (SKB, 2016). Local NGOs were given some financial support, and the municipality discussed final disposal in its own information newspaper and in a regular newsletter. Towards the end of 2003, Östhammar and Oskarshamn started regular cooperation designed to rationalize the use of resources and to deliberate on common issues. This led to the 2008 cooperation agreement, resulting in an agreement concerning the Added Value Program (Frostenson, 2010).

6.1.2. The site selection and onwards

To ensure high-quality information and decision-making on SKB's construction license applications, the local final disposal organization was once again revised in 2009 (see Fig. 4).

Under the municipal board, and the new municipal board's working group for final disposal, the organization was divided into three parts. Two corresponded to the applications required under the two distinct legislations governing the licensing process, i.e. the Safety group and the EIA group, whereas the third consisted of the Reference group and its working group. The Safety and EIA groups were to review SKB's research plans and reports and the work of the authorities, with a view to preparing questions, statements and proposals. The Reference group was to stay informed regarding the final disposal plans, inform and maintain dialogue with the public, and, together with the other groups, to maintain dialogue with the municipal council and to ensure adequate training and knowledge for the municipal representatives.

Both the Safety and EIA group had 11 members, whereas the Reference group grew to 27 members, with the addition of members from neighboring municipalities, including Åland Islands (from Finland), and of the chairpersons and vice-chairpersons of the Safety and EIA groups. The chairperson of the Reference group chaired also the five-member working group. Later, in 2016, in anticipation of the approaching licensing decision, all members of the municipal council were incorporated into the Reference group.

Expecting that the need for information and dialogue would increase once SKB would submit its construction license applications, the municipality significantly strengthened its ability to understand, form opinions and inform the public about the applications. The organization

would review and revise SKB's RD&D reports, the preliminary EIA report, as well as the actual applications and their amendments. It would also monitor the work and opinions of the authorities and other stakeholders e.g. by reviewing the nuclear safety authority's (SSM) technical notes and preliminary reviews and by following the completion round initiated by the Land and Environmental Court, as well as SKB's responses in the process.

The final disposal organization continued to organize study visits, workshops, seminars and conferences, but also consultations with SKB. The organization employed its own consultants, networked with other communities (e.g. by initiating the European Local Network of Radioactive Waste Dialogue, ENWD), followed international research programs and participated in international reviews and discussions. The organization had its representatives at the SKB's copper corrosion reference group and in the roundtable discussions of the National Council for Nuclear Waste. On several occasions, the municipal board requested discussions with SKB and SSM.

The several capacity building initiatives included regular updates and thematic training days. In 2011–2013, a series of intensive internal education, ranging from chemistry and thermodynamics to environmental ethics, took place. Around the same time, the municipality conducted a so-called dialogue tour consisting of 50 stops and resulting in about 300 comments from the public. Web-based activities were given emphasis: the earlier active blog was complemented by a digital working room, and by an internet-based portal with online seminars, meetings, and reporting from EIA hearings.

6.2. Eurajoki, Finland

6.2.1. Preliminary and detailed site characterization phases

In 1987, TVO informed Eurajoki that the company had chosen Olkiluoto as one of the alternative investigation sites for an SNF repository, alongside sites in four other municipalities. The municipal board took note of the announcement, but neither decided on any organizational measures, nor asked the municipal board's consent. In 1980, as part of the Olkiluoto planning process, the municipality had asked TVO to promise that no high-level waste repository would be located in the Kaalo area in Olkiluoto (Litmanen 1994, 98, 101). The municipality opposed the siting of a repository in Eurajoki – a position documented in the municipality strategic plan in 1982 and rehearsed in several documents in the 1980s and 1990s (Kojo, 2009, 174–177.). It was hence unsurprising that the municipality did not prepare for any kind of partnering activities. However, in 1987, following a request by the Ministry of Trade and Industry that information or liaison committees be established in the municipalities on TVO's list of candidates, the first liaison committee between TVO and Eurajoki was established, focused on bedrock investigations (Nikula et al., 2012, 32–33) (see Fig. 5).

According to Äikäs (2016), a retired Executive Vice President of Posiva, the liaison committee was “to act as a forum for discussion at the local level”, as “the main information channel to members of the community and as a vehicle for TVO to gain feedback and advice”. Thus, TVO primarily aimed at exchange of information and improving

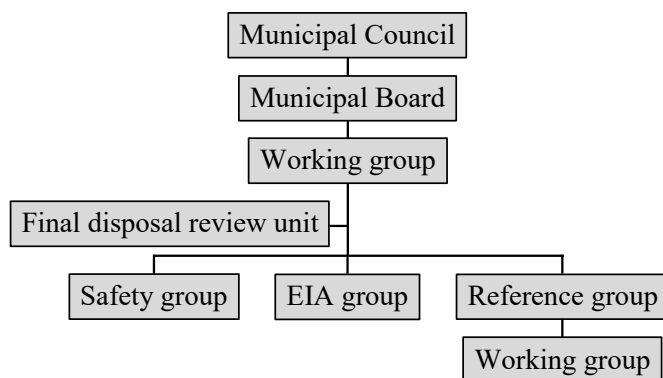


Fig. 4. General organizational outline during and after the site selection phase.

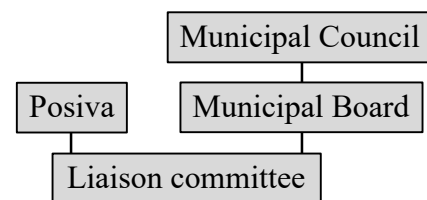


Fig. 5. Organization for the bedrock investigations phase.

knowledge on final disposal in the host municipality, but did not seek the kind of extensive competence building and independent reviewing as practiced in Sweden. The municipal board appointed to the committee local elected politicians and civil servants. The tasks of the committee included monitoring of the investigations and the use of local services and workforce, communication, and other relevant issues related to the investigations.

Despite this initially negative position, and the controversial nature of both nuclear power and nuclear waste in Eurajoki in the 1980s, the municipality was attracted by the economic benefits from an NPP. The municipality was not familiar with either TVO as a company or the construction and operation of an NPP as an industrial and business activity. TVO was economically independent from the municipality and did not require any economic support. By contrast, for the municipality, the NPP constituted an opportunity to boost local economic development. As described by one of the municipal directors of the time, it was important for the municipality to take things forward and decide quickly, to avoid any unnecessary delays (Vahekoski, n.d., 74).

By the mid-1990s, Eurajoki had changed its position on final disposal. In 1995, it signed a cooperation agreement with TVO, the parties committing themselves to taking into account the interests of each other (Kojo, 2009, 177.). No new liaison committee was established but the two permanent Eurajoki-TVO joint committees continued their work. One covered a wide range of issues such as the operation of the NPP, taxation, tourism, and NWM, while the other focused on bedrock investigations only (see Fig. 6). In 1997, the latter committee was transformed into an Eurajoki-Posiva committee with the task of steering and following the advancement of the EIA process concerning the final disposal project.

The liaison committees constituted the backbone of the partnership in Eurajoki. They established new ad hoc sub-committees when necessary, to complement the partnership network.

In the partnership, issues related to municipal economy were a primary concern for Eurajoki. The property tax, as an incentive for locating a nuclear facility, constituted a central topic in these considerations. In March 1999, Eurajoki drafted a ‘wish list’ for the government concerning the final disposal project. The municipality argued that the real estate tax rate should be considerably higher for a repository than for an NPP, and that the rate should be specified in the real estate tax legislation (Kojo, 2009, 182.). Only six months later, the government proposed that the higher tax rate for nuclear facilities would be applied also to an SNF repository. In this way, the government wished to reduce ambiguity and thus facilitate the advancement of the final disposal project.

The compensation negotiations with Eurajoki are an example of the leverage that the host community can exert in the Finnish context. The power of Eurajoki derived from the right of veto, the municipality’s ‘comparative advantage’ as the location of the NPP, the existing SNF storage facility, and a supportive local opinion. On the other hand, Posiva wanted to retain control over site selection and, at the same time, to ensure the commitment of the host municipality by considering only one site in its application for a Decision-in-Principle (DiP) (Nikula et al., 2012, 156.).

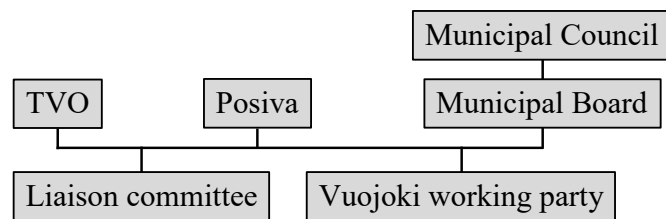


Fig. 6. Organization for the EIA phase.

6.2.2. The site selection and onwards

The Eurajoki municipal council accepted the location of the repository in 2000, on the condition that the facility would host only SNF produced in Finland. The statement on Posiva’s DiP application was prepared by the Vuojoki working group (Kojo 2009, 184), which indicates close partnership between the municipality, TVO and Posiva. Since then, several decisions concerning nuclear energy and NWM at Olkiluoto have been taken. The partnership has contributed significantly to the municipal economy and has helped the companies to promote their projects. For example, in March 2008, Eurajoki announced, already before the DiP phase, its willingness to host at Olkiluoto both the planned new NPP unit and the SNF the reactor would produce. The municipality justified this position openly, arguing purely on the grounds of municipal economy. Until now, Eurajoki has accepted the extension of the repository twice, in 2008 for SNF from TVO and in 2009 from Fortum Power and Heat, although the latter decision was not unanimous, but required a vote. In its statement on the construction license application for the Posiva SNF facility in 2013, Eurajoki relied totally on STUK’s expertise in safety assessment and did not pose any additional conditions for approval. The economic stakes are high: in 2010, about 90% of the Eurajoki’s real estate tax revenue, i.e. almost a third of its total annual tax revenue, came from TVO and Posiva.

Partnering arrangements between Eurajoki and the nuclear industry were revised in 2013 as the two liaison committees (Eurajoki-TVO and Eurajoki-Posiva) were merged (see Fig. 7). NWM is therefore again only one among many nuclear-related issues on the local agenda, as it used to be when Eurajoki and TVO began partnering.

Eurajoki improved its international connections in 2013, when the municipality decided to join the European local Network of radioactive Waste Dialogue initiated by Östhammar. It considered that exchanging information and experience with other nuclear communities was important, because nuclear companies were already collaborating across the borders. Amongst themselves, the three Finnish nuclear communities (Eurajoki, Loviisa and Pyhäjoki) met only occasionally, without any established discussion forum until 2017, when a new liaison committee was established between the power companies (i.e. TVO, Fortum Power and Heat and Fennovoima) and the nuclear communities. The agenda and the details of this committee’s work are only gradually being made public. Until now, the relationships between the Finnish nuclear communities have been characterized more by rivalry than collaboration, largely because of the property tax revenue that an NPP generates for its host municipality. Eurajoki also saw Loviisa as a rival for hosting the repository (Kojo, 2009, 183). The latest point of tension concerns the site for Fennovoima’s SNF repository. In 2016, Fennovoima named Eurajoki and Pyhäjoki as alternative host communities without consulting the communities in advance (Vilhunen et al., 2019).

While Eurajoki residents strongly trust the safety authority, they see the government as far less trustworthy (Kari et al., 2010; Vilhunen et al., 2019). Already in the late 1990s, it was speculated that the government could interfere with siting, and that Eurajoki might hence lose the possibility to negotiate with the power companies (Kojo, 2009, 179). Concerns were raised also in 2010 in the context of discussions regarding SNF from the future Fennovoima plant (Kojo and Oksa, 2014).

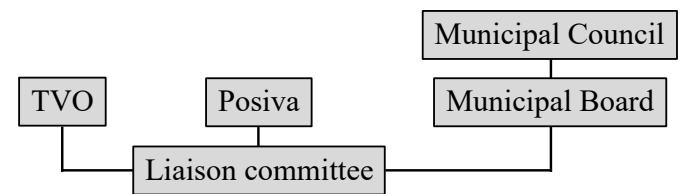


Fig. 7. Organization after the construction license application.

In 2010, the Eurajoki municipal board reminded that the right of the municipality and its residents to decide on whether a facility should be sited in its territory, underlining the responsible manner in which Eurajoki had applied this right in the past. The municipality further highlighted mutual openness, confidence and accountability as features that make the conditions for building and operating nuclear facilities in Eurajoki considerably better than in the rest of the EU.

7. Conclusions

This article compared the long-term evolution of host municipality approaches to final disposal of SNF in Eurajoki and Östhammar. The results indicate that the main components of partnering have been applied differently in the Nordic context. This is partly due to differences in the evolution of the site selection strategies and subsequent institutional arrangements. For instance, in Sweden, the municipalities can apply for funding for review and information activities, whereas in Finland, institutional arrangements do not empower and encourage potential host communities to undertake such activities, but instead ensure that the candidate municipalities have an economic incentive to host a facility. In Sweden, Östhammar has adopted an active role as an involved host community, seeking to strengthen its competence and posing demands on the implementer and the authorities, challenging policies and actions, and actively engaging public and local actors in project planning. In this manner, the host community has gained independence in relation to the NWM company. The Finnish Eurajoki has taken somewhat of a role of a bystander, holding a high level of trust in the safety regulator, and tending primarily to municipal economic interests. The structure of the partnership reflects a close relationship with the implementer and the nuclear utility, and delegation of safety issues to the regulator. The cases illustrate how apparently similar Nordic high-trust contexts nevertheless produce distinct partnership approaches, following from choices made throughout the entire process.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgements

This paper was originally submitted to IAEA International Conference on the Management of Spent Fuel from Nuclear Power Reactors 2019 Vienna, Austria, 24–28 June 2019.

The work was funded by the Finnish Research Programme on Nuclear Waste Management (Dnro KYT 13/2019; Dnro KYT 14/2020), and by the European Commission Marie Skłodowska-Curie Individual Fellowships (IF) grant number 794697-TENUMECA.

References

- Äikäs, T., 2016. Decision making on siting of a geological disposal facility in Finland. In: A Paper for RESET Project's Meeting on Consent-Based Siting, March 9 – 10, 2016, Stanford CA.
- Bergmans, A., 2008. Stakeholder Participation and Voluntary Siting in Radioactive Waste Disposal in Belgium. NWMO SR-2008-29. Nuclear Waste Management Organization, Ontario.
- Bergmans, A., Van Steenberge, A., Verjans, G., 2006. CARL Country Report – Belgium. University of Antwerp; University of Liège.
- Bergmans, A., et al., 2008. Wanting the Unwanted: Effects of Public and Stakeholder Involvement in the Long-Term Management of Radioactive Waste and the Siting of Repository Facilities. Final Report. CARL project.
- Blowers, A., Sundqvist, G., 2010. Radioactive waste management – technocratic dominance in an age of participation. *J. Integr. Environ. Sci.* 7 (3), 149–155.
- Elam, M., Sundqvist, G., 2007. Stakeholder Involvement in Swedish Nuclear Waste Management. SKI Report 2007:02. Swedish Nuclear Power Inspectorate.
- Elam, M., Soneryd, L., Sundqvist, G., 2010. Demonstrating safety – validating newbuild: the enduring template of Swedish nuclear waste management. *J. Integr. Environ. Sci.* 7 (3), 197–210.

- Frostenson, M., 2010. Slutförvarets industriella organisering: Fallgrop eller följdiriktighet? SKB R-10-55. Swedish Nuclear Fuel and Waste Management Co, Stockholm.
- Kari, M., 2020. First of its kind: Eurajoki as a nuclear community and site for the final disposal of spent nuclear fuel. *JYU Dissertations*, vol. 255. Jyväskylä: University of Jyväskylä. <http://urn.fi/URN:ISBN:978-951-39-8245-4>.
- Kari, M., Kojo, M., Litmanen, T., 2010. Community Divided: Adaptation and Aversion towards the Spent Nuclear Fuel Repository in Eurajoki and its Neighbouring Municipalities. University of Jyväskylä; University of Tampere. <http://urn.fi/URN:ISBN:978-951-39-4149-9>.
- Kojo, M., 2009. The strategy of site selection for the spent nuclear fuel repository in Finland. In: Kojo, M., Litmanen, T. (Eds.), *The Renewal of Nuclear Power in Finland*. Palgrave Macmillan, New York.
- Kojo, M., Oksa, A., 2014. The second repository for disposal of spent nuclear fuel in Finland: an analysis of the interests, resources and tactics of the key actors. *InSOTEC Working Paper*. University of Tampere. <http://urn.fi/URN:ISBN:978-951-44-9514-4>.
- Laine, M., Bamberg, J., Jokinen, P., 2007. Tapaustutkimuksen käytäntö ja teoria. In: Laine, M., Bamberg, J., Jokinen, P. (Eds.), *Tapaustutkimuksen Taito*. Gaudeamus, Helsinki.
- Lehtonen, M., Kojo, M., Jartti, T., Litmanen, T., Kari, M., 2020. The roles of the state and social licence to operate? Lessons from nuclear waste management in Finland, France, and Sweden. *Energy Research and Social Science* 61 (March).
- Lidskog, R., 1994. The politics of radwaste management in Sweden: civil society, the economy and the state. *Acta Sociol.* 37 (1), 55–73.
- Litmanen, T., 1994. Kallion uumenissa, satojen metrien syvyydessä: paikalliset ydinjätekonfliktit Suomessa. Licentiate thesis. Jyväskylä: University of Jyväskylä.
- Litmanen, T., Kari, M., Kojo, M., Solomon, B.D., 2017. Is there a Nordic model of final disposal of spent nuclear fuel? Governance insights from Finland and Sweden. *Energy Research and Social Science* 25, 19–30.
- NDA, 2007. *Managing Radioactive Waste Safely: Literature Review of International Experiences of Community Partnerships*. Nuclear Decommissioning Authority, London.
- NEA, 2004. *Learning and Adapting to Societal Requirements for Radioactive Waste Management: Key Findings and Experience of the Forum on Stakeholder Confidence*. Nuclear Energy Agency, OECD, Paris.
- NEA, 2010. *Partnering for Long-Term Management of Radioactive Waste: Evolution and Current Practice in Thirteen Countries*. Nuclear Energy Agency, OECD, Paris. NEA No. 6823.
- NEA, 2013. *Stakeholder Confidence in Radioactive Waste Management: an Annotated Glossary of Key Terms*. Nuclear Energy Agency, OECD, Paris. NEA No. 6988.
- NEA, 2015. *How Can Stakeholder Involvement Be Improved? Flyer*, December 2015. Nuclear Energy Agency, OECD, Paris.
- Nikula, A., et al., 2012. Kohti turvallista loppusijoitusta – Ydinjätehuollon neljä vuosikymmentä. Eurajoki: Posiva Oy, 978-951-652-218-3.
- Nyberg, H., 2011. *Från Början till Slutförvar? En Dokumentation Av Slutförvarsprocessen I Östhammars Kommun*. Östhammar: Municipality of Östhammar.
- Posiva, 1999. *The Final Disposal for Spent Nuclear Fuel. Environmental Impact Assessment Report*. Posiva Oy, Helsinki.
- Rasilainen, K., 2002. *Nuclear Waste Management in Finland. Final Report of Public Sector's Research Programme JYT2001 (1997–2001)*. Studies and Reports 15/2002. Ministry of Trade and Industry, Helsinki. Finland.
- Reset Steering Committee, 2018. *Reset of America's Nuclear Waste Management Strategy and Policy*. Final Report. Stanford University; George Washington University.
- Rosenberg, T., 1999. Turhauttavaa teatteria. Loppusijoitus-YVA Loviisa-liikkeen näkökulmasta. In: Litmanen, T., Hokkanen, P., Kojo, M. (Eds.), *Ydinjäte käsissämme. Suomen ydinjätehuolto ja suomalainen yhteiskunta*. SoPhi, Jyväskylä, pp. 266–282.
- SKB, 1986. R&D-Programme 86: Handling and Final Disposal of Nuclear Waste. Programme for Research, Development and Other Measures. September 1986. Swedish Nuclear Fuel and Waste Management Co, Stockholm.
- SKB, 1989. R&D-Programme 89: Handling and Final Disposal of Nuclear Waste. Programme for Research, Development and Other Measures. September 1989. Swedish Nuclear Fuel and Waste Management Co, Stockholm.
- SKB, 1992. RD&D-Programme 92: Treatment and Final Disposal of Nuclear Waste. Programme for Research, Development, Demonstration and Other Measures. September 1992. Swedish Nuclear Fuel and Waste Management Co, Stockholm.
- SKB, 1994. FUD-PROGRAM 92 – Kompletterande redovisning. Kärnkraftavfallets behandling och slutförvaring. Komplettering till 1992 års program sammanställt med anledning av regeringsbeslut 1993-12-16. Swedish Nuclear Fuel and Waste Management Co, Stockholm.
- SKB, 1995. General Siting Study 95. Siting of a Deep Repository for Spent Nuclear Fuel. Swedish Nuclear Fuel and Waste Management Co, Stockholm. SKB TR-95-34.
- SKB, 2000. Förstudie Östhammar. Slutrapport. Swedish Nuclear Fuel and Waste Management Co, Stockholm.
- SKB, 2016. *Environmental Impact Statement*, March 2011. Swedish Nuclear Fuel and Waste Management Co, Stockholm.
- SOU, 1999. *Slutförvaring av kärnavfall - Kommunerna och platsvalsprocessen*. Swedish Government Official Reports. SOU 1999:45.
- SOU, 2004. *Nuclear Waste: State-Of-The-Art Reports 2004: A National Council for Nuclear Waste (KASAM) Report*. Swedish Government Official Reports. SOU 2004: 67.
- SOU, 2007. *Time for Final Disposal of Nuclear Waste – Society, Technology and Nature. An In-Depth Report Supplementing KASAM's Nuclear Waste State-Of-The-Art Report 2007*. Swedish Government Official Reports. SOU 2007:38.
- SOU, 2014. *Kunskapsläget på kärnavfallsområdet 2014. Forskningsdebatt, alternativ och beslutsfattande*. SOU 2014:11. Swedish Government Official Reports.

- Sundqvist, G., 2002. *The Bedrock of Opinion: Science, Technology and Society in the Siting of High-Level Nuclear Waste*. Kluwer Academic Publishers, Dordrecht.
- UK Government, 2018. Implementing geological disposal – working with communities: long term management of higher activity radioactive waste. In: Policy Paper, 19 December. London: UK Government, Department of Business, Energy and Industrial Strategy.
- Vahekoski, R. (n.d.). Eurajoen ydinvoimalahanke jälkikäteen muisteltuna. In: Kotiseutumme Eurajoki IX. Eurajoen Kotiseutuyhdistys; Eurajoen kunnan kulttuurilautakunta. 69–88.
- Varjoranta, T., Paltemaa, R., 2015. Construction of first phase of spent fuel repository in Finland: lessons learned and success factors. In: Proceedings of an International Conference on the Management of Spent Fuel from Nuclear Power Reactors. Vienna, Austria, 31 May – 4 June 2010. International Atomic Energy Agency, Vienna.
- Vedung, E., Olofsson, P., 1997. Lokalsamhällets beslutsfattande om kärnavfallet. Tre kommuner i norr. SKI Rapport 97:38. Swedish Nuclear Power Inspectorate.
- Vilhunen, T., Kojo, M., Litmanen, T., Taebi, B., 2019. Perceptions of justice influencing community acceptance of spent nuclear fuel disposal. A case study in two Finnish nuclear communities. *J. Risk Res.* <https://doi.org/10.1080/13669877.2019.1569094>.