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Is there a Nordic model of final disposal of spent nuclear fuel? Governance insights from Finland and Sweden

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ABSTRACT

This paper explores citizen participation in Swedish and Finnish regulatory processes for final disposal of spent nuclear fuel (SNF). Finland and Sweden are considered the most advanced worldwide in term of SNF disposal plans. Our aim is to analyze the institutional waste management frameworks, focusing on the role of civil society organizations (CSOs); how lay-people and civil society organizations have been able to participate and contribute to radioactive waste licensing processes; and the nature of radioactive waste risk debates. We review official documents of the waste companies and nuclear safety authorities, plus information from civil society organizations and laypeople. Our theoretical framework takes a civil regulation perspective, which is oriented towards institutional issues. The analysis indicates that civil regulation of SNF is better established in Sweden than in Finland because of institutional arrangements and the more controversial nature of nuclear power. Swedish civil regulation resembles a more liberal approach, whereas in the Finnish case technocratic domination is more evident and therefore CSOs have been left to choose critical, confrontational and antagonist civil regulation strategies producing dispersed and random civil regulation. We conclude that due to differences in civil regulation there is not a Nordic model for SNF disposal.

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1. Evolution of SNF management in Finland and Sweden

Spent nuclear fuel (SNF) management in Finland and Sweden have long been praised as the most advanced among the nuclear powered countries, in both technical and social senses. On the technical side the development of the KBS-3 disposal concept has continued for decades and the main principle of the concept has remained almost the same for nearly 30 years [102,44]. In Swedish and Finnish SNF management the ideology to govern social and political tensions is a mixture of transparency, openness, voluntarism, incentives, science communication and public engagement in policy making. However, in recent years skeptics have increasingly called into question both the integrity of the disposal concept and the effectiveness of the participatory process [8,50,22,46,7,57,43].

Seemingly similar societal features such as consensual and apolitical decision-making styles and general trust in governmental and regulatory institutions in these countries, however, mask some fundamental differences in nuclear policies (see Table 1). For example, Finland lacks the dramatic nuclear power history that Sweden has had. The 1980 national referendum on the future use of nuclear power in Sweden has been part of the controversy over nuclear waste [102]. It led to a historical and disputed nuclear phase-out agreement, while in Finland initiatives concerning phase-out never gained enough political support, even though an anti-nuclear movement was active in the 1970s and 1980s. When the Finnish parliament rejected the application for a new nuclear build in 1993, the nuclear waste problem was the most frequently mentioned argument ([48], 74). Since the late 1990s, Finnish energy policy has become more nuclear friendly as Parliament has approved three applications for new nuclear reactors whereas in Sweden the nuclear power companies have struggled with profitability of operating nuclear power plants e.g. due to a tax on installed capacity [56,115,76]. Both countries have continued pro-nuclear power policy after the Fukushima nuclear power accident of 2011 [25,26].

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Table 1
Comparison of Finnish and Swedish nuclear power policies.

Finland	Sweden
No Referendum. Limited support for phase-out. Four operating NPP units providing 33.9% of total electricity production in 2014. Since the late 1990s a pro-nuclear renewal policy: TVO's Olkiluoto-3 unit under construction, but delayed and over budget; Fennovoima's Hanhikivi-1 unit in the site preparation phase. Fennovoima's DiP was ratified in 2010 and DiP supplements were issued in 2014 by the Parliament. A construction license application was submitted to the Government in 2015, with a decision expected in 2018.	A Referendum was voted on in 1980. A phase-out decision was taken in 1980 based on the Referendum. Nine operating NPP units providing 41.2% of total electricity production in 2014. Nuclear policy under continuing discussion due to a struggle with profitability. In June 2010, the Parliament voted to repeal the phase-out decision. In 2015, decisions were made to close four older reactors by 2020. In 2016, a framework agreement was announced by five parties in the Parliament: the nuclear tax on existing plant capacity will be phased out over two years. The agreement also allows for the construction of up to ten new nuclear reactors at existing sites, to replace plants as they retire, but only with private funding. The year 2040 is the target date at which Sweden should have a 100% renewable electricity system, which could result in a phase-out of nuclear power by then.

However, in Finland the implementation of this policy has been more straightforward than in Sweden.

National policies for management of radioactive waste have been an expert-driven exercise in many countries, but since the late 1990s, particularly due to local conflicts in site selection, the technically oriented approach has changed. This has been called a 'participatory turn' [59,14,11]. In Swedish and Finnish radioactive waste management policy, public engagement has been discussed and developed particularly in the site selection processes for an SNF repository. Both countries have had siting conflicts [53]. However, in Sweden public consultation has also been part of the research and development (R&D) process of the safety analysis although effectiveness of participation has been criticized [24], whereas in Finland R&D has been in the hands of experts only [57,58].

The site selection process in Sweden started in the 1970s, though due to strong local opposition the process was discontinued in 1985 (Table 2). The Swedish Nuclear Fuel and Waste Management Company (SKB) began feasibility studies in 1992, which were based on a flexible siting strategy. This meant that the studies were carried out in municipalities, which through their own initiatives had displayed an interest in investigations ([102], 115; [24]). Therefore, voluntarism became the cornerstone of the Swedish site selection process. After consideration of alternative host municipalities the site investigations in 2002–2008 focused on two, so called nuclear communities, i.e. municipalities with nuclear facilities already located in their territory.

A clear difference between Sweden and Finland is the public participation initiatives taken by societal actors other than the SKB, such as the Dialogue Project by the Swedish nuclear safety authority and the Transparency Programme by the Swedish National Council for Nuclear Waste [24,27]. Also, the candidate municipalities in Sweden have been more active in promoting public participation than in Finland.

In Finland the site selection process began in the early 1980s. The first test site for developing bedrock drilling and the first possible host municipality for the repository were announced by the nuclear power company Teollisuuden Voima (TVO) in the mid 1980s. At that time public participation was non-existing and the style was in line with the Decide-Announce-Defend (DAD) approach, meaning that local politicians were told about the site selection on very short notice and local residents were informed only once the site investigations had been initiated. The power company thought that the permission of landowner was enough for initiating site investigations. Local resistance, particularly after the 1986 Chernobyl accident, prompted TVO to reconsider its approach. However, the site selection strategy was not as significantly reformed as in the case of Sweden, where SKB adopted voluntarism based on existing nuclear communities in the site selection process. In the late 1980s TVO, the company responsible for site investigations started negotiations with local politicians in the potential host municipalities and improved local communication. Later communication became also more reciprocal as the company wanted to learn stakeholders' views and perceptions concerning the final disposal and its impacts. An important legislative change was passage of the Nuclear Energy Act in 1987, which gave veto power to the local council of the proposed host municipality. Public participation was a visible part of the Environmental Impact Assessment (EIA) procedure in the late 1990s, but it was criticized for ineffectiveness by local opposing groups and academics/researchers for instance due to narrow framing [88,29,30]. Another argument for ineffectiveness was the benefit package negotiated between with the representatives of Eurajoki municipality and Posiva and TVO parallel to the EIA procedure behind closed doors [43,46,96,97]. Thus, during the site selection process the style of public participation moved from the DAD approach towards a MUM (Mitigate-Understand-Mediate) approach. However, in the case of Finland, the success factors in siting are deemed to be based more on trust in safety authorities, representative decision-making, economic dependency and incentives and tolerance of nuclear power technology at the municipal level than the role of public participation [43].

Currently nuclear waste companies in both countries are advancing their plans to construct the first geological repositories in the world for SNF. The Finnish Expert Organisation in Nuclear Waste Management, Posiva Oy, submitted its construction license application for a final repository for spent nuclear fuel to the Government on 28 December 2012. The license was issued on 12 November 2015. The plan is to build the repository in Olkiluoto, Eurajoki. The Swedish SKB submitted its construction permit applications on 16 March 2011 to the Radiation Safety Authority (Strålsäkerhetsmyndigheten, or SSM) and to the Land and Environment Court to build the SNF repository in Forsmark, Östhammar. According to the schedule of the Environmental Court it will submit its statement to the government in February–June 2017 [66]. The government will take the decision after that. Before the decision is made, approval will be sought from the host municipalities of Östhammar and Oskarshamn, which are both vested with veto power. It is possible that a local referendum will be arranged in Östhammar in 2017 [67].

Posiva's application for a construction license concerned a complex of two interconnected nuclear facilities – an aboveground encapsulation plant and an underground final repository. Both facilities will be located in Eurajoki. In Sweden, the final disposal repository and the encapsulation facility were applied for at two different sites – the encapsulation facility in Oskarshamn, and the underground repository in Östhammar. In both cases the handling of the application and review of the safety case is expected to take several years [6].

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