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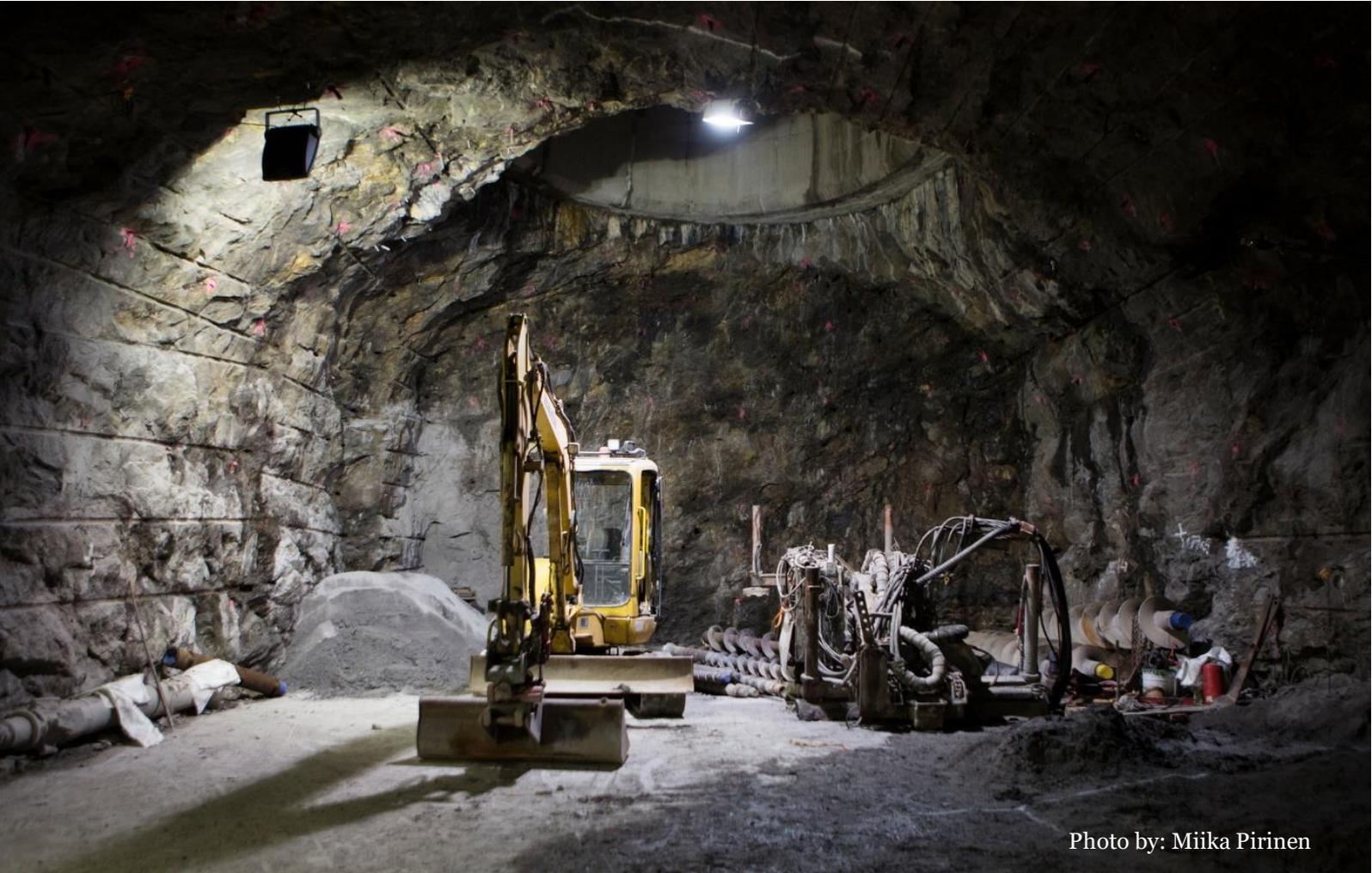


Photo by: Miika Pirinen

# Factors Affecting the Influence of Local Movements and Non-Governmental Organisations in Nuclear Waste Policy-Making

In Finland and the Netherlands

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## Abstract

Finland is the first country that is constructing a final depository for nuclear waste, in the municipality Eurajoki. While many consider the nuclear waste policy-making process to be participatory, others state that local movements (LMs) and non-governmental organisations (NGOs) lacked influence during this process. Based on concepts from the actor-network theory, the objective of this thesis is to study how human and non-human actors affected the lack of influence of LMs and NGOs during the nuclear waste policy-making process in Finland and the Netherlands. To do so, nineteen semi-structured interviewees were conducted in Finland and six in the Netherlands. In Finland, the findings illustrate that: first, there was little legitimacy for LMs and NGOs during the nuclear waste policy-making process, as the discussion was dominated by technical experts and the schedule for final disposal predestined. Secondly, an elderly home, the municipality Loviisa and the fifth nuclear reactor, were identified as places that adjusted the policy-making process and the influence of LMs and NGOs. Thirdly, as many pro-nuclear actors had their own interests for a final depository, a strong pro-nuclear actor-network was formed. At the same time, LMs and NGOs lacked resources and credibility to set up a strong anti-nuclear actor-network. Findings from the Netherlands illustrate that: first, currently there is no discussion regarding nuclear waste, therefore it is now considered a black-box. Borssele and the Disposal Advisory Platform (DAP) might open this black-box and consequently a public discussion could start. Through the DAP or public discussions, LMs and NGOs might be able to influence the process. However, for this the final depository schedule should not be predestined till 2100. For further research it is recommended to analyse factors affecting predestined policy-making and hence the influence of LMs and NGOs in other sociotechnical issues such as climate change policy-making. Moreover, it would be interesting to study the factors that affect the influence of LMs and NGOs during the nuclear waste policy-making process in upcoming decennia in the Netherlands.

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## List of Abbreviations

ANT	Actor-network theory
ANVS	Authority Nuclear Safety and Radiation Protection (Dutch: Autoriteit Nucleaire Veiligheid en Stralingsbescherming)
CSO	Citizen society organization
DAP	Disposal Advisory Platform
DiP	Decision in Principle
EIA	Environmental Impact Assessment
IAEA	International Atomic Energy Agency
I&W	Infrastructure & Water Management (Ministry)
LM	Local movement
NEA	Nuclear Energy Act
NGO	Non-governmental organization
OPERA	Research Program Final Disposal Radioactive Waste (Dutch: Onderzoeksprogramma Eindberging Radioactief Afval)
SIA	Social Impact Assessment
SFR	Swedish Final Repository
STRONG	Structure Vision Sub-soil (Dutch: Structuurvisie Ondergrond)
STS	Science and Technology Studies
STUK	Radiation and Nuclear Safety Authority (Finnish: Säteilyturvakeskus)
TVO	Teollisuuden Voima Oyj (nuclear power operator)
WANP	Women Against Nuclear Power
WISE	World Information Service on Energy

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## 1. Introduction

In this thesis, human and non-human factors that affected the lack influence of local movements (LMs) and non-governmental organisations (NGOs) in nuclear waste policy-making in Finland are analysed. Moreover, current nuclear waste policy-making process in the Netherlands is explored. Finland and the Netherlands are both nuclear energy producing countries. Because nuclear energy production always comes with generation of nuclear waste, nuclear waste policy-making is essential in these countries. However, nuclear waste management is not an easy task, because nuclear waste is impossible to destroy or to recycle completely (Schröder, 2016). Therefore, all countries that generate nuclear energy, need to deal with long term radioactive waste storage. Dealing with radioactive waste, is mainly focused on technologies that can concentrate, contain and isolate radioactive waste at distance from humans and the environment (Schröder, 2016). However, radioactive waste brings forth several risks and issues. First, radioactive waste can do much harm for nature and humans, as shown by disasters such as Chernobyl and Fukushima. When this happens, environmental damage can be substantial and the costs of cleaning up after such a disaster are enormous (Sovacool et al., 2015). Besides this, practicalities such as transportation of radioactive waste go together with risks for humans and the environment (Marshall, 2005). Moreover, since the radioactivity of nuclear waste lasts for at least 10.000 years, nuclear waste must be taken care of for periods of time that are beyond all human experience (Ahearne, 2000; Brunnengräber & Schreurs, 2015). Hence, nuclear waste policy-making is a complex issue that involves many long-term risks for humans and the environment.

The International Atomic Energy Agency (IAEA) imposes countries to be responsible for one's radioactive waste without imposing undue burdens on future generations. However, there are still many uncertainties involved in long-term nuclear waste policy-making, related to the lack of complete knowledge regarding chemical, physical and biological processes over time (Van de Poel, 2011). Therefore, it is scientifically impossible to predict how people in the far future will deal with geological nuclear waste depositories (Van de Poel 2011) and to secure that there will be never any radioactive release from a final disposal facility in the next ten thousands of years (De Vate, 2018). For this, a long-term nuclear waste solution is needed to prevent leaving future generation to deal with even greater nuclear waste problems (Di Nucci et al., 2015). In many countries this solution is a final depository. A final depository is a deep geological storage, which is filled with nuclear waste and backfilled with concrete. In this way, no human conservation for the depository is needed in the future.

Although there are guidelines from the IAEA, policies regarding nuclear waste change over time. Various ethical, technical and social components of nuclear waste management result into complex nuclear waste policy-making. Thereby, dealing with nuclear waste involves

relations between the state, civil society and private sector (Litmanen, 1996). Actors and accidents shape the way how nuclear energy and its waste are framed and perceived within countries. Factors such as trust, capital and labour related issues are all part of dealing with nuclear waste (Litmanen, 1996). Therefore, nuclear waste decision-making is a complex process in which many perspectives and interests are involved. Despite the risks of nuclear energy and waste, nuclear energy is considered a low-carbon energy system and recently often framed as essential energy system in counteracting climate change. While there are many people in advance of nuclear power and corresponding nuclear waste solution, there is also much opposition and resistance as result of the issue of nuclear waste.

### 1.1. Nuclear Waste in Finland

Finland is the first country that has a final depository under construction to store nuclear waste. It is a deep geological depository that is under construction since 2004 and built by the nuclear power company Posiva (Brunnengräber & Schreurs, 2015). The facility is called Onkalo and extends to the depth of about 450 meters. It will look like Figure 1. For now, Onkalo is in the development and test phase, the start of operating is planned around 2020 (Brunnengräber & Schreurs, 2015). Eventually, the proposal for the final depository in Eurajoki received local support from the citizens and municipality. Hence, the Finnish government decided to grant the construction license for the final disposal in Eurajoki, by 2001.

The final disposal process in Finland has been the first example in the world of constructing a final depository. Finland has gained international attention for the final disposal process. The Finnish governance and management approach are often seen as model by other countries (Di Nucci et al., 2015). Finland is especially known for its voluntary procedure due to the right for all municipalities to veto a final depository within their municipality. Hence, the process is a role model for other countries but whether this has been a full democratic decision-making process has been questioned (Lammi, 2009). As there was no strong local opposition to have critical perspectives from the ‘other side of the coin’, this placed a heavy burden on civic organisations and NGOs to fulfil this role (Lammi, 2009). Therefore, it is important to analyse this site selection process in Finland, in order to understand and improve the nuclear waste decision-making processes that will follow in other countries.

The Netherlands is such a country that uses insights from the nuclear waste policy-process in Finland. For instance, Van Soest (2018) reported that the most important lesson learned was that a shared and supported view of a nuclear waste solution should be established by involving relevant stakeholders at the start of the discussions. In this way, trust and acceptance can be gained among citizens and municipalities, and consequently this may lead to less opposition. At the moment, nuclear waste is stored aboveground for the next 100 years in the Netherlands (Ministry of Economic Affairs, 2013) until nuclear waste will be stored in a final depository. As

there are no possible sites selected so far, there are no LMs or NGOs that are actively opposing this plan.

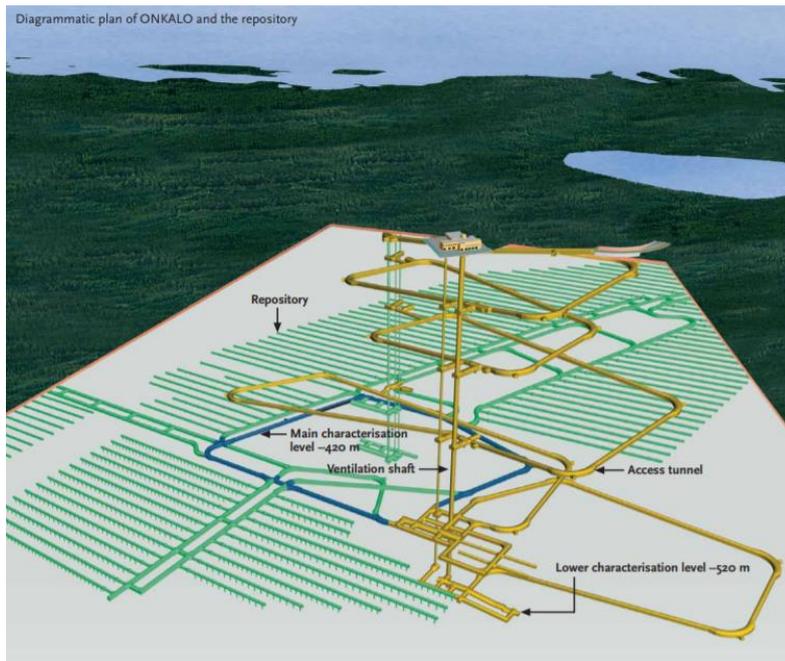


Figure 1: Diagrammatic plan of ONKALO and the repository. Reprinted from Programme of monitoring at Olkiluoto during construction and operation of the ONKALO. Posiva Oy Report (2003), p. 5.

## 1.2. Local Movements and Non-Governmental Organisations

Due to the contested issue of nuclear waste, LMs and NGOs acting against nuclear power and waste arose in various industrialized countries including Finland. LMs are defined as “networks of informal interactions between a plurality of individuals, groups and/or organizations, engaged in political or cultural conflicts, on the basis of shared collective identities” (Diani, 1992: 13). Whereas NGOs are “formed in response to social or environmental degradation and damage to social natural resources” (Zchout & Tal, 2016: 1112). NGOs aim to affect public policies, industrial business, environmental development and social behaviour, and ecological and health-related issues (Schreurs, 2002). In this way, LMs and NGOs that are engaged in nuclear waste management in Finland and the Netherlands can affect nuclear waste policy-making.

The importance of public acceptance and the role of LMs and NGOs to establish more critical perspectives during policy processes, have been studied already. According to Hutter and O’Mahony (2004), social movements can be important for pushing organizations to sustainable policy-making, empowering citizens, build political support for regulations, and advocate for protecting the environment. Moreover, LMs and NGOs can be helpful for researchers, companies or public institutions to know and understand concerns (Litmanen, 1996). Citizens, LMs and NGOs can inform institutions about social, psychological, ethical, and

political questions regarding nuclear waste decision-making (Litmanen, 1996). Therefore, LMs and NGOs can be of additional value during nuclear waste policy-making.

Some studies already focussed on the involvement of LMs and NGOs during the site selection process in Finland. Most research about the influence of LMs and NGOs involved in nuclear waste policies is at national level, or are comparisons between nations (e.g. Bernardi et al., 2017; Brunnengräber & Schreurs, 2015; Di Nucci, & Brunnengräber, 2017; Kitschelt, 1986; Högselius, 2009). In these national comparisons, Finland is often mentioned as country with little resistance, as the municipality volunteered for constructing the final depository in the area (Högselius, 2009). Or the Finnish process is referred to as “on a voluntaristic basis with relatively broad local support” (Brunnengräber & Schreurs, 2015:72). Furthermore, other research was more directed towards the case of Onkalo (Kojo, 2005; Lammi, 2009; Vira, 2006; de Vries et al., 2015), in which it is in general concluded that the influence of the opposition in Eurajoki was little.

Other studies pointed out reasons for the lack of influence from NGOs during the site selection. For instance, Kojo (2009) mentioned that NGOs were poorly funded compared to the resources that the pro-nuclear lobby had access to. According to Lammi (2009), NGOs had lost many of its supporting network actors and that NGOs had their argumentation line too strongly focussed on the advantages of renewables instead of risks of nuclear waste. Moreover, Högselius (2009) described that Finnish anti-movements rather contributed to legitimization and even strengthening the pro-nuclear lobby regarding the final depository. Although these are studies that have examined what roles NGOs played in the site selection process, not much attention has been given yet to the effects of human and non-human entities on LMs and NGOs during the site selection process. Human and non-human actors can alter relations within the policy process and assist in understanding underlying relations that affected the influence of LMs and NGOs during the site selection.

The objective of this study is to analyse and explore the factors that affected or will affect the (lack of) influence of LMs and NGOs in nuclear waste policy-making in Finland and the Netherlands. The specific research questions are theoretically informed. Therefore, the sub-research questions will follow after the theory chapter.

### 1.3. Thesis Outline

In chapter 2, the theory and research approach used for this study are explained. Hybrid-socio-technological systems, places of concern, boundary objects and ways of framing stem from the actor-network theory and are explained, as these are used as research approach in this study. Thereafter, the methodology is described in chapter 3, in which the methodological approach, data collection, and description of data analysis are set out. In chapter 4, the case study in

Eurajoki is analysed in which the lack of influence of LMs and NGOs during the site selection process is studied from late 80s till 2018 in chronological order. In this case study, special attention is given to role of how the nuclear waste discussion is framed and how this affected the influence of local groups and NGOs. This is important since the way of framing has consequences for the legitimacy of arguments that are given in conflict situations during policy-making. Besides this, places of concern are examined to reflect how these places influenced the development of LMs and NGOs. Subsequently, an analysis of the nuclear waste policymaking process at national level is described in chapter 5, in which besides the concepts used in the case-study, also boundary objects are defined. The national policy analysis exposes interlinkages between the site selection at local and national level, which interactively affected the influence of LMs and NGOs in the decision making for a final depository. After this, in chapter 6, an analysis is given regarding the contemporary state of nuclear waste policy-making in the Netherlands. Insights from the analysis concerning Finland are used to explore possible roles that places of concern, boundary objects and effects of ways of framing might play in the nuclear waste process in the Netherlands. In the discussion, chapter 7, a reflection is given on the findings and limitations and recommendations are discussed. Lastly, an overall answer on the main research question is given in chapter 8, based on the analysis at local level in Eurajoki and both national analyses in Finland and the Netherlands.

## 2. Theory and Research Approach

In this research, actor-network theory (ANT) is used as an approach for analysing relations between actors, involved in the site selection process.<sup>1</sup> In this chapter, first the origin of ANT is described shortly. Thereafter, some examples are given of how ANT has been used in various research. After that, an overview is given of the following ANT concepts that are used as approach for this thesis; first, the issue of nuclear waste is framed as a hybrid socio-technical combination. Secondly, places of concern and black-boxes are explained that affected the influence of local movements (LMs) and non-governmental organisations (NGOs) during the site selection process. Thirdly, boundary objects are examined since these are helpful in analysing why and how actor-networks are formed. Lastly, the concepts of separative and integrative ways of framing of the nuclear waste discussion, are introduced. The way of framing influenced the legitimacy of actors, and hence affected the influence of LMs and NGOs. At the end, a short explanation is given about how ANT is applied in this analysis.

### 2.1. Origins of the Actor-Network Theory

ANT is developed in Science and Technology Studies (STS) in order to study the making of scientific facts, objects and technologies (Stockbruegger & Bueger, 2017). STS introduced a new way of thinking about technology and society within research (Baron & Gomez, 2016). According to STS scholars, science and technology are thoroughly social activities (Sismondo, 2010). As scientists and engineers are always part of communities, trained into practices and use these practices, research and evaluation of knowledge will be affected by these practices (Sismondo, 2010). According to Sismondo (2010: 11) a key premise within STS is “that scientists and engineers *use* the material world in their work; it is not merely translated into knowledge and objects by a mechanical process”. Hence, STS became known for the belief and claim that the social and natural sciences are interlinked and across each other’s divisions. In addition to STS, ANT scholars argued that besides humans, non-human actors have agency as well.

ANT scholars started in 1980s and offered an approach for STS research to trace links between human and non-human actors in order to understand social dynamics between actors (Baron & Gomez, 2016). Diving further in the division of natural and social worlds, authors associated with ANT understand that the social world also incorporates the natural world and materials (Baron & Gomez, 2016). Scholars of ANT included both human actors and non-human entities in the approach that together were framed as actor-networks. Through these actor-networks,

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<sup>1</sup> In this thesis, ANT is considered an approach instead of a conceptual framework. Using a conceptual framework, variables are identified in order to understand how these variables connect with each other. For this, ANT is used not only for identifying these variables (in this case, actor-networks), but also describes concepts and approaches how to explore these actor-networks.

scholars attempt to understand technology and society. However, there is not one set of definitions for ANT, but one's interpretation and use of ANT may differ from that of others. In the next section, I summarized some scholars in order to explain ANT.

## 2.2. Actor-Network Theory Explained

ANT is described by various scholars and each with their own perspectives and interpretations. Law described ANT approach as “the enactment of materially and discursively heterogeneous relations that produce and reshuffle all kinds of actors including objects, subjects, human beings, machines, animals, ‘nature’, ideas, organizations, inequalities, scale and sizes, and geographical arrangements” (Law, 2009: 141). Hence, an actor network is a collection of human, non-human and hybrid (human/non-human) actors who jointly participate in some organized and identifiable collective activity for some period of time (Kaghan & Bowker, 2001: 258). Actors within a network are linked to each other, interact, and may change. Therefore, an actor-network is a dynamic and hybrid construct. An example of what an actor-network could look like is shown in Figure 2.

An actor is described by Latour (1996: 373) as “[...] something that acts or to which activity is granted by another. An actor can literally be anything provided it is granted to be source of action”. Through the relations to other human and non-human actors, the actor becomes an actant and receives an identity (Justesen & Mouritsen, 2011). In line with this, instead of actors, ANT scholars used the term ‘actant’, because human or non-humans, such as animals, objects or concepts, can accomplish or undergo an act (Dankert, 2011). In this way, ANT approach is used to describe how relations between human, non-human and hybrid actants arise or do not arise.

Actant relations comprise human and non-human entities, that all have the same agency. In this way, actants are able to change other actants (Latour, 1993). To describe the quality of these relations and how hybrid networks are formed, ‘translation’ is used as concept in ANT (Stockbruegger & Bueger, 2017). Translation is a way to explain how different actants, that can contain a variety of political, social and economic elements and have never interacted before (Cressman, 2009), become connected and start to behave as a network (Stockbruegger & Bueger, 2017). The term ‘translation’ attempts to overcome the arbitrary divisions between all these related elements (Cressman, 2009). According to Stockbruegger and Bueger (2017: 9) translation “[...] is a device to study the evolution of new relations, what happens to the actants in that relationship, and how they struggle over the shape and content of their relationship”. Through translation, it can be analysed how ideas and plans are turned into actual research, how people, institutions and processes are shaped, and how people and technology transform each other to achieve their goals (Cressman, 2009). Hence, through translation actants are linked together within networks.

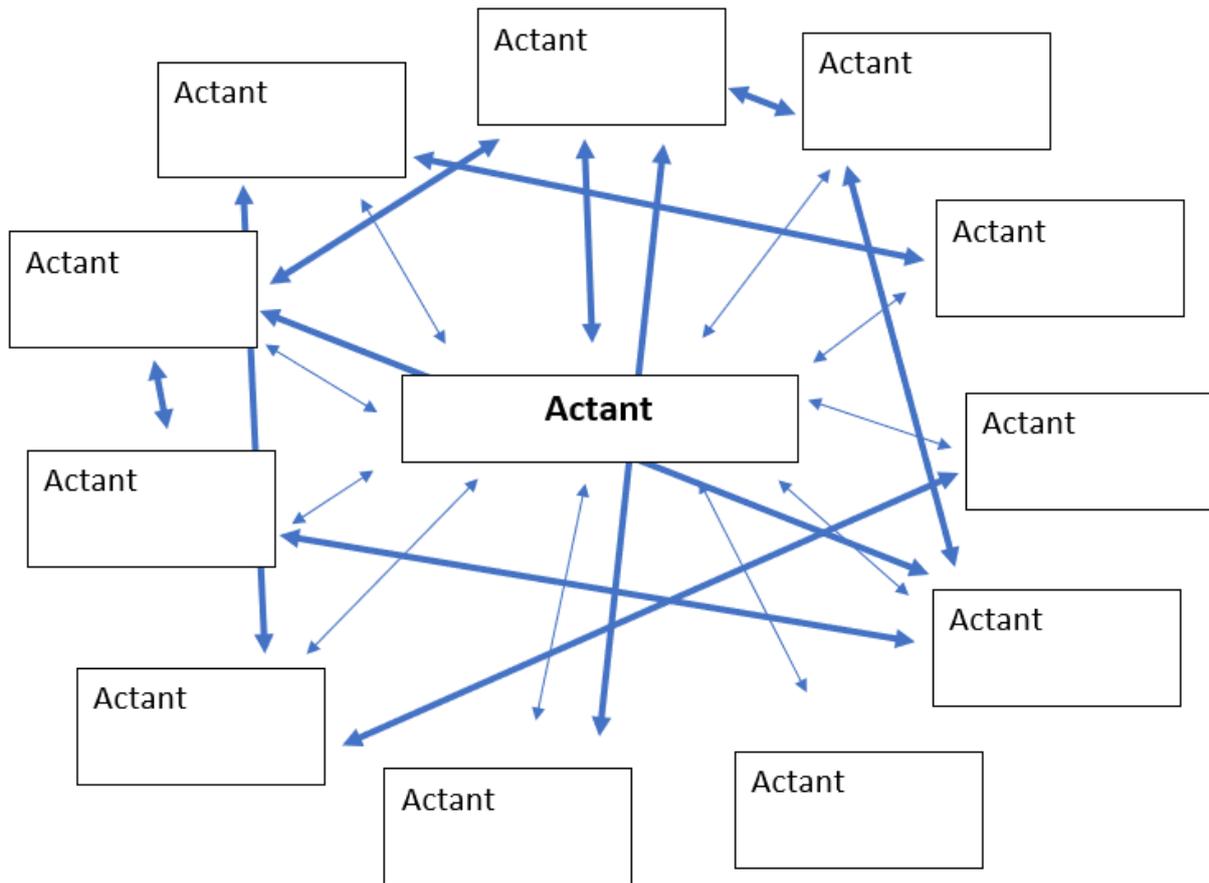


Figure 2. Visualization of what an actor-network could look like.

In Finland, many relations between actants exist that form an actor-network. For instance, the final depository (non-human entity) includes the innovation of social roles, policy-making processes and involvement of institutions (human entities), and hence form a network of actors. Hence, the aim of using ANT is to trace relations between actors such as municipalities, nuclear industries and citizens, but also knowledge, money and technologies. By using ANT approach, concepts such as power and influence of actors during the site selection process are not permanent conditions, but effects that are performed by other actants (Cressman, 2009). When these conditions within the actor-network are (temporary) determined and work together, translations are defined. As the site selection process is a very complex issue with many actants involved, ANT is used as approach to study the actor-networks and its effects to the influences of LMs and NGOs during the site selection process.

### 2.3. Actor-Network Theory in Practice

Although ANT is an established approach within STS, it is constantly being revised and re-constructed (Stockbruegger & Bueger, 2017). It is not a straightforward approach that can be applied universally (Cressman, 2009). Various authors including philosophers, anthropologists, economists and geologists, have applied ANT differently to their work.

Examples of ANT as approach and analytical tool are found in a broad range of literature including International Relations studies (Nexon & Pouliot, 2013), policy analyses (Gorur, 2008; Rutland & Aylett, 2008; Young, Borland & Coghill, 2010), information system analysis (Doolin & Lowe, 2002; Sarker, Sarker & Sidorova, 2006), consumer research analysing consumption objects (Bettany, 2007), research regarding torture (Austin, 2016), political analyses (Ernstson, 2012), and tourism research (van der Duim, Ren & Jóhannesson, 2013; Beard, Scarles & Tribe, 2016). Another example of applying ANT in political analysis, is a research concerning African urbanism (Ernstson, 2012). Platforms of engagement were studied, in order to analyse how emancipatory change in African cities can be built (Ernstson, 2012). Here, ANT was used to give voice to non-humans, such as the relations between residents and plants, authorities, and memories of apartheid and oppression. This is an example of the value of ANT, when non-human entities play an active role during a process.

Overall, these studies use ANT to explain practices and relations between actors, by which ANT is used to enable radical new ways of describing actor-networks in a process. Nevertheless, so far, ANT is not often applied to studies regarding nuclear waste. However, there are some scholars that used ANT in nuclear waste research, among which Schröder (2016). Schröder (2016) applied ANT to the notion that nuclear waste issues are social experiments. He stated that geological disposal involves networks of humans to build a final depository but also involves geological non-human entities. As the functioning of either humans and non-humans during this process relies on each other, the social and technical should be treated as these are integrated. So, Schröder illustrated that using ANT in nuclear waste issues can expose non-human actants that affected policy-making process, just like human actants.

Overall, within ANT approach it is emphasized that issues such as nuclear waste policy-making process are complex issues that include human and non-human actants. Whereas human actants can alter or mobilize non-human actants, it can also happen the other way around. Hence, in order to analyse the nuclear waste policy processes and the lack of influence of LMs and NGOs, both human and non-human actants should be considered. Therefore, several concepts from ANT are used as approach in this thesis for analysing the site selection process in Finland and the Netherlands.

## 2.4. Actor-Network Theory Concepts

### 2.4.1. Hybrid Socio-technical Combinations

To examine the process of stakeholder engagement in terms of social and technical relations, Latour (1993) argued to see such issues and processes as hybrid socio-technical combinations. He states that in general, people divide the world into nature (technical) and culture (social), while in daily life humans deal with mixtures of nature and culture. While nature and society are entangled, neither nature nor societal reasoning can fully explain scientific or technological artefacts (Frohmann, 1995). Diaz-Maurin & Ewing (2018) explained in their paper the connection between the social and technical in nuclear policy-making:

At the socio-economic and political levels, choices made about nuclear energy technologies in relation to energy policy directly affect the nuclear fuel cycle, which ultimately drive the technical needs at the back-end of the fuel cycle. In turn, decisions made about disposal strategies affect the energy policy discussions. Nuclear energy systems and nuclear waste disposal systems are therefore connected through socio-economic and political drivers. (p. 17)

Hence, the world is construed of interlinkages between the social and technical, and therefore referred to as hybrid socio-technical combinations.

In this thesis, nuclear waste is considered a hybrid socio-technical combination. The nature part of nuclear waste includes for instance deep geological layers and artificial layers that keeps the radioactivity from releasing to the surface (Schröder, 2016). While the cultural part is about risks for humans and the environment and the ethics of the issue regarding radioactivity that will remain for over thousands of years (Schröder, 2016). Therefore, the issue of nuclear waste policy-making is a hybrid socio-technical combination. In general, people tend to see the world not as hybrid socio-technical but distinguish between the social and natural. As these hybrid socio-technical networks are very complex with lots of interlinkages, people rather tend to simplify everything in order to comprehend modern societies. For this, often a distinction is made between social and technical aspects. Whether social and natural/technical aspects are discussed as separately or as integrated issues, can be reflected by the way how nuclear issues are framed.

### 2.4.2. Separative and Integrative Way of Framing

In order to study these socio-technical combinations, a distinction between separative ways and integrative ways of framing can be made (Bergmans et al., 2015). Framing is the way that mental structures shape the way people view, interpret or value the world around them (Bales, 2005). Language shapes how words will evoke associations and connotations and in this way form frames (Jelgersma & Schröder, 2014). For instance, nuclear waste is often

framed as a technical issue that needs to be solved by technical experts and organisations. Litmanen stated (1996: 530) that “From the beginning, the way in which nuclear waste and conflicts are defined, determines which arguments are legitimate, who are the legitimate participants in the conflict, and in what kind of arena the conflict is played.” Hence, often more legitimacy is given towards technical actors compared to social actors. Therefore, the way of framing is essential in nuclear waste policy-making and affects the relations and legitimacy between actors within an actor-network.

In ANT, no distinction is made between the agency of social or technical actants but considered equal. However, the way of framing might affect the legitimacy of certain actants. Bergmans et al. (2015) outlined two ways of framing. Firstly, separation is when the issue is framed and treated as if there is a clear boundary between social and technical factors. Secondly, with an integrative way of framing there is no distinction made between social and technical aspects. According to Bergmans et al. (2015: 11): “The frame of *integration* presents the social and technical aspects as being coproduced, i.e. that they are shaping each other through an interdependent process. Such co-production means that social aspects influence technical projects, while a technical project simultaneously supports and justifies the corresponding social project”. Therefore, in this perspective, actors are not framed as part of a social or technological side of the process. Rather, an actor is both social and technical, and hence part of a hybrid socio-technical combination.

In practice, the way in which the nuclear waste issue is defined and framed affects the influence of LMs and NGOs. Because the way of framing has consequences for the legitimacy of arguments (Litmanen, 1996). According to ANT studies, social and technical factors are both involved in policy processes while neither social nor technical factors have priority. However, Bergmans et al. (2015) suggest that technical experts often overrule the nuclear debate. Consequently, the legitimacy of the input of LMs and NGOs is often minor. So, one may argue that with a separative framing more legitimacy is given towards scientific-technical definitions of the nuclear waste issue. As a result, the legitimacy will be more in hands of the technical experts that defined the process already. For instance, when the geological conditions of a site in Finland dominate the process, social aspects (such as citizen acceptance) are being involved just to justify decision making based on these technical aspects. Moreover, with a separative way of framing nuclear waste issues, social aspects are considered less manageable and therefore framed as aspects that are obstacles and barriers that block or terminate technical activities (Bergmans et al., 2015). In this way, it could be argued that when there is a separative way of framing, LMs and NGOs will have less legitimacy and therefore less influence on the decision making.

Whereas with an integrative way of framing, no clear distinction is made between social and technical aspects, hence considered a socio-technical combination. Consequently, it would be not just technical factors that dominate the discussion and receive most legitimacy. As a result, there might be more space for arguments from social and technical perspectives including those of LMs and NGOs. In this way, an integrative way of framing will affect the influence of LMs and NGOs during the nuclear waste policy-making. An overview of differences between separative and integrative ways of framing are given in Table 1.

Table 1

*Examples of Separative and Integrative Way of Framing for Nuclear Waste*

<b>Separation</b>	<b>Integration</b>
Nuclear waste issue as social construct or technical construct	Nuclear waste issue as hybrid construct; interlinkages between social and technical aspects
Social acceptance and geological factors are discussed separately	Social acceptance, geological factors are considered interlinked
Framing of discussion used to legitimize the dominant social or technical perspective	Framing of discussion used for integrating various perspectives
Little influence of LMs and NGOs in the site selection process and decision-making	Substantial influence of LMs and NGOs in the site selection process and decision-making

The way of framing is about whether the nuclear issue is perceived as a hybrid socio-technical construction or whether it is framed separately. As mentioned above, this possibly affects the influence of LMs and NGOs during the policy process. However, for LMs and NGOs to be able to have influence in the first place, it is often desirable to create public discussion. In the next section, it is discussed how discussions can start, what role non-human actants play in this, and how this possibly affects the influence of LMs and NGOs.

### 2.4.3. Black-Boxes and Places of Concern

When there is no controversy or discussion regarding an issue such as nuclear waste, it can be called a 'black-box'. A black-box is an issue that for now is stable without much discussion or controversy (Latour, 1999). In social sciences, a 'black-box' is described as part of a more complicated system that is so unquestioned and stable that it can be ignored within that system (Rice, 2011: 33). However, a black-box might be opened as result of discussion and controversy. LMs and NGOs can play a role in opening black-boxes through turning places into places of

concern. Therefore, black-boxes give insights in the influence of LMs and NGOs during the nuclear waste policy-making process.

Places of concern can open black-boxes and in this way influence the nuclear waste policy-making. In hybrid socio-technical combinations, non-human actants can also enable action, including places (Justesen & Mouritsen, 2011). Places or spaces are continuously redefined through repeated engagement (Moeckli & Lee, 2007) and “are defined by and in turn define people’s identities” (2007: 66). Hence, Moeckli and Lee (2007) emphasize that a place has agency and can alter humans, identities or policies and in this way turn into a ‘place of concern’.

Places can turn into places of concern as result of LMs and NGOs, and consequently start debates or adjust policy-making. Schaeffer and Smits (2015) studied the role of social movements in the energy transition in Chile and Thailand. They used the concept of place-making in order to examine how certain black-boxes became ‘places of concern’. As shown by Schaeffer and Smits (2015), the Bo Nok power station in Thailand and HidroAysen dam in Chile became places of concern in energy controversies, and hence became key actors during policy-making. These places became key actors because concerned citizens and NGOs gathered in order to protect this place (Schaeffer & Smits, 2015). Also, Schaeffer and Smits (2015) found that various images, symbols and material artefacts played a role in the production of these places of concern. This shows that movements create places of concern, while at the same time places of concern also create concerned citizens and movements. It is an iterative process in which both human and non-human actants have agency. When a place turned into a place of concern, controversy arises and a black-box can be opened.

Places turn into places of concern due to LMs and NGOs and in this way open black-boxes. Moreover, these places of concern can draw LMs, NGOs and people together for collaboration, as shown in the example of Schaeffer and Smits (2015). It gives insights in how places of concern are actants within the actor-network. Therefore, places of concern and black-boxes are considered in analysing the influence of LMs and NGOs in this thesis. Besides these places of concern, boundary objects can also facilitate actor-networks through a shared goal.

#### 2.4.4. Boundary Objects

Another concept for related to the formation of actor-networks are boundary objects. Boundary objects are non-human actors that coordinate and maintain collaborative activities across social worlds (Star & Griesemer, 1989). In this way, groups without shared knowledge or goals, can work towards an end goal due to a similar understanding of the boundary object (Thompson, 2016). They can either be abstract or concrete objects and have different meanings in social world, but their structure is common enough to make them recognizable. For a boundary object to be created, connections between actors are needed while the objects remain

a common identity across different social worlds that these actors come from (Star & Griesemer, 1989). A visualization of the boundary object that connects actants without shared knowledge is shown in Figure 3. Figure 3 illustrates that actants without shared knowledge or backgrounds are linked together and can collaborate due to the boundary object as shared end goal. Therefore, boundary objects can be valuable for analysing settings in which many actors with different interests are involved.

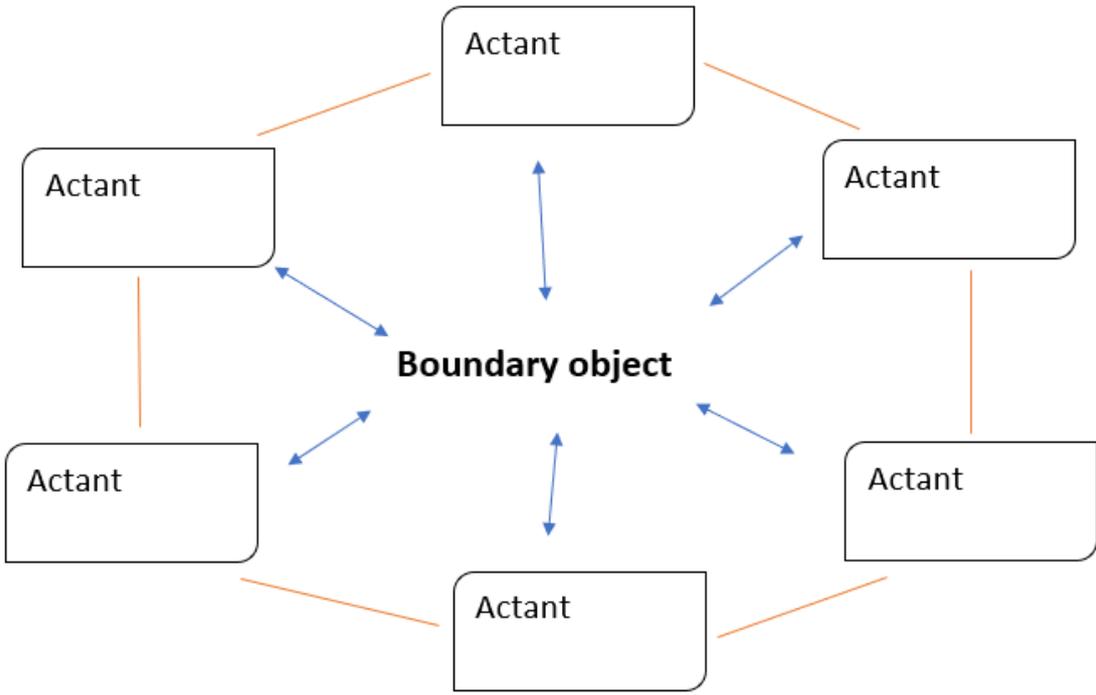


Figure 3. Boundary object connects actants without shared knowledge or backgrounds.

In nuclear waste management, many stakeholders and different perspectives are involved that can be coordinated by a boundary object. For instance, Ialenti (2014) revisited the legal-procedural framing of the nuclear waste depository in Yucca Mountain, United States. A hypothetical body that defined the model how to evaluate expected radionuclide dosages, facilitated coordination among diverse teams of experts involved in the project and therefore functioned as boundary object. In this way, the use of boundary objects in analyses can give insights in which actors are cooperating, for what reasons, and how they form actor-networks. Therefore, boundary objects are used as part of the approach to analyse the site selection process in Finland.

Table 2

*Overview of Concepts Actor-Network Theory Applied in this Research*

<b>Concept ANT</b>	<b>Explanation</b>	<b>Application in Thesis</b>
<i>Actor-network</i>	Network of human and non-human actants that are connected.	Final depository policy-making process at local and national level are starting point around which the actor-network is constructed.
<i>Hybrid socio-technical combination</i>	'The social' and 'the natural/technical' are intertwined and affect each other.	The nuclear waste issue is considered a hybrid socio-technical combination in which technology affects social factors and the other way around.
<i>Integrative way of framing</i>	An issue or discussion is framed as a socio-technical combination, hence no distinction between social or technical factors that are more important in discussions.	An integrative way of framing nuclear waste discussions can result in more influence of LMs and NGOs, as the discussion is open to social and technical perspectives. Also legitimacy is given to LMs and NGOs, instead of technical experts.
<i>Separative way of framing</i>	An issue or discussion is framed as there is a distinction between social factors and technical factors.	In nuclear waste issues, often technical factors dominate and hence have more legitimacy during discussions. Social factors are involved to justify decision-making plans based on mostly technical factors. In this way, LMs and NGOs might have little influence during nuclear waste discussions.
<i>Black-box</i>	An issue that is stable and non-controversial without any debate. A black-box can be opened, consequently discussion will raise.	It is analysed and explored whether the nuclear waste policy-making processes in Finland and the Netherlands have been black-boxes, and how and by whom these were or will be opened.
<i>Places of concern</i>	When attention is given to a certain place for some reason, it might turn into a place of concern. For instance, municipalities that were selection as possible sites for final disposal turned from places into places of concern.	These are non-human actants that might affect the nuclear waste policy-making processes as part of the actor-network, through opening black-boxes, and might bring together pro-nuclear or anti-nuclear actants.
<i>Boundary objects</i>	It is a non-human object that gathers actants around it. These actants have no shared knowledge or interests but the boundary objects function as shared end goal and therefore facilitates collaboration.	Boundary objects can gather actants, which form actor-networks. In this thesis, boundary objects give insights in how actor-networks were formed.

## 2.5. Application of Actor-Network Theory in this Research

ANT is used as approach for analysing and exploring the nuclear waste policy-making processes in Finland and the Netherlands because it is suitable for exploratory research and for understanding connections between various actants involved in processes (Dankert, 2011). The nuclear waste policy-making processes, at local and national level, are the main actants from which the study starts. Using ANT, I strive to get a realistic understanding of hybrid socio-technical policy processes in which connections between both human and non-human actants are analysed and considered important. An overview of ANT concepts and how these are applied in this thesis, can be found in Table 2.

Using ANT is a promising approach to get an understanding of how the nuclear policy-making process was in reality, instead of using either a ‘social’ or ‘natural/technical’ research angle. Therefore, nuclear waste issue is considered a socio-technical combination, which is used as starting point for this research. In this way, it is presumed that nuclear waste policy-making is neither a social nor a technical issue but hybrid.

During the interviews and reading literature, the way of framing is analysed in order to examine whether a separative way of framing of the nuclear waste issue affects the lack of influence of LMs and NGOs during the nuclear waste policy-making process. In line with this, it is also studied whether LMs and NGOs have more legitimacy during the process, when the nuclear waste issue is framed as socio-technical combination. Furthermore, the nuclear waste policy-making process at local and national level are considered part of actor-networks and comprise human and non-human actants. Moreover, based on the interviews and by visiting Finland, non-human actants are identified to analyse how these affected the policy-making process and influence of LMs and NGOs. In line with ANT, all actants are regarded to affect the policy-making process in the same way. In this way, places of concern objects can be observed and considered as actant that are part of the actor-network. Besides this, boundary objects can be identified after the data is collected and an overview is gained regarding which actants were involved. Boundary objects can give insights in how these actor-networks were formed and how this affected the policy-making process. Overall, connections between actants are expounded and actor-networks are identified. In this way, factors that affected the influence of LMs and NGOs in Finland and the Netherlands are studied.

## 2.6. Sub-Research Questions

Using concepts drawing on and inspired by ANT, effects between human and non-human actants during the nuclear waste policy-making process, are analysed. Actants that relate to the site selection process are explored through interviews and the analysis of literature and reports. Based on these concepts, the following main research question is answered:

- What factors affected, or will affect, the influence of LMs and NGOs during the nuclear waste policy-making in Finland and the Netherlands?

In order to answer these main questions, three sub-research questions are constructed to analyse the influence of LMs and NGOs in nuclear waste policy-making at local and national level in Finland and the Netherlands:

- What places of concern and ways of framing affected the influence of LMs and NGOs during the site selection process in Eurajoki?
- What places of concern and boundary objects affected the influence of LMs and NGOs during the site selection process at national level?
- What can be the role of places of concern, boundary objects and the way of framing during the nuclear waste policy-making process in the Netherlands, and to what extent does this affect the influence of LMs and NGOs during Dutch decision-making?

## 3. Methodology

In this chapter, an overview is given of the methodology for this thesis. First, the methodological approach used for this thesis is outlined. Thereafter, the methods for collection of data is discussed which include mostly interviews and literature. Lastly, a detailed overview is given of how the research is conducted and analysed including transcription and coding of interviews.

### 3.1. Methodological approach

#### 3.1.1. Case Study

This research is split up into two parts. First a qualitative case study is done in Eurajoki, in order to gain in-depth insights and an understanding of the site selection process. A case study is suitable for the Eurajoki case for three reasons (Hancock & Algozzine, 2016); first, it focuses on a particular event, namely the site selection for final disposal in Eurajoki. The study focuses on the discussions and actors during the site selection process. Secondly, the phenomenon is being researched in its natural context, therefore I went to Finland and Eurajoki for 3.5 weeks. In Finland I tried to meet as much stakeholders that were involved during the site selection, that I interviewed. Lastly, diving into this case study gave the opportunity to gain multiple perspectives by interviewing different stakeholders and by visiting Eurajoki itself. By going there, I got a better understanding of the context, met interesting people to interview and to gained insights in the socio-technical networks around the final depository Onkalo (non-human actors included).

#### 3.1.2. National Level

In order to gain more insights in the influence of local movements (LMs) and non-governmental organisations (NGOs) in nuclear waste policy-making at national level, a comparison was made between Finland and the Netherlands. However, this comparison is not based on the exact same factors and aspects. As in Finland the final depository is already under construction, the national policy-making process is analysed in hindsight. In contrast, in the Netherlands there is no final depository under construction yet. At the moment COVRA, a Dutch company responsible for nuclear waste disposal, is doing research regarding suitable sites for final disposal. Later on, decisions will be made regarding the Dutch national policy-making. Therefore, the Netherlands is analysed according to a different policy-making phase, compared to Finland. Nevertheless, insights from Finnish nuclear waste policy-making for their final depository were used to examine current Dutch nuclear waste policy-making.

#### 3.1.3. Research Design

This study is an explorative research, as variables were examined in order to analyse a policy-making process. In this thesis, data is used to analyse whether the way of framing, places of

concern and boundary objects, affected the influence of LMs and NGOs during nuclear waste policy-making. It has a qualitative and partly exploratory design. The qualitative design is used to describe patterns in order to explore factors that influenced a situation (Hancock & Algozzine, 2016). At the start of this research, the exact research question is not fully clear yet. Due to the qualitative and explorative approach, I was able to adjust the aim of my research based on the interviews I arranged in Finland and the Netherlands. Also, more emphasis was given to certain research topics according to the content of the interviews. Moreover, the research in the Netherlands was even more exploratory in nature, as little research has been done yet regarding influence of LMs and NGOs during nuclear waste policy-making in the Netherlands.

### 3.2. Data collection

The collection and qualitative analysis of texts and documents and qualitative interviewing were used as methods to collect data. Most emphasis in this research is given to the site selection process in Finland, as reflected in the number of read literature, documents and interviews per country as well. In line with ANT, the methodological approach is partly based on 'follow the actors'. In ANT, actors can be followed to understand and analyse what moves them and what made them act. By going back to the actors and let them speak, they are granted the ability to explain their own theories of what the social is made (Baron & Gomez, 2016). The site selection process in Eurajoki is the actant that is used as starting point in this analysis. Human and non-human actants that relate to the site selection process is explored, through interviews and the analysis of literature and reports. For Finland, the period between late 1980s until now was researched. This is the period in which different sites were investigated as possible final depositories and when Eurajoki is chosen as final site. For the Netherlands, the late 1990s is examined until present. Because during this period of time, discussions started to rise regarding final depository possibilities. As the process of finding a suitable final depository site is still in progress, more emphasis was given to the current situation in the Netherlands, compared to Finland.

#### 3.2.1. Interviews

Since probability sampling seems not appropriate for this research, snowball sampling is used. With this technique, initially just a small group of relevant people is sampled and were asked to propose useful new interviewees (Bryman, 2012). At the start of my data collection, I had e-mail contact with some NGO employees and someone from Posiva, but no interviews were scheduled yet. So, I went to Finland in order to call LMs and NGOs, walk by the offices from NGOs, the Eurajoki municipality, and Posiva. In this way I scheduled interviews in Finland. After contacting or interviewing participants, they were asked if they knew other relevant people to interview for the research. Besides this, opportunistic sampling was used to make

sampling decisions during the process (Bryman, 2012). As more knowledge was gained during the process and data generation, new decisions regarding interview questions or adjustments in topic lists were made to optimize data.

Semi-structured interviews were used to gain information regarding the site selection process and the involvement of various actants. Semi-structured interviews were appropriate for this research, since it allowed the interviewees to give their own perspectives on the process without pigeon-holing the response (Bryman, 2012). An interview guidance was made per interview, as various stakeholders had different experiences, interests and perspectives.

### 3.3. Conducting Research

#### 3.3.1. Administration of Method

To have an understanding of nuclear waste policy-making in Finland and the Netherlands, knowledge was acquired by reading literature. Both literature and reports are collected online via the WUR library and google scholar. Among this literature, most useful publications were comparisons between nuclear waste policies at national level (Lehtonen, 2010; Bergmans et al., 2015), nuclear waste policy in Finland (Kojo & Litmanen, 2009; Kojo, Kari & Litmanen, 2010; Vira, 2006) and reports written by Posiva (2003) *Programme of Monitoring at Olkiluoto During Construction and Operation of the ONKALO* and Äikäs and Sundell (2014) *Onkalo – from concept to reality*. For the Netherlands, the *Dutch National Program for Radioactive Waste Control and Spent Nuclear Fuel*, published by the Dutch Ministry of Economic Affairs (2016), and the Dutch nuclear waste policy process by Van Soest (2018), were mainly helpful.

#### 3.3.2. Interviewees

In Finland, local people and members of the municipal council in Eurajoki were interviewed. Moreover, I interviewed campaigners from LMs and NGOs, such as Greenpeace and Women Against Nuclear Power. Furthermore, employees from Posiva, a geologist, a member of the European Parliament and an environmental journalist were interviewed.

In the Netherlands, I interviewed a researcher and the director from COVRA. Moreover, WISE Nederland and Laka were interviewed, both anti-nuclear movements. Besides this, I interviewed Van Soest, who is involved in current nuclear waste policy-making in the Netherlands. Lastly, ANVS (Authority Nuclear Safety and Radiation Protection) replied to the interview questions by e-mail. An overview of the interviewees and associated organisations or institutions, is shown in Appendix 1.

### 3.3.3. Transcribing Interviews

In total, 26 interviews were conducted, of whom 19 in Finland and 6 in the Netherlands. All interviews were transcribed as soon as possible after the interview was conducted.<sup>2</sup> For short interviews, the FTW Transcriber was used. This FTW Transcriber enabled me to transcribe for 15 minutes, with helpful tools such as slowed down speech and easy rewinding of sentences. By using this, I was able to listen to the interview and type it word by word. Since for my analysis the way of speaking is not so important, I did not include all pauses taken in between words or sentences. However, most interviews were between 45 minutes to 90 minutes long. For these interviews I used Temi.com. By uploading an interview, a full transcribed version was sent to me by e-mail. However, these transcriptions were of low quality so that almost every sentence did not correspond to the spoken words. Therefore, I listened to the interviews one by one again, to correct the transcribed version. Because of background noise and Finnish accents, it was sometimes hard to hear the right correction. Also, the Temi-website did translate very literally, hence *uhh's* and and some words that were said repetitively, were also transcribed. Therefore, these transcribed interviews are sometimes very spoken-language and not convenient to read. For each interview, I also made a short summary as front page. In this way I was already able to summarize some main points that seemed interesting to me during transcribing.

All interviewees were asked how they wanted to be referred to. This could be by their names, company name or anonymous. All transcriptions were sent to the interviewee themselves by e-mail, with the question whether they agreed with the transcription and/or have any additional comments, changes in the transcription or feedback. Most interviewees replied to this e-mail. Comments and changes were adjusted in the transcription. Those that did not reply, were sent another e-mail after one and a half month in which they were asked again to comment on the transcription. One interviewee demanded to use the summary and main points of the interview and the articles he provided me. Because in his view the interview was difficult to read due to spoken-language and therefore might be challenging to interpret correctly for a non-geologist like me.

### 3.3.4. Coding of Data

All interviews were printed and coded by hand. I marked those sentences that I thought were relevant for the analysis or were repetitively mentioned. Once I marked a sentence, I added these main codes in Excel. Other codes that were strongly linked to one of these main codes were added next to the code.

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<sup>2</sup> All transcribed interviews can be found in the Appendix 3.

Once all interviews were coded, the Excel file consisted of 57 main codes for Finland and 24 main codes for the Netherlands. An overview of the codes can be found in Appendix 2. A distinction between these countries was made, as the policy-making analysis will be different based on the policy phase that these countries are in, as mentioned before. On average, each main code was followed by one to five descriptive codes. These main codes then were narrowed down to 22 themes and categories, organized per country. The transcriptions and codes helped me to better understand the interview content and to find the thread throughout my thesis. An overview of all themes and categories can be found in Appendix 2.

This methodology is used to do a case study in Eurajoki at local level and the analysis of Finland at national level, which are described in the following two chapters. After that, results from the analysis regarding current nuclear waste policy-making in the Netherlands are described.

## 4. A Lack of Influence from Local Movements and Non-Governmental Organisations in Eurajoki

### 4.1. Introduction

Nuclear waste management in Finland is considered a role model for other countries. Whereas nuclear waste is a controversial issue that involves various actors and divergent perspectives of proponents and opponents, Eurajoki has been the first municipality globally where a final depository is currently under construction. Although various local movements (LMs) and non-governmental organisations (NGOs) were concerned about the site selection process for final disposal in Eurajoki, they had little influence.

In this chapter, the effects of places of concern and ways of framing on the lack of influence of LMs and NGOs during the site selection process in Eurajoki, are analysed. For this, first, an overview is given of the actants that were active in Eurajoki and were interviewed for this thesis. These actors include various campaigners from NGOs and LMs, citizens from Eurajoki, a critical geologist, the mayor of Eurajoki and (former) Posiva employees. An overview of the main actors involved during the site selection process is given in Table 3. Thereafter, based on data from the interviews and literature, the influence of NGOs and LMs is analysed and described in chronological order in three periods of time during. The analysis starts with a brief study of the site selection process in the late 80s and begin 90s. Then, the site selection between 1994 until 2000 is discussed, in which Eurajoki became the preferred municipality for final disposal. In this period, Posiva needs to gain citizen trust, local opposition arose, and an Environmental Impact Assessment was conducted by Posiva to involve citizens. From the period of 1999 onwards, several places of concerns are identified and discussed. Lastly, a conclusion is given regarding the role of the way of framing and places of concern on the influence of LMs and NGOs.

### 4.2. Actors Involved in Site Selection Eurajoki

#### 4.2.1. Local Movements and NGOs

Active NGOs in Eurajoki were Greenpeace, the Finnish Association for Nature Conservation and Luonto-Liito. These movements were mostly supporting LMs in different municipalities, opposing possible final depository in their area. In Loviisa, a municipality that was also a possible site for final depository in Finland, a strong anti-waste and anti-nuclear movement could be build. While in Eurajoki, there was no strong anti-nuclear movement. The overall aim of the LMs and NGOs was to have more research done, before the license for Onkalo would be granted. Moreover, they supported LMs in their actions through provision of social and financial resources.

The Women Against Nuclear Power (WANP) movement is a national movement part of the Women for Peace Movement. It started as a movement when a new nuclear reactor was built in Loviisa. The goal of the WANP movement is to stop nuclear power production. Furthermore, they criticize the method used for Onkalo. According to the movement, more research regarding final depository methods should have been done, like in Sweden, instead of building Onkalo as a quick solution. Also, they argue that Posiva should have collaborated with experts from Sweden and should have organised more discussions in Finland. Their strategy was to get media attention by doing direct actions. For instance, they went several times to the office of the Finnish power company Teollisuuden Voima Oyj (TVO). For instance, they handed over written poems to the CEO while crying in silence because of the nuclear risks. Thereby, they had organised a press release and told the CEO that they wanted to nuclear power production to stop.

Another important actor during the site selection were the opposing citizens in Eurajoki. It was their goal to prevent to municipality from granting the construction license for a final depository in Eurajoki. It was a small LM within the municipality. At a certain point just two people were involved. They used direct actions such as protests to get media attention to achieve their aim.

#### 4.2.2. Municipality of Eurajoki

The municipality of Eurajoki has been important in the site selection process because they had the right to veto against granting the license. The municipal council had to grant the license for constructing the final depository within Eurajoki. Because of this, Posiva needed to get approval of the municipality to get the license for constructing the final depository.

Three nuclear reactors are located in Eurajoki. Because of this, many citizens in Eurajoki are or were employed by the nuclear industry. Hereby, Posiva and TVO have a strong collaboration with the municipality.<sup>3</sup> Moreover, the municipality receives estate tax from Posiva and TVO. As a result, Eurajoki has a good economic situation compared to other municipalities in Finland.

#### 4.2.3. Nuclear Industry: Posiva and STUK

Posiva is the company that is responsible for storing spent nuclear fuel in Finland. It is owned by TVO and Fortum.<sup>4</sup> At first, TVO was responsible for the nuclear waste of their own reactors. During the nuclear waste policy-making process, Posiva was established in 1996. This happened after the Nuclear Energy Act in 1995 which prevented that spent fuel could be

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<sup>3</sup> TVO is a nuclear power company, owning the nuclear reactors of Olkiluoto in Eurajoki.

<sup>4</sup> Fortum is a nuclear power company possessing nuclear reactors in the municipality Loviisa.

returned to Russia (McEwen & Äikäs, 2000). Posiva applied to the government for a construction license in order to start building a final depository in Eurajoki (Posiva, 2003).

STUK is the Radiation and Nuclear Safety Authority that supervises radiation and nuclear safety in Finland. During the final depository process, STUK assessed the long-term safety, technical feasibility, safety of the use and readiness of Posiva to construct the nuclear facility (STUK, 2017).

Table 3

*Overview of Main Actors in Final Depository Decision-Making*

<b>Organisation/Industry</b>	<b>Actor</b>	<b>Involvement in Site Selection</b>
NGOs	Greenpeace, FANC, Luonto-Liito	Lobby for more research regarding (alternatives to) final depository in Eurajoki. Also, they support LMs.
Local Movement	Women Against Nuclear Power	Direct actions to stop nuclear power production and request for more research concerning the final depository.
Local Movement	Citizens opposition	Several citizens were publicly against granting the construction license for Onkalo.
State	Municipality of Eurajoki	Right to veto granting the construction license for Onkalo.
Nuclear Industry	TVO	Owner of nuclear reactors in Eurajoki. At first responsible for nuclear waste. Later, established Posiva to take over responsibility for a final depository.
Nuclear Industry	Posiva	Responsible for spent nuclear fuel in Finland. Posiva is building Onkalo.
Nuclear Industry	STUK	STUK is the Radiation and Nuclear Safety Authority and assesses and supervises the safety and feasibility of constructing Onkalo.

Together these actants are part of an actor-network of the site-selection process in Eurajoki. The results discussed in this chapter describe how certain actants affected the site selection process and the influence of LMs and NGOs during this process.

### 4.3. Late 80s-1993: Selection of Possible Sites

Already from the 80s, a schedule was made concerning the nuclear waste policy process in Finland, as shown in Table 4. The process would start with a suitability analysis in which over 300 municipalities were examined by the Finnish power company TVO, to study which

municipalities were suitable for a final depository. In this period, there was a rather large number of possible sites and hence a broad discussion. The discussion and anti-nuclear arguments were more directed towards the nuclear waste problem and options for alternative energy, of which the need for the low carbon energy system was the main pro-nuclear argument (Lammi, 2009). TVO studied the suitability of the bedrock for a nuclear waste facility in different municipalities since the early 1980s (Litmanen, 1996). At this point, the municipality Eurajoki was one of them but the municipal council of Eurajoki was against final disposal due to environmental and social risks (Kojo, 2006). This was no exception compared to other municipalities, as most citizens in Finland were a bit more hesitant regarding nuclear waste disposal after the Chernobyl accident in 1986.

Over time, the selection of possible sites for facilitating a final depository narrowed down and Eurajoki remained one of them. Based on environmental factors, areas were selected for possible final depository facilities (Kojo, 2006). In the first place, this was based on geological factors and later environmental factors as well, including population density, transport infrastructure and land-use planning. It was “[...] a technical approach or a geological suitability approach, in which the general geological conditions of different areas were analysed to verify their suitability as final depository site” (Nucci & Brunnengräber, 2017: 303). Hence, these have been factors that were either technical or facts, and not very open to debate. In this way, LMs and NGOs were not able to affect this part of the site selection process.

As the site selection process so far is framed as a geological choice, it can be seen as an example of a separative way of framing. It seems that there is a distinction between social consequences, that might happen later, and the technical and geological decisions that the site elimination is based on. During this period, there was little space for involvement of NGOs and LMs as decisions were already made regarding site elimination. As the government had approved the start of the site selection process by 1983, the geological discussion dominated the decision-making. Because of this, there was little resistance regarding the site selection process.

Table 4

*Timetable for Spent Fuel Final Disposal*

1980–1982	Suitability study with safety analyses
1983–1985	Preparation for the preliminary site characterisation
1986–1992	Preliminary site characterisation in chosen areas (5–10 sites)
1993–2000	Additional siting studies (2–3 sites)
2001–2010	Detailed studies of chosen disposal site and preplanning of the siting and the encapsulation plant
2011–2020	Planning and construction of the disposal site and the encapsulation plant

2021–2050	Final disposal facility is operational
2050–2060	Closing of disposal site

*Note.* Reprinted from Programme and Schedules for TVO's Nuclear Waste Management, by Raumolin, H. (1982). Report YJT-82-55, p. 7.

## 4.4. 1994-2000: Eurajoki as Favourite?

### 4.4.1. Preliminary Site Selection

During the preliminary site studies between 1993-2000, executed by Posiva, Eurajoki was one of the final municipalities that was geologically most suitable for hosting the final depository, together with Loviisa, Kuhmo and Äänekoski (McEwen & Äikäs, 2000; Kojo & Litmanen, 2009). Again, this selection of municipalities was mainly based on geological factors and technical expertise. But in 1994, the NEA was amended and as a result, all spent nuclear fuel produced in Finland should be disposed in Finland from 1996 onwards (McEwen & Äikäs, 2000; Äikäs & Sundell, 2014). This NEA raised concerns among citizens and resulted in a lot of LMs revolving around individual possible disposal locations (interview Lammi, campaigner Greenpeace, p. 4). So as it became clear that nuclear waste had to be disposed somewhere in Finland, local opposition started to arise.

During the late 90s, more emphasis was given to citizen acceptance in order to reduce the local opposition. It became clear to Posiva that decision making mainly based on technical expertise was not appropriate for long term decision making (Kojo & Litmanen, 2009). So, whereas at first, emphasis was given to geological factors, focus shifted towards social factors and implementation (Kojo, 2006). Later, two municipalities (Loviisa and Eurajoki) were chosen as most preferred municipalities to host the final depository. The municipal councils were able to veto granting the construction license for a final depository in their municipality. Therefore, more emphasis was brought to the acceptance of nuclear waste in the municipality and its citizens (Kojo & Litmanen, 2009). In this way, Posiva experienced that the disposal of nuclear waste is not just a technical or scientific issue, it became a social issue as well (Vira, 2006). Therefore, this right to veto has played an important role in the site selection and affected the strategy of Posiva during site selection.

During the preliminary site selection, there was discussion regarding the possible sites in which social factors received increased attention since the implementation phase approached. It seemed that these geological and social discussions were not integrated but separated. At first, NGOs and LMs did not have any influence regarding the site elimination at first, but this changed when the implementation aspect became more important during the process. LMs and citizens within the municipalities became more empowered, as the municipality had the right to veto. The influence of NGOs was mostly directed towards supporting LMs since they did not have the resources for a nuclear waste campaign at that time (interview Lammi, p. 10).

In this period, the way of framing seemed to be more integrative. As the site selection process, based on geological factors, was linked with the notion that the municipality and its citizens should grant a construction license. Hence, despite that LMs arose, the municipality was still against the final depository and no decision had been taken yet. In this way, there was little influence from the LMs and NGOs on the site selection process.

#### 4.4.2. Citizen Acceptance and Trust

In order to get the licence granted by the municipalities, approval of citizens of Eurajoki or Loviisa was needed. For this, Posiva had to gain trust within the municipality. So, in order to win trust and to be convincing, people had to get to know Posiva (interview Seppälä, ex-Communication Manager Posiva, p. 5). Furthermore, Posiva wanted citizens to have faith in the safety monitoring by Posiva and STUK, and to see the benefits of a final depository in Eurajoki. In this way, the discussion slowly changed from technical and geological factors, towards safety and trust in the area. The discussion regarding the technical aspects of the final depository also relies on trust because nuclear waste is a complex issue to understand. As environmental journalist Jokinen mentioned in the interview:

It's very hard to understand radioactivity issues, [...] the timescale, the amount of waste, the depth and quality of the bedrock. [...] So I think they [citizens] mainly trust the company Posiva and also STUK. [...] Although citizens might think that they trust the method itself, they often trust Posiva and STUK as they don't know enough about the technical complexities of the final depository. (p. 8)

So, STUK and Posiva longed for a safe final depository. But how citizens perceived safety and how to generate acceptance among citizens for a final depository, became topic of concern. So, at this point in time it seems that now the social factors such as trust and safety started to dominate the discussion.

As the final depository was a technical issue that needed to be accepted by involving social aspects, the discussion did not turn into a discussion in which many perspectives were included. For instance, alternatives to a deep geological facility were not discussed and critical notes from LMs were ignored (interview Municipality Eurajoki, p. 10). It seemed that the aim of discussion was more about how to justify the decisions, and how to get social barriers accepted by the citizens and municipality in Eurajoki. The acceptance of the municipality and citizens of Eurajoki were not seen as less important but seemed to be more understood as a social issue that needs to be resolved by gaining trust and transparency. In line with Bergmans et al. (2015), this would be a separative way of framing in which the involvement of social aspects is used by Posiva as an instrument. In this way legitimacy was increased and trust created in order to continue the decision-making process, instead of involving LMs and NGOs to adjust decision-making process according to their perspectives or critics.

#### 4.4.3. Eurajoki and the Nuclear Industry

Over time, the municipality and its citizens became more interested in hosting the final depository. TVO and Posiva have been part of a long nuclear industry history and close co-operation within Eurajoki (Kojo, Kari & Litmanen, 2009). Therefore, building trust and acceptance in Eurajoki was easier to achieve compared to other municipalities such as Loviisa. Also, the municipal council became slowly in favour of a final depository, mainly due to the tax benefits. Together with the municipality, Posiva organised open meetings, lobbied and communicated in a transparent and open way in the media or at local meetings. In this way, Posiva slowly changed people's minds (interview Kari, citizen Eurajoki, p. 5). Partly because of this, the municipal council decided in 1997 to link the future image to nuclear power and be able to benefit from economic advantages of the industry (Kojo, 2006). These advantages of a final depository in Eurajoki were offered by Posiva, including job security and taxes paid by TVO and Posiva to the municipality (interview Municipality Eurajoki, p. 5).

Moreover, most citizens were already in favour of nuclear energy as many of them worked for TVO or knew a family member or friend that worked there (Kojo, Kari & Litmanen, 2009). Due to the Olkiluoto reactors, the municipality already depended on the nuclear industry (Kojo, Kari & Litmanen, 2009). Over time, citizens got used to these advantages and hence developed a pro nuclear attitude as Kari (interview Kari, citizen Eurajoki, p. 4) stated: "I have always lived in the shadows of the nuclear plant". He explained that he was raised as a child with the notion of nuclear industries in his municipality, and therefore most citizens had a pro nuclear attitude. So, when the municipality had to choose whether they accepted the construction license for Posiva, the majority of the citizens eventually was in favour. Consequently, Eurajoki became the preferred municipality for final disposal because there was less resistance compared to Loviisa.

So, Posiva, and in the end the municipality as well, managed to create a more pro-nuclear environment in which social advantages played a key role. Objections were raised by the opposition, pointing out the environmental risks and the need for more profound research for a final depository. The separative framing of the nuclear waste issue with focus on the social advantages was strong and created a pro-nuclear attitude within the municipality. Nevertheless, not everyone in Eurajoki was in favour of the construction license.

#### 4.4.4. Opposition in Eurajoki

There was still some opposition in Eurajoki as well. For example, the WANP movement were protesting in the municipal council and at the TVO office, and some citizens were raising their voices. Nevertheless, there were just a few citizens in Eurajoki that were opposing the final depository at this point. The small number of people was partly the result of intimidation and threatening from other citizens (interview citizen, opposition Eurajoki, p. 1). According to a

woman who has been actively opposing the final depository in Eurajoki, these threats were serious. She described that when she went to the supermarket, people yelled at her and disturbed her. Once, when she walked out of the supermarket, a car stopped in front of her and when the window was opened, the person inside told her: 'If you don't stop the resistance, you're going to be the first one to be buried in the cave'. As reporting threats were not taken seriously by local authorities many people that were opposing Onkalo moved to Rauma, a town nearby (interview citizen, opposition Eurajoki, p. 1).

Most proponents were linked to TVO or Posiva and wanted Olkiluoto 3 reactor, and hence wanted Onkalo to be built in order to have more job security and tax for the municipality (interview citizen, opposition Eurajoki, p. 1; interview citizen Eurajoki, p. 1). Consequently, citizens that were against nuclear energy or the final depository in particular, rather did not talk about it openly. For instance, in an interview with a citizen from Eurajoki, a retired captain that lived closed to Olkiluoto explained that he himself is against nuclear. But he never talks about it with anyone, because no one does. He also did not know anyone else who is against nuclear power as nobody talks about it. Since many people work at Olkiluoto (and Onkalo), the opponents remain quiet (interview citizen Eurajoki, p. 1). So, there was little space given for the opposition to raise their voice, undermined through the overall pro-nuclear attitude that fellow citizens within the municipality expressed.

Overall, the site selection affected the social cohesion between citizens within the municipality and contributed to the little influence of LMs and NGOs. People felt social pressure to be pro-nuclear or otherwise felt they had to remain silent. However, there have been opportunities for opposing citizens, LMs and NGOs to raise their voices against the construction. Posiva executed an Environmental Impact Assessment (EIA), in order to involve local citizens. How the EIA affected the site selection process is discussed next.

#### 4.4.5. Environmental Impact Assessment (1997-1999)

Another influencing actant in the site selection process and involvement of citizens in Eurajoki, has been the EIA, executed on behalf of Posiva. Finnish legislation has emphasized the need for involving citizens in planning and implementation (Strauss, 2010). Hence, the EIA has been executed by Posiva in 1998, at the site investigations of the final four municipalities (Eurajoki, Kuhmo, Loviisa and Äänekoski). For this EIA, opinions and feedback from citizens of these municipalities were collected to ensure that the local people would consider the EIA as a proper and complete research (Pasanen, 1998). In this way, it opened new discussions about final depository in the area (Kojo, 2001), and social and technical questions were combined and connected (interview Seppälä, p. 6). The EIA results pointed out that Olkiluoto was more suitable as most spent nuclear fuel was already stored there and there was more space for building a final depository (interview Seppälä, p. 8). Moreover, Seppälä mentioned

(interview, p. 8): “[...] The EIA also indicated that Olkiluoto would be at better place. A better place because, well, the public was not so divided with the issue as was the case in Loviisa”.

The question remains if the EIA has led to more influence of LMs and NGOs. According to Joensuu et al. (2015), the aim of doing research and publish reports is often to steer public attention towards positive attitudes and away from the obstacles a company is facing. In Eurajoki, local views were heard in these meetings. But as stated by Kojo (2001: 367): “[...] the process did try to teach the people how to speak with the decision-making system, in the system’s language. Thus, the purpose of EIA was to make the local discussion controllable.” Litmanen et al. (2017) refer to the EIA as ‘[...] an instrument, which opened possibilities for civil society organizations (CSOs), but very limited ones.’ Hence, the EIA process was dominated by a pro-nuclear establishment, in which the EIA was a legislative requirement and bureaucratic undertaking instead of a participatory policy process (Blowers & Sundqvist, 2010). In this way, the participation of citizens, LMs and NGSO was part of pre-designed planning and decision-making processes (Blowers & Sundqvist, 2010; Hokkanen referred to in Litmanen et al., 2017). For this reason, opposing groups, not only in Eurajoki but also in North and Central Finland, did not want to participate in the EIA because the report was driven by the project owner, Posiva. Therefore, they did not want to support the law-based process of decision making and therefore did not participate (interview Äikäs, former executive vice-president and corporate adviser of Posiva, p. 11). Overall, the EIA had therefore not led to influence of LMs and NGOs within the policy-making process.

Although the EIA has been an opportunity to involve NGOs and LMs, this was not the case in Eurajoki. The example of the EIA shows that involvement of NGOs and LMs is framed separately as there is a clear boundary between social and technical actors and aspects. In this case, whereas Posiva and the municipality already seemed to prefer to construct a final depository in Eurajoki or Loviisa, the social actors were involved to increase legitimacy and trust. Hence, the nuclear issue was framed separately as technical aspects dominated the discussion, but social aspects were included in the EIA to endorse the construction of a final depository.

## 4.5. 1999-2018: Decision in Principle and Behind

Up until 1999, citizens from Eurajoki were informed by the municipality and Posiva. The majority of the citizens had slowly changed their minds but still Loviisa and Eurajoki were both in the running for hosting the final depository. Besides the way of framing the discussion, places of concern have affected the decision making. As mentioned in the research approach, black-boxes that are issues that were thought to be fixed and stable could be opened and turn into places of concern (Schaeffer & Smits, 2015). In the case of Eurajoki, it seems that LMs and NGOs have not been able to turn a place into a place of concern. As Eurajoki turned into a place of concern by being one of the final municipalities left to facilitate a final depository, this has been rather the result of the decision-making by Posiva and TVO.

Two sites have played a role in the final decision making at this stage: Loviisa and the Vuojoki Mansion. Moreover, the right of the municipality to veto a construction license and the Decision in Principle (DiP) has affected the site selection as well. The DiP is a policy design required by the Nuclear Energy Act (NEA) before any significant nuclear facility can enter the phase of implementation (McEwen & Äikäs, 2000: 11). Loviisa, the Vuojoki Mansion and DiP are places of concern that influenced the site selection process and influence of LMs and NGOs.

### 4.5.1. Right to Veto and Decision in Principle

Since most of the citizens in Eurajoki and the municipal council were informed, in favour of the final depository, satisfied with the Vuojoki arrangement and with least opposition compared to Loviisa, Posiva submitted the application for the DiP to the government in 1999. According to Äikäs, former executive vice-president at Posiva (interview) the local citizens were aware of their veto right and for the final approval they awaited the evaluation of STUK:

Like whenever we have proposed that we would like to explore the bedrock here or here, the local people became aware at the same time, they have the final say. They will have the final veto right. So, they elect us to make the research, collect information and data, make the analysis and the technical assistance. (p. 4)

So, when the local people became aware of their final say, they waited for the regulator STUK to approve the safety of Onkalo. A safety assessment was done by STUK for the Eurajoki site approved the choice for this location. When STUK approved this, the citizens also accepted to grant the construction license. After this, the Parliament decided that the final depository would be a better solution than waiting for a miracle solution, so therefore the DiP was accepted in 2001 to build Onkalo, the final depository in Eurajoki.

Because of the right to veto and the DiP, Posiva had to make sure that the construction license would be granted by the municipality and the Parliament. Consequently, a switch from geological aspects towards trust and acceptance took place. This has set in action a bunch of

other matters such as; a division between pro- and anti-nuclear citizens even resulting into intimidation, tax advantages and extra jobs that were offered by Posiva, agreements that were made with the municipality, but also opposition in other municipalities.

#### 4.5.2. Loviisa

The municipality Loviisa, has also affected the site selection process. Loviisa was selected as an alternative candidate for final depository, as there was also a nuclear power plant located (Kojo, 2006). Due to the nuclear plant, citizens in Loviisa generally had a more positive attitude towards nuclear power (McEwen & Äikäs, 2000). However, in Loviisa, the population was divided in their opinions regarding nuclear power. The Swedish-speaking people often held more negative nuclear power attitudes compared to Finnish-speaking people. As reported in the Posiva EIA (Posiva, 1999) this resulted in polarization regarding a positive or negative nuclear power attitude and hence polarized opinions regarding final depository within the municipality of Loviisa. During this period, opposition in Loviisa arose. Opposition Loviisa did also affect the decision making for final depository in Eurajoki. Because of this opposition in Loviisa, it became clear to Posiva that there was more social acceptance in Eurajoki. Hence, they focussed on an agreement with the Eurajoki municipality. It should be mentioned that also other reasons were mentioned in favour of choosing Eurajoki over Loviisa such as better infrastructure and facilities in Olkiluoto for final depository (Kojo, 2006). Nevertheless, without opposition in Loviisa it is uncertain whether Eurajoki would have been the preferred municipality for a final depository.

The case of Loviisa shows that the decision-making process is a network of actants, in which Loviisa is one actant that affected decisions made during the policy-making process. As Posiva decided to focus on Loviisa and Eurajoki as final possible sites, LMs in Loviisa became stronger and managed to prevent a final depository within their municipality. At the same time, this opposition in Loviisa resulted in the decision that Eurajoki would be the preferred municipality to host the final depository.

#### 4.5.3. Vuojoki Mansion

As Eurajoki became the preferred municipality due to less opposition compared to Loviisa, Posiva and the municipal council started to discuss possibilities. The Vuojoki Mansion played an important role in the actual decision making of the municipality to accept Onkalo in Eurajoki. It was a home for elderly people and the municipality wanted to build a new home because the old mansion was too impractical for that purpose (Kojo, 2009: 180). Hence, they needed a new home for elderly people. At this point, the municipality also was already keen on facilitating the final depository. So, the municipality proposed to Posiva that the final depository would be accepted if Posiva would rent the Mansion. The Eurajoki local council approved this agreement in 1999, and in this way the municipality leased the Vuojoki Mansion

to Posiva (Kojo, 2006). Moreover, Posiva would lend about €6,9 million to the municipality for construction of a new elderly home (Kojo, 2006), what would be used to build a new home for elderly.

As Posiva approved to rent the Vuojoki Mansion, many local politicians in Eurajoki became proponents of the final depository as this agreement represented the development of health and social care, funded by Posiva (Kojo, 2009). The cultural heritage Vuojoki Mansion was restored financed by Posiva and was turned into a cultural and congress centre to increase tourist attraction in the region (Yli-Kauhaluoma & Hänninen, 2014). In this way, trust and support from the citizens increased and the application. Also, other compensation options including an ice-stadium project, a development fund for business projects in the municipality, various loans and sale and leasing of water areas were arranged between the municipality and Posiva (Kojo, 2006). Together with the pressure of competition from Loviisa as other candidate, the municipality accepted to submit the DiP in 1999, for approval of the Parliament for construction of the final depository.

So, this request turned the Vuojoki Mansion into a place of concern and shows how non-human objects activate behaviours, decisions or movement. The Vuojoki Mansion played a key role in the final decision of the municipality to approve granting the license, while for Posiva it has been a way to increase citizen acceptance and to be able to have citizens from Eurajoki willing to host the final depository in their municipality.

## 4.6. Conclusions

The site selection process is analysed as an actor-network that involved various human and non-human actants, as illustrated in Figure 4.<sup>5</sup> The influence of LMs and NGOs during the site selection process was affected by the separative way of framing and various places of concern. However, it seems that the main goal of Posiva was to find a suitable municipality that can host the final depository. As Posiva was established with the aim to build a final depository, there was already a clear end goal. Consequently, LMs and NGOs were not welcomed to give their input and raise their voices, as this would counteract the site selection process.

The way of framing has played a role in this, as it has been easier to ignore opposition. Because at first, the preliminary site selection was based on geological factors and hence little influence was there for LMs and NGOs. This was a separative framing as solely geological factors were considered at first, while social factors were not included in the site selection yet. In this way, technical actors such as Posiva, had most legitimacy for making decisions. When there were

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<sup>5</sup> Figure 4 illustrates various links within the site selection actor-network. However, it should be noted that this is just some representation of all links and effects within the actor-network, as there are many more links and more actants involved in the site selection process.

only a couple of municipalities left that were considered suitable and hence the implementation phase approached, the social factors dominated the discussion. As the site selection would now be based on acceptance, this was an opportunity for LMs and NGOs to arise and affect the decision making. In Loviisa, this has been successful as due to local resistance, Loviisa as municipality was not the preferred site anymore.

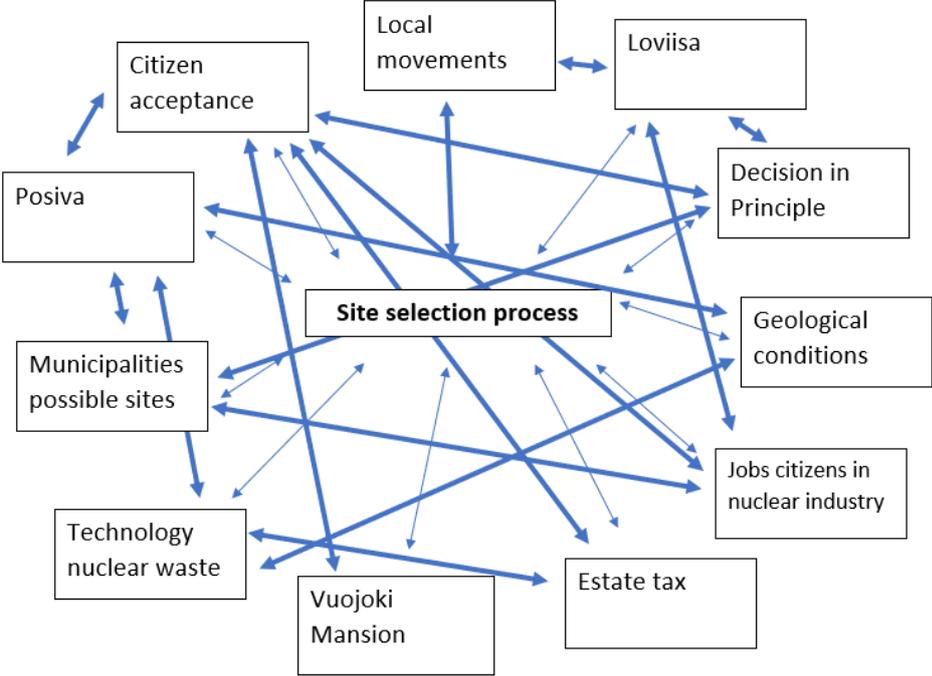


Figure 4. The site selection process as part of an actor-network.

However, in Eurajoki, opposition proved not to be successful because of the following reasons: first, acceptance and trust were gained quite easily in Eurajoki as its citizens were already familiar with the nuclear industry, due to the Olkiluoto reactors. There was little opposition as LMs and NGOs did not have resources to actively oppose the construction license for a final depository. Moreover, the pronuclear attitude that arose in Eurajoki resulted in threatening and insults towards local opposition in the municipality. Social aspects within the discussion have been used as a tool by Posiva and TVO, to facilitate the implementation of a final depository and to gain trust and acceptance among citizens. One of the tools for this was the EIA, in which citizens were involved and asked for their input and concerns. In this way, concerns and questions of citizens were investigated and responded to. Because of this, citizens acceptance increased. So in general, technical actors such as Posiva remained most legitimacy, as social aspects seemed to be included for justifying the predestined final depository schedule. Secondly, the right to veto, Loviisa and the Vuojoki Mansion have become places of concern that affected the site selection process as well. The right to veto and DiP have played a role, at

because of this it became important for Posiva to gain citizen trust and acceptance. Whereas the local opposition in Loviisa was quite strong, the municipality turned from possible site into a place of concern. As a result of the successful LM strategies in Loviisa, Eurajoki became the preferred municipality to host the final depository due to less local opposition. Therefore, the opposition in Loviisa has affected the site selection. This increased the need for citizens acceptance in Eurajoki. Consequently, the Vuojoki Mansion played a key role in the final choice for Eurajoki, as the municipality and Posiva came to an agreement based on the Vuojoki Mansion deal. This shows how also places (non-human actants) affected decision making and were part of the site selection process.

## 5. Local Movements and Non-Governmental Organisations in Finnish National Nuclear Waste Policy

### 5.1. Introduction

As discussed in previous chapter 4, the way of framing and places of concern affected the influence of local movements (LMs) and non-governmental organisations (NGOs) during the site selection process in Eurajoki. In this chapter, the actor-network that was analysed regarding the site selection process in Eurajoki is extended with various actants at national level. Actants that affected the influence of LMs and NGOs in nuclear waste policy-making at national level and thus the site selection process in Eurajoki, include places of concern, the pro-nuclear actor network formed by various pro-nuclear actors, and boundary objects.

In this chapter, the licence for a fifth nuclear reactor in Finland that became a place of concern in the final depository process is described first. Secondly, the lack of influence from LMs and NGOs on the national nuclear waste policy-making is discussed. After that, the nuclear lobby and strong pro-nuclear actor-network that affected the influence of LMs and NGOs is examined. The examination of the final depository as boundary object follows afterwards. Lastly, a conclusion is given.

### 5.2. Fifth Nuclear Reactor

The fifth nuclear reactor in Finland has functioned as place of concern in the nuclear waste policy-making process and in this way affected the influence of LMs and NGOs in the decision-making process. Places of concern are part of the actor-network during the nuclear waste policy-making process. The fifth nuclear reactor was given much attention as politicians and industries wanted to increase nuclear energy production. However, nuclear waste was considered an obstacle for granting the license for a fifth nuclear reactor. Therefore, in this section the role of the fifth nuclear reactor is analysed.

From the 60s onwards, there were already plans made for a fifth nuclear reactor in Finland. As in 1986 the Chernobyl disaster took place, a strong anti-nuclear movement evolved in Finland (interview Lammi, energy campaigner Greenpeace, p. 7). As a result of the Chernobyl disaster, companies withdrew their application in 1986 (Lammi, 2009). Besides emphasizing the risks of nuclear energy production, anti-nuclear movements argued that there should be a solution for the waste first before building a new nuclear reactor. In 1993, the Parliament rejected the construction license for a fifth nuclear reactor but not the process inside the industry for acquiring a new reactor (Lammi, 2009).

However, the nuclear industry still pushed for a fifth nuclear reactor in the mid-90s. To achieve this, the nuclear industry put all their resources into solving the nuclear waste problem in order to have the license for a fifth reactor approved (interview Lammi, p. 20). They did this by

overruling the nuclear waste discussion by emphasizing the need for nuclear energy. The framing of the discussion was focussed on nuclear energy as a whole instead of discussing nuclear energy production and nuclear waste separately. Nuclear energy was advertised as essential for the heavy industries in Finland and as low carbon system in times of climate change. According to Nissinen (interview Nissinen, campaigner FANC) this pro-nuclear campaign emphasized that there were no alternatives to nuclear energy: “That was the storyline that ‘we just simply need nuclear power and we cannot use anything else’.” (p. 7)

As a strong pro-nuclear lobby emphasized the need for a fifth nuclear reactor, this became a place of concern. As a result, the anti-nuclear attitude shifted again towards a more pro-nuclear attitude. Moreover, the plan for a final depository was still scheduled for being accepted by 2000. Hence in 1999, the application for the final depository and the fifth nuclear reactor were both sent to the Parliament. In general, Onkalo was presented as a solution for the nuclear waste and it was thought this would pave the way for acceptance for the fifth nuclear reactor. So, the discussion was mostly dominated by voting for a fifth nuclear reactor, instead of voting for both a waste facility and nuclear reactor separately (interview Lammi, p. 8). Lammi stated:

So even the people who would be critical of the waste normally or in general, say: “Well maybe we need a time out and we need more research? Why do we have to hurry this?” They were convinced for a reactor by the nuclear reactor lobby. [...] So, even the people who were convinced that we need more nuclear power in Finland, were maybe not convinced that we have a waste solution. But they didn't want to boost that problem because that had been one of the issues that had been stopping the reactor last time. (p. 10)

As the fifth nuclear reactor functioned as place of concern, people thus did not separate their opinions regarding nuclear energy and nuclear waste. People who were against the final depository were perceived as if they were against nuclear energy in general too. As the DiP for the fifth reactor and Onkalo were both accepted, Eurajoki officially became the municipality to host the final depository. So, the DiP for the fifth nuclear reactor has affected the decision making in a way that the discussion about nuclear energy dominated the debate about nuclear energy in general.

The shift from a national anti-nuclear environment towards a pro-nuclear environment can also be noted in Eurajoki, as there was a shift from anti-nuclear attitudes among citizens which became more pro-nuclear over time due to advertisements of Posiva and the fact that they gained trust. Whereas the national campaign might also have affected the trust and pro-nuclear attitude in Eurajoki, the pro-nuclear attitude in Eurajoki that resulted in proposing Eurajoki as host for the final depository probably helped the Parliament for being willing to grant the construction license. In Eurajoki too, places served as place of concern in order to

create a more pro-nuclear attitude in the municipality. For instance, the agreement concerning the Vuojoki Mansion (discussed in chapter 4) increased trust and acceptance among citizens for a final depository in Eurajoki. The Vuojoki Mansion acted as place of concern and in this way, a more pro-nuclear environment was created and cooperation established between the municipality and Posiva. The same accounts for the fifth nuclear reactor that created a pro-nuclear environment and stimulated cooperation between these pro-nuclear actors. This shows how non-human actors, such as places of concern, also influenced the nuclear waste discussing and policy process at local and national level. Apparently, LMs and NGOs were not able to counteract the shift in discussion from nuclear waste towards nuclear power.

### 5.3. Local Movements and Non-Governmental Organisations Lack Influence on National Policy-Making

During the discussion regarding the nuclear waste issue and the fifth nuclear reactor, around 1997-1999, there were few discussions in which NGOs were involved (interview Äikäs, former executive vice-president and corporate adviser of Posiva, p. 11). This period has been referred to as the 'dialogue of the deaf' where there were hardly any critical debates and people did not listen to each other (interview Äikäs, p. 11).<sup>6</sup> There are several factors that affected the lack of influence of LMs and NGOs during the decision-making process which resulted in the 'dialogue of the deaf'.

First, a reason for this, explained by Lammi (interview, p. 8) was that Greenpeace Finland had to stop their campaigns due to bad publicity after a forest campaign. These forest logging companies have a lot of influence as they are important for the Finnish economy and at the same time are big users of energy (interview Lammi, p. 8). As a result, there were no NGOs that worked on the nuclear waste issue during the crucial years for policy-making between 1998-2000. However, these have been crucial years for the decision-making process. By 2000, Lammi thus started to work as energy campaigner but only with a couple of months for preparing any critical campaign concerning the nuclear waste depository (interview Lammi, p. 8). At first, the discussion at national level was based on technical arguments. Lammi wrote a report in which technical criticism on the final repository was given and the report included some international expertise (interview Lammi, p. 8). But as Greenpeace and other NGOs lacked the credibility regarding technical aspects of the final depository, this report had no influence on the DiP (interview Lammi, p. 19).

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<sup>6</sup> 'This dialogue of deaf has been used by Matti Kojo, for example. He is a researcher at Tampere University and has made his dissertation on spent fuel issue. I don't recall who originally started to use it but basically means that people did bit listen to each other in the process.' (interview Äikäs, former executive vice-president and corporate adviser of Posiva, p. 11)

Besides of the collapse in resources and finance of Greenpeace in Finland due to bad publicity, there was also a lack of societal support. The NGOs did not have enough financial support and Nissinen, former campaigner at FANC, stated that they did not have the capacity and their members did not really think that the nuclear waste issue was most important to focus on. Therefore, they directed their resources to other areas (interview Nissinen, p. 3). This lack of resources was also the case for LMs in Eurajoki, as Launokari explained that more money and people were needed in the Women Against Nuclear Power (WANP) movement in order to have actual impact (interview Launokari, WANP, p. 10). Hence, for NGOs and LMs to be able to influence a decision-making, financial and human resources are essential.

It was not just a lack of resources and credibility of the NGOs that resulted in little influence in the decision making but also the fact that the lobby of the nuclear industry started to focus on the economic benefits of nuclear power of the fifth reactor, as discussed in previous section. The NGOs made a ‘mistake’ as they went along in the discussion about economic benefits of a fifth nuclear reactor and hence, they tried to convince politicians and citizens that renewables would be more feasible than building a new reactor (interview Nissinen, p. 7; interview Lammi, p. 15). But in this way, “[...] we went into their field, and we lost in their field” (interview Nissinen, p. 7).

However, NGOs together with some parliamentarians did have an influence in the decision-making because their efforts resulted in a compromise regarding the retrievability of the waste (interview energy campaigner Greenpeace, p. 13). They questioned whether a final deep geological repository would be the best choice. Therefore, a compromise was made to have a repository in which it would be possible to get back the nuclear waste. Lammi explained in the interview that this was one of the only things that NGOs could move during the decision-making process around 2000. However, according to Seppälä, ex-Communication Director of Posiva, the starting point for a final depository would be that the waste would not be retrievable in order to maintain all safety requirements (interview, p. 3). So, Posiva and also STUK were not in favour of this plan as it was a compromise on safety, as retrievability of the nuclear waste makes it easier to intrude within the final repository and the tunnel (interview Seppälä, ex-Communication Manager Posiva, p. 3). Nevertheless, the government requested that these safety requirements should be written in a way that the waste could still be taken out the repository. Hence this shows that the decision was a very political decision and not based on solely technical or geological arguments.

Besides Greenpeace and other NGOs, there were also geologists that had given critique on the final depository in the 90s. However, Posiva was one of the main potential employers for these graduated geologists. According to Lammi (interview, p. 9) there were not many possibilities to have disagreements or alternative perspectives towards nuclear waste. Hence those who

were critical would not get the job next time (interview Lammi, p. 9). At the same time, there was very little financing for alternative views to a deep geological depository or different viewpoints on the technical side of nuclear waste at national level (interview Lammi, p. 8). Altogether, this narrowed down the critical position of the geologists and the debate and therefore there were few critical geologists that were active during the decision-making process.

Nonetheless, there have been more geological and technical critiques expressed regarding the final depository, mostly by geologists. There has been one geologist in particular, professor Saarnisto, who was known for criticizing the site in Eurajoki. Saarnisto criticized Eurajoki as chosen municipality since the highly active waste should not be stored in the broken granitic bedrock (interview Saarnisto, retired geologist, p. 7). His research modelled that in 10.000 years, when Onkalo will be covered by ice sheets for several thousands of years, the permafrost will penetrate deeper than the nuclear waste depository which will result in a strong pressure that may destroy the nuclear waste canisters at 450m depth (Lunkka et al., 2004). Moreover, there are risks of earthquakes and seismicity as a result of uplifting of the bedrock after ice retreat of the ice sheets (Lunkka et al., 2004). However, his criticism was largely ignored by the media, citizens, politicians and nuclear waste industry (interview Hassi, member European Parliament, p. 2). So despite that there was criticism of Saarnisto and NGOs, no serious attention has been paid to this by Posiva and politicians at national or local level.

Whereas it was mostly critical geologists that were not able to speak out openly about the risks for Onkalo at national level, at local level it was mostly critical citizens that seemed to be overruled by the pro-nuclear actors. As citizens in Eurajoki were afraid to express themselves against Onkalo or nuclear energy in general, this resulted in a dominant pro nuclear framing that left little space for critiques. Hence, at local and national level, not much space was there for alternative perspectives to the predestined schedule or additional researched that some anti-nuclear movements were postulating.

Saarnisto's criticism was rather technical concerning safety aspects of the site, while that of LMs and NGOs was mostly directed to the need for more research. However, both forms of criticism were ignored, since politicians and Posiva were more directed by the social acceptance and implementation of the final depository. As politicians and the nuclear industry dominated the nuclear waste discussion, it might not have made a difference what the criticism beheld, either social, technical or socio-technical. Rather, if it would have created an obstacle for the predestined schedule, it would not have been taken into account. However, it seems that Saarnisto, LMs and NGOs were not cooperating as much as pro-nuclear actors did, which might would have made a difference in declaring their criticism.

## 5.4. A Pro-Nuclear Actor Network

Whereas LMs and NGOs seemed not to be able to form a strong anti-nuclear actor network, the opposite seemed true for pro-nuclear actors. In this way, the formation of a strong pro-nuclear actor network during the decision-making process affected the influence of LMs and NGOs. This pro-nuclear actor network has affected the influence of LMs and NGOs for several reasons which are discussed in following paragraphs, after a short introduction.

Altogether, in the early 80s it was already decided that a nuclear waste solution should be built by 2020. This was achieved partly through a strong pro-nuclear actor network. The government made the decision regarding the general final depository plan in 1983, as a license for nuclear reactors was granted for five years and the precondition for prolonging the operation license was that there would have to be a nuclear waste management plan (interview Seppälä, p. 4). In this way, it was easier for politicians to make decisions as they were able to resort to earlier decisions made concerning the complex issue of nuclear waste. In 2001, when the DiP was made, there were only three votes against final disposal. This shows that for almost all politicians it was sensible to go forward with the plan on disposal instead of postponing the decision or starting new research for alternatives aboveground (interview Seppälä, p. 4). So from then on, the nuclear waste program and schedule has been followed ever since.

At local level, the same processes are shown as described in chapter 4, 'Eurajoki as Favourite?'. As the estate tax was important for financial resources of the municipality, many politicians seemed to be hesitant to counteract the agreement regarding the final depository. Questions regarding long-term environmental or social issues were postponed for future council members, as happened at national level in the government as well. According to environmental journalist Jokinen (interview, p. 10), when an environmental issue arises that concerns these nuclear companies, the municipal politicians had nothing to say about it. Jokinen explained that this is because there are so many people in the municipality working in the nuclear industry and because they receive estate tax. Therefore, the municipal council rather had nothing to say and planned to continue scheduling the final depository with Posiva.

The schedule from the 80s was followed by Posiva and stakeholders without much critical debate, for four reasons: first, there was a strong lobby from the Finnish steel and forest industry as the forest and steel industry want cheap electricity. These industries have strong ties with the political machinery, as the politicians always have had a strong belief in creating welfare through economic growth, which relied on the heavy industries to a large extent (interview Nissinen, p. 4). So therefore, there was a close cooperation between the industrial elite and parliament elite, no matter whether if they were left or right-wing party members (interview Nissinen, p. 5). In this way, most politicians were pro-nuclear and therefore not eager to raise criticism.

Secondly, the Finnish legislation and institutional arrangements strengthen the role of Posiva and STUK due to institutional closures (Litmanen et al., 2017). For example, STUK has the role to be critical and to evaluate and monitor the process. But while on the one hand there is much trust in STUK as an authority, STUK is also questioned concerning its independency. For instance, member of the European Parliament Hassi, pointed at the fact that the nuclear energy sector brings a lot of work to STUK, so there might be a pronuclear attitude within STUK, either consciously or unconsciously. In this way STUK makes sure that nuclear energy is safe, but at the same time also makes sure that nuclear power can be there (interview Hassi, p. 3). Hence, actors such as STUK and Posiva did have little interest in raising critical debate.

Thirdly, the overall media has been pronuclear as well. The vast majority of chief editors from Finnish newspapers were pronuclear, according to a survey conducted in 2001 (Lammi, 2009; interview Hassi, p. 7). Media and newspapers were important in raising debate and discussion through critical comments especially in times that there was hardly any use of social media. The media was also pro-nuclear in Eurajoki, as flyers were distributed and the *Länsi-Suomi* was traditionally the most influential newspaper in Eurajoki, which was back then considered pro-nuclear (interview Jokinen, environmental journalist, p. 3). Again, media was less prone to raise criticism from LMs and NGOs in newspapers and other media.

Lastly, several of these parliamentarians who had been key pro-nuclear actors in 1993, had become ministers in the new government (Lammi, 2009). In this way, pro-nuclear actors were able to mobilize resources and received support from governmental organizations, such as research materials from the Technical Research Centre of Finland (Lammi, 2009). This strengthened the pro-nuclear actor network and made it harder for LMs and NGOs to counteract the pro-nuclear lobby.

Overall, partly due to this pro-nuclear actor network, LMs and NGOs had little influence on the final depository decision-making process. There were many pro-nuclear actors that all had the same goal to get the license for final depository construction granted. NGOs were not able to compete with the pro-nuclear lobbying, as they did not have those resources and technical expertise. Therefore, this pro-nuclear actor network has affected the influence of LMs and NGOs in the nuclear waste policy process.

## 5.5. Final Depository as Boundary Object

This pro-nuclear actor network mentioned above was formed due to the final depository that functioned as boundary object. Because of this boundary object, which is a non-human actor that coordinates and maintains collaborative activities across social worlds (Star & Griesemer, 1989), cooperation was facilitated between various pro-nuclear actors. There have been many actors involved including heavy industries, politicians and the nuclear industry with different

interests for supporting the final depository. Although these actors have had different interests, they formed a pro-nuclear actor-network and cooperated. For instance, while heavy industries were in need for cheap nuclear energy, the economic value of these industries was of importance for politicians as well. In this way, these actors were connected in their final interest, namely granting a license for a final repository, through the final depository as boundary object.

Besides the final depository, the fifth nuclear reactor can also be identified as boundary object as it brought together different actors that were in favour of more nuclear energy production and for that a solution for nuclear waste was needed. Together with the fifth nuclear reactor, the final depository functioned as boundary object that resulted in a pro-nuclear lobby in which several actors were involved. This is illustrated in Figure 5. It shows that various actants with different interests are linked in a strong network, as all actants want licenses for building a fifth nuclear reactor and final depository. In this way, the fifth nuclear reactor and final depository both functioned as boundary objects.

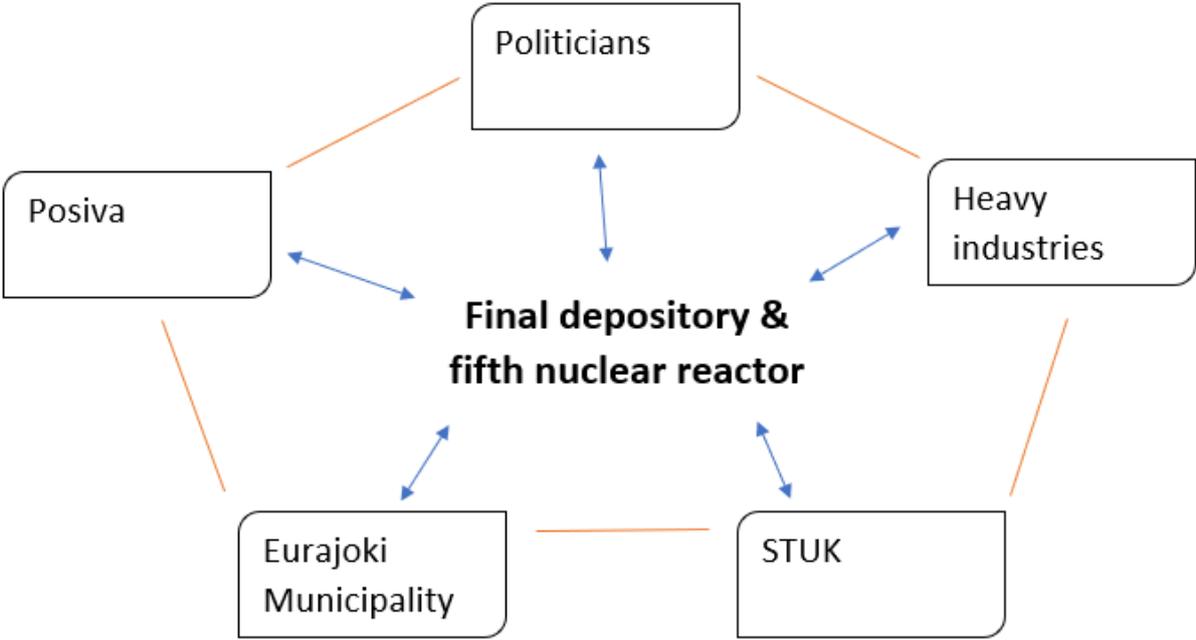


Figure 5. The final depository and fifth nuclear reactor as boundary object in Finland.

Both the fifth nuclear reactor and final depository resulted in strong pro-nuclear actor networks and decreased the influence of LMs and NGOs within the discussion. Due to the strong pro-nuclear lobby that aimed for the same goal, namely a final depository in Eurajoki, it has been very difficult for LMs and NGOs to influence any decisions. In comparison with the process in Eurajoki there was also some sort of network of actors. The municipality worked close with Posiva and TVO in order to become the final depository host. Besides this, citizens

that were pro-nuclear because they worked at Posiva or Olkiluoto or knew someone who did, got involved as well and therefore opposition in Eurajoki was inferior to the pro-nuclear lobby. Hence, these pro-nuclear actor networks as a result of the boundary objects have been too strong for anti-nuclear movements to be effective in influencing the decision-making.

### 5.6. Conclusions

The nuclear waste site selection process at local level has been influenced by various actants at national level as well. As shown in Figure 6, the actor-network in this chapter was extended and several factors that affected the influence of LMs and NGOs at local and national level were identified. The decision-making process at national level has been influenced by places of concern, lack of discussion and a strong pro-nuclear actor network as result of the boundary object. As the Parliament decided that the nuclear waste issue should be solved first before granting the license for a fifth nuclear reactor, the fifth nuclear reactor has affected the nuclear waste policy process. Posiva and the nuclear industry including heavy industries in Finland focussed on creating a pro-nuclear environment to grant the license for a fifth nuclear reactor.

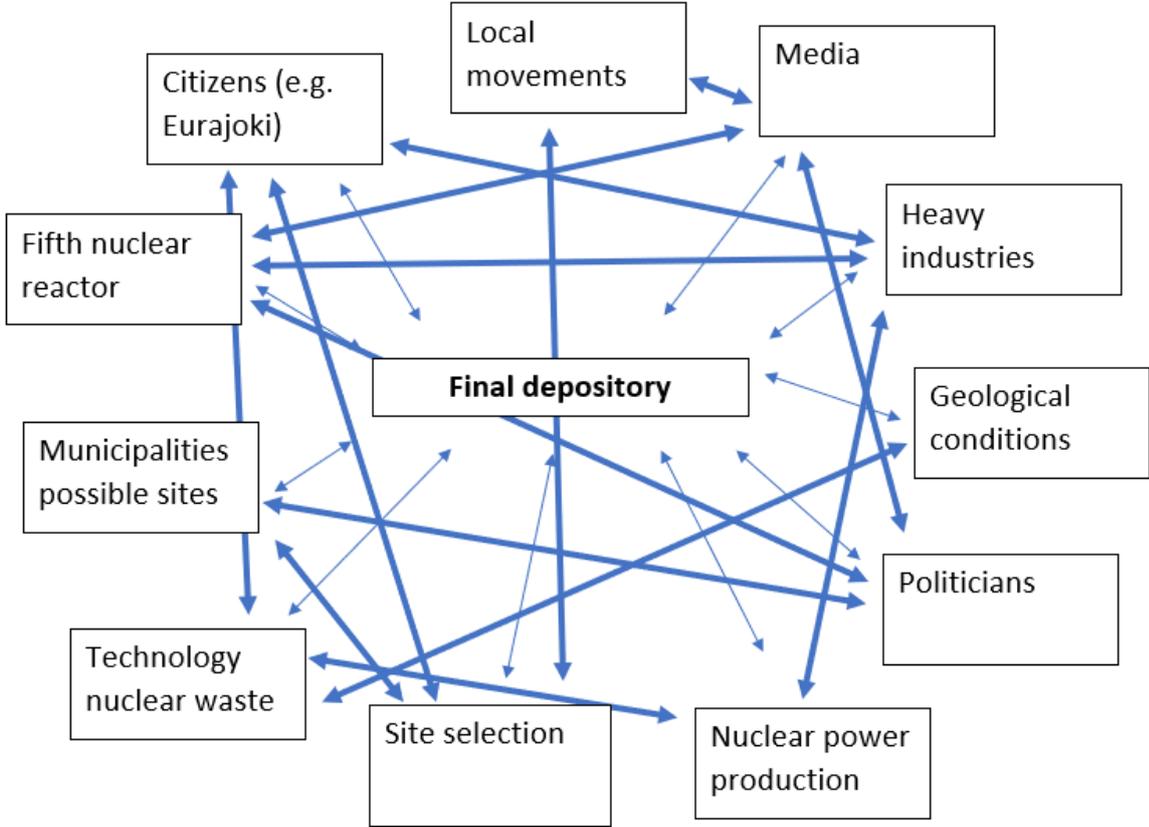


Figure 6. Actor-network of final depository process at national level in Finland.

In this way, the fifth nuclear reactor became central point of discussion and therefore was a place of concern. Furthermore, due to the lack of discussion, LMs and NGOs did not have much influence on the decision-making. The lack of discussion was the result of the lack of energy

campaigners during most of the crucial years of decision-making. Moreover, the nuclear industry was able to create a pro-nuclear environment around the nuclear waste issue especially focussed on the economic benefits of nuclear energy production. The final depository and nuclear waste issue as boundary object resulted in various actors with different perspectives but a common end goal. Moreover, NGOs went along in the economic discussion through promotion of renewable energy, but they were not able to succeed in this campaign. However, there were some critical geologists that also questioned whether Eurajoki would be a suitable location for final disposal. Due to the strong network of pro-nuclear actors, these critiques were ignored by the nuclear industry, media and politicians.

Places of concern have played a role in decision-making at national and local level. At national level the fifth reactor became a place of concern as it became a key point of discussion in the decision-making process for nuclear waste. At local level, the Eurajoki municipality became a place of concern. Because at national level it was decided that all municipalities had the right to veto granting a construction license in their municipality. In this way, municipalities had the right to veto granting the license. So, when the number of possible sites decreased and Eurajoki became the preferred host for a final depository, the 'solution' for nuclear waste laid in the hands of the Eurajoki municipal council and its citizens. If the municipality would have rejected granting the license, the policy process timeline developed in the 80s, should have been adjusted or alternatives to deep geological depositories might have been needed to be researched.

Moreover, at local and national level, places of concern have been used by the pro-nuclear actors to enhance a pro-nuclear environment. At national level, the fifth nuclear reactor has affected the decision-making by shifting the discussion from nuclear waste towards nuclear energy. Together with a national pro-nuclear energy campaign, a pro-nuclear environment was established again after the Chernobyl disaster. In Eurajoki, the Vuojoki Mansion functioned as mean by which the municipality and Posiva both created even more citizen acceptance for a final depository. Since the municipality was willing to grant the license, Posiva and the government were able to present Onkalo as a solution for nuclear waste. In this way, the pro-nuclear actors were incited to grant the construction license and accept the DiP. Consequently, anti-nuclear actors such as LMs and NGOs had difficulties in raising counter-statements because of their little credibility and few resources compared to the pro-nuclear lobby. In this way, these places of concern were part of a network of actants that affected the site selection and nuclear waste policy-making at local and national level.

Another reason for the limited influence of LMs and NGOs is the strong pro-nuclear actor network that was strengthened due to the final depository and fifth nuclear reactor that functioned as boundary objects. Because of the boundary objects, pro-nuclear actors were able

to create and remain a pro-nuclear environment and to support the decision making for granting the construction license. Although the construction license for a final depository involved aspects that LMs and NGOs had a say about, they were not able to break open the pro-nuclear environment or to separate the discussion between nuclear energy and nuclear waste. In this way, there was little influence of LMs and NGOs in the nuclear waste policy-making in Finland.

## 6. Nuclear Waste Policy-Making in The Netherlands

### 6.1. Introduction

The nuclear waste policy-making in Finland often functions as role model for other countries that need a final depository, such as the Netherlands. Whereas Finnish politicians in the 80s decided already that within 20 years a site should have been selected for final depository in Finland, current decision-making regarding a final depository in the Netherlands is postponed till 2100. In this chapter an explorative study is done based on the insights from the policy-making process in Finland. The aim of this analysis is to get an understanding of what roles several actants might play during the nuclear waste policy-making process. For this purpose, current nuclear waste policy-making process is analysed in order to explore what roles places of concern, boundary objects and the way of framing can play during the nuclear waste policy-making process in the Netherlands, and to what extent this affects the roles of local movements (LMs) and non-governmental organisations (NGOs) during Dutch decision-making process.

For this, first, the main actors involved in nuclear waste policy-making in the Netherlands are introduced briefly. This is followed by a brief overview regarding current nuclear waste policy-making in the Netherlands. Thereafter, an analysis is given concerning the possible roles of places of concern, the way of framing and boundary objects. The analysis starts with Dutch nuclear waste policy-making as black-box. Afterwards, places of concern are identified that might open the black-box. Thereafter, boundary objects are examined within the Netherlands, which shape cooperation between certain actors. The way of framing is analysed next, including the role of the Disposal Advisory Platform (DAP) that might enable integrative ways of framing in discussions. At the end, a conclusion is given regarding these concepts in the nuclear waste policy-making in the Netherlands.

### 6.2. Actors in the Netherlands

#### 6.2.1. Non-Governmental Organisations

In the Netherlands, the NGO WISE is part of an international anti-nuclear movement, to stop nuclear energy production. On the one hand, they want to stop the production of nuclear waste. On the other hand, if there is still nuclear energy production there should be a nuclear waste facility as soon as possible. The latter because this generation should take its responsibility for its own waste. Mostly by lobbying, they aim for creating discussions around this topic.

Furthermore, 'Laka' is a foundation for documentation and research concerning nuclear energy, established in 1988. Their aim is to file and store documentation about nuclear energy. Besides this, their overall vision is that nuclear energy production should be stopped. According to Laka, when nuclear energy production is stopped in the Netherlands, waste should go as soon as possible into a final depository.

### 6.2.2. Governmental Actors Nuclear Waste

COVRA (Central Organisation for Radioactive Waste) is responsible for the collection, processing and storage of all radioactive waste in the Netherlands. It is an organisation of which all shares are owned by the Dutch Government. All Dutch companies must hand over their radioactive waste to COVRA (ANVS, 2018). It is established in 1982 and is a non-profit organisation. Regarding final disposal, COVRA is responsible for the execution of nuclear policies that are created by the government and prepared by the ANVS. Moreover, COVRA collects and manages funds for final disposal (ANVS, 2018).

The ANVS (Authority Nuclear Safety and Radiation Protection) monitors the nuclear safety and radiation protection in the Netherlands. Licenses and regulations are monitored, regulated and evaluated by the ANVS. The State Secretary of Infrastructure and Water Management (I&W) has the overall (political) responsibility for the ANVS. ANVS prepares radioactive waste policies, including policy for final disposal. Besides this, ANVS is responsible for the license for a final depository, that is expected to be envisaged around 2130. At the moment the ANVS is working on the establishment of a DAP (see below).

The Disposal Advisory Platform (in Dutch: *Klankbordgroep*) is composed of representatives from scientific, societal and governmental organisations (Ministry of Infrastructure and Environment, 2016). It will be established in order to examine trends and developments regarding nuclear waste policy in the long-term. The DAP is responsible for advising on future decision-making and participation processes in radioactive waste management during the route to final disposal (ANVS, 2018:19). Moreover, it gives advise whether and when certain (participatory) trajectories should be started or intensified (Ministry of Infrastructure and Environment, 2016).

The Commission for environmental impact assessments (in Dutch: *Commissie Milieueffectrapportage*, referred to as the Commission) is a committee that consists of various experts from different backgrounds, who are chosen depending on the topic of what they must advise. This committee researches and advises whether certain environmental information is sufficient to continue the process regarding for instance a license or development plan. In the case of final disposal in the Netherlands, the Commission has made several recommendations regarding the process for final disposal and how to shape the final depository process. Their main recommendation is that the National Program should be more tangible and testable (interview Lembrechts, the Commission, p. 3). This advice about the process is exceptional for the Commission, as they usually only give advice regarding the information received instead of the process of a policy.

All actors mentioned above play key roles in the nuclear waste policy-making in the Netherlands. In the next sections, an explorative analysis is given how these and other actants influence the nuclear waste policy-process and might affect the influence of LMs and NGOs.

### 6.3. Current Nuclear Waste Policy in the Netherlands

As described in the Dutch National Report for radioactive waste management, a decision regarding final depository will be made around 2100 which should result in a final depository around 2130 (ANVS, 2018). In the National Report of the Netherlands (ANVS, 2018), it was that stated:

The current policy assumes long-term storage of the radioactive waste and spent fuel in specially designed buildings (at COVRA) until 2130. During this period the deep geological disposal is prepared financially, technically and socially in such a way that the disposal facility will be ready to receive radioactive waste around 2130. A decision on disposal will be made around 2100. Up to that moment, society may also opt for another management option, depending on insights at that moment, and assuming that other alternatives are possible at that time. (p. 15)

Currently, there is a centralized long-term interim storage facility in Borssele that can last for at least 100 years. During this storage time funds are saved, and research is executed for final depository and accompanying technologies (Brunnengräber & Schreurs, 2015). According to Verhoef and Neeft (2014: 3) “It requires at least 100 years to collect sufficient radioactive waste to make a disposal facility economically viable.” Hence this is a different final depository process phase compared to Finland, since Onkalo is under construction already. Therefore, the comparison between factors that affected Dutch and Finnish nuclear waste policy-making and influences of LMs and NGOs can be somewhat speculative for the Netherlands. Still, in order to gain some insights in nuclear waste policy-making and the influence of LMs and NGOs in the Netherlands, possible effects of places of concern, boundary objects and the way of framing are explored in this chapter.

### 6.4. Closed or Open Black-Box?

In the Netherlands, the final disposal policy-making can be considered a black-box consisting of a quite stable nuclear waste policy for now. As mentioned in chapter 2, a black-box is an issue that is stable without much discussion or controversy (Latour, 1999). These complex issues referred to as black-boxes often remain closed or questioned as it is time-consuming and expensive to open them (Latour, 1999). In the Netherlands, there are few discussions regarding final disposal policy-making and therefore nuclear waste policy is a stable issue without much controversy. However, this black-box could be opened, for instance by LMs or NGOs raising controversy, nuclear disasters abroad or public debate. LMs and NGOs are

considered important contributing actants for opening black-boxes and consequently can turn matters of fact into matters of concern (Schaeffer & Smits, 2015). This section explores the effects of LMs and NGOs in whether the black-box will remain closed or break open.

Dutch government postponed the decision-making regarding final disposal till 2100 as there is a well-built interim storage that lasts for another 100 years. According to De Rijk from WISE (interview, p. 5), there should be a discussion regarding nuclear waste earlier, as it is an ethical question whether and when there should be a final depository. However, due to postponing the decision-making, there are few incentives for actors such as NGOs and politicians to start a discussion. Politicians are not interested in starting a discussion until there are specific possible sites for final disposal announced (interview Bannink, Laka, p. 4). In this way, politicians and local governmental institutions do not have to deal with opposition and resistance which might undermine their chances of re-election. When possible sites for final disposal will be announced, a public discussion will start (interview Bannink, p. 5). Moreover, as there is little interest in public debate around nuclear waste at the moment, it is very difficult for NGOs to start discussions or alter the policy-making (interview De Rijk, WISE, p. 2). Consequently, current nuclear waste policy-making has become a closed black-box, as there is no discussion yet.

In Finland the final depository process was a black-box too, when during the preliminary site selection, the process was based on geological factors without public discussion. But when the implementation phase approached, the black-box opened as citizens acceptance became important for continuing the final depository process. For instance, the black-boxed broke open when opposition started to rise, especially in Loviisa what resulted in selecting Eurajoki as preferred municipality for final disposal. The same might account for the Netherlands. Namely, a public debate might start when possible sites for final disposal will be announced (interview Bannink, p. 5) or the implementation phase starts off. When this happens, black-boxes will have to be opened.

In the Netherlands, the Commission advised to start discussions regarding possible sites for final disposal before 2040 (Bergsma et al., 2015).<sup>7</sup> This would mean that the black-box will be opened by ANVS, COVRA or politicians. As research projects, including OPERA and STRONG, already described opportunities to make decisions regarding possible sites, postponing this discussion might result that suitable locations will be used for other purposes in coming decennia (Bergsma et al., 2015).<sup>8</sup> So, the Commission proposes to select several possible sites

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<sup>7</sup> Reported in the National Program for Long-term Management for Radioactive Waste and Spent Fuel (2015).

<sup>8</sup> OPERA is a safety strategy for achieving safe and acceptable disposal of radioactive waste (Verhoef & Neeft, 2014). Report available at: <https://covra.nl/downloads/opera/Toward-a-safety-strategy.pdf>  
STRONG is a report on behalf of the Ministry of I&W and Economic Affairs and Climate, for agreements

for final disposal, which would most likely result into discussions and opposition in these municipalities. However, according to Bannink and De Rijk (interview Bannink, p. 5; interview De Rijk, p. 3) this advice has been ignored so far, as politicians do not want to raise discussion and opposition regarding these possible sites for final disposal.

Nonetheless, at some point, certain sites should be pointed out that are suitable for final disposal in the Netherlands. According to Bannink and De Rijk, this generation should establish a solution for nuclear waste. This was also one of the main arguments in Finland for accepting the DiP, since the generation that benefits from the nuclear energy production should also take responsibility for its waste (interview Seppälä, ex-Communication Director Posiva, p. 3). However, Bannink questioned whether there will be an open discussion within next 100 years, as he doubts if any government dares to rake up these complex issues especially when at that time for citizens no benefits from the generated nuclear energy are left (interview, p. 5). Hence, this is one of the main arguments of in Finland and the Netherlands why the black-box should be opened before 2100.

Despite the similarities between Finland and the Netherlands that they were both black-boxes and the argument that a final depository should be built by the generation that is using nuclear energy, a distinction should be made between the influence of LMs and NGOs in these countries. Whereas the lack of resources within LMs and NGOs in Finland has played a role in their influence, this could be different in the Netherlands. While the Finnish society relies on nuclear energy for almost 40%, this is a completely different context in the Netherlands with a share of 3% of nuclear energy at national level (Wezel, 2015). As was mentioned in many interviews in Finland (interview Jokinen, p. 8; interview Nissinen, FANC, p. 4; interview Äikäs, former executive vice-president and corporate adviser of Posiva, p. 7; interview Seppälä, p. 3), Finnish people trust authorities and politicians. Therefore, Finnish people were less involved in activism regarding environmentalism, which is reflected by the lack of influence from LMs and NGOs. In the Netherlands, it seems that Dutch citizens in general are less trustworthy in authorities and environmental issues. The Dutch are more critical towards nuclear energy, as the majority of the population is anti-nuclear (Dekker, De Goede & Van der Pligt, 2011). Consequently, this might result in more local opposition at possible sites in the Netherlands compared to Finland.

Overall, the issue of nuclear waste is currently black-boxed, as politicians and NGOs do not want to start discussions without areas being selected as possible sites. At the same time, possible sites have not been announced by COVRA, though the Commission advised to do so.

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regarding efficient usage of soil and sub-soil. Report available at:  
<https://www.rijksoverheid.nl/documenten/rapporten/2018/06/11/structuurvisie-ondergrond>

While public discussions seem essential for creating societal acceptance, it is for now postponed till 2100. Keeping the black-box closed, can result in a lack of influence from LMs and NGOs. When the policy-making process is predestined, decisions regarding final depository would be made by 2100. Hence, there would be little possibilities for LMs and NGOs to present their alternative views. Similar policy processes took place in Finland. Namely, decisions are made based on technical feasibility and geological factors of possible sites for final disposal. As there was a separative way of framing, social factors were mainly involved for justifying the schedule of construction a final depository. In this way, LMs and NGOs voices were not legitimate.

As Bannink mentioned, it is questionable whether societal acceptance can still be established by 2100, when Borssele is closed and citizens do not benefit from nuclear power production anymore. However, there might be instances in which the black box will be opened.

## 6.5. Borssele as Place of Concern

Besides human-actors, non-human actors can affect the policy-making process too and open black-boxes, as seen in Finland (chapter 4 and 5). Places of concern are non-human actants, that are formed through concerns of citizens or other actors and in their turn form or shape these or other actors. A black-box can turn into a matter of concern when controversy and discussion is raised around a black-box that was stable before (Schaeffer & Smits, 2015). Whereas in Finland, Loviisa and the Vuojoki Mansion were identified as places of concern that influenced the decision-making, in the Netherlands no such place can be identified yet as the process is just at its start. Therefore, in this section a more explorative study is done in order to examine possible places of concern in the Netherlands.

One such possible place of concern is the only operational nuclear reactor in Borssele. The closure of this reactor is planned for 2033 (ANVS, 2018), which could result in discussion. Because when all nuclear waste is produced but still a final solution is needed, this would be a starting point for discussion. As De Rijk, campaigner at WISE, mentioned (interview, p. 3): “If Borssele would close, it would be a good moment to reorganize a discussion regarding final disposal: what to do with the waste that we now produced?”.

In this way, Borssele would function as a place of concern, as the current nuclear waste policies are planning on making decisions by 2100, but a public discussion triggered by the closure of Borssele, could adjust this policy-planning. Closing Borssele cannot only happen because of the timing that all nuclear waste is produced in the Netherlands but also due to financial reasons as Borssele is not that profitable anymore (interview De Rijk, p. 2). LMs and NGOs can start discussions around the nuclear final disposal, as is also one of the aims of Laka (translation interview Bannink):

In 2033, Borssele will most likely close and we presume that no another nuclear reactor will be built. That seemed very reasonable, and it still does if you think about it. But [the nuclear reactor] did operate again, which was unexpected to us, although we noticed some concealed discussions and there were individuals lobbying for it. But we think, when Borssele is closed, all nuclear waste will be processed in France and then be collected in 10-20 years after closure [of Borssele], and it should go straight into a final depository. (p. 2)

A similar process happened in Finland, but instead of starting a discussion about nuclear waste, the fifth nuclear reactor as place of concern shifted the discussion towards nuclear energy in general (chapter 5). Consequently, the discussion integrated a final depository as solution for nuclear waste into the debate of whether there should be more nuclear energy produced. Although Bannink (Laka) and De Rijk (WISE) mentioned Borssele as possibility to open the black box of current policy-making decision, it could also be possible that Borssele will have the same effect as happened in Finland. Hence, instead of activating a nuclear waste discussion, a discussion will be positioned around whether more nuclear energy in general instead of nuclear waste. For instance, whether nuclear energy or new nuclear reactors are needed to fight climate change.

In conclusion, Borssele might function as a place of concern around 2033 in opening the black-box and start discussing what to do with all produced nuclear waste. However, it is also possible that the policy-making as made up now, will continue business as usual. Moreover, it might be the case that a similar thing will happen in the Netherlands as happened in Finland. Whereas in Finland, the fifth nuclear reactor as place of concern shifted attention from nuclear waste to nuclear energy in general, this is also possible in the Netherlands. Though this scenario might be less unlikely as Borssele is the final reactor in the Netherlands and there is no pro-nuclear environment in the country, as was the case in Finland. However, there might be instances in which a similar network is or will be formed in the Netherlands that can affect the influence of LMs and NGOs.

## 6.6. Final Depository as Boundary Object

Policy-making regarding final disposal might bring together various stakeholders with different interests and in this way actor-networks can be formed as result of a boundary object. As mentioned in chapter 2, boundary objects enable various actants to collaborate with a shared aim. Actants without shared knowledge or goals work towards a shared end goal due to a similar understanding of the boundary object (Thompson, 2016). Boundary objects can explain how various actors collaborate, how actor-networks are formed and can enable the start of a discussion.

Discussion regarding final disposal might start when the DAP is formed on behalf of the Secretary of I&W, as stakeholders from different backgrounds will work towards the end goal of finding a suitable process for final disposal. The DAP is established in order to come up with a proposal for a participative decision-making process for final depository in the Netherlands (interview ANVS, p. 2). This participative decision-making process is important for the realization of a final depository (interview ANVS, p. 5). Through involvement of citizens and other stakeholders, activities of the DAP will be formed participatively. Experts will represent those stakeholders involved. In this way, all stakeholders can bring in their interests during the preparation of the participation trajectory, including LMs and NGOs (interview ANVS, p. 2). As the final depository process is the shared end goal for all stakeholders, the topic of final disposal process can be considered as boundary object. This is illustrated in Figure 7. Experts that represent different interests will collaborate to create a participatory process for nuclear waste policy-making. In addition, actors such as COVRA and NGOs can give input for discussion.

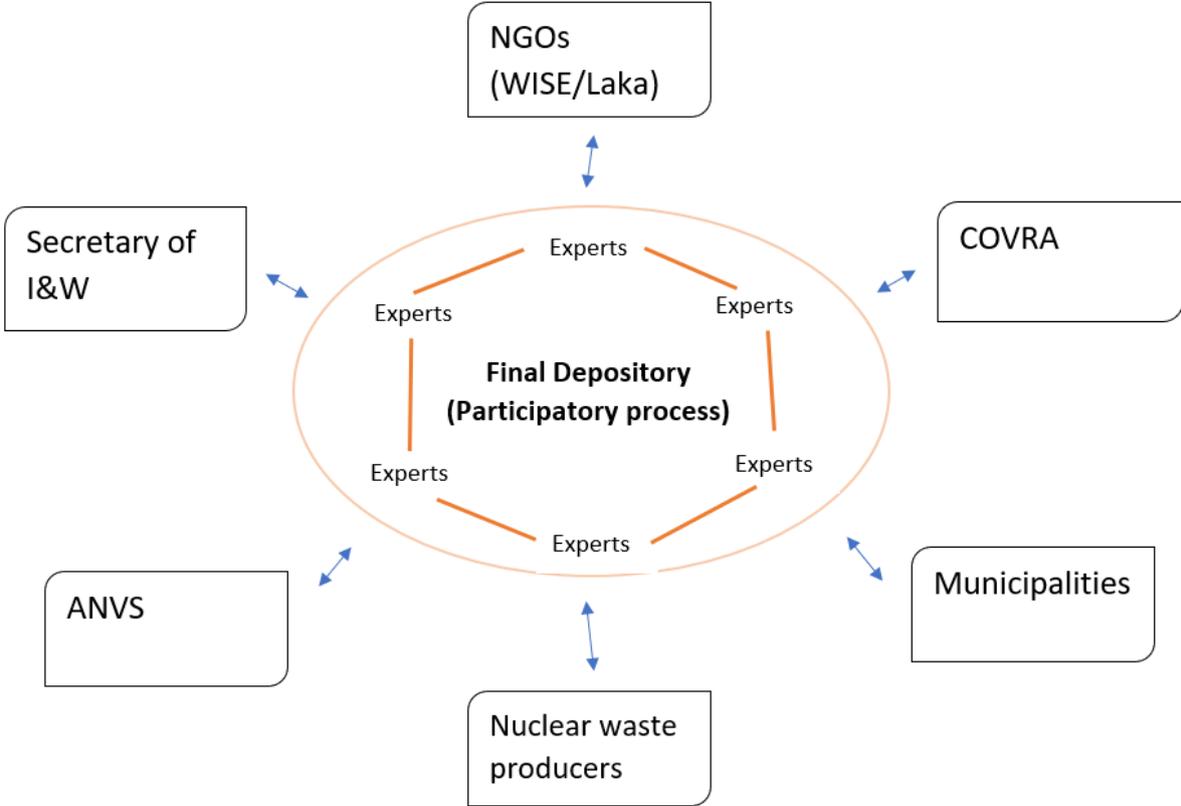


Figure 7. Final depository as boundary object in the Netherlands.

Whereas in Finland the boundary object resulted in a pro-nuclear actor network, in the Netherlands it involves pro-nuclear and anti-nuclear actors. The main difference between the countries is that in Finland, because of the boundary object, pro-nuclear actor-networks were formed naturally and not due to agreements on beforehand. While in the Netherlands, the

Secretary of I&W instructed Van Soest to explore how to compose the DAP and compile some guidelines for the formation and content of the DAP. Van Soest (translation interview Van Soest, p. 6) mentioned that: “In fact, the establishment of the DAP [Dutch: instellingsbesluit] is top-down, but they receive the assignment to look for a bottom-up process that can ultimately lead to results.” Hence, the DAP can lead to a more bottom-up process in order to involve or represent the society as well. At first, this process starts as a small representation of the actual opinions, interests and visions of all stakeholders at national level (interview Van Soest, p. 6). While in Finland, it was not about involving or representing the society. It was rather a top-down process in which the pro-nuclear actor-network was involved as result of the boundary object. In this way, this contributed to the little involvement of LMs and NGOs in Finland, while in the Netherlands there might be more space for LMs and NGOs when the full society will be represented in the DAP that will establish (public) discussion. However, this depends on however has legitimacy within the DAP to decide and adjust the nuclear waste policy-making process.

## 6.7. Ways of Framing

The way of framing is important for the legitimacy of actors during discussion and policy-making processes and hence the influence of LMs and NGOs. In Finland most legitimacy was in hands of technical actors during the site selection and after. According to Van Soest (interview Van Soest, p. 4), a distinction between social and technical actors in the Netherlands can already be noticed, although the site selection phase has not been reached yet. Van Soest mentioned for instance that COVRA is rather technical involved in the final disposal process, but those technicians do understand that there are also social components. Director of COVRA, Verhoef, stated that COVRA has a rather technical role in the policy-making process and discussions (translation interview Verhoef, director COVRA):

We would like to have a participative process, in which people are involved. In this position, I expect that COVRA will have a supportive role. Because we have lots of knowledge regarding final disposal and radioactive waste. In order to execute such a policy-making process, it should be checked whether possible sites can be selected in the long-term, or formations should be indicated. And this should be tested. Does all waste fit in there? What about the safety? For this, technical support is needed, and that technical support will most likely be provided by COVRA. (p. 9)

So, this would be a rather technical function of COVRA within the DAP. Moreover, Neeft (interview Neeft, researcher COVRA, p. 12) mentions that discussions should be held in order to inform each other and to have mutual consensus regarding aspects involved in a final depository. For this, Neeft emphasized that COVRA wants to have directed discussions, in which topics of discussion are feasible. In this way, COVRA frames the discussion within

certain boundaries of technical feasibility. Hence, while emphasis is given to technical input of COVRA, they also acknowledge that input is needed from social actors regarding feelings of safety and societal acceptance (interview Neeft, p. 15). This seems similar to the role of Posiva in Finland, where pre-site selection phase it was mostly based on geological and technical factors, but social factors were considered when the implementation phase approached.

In the Netherlands, the nuclear waste issue is reported by the government and ANVS as an issue that involves social and technical factors that interact. According to the ANVS (translation interview ANVS):

Technical and social actors are two of many actors that are needed to make a solid decision regarding final disposal. Technically, it should be a safe and feasible final depository, simultaneously there should be a societal basis to realize this final depository. Both actors can influence each other. Societal preconditions can for instance redirect technical research and the other way around. (p. 5)

In this way, it seems that the starting point in the Netherlands is already different during pre-site selection phase, compared to Finland. Because in the Netherlands, hybrid socio-technical combinations are acknowledged practice, as reflected in the abovementioned statement of ANVS. In contrast, in Finland, there was no DAP or integrative participatory process in the pre-site selection. As observed in Finland, there was a more separative way of framing due to a predestined schedule. This resulted in technical factors dominating the policy process until the site selection. Later social aspects including societal and citizen support were emphasized in order to be able to implement the final depository but for continuing the site selection process.

Framing the nuclear waste issue as socio-technical combinations, hence in an integrative way, will possibly be integrated in discussions within the DAP. Ways for giving shape to the participatory trajectory have been examined and reported by Van Soest (2018) on behalf of the State Secretary of I&W. Van Soest emphasized in his report (2018) that all actors within the DAP should start exchanging different perspectives regarding final depository, before aiming for having consensus within the DAP. Since all actors do not have the same opinions whether the final depository should be built around 2100 or earlier, discussions about the underlying ethical questions are important (interview Van Soest, p. 2). As Van Soest stated (translation interview Van Soest):

In order to examine whether the discussion can be more extended and to interlink those different languages, so to speak. To create a shared conception, which can go either this or that way. To create comprehension regarding different ethical approaches that exist, which are legitimate in itself already. (p. 4)

Hence, social and technical aspects are discussed as interlinked factors with ethical foundations. This is an integrative way of framing in which more perspectives from social and technical backgrounds are demanded. It is a combination of technical and social arguments through an ethical discussion of perspectives (interview Van Soest, p. 4). In this way, the DAP would provide LMs and NGOs opportunities to give voice to their perspectives and in this way influence the policy-making of nuclear waste in the Netherlands.

However, it should be noted that for this to happen trust is needed in the process (interview Van Soest, p. 9). As both NGOs, WISE and Laka, mentioned in the interviews, they support the idea of DAP but solely when it is not used as an instrument by ANVS or the Ministry of I&W to justify their policy-making (interview De Rijk, p. 9; interview Bannink, p. 6). Hence, there should be space for input from their organisations to make their statements and be able to adjust current policies, otherwise they would rather not participate in the DAP.

## 6.8. Conclusions

In this chapter, the nuclear waste policy of the Netherlands is explored and shows that at this point there is no discussion regarding final disposal, but certain factors that can change this are identified. The analysis shows that currently there is no discussion and therefore it can be considered a black-box. However, this black-box can be opened and turned into a place of concern when all nuclear waste is produced and Borssele closes, since this would be a new starting point for start discussing responsibilities and schedules for a final depository. Moreover, this might be brought into practice when the DAP is established. In this way, the topic of final depository will serve as a boundary object that brings together these actors of different backgrounds in order to work towards a shared end goal. The way of framing can affect the influence of LMs and NGOs during the process of DAP. An integrative way of framing might enhance the influence of LMs and NGOs as more legitimacy is given towards these actors.

It is difficult to compare both countries as the Netherlands has not started a site selection so far, while in Finland the site selection is analysed, and the final disposal is already under construction. Nevertheless, some observations regarding similarities and differences in the process can be made. First, in both countries the policy-process started off as black-boxes. Whereas in Finland, the pre-elimination of possible sites was purely based on geological factors and there was hardly any discussion about it, in the Netherlands no discussion has been raised about nuclear waste since the government decided to postpone decision-making till 2100. However, in Finland discussion started when possible sites were selected, and the implementation phase approached. Differently, in the Netherlands this black-box might be opened when Borssele will close and discussion can start as the schedule of final disposal is brought forward.

Moreover, if a DAP will be established, various actors will be involved in creating a participatory process. Whether participation is needed before, during or after possible sites are announced, will be decided by DAP itself. In Finland this has not been the case as participation process started when possible sites were already chosen, and implementation was needed. Due to the separative way of framing in Finland, LMs and NGOs had less chance to affect the policy-making. Moreover, LMs and NGOs in Finland were not able to compete with a strong pro-nuclear network, supported by the fifth nuclear reactor as place of concern and a solution for nuclear waste as boundary object. In the Netherlands there is a higher chance of involvement of LMs and NGOs as there is no strong pro-nuclear actor network formed yet, and DAP might include LMs and NGOs among various actors in a discussion that is framed in an integrative way. In this way, LMs and NGOs can have a legitimate voice as well. Though for this to happen, outcomes of DAP should not be predestined but should be open for adjustments and reconsideration.

## 7. Discussion

This research was conducted to analyse (1) the effects of the way of framing, boundary objects and places of concern on the influence of local movements (LMs) and non-governmental organisations (NGOs) in nuclear waste policy-making at local and national level in Finland, and (2) to explore the role of the way of framing, places of concern and boundary objects in current nuclear waste policy-making in the Netherlands. During the analysis, I observed some limitations within this thesis and the surplus value of it for science.

In this chapter, first I will reflect upon the objective of this study, since the objective has been adjusted during the research. Then, I will discuss some limitations of actor-network theory (ANT) as approach and I will elaborate on why I think it is valuable to take culture and attitudes into account in this study. Thereafter, the relations between the extent of participation of LMs and NGOs and their influence are discussed. After that, an overview is given of alternative concepts that could be useful for analysing the influence of LMs and NGOs. Next, I will discuss my reflection upon how the influence of LMs and NGOs might have been mediated by a predestined process. Lastly, several recommendations for further research are presented.

### 7.1. Objective of Thesis

At the start of my research I was interested in how LMs and NGOs influence or did not influence the nuclear waste policy-making process. In line with this, during the description of my data I was mostly focussed on the influence of LMs and NGOs during the site selection process instead of focussing on the *factors* that affected their influence. I think this happened for two reasons. First, because I might already have had a positive bias towards LMs and NGOs. As I have been involved in several LMs and NGOs myself, for me it would have been a ‘nice’ outcome if these LMs and NGOs had an influence. Secondly, in my research proposal I used a framework of Tilly (1999) as a tool measure the influence of LMs and NGOs. With this framework, the claims and outcomes of movements are measured, compared to the outcomes of external parties. By focussing on this, I skewed my focus more towards measuring the influence of LMs and NGOs instead of researching the conditions of what is needed for LMs and NGOs to either have or have no influence in my case study.

However, when I started analysing my data, I noticed that based on my data, it would be more interesting to research the factors that affected the lack of influence of LMs and NGOs. In this way, the objective of my research became to identify possible human and non-human actants that affected or will affect the influence of LMs and NGOs in nuclear waste policy-making in Finland and the Netherlands. I think this objective gives more insights in *how* and *why* LMs and NGOs lacked influence in Finland, instead of just focussing on *if* they had any influence. Also because of this angle, I was able to explore possible influential actants in the Netherlands.

I found ANT as most suitable approach in order to identify human and non-human factors that affected the influence of LMs and NGOs.

## 7.2. Limitations Actor-Network Theory as Research Approach

The effects of the way of framing, places of concern and boundary objects on the influence of LMs and NGOs were analysed in Finland and the Netherlands by means of the actor-network theory (ANT). The way of framing, black-boxes, boundary objects and places of concern have been used as an approach for this research but also as part of the methodology. These concepts have shaped the methodology of analysing interviews and literature. I ‘followed the actors’ in order to identify and interview all main actants within the actor-networks. Moreover, the concepts of way of framing, boundary objects and places of concern have been used as conceptual approach but also as method to analyse the influence of LMs and NGOs during the policy process. Because using ANT, I examined the connections between human and non-human actants. Hence, there was no clear distinction between the methodology and research approach. In line with this, ANT as approach is interlinked with the methodology and discussed accordingly.

Actor-networks have countless links and actants involved, and therefore required me to decide which actants and actor-networks to involve in this study. Beforehand, no definitions were made which actants to include in this study and who to interview. By following the actors and throughout the interviews, it became more clear who played key roles in the nuclear waste policy-making in Finland and the Netherlands. While in ANT it is stated that all actants should be described and analysed in the same way instead of giving more significance towards one or the other (Dankert, 2011), I believe that certain actants can have a bigger influence of the policy-process compared to other actants. Based on this, I wanted to make sure that in my thesis most important actants were included. Despite my efforts, several actors were not interviewed due to a lack of response or limited time. For instance, STUK could have gained more in-depth perspectives on links with Posiva and pro-nuclear attitudes in Finland, but never responded to my interview-requests. Also, representatives from the heavy industries were actants that could provide insights regarding the pro-actor network formed in Finland at national level. However, during interviewing various actors, I gained insights in all actants involved and in my perspective the 25 interviews that are collected, provide a sufficient starting point for the analyses in this study.

Besides these actants within Finland, even more actants from abroad could have been included in the analysis. For instance, the Swedish Final Repository (SFR) is a deep geological construction similar to Onkalo (Won, Han, & Bonne, 1997). Therefore, Swedish nuclear industries and experts have affected the nuclear waste process in Finland, as the Finnish nuclear waste management has heavily relied on expertise and technology built up in Sweden

(Blowers & Sundqvist, 2010). Moreover, there are many Swedish people living in Finland that were either against nuclear power or demand participation. For instance, in Loviisa, many Swedish citizens opposed the construction of a final depository which resulted in Eurajoki as preferred municipality. Furthermore, Finnish LMs and NGOs often compared their situation with the policy process in Sweden and based some of their arguments for Onkalo on the Swedish policy process. Besides Swedish actors, the IAEA is important for international legislation, as well as the European Union, which affect the policy process. Hence, many more actants could have been involved in this thesis, as the actor-networks can even extend internationally. However, due to time restrictions this study has limited the analysed actor-network to key actors at local and national level in Eurajoki and Finland.

Moreover, as the site selection took place from the late 80s already, interviewees might have interpreted situation differently or forgot certain factors or details over time. Because of this, this research analysed the process in hindsight, while ANT scholars often emphasized the need to follow the actors during the process to get a better understanding of how relations and networks establish. In chapter 6, The Netherlands, the study is about the current nuclear waste policy-making process. Although it is more explorative as the process has just started, using ANT and gave more space to me as a researcher to dive into current discussions and analyse current actors involved. While in Finland, the interviewees already made up their own 'stories' and 'explanations' regarding the site selection process so many years ago. In this way, ANT helped to include non-human actors in the process, but the human actors and their roles were already defined by actors themselves.

### 7.3. Cultural Factors in Addition to Actor-Network Theory

An additional value of this thesis in my perspective, is the addition of the influence of cultures and practices to ANT approach. Because within ANT, human and non-human are treated heterogeneously and therefore cultural networks do not fit the actor-network approach. As ANT is entirely symmetrical regarding human and non-human divides, non-humans act in the same way as humans do (Sismondo, 2010). In this way, in ANT no attention is paid to subjective factors as cultures and practices but are considered arrangements between actors that produce them (Sismondo, 2010). However, to me including factors such as general attitudes within countries have been of value for this research.

Finnish and Dutch cultures have affected the nuclear waste policy-making and therefore should be taken into account. Namely, analysing Finnish and Dutch cultures showed that trust in authorities and pro- or anti-nuclear attitudes in the past affected the influence of LMs and NGOs within Finland and the Netherlands. As mentioned in chapter 5, in Finland there is much trust in authorities. In this way, trust in authorities affected the influence of LMs and NGOs because in general less support was given towards opposing movements. In contrast, in the

Netherlands, in general there is a more critical attitude towards authorities. Consequently, this can possibly result in public debates and stronger anti-nuclear movements which might affect the influence of LMs and NGOs and open black-boxes. Therefore, in addition to ANT approach, cultural factors such as trust in authorities can be of importance to consider in nuclear waste policy-making analyses.

Overall, using ANT approach allowed me to analyse the nuclear waste policy process as a set of linked actants, ideas and technologies that shaped and reshaped each other. Instead of studying a set of actors and process that were involved during site selection, using ANT provided insights in how actors were related to each other, what role non-human actors played and to what extent these factors affected the influence of LMs and NGOs during site selection process in Finland or might affect during the Dutch nuclear waste process. Therefore, using ANT has provided me valuable insights within this research.

#### 7.4. Boundary Objects and Places of Concern

Another valuable insight that arose over the course of this thesis, has been the effects as result of the final depository as boundary object. While I examined the lack of influence of LMs and NGOs in Finland through interviews, it became more clear to me that the pro-nuclear lobby has been strong in Finland and in this way supported and continued the predestined plan to build a final depository. This thesis showed that pro-nuclear actor networks were formed, as heavy industries, various politicians and the nuclear industry wanted to achieve a shared goal. Namely, building a fifth nuclear reactor and therefore also a final depository.

Much has been written regarding the pro-nuclear lobby in Finland. About the time that the DiP would be accepted or rejected, the pro-nuclear lobby argued that a new reactor was essential for several reasons (Lehtonen & Martiskainen, 2010). The strong pro-nuclear lobby is explained as result of providing energy security, as measure against climate change, to guarantee production of energy and for the benefit of the economy. So, studies mainly focus on the reasons for a fifth nuclear reactor and the effects for Finnish society and industry (Lampinen, 2009; Lehtonen & Martiskainen, 2010). Hence, the pro-nuclear lobby is seen as a result of the reasons just mentioned.

In this thesis it is shown that the fifth nuclear reactor and need for final depository were actants by itself which resulted in the establishment of a pro-nuclear nuclear actor network. Moreover, it emphasizes that boundary objects and places of concern could be used by actants as a tool within policy-making. A boundary object gathers various actants with different interest, which could be an instrument for stakeholders collaborate with others that in the first place might have a different background. Whereas in Finland a pro-nuclear actor-network seemed to be formed quite naturally, in the Netherlands the DAP will be established

in which the final depository process is actively chosen as boundary object. Moreover, places such as possible sites for final disposal can be turned into places of concern by LMs and NGOs as happened in Loviisa. In the Netherlands, LMs and NGOs could use these insights in their strategies for raising opposition and creating a debate. In addition, this thesis showed that not only LMs and NGOs could turn places into places of concern but also organisations or governments as illustrated by the example of the fifth nuclear reactor. Hence, boundary objects and places of concern can be important actants that affect the influence of LMs and NGOs in policy-making.

### 7.5. Lack of Participation or Lack of Influence?

This thesis concludes that various actants affected the lack of influence of LMs and NGOs in the policy-making process although Posiva organised some events in which citizen and NGO participation was possible. Several scholars wrote about the participation of citizens and NGOs within Finnish nuclear waste policy-making (Kojo, 2008; Blowers & Sundqvist, 2010; Strauss, 2010). For instance, Blowers and Sundqvist (2010) state that there was participative nuclear waste management in several countries, including Sweden and Finland. They stated that the Finnish participatory process involved LMs and NGOs, hence this would enable LMs and NGOs to influence the policy-making process. According to Blowers and Sundqvist (2010):

The contribution of the social side was an emphasis on participative approaches to siting a geological disposal facility or repository. Participation involved an inclusive approach where municipalities voluntarily engage in a siting process where also local communities and NGOs are given the opportunity to work in partnership with the nuclear industry in finding a solution. (p. 151)

Various researchers argue that Sweden and Finland are examples in which the site selection for final disposal has been possible on a voluntary basis and with broad local support. They argued that through public debate, discussions and a flexible siting strategy based on local acceptance, there was space for LMs and NGOs to influence this process (Högselius, 2009; Brunnegräber & Schreurs, 2015; Van Soest, 2018). In this way, the Finnish nuclear waste policy-making process has been often mentioned as model for site selection process in other countries as well.

Contrary to the perspective of Finland as participatory process, in this thesis it is argued that there was little influence as result of participation. By including the way of framing, places of concern and boundary objects, an overview is given of the involvement of LMs and NGOs and their legitimacy during the process. This is an extension to previous studies that questioned the amount of participation but mainly analysed the Environmental Impact Assessment (EIA) in which citizens were involved through participatory approaches. However, several studies that analysed the Finnish EIA showed that the involvement of citizens within this EIA does not

reflect actual influence. These reasons reflect not only the lack of influence during the EIA, but also at national level. For instance, Strauss (2010) examined the involvement of the public through the EIA and questioned whether this form of participation functioned to inform citizens and alleviate conflicts instead of meaningful participation. According to Marshall (2005) this question would be accurate, as he stated that the EIA process was “steeped in scientific camouflage by the experts involved, alienating the citizenry from decision” (p. 17). Based on several studies, Marshall (2005) stated that the lack of influence could partly be attributed to the lack of understanding complex issues such as nuclear waste. Moreover, he mentioned that due to a lack of resources, citizens were not able to hire independent experts to provide independent and alternative perspectives (Marshall, 2005). This shortage of resources has been also a factor at national level that contributed to the lack of influence from LMs and NGOs.

Besides this, there have been more results from EIA research, that can be linked to effects at national level. For instance, Strauss (2010) stated that because there was no independent regulator to protect the accountability and quality of citizens and LMs involvement in Finland, there was a stronger aim during the process towards acceptance and implementation of a final depository instead of a deliberative approach in policy-making. This is in line with the predestined policy-making process that was identified in this study, as politicians and nuclear industries wanted a solution for nuclear waste, there was a predestined path to realize a final depository. In addition, Lehtonen (2010) studied the level of participation according to the EIA and suggested that the high degree of trust in authorities and the pro-nuclear discourse in Finland let little room for new perspectives. Again, trust in authorities has affected the decision-making process at national level too because there was little support for opposing movements. Furthermore, Litmanen (1966) examined the nuclear waste issue in Finland as social construct and concluded that there was little influence of LMs and NGOs due to the framing of the discussion, which was dominated by pro-nuclear actors. The strong pro-nuclear actor-network that was identified in this study can be an example of the dominating pro-nuclear actors that functioned even better due to the separative way of framing. Overall, the abovementioned scholars emphasized that there was a certain level of citizen, LM and NGO participation during the site selection process, but their input lacked resources, expertise or legitimacy. This has been in line with the findings in my thesis. Complementary to these findings, this study has not solely focussed on the EIA at local level but attempted to gain a broader perspective by analysing the influence of LMs and NGOs at national level as well.

This research emphasized that influence of LMs and NGOs goes beyond the resources and legitimacy of participation, such as in EIAs or the influence of local and national opposition. Namely, it is also the result of other actants within an actor network, such as places of concern

and boundary objects. As showed in this thesis, places of concern affected the content of discussion and hence the legitimacy and credibility of LMs and NGOs. Moreover, the final depository as boundary objects facilitated the formation of a strong pro-nuclear actor network. Therefore, the influence of citizens, LMs and NGOs cannot be attributed to solely the legitimacy of participation but is a broader result of effects of various actants within an actor-network.

## 7.6. Alternative Concepts to Ways of Framing

There are alternative concepts that can contribute in analysing the influence of LMs and NGOs in nuclear policy-making. In the study of Litmanen (1996), research is done regarding the definitions that have been used for the nuclear waste issue during the site selection process. Litmanen (1996) described three definitions of how nuclear waste conflicts are analysed; scientific-technical, economic and political definitions. Litmanen explains that pro-nuclear groups tend to support economic and scientific-technical definitions, whereas anti-nuclear groups are more focussed on the political dimension of nuclear waste. In conflicts over nuclear waste management, the scientific-technical definition often dominates and therefore opposition needs to adapt to the same way of thinking in order to break with this definition by using an alternative definition, such as an economic or political one (Litmanen, 1996). Hence, in comparison to the ways of framing used in this thesis, Litmanen his definitions are in line with a separative way of framing, as scientific-technical definitions are distinguished from either economic or political definitions.

Whereas in this thesis, it was stated that during the site selection it was mostly technical and geological factors that defined the site selection process and later social factors when the implementation phase approached, according to Litmanen (1996) it was mostly economic factors that defined the site selection process in Eurajoki. According to Litmanen (1996), Posiva defined and influenced the dominating definition of the nuclear waste issue most. As citizens of Eurajoki benefited from the estate tax provided by Posiva, the economical definition was dominant. Whereas opponents pointed out the environmental risks, they were not able to break the economic definition and bringing in an alternative definition. Furthermore, risks were linked to the high-level radioactivity and hence dominated by the scientific-technical definition. But as citizens trust in Posiva and STUK increased, again opponents were not able to break with this definition either. Though the economic factors did play a key role during the site selection process, in this thesis the pre-site selection phase has also been analysed and showed that the site selection process was partly predestined. In this way, this study emphasizes that geological and technical factors – in line with the scientific-technical definition of Litmanen – were dominating the site selection process, but emphasis was given towards social factors to be able to continue this process when the implementation phase

started. Hence, it seems that my study the site selection process is analysed in a broader time schedule, while Litmanen focussed on specific phases during the site selection.

Besides these definitions for measuring the influence of LMs and NGOs, other studies have been done concerning the impact of social movements in nuclear energy policy-making. For instance, Joensuu et al. (2015) describe the stakeholder theory as explanation for the lack of influence by NGOs and LMs. In this theory, it is stated that the success of an NGO depends on how well the relation with other stakeholders are managed. Moreover, Kitschelt (1986) compared nuclear power conflicts in four countries and explained the impact of social movements based on the domestic political opportunity structures. He argued that pre-established ways by channels and opportunities that political regimes offered to opponents, form to what extent can be learned from opposition and conflicts. When political input structures were open and responsive to mobilization of protest, searches for new policies were triggered. When these were closed, governments insisted more on following the predetermined policy course. Moreover, when the political capacities were strong, nuclear policies were shielded from opponents that attempted to change these policies.

These political structures can also be identified in Finland. As the schedule of a final depository was already predestined in the 80s and therefore not open or very responsive towards opposition, the political structure in Finland can be defined as closed. Consequently, there was little room for impact of LMs and NGOs. Moreover, in Finland there is much respect for authorities and politicians, and hence strong political capacities. This too, is a possible reason for the lack of influence from LMs and NGOs during the nuclear waste policy-making process. As nuclear industries and the Parliament both were following the predestined final depository schedule, the nuclear policy-making process was shielded from input of opposition.

Overall, this study showed that the nuclear waste policy-making process in Finland and the Netherlands were or will possibly be affected by human and non-human actants that are all interlinked. While many scholars often emphasize the roles of human actors such as nuclear industries, politicians and NGOs, this thesis extended the analysis to examine nuclear waste policy-making as hybrid socio-technical combination in which both human and non-human actants affect the process. Places of concern and boundary objects have affected the influence of LMs and NGOs in Finland. In the Netherlands, a discussion can arise as result of possible places of concern and boundary objects. This approach has therefore gained insights in how the process has taken place and how human and non-human actants affected this process. Therefore, this approach could also be extended to other fields in order to be able to further examine in depth how complex socio-technical combination process take place. However, although many actants affected the policy-making process, there seems to be one condition needed for LMs and NGOs to be able to influence the process at all.

## 7.7. A Predestined Policy-Making Process

At local and national level, the way of framing was analysed in order to examine if a separative way of framing resulted in a lack of influence of LMs and NGOs because they had little legitimacy. However, during the analysis, I started to question whether this correlation is likely. While I focussed on the legitimacy of several actors in relation to the way of framing, I think one more step should be taken. Namely, whether there even was a discussion regarding the final depository process.

In Finland, there was a predestined policy-making process that started in the 80s and therefore legitimacy was solely in the hands of those actors that dominated the policy-making process. In this way, LMs and NGOs lacked influence as involvement of social factors was part of legitimizing the predestined process, as exemplified by the Environmental Impact Assessment in Eurajoki (chapter 4). Although LMs, NGOs and geologists argued that Eurajoki was not the best geological site for final disposal, the policy process continued and Onkalo is now under construction in Eurajoki. This shows that opposing arguments from LMs and NGOs seemed to be faced as obstacles and were not seriously considered. Consequently, due to the predestined schedule there was no discussion in which new perspectives would be considered, so therefore a separative way of framing might have had little effect on the influence of LMs and NGOs.

In the Netherlands, the nuclear waste issue seems currently to be framed in an integrative way. Because interlinkages between the social and technical aspects in nuclear waste policy-making are acknowledged by ANVS and reflected in the ethical topics of discussion within the DAP. Possibly this might result in more legitimacy of LMs and NGOs when these are involved in the DAP. However, again, when the process turns out to be predestined and not much legitimacy is given to input of opposing or critical voices, LMs and NGOs will not be able to influence the process. Hence, the process and influence of LMs and NGOs seems to be linked to the legitimacy of their arguments, which is a result of whether the process is predestined or not instead of how the discussion is framed.

## 7.8. Recommendations for Further Research

Based on this study, some recommendations for further research can be made. In this thesis factors that affected the influence of LMs and NGOs have been analysed, thereby not paying much attention to LMs and NGOs as actants themselves. LMs and NGOs have been referred to as if these are one actant, however these LMs and NGOs comprise various interests, strategies and interactions which could actually be considered as actor-networks in itself. In this way, LMs and NGOs could be considered black-boxes in my thesis. Therefore, it could be interesting to research the influence of LMs and NGOs, how they gained little legitimacy, credibility and

accountability. This could also be helpful for LMs and NGOs to affect policy-making in future nuclear waste issues.

In line with this, more research can be executed in order to study the influence of LMs and NGOs during the site selection process in Finland. For this, it could be useful to study reasons and factors that affected the successful local opposition in Loviisa, in contrast to the lack of influence in Eurajoki. In this way, more insights can be gained for not only the lack of influence of LMs and NGOs as studied in this research, but also factors that contributed to opposition that did significantly affect the process.

Furthermore, there is great research potential for nuclear waste policy-making processes in the Netherlands. So far, no research has been done yet regarding the influence of LMs and NGOs in the Netherlands, as there is no public discussion yet. The formation of actor-networks can have significant influence in the nuclear waste decision-making. Whether the DAP can facilitate a participatory process without predestined agenda and without strong pro-nuclear actor network dominating the discussion, can be observed in coming years.

Lastly, it would be interesting to study other environmental issues in which technical decisions have to be made. Issues such as climate policy-making or energy transition policy-process could be analysed in order to examine whether these processes are predestined, which actants influence the policy-making process and what roles LMs and NGOs can play. Especially with current global climate change issues, LMs and NGOs could be helpful for critical insides and to protect the environment and make use of turning places into places of concern. However, if LMs and NGOs critics are ignored or solely involved to justify predestined plans, studies are needed to identify these patterns and to prevent predestined policy-making.

## 8. Conclusions

The influence of local movements (LMs) and non-governmental organisations (NGOs) is affected by boundary objects, places of concern and the legitimacy of actants. Not only affected these concepts the influence of LMs and NGOs, but also the nuclear waste policy-making process in general. The final depository process in Finland functions as a participatory role model for other countries. However, while there were critics from geologists, LMs and NGOs regarding the site selection process in Eurajoki, these actants lacked influence during this process. Hence, the objective of this thesis was to show how various factors affected the lack of influence of LMs and NGOs and the nuclear policy-making and site selection process. These insights can also be applied to nuclear waste processes in other countries.

For this, a qualitative research was executed in Finland and the Netherlands. First, a case study was done at local level in Eurajoki, the Finnish municipality where the first final depository is currently under construction. Places of concern and how the way of framing affects the influence of LMs and NGOs during the site selection process were examined. Moreover, at national level in Finland, places of concern and boundary objects were studied to analyse the effects of these concepts on the influence of LMs and NGOs during the national nuclear waste policy-making. After the analysis of Finnish nuclear waste policy process, an explorative study was done in the Netherlands in order to see whether some insights of the study in Finland are applicable to current Dutch nuclear waste policy-making.

### 8.1. Eurajoki

In Eurajoki, the way of framing and various places of concern have affected the site selection process and influence of LMs and NGOs. As during the late-80s till mid-90s the issue of nuclear waste was considered a geological issue without focus on social factors or involvement of other actors, it was framed separately. Consequently, LMs and NGOs had little influence or legitimacy regarding the preliminary site selection. When the implementation phase approached, discussions started regarding how to gain citizen acceptance and feelings of trust in municipalities, that could possibly host a final depository. Although social factors were pointed out, the reasons for this were to create trust and to increase legitimacy within the decision-making. In this way, the site selection process could be continued as was planned in the 80s already. Hence, the discussion was still framed separately while the LMs and NGOs still lacked influence in Eurajoki. Moreover, most citizens in Eurajoki have a pro-nuclear attitude due to relatives or friends that work in the nuclear industry, based in Eurajoki. Besides this, much emphasis was given towards economic and job-related advantages of a final depository. In this way, the pro-nuclear network was stronger than the anti-nuclear network. There was little attention given to the arguments of opposition, and within the municipality anti-nuclear citizens were badgered. Although Posiva organised an Environmental Impact

Assessment (EIA), to involve citizens within final suitable municipalities and to include social and technical aspects, this has been mainly used as a tool to increase acceptance for a pre-designed planning and decision-making process. In line with this, it seems that due to the predestined schedule for a final depository, actants such as TVO, Posiva and politicians who were pro-nuclear had most legitimacy.

Besides the little legitimacy of LMs and NGOs, there have been three places of concern in Eurajoki that affected the site selection process. First, opposition in Loviisa, an alternative candidate municipality to host the final depository, resulted in lower citizen acceptance for disposal compared to Eurajoki. Therefore, Eurajoki became the preferred municipality to host a final depository. Moreover, the Vuojoki Mansion, an elderly home in Eurajoki, became key in an agreement between Posiva and the municipality. As Posiva would rent the Vuojoki Mansion, this increased municipal and citizens' trust and contributed to the municipality granting the construction license. In the end, the government accepted the Decision in Principle (DiP) to grant a construction license for a final depository in Eurajoki, in 2001. Hence, these places of concern enlarged the focus on Eurajoki as the most suitable host for final disposal and at the same time the Vuojoki Mansion increased trust and acceptance of citizens within the municipality. In this way, these places of concern affected the site selection process at the local level.

## 8.2. Finland

At the national level, places of concern and boundary objects affected the influence of LMs and NGOs during the nuclear waste policy-making process. The decision regarding the fifth nuclear reactor in Finland functioned as a place of concern, because there was a discussion regarding whether a fifth nuclear reactor in Finland should be built. This discussion was simultaneously with the DiP for final disposal, and therefore the discussion regarding nuclear waste shifted more towards a discussion regarding nuclear energy in general. As there was a pro-nuclear environment in Finland already, politicians dealt with the issue quite pragmatically, in order to implement the solution for the nuclear waste issue and to be able to expand nuclear energy production with a fifth nuclear reactor. Because the nuclear energy production and nuclear waste issue were dealt with as one issue, while at the same time there was a very strong pro-nuclear attitude, the influence of LMs and NGOs during this process was little.

Moreover, the lack of influence from LMs and NGOs can be attributed to the lack of resources of these organisations. Although there have been critiques given by NGOs and geologists, these came short in credibility and attention compared to arguments of pro-nuclear actors. In addition, these pro-nuclear actors formed a strong pro-nuclear actor network that made it easier to continue the predestined schedule of building a final depository. It comprised heavy industries that needed cheap nuclear energy. Also, connections between Posiva and STUK might result into conflicts of interests, as the nuclear industry is one of the main employees

for STUK and hence important for employment. Moreover, media and several parliamentarians have been pro-nuclear, also strengthening the pro-nuclear actor network facing a weak fragmented anti-nuclear actor network. This shows that the final depository and fifth nuclear reactor have functioned as boundary objects, since various pro-nuclear actors aimed for a shared end goal, namely a final depository in order to get the license for a fifth nuclear reactor. Due to the boundary objects, a pro-nuclear actor network was formed and followed the predestined policy-process. While LMs and NGOs were not able to get involved in this network or to form their own strong anti-nuclear network, they were not able to affect the policy-making process.

These insights show that long-term nuclear waste policy-making is a hybrid socio-technical combination in which social and technical factors are interlinked and affected by human and non-human actants. These non-human actants have turned black-boxes into places of concern and boundary objects assembled actor networks of pro-nuclear stakeholders. Moreover, the way of framing has given more legitimacy towards TVO and Posiva, as sites were selected based on geological factors. Later, the discussion was still separately framed as the emphasis shifted towards societal acceptance and trust to smoothen the implementation of a final depository. As Posiva still dominated the discussion, LMs and NGOs had little legitimacy and were unable to influence the overall site selection process in Finland.

### 8.3. The Netherlands

In the Netherlands, no preliminary site selection has started yet. The government decided to make a decision regarding final disposal by 2100. Based on the insights in Finland, it is analysed whether the Dutch policy-making is a predestined schedule too, that still can be affected by actants as was the case in Finland. At the moment, Dutch nuclear waste is a black-box as there is a stable nuclear waste policy without much controversy. However, Borssele as final operational nuclear reactor in the Netherlands can serve as starting point for discussion. Because when Borssele closes down, all nuclear waste is produced and hence the question might be raised what to do with all the waste. In this way, the black-box is opened and Borssele turns the final depository from matter of fact into a place of concern. Another starting point for discussion is when the DAP is established, which is the advisory board consisting of various stakeholders or experts. As DAP members have a shared goal of creating a participatory final disposal process, this could also result in opening the black-box by starting public discussions before 2100.

Besides this, in the Netherlands the final disposal functions as boundary object too. Consequently, the DAP is established and hence could be considered a result of a participatory final depository process as boundary object. Furthermore, the way of framing might be more integrative in the Netherlands compared to Finland. As proposed by Van Soest (2018), DAP

would first discuss ethical underlying opinions and beliefs, in order to come to consensus later. In this way, the process for a final depository integrates the idea that the issue of nuclear waste is a complex socio-technical network in which many actors with different interests and perspective are involved. As a result of this integrative way of framing, NGOs in the Netherlands seem to have more opportunities to raise their voices, have more legitimacy, and in this way affect the decision-making process.

#### 8.4. Recommendations for Nuclear-Waste Policy-Making

Based on these conclusions, the following recommendations are given concerning nuclear waste policy-making and influence of LMs and NGOs: firstly, in thesis it is emphasized that when a policy decision is already made, there is not much space left for LMs and NGOs to have any influence on this decision making. When the decision is predestined, not much legitimacy might be given to any arguments of the opposing parties. Opposing arguments are considered obstacles, whether these are technical or social aspects. However, LMs and NGOs can be of additional value for the policy-making process by promoting sustainable policy-making and raising criticism. For critical perspectives from LMs and NGOs to be heard, there should be no predestined schedule and an independent authority to arrange (public) debate.

Secondly, it should be noted that resources are essential for LMs and NGOs to be able to influence the process. Not only financial resources are essential but also social conditions such as the amount of people or volunteers that are involved or support LMs and NGOs. For example, in Sweden opposing organisations are funded by energy companies that have to dispense a small percentage of the energy bill towards NGOs and research institutes.

Lastly, LMs and NGOs could become aware of the possibility to use these insights in their strategies to influence policy-making. For instance, they can actively turn places into places of concern and in this way open black-boxes. When a black-box is opened, there might be higher chances for LMs and NGOs to be heard by either the public or policy-makers. Moreover, it could be possible to use boundary objects in order to form strong actor-networks with LMs and NGOs, which can be of additional value in influencing policy-making.

#### 8.5. Concluding Remarks

In conclusion, the nuclear waste policy process in Finland can fruitfully be analysed as network of citizens, nuclear industry stakeholders, governmental stakeholders and non-human actants such as the Vuojoki Mansion, Loviisa and the fifth nuclear reactor. Although geologists, LMs and NGOs questioned whether Eurajoki is suitable for constructing a final depository, the license was granted in line with the predestined schedule made in the 80s. Accordingly, LMs and NGOs were not able to influence the policy-making process due to a lack of legitimacy and not being able to compete such a strong pro-nuclear actor network. To me this is worrisome,

as a 'quick solution' seemed to be chosen over a well-considered process in which critical remarks were integrated in the process.

Whether the same will happen in the Netherlands depends on the role of the DAP and how ANVS and politicians will deal with criticism. The establishment of DAP might play a key role, as it might give a platform for different perspectives including anti-nuclear attitudes and critical voices. Moreover, it is interesting to see what will happen when Borssele closes. Because by then, possibly new discussions will start regarding final disposal. As there is less trust and respect for authorities in the Netherlands compared to Finland, I believe that no such strong pro-nuclear actor network will be established in the Netherlands against which anti-nuclear networks would not be able to compete. Instead, I hope that critical voices will be heard and included in order to find a suitable and safe long-term solution for nuclear waste in the Netherlands. Establishing the DAP seems like a promising first step to accomplish an inclusive final depository process. However, it should be clear that if current Dutch nuclear waste policy-making process is predestined till 2100, it might be the same Finnish 'participatory process' all over again. Predestined and with a lack of legitimacy for any critics.

## 9. References

- Ahearne, J. F. (2000). Intergenerational issues regarding nuclear power, nuclear waste, and nuclear weapons. *Risk Analysis*, 20(6), 763-770.
- Äikäs, T., & Sundell, R. (2014). ONKALO—From Concept to Reality. WM2014 Conference.
- ANVS (2018). National report for the Council Directive 2011/70/EURATOM. Establishing a Community framework for the responsible and safe management of spent fuel and radioactive waste. Retrieved February 14<sup>th</sup>, 2019. Available at:  
<https://www.rijksoverheid.nl/binaries/rijksoverheid/documenten/rapporten/2018/08/29/national-report-for-the-council-directive-2011-70-euratom/national-report-for-the-council-directive-2011-70-euratom.pdf>
- Bales, S. N. (2005). Framing public issues. *Washington, DC: FrameWorks Institute*.
- Baron, L.F., & Gomez, R. (2016). The associations between technologies and societies: the utility of Actor-Network Theory. *Science, Technology & Society*, 21(2), 129-148.
- Beard, L., Scarles, C., & Tribe, J. (2016). Mess and method: Using ANT in tourism research. *Annals of Tourism Research*, 60, 97-110.
- Bergmans, A., Sundqvist, G., Kos, D., & Simmons, P. (2015). The participatory turn in radioactive waste management: Deliberation and the social–technical divide. *Journal of Risk Research*, 18(3), 347-363.
- Bergsma, G. C., Hack, H. R. G. K., Kops, J. A. A. M., Lembrachts, J., Passchier, W. F., Smetsers, R. C. G. M., van der Vlist, J.H., & de Zoeten, G. (2015). Nationaal uitvoeringsprogramma voor het langetermijnbeheer van radioactief afval en verbruikte splijtstoffen: toetsingsadvies over het ontwerpprogramma. Retrieved September 18<sup>th</sup>, 2018. Available at:  
<https://www.commissiemer.nl/docs/mer/p28/p2842/a2842ts.pdf>
- Bernardi, L., Morales, L., Lühiste, M., & Bischof, D. (2017). The effects of the Fukushima disaster on nuclear energy debates and policies: a two-step comparative examination. *Environmental Politics*, 27(1), 42-68.
- Bettany, S. (2007). The material semiotics of consumption or where (and what) are the objects in consumer culture theory?. In *Consumer culture theory* (pp. 41-56). Emerald Group Publishing Limited.
- Brunnengräber, A., & Schreurs, M. (2015). Nuclear energy and nuclear waste governance perspectives after the fukushima nuclear disaster. In *Nuclear Waste Governance*, 47-78.

- Bryman, A. (2012). *Social Research Methods*. Oxford University Press.
- Cressman, D. (2009). A brief overview of actor-network theory: Punctualization, heterogeneous engineering & translation.
- Dankert, R. (2011). Using actor-network theory (ANT) doing research. Retrieved February 2<sup>nd</sup>, 2019. Available at: <https://ritskedankert.nl/using-actor-network-theory-ant-doing-research/>
- De Vate, L. (2018). Eindberging hoogradioactief afval met diepe boorgaten bij de kerncentrale Borssele. Retrieved September 19<sup>th</sup>, 2018. Available at: <https://wisenederland.nl/sites/default/files/images/DBG%20ovdv%20DEFF%203%20mei%2018.pdf>
- De Vries, A., Waes, van, A. H. M., Est, van, Q. C., Meulen, van der, B., & Brom, F. (2015). Bouwstenen voor participatie: visie op publieksparticipatie bij de besluitvorming over langdurig beheer van radioactief afval. Den Haag: Rathenau Instituut.
- Dekker, P., Goede, de, I., & Pligt, van der, J. (2011). Kernenergie in de publieke opinie. Ontwikkelingen in het marktonderzoek: jaarboek MarktOnderzoekAssociatie, 36, 207-221.
- DELTA (2012). DELTA stelt besluit enkele jaren uit, voorlopig geen tweede kerncentrale in Borssele. Retrieved January 23<sup>rd</sup>, 2019. Available at: <https://kernenergieinnederland.nl/files/20120123-deltapersbericht.pdf>
- Diani, M. (1992). The concept of social movement. *The sociological review*, 40(1), 1-25.
- Diaz-Maurin, F., & Ewing, R. (2018). Mission Impossible? Socio-Technical Integration of Nuclear Waste Geological Disposal Systems. *Sustainability*, 10(12), 4390.
- Di Nucci, M. R., Brunnengräber, A., Mez, L., & Schreurs, M. (2015). Comparative perspectives on nuclear waste governance. In *Nuclear Waste Governance* (pp. 25-43). Springer VS, Wiesbaden.
- Doolin, B., & Lowe, A. (2002). To reveal is to critique: actor–network theory and critical information systems research. *Journal of information technology*, 17(2), 69-78.
- Ernstson, H. (2013). Re-translating nature in post-apartheid Cape Town: The material semiotics of people and plants at Bottom Road. *Actor-network theory for development: Working paper series*, 1-35.

- Frohmann, B. (1995). Taking information policy beyond information science: applying the actor network theory. In *Annual Conference of the Canadian Association for Information Science*, 23, 7-10.
- Gorur, R. (2008). Explaining global policy phenomena using the small and the mundane: A network analysis of PISA. In *AARE 2008 International Education Research Conference*, 30, 1-13.
- Hancock, D. R., & Algozzine, B. (2016). *Doing case study research: A practical guide for beginning researchers*. Teachers College Press.
- Högselius, P. (2009). Spent nuclear fuel policies in historical perspective: An international comparison. *Energy Policy*, 37(1), 254-263.
- Hutter, B. M., & O'Mahony, J. (2004). *The role of civil society organisations in regulating business*. London: Centre for Analysis of Risk and Regulation, London School of Economics and Political Science.
- Ialenti, V. (2014). Adjudicating deep time: revisiting the United States' high-level nuclear waste repository project at Yucca Mountain. *Science & Technology Studies*, 27(2), 27-48.
- Jelgersma, E., & Schröder, T. J. (2014). *Report on communicating Safety Case results*, 1-79. OPERA report OPERA-IR-NRG131.
- Joensuu, K., Koskela, M., & Onkila, T. (2015). Social proximity and environmental NGO relationships in corporate sustainability reports. *Sustainable Development*, 23(1), 26-40.
- Justesen, L., & Mouritsen, J. (2011). Effects of actor-network theory in accounting research. *Accounting, Auditing & Accountability Journal*, 24(2), 161-193.
- Kaghan, W. N., & Bowker, G. C. (2001). Out of machine age?: complexity, socio-technical systems and actor network theory. *Journal of Engineering and Technology Management*, 18(3-4), 253-269.
- Kitschelt, H. P. (1986). Political opportunity structures and political protest: Anti-nuclear movements in four democracies. *British journal of political science*, 16(1), 57-85.
- Kojo, M. (2001). *The political styles of local anti-nuclear waste movements in Finland* (No. NEI-SE--436).
- Kojo, M. (2005). Changing approach: local participation as a part of the site selection process of the final disposal facility for high-level nuclear waste in Finland. In *10<sup>th</sup>*

*International Conference on Environmental Remediation and Radioactive Waste Management, Glasgow, September* (pp. 4-8).

- Kojo, M. (2006). *The Site Selected. The Local Decision-Making Regarding the Siting of the Spent Nuclear Fuel Repository in Olkiluoto* (No. NEI-SE--613). Retrieved November 13<sup>th</sup>, 2018. Available at:  
[https://inis.iaea.org/collection/NCLCollectionStore/\\_Public/37/101/37101557.pdf](https://inis.iaea.org/collection/NCLCollectionStore/_Public/37/101/37101557.pdf)
- Kojo, M. (2009). The revival of nuclear power in a strong administrative state. In *The Renewal of Nuclear Power in Finland* (pp. 221-251). Palgrave Macmillan, London.
- Kojo, M. (2009). The strategy of site selection for the spent nuclear fuel repository in Finland. In *The renewal of nuclear power in Finland* (pp. 161-191). Palgrave Macmillan, London.
- Kojo, M., & Litmanen, T. (Eds.). (2009). *The Renewal of Nuclear Power in Finland*. Basingstoke: Palgrave Macmillan.
- Kojo, M., Kari, M., & Litmanen, T. (2009). Extension of the Repository Under Excavation. The Opinions of the Local Residents in the Municipality of Eurajoki.
- Kojo, M., Kari, M., & Litmanen, T. (2010). The socio-economic and communication challenges of spent nuclear fuel management in Finland: the post site selection phase of the repository project in Eurajoki. *Progress in Nuclear Energy*, 52(2), 168-176.
- Lammi, H. (2009). Social Dynamics Behind the Changes in the NGO Anti-Nuclear Campaign, 1993–2002. In *The Renewal of Nuclear Power in Finland* (pp. 69-87). Palgrave Macmillan, London.
- Lampinen, A. (2009). An analysis of the justification arguments in the application for the new nuclear reactor in Finland. In *The Renewal of Nuclear Power in Finland* (pp. 41-68). Palgrave Macmillan, London.
- Latour, B. (1993). *We Have Never Been Modern*. Cambridge, MA: Harvard University Press.
- Latour, B. (1996). On actor-network theory: A few clarifications. *Soziale welt*, 369-381.
- Latour, B. (1999). *Pandora's hope: essays on the reality of science studies*. Cambridge, MA: Harvard University Press.
- Law, J. (2009). Actor network theory and material semiotics. *The new Blackwell companion to social theory*, 141-158.

- Lehtonen, M. (2010). Opening up or closing down radioactive waste management policy? Debates on reversibility and retrievability in Finland, France, and the United Kingdom. *Risk, Hazards & Crisis in Public Policy*, 1(4), 139-179.
- Lehtonen, M., & Martiskainen, M. (2010). Pathways towards the nuclear revival in Finland, France, and the UK. 1-36.
- Litmanen, T. (1996). Environmental conflict as a social construction: Nuclear waste conflicts in Finland. *Society & Natural Resources*, 9(5), 523-535.
- 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 & social science*, 25, 19-30.
- Lunkka, J.P., Johansson, P., Saarnisto, M., & Saarasmaa, O. (2004). Glaciation of Finland. In: J. Ehlers & P.L. Gibbard (Eds.). *Developments in Quaternary Science*, 2, 93–100.
- Marshall, A. (2005). The social and ethical aspects of nuclear waste. *Electronic Green Journal*, 1(21), 1-28.
- McEwen, T., & Äikäs, T. (2000). *The site selection process for a spent fuel repository in Finland. Summary report*, 00-15. Posiva.
- Ministry of Infrastructure and Environment (2016). Het ontwerp nationale programma voor het beheer van radioactief afval en verbruikte splijtstoffen. Retrieved February 1st, 2019. Available at:  
<https://www.autoriteitnvs.nl/binaries/anvs/documenten/publicatie/2016/06/24/nationale-programma-radioactief-afval/het-nationale-programma-radioactief-afval.pdf>
- Moeckli, J., & Lee, J. D. (2007). The making of driving cultures. *Improving Traffic Safety Culture in the United States*, 38(2), 59-76.
- Nexon, D. H., & Pouliot, V. (2013). “Things of Networks”: Situating ANT in International Relations. *International Political Sociology*, 7(3), 342-345.
- Pasanen, T. (1998). Municipal Feedback on Environmental Impact Assessment of Final Disposal of Used Nuclear Fuel: Written Feedback, Small Groups and Journal Writing. *Posiva. Work Report*, 98-64.
- Posiva Oy. (1998). Social Impact of Final Disposal of Spent Nuclear Fuel from Municipal Perspective. *Work Report*, 98-16.
- Posiva Oy. (1999). The Final Disposal Facility for Spent Nuclear Fuel: Environmental Impact Assessment Report. *EIA Report*, 99-16.

- Posiva Oy (2003). Programme of monitoring at Olkiluoto during construction and operation of the ONKALO. *Posiva Report 2003*, 5.
- Posiva Oy. (2008). Environmental Impact Assessment Report: Expansion of the Repository for Spent Nuclear Fuel. Retrieved December 1<sup>st</sup>, 2018. Available at: [http://www.Posiva.fi/en/databank/publications/eia\\_reports/environmental\\_impact\\_assessment\\_report.2270.xhtml#.XFL-1xKhPY](http://www.Posiva.fi/en/databank/publications/eia_reports/environmental_impact_assessment_report.2270.xhtml#.XFL-1xKhPY)
- Raumolin, H. (1982) *TVO: n ydinjätehuollon toimintaohjelma ja aikataulut* (Programme and Schedules for TVO's Nuclear Waste Management). The Nuclear Waste Commission of Finnish Power Companies. Report YJT-82-55. Helsinki: Teollisuuden Voima Oy.
- Rice, L. (2011). Black-boxing sustainability. *Journal of Sustainable Development*, 4(4), 32.
- Rutland, T., & Aylett, A. (2008). The work of policy: actor networks, governmentality, and local action on climate change in Portland, Oregon. *Environment and Planning D: society and space*, 26(4), 627-646.
- Sarker, S., Sarker, S., & Sidorova, A. (2006). Understanding business process change failure: An actor-network perspective. *Journal of management information systems*, 23(1), 51-86.
- Schaeffer, C., & Smits, M. (2015). From matters of fact to places of concern? Energy, environmental movements and place-making in Chile and Thailand. *Geoforum*, 65, 146-157.
- Schreurs, M. A. (2002). Democratic transition and environmental civil society: Japan and South Korea compared. *The Good Society*, 11(2), 57-64.
- Schröder, J. (2016). Geological disposal of radioactive waste: a long-term socio-technical experiment. *Science and engineering ethics*, 22(3), 687-705.
- Sismondo, S. (2010). *An introduction to science and technology studies* (Vol. 1). Chichester: Wiley-Blackwell.
- Sovacool, B. K., Andersen, R., Sorensen, S., Sorensen, K., Tienda, V., Vainorius, A., Schirach, O.M., & Bjørn-Thygesen, F. (2015). Balancing safety with sustainability: assessing the risk of accidents for modern low-carbon energy systems. *Journal of cleaner production*, 112, 3952-3965.

- Star, S. L., & Griesemer, J. R. (1989). Institutional ecology, translations' and boundary objects: Amateurs and professionals in Berkeley's Museum of Vertebrate Zoology, 1907-39. *Social studies of science*, 19(3), 387-420.
- Stockbruegger, J., & Bueger, C. (2017). Actor-Network Theory: Objects and actants, networks and narratives. In *Technology and World Politics* (pp. 54-71). Routledge.
- Strauss, H. (2010). Involving the Finnish public in nuclear facility licensing: participatory democracy and industrial bias. *Journal of Integrative Environmental Sciences*, 7(3), 211-228.
- STUK. (2017). Nuclear Waste in Finland. Retrieved December 2<sup>nd</sup>, 2018. Available at: <https://www.stuk.fi/web/en/topics/nuclear-waste/nuclear-waste-in-finland>
- Thompson, E. (2016). An actor-network theory of boundary objects: construction and disappearance. British Academy of Management.
- Tilly, C. (1999). From interactions to outcomes in social movements. *How social movements matter*, 10, 253-270.
- Van De Poel, I. (2011). Nuclear energy as a social experiment. *Ethics, Policy & Environment*, 14(3), 285-290.
- Van Der Duim, R., Ren, C., & Thór Jóhannesson, G. (2013). Ordering, materiality, and multiplicity: Enacting actor–network theory in tourism. *Tourist Studies*, 13(1), 3-20.
- Van Soest (2018). Diepgravende Dialogen, Bouwen aan Vertrouwen. Eindrapportage Kwartiermaker Eindberging radioactief afval en verbruikte splijtstoffen.
- Verhoef, E., & Neeft, E. (2014). Towards a safety strategy. Developing a long-term Dutch research programme into geological disposal of radioactive waste. *OPERA-PGCOV014*, 26.
- Vira, J. (2006). Winning citizen trust: The siting of a nuclear waste facility in Eurajoki, Finland. *Innovations: Technology, Governance, Globalization*, 1(4), 67-82.
- Wezel, B. V. (2015). „Elektriciteit in Nederland.”. *Centraal Bureau voor de Statistiek, Den Haag*.
- Won, K., Han, J., & Bonne, A. (1997). Radioactive waste disposal: Global experience and challenges. *Iaea Bull*, 39(1), 33-41.
- Yli-Kauhaluoma, S., & Hänninen, H. (2014). Tale taming radioactive fears: Linking nuclear waste disposal to the “continuum of the good”. *Public Understanding of Science*, 23(3), 316-330.

Young, D., Borland, R., & Coghill, K. (2010). An actor-network theory analysis of policy innovation for smoke-free places: understanding change in complex systems. *American Journal of Public Health, 100*(7), 1208-1217.

Zchout, S. L., & Tal, A. (2017). Conflict versus consensus strategic orientations among environmental NGOs: An empirical evaluation. *VOLUNTAS: International Journal of Voluntary and Non-profit Organizations, 28*(3), 1110-1134.

## 10. Appendices

### Appendix 1. Overview Interview Data

#	Interviewee	Organisation/Institution	Country	Recorded	Comments
1	Sami & Francisco	Luonto-Liito	Finland	Yes	
2	Kari	Citizen Eurajoki	Finland	Yes	Use first name
3	Anni Rossi	Junior Posiva Oy Solutions	Finland	Yes	
4	Kimmo Saarikko	Citizen Eurajoki	Finland	yes	
5	Jami Jokinen	Environmental journalist	Finland	Yes	
6	Anonymous	Citizen Eurajoki	Finland	Written	Requested to remain anonymous
7	Marti	Citizen Eurajoki	Finland	Written	Adolescent as interpreter
8	Fruzsina Nagy	Citizen Eurajoki	Finland	Yes	
9	Matti Kaunisto	Citizen Eurajoki	Finland	Yes	
10	Emma Puosi	Municipality Eurajoki – Tourist Information	Finland	Yes	
11	Vesa Lakaniemi	Municipality Eurajoki - Mayor	Finland	Yes	
12	Harri Lammi	Greenpeace	Finland	Yes	
13	Jouni Nissinen	Finnish Association for Nature Conservation	Finland	Yes	
14	Lea Launokari	Women Against Nuclear Movement	Finland	Yes	
15	Matti Saarnisto	Geologist (retired)	Finland	Yes	Solely main points in appendix <sup>9</sup>
16	Anonymous	Local opposition Eurajoki	Finland	Phone call with Finnish translator	Requested to remain anonymous
17	Timo Äikäs	Posiva Executive Vice-President and Corporate Adviser (retired)	Finland	Yes	
18	Timo Seppälä	Posiva Communication Manager (retired)	Finland	Yes	
19	Satu Hassi	Member Parliament	Finland	Yes	
20	Erika Neeft & Ewoud Verhoef	COVRA	Netherlands	Yes	
21	Dirk Bannink	Laka Research Institute	Netherlands	Yes	
22	Johan Lembrechts	Commission MER	Netherlands	Yes	
23	Peer de Rijk	WISE Nederland	Netherlands	Yes	
24	Jan Paul van Soest	Kwartiermaker Klankbordgroep	Netherlands	Yes	
25	ANVS	Dutch Authority for Nuclear Waste	Netherlands	List with questions and answers by e-mail	

<sup>9</sup> Did not give consent to publish the transcription of the interview. as the ‘speaking-language’ was transcribed literally, Saarnisto requested to use the main points of the interview and summary of reports provided.

## Appendix 2. Finnish and Dutch Codes

<b>Theme/Category</b>	<b>Coding name</b>	<b>Coding Colour</b>
<i>Nuclear waste Finland</i>	Pro nuclear environment	
	Discussion final disposal in general	
	Socio-technical combinations	
	NGOs and local movements	
	Strategy Posiva/TVO/STUK/Industries	
	Policy making process	
<i>Nuclear waste Eurajoki</i>	Eurajoki Municipality	
	Eurajoki	
	Discussion final disposal in Eurajoki	
	Discussion	
	NGOs and local movements	
	Political decision-making	
<i>Role of concepts ANT</i>	External parties that influenced outcome	
	Separation	
	Integration	
	Places of concern	
<i>Nuclear waste the Netherlands</i>	Actors	
	Discussion 100 years	
	Citizens participation/discussion	
	NGOs	
	Technical/political decision	
<i>Role of concepts ANT</i>	Separation	
	Integration	
	Places of concern	

## **Finnish codes**

**Reasons for final disposal location or not**

**Strategy Posiva**

**Strategy Municipality**

**Relation between actors**

**Opposition**

**Image Eurajoki/Olkiluoto**

**Participation citizens Eurajoki**

**Finnish trust in politicians/authorities**

**long term concerns**

**open discussion**

**reasons final disposal**

**proces Finland**

**Opposition Eurajoki**

**Predestined with time schedule**

**Communication municipality & Posiva**

**Distinction social/technical actors**

**Distinction social/technical aspects**

**Aim NGOs**

**Outcomes of Movements**

**External parties that influenced outcome**

**Conflicts of Interests**

**Strategy NGOs**

**Political vs. geological decision**

**Criticism**

**Timeline Issue**

**Critics NGO Greenpeace**

**Critics NGO Women Against Nuclear Power**

**Strategy NGOs**

**Citizens opposition in Eurajoki**

**Geological features**

**Critics Satu Hassi**

**Needed**

**Places of concern**

**separation**

**integration**

**why Eurajoki**

**Chernobyl**

**politicians Finland**

**Greenpeace timeline**

**hybrid sociotechnical combinations**

**local movements Eurajoki**

**lock in**  
**strategy industries**  
**debate narrowed down**  
**forest industry**  
**Aim pro nuclear industries lobby**  
**Decision in Principle**  
**threats citizens Eurajoki**  
**political decision**  
**STUK**  
**Media**  
**society**  
**technical actors**  
**communication Posiva**  
**Matti Saarnisto**  
**Debate**  
**Information citizens**

### **Dutch codes**

**Discussion**  
**Postponing discussion**  
**Citizens discussion lock in**  
**Aim Laka**  
**Strategy Laka**  
**Aim WISE**  
**Strategy WISE**  
**Social and technical actors**  
**Klankbordgroep = integration**  
**ANVS**  
**Commissie MER advice**  
**Citizens participation**  
**NGOs**  
**technical actors/social actors**  
**technical /political decision**  
**Finland - NL**  
**Double role ANVS**  
**Top-down/bottom-up**  
**Klankbordgroep**  
**Borssele**  
**Politics**  
**COVRA**  
**geology Netherlands long term**  
**Participation**

## Appendix 3. Transcriptions of Interviews

As all interview transcriptions comprise over 200 pages, these are available on request.