

CARL COUNTRY REPORT

SWEDEN

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February 2006

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1. Introduction: Three Dimensions of Swedish Nuclear Waste Management

This report addresses current practices of Swedish nuclear waste management and their historical development. The main focus is on past, current and emerging patterns of stakeholder involvement in the siting of a deep repository for the final disposal of Sweden's spent nuclear fuel. The general questions attended to in the report are: Who are the main stakeholders, and how have they emerged and gained recognition as such? What are the issues currently subject to stakeholder involvement and how have these been decided upon? How is stakeholder involvement organized locally and nationally and how has this changed over time? How has stakeholder involvement gained acceptance as an activity of value in the siting of major waste facilities? Given this focus on *stakeholder involvement*, the report highlights three dimensions of Swedish nuclear waste management (nwm):

- The changing degree to which nwm has been treated as a scientific-technical challenge versus a socio-political challenge
- The changing degree to which nwm has been treated as an internationally, nationally or locally-focussed undertaking
- The changing degree to which nwm has been understood as wedded to, or divorced from the overall future of the Swedish nuclear industry

Highlighting these three dimensions is seen as a way of approaching stakeholder identities as contingent, fluid and relational, rather than as static, fixed and given from the outset in a siting process. In our eyes, stakeholder involvement is a process of becoming. Our ambition is to chart the process through which different actors have become (or failed to become) recognized stakeholders: the history of technical twists and political turns through which different actors have voluntarily (or involuntarily) become connected to (or disconnected from) the siting of a deep repository for Sweden's spent nuclear fuel. We chart this process both, back in time to the very beginnings of the Swedish nuclear programme and the belated discovery of a nuclear waste problem (Chapter 2), and into the future in relation to the changing pattern of uncertainties currently shadowing the development of Swedish nuclear waste management (Chapter 9).

Since the beginning of 2002, SKB (the Swedish Nuclear Fuel and Waste Management Company) have been conducting site investigations for a final repository for Sweden's spent nuclear fuel in two Swedish municipalities: Oskarshamn and Östhammar. The initiation of these investigations, focussing on local bedrock conditions, marks what is imagined to be one of the final steps in a flexible stepwise siting strategy for such a repository. After eight years of feasibility studies in eight different municipalities, two municipalities have emerged and agreed to participate in site investigations after the government approved SKB's choice of them as suitable candidates for such investigations. In the 1980s and 1990s, most Swedes thought that spent nuclear fuel would never find a deep geological home anywhere in/under the country.

In Chapter 3 the politicisation of nuclear power in Sweden in the 1970s, as in many Western countries at this time, is described. In Sweden a new government as well as a new act making the fuelling of new reactors conditional upon the guaranteed safe disposal of spent fuel, were important factors shaping the formation of a Swedish nuclear waste system. The new act forced the nuclear industry to devise 'an absolutely safe' waste disposal system. After much political conflict, public debate and a national referendum, the nuclear industry succeeded in winning approval for the KBS-3 method for the deep disposal of spent nuclear fuel as a nationally-acceptable system of nuclear waste disposal.

In Chapter 4 it is described how during the 1980s SKB tried to build on its success in achieving approval for the KBS-3 method by searching for the ‘absolutely best’ bedrock in Sweden where final disposal could most appropriately take place. As is discussed, SKB ran into difficulties during the course of this geological search process. Local citizens organized themselves in opposition to SKB’s programme of test drillings which were advertised as constituting a purely geoscientific research programme. As the local protests grew in intensity and won growing public sympathy, the nuclear industry was forced to change its strategy and abandon its search for the ‘best’ bedrock in Sweden to house the KBS-3 method for waste disposal.

In Chapters 5 and 6 the new SKB strategy presented in 1992, based on voluntarism, dialogue and ‘enough good’ bedrock, is described. By this time SKB had grown successful at establishing major nuclear waste facilities in municipalities already hosting nuclear facilities, while still remaining inept at making new friends with municipalities not previously connected with the nuclear industry. So-called feasibility studies were launched by SKB as a means for cultivating new municipal stakeholders capable of voluntarily committing themselves to participating in the search process for a sufficiently suitable site to accommodate the KBS-3 method of waste disposal. In Chapter 6, the two initial feasibility studies carried in Norrland are described including the disappointment SKB came to experience when these two studies ultimately came to assume the identity of ‘infeasibility’ studies.

In Chapters 7 and 8 we follow how SKB, once more, reframed its siting strategy in 1995 when falling back into the municipalities already hosting nuclear facilities to see if any of these could be persuaded to become stakeholders in the siting process for a final repository for spent nuclear fuel. As is discussed, three of these municipalities agreed to host feasibility studies, as did some of their neighbours. As the fate of the different feasibility studies carried out is outlined, more and more attention is focussed on the two established nuclear municipalities of Oskarshamn and Östhammar and the stakeholder identities they have developed and refined in the last 10 years or so, both before and after they have become the favoured localities hosting current site investigations.

This report draws in the first instance on published documents and previous research. Concerning the current situation in the municipalities of Oskarshamn and Östhammar, however, we rely extensively on information gathered in recent meetings and discussions with local politicians, civil servants, citizens and expert consultants. During 2004 and 2005 we attended meetings in the two municipalities – five in Oskarshamn and three in Östhammar. Some of these meetings were connected with the formal Environmental Impact Assessment process currently being pursued in the two municipalities, while others had more the character of regular municipal meetings connected with the on-going site investigations. We have also met and discussed with representatives from the Swedish nuclear industry, government authorities and relevant environmental organizations. During the researching and writing up of this report, three national meetings were organized where we had the opportunity to present our work in progress and receive valuable feedback from all our institutional sponsors. The descriptions of the current situation regarding the ongoing site investigations, and the former feasibility studies, carried out in Oskarshamn and Östhammar presented in chapters 7 and 8 are to a considerable extent based on the information gathered at these various local and national meetings. We wish to thank all involved parties and persons for their co-operation, but of course the conclusions we have reached are the solely responsibility of the authors.

This report concerning Swedish nuclear waste management has been produced as part of a cross national research project: *CARL – A Social Science Research Project into the Effects of Stakeholder Involvement on Decision-Making in Radioactive Waste Management*. Besides Sweden, the participating countries are Belgium, Canada, Finland, Slovenia and United Kingdom. A social science research team, working for three years, is in the first phase conducting research in their own countries in order to produce 6 country reports. During the next two years the focus will shift to comparisons of stakeholder involvement practices in the participating countries. During the production of the country reports, the CARL research team has met five times, and we, the Swedish researchers, are most grateful for the comments we have received from our international colleagues on earlier drafts of this report. In addition, local and national stakeholders from the participating countries have met three times with the international research team – in Brussels, Ljubljana and Antwerp – these meetings have also been of considerable value in helping to enhance the quality of this country report.¹

¹ For more about CARL see www.carl-research.org. The CARL project is nationally-funded, and Swedish participation is supported by the Swedish Nuclear Fuel and Waste Management Co. (SKB), the Swedish Nuclear Power Inspectorate (SKI), the Swedish Radiation Protection Authority (SSI), as well as the municipalities of Östhammar and Oskarshamn.

2. Origins of Swedish Nuclear Programme: 1945-1972

Swedish Military and Civil Responses to the Hiroshima bomb

Just eleven days after the atomic bomb was dropped over Hiroshima, on August 6, 1945, the Swedish Commander-in-Chief (ÖB) asked the National Defence Research Institute (FOA) to start investigating the possibilities of developing nuclear weapons in Sweden (Jonter 2003: 43). Several months later in November 1945, the Swedish Minister of Education and Research, Tage Erlander, was contacted by a group of scientists proposing that a committee on atomic energy for civil purposes be set up. One year later, Erlander established the National Atomic Committee, the same year as he was elected Prime Minister, a position he was to hold for the next twenty-three years.

The new Committee was given the task of investigating and assisting the Government on how best to develop methods for the domestic use of atomic energy for peaceful ends (Larsson 1987: 126). Nine of the eleven members on the Committee were academic professors (Lindström 1991: 59-61). After a few months the Committee delivered its first report to the Government. The report proposed considerably improved funding to Swedish universities to strengthen education and research in the field of atomic research. It also recommended mission-oriented applied research on a large scale, a national mobilization of science. This meant something new in the Swedish political landscape: the introduction of Big Science.

In 1947 the Atomic Committee delivered its second report, suggesting that domestic supplies of uranium should be exploited and one or more nuclear reactors constructed. Sweden has one of the world's largest supplies of uranium, but the quality of the ore is low. As in relation to the Committee's first report, Swedish politicians agreed to follow its recommendations very closely. The Swedish Parliament decided unanimously to support the establishment of the partly State-owned Atomic Energy Co. to carry forward the implementation of a national nuclear energy programme. The company was formally registered in September 1947 (Larsson 1987: 127).

In parallel, FOA started working on military applications. In 1948 a first report was presented to the Commander-in-Chief proposing a plutonium bomb as the preferred alternative (Jonter 2003: 43). The basic ideas in this report coincided in one important respect with the ones in the report presented by the Atomic Committee: the exploitation of domestic uranium.

Decisive actions taken by a few experts, quickly gave Sweden a strong organization for the development of nuclear energy, for both civil and military purposes. The role of government and Parliament was reduced to blessing the technological promises made by these experts; financially supporting the programme and deciding on means, organization and legislation, when needed, for example bringing natural reserves of uranium under State control (Lindström 1991: 56). According to the involved experts, there was no doubt that Sweden, despite its small size, could play a significant role in the development of nuclear technology (Lindström 1991: 71-72).

The Doctrine of Freedom of Action: National Autonomy and a Civil-Military Union

After the World War II experiences of trade blockades and shortages of supply, it seemed important for political leaders to propose national autonomy as part of the justification for a nuclear programme. Obviously, the idea of self-sufficiency also served a military purpose. According to the political leaders, to support its position as an alliance-free state in a post-war world, nuclear weapons could be of strategic importance to Sweden. The favoured nuclear

technology, heavy water reactors, could be used for both military and civil purposes. Moreover, if imported uranium from the USA had been used this would have made Sweden's programme liable to international inspection, which would have greatly hindered military ventures (Jonter 2003: 47). However, it is important to notice that the demarcation between military research aimed at developing a weapons capability versus military research aimed at actual weapons production was important, not least for the politicians when defending the military ambitions before the national electorate. The work in Sweden was publicly presented as aimed only at developing a weapons capability, and not at actual weapons production. However, what was called the *doctrine of freedom-of-action*, meant that research for developing capabilities could be quickly transformed into research geared towards actual weapons production, thus effectively blurring the distinction between the two types of research. How far Sweden went down the road of actual weapons production is still not clear and remains a controversial issue for scholars still wrestling with the historical sources (Jonter 2003: 47). What is clear is that a reprocessing plant was needed, and measures for its preparation were taken early in the 1960s (more on this below).

In the 1950s and 60s the Atomic Energy Co. developed and operated three R&D reactors (R-1, R-2 and Ågesta) and extracted uranium from ore mined at Ranstad. The R-1 reactor, located at the Royal Institute of Technology in central Stockholm started to operate in June 1954. In 1955 the Atomic Energy Co. obtained a piece of coastal land north of the city of Nyköping, Studsvik, where further research and development work could take place, for instance reprocessing. The R-2 reactor, located at Studsvik was started in 1959. In 1963 the Ågesta reactor south of Stockholm was in operation (Östman 2003). The next and important step in the Swedish nuclear reactor programme was taken when the Atomic Energy Co. in 1962 got approval to start the construction work on a reactor of 100 MW(e) at Marviken outside the city of Norrköping (Wingefors 1999).

However, a split could be noticed in the state-driven Swedish reactor programme supporting the freedom-of-action doctrine. A private Swedish consortium (AKK) was set up in 1955 in order to construct nuclear reactors. A state-private sector competition began to take shape (Wingefors 1999: 27).

The early Swedish nuclear era is an amazing example of experts making national policy. Nuclear experts became the bearers of new dreams, a vision of a new society, which made them part of an 'expert priesthood' with the power to decide in isolation what they thought to be best for society (Anshelm 2000: 66-67). For more than two decades this dream of an expert-driven nuclear society was a consensual political project in Sweden. Nuclear experts were considered the heroes and saviours of their time, possessing the ability to transform a technical power of warfare into social welfare, through the production of clean and cheap energy. The strong military connection was not discussed in public by politicians. It was motivated as a defence project in order to support Swedish autonomy in the Cold War era.

The End of the Domestic Concept

When the flagship of the Swedish domestic programme, the heavy-water reactor Marviken, was almost completed, in 1970, the Government decided to cancel its finalisation. Changes in the world made the struggle for self-sufficiency, pursued by the Atomic Energy Co., obsolete. Light-water reactors were judged both easier to manage, and cheaper than heavy-water reactors. Enriched uranium had become cheap to obtain on the world-market. After the UN conference 'Atoms for Peace', in Geneva in 1955, nuclear technology and expert knowledge from the United States, the United Kingdom and the Soviet Union, earlier classified as secret, was

publicly released. The experiences from the war, awarding self-sufficiency high priority, now seemed to be out of date. Another important reason for Sweden to pursue a domestically based programme for such a long time was that the possibility of developing atomic weapons could be held open: the doctrine of freedom-of-action. In 1968 Sweden joined the UN non-proliferation-treaty. Thereafter, national exploitation of domestic uranium ore no longer served a military purpose (Larsson 1987).

In 1968, when the Marviken failure became obvious to Swedish politicians, the Atomic Energy Co. was fused with the nuclear division of the private company ASEA to form a new, partly State-owned company, the ASEA Atom Co. The new company was to be part of the ASEA corporation (today ABB) and ASEA was to have the deciding vote (Larsson 1987: 149-150). ASEA Atom soon became a leading producer of light-water reactors, which at this time were being ordered at a high rate by Swedish utilities. The first generation of nuclear experts, most of them famous university scientists, now disappeared from the scene and were replaced by engineers from private industry.

In 1965 the private consortium AKK was re-established as the Oskarshamn Power Group (OKG) and signed a contract with ASEA Atom for a 400 MW(e) reactor located on the coast north of the city of Oskarshamn. This reactor, still in operation, was the first built on a strictly commercial bases. In 1972 the Oskarshamn reactor reached full capacity operation (Wingefors 1999: 28).

International Co-operation on the Waste Issue

Before 1970, in Sweden, nuclear waste was not defined as a problem. Government reports, formulated by the best available expertise, gave responsible politicians no reason to start worrying about a nuclear waste problem. The experts acting as political advisers, raised the prospect of international solutions, where the final disposal of the waste could take place, through recycling and new promising fields of application (Sundqvist 2002: ch. 3). There was no public discussion, not even in the political arena. There was only strong public trust in a widely supported technical programme.

In a Government Inquiry published in 1970 it is stated that the plan for Swedish nuclear waste is that 'the spent fuel will be sent to foreign reprocessing plants, guaranteeing that the waste products will be disposed of' (SOU 1970:13, p. 104). Nothing is mentioned about the products remaining after reprocessing, who would be responsible for these and what should be done with them. The wording gives the impression that reprocessing amounts to solving the waste problem, i.e. 'that the waste products will be disposed of'. The picture is quite clear: the by-products are defined as waste, and even as a problem, but assistance is available. Foreign nations will solve the problems and finally dispose of the Swedish waste.

Throughout the 1960s it was taken for granted in Sweden that spent fuel would be reprocessed. There was also hope for international collaboration, that foreign facilities could be used for the reprocessing of the spent fuel from Sweden. In 1971 a new investigation was carried out, the first in Sweden focusing solely on the back-end of the nuclear fuel cycle. The aim of reprocessing was to improve the supply economy of nuclear fuel by enabling recycling of uranium and plutonium. Reprocessing, it was stated, is also a requirement for achieving an acceptably safe handling and final management of the radioactive waste from nuclear reactors. In Sweden – as in other nuclear countries at this time – the growth of reprocessing services was judged a prerequisite for the expansion of nuclear power (DsI 1971:1, p. 1).

In the 1971 report, the Eurochemic project is described involving co-operation between thirteen OECD countries including Sweden (DsI 1971:1, pp. 1-8). As a part of this project a reprocessing plant at Mol in Belgium was constructed, to which Sweden sent spent fuel from their research reactors and also technicians to gain work experience at the plant. Sweden's participation in the project was based on the assumption that reprocessing and waste management could not be viewed as an isolated national affair. Furthermore, it was observed that at present, reprocessing services from foreign countries were available, including final disposal of nuclear waste. However, it was also argued that requirements that the country of origin would be responsible for the waste could be introduced in the future.

The 1971 report concluded that 'reprocessing and the subsequent storage of nuclear waste constitute a future solution, which can be postponed without putting the energy production of nuclear power plants at risk' (DsI 1971:1, p. 11). A few years later this kind of wording was taken, by the opponents of nuclear power, as demonstrating the irresponsible attitude characterizing both the government bureaucracy and the utilities: proposing expansion of nuclear power, while admitting unsolved waste problems which could be conveniently ignored.

The picture offered by the experts in the various government inquiries is that there is a waste problem, but that promising international work is being carried out, which can be expected to solve the problem. There was no reason to think otherwise. Around 1970 the politicians did not know much about waste handling and government reports gave them no reason to start worrying about a waste problem. The experts, acting as political advisors, suggested the prospect of international solutions, where the final disposal of the waste would take place through recycling and new promising fields of application. Without hesitation, the waste problem was assessed as technically solvable.

The military connection is visible also in the planning of waste handling. For many years Sweden planned to construct its own reprocessing plant. During the years 1960-1962 the Atomic Energy Co. carried out a preliminary study for a reprocessing plant. Sannäs, on the Swedish west coast, was proposed as a suitable site (DsI 1971:1). In 1966, the State acquired land at Sannäs. This was an effort to create freedom for future actions, and not a decision to actually construct a reprocessing plant. Obviously, this initiative was more oriented towards holding open an option to produce nuclear weapons than to safely and efficiently dispose of nuclear waste (cf. Jonter 2003: 47, Vedung 2005: 35).

Conclusion

Trying to connect the first phase in Sweden's nuclear programme to the three dimensions presented in the first chapter, the following can be concluded. A hostile world outside Sweden, made Swedish politicians take quick and decisive initiatives shortly after World War II regards the exploitation of nuclear energy for national purposes. Both military and civil purposes were considered from the start. The acting of a few experts in the field was of great importance. But the will of the political leaders to support a clearly national concept, based on self-sufficiency, was of equal importance. Nuclear experts in the field of civil nuclear engineering had to adapt to the politically determined doctrine of freedom-of-action. Technological and political, as well as civil and military considerations were of importance when a national autonomous Swedish nuclear programme was shaped.

The waste issue was not a big topic during this time. It was not yet defined as an independent waste problem, but more broadly viewed as a possible future resource to exploit. Contrary to other parts of the nuclear programme, Sweden was at an early stage involved in international

co-operation concerning reprocessing and waste handling. However, this could be assessed as co-operation geared towards learning more about reprocessing in order to guarantee a military capability, rather than take care of an emerging waste problem. As part of this ambition Sweden made preparations to build its own reprocessing plant.

In the mid 1960s a private alternative to the state-driven military-civil union, based on heavy water technology and domestic uranium, became visible. The national programme of self-sufficiency became obsolete. In 1972 the first nuclear reactor constructed from a strictly commercial viewpoint, based on light-water technology and imported uranium, was in operation. This reactor was built by the ASEA Atom Co. and located in Oskarshamn. This was also the time when nuclear waste for the first time became a publicly discussed problem.

3. Nuclear Power Dividing the Nation: 1972-1980

The Politicisation of Nuclear Power

In the early 1970s the consensual national project of nuclear power became a highly controversial issue in Sweden, dividing the modern welfare state as no other issue before. One important reason for this was the discovery (or reinterpretation) of nuclear waste as a highly problematic matter. In the 1950s and 60s, the waste issue was not considered important, it was practically a non-issue. In the early 1970s it was re-assessed by many experts as well as Swedish citizens as an irresolvable problem, a dangerous matter that no one wanted to be involved in. Nuclear waste became a key issue for those wanting to shut down Sweden's nuclear reactors.

The year 1972 is often mentioned as the starting point for the politicisation of nuclear power in Sweden. After this point, the issue of nuclear waste would play a leading role in the opposition against nuclear power. At this time the Swedish nuclear power programme was in the middle of its realisation. Despite some early criticism from the environmental movement, consensus in Parliament had so far been noteworthy. Political parties, which in 1970 motioned for the further expansion of the Swedish nuclear power programme, a few years later became strongly opposed to nuclear power.

The technocratic framing of nuclear power was dramatically changed into one of the most politically controversial topics in Swedish society. The issue had unique effects on Swedish domestic politics; it cut across the traditionally strong left-right division in the party system; brought about the dissolution of the first non-socialist government after World War II, and as the subject of a National Referendum (in 1980), it caused hotly debated problems of interpretation as regards the future of nuclear power in the country (Lidskog and Elander 1992). The obvious change was the growing importance of the public arena. Governance was broadened; both experts and politicians became anxious about how to govern the issue of nuclear power.

The intense debate was firstly about the framing of the nuclear power issue. Critical voices raised questions about risks and technical uncertainties, about a future nuclear society where we all would have to live in fear. Critical groups tried to reframe the issue from a technical question to one dealing with what kind of society we want to have. In Sweden, this debate started in the expert arena. A few experts, and above all the Nobel Laureate Hannes Alfvén, influenced by the critical debate in the US in the 1960s about bomb-testing and the effects of low-level radiation, tried to convince environmental organizations and politicians about the risks connected with nuclear activities (Sundqvist 2002: ch. 3). In the political arena, the Centre Party, a former agricultural party trying to transform itself into a modern green party, soon picked up the critical arguments. In the campaign leading up to the parliamentary election in 1973, the Centre Party pushed the problems with nuclear power, and above all, the unsolved waste problem, as an important issue for the citizens to vote on in the election. In this they became most successful and increased their votes to 25 per cent (an all time high) (Sundqvist 1991: 40).

In 1972 nuclear waste for the first time was discussed in Parliament. Birgitta Hambræus, a Member of Parliament representing the Centre Party, asked the Minister of Industry, Rune Johansson, representing the Social Democratic Government, if he considered it '... morally defensible to produce matter that must be supervised and handled using complicated technical methods by coming generations for an indefinite future, which could irreparably destroy the biosphere if the management was stopped' (Kågeson and Kjellström 1984: 26). Johansson

responded that there were no internationally agreed upon methods for final disposal of nuclear waste, but referred to the recently set up Swedish Government AKA Committee, intended to propose solutions in the field of nuclear waste management.

The AKA Committee, working for four years 1972-76, was set up at a time when nuclear waste was not yet strongly politicised, but carried out its work during a time of great political controversies. When its findings were presented, in 1976, they became subject to different interpretations. Some argued that Sweden now had a firm base for nuclear waste management, while others focused on the many uncertainties presented in the findings from the Committee (Sundqvist 2002: 100-102). An important legacy from the AKA Committee was the presentation of a first detailed concept of geological disposal of spent nuclear fuel, which was soon picked up by the nuclear industry.

When voting in the election for the national Parliament in 1976, most citizens were guided by their attitudes towards nuclear power. The election resulted in the first non-socialist government in Sweden in forty-four years. A new government was formed, consisting of the anti-nuclear Centre Party, and the Liberal and the Conservative parties, which were positive to an enlarged nuclear power programme. The new Prime Minister, Thorbjörn Fälldin from the Centre Party, in the election campaign promised to stop the expansion of nuclear power in Sweden.

New Legislation and an Absolutely Safe Nuclear Waste Storage System

The internal tension on nuclear power in the new government was immense. A way to handle the conflict was new legislation concerning the fuelling of new nuclear reactors. The new law, called the Nuclear Power Stipulation Act, required that prior to fuelling a nuclear power plant, its owner had to show how, and where, the spent nuclear fuel could be finally stored with *absolute safety* (SFS 1977:140). The focus on nuclear waste was much due to the Centre Party's assessment that nuclear waste was the most difficult problem for nuclear power to deal with.

When the Act came into force, six power plants were in operation, four under construction and another three planned. Consequently, to get permission to start the reactors under construction, the owners were obliged to develop a technical concept for the final disposal of nuclear waste. As a joint initiative the owners of the nuclear reactors established a project called KBS (kärnbränslesäkerhet – Nuclear Fuel Safety), a forerunner to the company SKB, to take care of nuclear waste management. First of all, a technical concept had to be presented, and because of the new legislation this had to be done quickly. In this situation, already completed reactors were on hold and could not get approval from the Government to begin operation before an absolutely safe nuclear waste storage system could be presented. For nine months some 450 scientists and technicians were involved in this work, which resulted in more than sixty technical reports (Sundqvist 1991). On the basis of these reports, the KBS concept was presented. This technical system was based on a multi-barrier principle of safety, consisting of both technical barriers (canisters of lead and titanium and a buffer zone of bentonite) and a geological one (the repository being located 500 meters down in the bedrock). This concept was quite similar to the one presented a year earlier by the AKA Committee.

Through the new legislation the nuclear power issue was transformed into a technical discussion of nuclear waste disposal. The Government tried to narrow the definition of the issue by the Stipulation Act, by which the future of nuclear power became a question about safe nuclear waste management. This was an effort by political actors to take the initiative in a situation where the debate in the public arena dominated. The Act, however, did not create consen-

sus. On the contrary, it created more controversy, generated by conflicting expert advice which became widely debated in society (Sundqvist 2002: ch. 4).

The nuclear waste experts trying to assess the safety of waste storage in the Swedish bedrock were not given the opportunity to decide in isolation. Due to intense external pressure it was hard for them to assess the issue in a purely technical way. Moreover, they were not in unanimous agreement and not trusted. Esoteric questions about long term stability and cracks in the bedrock were broadly debated in the public arena. Due to these heated debates and political pressure to reach quick and firm statements, the experts became strongly polarised. For political parties the enforcement of the new legislation became a matter of how to navigate among diverse expert opinions. In a situation where state power was weak, a new kind of state governance emerged. This was about expert consultations. When both experts and the public opinion were divided it became important for politicians to pick the 'right' expert. Thus, they tried to intervene as well as adapt both to expert opinions and the public debate. The controversies among the political parties, as well as within the Government, intensified this pattern of actively picking the right expert. At a time of agonistic political and public debate, this amounted to trying to see through the apparent homogeneity of expertise in order to find support for policies of either stopping or expanding nuclear power (Sundqvist 2002: 102-103). This 'picking' strategy was a new development in Swedish political life regarding how to govern technology and was taking place in a situation characterized by a strong public arena and a weak Government paralysed by internal conflicts.

The discussion on how to regulate nuclear power, triggered by the wording of the Stipulation Act, was polarised between opinions on absolutely safe versus absolutely unsafe disposal of nuclear waste. However, the divide between expert and lay knowledge was also brought up. Experts, politicians and citizens were all debating technical safety issues and bedrock conditions, and how to decide on the issue in relation to the requirements of the Stipulation Act. However, in this discussion an external event intervened: the accident at the Three Mile Island (TMI) nuclear power plant.

A few weeks after the TMI accident in March 1979, the political parties in Sweden agreed that a National Referendum on the future of nuclear power, should be held early in 1980. The demand for a National Referendum had already been proposed by environmental organizations, and above all by the People's Campaign Against Nuclear Power. The Campaign had won strong public support, demonstrated by the many signatures on petitions circulated in support of a National Referendum. Behind the Campaign stood many different non-governmental organizations as well as political parties. The TMI accident, occurring at a time when Swedish citizens were discussing geology and cracks in bedrock and politicians had great problem to reach a decision, turned the opinion among politicians in favour of a National Referendum.

Many Swedes took an active part in the referendum campaign. Many participated in study circles – 80.000 people in 8.000 circles – and educated themselves in questions of energy production, nuclear power and nuclear waste management (Lidskog 1998: 36). No question seemed to be too technical for laypeople to discuss. The mass media reported from the campaign on the front pages almost every day. A lot of public discussion went on and mass demonstrations were arranged. Most active in the public arena was the People's Campaign Against Nuclear Power (Jamison et al. 1990). A detailed study of the nuclear power debate in Sweden in the 1970s concludes that no other 'political issue during the post-war era can be

compared to the nuclear power issue in regard to the extent and intensity of different activities aiming to influence and engage the general public' (Holmberg and Asp 1984: 540).

During the 1970s we can discern a strong controversy – an agonistic clash – between two different framings of the nuclear power issue, including the waste problem: a narrow technical definition, which was the old dominant type of framing, and a new broader political definition. For the first time in Sweden's history a high-tech, scientifically-based activity was contested by politicians and the general public. The politicisation of the nuclear issue reached its zenith during the national referendum campaign, when every citizen was invited to take part in the decision on a technical issue. For technocrats the referendum was both incorrect and humiliating. To them nuclear power was not an issue to vote on; it was irresponsible to let the general public vote on nuclear safety issues and geological questions of waste storage. These questions ought to be handled and judged by technical experts. Other actors, however, considered the referendum a good idea for solving a controversial issue. They did not see nuclear power as a question for experts only, but as a political issue, and more so when experts were in disagreement. In their opinion politicians were free to use different methods in order to solve critical questions, and a national referendum was one way to do this. Even some experts took this view (Brante 1984: 136-137).

The formats of public engagement were organized both through political parties and civil organizations. The agenda was very much set and decided upon in the public arena. The mass media was of great importance. Demonstrations and activities in the streets were well covered by the mass media. The Government had difficulty reaching consensus and deciding on the issue. The divide was within the coalition bourgeois government as well as the Social Democrats (the biggest party in Sweden). What the Government tried, but failed to do, due to internal controversy was to define nuclear waste as a technical issue, and connect experts to a political decision on absolutely safe disposal. The Government finally gave in to the public arena and a national referendum was held in March 1980. A slight majority of the general public in Sweden (58%) voted in favour of the decision to fuel another six reactors. For seven years, nuclear power and nuclear waste was a national issue – even a national trauma dividing the nation down the middle. Nuclear waste played a central role as well as expert opinions on bedrock conditions. After the referendum this situation changed, the national focus declined and nuclear waste became a critical issue most of all for those living in the vicinity of the places decided of interest for further studies.

The Critical Aspect of Nuclear Power Becomes an Issue of Its Own

Due to the Stipulation Act, nuclear waste in the 1970s became a problem to solve for the Swedish nuclear industry. The future of nuclear power became conditional upon the safe handling of nuclear waste. In this respect, nuclear power and nuclear waste became one and the same issue. Nuclear waste was considered the most important aspect of nuclear power safety. However, the importance given to the waste problem made it into something of a separate issue, and paradoxically less connected to nuclear power. An organization was built up for taking care of the waste; a separate legislation (including a national review system and more resources to Government Agencies: the Nuclear Power Inspectorate – SKI, and the Radiation Protection Authority – SSI) and a financial system was proposed on the polluter-pay principle (a tax was decided on all electricity produced by nuclear power plants and the money is stored in a state-regulated fund to be used for nuclear waste management) (more about this below). In order to manage the new situation the nuclear industry presented the KBS technological waste system as a response to the new requirements, and the company SKB was formed to carry out the needed work.

After the referendum and in agreement with the Stipulation Act, Parliament decided that another six reactors should be fuelled and also that nuclear power should be phased out by the year 2010. Additionally, the KBS system of waste disposal was *approved* by government. Sweden now had a back-end nuclear fuel system approved by the Government as absolutely safe. These decisions, rather contradictory when put together, signalled an end to the intense nationwide debate on nuclear power and nuclear waste. People in general were at this time extremely tired of discussing these issues, which increasingly disappeared from the national public arena and also from the agenda of national politics. The task of continuing the nuclear waste programme was however still prioritised. More reactors in operation meant, of course, the production of more waste. The waste problem got a life of its own, being much less important on the national scene but locally causing great controversies. The result of the referendum created a waste problem that should be taken care of – a waste issue separated from nuclear power. The earlier intertwined nuclear power and nuclear waste issues became disentangled and the waste issue was no longer national top priority, but a controversial local issue. National politicians did no longer want to be involved in a topic that had created so much trouble and so little political goodwill for national political life.

The heated nuclear power debate starting in the early 1970s forced the Swedish nuclear industry to act promptly in the field of waste management. The Stipulation Act did not allow the industry to wait and see and lean on international co-operation. To get permission to fuel more reactors the Swedish industry had to construct their own back-end system. As a consequence, Sweden became a world leader in nuclear waste management, and the multi-barrier KBS system, an international point of reference for technological work in the field. Since the early 1980s, the principle of *national responsibility* has been supported as an ethical principle. This happened at the same time in other important nuclear countries, such as France, Germany and the United Kingdom (Cramér 2005: 117).

Conclusion

In the 1970s nuclear power and nuclear waste were the most discussed topics in political and public debates. The topics were highly controversial, where half of the Swedish population were pro and the other half against. This situation was very untypical of Swedish political life. However, in most Western countries with a nuclear power programme the situation was the same. Arguments, most of all from the United States (including the TMI accident), were imported into the Swedish discussion. This was part of a democratization of technology, where better educated people, many of them young people, wanted to take part in discussing the future. A growing green movement was also an important factor behind these changes. The international influences were clearly visible. However, somewhat paradoxically, the consequence in Sweden was an international debate, leading to an independent national solution to the waste problem. Earlier ideas on international co-operation quickly disappeared, when the nuclear industry had to fight new legal requirements in order to save their almost completed, but not yet approved, nuclear power programme. The KBS system changed its concept from reprocessed waste (KBS 1) to non-reprocessed waste (KBS 3), which made possible a national independent back-end system.

What could be said is that during the 1970s a technical project became politicised and widely discussed in public, in a way that seemed to blur the earlier boundaries between the technical and political aspects of nuclear power. However, the Nuclear Power Stipulation Act, as a consequence of strong political debates, made technical issues re-appear centre-stage, but now handled in new ways. No longer were they purely technical issues but issues that everyone

tried to interpret in their own way based on conflicting expert advice. The National Referendum switched an expert-based discussion to a question of public voting. Nuclear technology was put in the public's hand.

Obviously, the discussion was national, not international or local. In the negotiations between the Government and the nuclear industry, mediated by experts and government authorities, a nuclear waste system was shaped, which became a world-leading national programme, an example given to the world. The way to achieve this was via strong political controversies, which made conflicting experts visible as politics invaded worlds of expertise.

4. A National Nuclear Waste System Takes Form: 1979-1985

New Legislation on Nuclear Activities and Their Financing

The turbulent time during the 1970s led to an ambiguous new start for the nuclear industry. According to the result of the referendum, another four reactors were soon given approval to be fuelled and the last two reactors, in the now decided 12-reactor programme, were given permission to be constructed. The technical concept developed by industry was now approved as a way to store nuclear waste with absolute safety. This concept now had to be implemented.

Soon after the referendum Parliament decided that nuclear power should be phased out by the year 2010. The paradoxical decision to fuel another six reactors and at the same time decide to phase them out created uncertainties. Did these decisions mean a new beginning for Sweden as a strong nuclear power nation, or the gradual phasing-out of a dangerous and controversial technology? It did of course mean both, a way for confused and conflicting politicians to offer something to both the proponents and opponents of nuclear power and thereby get an end to a paralysed situation.

The Social Democrats were successful in the national elections of 1982 and set up a new Government after six years of non-socialist rule. The new Minister of Energy claimed that the Government would never decide to fuel the last two reactors in accordance with the Nuclear Power Stipulation Act. This Act was a horrific result of bourgeois leadership, reflecting their inability to rule. Nothing could be guaranteed as absolutely safe. Therefore, a new act called the Act on Nuclear Activities, which is still in force, was proposed by the new Government as a replacement for the Stipulation Act and was passed by Parliament in 1984 (SFS 1984:3). The new Act stated that the owners of the reactors are responsible for preparing a programme 'for comprehensive research and development and other measures required to safely handle and finally dispose of the radioactive waste from the nuclear power plants'. One requirement of the Act is that the programme should be submitted for review every third year to a new government authority, the National Board for Spent Nuclear Fuel (SKN), which was set up at this time. The Nuclear Power Inspectorate (SKI) would, however, still bear the main responsibility for the assessment of the future application for constructing a final repository for spent nuclear fuel, i.e. the task of licensing. For receiving approval to charge new reactors with nuclear fuel, the new Act replaced the requirement of 'absolute safety' with the demand to 'safely handle and dispose of the radioactive waste'. The new Act was a typical Swedish 'frame law', which left it to the reviewers and ultimately the government to interpret and formulate criteria to decide on the fulfilment of concepts like 'comprehensive research and development' and 'safely handle and finally dispose of'.

The SKN also became responsible for the new legislation on financing nuclear waste management, based on the 'polluter pays' principle (SFS 1981:669). As part of the stricter requirements on the nuclear industry, the AKA Committee in 1976 presented the idea that owners of nuclear reactors should calculate for future costs of the reprocessing of spent fuel and final disposal already when the fuel is used in reactors. They should also themselves bear all the costs of the waste management, including low- and intermediate waste. Every year an specific amount of money correlated to calculated costs should be put in a specific waste fund, and placed on account at the Bank of Sweden (Eriksson 1999: 112-113). Every year reactor owners have to calculate the future costs and propose a proper tax on the electricity produced by nuclear reactors to cover the calculated costs. These calculations are to be reviewed by SKN and the tax every year confirmed by the government. In relation to the Act on nuclear activities the nuclear industry, when they get approval for their research and development

programme, could receive from the fund the amount of money needed to carry out the waste management work. The State becomes in this respect a bank for the industry, but also a controller that only offers money when the programme has been reviewed and approved (Eriksson 1999).

CLAB and SFR: Non-Controversial Local Siting Processes

After the referendum an integrated waste disposal system, with a clear organization and legislation of its own, began to take form. SKB planned for and received permission to construct a central interim storage facility for spent fuel, where it will be stored for at least 30 years, at the Simpevarp reactor site in the municipality of Oskarshamn (CLAB). This facility has been in operation since 1985. A sea transportation system, including a specially designed vessel (called Sigyn) and harbours at all four reactor sites, was also constructed at the beginning of the 1980s. Contrary to the situation in most other countries these facilities were not politically controversial in Sweden, and were not given much attention in the mass media. A final repository for low-level nuclear waste was also established at the Forsmark reactor site (SFR) in Östhammar municipality, and has been in operation since 1988.

The two facilities CLAB and SFR were established without any elaborate processes of stakeholder involvement. One reason for this could be that after the referendum the national discussion, for example in the media, on nuclear waste almost disappeared. National politicians, after the paradoxical decisions to expand the nuclear programme but at the same time decide about its termination, were happy to forget the issues of nuclear power and nuclear waste. Another reason is that critical opinion groups (as will be presented below) made a choice to focus on the siting of a final repository for spent nuclear fuel. A reason not to forget, and also mentioned above, is that the nuclear industry during the 1970s managed to achieve momentum. After the referendum, in the shadow of declining national interest, SKB managed to successfully carry forward and initiate an integrated nuclear waste system. What at this time still remains is to find a piece of land with good enough bedrock conditions to be able to store spent nuclear fuel for hundred of centuries. This remaining part has been hard to achieve.

But how was the situation after the referendum interpreted locally in the two municipalities of Oskarshamn and Östhammar? The result of the referendum meant two new reactors in Östhammar at the Forsmark site and a third reactor in Oskarshamn at the Simpevarp site. In this respect the result clearly meant an expansion of nuclear power, which with the decisions to construct CLAB and SFR was strengthened further. But should the two planned waste facilities be framed as end stations for the nuclear power programme (a burial site, a final repository as securing an end of nuclear power: Swedish nuclear power rest in peace), or as developments, securing a new beginning? At this time the work of waste management was nationally framed as clearing up after nuclear power. Waste management was not possible to advertise as something concerned with securing a new beginning or long-term future for nuclear power in Sweden. But locally, in Oskarshamn and Östhammar, this meant a new beginning and local prosperity.

CLAB never became a source of notable controversy, which is remarkable when bearing in mind how difficult it has been to site such a facility internationally. Obviously SKB by proposing Oskarshamn as the preferred location for several nuclear facilities tried to establish Simpevarp as a nuclear waste super site. This is in accordance with the strategy internationally known as the *nuclear oases* siting strategy, i.e. that people living in an area close to existing nuclear facilities are positive to an expansion of these activities (Blowers et al., 1991: xviii, 326; Lidskog 1994: 39, 87). These attitudes are usually very local, and could strongly

differ to those existing just outside the specific oasis. One consequence of the oases strategy means that national (outside) attitudes towards the activity may be negative, but this does not matter because others want to host this generally unwanted activity. One example of this phenomenon is that citizens in the Municipality of Oskarshamn voted strongly for an expansion of nuclear power in the National Referendum in 1980 (only 30.3% voted against, compared to the national average 38.7%) (SOU 1999:45, pp. 80, 114).

But why did SKB choose the sites at Forsmark and Simpevarp as locations for the two waste facilities? In the applications, SKB proposed the advantages of siting new facilities in close connection to already existing ones. Government authorities agreed to this general view. Moreover, SKB argued that bedrock conditions are not acceptable at the Barsebäck and Ringhals sites, and that only Forsmark, Simpevarp and Studsvik remained possible sites (Westerlund 1984: 85-86). A conjecture could be that SKB wanted to expand their activities in Oskarshamn and Östhammar, but not at the old research site in Nyköping (Studsvik), and that these two municipalities should get one facility each.

The planning process for CLAB started already in the 1970s. In November 1977 SKB sent an application to the Government to construct an interim storage facility for spent nuclear fuel. The application was reviewed by government authorities and the Municipality of Oskarshamn in 1979, during the critical period between the TMI accident and the national referendum. Local representatives of the Centre Party in Oskarshamn argued in their proposal to the local council that SKB should not be given permission to construct an interim storage facility (CLAB) in Oskarshamn due to the extremely uncertain conditions in Sweden about the future of nuclear power. A result of the referendum could have been that nuclear power would be phased out rapidly, and in that case no interim storage would be needed (Oskarshamns kommun 1979). In August 1979 the Government decided to approve the SKB application, with the stipulation that the start of the project should not take place before the National Referendum was held in March the next year. In 1985, six years later, and after a referendum that decided to expand the nuclear power programme, the CLAB facility was in operation.

In March 1982 an application was given to the Government for the construction of a final storage facility for low- and intermediate level nuclear waste at the Forsmark reactor site in Östhammar municipality. The applicant, SKB, argued once again for the benefits of choosing a site where nuclear activities already exist. The government authorities SKI and SSI had some critical remarks on the application and choice of location, however gave approval of the application which was finally approved by the Government in June 1983. In the decision from the council of Östhammar Municipality it was stated that the assumption was that government authorities are watching over the process and the proposed facility, and that a municipality must trust experts (Westerlund 1984: 106). By 1988 the SFR facility was in operation.

The Swedish Society for Nature Conservation (SNF) and its local counterpart in Uppsala County, shortly after the Government decision presented a White Paper on the decision process for the SFR facility (Westerlund 1984). In this, a detailed description of the process is given and the different steps taken by SNF to try and achieve better quality in decision, for instance, comparisons with other possible locations, are documented. SNF found three main reasons for considering the Forsmark site unsuitable for the location of SFR: i) bedrock conditions are worse in Forsmark compared to for instance Simpevarp and Studsvik, ii) the Forsmark site is located upstream the outside archipelago (including the Finnish Åland archipelago), iii) investigations were lacking on how radioactive material could spread in the marine environment and its food chains (Westerlund 1984: 41).

According to the White Paper, the applicant has not motivated its choice of site, or compared it with other sites. The Nuclear Power Inspectorate (SKI) was critical to the choice of site, but said they had no legal possibility to propose another site, only to assess if the site is good enough in relation to safety requirements (Westerlund 1994: 40). SKI argued that it is possible, by technical measures, to compensate for a less than ideal bedrock. However, the construction work will be more expensive in this kind of bedrock (Westerlund 1984: 61). Lastly, SNF found it remarkable that SFR, as the first facility of its kind in the world, was not subject to international review (Westerlund 1984: 49).

Even if it is possible to find some critical remarks concerning the siting of CLAB and SFR, by a local political party and a local environmental group, we can conclude that they did not create an intense national public debate, as such debate never got elevated above local level. The decisions were based on local consensus and a technocratic siting process. CLAB and SFR made Oskarshamn and Östhammar nodes in an integrated waste disposal system – all routes now lead to them: they became already in the 1980s hubs of nuclear waste activity. These initial vital sitings at beginning of the 1980s made both communities natural/logical locations for further facilities. Through the sitings of CLAB and SFR, Östhammar and Oskarshamn became understandable as stakeholders in further siting decisions completing an integrated waste system.

Test Drillings and Local Protests

In the early 1980s SKB formulated a systematic geo-scientific research programme of test drillings across Sweden with the aim of supporting the site selection process for finding a proper location for the last missing part of the Swedish waste system, the final repository for spent nuclear fuel (the government agency PRAV was first responsible for the drillings but after 1981 SKB took over). The sites chosen were selected from a strictly geological point of view, which was made possible by a comparison of different regions and types of rock (primarily gneiss, granite and gabbro) (SKB 1986: 85-88). The original intention was to set about discovering the absolutely best and safest place to locate a final repository.

When the programme was terminated in 1985, geo-scientific investigations, including test drillings, had been conducted at about ten different locations (SKB 1992a: 49). The drillings resulted in political protests in most of the municipalities where they were conducted, even though they were advertised as more concerned with basic research and definitely not part of a site selection process. At several of these places the investigations were terminated at an early stage, and at others they were not able to start at all. In the immediate aftermath of the National Referendum in 1980 this programme of geo-scientific research provoked widespread protests. For many, having just voted no to nuclear power to no avail, to then find their municipality scheduled for investigation as a hypothetical site for nuclear waste disposal was considered unacceptable. At seventeen of the sites planned for investigation so-called 'rescue groups', local groups opposing test drillings, were founded (Lidskog 1994: 57). Together these groups were organized in the still existing national 'Waste Network' (Avfallskedjan).

The most famous of these sites is Kynnefjäll in north Bohuslän, on the Swedish west coast. The drilling plan was strongly opposed by local residents, who formed the 'Save Kynnefjäll Action Group'. From a small cottage, strategically located, the approach roads in the area were guarded day and night (actually for almost twenty years, from April 21, 1980, to February 8, 2000), preventing further studies of the bedrock (Göteborgs-Posten 2000). The group was successful; the drills never hit the ground and the work was cancelled.

From the perspective of the Kynnefjäll group, what was advertised as pure research was actually about 'who should have power over the local territory and under what circumstances a minority of people should have to bear the risks and consequences of a decision they have never supported' (the nuclear power programme) (Lidskog 1994: 57). Important for the group was to achieve national support for a local veto of siting plans and to campaign for a more democratically accountable approach to the controversial issue of siting nuclear waste. It was from their perspective totally illegitimate that nuclear agencies (at this time PRAV) could without warning turn up in a local community with drilling equipment to carry out geological surveys as part of a nuclear waste siting programme without dialogue with citizens and the local council. A majority of the citizens in the three surrounding municipalities voted no to further expansion of nuclear power in the National Referendum. One of these had the most no-sayers in the whole country (64.2 %) (Holmstrand 2000: 25). The Action Group succeeded in winning broad support from local political parties.

From the perspective of the nuclear agencies the test drillings were only about research aiming to gather information about the bedrock at different sites, from which it later would be possible to draw conclusions about suitable and less suitable conditions for the final disposal of spent nuclear fuel. Their attitude to local groups was that they were lacking knowledge to assess what was going on, and that they had no facts to base their arguments on: their protests were only based on emotions (Lidskog 1994: 56).

Besides the Kynnefjäll experience, dramatic confrontations took place at two other sites, where SKB called in the police to help remove people occupying the area and preventing the drillings. Once, local protesters were found guilty of threatening behaviour (Holmstrand 2000: 26). Finally, the Minister of Environment declared that the industry had to stop calling in the police to remove people protesting and occupying drilling areas (Holmstrand 2000: 29). The industry must start trying to communicate with concerned people, and realize that there is a society out there.

The drillings were conducted without informing residents and engaged groups about the activities or the purpose of the drillings. This strategy of not involving people, and defining the drillings as research of interest only to the company itself and its geo-scientific experts, turned out to be a disaster for the nuclear industry. The protest groups received widespread public support, as did their interpretation of how to frame the nuclear waste issue. The industry was forced to change its narrow technocratic siting strategy to become more socially sensitive and include the opinion of local residents in their future activities.

SKB was now caught in a difficult position. The test drillings had led to more well-organized protests. According to Swedish legislation at that time SKB was solely responsible for proposing a suitable site for the final disposal of nuclear waste. It was only when SKB identified a site, that the government and its authorities were meant to step into the siting process. However, it was now clear to SKB that they could not handle the search for appropriate sites as a purely technical issue that they could decide over in isolation.

Conclusion

During the period 1979-1985 nuclear power and nuclear waste became relatively separated from each other. SKB was set up as an organization dedicated to addressing the waste issue. An integrated waste disposal system began to take form. Special financial arrangements were put in place based on the 'polluter pays' principle. SKB as a private industry body became

state-financed through the new tax on nuclear power. This new mechanism also became part of a new government review system, where SKB's R&D programme, including the costs for the implementation of the programme, has to be approved by the government before SKB can get the money needed from the waste fund. According to the Act on Nuclear Activities this review should take place every third year.

Two diverging tendencies characterized this period. On the one hand a series of local consensual project sitings in existing nuclear communities took place: the biggest two are CLAB in Oskarshamn and SFR in Östhammar. A waste transportation system via boat round the coast was also established. These decisions and the processes behind them never got elevated above the local level. They remained local consensual projects governed by a technocratic siting process. On the other hand, test drillings began in search for the best geological site for a final deep repository, which will be the jewel in the Swedish waste disposal crown. These drillings, carried out all around the nation, met with strong local opposition. However, we find big differences concerning what happens inside, versus outside, nuclear communities. The similarities of these different tendencies is the ending of a national public debate. The nuclear waste issue became a separate and highly localised issue of consensus and conflict.

CLAB and SFR made Oskarshamn and Östhammar nodes in an integrated waste disposal system – all waste routes lead to them. These vital sitings made both communities natural/logical locations for further sitings, e.g. an encapsulation plant (see below). Through the sitings of CLAB and SFR, Östhammar and Oskarshamn, became understandable stakeholders in future siting decisions in an integrated waste system. Oskarshamn and Östhammar became hosts of internationally unprecedented facilities, but the last component – a final repository for spent fuel – was still lacking and during this period and it was hard to see how it would ever be achieved.

5. Research-Based Approach to Siting a Deep Geological Repository for Spent Fuel Re-Organized: 1986-1992

Re-Interpretation of a Technocratic Failure: Political vs. Physical Geology

The ‘politicized’ nature of the waste issue seems to refuse to go away outside nuclear communities. A crucial part of SKB’s planned solution for the final repository for spent nuclear fuel was to find the best bedrock in the country and build it there. This ambition, as described above, became a stumbling block for SKB. It lured them into what quickly turned out to be wild and uncharted political territory.

It is worth reflecting further, however, over what we label the ‘failure of technocracy’ in the siting of a final repository for spent nuclear fuel. Ignoring local sentiment can also be interpreted in terms giving precedence to ‘non-human’ factors, and firstly physical geology, in the siting decision. To what extent should physical geology be allowed to dominate the siting decision? When, and under what circumstances is it acceptable to reduce a municipality to its physical geology in a siting decision? After SKB abandoned its test-drilling programme in 1985, they began, after a respectable interval of time, to assert that, on the basis of the 10 investigations they had been able to carry out, it was clear that many sites in Sweden are geologically suitable for the construction of a final repository. This conclusion allowed SKB to claim that ‘other factors can be accorded greater importance in the siting’, and in particular the question of local acceptance (SKB 1989: 27). While siting a repository in a municipality against the will of the local population is not an alternative in Sweden today, the issue which continues to loom over the siting process is that of just to what extent can political geology be played off against physical geology? Over a period of 100,000 years surface populations will inevitably come and go, but the success of a deep repository must ultimately be seen to depend upon the ability of geology and the technology of storage to remain the same.

How could SKB soften the standards of ‘absolute safety’ and technological acceptability for a deep repository and render them more malleable to social and political circumstance? After running into controversy, SKB could not just turn around and say we will site wherever we are able. A gradual process of re-adjustment was required, where both political, as well as physical geology could be taken into consideration. The most important lesson SKB learned during the test drillings was that a deep repository must be locally acceptable; the recognition that political geology at the surface matters too. SKB now had to find new ‘technical’ ways of overcoming new political obstacles.

Äspö Hard Rock Laboratory

In the mid-80s, however, SKB still remained successful at siting new waste facilities in existing nuclear communities. In 1986, the Oskarshamn nuclear oasis became even larger when SKB presented the idea of developing its R&D work with a study site, an underground research laboratory. Research sites were not new to SKB. In a former mine, Stripa, geohydrological investigations had been carried out for many years (Uggla 2004). Experiences from the construction work with SFR had also been important. What was new with the idea of a laboratory was the ambition to carry out large-scale demonstrations and technology pilot tests of the KBS-3 method. The laboratory was planned to be a dress rehearsal for the final repository for spent nuclear fuel (SKB 1986: 28). The Simpevarp peninsula was considered of special interest for SKB to explore as a site for a laboratory. At this time no further reasons for the choice of location were given. In 1988 SKB decided to locate the laboratory on a small island north of Simpevarp, Äspö. Important reasons for the choice of location, were access to land, the area is owned by the nuclear company OKG, and the availability of nearby services,

facilities and personnel (SKB 1989: 152). After regulatory review the construction work started in 1990 (SKB 1992a: 95) and was completed in 1995. The laboratory includes a 3,600 m tunnel to a depth of 460 m. Today this laboratory is a popular tourist attraction in the region. It is publicly presented as a site for witnessing the feasibility of deep geological disposal and successful encapsulation; showing the feasibility of final disposal of spent nuclear fuel in general, and in Oskarshamn in particular.

The aim of the Äspö Laboratory is to explore physical geology. Built in poor quality rock, and criticised for this, the facility is useful for negotiating necessary rock quality for a safe repository. The advancing technology of storage can be argued to compensate for non-optimal geology meaning that a broader spectrum of possible sites for a repository can be entertained. Why not a site just a stone's throw away from Äspö itself? Through the construction of the Äspö laboratory, SKB has become better able to discuss how to balance geological factors with social and technical factors, and from this they have tried to reformulate their earlier strategy of finding a 'perfect' site, from a geological point of view. Äspö is a key site for renegotiating the boundaries of 'absolute safety'. Built in poor quality rock Äspö can serve as a site to demonstrate the robustness of storage technology in less than perfect bedrock. In this respect, Äspö can be seen as a site for refitting geology and technology in a credible fashion.

The Municipality of Oskarshamn, however, insisted that Äspö should never be translated into a final repository. To get acceptance from the Municipality SKB had to guarantee that Äspö would never be used for the actual storage of nuclear waste (Hedberg and Sundqvist 1998: 74).

The Search for a New Siting Strategy

In 1986 it became obvious that SKB was trying to escape detailed geological criteria for finding proper sites. In its 1986 R&D programme, SKB drew the conclusion that 'site investigations have shown that it is possible to find many sites in Sweden that are geologically suitable for the construction of a final repository' (SKB 1986: 86). This conclusion led SKB to claim that, 'other factors can be accorded greater importance in the siting' (SKB 1989: 27; cf. SKB 1986: 51). SKB explicitly argued *against* the opinion that, with reasonable efforts, it would be possible, from a geological point of view, to find a *best* place (SKB 1989: 27). According to SKB, it is of greater importance for safety to be certain of high quality in the technological construction work, than to find the 'best' bedrock. A rationale behind the changing SKB strategy is tactical, i.e. an adaptation to the social conflicts around the test drillings. If the bedrock is a less important safety barrier it will become easier for SKB to find the number of sites needed. A threat to SKB would be if an area, restricted in space, were judged as one of the best from a geological point of view, but the residents and local politicians strongly opposed a nuclear waste repository there (Sundqvist 2002: 130). Swedish legislation, which includes the right of veto for municipalities on land-use issues (see below), would then make siting highly problematic.

The SKB Conflict with Government Authorities

In the reviews of their 1986 and 1989 R&D Programmes, SKB received a great deal of criticism, with regards to the proposed site selection process. First and foremost, the reviewers argued that SKB too quickly and without clear arguments had shifted from local investigations of bedrock conditions to general conclusions about the suitability of much of the bedrock throughout Sweden for hosting a deep repository. Many of the reviewing bodies argued that SKB had not shown how such general conclusions could be drawn. Furthermore, SKB did not

show how the three candidate sites (the detailed investigations at this time planned for), were to be selected; no criteria for this selection were presented (SKN 1990a: 27).

SKN, the government authority responsible for the review of the R&D programmes in 1986 and 1989, in its 1986 review proposed an alternative site selection strategy with a gradual selection of possible sites. In this it received strong support from the Swedish Geological Survey (SGU). According to SKN the procedure should be divided into three different phases of screening: a test phase, a selection phase and a licensing phase. During the test phase a relatively large number of areas, initially judged to be suitable, should be chosen. Concerned municipalities and county administrations should be contacted and asked to reserve those sites in their general plans for land use (SKN 1987; cf. SKB 1989: 26).

In its review of the 1989 R&D Programme SGU criticized SKB's claim that it would be possible to find many sites in Sweden that, from a geological point of view, are suitable as locations for final disposal of spent nuclear fuel. SGU argued that perhaps this...

...opinion is correct, but the facts for making such judgement are too limited. Of greatest importance is not only the optimizing of different technical solutions but also the choice of rock for the final disposal. The choice of sites must be based on a modern and for the purpose well adapted classification of the bedrock in Sweden... Therefore, it is of great importance that the investigation will continue and that the classification will be made more detailed... the reason for selecting different site areas and sites for final disposal should be accounted for... (SKN 1990b: 91-92).

These requirements were not accepted by SKB. On the contrary, SKB consistently argued that such a strategy was neither possible nor relevant. SKB systematically avoided detailed discussions and comparisons between different sites (a systematic strategy). Instead SKB chose to claim that final disposal of spent nuclear fuel was possible to realize in most parts of the country.

In the 1992 R&D Programme SKB argued 'that suitable or less suitable areas cannot be associated with any particular part of the country or any particular geological environment', regions or kinds of rock (SKB 1992a: 70). Moreover, it was asserted that it is 'possible to find sites that meet the stipulated requirements in most parts of the country' (SKB 1992b: 21). SKB referred to its own new comprehensive safety analysis, SKB 91, where safety was analysed in relation to the importance of the bedrock as a safety barrier, which showed that 'the rock as a barrier to radionuclide transport is very limited' (SKB 1992c: xiii). According to SKB, geological factors will only be of importance during the construction work, when the repository is locally adapted to the surroundings. Some sites could be harder than others to evaluate (to predict the conditions at the depth of 500 metres) and also to carry out the construction work at (higher risks of collapse-prone rock volumes and major water leakage) (SKB 1992b: 40). Questions regarding constructability could only be decided after more detailed studies, which means drilling in the bedrock. Therefore, comparisons between different sites, on a national or regional scale, will be of no value in the site selection process.

In 1986 SKB argued that other factors than geological ones could be 'weighed in' (SKB 1986: 51) and in 1989 that they could be 'accorded greater importance' (SKB 1989: 27) when selecting sites for detailed investigations. In 1992 these assertions, according to the SKB 91 safety analysis, were proved valid. Therefore, a new strategy of site selection was formulated by SKB on the basis of the assessment of the role of the geological barrier for attaining safety as described above. *Candidate sites* should not be selected by SKB on geological considerations. Instead, the new strategy meant that *feasibility studies* (at this time called pre-studies)

should be carried out in municipalities, which ‘through their own initiative, display an interest in having a closer examination made of their potential for hosting a deep repository’ (SKB 1992a: 66).

In the review of the 1992 R&D Programme the Nuclear Power Inspectorate (SKI), the government authority responsible for the review after the restructuring of SKN in 1992, maintained the requirement for a more systematic and scientifically-based site selection process. Furthermore, SKI claimed ‘that important safety-related factors can be defined to a much more detailed and quantitative extent than SKB has managed’ (SKI 1993a: 64). SKI also criticized SKB for not being systematic in relation to the social factors, which from SKB’s perspective could play an increasingly important role when bedrock become less important.

As regards societal factors, it is obvious that it is possible to make useful comparisons between sites or between regions... The siting process can hardly benefit from SKB discussing siting with municipalities which, in practice, can never be considered as suitable sites for a repository. In the worst case, such discussions could raise the suspicion that SKB was playing one municipality off against the other (SKI 1993a: 66).

The Government which, based on SKI’s review, has to take the final decision on whether or not the SKB R&D Programme fulfils the requirements of the 1984 Act on Nuclear Activities, concluded that SKB has to supplement its programme, in regard to ‘those criteria and methods which could form the basis from which sites suitable for final disposal could be selected’ (Swedish Government Decision 40, 1993-12-16). SKB did so but managed to hold these factors on a very general level and maintained the opinion that many of the factors, especially those which are of importance for long-term safety would not be possible to apply on a general level or in feasibility studies. Therefore, other factors than geological, for example the interest shown by municipalities, could be of greater importance when selecting sites. As will be seen in the next chapter, SKB became the winner in the conflict with the government authorities.

Another important indication of the SKB and SKI conflict on siting issues at this time was the SKI Dialogue Project set up in 1990. In this SKI invited recognizable stakeholders in the nuclear waste issue to discuss the siting process as a national and systematic process and to propose legislative improvements. The aim of the project was to bring together important stakeholders to discuss and formulate a trustworthy procedure for managing nuclear waste. A consensus report was written after the project was completed (SKI 1993b). Several environmental organizations took part, and afterwards they assessed the project very positively. One problem, however, was that the most important stakeholder, SKB, declined to take part in the project. At this time SKB had completely different plans for the siting process, which ended up in contacts with new alternative stakeholders, located in remote municipalities in the interior of northern Sweden.

Conclusion

After the test-drilling disaster SKB had to formulate a new siting strategy. Most obvious in SKB’s re-orientation was its attempt to escape geology, by transforming siting from a question of detailed expert assessments of physical geology to contacts with interested municipalities. No longer should siting be about geological assessments, made by experts in advance, followed by contacts with municipalities. On the contrary, the process was to be reversed and the starting-point was to be contacts with municipalities. The rationale behind this reversal, according to SKB, was that the Swedish bedrock is homogenous, i.e. good enough bedrock

can be found at many different places. In this way the initiative in the siting process is delegated to interested municipalities.

This reversal was interpreted by government authorities as a too big a leap from a science-based national siting strategy to one involving SKB in the work of local diplomacy prior to research-intensive site investigations. Government authorities found this strategy too political and even strategic; a too quick a leap from the best site to any site! However, according to SKB a focus on the importance of construction work and technical quality could bridge this gap. Here Äspö was designed to play an important role in repairing SKB's siting strategy and transforming the safety issue. Long-term safety was now to be seen as firstly dependent upon good quality in the site construction work.

6. Switch to a Siting Strategy for a Deep Geological Repository Based on Voluntarism and Dialogue: 1992-1995

Any Volunteers? SKB's Letter to Every Swedish Municipality

In October 1992 SKB sent a letter to all 286 municipalities in Sweden (SKB 1992d). In this letter the work of managing and disposing of nuclear waste was presented. It was stated that *feasibility studies* were required in order to establish which municipalities were best suited as hosts of a final repository for spent nuclear fuel. If any municipality wanted to know more about nuclear waste management, or would be prepared to allow SKB carry out a feasibility study, they were asked to get in touch with SKB. The letter was openly worded, and it was pointed out that a display of interest would not mean future commitments. This new initiative from SKB, to contact all the Swedish municipalities, signalled the adoption of a site selection strategy offering priority to local involvement.

A feasibility study would include investigations in different fields: bedrock (no drillings included, only investigations of already collected geological data), land and environment, transportation and societal impact, and also compilations of previously made studies and existing knowledge. The study was viewed by SKB as a tool to start talking to citizens and their representatives (SKB 1997: 21).

At this time SKB considered the siting process to be based on the following steps: i) feasibility studies (the proper number of these was later, in 1994, decided to be between 5 and 10), ii) site investigations (including drillings in the bedrock) at two sites chosen after a comparison of the results from feasibility studies, iii) detailed investigation (at 1 site), iv) demonstration repository and v) full-scale repository (SKB 1992a: Figure 9.5). It was important for SKB to tell municipalities interested in feasibility studies that they could decide to opt out of a site investigation even if SKB found good possibilities in the physical geology of the municipality.

When a municipality agreed to let SKB conduct a feasibility study it declared an interest in hosting a final repository for spent nuclear fuel. When SKB was invited by a municipality to carry out a feasibility study, its interest in this territory had already been declared and also its belief that it may be possible to locate a repository in the area. Therefore, both SKB and the municipalities involved had reasons for participating in a feasibility study, and could be said to be strategic actors, though focusing on different aspects of the nuclear waste issue: the municipalities on employment opportunities, and SKB on possibilities to conduct more detailed investigations and finally construct a repository at some specific site (Sundqvist 2002: 205-206).

The new siting strategy provided a way beyond a narrow technocratic siting strategy: offering local politicians and concerned citizens a say in the siting process with some room to negotiate where to store spent nuclear fuel. However, giving local politicians and citizens voice also meant strengthening SKB by supplying them with new opportunities to try and achieve local acceptability in relation to their mission of implementing a ready-made technical concept.

Feasibility Studies in Northern Sweden

SKB's letter resulted in contacts with a handful of municipalities, all of them located in the sparsely populated interior part of northern Sweden (Olofsson and Vedung 1998: 124, cf. SOU 2002:46, p. 87). In 1993, two neighbouring municipalities, Storuman and Malå, decided to allow SKB to carry out feasibility studies (SKB 1995, 1996a). In September 1995, after the

completion of such a study, the residents of Storuman voted in a local referendum against participating further in the siting process for a deep repository (71 percent voted against), and two years later the residents of Malå did the same (54 percent voted against) (SKB 1998: 94).

The two studies were organized in a similar way. A steering committee (consisting of two managers from SKB and two politicians from the municipalities) was established to lead the work, and a reference group (representing political parties, the County Administrative Board and the most important non-governmental organizations) was created as an advisory group to the steering committee. However, in the signed agreement between SKB and the municipalities it was clearly stated that SKB was responsible for the feasibility study, which in practice was led by a project manager, while the steering committee and the reference group could give advice and influence the work. The feasibility study was to be paid for by SKB and this would include the costs the municipality would incur in the execution of the study. Due to these arrangements the general public as individuals had no possibility to formally influence the work. However, several public information meetings were held during the studies, where individuals could ask questions and comment on specific issues. In both municipalities SKB opened a local office where citizens could receive information and ask questions.

What characterized these two studies were the contradictory tendencies of co-operation and conflict, the latter however a reaction to the former. The conflicts were also a reaction to the lack of open space where critical questions could be asked and listened to, such as in the working of the reference groups. Co-operation was most visible in the formal organization of the studies, where representatives from SKB and the municipality worked close together, too close in the opinion of many citizens. Strong conflicts were important features of the referendum campaigns.

The steering committees were elite organizations for important negotiations. The general public had no access to these groups. The referenda changed this pattern, since there everyone's vote was counted. The public arena was lively during the whole process, but became of crucial importance in the referendum campaigns (for details see Sjölander 2004). The feasibility studies became a clash between strong actors who wanted, respectively, to continue or reject the work on final disposal of spent nuclear fuel in their municipality. These two opposing groups were represented by SKB and critical groups. Some leading politicians were also widely viewed as holding pro-opinions. Therefore, two well-organized interests involved in a power game tried to influence the general public on how to vote in the referenda.

Campaign organizations (both negative and positive) were quickly established in both municipalities. The media debate, as well as the discussion between the general public and the political parties, was intense during the studies, and peaked during the referendum campaigns. The debate was more intense in Storuman than in Malå. During the period from January 1993 to December 1994, before the Storuman referendum campaign started, more than 1,000 items were published in the media on the subject (SKB 1995a: Appendix 5). Another important difference was that in Malå an independent review of the final report of the feasibility study was organized before the referendum was held. This was made possible by a government decision allowing concerned municipalities to apply for funds to compile and distribute information to citizens and carry out review work in addition to feasibility studies (Swedish Government Decision 11, 1995). This was a decision aimed at strengthening the independent role of the municipality as a reviewer of the work of SKB. One reason for this decision was that the citizens of Storuman viewed the municipal administration as a supporter of the feasibility study and not as an independent reviewer.

In its own evaluation of the Storuman study SKB criticises the voters in the referendum for deciding too early on how to vote. The results of a survey showed that 55 percent of the voters had decided how to vote when they first heard about the plans for a nuclear waste repository in Storuman. Only 30 percent of the voters changed their minds during the study. SKB asserted that this shows that ‘attitudes were based on emotions’ (SKB, 1996b: 4). However, this could also be said of SKB’s opinion of Storuman and Malå as suitable areas for a final repository for spent nuclear fuel. Since 1992 SKB has believed that almost every municipality in Sweden would be suitable for hosting a final repository, and this was also SKB’s judgement of Storuman and Malå before the investigations of their suitability started. Consequently, SKB’s conclusion in the final reports (identical wording in both) is that ‘areas exist within [Storuman/Malå] Municipality which may offer good prospects for the siting of a deep repository’ (SKB 1995a: x, 1996a: x). In Malå this conclusion was drawn despite the fact that i) most of the bedrock consists of ores and mineral deposits valuable for extraction; ii) the waste would have to be transported through the municipalities of Skellefteå and Norsjö, which both have stated that they would not allow such transportation; and iii) existing road and railway systems were not sufficient to carry the waste. These factors were not considered negative for the evaluation of Malå as a suitable municipality for hosting a final repository for nuclear waste, despite being viewed as important factors (SKB 1996a: 129, 131). In Storuman, SKB was critical of the early date set for the referendum, before evaluation of the study was undertaken. According to SKB this gave the citizens less time to learn about the results and inform themselves from a broad base of arguments (SKB 1996b: 7).

Scientific questions about the bedrock, the engineered barrier and long-term safety never became important parts of the discussion in the municipalities. The question of justice (why store the waste in the North when all the nuclear reactors are located in the South?) was considered important by many citizens in Storuman and Malå but never became a topic in SKB’s studies, or in the review work. Neither did the mineral-rich bedrock in these municipalities pose a big problem in the public debate, which concentrated on job opportunities and negative effects on tourism. Critical groups involved in the reference group felt co-opted, arguing that the group and its work was a ‘flagrant example of pseudo-democracy: A travesty of democracy’ (SKB 1995a: Appendix 4:3). This was part of an assessment that the work of the municipality was not independent of the work of SKB.

Conclusion

It is hard to assess if the two feasibility studies in northern Sweden were a success or a failure for the new SKB strategy. Two municipalities out of 286 does not seem to be an evident success. However, at this time many commentators thought it was an impossible mission to find any community interested in hosting spent nuclear fuel. Living close to a nuclear waste facility was in opinion polls at this time the most undesirable thing Swedish people could imagine (Hedberg and Sundqvist 1998). Just making contact with a municipality could be viewed as a success, and if this was a new municipality not earlier hosting nuclear facilities, the success could be seen as even greater.

The new SKB strategy made clear that ‘other factors’ (social factors) were of interest to the municipalities and that they had to decide about these by themselves, independently of SKB and the technical knowledge of the company. The municipality should decide on their own whether to take part in a study, and after the completion of the study once again decide by themselves whether to continue or not. This meant a clear division of labour between SKB and the municipality, and a separation between technical and social issues. However, in the

Storuman and Malå studies, SKB was accused of trying to intervene in the work of the municipality and of trying to use the study as a way to influence the opinion of citizens and politicians. The way the studies were organized, with a steering group with representatives from both SKB and the municipality, made the studies joint ventures, where it was hard to see what the opinion of SKB was, as opposed to that of the municipality. This kind of highly intimate organization was after the studies criticized by the municipalities and even by SKB.

7. The Turn to Communities Already Hosting Nuclear Facilities as the Most Feasible Sites for a Deep Repository: 1995-2002

Re-Defining Feasibility in Established Nuclear Communities

In 1994, in the same document that SKB pledged to carry out five to ten feasibility studies, the desirability of carrying out such studies in communities already hosting nuclear facilities was for the first time explicitly stated (SKB 1994). By this time it had already become apparent that the new siting strategy based on voluntarism and dialogue, launched in 1992, was not an overwhelming success. With only two feasibility studies having been initiated in the space of two years, the turn to voluntarism was visibly suffering a lack of volunteers. In May 1995, SKB published a report providing an overview of the nation's five nuclear municipalities offering a first assessment of their suitability for the siting of a deep repository (SKB 1995). Given the likely presence of appropriate bedrock in several of these communities, the existing infrastructure, as well as the established knowledge and competence in these locations is deemed important for defining them as prospective sites for a deep repository. Furthermore, it is suggested that municipalities already hosting nuclear facilities may be able to supply something that has proved elusive: the combination of a physically appropriate site and 'a local understanding and commitment' to working together with SKB in the establishment of a deep repository (SKB 1995: 2).

On the basis of its preliminary overview, SKB was able to identify Östhammar, Nyköping and Oskarshamn as good candidates for feasibility studies. Varberg remained currently harder to judge, but should not be excluded from hosting a feasibility study. Kävlinge, on the other hand, could be safely defined as uninteresting due to the inappropriateness of its local geology (SKB 1995). When SKB proceeded to invite the first four municipalities to accept feasibility studies they received four different responses (Sundqvist 2002: 191, SOU 2002). Östhammar took just four weeks to say yes to a feasibility study after a vote in the municipal council. Varberg, after suffering a minor earthquake at the time of SKB's invitation, voted not to allow a feasibility study. Nyköping decided not to take a formal decision on the issue, as they saw no way of formally preventing SKB from assessing their feasibility if that is what they wished to do. At the same time they also stated that they were not opposed to a study and would cooperate with SKB if one was initiated. Oskarshamn it appears chose to read SKB's preliminary overview of communities already hosting nuclear facilities with a greater eye for detail paying special attention to the assertion that:

The existing Swedish system with interim storage in CLAB makes it possible, without time pressure, to explore all the possibilities available for implementing deep storage with local involvement. It is, therefore, indefensible to design a siting process under the presumption that eventually you are going to have to force yourself upon a locality (SKB 1995: 2)

Oskarshamn voted yes to a feasibility study, but only after 17 months of local deliberations and planned activities. It was not until October 1996 that SKB finally learnt that they were officially welcome to carry out a feasibility study in Oskarshamn.

Rather than simply signing-up or signing-off from a feasibility study, Oskarshamn were intent on redefining the nature of feasibility studies in relation to themselves as an experienced host of nuclear facilities. Feasibility studies as initiated by SKB in 1992 were explicitly designed as studies *prior* to detailed site investigations. In the first instance, they were to focus upon the feasibility of specific municipalities *not* underlying bedrock formations as safe and secure hosts to a deep repository. Feasibility studies were launched as a means for SKB to try and

gain physical *access* to a collection of municipalities, and having gained a foothold, to work towards achieving local *acceptance* in hope of being able to move on to future site investigations (Lidskog and Sundqvist 2004: 263).

For this reason, SKB's original invitation to each and every municipality in Sweden in 1992 asking for expressions of interest in hosting a feasibility study was viewed by the communities already hosting nuclear facilities as not seriously directed towards them. For these communities issues of physical access and local acceptance were considered *passé*. Nuclear waste management was already a fact of everyday life in all of these communities, and no where more so than in Östhammar and Oskarshamn. In these two communities in particular 'feasibility' studies could appear superfluous as no extended introductions to SKB and the challenges of waste management were required.

Concentrating on the cases of Östhammar and Oskarshamn, how then should we interpret their contrasting approaches to accepting a feasibility study? Regards Östhammar, it appears that they reasoned that they had been asked to participate in a nationwide siting process and although all the steps in this process are clearly not of equal relevance to them, being a participant requires that you follow them. Unlike all those municipalities who had ignored SKB's 1992 invitation, Östhammar were happy enough, when directly asked, to speedily confirm their faith in SKB as a local employer, and their willingness to develop their co-operation with the nuclear industry further. Oskarshamn reasoned along different lines: they recognized a feasibility study as offering them a strategic opportunity to re-negotiate their established relationship with SKB. Rather than first learning about themselves as the planned site for yet another waste facility via SKB's research and development programmes, they were now being openly invited by SKB to enter into early discussions about themselves as a 'feasible' site for a deep repository. Oskarshamn recognized that the rest of the nation's disinterest in a deep repository was leading to their relative empowerment in relation to SKB. Oskarshamn recognized that either SKB went forward in siting a deep repository in close co-operation with those communities already hosting nuclear facilities, or they risked not going forward at all.

The Early History of Stakeholder Involvement in Oskarshamn

Oskarshamn was able to see participation in a feasibility study as a strategic opportunity for them, as by 1995 they were already an experienced and organized local stakeholder in nuclear waste issues. In this respect they had already assumed a unique position in relation to the other nuclear municipalities in Sweden. Already with the siting of CLAB in Oskarshamn in 1980, the future of the municipality became wedded with the success or failure of the KBS-3 method of spent fuel disposal. In connection with the planning of the Äspö Hard Rock Laboratory in Oskarshamn in 1986, SKB initially stated that the site of the laboratory could eventually turn out to be one of the two sites chosen for detailed investigation as the repository site itself (SKB 1986: 35-37). Here the municipality reacted strongly, and only agreed to allow the siting of the laboratory, on condition that nuclear waste would never be stored in it (Hedberg and Sundqvist 1998: 74).

In 1992, it was time for SKB to try and push forward the implementation of the KBS-3 method in Oskarshamn again. While SKB announced its intention to pursue feasibility studies for a deep repository nationwide, they also revealed plans to site a new encapsulation plant in Oskarshamn as an extension to CLAB, the storage capacity of which was also to be expanded (CLAB Stage 2). According to the plans, the spent fuel stored in CLAB would be placed in copper canisters with a cast iron insert in the new encapsulation plant in preparation for deep disposal. The aim was to submit an official application to site an encapsulation plant in

Oskarshamn towards the end of 1996 (SKB 1992: 53, Hedberg and Sundqvist 1998: 75). In response to these plans the municipality carried out its own extended review of SKB's latest research and development programme, and requested from the government that funds be made available to them so as to facilitate greater local understanding of, and involvement in nuclear waste management issues (Oskarshamns kommun 1993). This request was respected, and in January 1994 the municipality was allocated up to 2 million kronor a year until 1997 from the Nuclear Waste Fund to build up a local competence in waste issues (SOU 1999: 115, SOU 2002: 211). These funds laid the foundations for the establishment of the LKO organization of local competence development in Oskarshamn, where even expert advisors with previous experience of working for both SKB and SKI have been employed on a long-term basis.

In relation to the expansion of CLAB and the siting of an encapsulation plant in Oskarshamn, the municipality was insistent that both matters should be subject to new environmental legislation from the beginning of the 1990s. Chapter 4 of the Act on Natural Resources (Naturresurslagen) required that a detailed environmental impact statement be submitted to the government in connection with the siting of major nuclear facilities. In the preparation of such statements the relevant regional government authority, together with the developer, was to be held responsible for co-ordinating organized consultations between all the major parties implicated in the siting. In accordance with this legislation an Environmental Impact Assessment (EIA) Group for CLAB and Encapsulation Plant was convened by Kalmar County Administration in August 1994. The participants in this group were representatives from SKB, SKI, SSI and the Municipality of Oskarshamn. The Deputy Governor (länsråd) of the County Administration was appointed chairman of the group and the County Administration also supplied a secretary. The municipality was represented by the head of the local council and several of the expert advisors attached to the LKO organization (SOU 2002: 211). From the outset it was decided to hold meetings of the EIA Group approximately every other month.

Although it was agreed at an early meeting of the new EIA Group that the group itself had no formal powers of decision, the municipality of Oskarshamn quickly made it clear that they were not prepared to discuss the siting of an encapsulation plant independently of that of the other components in the KBS-3 system of waste disposal. The municipality's fear was that the development of an encapsulation plant risked falling seriously out of phase with the development of a deep repository. It was one thing to demonstrate the feasibility of the KBS-3 method through the establishment of the Äspö Hard Rock Laboratory, but the municipality did not want to bind itself further to this method of waste disposal before a 'secure and accessible' location for the siting of a deep repository had also been established (SOU 2002: 112).

While SKB attempted to marry an expansion of CLAB with the establishment of an encapsulation plant in Oskarshamn, the municipality succeeded in divorcing the two issues, and re-marrying the siting of the encapsulation plant with the siting of a deep repository. The plans to expand CLAB were unopposed by the municipality, and in June 1997 SKB submitted an Environmental Impact Statement (EIS) for the project to the government. This statement was produced in accordance with both the Swedish Act on Nuclear Activities and Chapter 4 of the Act on Natural Resources. SKI approved the project and in August 1998 the government gave SKB permission to proceed with the development (SOU 2002: 212).

At the end of 1995 the EIA Group for CLAB and Encapsulation Plant produced a joint planning report regards the siting of an encapsulation plant. Here it is emphasized that an alternative siting of the encapsulation plant must be seriously considered, and in particular a siting in close proximity to a deep repository (SOU 2002: 213). Although since this time SKB have

continued to present a siting of the encapsulation plant as an extension of CLAB as their preferred option, the possibility of another siting has continued to be left open. Joint agreement not to totally dismiss a siting in connection with a deep repository has meant that an encapsulation plant will not be finally sited until it has become reasonably clear where the former will be sited as well. Not dismissing a siting of an encapsulation plant close to a deep repository has also served to confirm municipal powers of veto over the former as will now be clarified below.

The Municipal Veto and Local Powers of Decision over Major Waste Facilities

Chapter 4 of the Act on Natural Resources, and replacing this in 1999, Chapter 17 of the Swedish Environmental Code, have granted Swedish municipalities powers of veto over the siting of new developments. These powers of veto are unconditional except in relation to particular specified cases including the siting of facilities for the interim and final storage of nuclear substances and waste. In these cases national government is allowed to override local powers of veto as the siting decisions concerned must be viewed as taken firstly in respect of the interest of the nation as a whole. Given the existence of this so-called 'veto valve' ('vetovärdet') deflating local powers of decision over the siting of nuclear waste facilities, the scope for local stakeholder involvement in decision-making processes could be presumed to be severely constrained. However, according to the legislation this veto valve does *not* in turn apply, if an alternative location for the facility in question can be shown to exist in another municipality which is potentially more willing to accept it. Furthermore, the veto valve does not apply if it can be persuasively shown that a more appropriate site than the one proposed for the facility in question might possibly exist elsewhere in the country (SFS 1998, SOU 2002: 122).

Potentially, the veto valve undercuts the relevance of environmental impact assessment procedures to the implementation of the KBS-3 method of spent nuclear fuel disposal, while affirming the overriding importance of the 1984 Act on Nuclear Activities to the siting of all the facilities concerned. Given this situation, the municipality of Oskarshamn has since the establishment of the EIA Group for CLAB and Encapsulation Plant continually argued for the abolition of the veto valve. By insisting that the expansion of CLAB should require the production of an EIS in respect of Chapter 4 of the Act on Natural Resources, the municipality was clearly displaying its non-acceptance of the veto valve. Because it would have been very difficult to propose an alternative site for CLAB Stage Two, it would have been relatively straightforward to enforce the veto valve if the municipality had attempted to stand in the way of the development. However, despite its extremely unlikely ability to halt an expansion of CLAB, Oskarshamn still persuaded SKB to act *as if* environmental impact assessment procedures were an inescapable part of the expansion plans.

Similarly, by seeking to divorce the siting of an encapsulation plant from the expansion of CLAB, by attempting to wed the former more closely to the siting of a deep repository, the municipality of Oskarshamn was also seeking to strengthen its powers of veto. By accepting that an alternative siting of the encapsulation plant other than as an extension of CLAB is possible, SKB has effectively disqualified the use of the veto valve in relation to its siting. It has done this not only by admitting that another location for the plant is possible, but also by accepting encapsulation as a relatively free-standing process which is arguably more concerned with the handling of nuclear waste than its interim or long-term storage.

Regards the relevance of the veto valve to the siting of a deep repository, the difficulties of using it to force a municipality into accepting such a facility appear immense. These difficul-

ties are again, it can be argued, significantly of SKB's own making. By asserting that a siting strategy based on the principles of voluntarism and dialogue is possible for a deep repository due to the fact that bedrock conditions throughout much of Sweden are potentially 'good enough' to house such a facility, it becomes practically impossible to insist that any site chosen after two or three site investigations could not be improved upon if still further investigations were carried out. However, even if the municipal veto may be hard to avoid in relation to the siting of a deep repository, the question of *when* in the siting process it can, or cannot, be applied can still be subject to controversy and debate. Before accepting a feasibility study, the municipality of Oskarshamn was very concerned about achieving clarity in the issue of when exactly the municipal veto can be wielded.

In March 1995, already in anticipation of being asked to host a feasibility study for a deep repository, the municipality of Oskarshamn wrote to the Swedish Ministry of the Environment criticizing, amongst other things, the veto valve and the uncertainty it created over if and when a community could back out of the siting process having voluntarily entered it (Oskarshamns kommun 1995, Sundqvist 2002: 196). A government decision on the siting process in May 1995 only appeared to add to the uncertainty over the issue as it seemed to imply that the municipal veto could only be applied in connection with the rejection or acceptance of a detailed site investigation which was being equated with the first step in the actual construction of a deep repository (Swedish Government Decision 1995, SOU 1999: 75). This contradicted the established understanding among the municipalities participating, or on the verge of participating in a feasibility study. For them, the municipal veto was understood to apply *both* before the acceptance of a detailed site investigation and, once again, after a final siting decision had been made, and before construction could commence. Limiting the validity of the municipal veto, would once again be a means of limiting the applicability of EIA procedures to the siting process, while reaffirming the weight and authority of the Act on Nuclear Activities. After the locations for detailed site investigations had been decided, and the opportunity to wield the municipal veto offered, the final siting decision would, providing that all the candidates had not withdrawn, be left firmly in expert hands and decided firstly in consultations between SKB, SKI and SSI, both before and after a government decision on the matter had been reached. An EIA process during the detailed site investigation phase according to environmental legislation, but with municipal powers of veto already expended would have been, from a municipal perspective, a largely meaningless exercise.

In response to fears that the siting process was in danger of following the above mentioned course, the four municipalities hosting feasibility studies in June 1997 sought an audience with Anna Lindh who was the current Minister for the Environment. They sought concrete assurances that the municipal veto would be possible to wield on two occasions, both, before a detailed site investigation was initiated, and later before construction of a deep repository should commence. In December 1997, the municipalities concerned received a letter from the Minister. Although she did not explicitly clarify on how many occasions the municipal veto can be wielded, she did confirm that participation in a detailed site investigation did not rob municipalities of their powers of veto. She also provided assurances that the government did not consider applying the veto valve as an acceptable solution to countering municipal opposition to the siting of a deep repository (SOU 1999: 76).

Establishing the Relative Relevance/Irrelevance of Environmental Legislation to Feasibility Studies for a Deep Repository

Compared to the two initial feasibility studies for a deep repository pursued in Norrland, those centering on communities already hosting nuclear facilities came to assume a different char-

acter. In this context the actions of the municipality of Oskarshamn must be awarded a special significance. Already in 1993, when requesting financial support from the government to follow SKB's plans to expand CLAB and site an encapsulation plant in the municipality, Oskarshamn made demands in respect of *all* the municipalities asked by SKB to explore the 'feasibility' of hosting of major new waste facilities:

The issue of economic support to municipalities chosen for feasibility studies regards an encapsulation plant or deep repository should be investigated... and the government... should clarify how the municipalities in question will be financially compensated in connection with such studies (Oskarshamns kommun 1993).

By being the first municipality to receive financial support from the Nuclear Waste Fund to follow SKB's siting plans for an encapsulation plant, Oskarshamn set a precedent which helped spur a government decision in May 1995 that all municipalities participating in feasibility studies for a deep repository and/or encapsulation plant could apply for up to 2 million kronor a year from the Nuclear Waste Fund to help enable them review SKB's work and inform local citizens about what was going on. Furthermore, Oskarshamn also set a precedent by insisting upon the relevance of new environmental legislation, and by attempting to place it on an equal footing with the Act on Nuclear Activities in the regulation of siting decisions for major waste facilities. As far as SKB were concerned, the initial feasibility studies carried out in Norrland for a deep repository were not part of a legally-defined EIA process. They implied informal, not formal negotiations with municipal authorities, and it was only as a sign of good faith that SKB were prepared to carry them out 'in the spirit of' new environmental legislation (Thegerström and Forsström 1995, see also SOU 2002: 110, Sundqvist 2002: 192).

Oskarshamn clearly rejected this approach to feasibility studies. For them, environmental legislation represented a vital platform upon which local stakeholder involvement in nuclear waste issues could and should be built. Because Oskarshamn already hosted CLAB, the time for merely informal discussions with SKB was considered long past. Informality may have been an understandable SKB tactic in relation to nuclear 'virgins' in Norrland, but in relation to the established hosts of nuclear facilities it was a redundant ploy. By 1995, Oskarshamn had been already explicitly named as the site for an encapsulation plant, and was already actively demonstrating the 'feasibility' of the deep disposal of spent nuclear fuel through the new Äspö Hard Rock Laboratory. Therefore, as far as the municipality was concerned, if they were going to explore the feasibility of hosting a real as well as an experimental repository, the more formal and well-organized the negotiations they held with SKB the better.

Again, the same government decision in 1995 which offered financial support to municipalities participating in the siting process for repository and encapsulation plant, also appears to have taken the establishment of the EIA Group for CLAB and Encapsulation Plant in 1994 as setting a pattern to be followed in the future. Even if SKB still continued to assert the essential informality of feasibility studies after 1995, it became after this time a matter of law that the relevant County Administration should play a co-ordinating role in assisting SKB maintain contacts with both local authorities and government agencies in the conduct of what became generally viewed as early EIA consultations regards the siting of a deep repository (Swedish Government Decision 1995, Sundqvist 2002: 186).

Therefore, even before Oskarshamn was officially invited by SKB to host a feasibility study for a deep repository in May 1995, they had already played an instrumental role in shaping the future character of such studies. Again, still in anticipation of receiving an invitation from SKB, Oskarshamn also declared in their earlier mentioned letter to the Ministry of the Envi-

ronment dated March 7th 1995, that they considered the implementation of the KBS-3 system of waste disposal as currently proceeding in a relatively uncoordinated fashion. The completion of different components in the system risked falling seriously out of step with one another. For this reason, the municipality of Oskarshamn wished to make it a precondition of their further participation in the completion of any component in the nuclear waste programme as a whole, that ‘a national environmental impact assessment process be initiated led by a government appointed independent expert or equivalent’ (Oskarshamns kommun 1995).

Having defined an urgent need for greater national co-ordination of the nuclear waste programme, the municipality of Oskarshamn again did not have to wait long until its particular diagnosis of the situation resulted in new government legislation. On the 15th May 1996, the government announced that a new National Coordinator on Nuclear Waste was to be appointed in order to facilitate better contact between the different feasibility studies being pursued in different parts of the country (Swedish Government Decision 1996). In particular the Coordinator was to help enable the different municipalities hosting feasibility studies to come together and demand clear answers from SKB on issues of common concern (SOU 1999: 35, Sundqvist 2002: 206). Therefore, by the time Oskarshamn finally agreed to host a feasibility study for a deep repository in October 1996, they had already assured future funding for the further development of their LKO organization of local competence development, similarly they had also guaranteed the future of the EIA Group convened by Kalmar County Administration in 1994 which now only had to re-christen itself the EIA Forum for Studies of the Final Disposal of Spent Nuclear Fuel in the Municipality of Oskarshamn. In addition, the municipality had also set in motion a process leading to the creation of a new National EIA Forum on Nuclear Waste which was to have its first meetings during 1997. Therefore, it is safe to say that after 1992, no party did more to establish and assert the direct relevance of evolving environmental legislation to the implementation of the KBS-3 system of nuclear waste disposal than the municipality of Oskarshamn. The relative standing of environmental legislation and the Act on Nuclear Activities in deciding the fate of the KBS-3 system has always been subject to contention. While after 2002, the two forms of legislation appear as ‘natural partners’ standing over the siting of deep repository and encapsulation plant alike, this should not conceal the significantly different worlds of stakeholder involvement the two continue to support and legitimate.

The Organization of Feasibility Studies in Nyköping, Östhammar and Oskarshamn – Patterns of Local Stakeholder Involvement and Disinvolvement

Before Oskarshamn finally agreed to host a feasibility study, the studies in Nyköping and Östhammar had gotten well underway. The approach adopted by the municipality of Nyköping towards a feasibility study was very different to the one adopted in Oskarshamn. The municipal leadership in Nyköping reasoned that if SKB wanted to carry out a study, this should be treated as essentially their business. No formal political decision was thought to be required locally, and should SKB proceed with a study, it was not the intention of the municipality to sign any formal agreement with them, or set up a joint steering committee. The municipality was prepared to surrender all possibility of influencing the planning and execution of the study, so as to avoid, as they saw it, a premature politicisation of the issue which risked ruining the chances for a sensible and well-informed debate (cf. Lidskog 1998: 257).

As SKB initiated its feasibility study in Nyköping, the municipality did go as far as to establish three different local groups. Firstly, an information and preparation group was formed with members from all the political parties represented on the municipal council. This group was to decide how the funds available to the municipality from the Nuclear Waste Fund

should be distributed and how/when various public meetings should be organized so SKB could inform about their work. Secondly, a group of local civil servants was tasked with following SKB's work and providing them with the relevant information they in turn required to complete their study. Thirdly, a reference group was formed with participants from 20 or so local associations and organizations representing interests as diverse as local boat-owners, ornithologists and shop-keepers. Initially, several NGOs critical of SKB and the siting process for a deep repository in general were represented in the reference group, but these quickly left the group once they appreciated that the ambition of the group was limited to helping to disseminate information about SKB's work more broadly (Sundqvist 2002: 193, Johansson, Lidskog and Sundqvist 2002).

SKB had already carried out drillings in the municipality during the 1980s and in connection with these a local protest group had formed called 'Save Fjällveden'. It would seem that the municipal leadership was influenced by this past experience of political unrest in its determined efforts not to address a feasibility study by SKB as an explicitly political matter. Could sufficient local respect for the technical challenges of nuclear waste management be maintained long enough for a feasibility study to be carried out? Combined with a relative disinterest in nuclear waste issues, a feasibility study was also approached by the municipality as equivalent to a test of Nyköping's maturity as a nuclear community. While the municipality could guarantee SKB initial access to the municipality, and offer them a free hand to carry out a feasibility study exactly as they wished, the danger remained that this access might again be threatened by local protests. In their attempts to stimulate responsible and well-informed debate, the municipality's preparation and information group expended much energy organizing local study circles and drawing on SKB's help to educate 20 or so study circle leaders. From the end of 1995 to the middle of 2000, the municipality arranged 75 bus trips together with SKB to CLAB and the Äspö Laboratory in Oskarshamn. Approximately 2000 citizens from Nyköping participated in these trips (SOU 2002: 205).

In accordance with new legislation and following the pattern established in relation to the expansion of CLAB and the siting of an encapsulation plant, Södermanland County Administration initiated during the autumn of 1995, a regional EIA forum in response to the feasibility study in Nyköping. In total, seven meetings were held during the time of the feasibility study. The main participants in these meetings were SKB, SKI, SSI, Nyköping Municipality, and representatives from neighbouring municipalities. The content of these meetings was restricted to the presentation of information about changing environmental legislation and the results of the feasibility study.

The approach adopted by the Municipality of Östhammar to a feasibility study was different again. A speedy decision was taken by the municipal council to accept SKB's invitation to host a feasibility study. Although the majority in favour of accepting the invitation was large, a clear political division in the municipality over the issue along party lines was still apparent. One representative from the Centre Party was particularly outspoken in claiming that it was undemocratic to take such a swift decision on the proposed study without seeking to properly inform local citizens on the matter (Östhammars kommun/Kommunfullmäktige 1995). Together with the Green Party, the Centre Party also forced a vote on the need for a local referendum prior to the acceptance of a feasibility study. Again, although this proposal was defeated by a large majority, the eventual need for a local referendum should Östhammar be pointed out as the site for a deep repository has subsequently been widely advertised by all the parties represented on the municipal council apart from the Liberal Party (Referensgrupp i frågan om slutförvar i Östhammars kommun n.d.).

After accepting a feasibility study, a reference group was set up by the municipality with representatives from all the political parties on the municipal council. The stated aim of this group was to, as publicly as possible, follow, review and inform on the feasibility study. A working group of four local civil servants was also formed to administrate over the municipality's role in the feasibility study. No additional groups were established by the municipality meaning that no local associations or non-governmental organizations were given the opportunity to directly participate in the feasibility study. The judgement was that the reference group covered a sufficiently broad spectrum of political interests within the local community not to require the formal inclusion of others in the municipal organization (SOU 2002: 135). In its preference for a minimalistic form of municipal organization in response to SKB's feasibility study, Östhammar was taking a radically different approach to the one evolving in Oskarshamn, and even a more modest approach compared to the one being adopted in Nyköping. Like in Nyköping, the ambition in Östhammar appears to have been not to make such a political 'big deal' out of a feasibility study and, as far as possible, to try and treat it as municipal business as usual. While Nyköping, by refusing to interfere in the slightest with the plans for a feasibility study, assumed an extremely deferential attitude towards SKB, Östhammar by opting for a minimal pattern of local organization appears to have expressed a willingness to treat SKB as practically no different from any other actor wishing to establish a new activity in the municipality. Both Östhammar and Nyköping in their acceptance of, and organizational responses towards, feasibility studies appear to have been more concerned to show their respect for SKB, than to pursue a clearly formulated local agenda.

The reference group in Östhammar did during the course of the feasibility study organize a series of public meetings and seminars with participation from SKB, SKI, and SSI. They also distributed an information brochure to all the households in the municipality, including the summer residents, after the preliminary results of the feasibility study had been presented. In general, the level of local public concern and interest regards the feasibility study was deemed low. In the beginning of 1997, however, a local group critical to the feasibility study was formed – Opinion for Safe Disposal (OSS). They organized several public meetings of their own, and were even offered financial assistance to do so by the municipality drawing on funds available from the Nuclear Waste Fund. In response to OSS, a small local group positive to the feasibility study also formed called Energy for Östhammar. They also received limited financial assistance from the municipality (SOU 2002: 151). Neither of these local groups, however, made any noticeable difference to the level of local debate concerning SKB's activities.

Responding to the new legislation, the municipality of Östhammar requested during the autumn of 1995 that Uppsala County Administration organize a regional EIA forum in relation to SKB's feasibility study. Meetings were held roughly twice a year and participation gradually expanded as feasibility studies were also initiated in two neighbouring municipalities to Östhammar. A larger collection of government authorities participated in the Uppsala EIA forum than in the forum in Södermanland, but again no NGOs were admitted. Also in the Uppsala forum, the neighbouring Finnish county of Åland was offered representation.

As previously mentioned, the municipality of Oskarshamn took approximately 17 months to reach a decision on whether or not to allow SKB to conduct a feasibility study. This delay was deliberate in order to allow for the investigation of local opinion for and against entering the siting process for a deep repository. In its first meeting after being invited to host a feasibility study, the municipal council agreed upon a detailed plan of action. Two working groups were

formed with members from all the parties represented on the municipal council; a feasibility group composed of party representatives with greatest experience of nuclear waste issues, and a youth group composed of ten young politicians in the municipality. The task of these two groups combined was to generate an interest among young and old alike concerning the management of spent nuclear fuel; to register local opinion; and on the basis of their understanding of this opinion, to help guide the municipal council in its decision whether or not to allow a feasibility study (Hedberg and Sundqvist 1998: 77). Both working groups organized public information meetings and debates; the feasibility group distributed information material to every household in the municipality. In connection with a debate between SKB and the People's Campaign Against Nuclear Power/Nuclear Weapons, the youth group organized a school vote among older schoolchildren in the municipality on whether or not a feasibility study should be allowed (Sundqvist 2002: 196, SOU 2002: 214). Together the two working groups organized and initiated as much public debate and discussion in Oskarshamn *before* a feasibility study was agreed upon, as the municipal organizations in Nyköping and Östhammar did *after* such studies were set in motion.

When Oskarshamn eventually said yes to a feasibility study, they made this conditional upon the fulfilment of a particular set of local demands directed as much towards central government as towards SKB. In many instances, these demands were not new concerns for the municipality, but related to established lines of local policy which the municipality was again taking the opportunity to advance. Oskarshamn insisted, for example, that greater national co-ordination of the siting process for a deep repository and encapsulation plant be established, and that if the municipality chose to withdraw from the siting process for a deep repository after a feasibility study that this should be respected. They also demanded that the municipal council be empowered to approve and decide upon a detailed programme for the feasibility study. It was also made clear that the municipality would not reach any decision on a possible future site investigation before all the feasibility studies had been concluded and evaluated by the relevant government authorities. In addition, no decision on an eventual site investigation would be made before concrete selection criteria had been established for the final choice of site, and the role of the 'veto valve' had been further clarified in the voluntary siting process (SOU 2002: 215, Sundqvist 2002: 197).

At the beginning of 1997, SKB developed a work plan for the feasibility study in direct consultation with the municipality and the other participants in the existing (re-named) regional EIA forum convened by Kalmar County Administration. The municipal organization set up for the feasibility study was highly elaborate. The reference group for the feasibility study was decided as the municipal council itself. The board of the municipal council (kommunstyrelsen) could then take more routine decisions in relation to SKB's study in relation to the framework laid down by the council as a whole. The established LKO organization in the municipality was to be developed in relation to the feasibility study through the formation of six working groups. Four of these groups were divided up into areas of concern corresponding to those SKB had decided for their own feasibility study organization, namely: Long-term safety/geoscience, technology (including transport issues), land/environment and social issues. A fifth group was concerned with information issues and a sixth with the encapsulation plant. The working groups were set two overriding tasks: firstly, to develop local knowledge and understanding of the different component areas of the feasibility study and to disseminate this to the municipal council and local citizens. Secondly, to advance the municipality's own questions and perspectives during the course of the feasibility study to both SKB, and the relevant government authorities. This latter ambition was to be largely fulfilled through mu-

municipal participation in the EIA forums established at the regional and national levels (SOU 2002: 217, Sundqvist 2002: 197).

Each of the municipality's six working groups was to be composed of five or six members and each one was to be led by a member of the municipal council. One member in each group was a local civil servant and to every group one of the external experts participating in the LKO organization was connected as a 'resource person'. All the remaining members of the working groups were decided upon by the board of the municipal council in a way designed to encompass a broad array of local interests and organizations. Before every EIA forum meeting, the participating members from the municipality would be briefed by members of the working groups (SOU 2002: 218). As the feasibility study progressed, the municipality chose to change the number, and the orientation of the working groups in the local organization as was deemed appropriate.

According to the municipality, the organization they established in relation to SKB's feasibility study amounted to the development of an Oskarshamn Model for local stakeholder involvement in the management of Swedish spent nuclear fuel. The main elements of this model which remain intact during the current site investigation phase of the implementation of the KBS-3 system have been summarized as follows:

- Openness and Involvement: 'All the facts on the table', genuine local influence;
- The EIA process is our platform: We produce the foundations for decisions together with others; but we make our own decisions independently;
- The municipal council is our reference group: A competent reference group accountable to the voters;
- The public is a resource: A transparent process and concrete proposals produce engagement and influence;
- Environmental groups are a resource: These groups and their experts offer an important contribution to our work;
- SKB should be pressed into supplying clear answers: We need to be properly informed in order to pose the most difficult questions, our questions must receive clear answers;
- The government authorities are our experts: SKI and SSI participate throughout the siting process, our decisions are made after these authorities have expressed their views.

(SOU 2002: 219, www.oskarshamn.se/lko)

The Oskarshamn Model of stakeholder involvement guaranteed that SKB's feasibility study assumed more the character of a genuine EIA process, than a purely technical investigation of the municipality's feasibility as a site for a deep repository. SKB themselves had made this possible by defining feasibility studies as something prior to detailed site investigations. The new siting strategy initiated in 1992 based on voluntarism and dialogue was expressly designed to explore local levels of understanding for the challenges of manage spent nuclear fuel, and varying degrees of willingness to constructively engage with them. In general, SKB's new strategy was met with suspicion by municipalities throughout Sweden. The fear was that if a municipality offered SKB even 'a little finger' they would end up losing 'a whole hand': that the municipality in question would become locked into a siting process for a deep repository with an uncertain ability to pull out at a later stage (cf. Lidskog 1998: 257). The time for such fear and suspicion in Oskarshamn, however, was long past. They already had CLAB and spent nuclear fuel was already regularly in-coming into the municipality. Although not designed firstly in relation to them, Oskarshamn saw a feasibility study as offering them the strategic opportunity to take a greater measure of their nuclear fate into their own hands.

As they saw it, it was SKB who was offering them a ‘little finger’, and the municipality that was intent on taking a ‘whole hand’.

Underlying, the Oskarshamn Model is the perception of something like a mutual hostage situation characterizing the relationship between SKB and the municipalities hosting nuclear facilities in Sweden. The same terminology has been used to describe the transformation of nuclear safety regulation in the United States after the Three Mile Island incident (Rees 1994). In that case, the diverse nuclear power producers across the nation agreed to voluntarily adopt the same new safety standards in order to rescue the credibility of the industry as a whole. In this process each producer was obliged to recognize itself as closely resembling the hostage of every other. In a similar sense, both the possible future, or the final burial of the Swedish nuclear programme is currently dependent upon the establishment of a new pattern of ‘voluntary relations’ between SKB and the municipal hosts of the KBS-3 system of spent nuclear fuel disposal. As new municipalities interested in entering into such a pattern of ‘voluntary relations’ with SKB were not sufficiently forthcoming after 1992, SKB was by 1995 obliged to start facing the prospect of siting the whole of the KBS-3 system within the Swedish nuclear industry’s own backyard. As the custodians of this backyard the municipalities already hosting nuclear facilities were thereby encouraged to recognize that SKB was on the verge of becoming just as much their hostage in the search for a safe solution to the waste problem, as they already were of them.

Arguably, although Oskarshamn had recognized the mutual hostage situation that had arisen when SKB asked four nuclear communities to host a feasibility study, Nyköping and Östhammar had not. If the latter two municipalities did recognize the new situation confronting them, they definitely did not act upon it. At a relatively early stage, Oskarshamn appears to have grown fully-aware of how SKB’s misfortunes in Norrland were helping to empower them as a local stakeholder, even to the extent that they could start viewing themselves as no longer simply a ‘local’ stakeholder, but a stakeholder roughly similar in stature to those currently deciding over the making of nuclear waste policy, i.e. SKB, SKI and SSI. If Oskarshamn started out by, in many respects, lacking its own agenda in relation to the formulation of national nuclear waste policy, they became after 1993 committed to developing the competence to decide upon this agenda. Before finally accepting a feasibility study, Oskarshamn had already learnt how to exert real influence over national nuclear waste policy. Their demands for the allocation of separate funds to municipalities hosting feasibility studies; for the treating of these studies as ‘early’ EIA consultations; and for the improved national co-ordination of the siting process for a deep repository all found favour with government leading to the introduction of new legislation. Arguably, CLAB has ended up offering Oskarshamn a ‘natural’ advantage over the other nuclear communities in its powers to influence nuclear waste policy: all routes for spent nuclear fuel in Sweden currently lead to Oskarshamn *and nowhere else*. However, despite this unenviable ‘natural’ advantage, the municipality has clearly recognized, and acted upon the situation that nuclear history and the opposition of others to nuclear waste has created for them.

Oskarshamn due to their ability to actively involve themselves in their own nuclear fate can be interpreted as making Nyköping and Östhammar look bad for their relative inability to do so. Nyköping can perhaps be justifiably accused of engaging in an ill-advised strategy of stakeholder ‘disinvolvement’ during the course of SKB’s feasibility study. Due to a special combination of municipal enthusiasm and disinterest, they ended up offering SKB what they had already given up all hope of encountering: voluntarism *without* dialogue. The municipal leadership in Nyköping apparently accepted that even the ‘feasibility’ of the municipality as a

site for a deep repository remained enough of a clearcut scientific and technical issue for it to be entirely inappropriate for them to take, what could only be, an ‘ignorant’ political decision on the matter. Due to their presumed lack of competence (and only limited interest) in nuclear waste issues, as well as their perceived inability to do anything immediate to remedy the situation, the municipality of Nyköping saw themselves as obliged to disinvolve themselves from the planning, execution and evaluation of SKB’s study. At the same time, in their partial ambition to strengthen the established reputation of the municipality for nuclear research dating back to the late 1950s, they remained reasonably well-prepared to offer SKB all the assistance they could provide to enable the successful completion of their study. As has been already charted elsewhere, Nyköping’s unfortunate attempt to effectively de-politicize SKB’s presence in the municipality had by the time the feasibility study was completed, proved itself to be socially unsustainable. Although SKB was interested in keeping Nyköping as ‘first reserve’ for a future site investigation, the voluntary self dis-empowerment of the municipality was leading to growing internal tensions within the municipal organization as a whole which could only lead to a withdrawal from the siting process. This withdrawal took place after a vote in the municipal council in May 2001 (SOU 2002: 204, Johansson, Lidskog and Sundqvist 2002).

Östhammar’s swift decision to allow a feasibility study can be seen as having been intended to serve as a sign of good faith towards SKB, and especially so as no conditions were attached to the decision. Therefore, in their acceptance of a feasibility study, Östhammar showed no ambition to qualitatively change their historical relationship with the nuclear industry, only a willingness to extend it further along roughly similar lines. Östhammar is fully-prepared to be a ‘host’ to nuclear facilities, but lacks a desire to be anything else than this. The general understanding of hosting is to have guests who stay for longer or shorter periods of time. Those to whom hosts extend a welcome and their hospitality, still remain relative strangers. Hosts have guests who come and stay under the same roof, while still remaining socially distant. The municipality of Östhammar appears happy to remain socially distant from SKB, while still welcoming them into the municipality. This attitude does not represent a social or political failing on the part of the municipality, so much as a conscious and measured choice.

In part, Östhammar’s choice to both welcome and remain distant from SKB reflects the likelihood that any attempt by the municipality to draw closer to the task of nuclear waste management and make it ‘their’ business to the same extent as Oskarshamn has done, would only lead to serious party political conflict in the locality. In part, it also reflects a related local desire to try and ‘normalise’ as far as possible the municipality’s relationship to the nuclear industry. Local acceptance of SKB and the nuclear industry in general in Östhammar hinges upon the ability of the municipality to successfully render them *unexceptional*, and largely no different from any other form of advanced industrial activity. If nuclear waste management can be successfully treated as a ‘normal’ and unexceptional activity then its potentially controversial nature can be locally contained. The consensually agreed limits to this strategy are also reflected in the broad political commitment to the holding of a local referendum in Östhammar should the municipality be finally selected as the site for a deep repository. On this one discretely-defined political occasion, the unexceptionality of spent nuclear fuel disposal will be subject to active contestation in order to confirm whether or not the municipality’s willingness to treat a deep repository as an industrial project like any other is genuinely supported by the local population.

Given the above analysis, positive and negative dimensions to Östhammar’s more passive and distanced attitude to the siting of a deep repository compared to Oskarshamn can be distin-

guished. On the positive side, Östhammar's relative passivity is fully-understandable given that spent nuclear fuel is currently out-going rather than in-coming into the municipality. It appears only natural to be cautious about participating in a process where Östhammar's 'successful' selection would promise to reverse this flow. Thanks to CLAB, the siting of a deep repository *is* a problem that Oskarshamn owns more than Östhammar. More than Oskarshamn, Östhammar appear justified in adopting a 'wait and see' attitude to the siting of a deep repository and encapsulation plant. Compared to Oskarshamn, they can afford to remain enthusiastic about being a participant in the process, while remaining relatively indifferent to the outcome. Maybe, SKB is more of Östhammar's hostage due to the general rejection of other municipalities for participating in the siting process for a deep repository: but so what? There appears no reason for Östhammar to be particularly concerned about trying to take advantage of the situation.

The negative dimension to Östhammar's relative passivity is that while still formerly appearing a 'player' in the siting process, they risk becoming an actor which is 'played' on many occasions by other more determined and competent players. By their more 'distanced' attitude, Östhammar appear destined to remain a genuine 'local' stakeholder even as they move, and are drawn, progressively closer to the centre of a national siting process. An aspect of the implementation of the KBS-3 system where Östhammar appears particularly vulnerable to the accusation of having become a 'dummy hand' (en träkarl) which is firstly being played, rather than itself playing an active role is the siting of an encapsulation plant. SKB have since the beginning of the 1990s been committed to siting an encapsulation plant in Oskarshamn as an extension of CLAB. However, due both to the recalcitrant attitude of the municipality of Oskarshamn, as well as the procedural demands imposed by new environmental legislation, SKB have been obliged to entertain the idea of an alternative siting for such a plant beside a deep repository in another municipality. Oskarshamn, while not seriously opposed to hosting an encapsulation plant have been interested in getting SKB to elaborate upon the possibility of an alternative siting in order to disable the veto valve and guarantee their municipal powers of decision in relation to its establishment. Therefore, although Östhammar officially stands as the alternative site for encapsulation plant after 1992, it is difficult to see this standing as anything else but a convenience and a necessity for the other players involved in the siting process. If Östhammar still remains a genuine alternative for the siting of a deep repository, they never have been anything else but the 'dummy site' for an encapsulation plant, and they have never shown the desire or the inclination to do much about this situation.

Because Östhammar's relative passivity as a stakeholder can be viewed in both a positive and a negative light, can Oskarshamn's long-standing activism also be viewed in similar terms? In contrast to Östhammar, Oskarshamn have since the early 1990s dedicated themselves to becoming something more than a mere 'host' to nuclear facilities. Through the LKO organization, they have continually striven to deepen their engagement with nuclear waste issues. Reflecting their consuming interest for such issues and the ever closer association with the nuclear industry this has brought, Oskarshamn have chosen to re-christen themselves: 'The Municipality with Energy!' (Kommunen med energi!). In other words, the relative distance that Östhammar have sought to maintain to SKB, Oskarshamn have been prepared to collapse. Nuclear waste management is now most definitely 'their' business, as well as that of SKB, SKI and SSI. In this transformation, Oskarshamn's mobilization of external expertise previously employed by SKB and SKI has been of vital, if not decisive, importance. The transfer of expertise to the municipality of Oskarshamn is important in the explanation of their ability to 'move up a league' as a stakeholder, and become something other than just a 'local' stakeholder in the siting process for both a deep repository and an encapsulation plant.

As Oskarshamn have elevated their identity as a stakeholder, they have also redefined themselves as not only a 'host' to an interim storage facility for Sweden's spent nuclear fuel, but also a potential *home* for all the major components of the KBS-3 system. When directed towards them, Oskarshamn took advantage of SKB's new strategy of voluntarism and dialogue and changed its terms of reference. Replacing initial access to the municipality, Oskarshamn substituted the vision of an established host potentially prepared to help make the municipality a permanent home for Sweden's spent nuclear fuel. Dialogue was to focus on specifying the terms enabling such a transformation of identity. If Oskarshamn was to become understandable as a feasible home for the major components of the KBS-3 system, then the host-guest relationship with SKB would have to be superseded. Hosts and guests don't build homes together, and for this reason what Oskarshamn were seeking from SKB through participation in a feasibility study was recognition as a worthy *partner* in the siting process. Upgrading local competence in nuclear waste issues has been Oskarshamn's way of trying to qualify itself for partnership with SKB. In this effort, Oskarshamn has not attempted to duplicate the competences commanded by SKB and other major actors like SKI and SSI, but to develop their own forms of competence which are also possible to recognize as having an important role to play in a successful siting process. How, for example, can the greatest socio-economic advantages accruing from the siting of major waste facilities be realized? Here SKB's two demonstration sites in Oskarshamn, the Äspö Laboratory and the Encapsulation Laboratory (opened 1998), can be seen as having been jointly developed with the municipality to demonstrate not only the feasibility of the KBS-3 system, *but also* the significant socio-economic spin-off effects that can be generated from nuclear waste facilities.

Compared with the relative distance and indifference of Östhammar to the implementation of the KBS-3 system, Oskarshamn's degree of identity and commitment to the project brings its own potential problems. Firstly, what are the opportunity costs of cultivating such a consuming interest in nuclear waste management? SKB is a mission organization. There must be limits to the extent to which a municipality can share SKB's mission without starting to neglect other areas of municipal responsibility. CLAB appears to have been allowed to lock-in Oskarshamn on one particular path of local socio-economic development. What alternative paths remain feasible, and might these also deserve closer attention? Secondly, through seeking partnership with SKB, the municipality of Oskarshamn have developed into perhaps the former's closest ally in their mission to implement the KBS-3 system. In principle, the method to be chosen for spent nuclear disposal in Sweden is still meant to be open. However, as SKB's activities in Oskarshamn have expanded, and both the Äspö Laboratory and the Encapsulation Laboratory have been established, the idea that an alternative to the KBS-3 method could be realistically pursued has grown ever more remote. While alternative methods still remain on the drawing-board, Oskarshamn have already assisted SKB in taking the KBS-3 system several decisive steps closer to reality. From a national perspective, Oskarshamn's activism as a stakeholder can be seen as having contributed more to a progressive narrowing of the 'method debate' than to its further expansion. Arguably, the same can be said in relation to the actual siting decision for a deep repository itself. By seriously volunteering to experiment with idea of becoming a permanent home for Sweden's spent nuclear fuel, Oskarshamn is offering SKB an option for potentially 'cutting-short' its search for alternative sites. Why look much further when you have received such an attractive offer? Also, after committing itself to an identity as a potential permanent home for Sweden's spent nuclear fuel, how committed can Oskarshamn be expected to remain to wishing to see all the best alternative sites identified and thoroughly investigated?

The Conclusion of the Feasibility Studies and the Emergence of Östhammar and Oskarshamn as the Two Locations for Site Investigations

The turn of SKB to communities already hosting nuclear facilities as potential hosts for feasibility studies, eventually led to three additional municipalities also accepting feasibility studies. These municipalities are neighbouring ones to Östhammar and Oskarshamn. Through their participation in the EIA forum convened by Uppsala County Administration in connection with the Östhammar feasibility study, the municipality of Tierp became progressively more entangled in the siting process for a deep repository. The Forsmark nuclear power station is very close to the border with Tierp, and in April 1998, SKB informed the municipality that a potential site for a deep repository existed 10 km from the power station on their side of the border. One month later, SKB officially invited Tierp to host a feasibility study, and within a matter of a few weeks the municipality accepted the invitation (Johansson 2004: 29). As this feasibility study got underway, a harbour in the adjacent municipality of Älvkarleby became of interest to SKB in relation to the potential transport of spent fuel from CLAB to a deep repository in Tierp. When contacting the leaders of the municipality of Älvkarleby, SKB learnt that they were also interested in hosting a fully-fledged feasibility study. Hence an official invitation was extended to them in February 1999 which was accepted four months later after a vote in the municipal council (SOU 2002: 177).

In the hope of entangling one of Oskarshamn's neighbours in the siting process for a deep repository, SKB took contact with the municipality of Hultsfred at the end of 1997. Thereafter, followed a drawn out stop-go process which eventually led to the acceptance of a feasibility study in May 1999. As in Oskarshamn, attached to the municipal decision in Hultsfred were a set of demands which SKB were obliged to follow. Also in similar fashion to Oskarshamn, a collection of local working groups was established and tasked in roughly the same fashion. However, in contrast to Oskarshamn, places for 'ordinary citizens', not formally representing any organization or association, were reserved in each working group in Hultsfred (Sundqvist 2002: 203). In the figure below the 8 feasibility studies are marked on the map of Sweden.

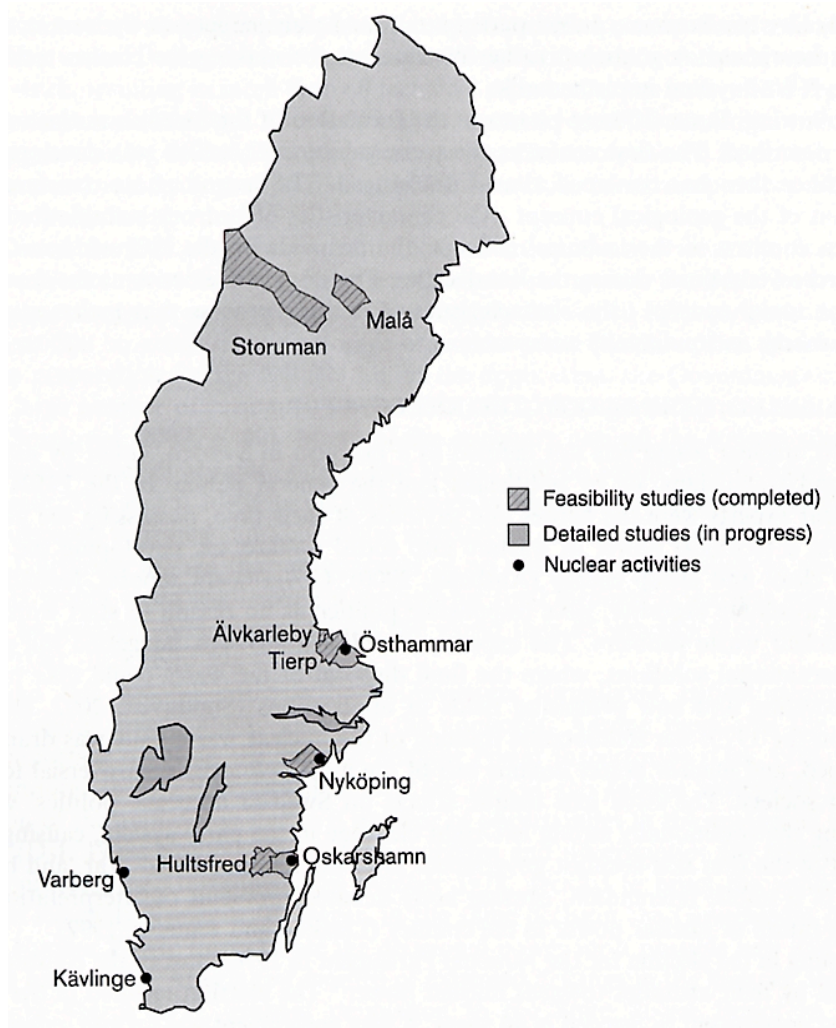


Figure: Site-specific studies conducted by SKB 1993-

Prior to the initiation of the last three feasibility studies, a National EIA Forum on Nuclear Waste was officially established in November 1997 as earlier mentioned. At a preliminary meeting, planning the orientation of this new Forum in June 1997, a selection of environmental organizations was brought together with the current feasibility study municipalities for discussion. The meeting proved turbulent as the environmental organizations sought to bring into question both the on-going siting process and SKB's chosen method of spent fuel disposal. The municipalities reacted by condemning the environmental groups for their 'unconstructive' attitude and their over-preoccupation with the question of SKB's overall credibility. As a consequence, it was decided by the government-appointed National Coordinator to proceed in the formation of a National EIA Forum without the direct participation of any environmental organizations (Sundqvist 2002: 206). This was in order to allow the new National EIA Forum to concentrate on advancing the siting process of a deep repository and encapsulation plant in respect of the KBS-3 system which remained SKB's current main alternative for waste disposal. The Forum was to dedicate itself to achieving transparency in the siting process for those municipalities already participating in it, and to find ways of encouraging additional municipalities to join the process in order to guarantee its legitimacy. Thus, the National EIA Forum, and the National Coordinator himself, came to serve a 'resource function' supplying those municipalities hosting feasibility studies, and especially new ones accepting such studies, with the help and guidance they might require to participate more effectively in

the siting process for a deep repository (SOU 2002: 71). Due to the nature of the task the National EIA Forum adopted for itself, its usefulness was seen to have expired with the culmination of, what turned out to be, 8 feasibility studies. It was, therefore, wound up during 2002.

Before the final version of four feasibility studies had been published, SKB publicly announced its choice of sites for site investigations on 15th November 2000, thereafter a full-scale report was published one month later (SKB 2000). The chosen sites were located in the municipalities of Östhammar, Oskarshamn and Tierp (a 'reserve' site was also identified in the municipality of Nyköping). The last three feasibility studies were hereby being rushed through to a conclusion. The municipality of Tierp had only just managed to respond to the preliminary version of SKB's feasibility study; Älvkarleby was actually publicly announcing its response to such a version on the very same day as SKB's November announcement. Hultsfred was still very much in the process of putting together its response to SKB's preliminary feasibility study. In Tierp, the reaction was one of anger and near outrage. Ultimately, the stress that SKB introduced into the decision-making process in Tierp, over whether or not to allow a site investigation led to the withdrawal of the municipality from the siting process in April 2002. In contrast, Älvkarleby remained relatively positive to being involved in a site investigation due to its connection with the site proposed in Tierp. However, when Tierp, after much debate and uncertainty, finally decided to withdraw, Älvkarleby's withdrawal from the siting process was also sealed as not even the municipality's harbour was of any further interest to SKB. Hultsfred's reaction to their sudden disappearance from the siting process was one of immense disappointment rather than anger. The municipality had managed to build up a high level of engagement with the issue of the siting of a deep repository, and suddenly this engagement had nowhere to go. The municipality decided that in some way they would try and continue to follow the siting process from which they had been so abruptly and disrespectfully excluded (Sundqvist 2002: 203).

8. Site Investigations in Östhammar and Oskarshamn: 2002-

Government Approval and Municipal Conditions for Site Investigations

The government decision approving SKB's choice of sites for site investigations was taken on 1st November 2001. In relation to the choice of the KBS-3 system as SKB's favoured method for spent nuclear fuel disposal, the decision clearly states that the meaningfulness of site investigations can be taken to depend upon them being carried out in relation to such a preferred method (Swedish Government Decision 2001: 3). However, while explicitly serving to strengthen the association between the siting process and the implementation of the KBS-3 system, the decision also states that SKB should continue to 'monitor' the development of alternative methods of spent fuel disposal in their R&D programme. It is also taken for granted that the 'method question' will be subject to serious debate and discussion in connection with the EIA process set to run in parallel with the site investigations (Swedish Government Decision 2001: 4).

While the decision also raises no objections to the choice of sites that SKB advance for investigation, it is also stated that Hultsfred should not be excluded from hosting a site investigation until questions raised by SKI pertaining to the geology of this municipality have been addressed by SKB. Furthermore, with the withdrawal of Nyköping from the siting process it is stated that SKB should consider identifying a new candidate for a site investigation in order to guarantee that a sufficient variety of geological conditions are properly examined during the siting process (Swedish Government Decision 2001: 5).

As during the feasibility study stage, the municipality of Östhammar wasted little time in agreeing to host a site investigation after the government decision at the beginning of November 2001. A decision on the matter was taken on 4th December when the municipal council voted 43 to 5 in favour of hosting an investigation. A contract with SKB was signed shortly after the municipal decision where the municipality set down 15 separate conditions. These conditions are not particularly exceptional and determine, for example, that SKB alone shall carry out the site investigation; that the municipality is not bound to accept further studies/investigations in connection with the siting of a deep repository; that the municipality shall be granted unlimited access to the results of the site investigation; that highly technical aspects of SKB's investigation shall be summarized in a fashion understandable by local citizens; that the municipality's reference group shall be kept well-informed about the progress of the site investigation in a fashion that enables them to pass on information to local citizens; that the municipality's reference group's own ideas and perspectives are given due attention by SKB; that SKB themselves maintain a high level of ambition to inform local citizens about the progress of their site investigation paying special attention to young people, summer residents and those living close to a proposed repository; and that municipal expenses in connection with a site investigation shall be reimbursed through the Nuclear Waste Fund (Östhammars Kommun 2002). At the beginning of 2002, it was decided that the reference group set up in connection with a feasibility study in the municipality should continue its duties during SKB's site investigation. Again their task would be 'to follow, to review and to inform' about SKB's work both in relation to the municipal council, and local citizens in general. A local EIA Group was also formed composed of 8 local politicians and 4 local civil servants. Their primary task is to represent the municipality in the regional EIA forum co-ordinated by Uppsala County Administration and other EIA events organized by SKB.

The municipal council in Oskarshamn voted to allow SKB to carry out a site investigation in March 2002. The 13 conditions they set down framing their agreement to host a site investiga-

tion are, as to be expected, far more detailed and challenging than those set down in Östhammar. They are also directed at SKI and SSI, and not only at SKB. In this way they make evident a clear ambition to shape and influence the site investigation process. Some of the more notable conditions include:

- Only spent fuel deriving from Swedish nuclear power plants in the volumes publicized by SKB is under consideration in the site investigation. The siting of a new repository for low- and medium-level waste (SFL3-5) remains a separate issue.
- SKB and the government authorities must deepen their dialogue with citizens over issues of safety and radiation protection and must not handle these issues in isolation from the public.
- SKI and SSI must remain highly observant of SKB's work and keep the municipality regularly informed of the latter's ability to live up to the rigorous investigative standards imposed upon them by government authority.
- The connection between safety analyses and the specific criteria for choosing one particular site over another for a deep repository must be clarified further by SKB
- The municipality demands that SKI and SSI during the course of the site investigation make a systematic summary of the relevant research which in important respects has come to conclusions other than those reached by SKB. The government authorities should also evaluate this alternative research.
- The municipality requires a decision from government as to the acceptability of their position that: Oskarshamn will only say yes to an encapsulation plant on condition that this facility will not be commissioned before a site for a deep repository has been subject to government review and decision.
- In accordance with the government decision on site investigations, the question of which alternatives (methods and sites) should be dealt with in a comprehensive fashion through the EIA process.
- The long-term relations of responsibility for a deep repository must be clarified further. (Full specification of conditions available at www.oskarshamn.se/lko and in Oskarshamns kommun 2005)

As during the feasibility study stage, the municipal organization set up in Oskarshamn in relation to a site investigation is highly elaborate. A new set of four working groups has been formed – the safety group, the municipal group, the society group and the Misterhult group. The last group is especially designed to represent those living in the immediate vicinity of a planned repository. The working groups are each tasked with policing several of the conditions laid down by the municipality in their acceptance of a site investigation. Furthermore, a development group has been formed bringing together the chairpersons of the other four groups and combining these with external experts employed by the LKO organization. The task of the development group is in particular to prepare the municipality's participation in the regional EIA Forum. The development group and the LKO project leadership are directly accountable to the Board of the Municipal Council and the Municipal Council itself (see www.oskarshamn.se/lko).

The Bifurcated Structure of Site Investigations

If feasibility studies were more concerned with surface conditions and the political geology of different municipalities, site investigations re-focus attention on underlying bedrock conditions determining a municipality's suitability for hosting a deep repository. Site investigations can be seen as coinciding with the resumption of a research-driven siting process for a deep repository. After an interlude lasting 16 years (1986-2002), issues of physical access to mu-

nicipal space and local political acceptance have been finally overcome, and SKB's drilling equipment has now once again assumed a position centre-stage in the siting process. There now exists a general expectation that the bedrock conditions in either Östhammar or Oskarshamn (or even in both locations) will, most likely, be deemed 'good enough' to host a deep repository by both SKB and the responsible government authorities (SKI and SSI). While initial test drillings in the early 1980s proceeded with only the informed consent of local land-owners, today's site investigations are being accompanied by highly elaborate EIA procedures.

The key characteristic of SKB's site investigations in Östhammar and Oskarshamn is their *bifurcated* nature. Three different types of government legislation have a bearing on the siting process for encapsulation plant and deep repository (SKB 2003a). The two major forms of legislation are the Act on Nuclear Activities from 1984 and the Swedish Environmental Code (superseding previous environmental legislation) from 1999. In addition, SKB have to apply for general planning permission for both developments from the relevant municipal authority. Current site investigations are in the first instance designed to produce the new technical and geological knowledge required to respond to the rigorous demands for nuclear safety that SKI and SSI are responsible for enforcing in accordance with the Act on Nuclear Activities. Thus, the stakeholders involved in assuring that this legislation is respected are both relatively few in number, and largely predefined by their possession of highly specialised and accredited forms of expertise.

Site investigations are also, however, to form the basis for the preparation by SKB of detailed EIS to be submitted to 'Environmental Courts' (*miljödomstolar*) in respect of the Swedish Environmental Code. Here the possible and expected impacts of the two planned facilities on the natural environment, human health and society are to stand in focus. The question of alternative sitings must be seriously addressed, as must the use of alternative methods for achieving the same technological ends. In addition, the option of carrying out no development at all must be addressed (the so-called zero-alternative) for both an encapsulation plant and deep repository. Compared to the Act on Nuclear Activities, therefore, the potential number of stakeholders involved in guaranteeing that sufficiently comprehensive EIS are prepared appears relatively large. Furthermore, who all these stakeholders are is not at all easy to define in advance of the EIA processes generating the EIS. For this reason, there appears to be a built-in tension in SKB's site investigations in Oskarshamn and Östhammar. Depending upon which government legislation achieves greatest influence over these investigations, stakeholder involvement will either be progressively opened up during the course of investigations, or continue to remain relatively limited and contained. The outcome of the site investigations will in the course of the next year or so, either appear increasingly open, or increasingly predictable. The built-in tension in SKB's site investigations is also heightened by the fact that it is intended to produce single documents where EIS and safety analyses will be attached and wedded to each other, allowing more or less the *same documents* to be submitted for trial/approval by *both* SKI and the Environmental Courts (SKB 2003b). In this ambition, the legitimacy of one style of addressing and responding to government authority clearly risks prevailing over the legitimacy of another.

Therefore, how SKB's site investigations will turn out can be seen to depend upon the extent to which their bifurcated nature is upheld or challenged. Will site investigations continue to focus on the safe implementation of the KBS-3 system of spent fuel disposal in either Oskarshamn or Östhammar with respect to the Act on Nuclear Activities? Or will the EIA process challenge this situation by breathing new life into the 'big issues' of alternative methods of

waste management and alternative sites? Clearly, as far as SKB are concerned the less new life that is breathed into the ‘big issues’ the better. The ‘big issues’ are to remain relatively-speaking non-issues, which are to be understood as already having been settled *prior* to commencement of site investigations. To keep the ‘big issues’ at bay and no threat to their basic mission of implementing the KBS-3 system in either Östhammar or Oskarshamn, SKB have serious reasons for wanting to keep the lid on the EIA process. In this situation the decisive actors during site investigations are likely to be the two government authorities SKI and SSI. Will these two actors be prepared to remain relatively closed away with SKB negotiating nuclear safety with respect to the KBS-3 system, or will they allow themselves to be drawn more into the open, and into the centre of a potentially expanding EIA process?

Keeping the Lid On Versus Taking the Lid Off the EIA Process

In September 2003, SKB published a report containing their suggestions regarding how extensive and broad-ranging the EIA process for a deep repository and encapsulation plant should be during the site investigations in Östhammar and Oskarshamn (SKB 2003b). They also published outline documents proposing and detailing a structure and content for the EIS they are obliged to produce in respect of the two planned facilities (SKB 2003c). After publication, SKB’s suggestions for defining the limits of the EIA process were themselves subject to public consultation in extended EIA meetings. They were also circulated for review by all those municipalities, local organizations, county administrations, government authorities and members of the public who see themselves as implicated in the siting process. SKB’s intention after comments have been collected and collated is to publish a ‘final version’ of their report setting out something like a consensus view of how extensive the EIA process they are in charge of co-ordinating should be. This ‘final version’ was due to be published in the middle of 2004, but now towards the end of 2005, it is still yet to appear. The indications are, therefore, that one means of containing the EIA process being used by SKB is delaying the moment when its scope and limits are officially set. The very act of setting limits risks of course triggering controversy, so delaying their setting may be an attempt to postpone controversy until the limits appear to more or less speak for themselves due to the form the EIA process has already assumed.

SKB’s current approach to the EIA process during site investigations is to focus most attention on 1) informing about the progress of their geological investigations in Östhammar and Oskarshamn and 2) staging discussions with municipalities, local citizens and local organizations concerning the design and construction of a deep repository and encapsulation plant in relation to local health and environmental issues. It is emphasized by SKB that EIA meetings are a valuable opportunity to take account of local citizens’ insights and perspectives, and that they should be characterized by a mutual exchange of knowledge and ideas (SKB 2004: 7). Given the preference of the municipality of Östhammar, discussed above, for treating nuclear waste management as far as possible as an unexceptional activity, it would appear that they can carry few objections to SKB’s current approach to the EIA process. The municipality of Oskarshamn, on the other hand, clearly have reasons for feeling relatively dissatisfied. The current EIA process neither lives up to the ‘Oskarshamn Model’ for local stakeholder involvement, nor to the specific conditions they have laid down governing their participation in a site investigation. The Oskarshamn Model emphasizes openness and involvement in the decision-making process for the municipality. It also stresses that SKB must be pressed into providing clear answers to ‘difficult’ questions. In relation to site investigations, the most ‘difficult’ question to which Oskarshamn require a clear answer is the one concerning the exact criteria by which SKB will decide which site investigated is best-suited for a deep repository (Oskarshamns kommun 2004). Considering the conditions laid down by Oskarshamn

for allowing a site investigation, it is obvious that they want to use the EIA process (their established 'platform') to open up issues of safety, alternative methods and sitings in order to achieve transparency. Just because they see themselves as a long-established ally of SKB in the implementation of the KBS-3 system (first a relatively involuntary ally, but now a more self-determining one), they refuse to be kept in the dark about the technical details of the siting process as the naming of a single site draws closer. While not opposed to the KBS-3 system in which they already have so much invested, the municipality of Oskarshamn is still prepared to challenge the currently bifurcated character of SKB's site investigations. As in the past, the municipality wants to strengthen their position as a stakeholder by mobilizing environmental legislation to loosen the grip of the Act on Nuclear Activities on the siting of major waste facilities. As the municipality of Oskarshamn has explicitly stated they consider SKB's current approach to the questions of alternative methods and sites in the preparation of an EIS as inadequate and insufficient (Oskarshamns kommun 2005). In this connection, Oskarshamn are also prepared to demand of SKI and SSI ('their experts' according to the Oskarshamn Model) that something be done about the situation in the further development of the EIA process. The interesting aspect to follow will be how far Oskarshamn's ambition to enlarge the EIA process will take it beyond what SKB currently intend. Also, if the lid is lifted on the 'big issues' of safety connected to alternative methods and sitings, is there a risk/chance that the EIA process will expand beyond what even the municipality of Oskarshamn desire?

9. Future Uncertainties in the Siting of a Final Repository on the Horizon

In the last few chapters we have seen that final disposal of spent nuclear fuel in Sweden has tended to become a thoroughly localised issue. From the start of SKB's new siting strategy in 1992, municipalities, and later the two municipalities of Oskarshamn and Östhammar, have become very much the focus of attention; first their political geology and more lately, their physical geology. However, as described in earlier chapters, other siting strategies were tried. In the 1950s and 1960s international co-operation was strived for and in the 1970s and early 1980s a systematic science-based siting strategy was considered most relevant. In this last chapter some critical questions about the robustness of the actual Swedish situation are asked and connected to the three themes structuring this report. Is it possible to identify future uncertainties and changing relations in today's situation of final disposal of spent fuel concerning the nuclear power-nuclear waste relationship, the technical vs. political aspects, and the international, national and local focus?

Climate Change, Nuclear Power and Nuclear Waste

Nuclear energy has always been connected to other energy and environmental issues. Today, nuclear proponents are increasingly putting forward the argument that nuclear energy means producing electricity in a sustainable way, combating the greenhouse effect. In Sweden, 87 per cent of the citizens consider an advantage of nuclear power that it produces less greenhouse gas emissions than other energy sources such as oil and coal (Eurobarometer 2005: 35). The former EU commissioner for Energy and Transport puts the relationship between nuclear energy and climate change in a dramatic way:

Either we shut down the nuclear sector and give up on Kyoto, or we do not shut down the nuclear sector and we respect Kyoto. It is as simple as that. Sometimes you have to put it crudely so that people understand (RTD 2004).

However, in the EU Commission Green Paper on secure energy supply it is stated that the future of the nuclear industry 'depends on finding a clear and unequivocal answer to the question of the processing and transportation of radioactive waste' (EC 2002: 7). To be a legitimate contributor to solving the climate change problem the nuclear sector first has to manage its waste problem. And as we all know the waste problem is in deep crisis in most nuclear countries. Therefore, it is considered that the nuclear option can only remain open if all kinds of radioactive waste can be dealt with in a safe and sustainable way. Obviously, nuclear waste management is today in a critical state in many EU nations, and is described as the Achilles' heel of the nuclear industry.

In the European Union, a picture of deep distrust of institutions responsible for nuclear waste management is discernible. 29 per cent of citizens state that they are very worried about the way radioactive waste is handled in their own country, and only 10 per cent trust the information provided by the nuclear industry (Eurobarometer 2002). But there are a few exceptions from this problematic picture. Sweden and Finland are often mentioned as countries that have managed to take care of their nuclear waste in a way that responds to the high demands of both science and democracy. Some figures from a Eurobarometer, published in 2002, called 'Europeans and Radioactive Waste', show us that Sweden is an exception in Europe. According to the survey, trust among the Swedish people seems to be the highest in Europe. Sweden shows the greatest trust in the information provided by the national nuclear industry, compared to all the other member states (Eurobarometer 2002). 59 per cent trust the information, which is provided by the nuclear industry. The average in the 15 EU countries is much

lower (27%). Compared to other EU nations few Swedes are worried about the way radioactive waste is handled in their own country. 29 percent of the respondents state that they are *very* worried about the way radioactive waste is handled in their own country, while in Sweden only 11 percent finds it very worrying. Concerning radioactive waste management in Central and Eastern Europe (at this time called candidate states), 62 percent of the Swedish respondents are very worried about this (average 48%):

	Sweden	Average (EU 15)
Trust in information provided by the nuclear industry	59.5	27.5
Concern about RWM at the national level (very worried)	11.0	29.1
Concern about RWM in the Central and Eastern European countries wishing to join the EU (very worried)	62.6	48.5

Table: The Swedish and EU radioactive waste opinion (percentage) (Eurobarometer 2002)

Thus, Sweden seems to be one of the few countries in the EU that has succeeded in creating public trust for its radioactive waste management (RWM) programme. There seems also to be a good portion of national pride and self-esteem in the Swedish opinion. We know what we are doing, whilst others do not. One possible reason for this result is that in Sweden there does exist a proposed solution to the nuclear waste problem, while many other countries' nuclear waste programmes have been stopped by strong opposition. SFR, CLAB and a final repository for spent nuclear fuel on its way could be presented, both domestically and internationally, as a powerful argument that nuclear waste management works and an Achilles Heel is no more. The Swedish example could be viewed as a strong response to the EU commissioner quoted above and a showcase for those proposing nuclear new build in Europe. In Finland, with a similar success in its nuclear waste management, a new reactor is under construction. Success in both Sweden and Finland may be seen as opening the way for new multinational pacts in the nuclear industry. Climate change and nuclear waste are together framing how the future of nuclear power is assessed.

Changing International/National and Local Focus

According to the timetable provided in the latest SKB R&D programme, an application to construct a final repository for spent nuclear fuel at either Forsmark in Östhammar or Simpevarp/Laxemar in Oskarshamn will be submitted to the government in the year 2008 (SKB 2004b: 30-31). Before the government accept or reject the application, it will be judged by the Environmental Court in respect of the Environmental Code and by SKI and SSI in relation to the Act on Nuclear Activities. After the recommendations of these organizations the municipality has to accept or reject the siting application. Finally the government will judge if the application fulfils the requirements set out in both forms of government legislation.

This means that in 2008, if not before, the issue of final storage of spent nuclear fuel will be raised to the national level again. The Environmental Court is by many pointed out as the most unpredictable player in the formal approval of a final repository. The reason for this is that few cases on nuclear activities have been tested in relation to the Environmental Code. In a recent recommendation (April 2005), however, the Environmental Court has judged if an application from the Ringhals Company, to raise the effect in two of its reactors, fulfils the requirements of the Code. The government has on nine previous occasions approved this kind

of applications (the latest in 1990) but never before when the Environmental Code has been in force.

In its recommendation the Court argued that Swedish nuclear power plants are in breach of the requirements of the Environmental Code, as regards three aspects. One of these is nuclear waste management (Vänersborgs tingsrätt 2005). The aim of the Environmental Code is to support a sustainable society. In fact, the Code is one of the most important tools to achieve this politically decided aim for the Swedish society. The Court pointed out that no facility for the final disposal of spent nuclear fuel is in operation in Sweden today. According to the Court it is doubtful if nuclear reactors, producing nuclear waste dangerous for a hundred thousand years, are fulfilling the intentions of the Code. At least, this is not the case when still no facility exists to take care of the waste, or no approved way to isolate the waste from the biosphere during the needed time span has been finalised. In such a situation, according to the wording of the Environmental Code, it is the government that has to decide if 'another common interest of sufficient weight can balance the environmental case', and then in such an event the Code need not be followed to the letter. In October 2005, the Government decided that such a case exists and that the operation of nuclear power plants in Sweden today should not be seen as in violation of the Code (Swedish Government 2005). However, the Ringhals case shows that the Environmental Court (enforcing the Environmental Code) will be an important, and challenging, player in relation to SKB's application for a final repository for spent nuclear fuel. How the government will handle the tension between the two different kinds of legislation will be of great interest to follow. Perhaps the decision in relation to the Ringhals reactors gives an indication that nuclear power is an activity that according to the government should be allowed to overrule the intentions of the Environmental Code and its focus on recycling and sustainability.

On the international level recent discussions within the European Union on the import and export of radioactive waste are of interest and worth highlighting. Since 1993 national responsibility is part of Swedish legislation, in which prohibition of final storage of foreign waste is stated (SFS 1992:1536). In 1995, this principle was extended to interim storage. Nuclear waste was also an important issue in the negotiations leading up to Sweden's EU membership, which took place in 1995. At this time Swedish legislation was sharpened and it was important for Swedish negotiators to win acceptance that Sweden could not be forced to take care of nuclear waste from other EU member states.

The principle of free trade for goods, services, labour and capital is at the heart of the ambition of the European Union. This principle, part of European Community Law, is also applicable to the Euratom Treaty. A common market for the supply of nuclear fuel is an important ambition of this Treaty. However, according to both European Community Law and the Euratom Treaty national exceptions can be accepted, based on the principles of proximity, self-capacity and priority of recycling (Cramér 2005: 126).

The European Commission is supporting co-operation between member states on nuclear waste on a voluntary basis (Cramér 2005: 135). In a situation where new member states with nuclear power programmes, but no clear plans on how to take care of their waste, will enter the Union, perhaps new solutions and initiatives from the Commission will be taken.

The issue of national responsibility for nuclear waste is a controversial and critical question to the Union. Sweden has for a long time claimed and interpreted the legal situation as that no foreign waste has to be taken care of within its own territory (Cramér 2005: 132). This view is

supported by the IAEA. In 1990 IAEA adopted guiding principles covering the international handling of nuclear waste, based on national responsibility, stating that every nation has the right to prohibit the import of nuclear waste (Cramér 2005: note 70)

National responsibility for the disposal of nuclear waste has for many years been a matter of consensus in Swedish society. Even if no agreement could be reached on whether nuclear activities are good or bad for the nation, or on how and where to store the waste, everyone agrees that Sweden should not take care of waste from other nations, but take care of its own. Given this commitment to national responsibility it is interesting to notice the strong hesitation among Swedish citizens to accept the storage of nuclear waste in their own community. Not more than 10 per cent have a positive attitude to accepting this (Hedberg and Sundqvist 1998). The principle of national responsibility together with a strong national attitude against hosting nuclear waste has forced the nuclear industry to turn to the few nuclear oases that actually exist in Sweden, where attitudes are more positive. Territorially speaking, the waste problem has become a problem for those parts of country most closely associated with the nuclear industry. Only those parts can see themselves with a stake in the solution of the nuclear waste problem. In theory, most Swedes accept the nation's waste as their collective responsibility, but in practice, only a few are prepared to recognize their involvement in finding a working solution. In the Swedish case two tendencies concerning international/national/local interplay could be identified today: i) a local tendency focusing on acceptability (geological as well as political) in Oskarshamn and Östhammar and ii) a discussion in the European Union on the free trade of nuclear waste (and its restriction), and not much in-between. In the coming years this pattern will no doubt change, not least when SKB submit its application in the year 2008. At this time the national level will be more important.

The Social and Technical Divide Revisited: New Demands on Bedrock

While stakeholder involvement in the siting of a final repository after 1992 in Sweden was firstly concerned with achieving local (surface) acceptance for such a facility, and specifying the terms of such an acceptance, it was also concerned with successfully holding at bay and postponing the issue of the deep geological suitability of any site. While after 1992, the political geology of Sweden was mapped from top to bottom regards the feasibility of siting a final repository for spent nuclear fuel, only in the last few years with site investigations in Östhammar and Oskarshamn has physical geology reassumed a central position in the siting process. As physical geology has re-entered the equation, so the nature of stakeholder involvement has been transformed in a number of ways.

An effect of the history of nuclear activity in Oskarshamn and Östhammar is that stakeholder involvement over a final repository can be divided into social and technical issues. Östhammar and Oskarshamn municipality accept that they still lack the competence, confidence and even the motivation to negotiate core issues of safety and alternative methods and sitings. A long-standing feature of their social acceptance of the nuclear industry is that they have been prepared to place their trust in the nuclear industry to successfully manage nuclear safety. You cannot live in a long-standing relationship with a potentially hazardous partner if you do not believe they can control their hazardousness in relation to you. So Östhammar and Oskarshamn out of tradition as part of their social acceptance of a new repository have been prepared to surrender extended involvement in key safety issues. They have been prepared to do this because they also see themselves being able to delegate these safety issues to the government authorities SSI and SKI. These two authorities have been acceptable to the two municipalities as their legitimate 'technological guardians'.

As physical geology re-enters the siting process for a deep repository, Oskarshamn appear more prepared to break with tradition than Östhammar. Oskarshamn are currently demanding transparency from SKB in relation to the exact technical and geological criteria they will use to choose between them and Östhammar as a repository site. In contrast to Östhammar, Oskarshamn are preparing with the expected help of SKI and SSI to dispute their geology and its relation to nuclear safety with SKB if they consider it necessary. If Oskarshamn act to draw safety issues in relation to alternative methods and sitings into the EIA process where might this lead?

In January 2002, a headline in Dagens Nyheter, Sweden's most important daily paper, announced: 'Worst Sites Chosen'. In an article signed by nine people – two geologists, one political scientist, and six representatives of environmental organizations – it is argued that new findings in geo-hydrology conclude that the best site for long-term storage of nuclear waste is an inflow area (recharge area). Such areas are usually located at inland sites characterized by groundwater inflow (Holmstrand et al. 2002). However, the sites proposed by SKB as most promising for site investigations are outflow areas, located in coastal areas (Oskarshamn and Östhammar), while the site investigated in the Hultsfred feasibility study, judged by SKB as being of less importance, is in an inflow area.

According to the article, the reason behind SKB's choice of sites has not been to find the best bedrock conditions, but to achieve political acceptance. SKB has been granted the right to independently select sites, as well as set its own selection criteria, and therefore it has chosen sites where social acceptance seems most assured. Hence, the ambition is only to find 'good enough bedrock'. From the perspective of geo-hydrology and long-term safety criteria the proposed sites are among the worst possible. Obviously, the site investigations should be carried out where the physical prerequisites are presumed to be the most promising in order to fulfil safety criteria. This is however not the case in Sweden today. According to new research findings, supported by the Swedish Nuclear Power Inspectorate (SKI), it is evident that inland sites have a better safety potential, but such sites have not been chosen. On the contrary, such sites have been consciously avoided by SKB. The article concludes that the selected sites can not be defended with reference to the available scientific evidence.

As described above, Hultsfred is mentioned as the most promising alternative from a geo-hydrological point of view. In its review of SKB's choice for site investigations, the Municipality of Hultsfred is strongly critical.

In an argument where, from the standpoint of final storage short-sighted private and public economic considerations predominate, SKB declares it to be sufficient that the bedrock be 'good enough'. Hultsfred Municipality does not share this opinion. Safety is uniquely important. The siting process must not focus on seeking acceptance at the expense of finding an absolutely safe location... To therefore dismiss test drillings in Hultsfred by saying that the Municipality is geologically similar to Oskarshamn, and that no more information is needed to assess the suitability of 'Småland-granite' is clearly mistaken in that regard... Of course it's not possible to draw conclusions about safety from the level of social acceptance, though it certainly is interesting from the business point of view. Or are we to suppose that the safest spot is located in the municipality which just happens to have the highest percentage of yes-sayers? (Hultsfreds kommun 2001)

From the arguments put forward in the Hultsfred review as well as in the Dagens Nyheter article we can notice that some currently peripheral stakeholders, i.e. environmental organizations and a municipality not part of site investigations, want to render safety issues relating to alternative methods and/or sitings more open to debate in the site selection process. They want to engage in a politics of safety in relation to matters of geology and technology.

As was already mentioned in the Dagens Nyheter article, the issue of inflow-outflow areas was first raised by a research project supported by SKI. Later SSI has followed up these concerns in its review of SKB's R&D programme from both 2001 and 2004 insisting that SKB should make comparisons of sites, and assess the importance of recharge and discharge conditions. This has been done by SKB in several studies, but these have been assessed by SSI as inadequate studies (SSI 2004, 2005). This conflict between SKB and the authorities is similar to the one that occurred during the late 1980s and early 1990s in relation to the choosing of locations for feasibility studies. In its over 400 page R&D programme from 2004, SKB does not say a single word about the inflow-outflow area issue. The studies demanded by the authorities have been published in less important technical reports (e.g. SKB 2003d) but not followed up and referenced in the much more important R&D programme. Apparently, SKB are not prepared to jeopardize the choice of Oskarshamn and Östhammar as their two main candidate sites for a final repository.

In 1995 the government decided that municipalities chosen for feasibility studies as regards an encapsulation plant or deep repository be offered financial assistance from the Nuclear Waste Fund. In 1996 the legislation was altered to confirm this (SOU 2002:46, p.124). In 2004, a similar change was made in order to offer financial support to non-governmental organizations participating in the EIA process connected with site investigations. As environmental groups now enter the process (three groups were granted funding in the first round – 2005) the character of site investigations may change. A different understanding of what should be subject to stakeholder involvement is now on the table, but how exactly this will influence the process is still too early to say. The group most visible so far, the Swedish NGO Office for Nuclear Waste Review (MKG), has published, however, a thorough review of SKB's R&D programme from 2004. In this it is obvious that the Group wants to focus on a more strict assessment of a proposed final repository in relation to the requirements stated in the Environmental Code, that the suitability of a site should be determined by its ability to protect human health and the environment, which places substantial demands upon the site chosen. Moreover, according the Code the best available technology should be used and alternative technology presented. According to the MKG, SKB are not fulfilling these requirements in respect of the Environmental Code. The KBS method as well as the two sites in Oskarshamn and Östhammar are not chosen in relation to these requirements (MKG 2005). MKG, therefore, seems unwilling to proceed on the assumption that a final repository should be sited in either Östhammar or Oskarshamn, without detailed comparisons with other sites being carried out.

Conclusion

Internationally, Sweden is often pointed out as a nation unlike other nuclear nations due to the fact that it has already succeeded in achieving a relatively high degree of success in the practical tasks of nuclear waste management. In contrast to other countries, the Swedish nuclear waste system already boasts a couple of major facilities which will soon have been in operation for as long as 20 years. Although, the jewel in the nation's nuclear waste disposal crown, a final repository for spent nuclear fuel, has yet to be sited, the process supporting this appears, again to be progressing in a relatively smooth and consensual fashion.

In this report we have attempted to show the development of stakeholder involvement in the siting of a final repository for Sweden's spent nuclear fuel as resembling something other than a straightforward linear process of improvement and refinement. Stakeholder involvement has developed, over the past 15 years or so, in something more like a patchwork of different shapes and forms. In this last chapter we have pointed to some of the forces that may well

contribute to the further elaboration of the patchwork of stakeholder involvement, contingently modifying once more its overall colour and orientation. We have raised questions about whether the European Union will become an important stakeholder in Swedish waste management, if climate change means new opportunities for nuclear power, if the national government and the Environmental Court will grow stronger as stakeholders, if environmental organisations will succeed in re-opening the big issues of method and site for a final repository, and if the strong social-technical divide will dissolve.

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Appendix 1

Glossary of Abbreviations:

AKA	Spent Fuel and Radioactive Waste (Använt kärnbränsle och radioaktivt avfall) – Swedish Government Committee, 1972-1976
ASEA	Allmänna Svenska Elektriska Aktiebolaget (Swedish Electrotechnical corporation, today Asea Brown Boveri, ABB)
CLAB	Central interim storage facility for spent nuclear fuel (Oskarshamn, Sweden)
EIA	Environmental Impact Assessment
EIS	Environmental Impact Statement
EU	European Union
FOA	Swedish State Military Research Institute (Försvarets forskningsanstalt)
IAEA	International Atomic Energy Agency (UN)
KBS 3	Technical plan for final storage of non-reprocessed spent nuclear fuel (Sweden)
MKG	The Swedish NGO Office for Nuclear Waste Review
NGO	Non Governmental Organizations
OKG	The Oskarshamn Power Group
R&D	Research and Development
SFR	Final repository for low- and intermediate level waste (Forsmark, Sweden)
SKB	Swedish Nuclear Fuel and Waste Management Co.
SKI	Swedish Nuclear Power Inspectorate
SKN	Swedish National Board for Spent Nuclear Fuel (discontinued in 1992)
SGU	Swedish Geological Survey
SSI	Swedish Radiation Protection Authority
TMI	Three Mile Island (US nuclear power station)
UN	United Nations

Appendix 2

Swedish Nuclear Facilities

Commercial Nuclear Reactors:

Barsebäck 1	1975-1999
Barsebäck 2	1977-2005

Forsmark 1	1980-
Forsmark 2	1981-
Forsmark 3	1985-

Oskarshamn 1	1972-
Oskarshamn 2	1975-
Oskarshamn 3	1985-

Ringhals 1	1976-
Ringhals 2	1975-
Ringhals 3	1981-
Ringhals 4	1983-

Nuclear Waste Facilities:

SFR	1988-
CLAB	1985-

Appendix 3

Key Players (2006):

Avfallskedjan – the Waste Network
The Environmental Court
EU – the European Union
Kalmar County Administration
MKG – the Swedish NGO Office for Nuclear Waste Review
The Municipality of Hultsfred
The Municipality of Oskarshamn
The Municipality of Östhammar
SKB – Swedish Nuclear Fuel and Waste Management Company
SKI – Swedish Nuclear Power Inspectorate
SSI – Swedish Radiation Protection Authority
Swedish Government
Uppsala County Administration

Appendix 4

Chronology of Key Events:

1945	Swedish National Defence Research Institute (FOA) starts an investigation to develop the possibilities of producing nuclear weapons
1946	Swedish Atomic Committee set up
1947	The Swedish Atomic Energy Co. formally registered
1954	The R1 reactor in the city of Stockholm started to operate
1959	The R 2 reactor in Studsvik started
1963	The Ågesta reactor south of Stockholm in operation
1965	OKG sign a contract with ASEA Atom on the first Oskarshamn reactor
1968	Sweden join the UN non-proliferation-treaty (the end of the Swedish 'freedom of action-treaty')
1972	The first commercial reactor in operation (Oskarshamn 1)
1972	Nuclear waste for first time discussed in Swedish Parliament as a serious problem
1972	The set up of the AKA Committee (completed 1976)
1976	A new Government elected, led by a Prime Minister with a mission to stop expansion of nuclear power
1977	The Parliament decides on the Nuclear Power Stipulation Act, requiring an absolute safe disposal of nuclear waste before new reactors are fuelled
1977	SKB presents the KBS concept
1977-1985	SKB site investigations (test drillings) – strong local conflicts
1979	Government approve SKB's application to construct CLAB
1980	March 23, National Referendum on the future of Swedish nuclear power programme
1980	National Parliament decides on an expansion of the Swedish nuclear power programme (up to 12 reactors) and that all reactors must be phased out until the year 2010
1981	New legislation on the financing of nuclear waste disposal (based on 'polluter pays principle')
1983	Government approve SKB's application to construct SFR
1984	The Parliament passes the Act on Nuclear Activities (replacing the Stipulation Act)
1985	CLAB in operation
1988	SFR in operation
1992	The SKB letter to all Swedish municipalities asking for volunteers posted
1993-2000	SKB conducts 8 feasibility studies
1995	Government decision to financially compensate municipalities participating in feasibility studies
1997	Swedish Government decides to phase out the first reactor (Barsebäck 1) and to remove the year 2010 as the final date for the Swedish nuclear programme. Reactors should be phased out at a pace that is not disturbing Swedish energy supplies
2002	Site investigations start in Oskarshamn and Östhammar
2006	SKB plan to apply for constructing an encapsulation plant
2008	SKB plan to apply for constructing a final repository for spent nuclear fuel