SKI Report 01:24

Research

Final Disposal of Spent Nuclear Fuel in Sweden

Some Unresolved Issues and Challenges in the Design and Implementation of the Forthcoming Planning and EIA Processes

Hólmfríður Bjarnadóttir
Tuija Hilding-Rydevik

June 2001

ISSN 1104-1374
ISRN SKI-R-01/24-SE

SKI's perspective

Background

Since the early 90:ies the Swedish Nuclear Fuel and Waste Management Co., SKB, is actively searching for a suitable site for a repository for spent nuclear fuel. The siting process engages also SKI, other authorities, municipalities, NGOs and others.

An important component in the siting and future licensing is the environmental impact assessment, EIA, which SKB must conduct. As a regulator SKI has an important role in the siting and licensing and actively promotes the development of open and transparent decision making.

Aim

The aim of this project was to systematically review experiences from other countries and from other large development projects, with focus on public involvement. Issues for consideration in the design of the EIA and decision-making processes for siting the repository were to be highlighted.

Results

The project has achieved the aims and a number of issues for further discussion and investigations have been reported.

Effects on SKI's activities

The project supports SKI's attitude towards transparency, public involvement etc. but also identifies several issues that must be considered when SKB's siting process proceeds to the next phase (site investigations with deep drillings). Among these issues are the co-ordination of different planning and EIA processes and the "management" of these processes over long periods of time (several years). Furthermore, the project highlights the need for SKI to establish competence for the review of SKB's EIA.

Need for further research

It is clear that further research will be needed in this field, since experience will increase as the siting process proceeds and since EIA is generally increasingly important.

Project information

Magnus Westerlind has been responsible for the project at SKI.

SKI ref. 14.9-0013032/00209

SKI Report 01:24

Research

Final Disposal of Spent Nuclear Fuel in Sweden

Some Unresolved Issues and Challenges in the Design and Implementation of the Forthcoming Planning and EIA Processes

Hólmfríður Bjarnadóttir
Tuija Hilding-Rydevik

Nordregio
Box 1658
S-111 86 Stockholm

June 2001

SKI Project Number 00209

Content

Summary

Background, aim and realization

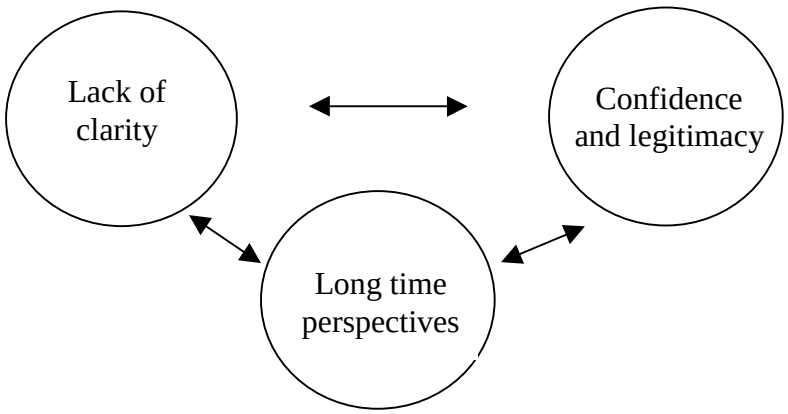
The aim of the study is to highlight some unresolved and challenging issues in the forthcoming approximately six year long Environmental Impact Assessment (EIA) and planning process of the long-term disposal of spent nuclear fuel in Sweden. Different international and Nordic experiences of the processes for final disposal as well as from other development of similar scope, where experiences assumed to be of importance for final disposal of nuclear waste, have been described. Furthermore, issues relating to 'good EIA practice' as well as certain aspects of planning theory have also been presented. The current Swedish situation for the planning and EIA process of the final disposal of spent nuclear fuel was also been summarized. These different 'knowledge areas' have been compared and measured against our perception of the expectations towards the forthcoming process, put forward by different Swedish actors in the field. The result is a presentation of a number of questions and identification issues that the authors consider need special attention in the design and conduction of the planning and EIA process.

The study has been realized through a literature survey and followed by reading and analysis of the written material. The main focus of the literature search was on material describing planning processes, actor perspectives and EIA. Material and literature on the technical and scientific aspects of spent nuclear fuel disposal was however deliberately avoided.

Results and conclusions

There is a wealth of international and Swedish literature concerning final disposal of spent nuclear fuel – concerning both technical issues and issues concerning for example public participation and risk perception. But material of a more systematic and comparative nature (relating to both empirical and theoretical issues, and to practical experiences) in relation to EIA processes and communicative planning for final disposal of spent nuclear fuel seems to be more sparsely represented.
Our perception of issues that need attention in the design and implementation of the forthcoming process for the final disposal of nuclear waste in Sweden can be summarized in three distinct, but interlinked, issues namely – uncertainty of how to design the forthcoming planning and EIA-process, how to achieve confidence and legitimacy for actors and processes, and the long time span of the planning process. The issue of uncertainty concerns the high expectations of the forthcoming process in relation to the actual paucity of existing proposals put forward concerning how, in practice, to go ahead with the process. Although the overall picture is clear, it is moreover difficult for an outsider to grasp how the design of the process will come about and what roles different actors will have, on a more practical level, in this process. Even if we can assume that the developers have 'good and honest intentions' as regards the forthcoming process, the knowledge level concerning planning processes in general does not seem to match the level of knowledge as regards physical disposal itself. Thus there seem to be room for further development of this knowledge area in connection with the final disposal of nuclear waste.

Another characteristic aspect of the process is the importance attached to achieving the stipulated levels of confidence and legitimacy, both for the process itself and as regards the different actors participating in the process. The need for trust and legitimacy is naturally important for other planning and EIA processes, e.g. concerning disposal of hazardous waste. However, the issue of final disposal of nuclear waste poses some extra challenges due to its history concerning public opposition and perceived connection to nuclear power.



A third factor that affects the confidence and legitimacy of the process is the long time perspective under which the planning process is conducted.
The following questions summarizes what we consider unresolved and challenging issues in the forthcoming process of final disposal of nuclear waste:

- Several potential EIA processes – risks duplication and a lack of clarity?
- How many different planning arenas, besides those focused on EIA, will there actually be?
- What level of legitimacy is to be expected for the EIA process in relation to other planning- and decision processes?
- Is it possible to design clear and understandable links between the several possible planning processes?
- The three roles of SKI – will they in themselves pose a legitimacy problem?
- Is there a major risk that SKB will be perceived to have a too dominant role in the forthcoming process causing negative impacts on the communication process?
- How are inputs from the various actors going to be addressed in the process?
- What level of knowledge exists to design, review, coordinate and lead communicative processes, in the municipalities, and at the County Boards, within SKB and SKI?
- How are coordination functions going to be undertaken with regard to already ongoing public consultations in the municipalities, in particular with regard to the forthcoming early consultations in connection with notification to the County Boards?
- What will be the content of the Environmental Impact Statement (EIA document)
- Does the necessary capacity exist to review the EIS at the County Boards, Environmental Courts, at SKI and SSI?
- Can SEA contribute in this context?
- Given the high level of expectation surrounding the EIA process, will transparency and consultation suffer at the hands of the already acknowledged lack of clear guidance in the legislation?

Sammanfattning

Bakgrund, syfte och genomförande

Syftet med studien är att lyfta fram olösta frågor och utmaningar i den kommande, cirka 6 år långa, planerings- och miljökonsekvensbeskrivnings (MKB)-processen för slutförvar av använt kärnbränsle i Sverige. Olika internationella och Nordiska erfarenheter av processer för slutförvar och processer för andra utvecklingsprojekt av liknande slag, där erfarenheterna kan vara av betydelse för slutförvarsprocessen, har samlats in och beskrivits. Vidare har s k god MKB-sed beskrivits tillsammans med olika planeringsteorier. Den svenska situationen för planeringen och genomförandet av MKB-processen i samband med slutförvar av kärnbränsle har sammanfattats. Vi har jämfört dessa olika ”kunskapsfält” å ena sidan med vår uppfattning av olika aktörers beskrivning och förväntan av den kommande svenska processen å andra sidan. Resultatet av denna jämförelse presenteras som ett antal frågor för vilka vi bedömer att det finns anledning till särskild uppmärksamhet i utformningen och genomförandet av den svenska processen för slutförvar av kärnbränsle.

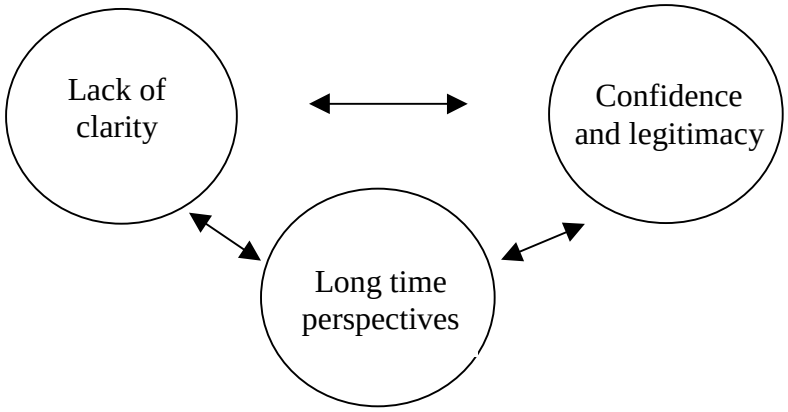
Studien har genomförts som en litteraturstudie med insamling av material bl a genom litteratursökning i olika kanaler. Litteraturen har lästs och analyserats. Litteratursökningen fokuserades främst på material om planeringsprocesser, aktörsperspektiv och MKB. Litteratur om tekniska och naturvetenskapliga aspekter av slutförvar av kärnbränsle inkluderades inte.

Resultat och slutsatser

Litteraturöversikten visade en stor rikedom på litteratur rörande slutförvar av kärnbränsle – både när det gäller tekniska och naturvetenskapliga frågor som frågor om allmänhetens deltagande och riskuppfattning. Men vi fann mycket litet material som mer systematiskt och ur ett jämförande perspektiv, baserat såväl på empiriskt och teoretiskt material som på praktiska erfarenheter, beskriver och analyserar resultat från MKB och kommunikativa planeringsprocesser i relation till slutförvar av kärnbränsle.

Vår uppfattning om frågor som kräver särskild uppmärksamhet i utformningen och genomförandet av den kommande slutförvarsprocessen i Sverige kan sammanfattas i tre tydliga, men kopplade, kategorier nämligen – oklarheter om hur den kommande planerings- och MKB-processen ska utformas, hur man kan åstadkomma tillit och legitimitet för aktörer och processer samt den långa utsträckningen i tid för processen. Frågan om oklarheter i den kommande processen avser dels de höga förväntningarna parad med bristen på förslag hur processen faktiskt kommer att genomföras i praktiken. För författarna av denna rapport, som står utanför processen och inte har tidigare erfarenhet av slutförvarsfrågor, och läser dokumenten är det svårt att förstå vad som i praktiken kommer att hända och vilka roller olika aktörer kommer att ha. De övergripande målen för processen är dock helt klara vad gäller t ex omfattande samråd och transparens i planeringsprocessen. Vårt intryck är dock att det finns utrymme att förbättra kunskapsnivån avseende planeringsprocesser, särskilt avseende s k kommunikativa planeringsprocesser, till samma nivå som för de tekniska och naturvetenskapliga aspekterna av slutförvar av kärnbränsle. Frågan om tillit och legitimitet för planeringsprocessen och dess aktörer är inte speciell för slutförvar av

kärnbränsle. Men att åstadkomma detta i den kommande svenska planerings- och MKB-processen utgör en större utmaning jämfört med andra frågor p g a frågans natur och bl a den historia som finns av allmänhetens motstånd och den koppling till kärnkraft som ofta görs.



En tredje faktor som påverkar både osäkerhetsnivån och möjligheten att skapa tillit och legitimitet är den långa planeringstiden. De följande frågorna sammanfattar de oklarheter och utmaningar vi bedömer kräver extra uppmärksamhet i planering och genomförande av den kommande planerings- och MKB-processen för slutförvar av kärnbränsle i Sverige, utifrån de perspektiv vi studerat:

- Det finns flera möjliga MKB-processer – finns det risk för duplicering och oklarheter?
- Hur många olika planeringsarenor, förutom de som är fokuserade på MKB, kommer det att finnas i praktiken?
- Vilken legitimitet kan förväntas för MKB-processen i relation till andra planerings- och beslutsprocesser?
- SKIs tre roller – finns det risk för legitimitetsproblem?
- Finns det en risk att SKB kommer att få en för dominant roll i den fortsatta processen så att negativa konsekvenser kan uppstå för kommunikationen mellan aktörer?
- Hur kommer resultaten från samråden att tas om hand?
- Vilken kunskapsnivå finns som grund för utformning, granskning, koordinering och ledning av kommunikativa processer – i de berörda kommunerna, på berörda länsstyrelser, inom SKB och SKI?
- Hur ska de i kommunerna redan pågående samrådsprocesserna koordineras med det kommande tidiga samrådet i samband med anmälan till Länsstyrelsen?
- Innehållet i MKB-rapporten.
- Finns det tillräcklig kapacitet, vilja och kompetens att granska MKB-dokument vid de berörda Länsstyrelserna, miljödomstolarna, SKI och SSI?
- Behövs SEA i detta sammanhang?
- Med tanke på de uttalat höga förväntningarna på MKB-processen kommer samrådsambitionerna och önskemålen om transparens i processen att kunna åstadkommas i praktiken bl a med tanke på de relativt vaga riktlinjerna i lagstiftningen?

1 Background and introduction

The Swedish Nuclear Fuel and Waste Management Company (SKB) has carried out feasibility studies on possible locations for a deep repository (SFL) for spent fuel since 1993. In November 2000 a number of these sites were chosen for further investigation and test drilling. In addition, a further site was chosen as the location for a new safety assessment. Test drillings will be conducted in connection with the site investigations, and will start in 2002 or 2003. The total length of time taken from the start of drilling until the delivery of the application for construction of the repository is estimated to be about 6-10 years. The application for the construction of a spent nuclear fuel repository requires an Environmental Impact Assessment (EIA) in accordance with the Environmental Code (1998:808). In addition, there are requirements on the disposal of spent nuclear fuel included in the Act on Nuclear Activities (*Kärntekniklagen 1993),* and in the Radiation Protection Act (*Strålskyddslagen 1993).* Furthermore, requirements on Environmental Impact Assessment are included in the *Council Directive 97/11/EC of 3 March 1997 amending Directive 85/337/EEC on the assessment of the effects of certain public and private projects on the environment* where one of the project categories listed in the EIA Directive concerns facilities designed for the permanent storage and disposal of radioactive waste. The amendments introduced to the directive in 1997 also adds; "*Installations designed solely for the storage (planned for more than 10 years) of irradiated nuclear fuels of radioactive waste in a different site than the production site*".

The assumption behind, and thus the point of departure for this study is that from an EIA point of view, both a more comprehensive view, and a greater understanding of this type of process are needed given the new developments in terms of the Swedish disposal of spent nuclear fuel. Research on the technical issues surrounding spent nuclear fuel depository has been ongoing for decades, and studies have been carried out for certain elements of the disposal process. However, what becomes quickly apparent is that only a rather limited number of studies have so far been carried out on the decision making process in general, as it relates to this issue.
The initial assumption held by the authors at the start of this study is that knowledge of decision making processes, particularly in the field of Environmental Impact Assessment and public participation, would significantly contribute to the creation of such an improved understanding, thus assisting in the design of forthcoming process. The uniqueness of the issues included in the process of disposing of spent nuclear fuel stem from the hazardous nature of the substance itself, the length of the process and the scope of the disposal concept and the public's sensitivity to issues relating to nuclear power. From an EIA point of view, the disposal process presented particular challenges, in particular with regard to its magnitude, both in terms of financial stakes involved, and the long time scales envisaged for the decision making process, as well as to the multitude of actors involved, and to the sensitive nature of such developments.

> *"The program that the Environmental Impact Statement must address is unprecedented for a federal project in its scope, time frame, and the geographical area it encompasses. It is also unique in that the EIS must address not only the more traditional effects of a large and complex project - impacts to the environment, to public health and safety, to area populations, and to state and local economies - but the EIS must also address those impacts that derive from the highly controversial nature of this activity and the fact that the program involves*

the handling, movement, and storage of nuclear materials. […] To be adequate, the final EIS must reflect this unique and unprecedented scope of analysis" (State of Nevada, 1995).

Changing societal conditions in the process of decision making, including increased demands for transparency within the decision making process, pose new challenges such as whether decisions relating to *"when and how to implement geologic disposal, will need a thorough public examination and involvement of all relevant stakeholders"* (NEA, 2000[1]). These include waste producers, regulatory agencies, different tiers of government, political representatives, the general public and interest groups and decision makers.

Aim

The aim of the study is to contribute to the ongoing discussions on the design and implementation of the planning processes in connection with the Environmental Impact Assessment aspects of the long-term disposal of spent nuclear fuel in Sweden. The identified aims of the project were:

- To describe the experiences of other planning processes that bear a resemblance to the forthcoming Swedish process.
- To analyse these experiences in order to identify and understand the crucial issues in environmental assessment and the repository process for spent nuclear fuel, particularly as it relates to the issue of public participation and consultation.
- To draw conclusions from such applicable experiences for the forthcoming process in a Swedish context.
- To lay out the background to the current Swedish situation as it relates to the disposal of spent nuclear fuel.

In addition to these stated aims, it was also the desire of the authors to encourage new input into these discussions from researchers with a thorough knowledge of Impact Assessment and planning, though without any previous experience in the field of the final disposal of spent nuclear fuel *per se*.

The main emphasis of the analysis and conclusions herein therefore focuses on the project phase commencing from the current situation (after SKB identification of potential host communities) up until site selection, in 2007.

Preconceptions

During the design phase of the study, assumptions were made about the most important questions to highlight. On the basis of preliminary data gathering, the following issues were considered to be of particular importance regarding the application of environmental assessment procedures to the site investigations:

- The issue of time
  When is it appropriate to start the EIA process - including public participation and consultation? What are the challenges involved in conducting such a long-term process, and in maintaining realistic levels of interest in the process and in the

relevant issues for such a long period of time? Does the existence of such a long time span put new demands on the choice of facts and materials presented? How is the issue of the changing nature of the stakeholders and the 'renewal' of a concerned public to be dealt with? Furthermore, questions regarding the ethical issues relating to the long time span arose with respect to the effects on future generations, in particular regarding decisions taken on their behalf, and on the permanent status of such decisions, i.e. should disposal material be retrievable in order to allow scope for future generations to review the process as a whole?

- The sensitivity and magnitude of the issue and the complexity of the entire disposal system
  What is the effect on the natural environment of the spent nuclear fuel? What are the risks of radiation involved with the material in question? Does the nature of the substances involved demand a particular management regime? What bearing does the magnitude of the project, the financial stakes involved, the size of the installations, and the long term nature of the processes involved, have on the nature of participation and consultation during the process as a whole? Furthermore, how does the complexity of the disposal system affect understanding and participation in the process?

- Determining the possible applicability of previous EIAs and SEAs from other sectors
  Are there examples of EIAs that have been conducted in this sector? How was the EIA methodology applied to the process? Where were such studies conducted? And at what stage of the process? What can be learnt from developments relating to other processes that are of a similar nature with regard to time-span and magnitude of issues, even where such projects can be found in other sectors? (i.e. outwith the area of spent nuclear fuel disposal). Furthermore, has the methodology of Strategic Environmental Assessment (SEA) been applied to the process?

Realization of literature study

The literature search was conducted in two parts; an initial search was undertaken on Internet, this was then followed up by a thorough search of the publications and literature at hand, including a data base search, carried out with the help of the search facility provided at the Swedish Royal College of Technology. The focus of this search was defined by the initial assumptions of the project, focusing on the main issues that should be addressed in the process of spent nuclear fuel disposal. This was accompanied by a complementary search as the focus of the study took shape. The main areas searched addressed experience of disposal of spent nuclear fuel, participation of different actors, with particular emphasis on public participation. Furthermore, a search was made on the issues of planning processes and decision making. These areas of connectivity were sought in the general literature on the subject, and in more specific research reports, and reports and studies carried out by various interested organisations and authorities. Material and literature on the technical and natural science aspects of spent nuclear fuel disposal was however deliberately avoided.

The material found on the subject can be divided into three main areas:

- Swedish material
  Including official material from SKB, both printed and electronic, such as the RD&D Programmes (in particular RD&D 98 presenting a detailed programme for research and development 1999 - 2004), feasibility studies carried out in the pilot municipalities and the SKB *'Integrated account of method, site selection and programme for the site investigation phase'*. Furthermore, material such as reports published by SKB and the regulatory authorities SKI and SSI on particular issues such as the coverage of alternatives in the decision making process, overviews of the management of nuclear waste in other countries, and the proceedings from various seminars and conferences was also used. A substantial amount of literature has also been published in the Swedish Official Report Series (SOU), prepared by the National Council for Nuclear Waste (KASAM). This resource mainly consists of proceedings from international and national seminars on different aspects of nuclear waste disposal. Another useful source of information in this regard has been the *Special advisor on nuclear waste disposal (Särskilde rådgivaren inom kärnavfallsområdet - En resurs inom Regeringskansliet (Miljödepartementet)).* Some material has also been assembled in connection to work carried out by the municipalities, in particular as a result of the 'MKB forum' in Kalmar County, where the municipality's vision of nuclear waste disposal is illustrated. This material also includes the results of opinion surveys carried out among the inhabitants of the municipality. Examples of such Swedish studies that have been conducted as a part of a site selection process, and further studies that seek to address the issues that should be examined at this study stage, include for example, reports such as the, *Avgränsningar av frågeställningar inför platsundersökningsskedet* (MKB-forum i Kalmar län, 2000).

- Articles from conferences, published in journals and in other research contexts
  Proceedings from international conferences and seminars on nuclear energy and radioactive waste include papers that address various aspects of the spent nuclear fuel disposal process, such as the role of stakeholders in the process, health aspects, participation and dialogue in the process, risk analysis and confidence in the process. A broad range of articles on decision making and planning theory were also assembled from the core literature contained in various journals and monographs in this area. Articles dealing with the lessons learned from the planning processes of other projects, as well as from the undertaking of an EIA as part of the spent nuclear fuel disposal process, were retrieved from such sources.
  The findings of a comparative study on '*The role of EIA in the planning and decision making process of big development projects in the Nordic countries'* currently being finalized by Nordregio has also made a useful contribution to the collected research material. The study consists of cases from each of the Nordic countries, each of which is analysed within the context of decision making theory in political science. In particular, the Finnish case directly relates to the issue of the spent nuclear fuel depository, and is itself partly based on the results of another concurrent research project, the aim of which was to come to an understanding of the social and decision making processes involved in such activities, and to present an analysis of the findings from a political science perspective.

- Reports and other materials from international organisations, state and independent agencies and organisations

Various publications are available from international agencies, such as the Nuclear Energy Agency/OECD and the Uranium Institute (The International Industrial Association for Energy from Nuclear Fuel). These include compilations of progress in different countries, national practices, proceedings from events organised by the agencies as well as information on the development of approaches for radioactive waste management strategies. International organisations such as the International Atomic Energy Agency and RasaNet provide national and regional updates on the practices of spent nuclear fuel disposal. Information is also available on the European Commission's (DG Energy and Transport) Radioactive Waste Management (R.W.M.) web-site [http://europa.eu.int/comm/energy/en/nuclearsafety] that provides information on the main issues of radioactive waste management, international conventions and instruments, and public information and involvement. National governmental agencies in other countries, such as the Finnish Center for Radiation and Nuclear Safety (STUK) in Finland, the NRC in the United States, the Canadian Environmental Assessment Agency (Panel), the US Department of Energy, and the U.S. Nuclear Regulatory Commission (NRC) were also of use in the collection of materials.

- Conventions and legislations
  National legislations regarding management of spent nuclear fuel, relevant EC directives and international conventions, e.g. the Join Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management, Aarhus Convention and the Espoo Convention.

Main themes identified

The balance of the reference literature seemed to roughly fall into the following categories:

- Decision making processes in relation to disposal of spent nuclear fuel.

These issues are addressed in the reports published in the Swedish Official Report Series (SOU), which are themselves based on conferences and seminars. They examine particular aspects of the disposal of spent nuclear fuel; such as safety issues, acceptance and participation in the disposal process, as well as investigating the perspectives of the different stakeholders in the process. The earlier reports focus, to a considerable degree, on establishing the necessary framework for the launch of the disposal process in Sweden, and what can be learned from other countries regarding issues that need special attention etc.

- EIA processes in relation to disposal of spent nuclear fuel.

In the global EIA literature, special attention has been given to public participation and consultation in numerous projects and reports. A study has been conducted under the auspices of the DG Environment, investigating the scope and application of EIA legislation and current EIA practice across the member states and the applicant countries of Central and Eastern Europe, specifically in relation to the geological disposal of radioactive waste (O'Sullivan et al., 1999). Projects have also been conducted in relation to the planning and decision processes connected to major development projects. Major development projects pose special demands on planning and decision processes, as they often tend to be highly politicised, and therefore very

politically sensitive. Within this area studies are available both with specific reference to the Swedish situation, and to international developments more generally. The SKB's RD&D programme examines the issue of environmental impact assessment of spent nuclear fuel disposal as it relates to the situation of Swedish waste producers in particular. Examples of the application of EIA processes to the disposal of spent nuclear fuel were also found in the North American literature, such as the decision making process of EIA used in relation to the location of a geological repository in Nevada, and the assessment of the method of spent nuclear fuel management in Canada.

- Risk analysis and communicating risk

A significant portion of the literature uncovered on the issue of risk was directed towards the technical aspects of safety analysis. (Issues that it was decided from the outset would not be included within the ambit of this report). This material also includes proceedings from a seminar where the relationship between the specialist knowledge and the communication of such risk to the general public was investigated, as well as the ethical issues involved in risk analysis and assessment. Furthermore, examples could also be found of the analysis of individual cases, and the role that management played in those specific examples, as well as analyses of differing cultural approaches to the perception of risk.

- Actors and stakeholders

The material uncovered relating to these issues included that which dealt with aspects of the roles of different stakeholders in the Swedish spent nuclear fuel disposal process. Proceedings from a conference on the decision making process and the creation of arenas for the actors involved in the processes showed that such things differ between the participating countries and across their decision making systems.

- Comparative National Systems

International overview studies have been conducted on the usage of nuclear energy and how spent nuclear fuel is managed in different countries, and the different methods available internationally. A study was conducted in 1999 on behalf of the European Commission, (DG Environment) on the demands made in the EU directive 97/11/EC for the final disposal of nuclear waste. Furthermore an overview of the national implementation of EIA requirements is also provided.
The European Commission's Radioactive Waste Management web-site also provides an overview of current policy and research on radioactive waste management in the European Union. Namely, which areas are being studied, and how the application of the EIA process is proceeding in such cases. Apart from the overview of the legal implementation of the EIA directive, a comparative study, specifically targeting the practices surrounding EIA implementation across different countries could however not be found.
Some cooperation has taken place between the Nordic countries, mainly with regard to the exchange of information on current issues and practices within the framework of NKS (Nordic Nuclear Safety Research), which has itself conducted a nuclear waste programme during the period 1998 – 2001.

- Ethical issues

'Ethical perspectives' with regards to disposal of spent fuel has been raised in both international (NEA/OECD) and Swedish (SOU). Among the issues addressed is; how to deal with the long time perspectives of such issues, collective responsibility and its

relation to democratic decision making, as well as the acceptance of the proposed project, and living with risk. Those issues are also a cause for concern across spent nuclear fuel management sectors, something that is addressed in their publications, in addition to which such issues are raised in publications and articles from the regulatory authorities themselves.

- Strategic areas

An issue that is often raised in both the national and the international discussions on spent nuclear fuel disposal is the application of Strategic Environmental Assessment to the process. The concept is put forward by the EU, and has been addressed in a research report by the NEA/OECD. Furthermore, the issue has been raised in the Swedish documents.

Comments on the realization of the study

Being new to the field of spent nuclear fuel disposal we assumed that a wealth of material existed in the areas we were looking at. This proved to be the case. Thus there was no problem encountered in finding material - except for one issue. We did not find material explicitly dealing with case studies of planning processes for projects with long time spans. The time allotted to the current literature survey, in the context of the report as a whole moreover, did not give us sufficient room to re-construct such cases as were applicable in such a manner. Rather, we needed material where such analysis had already been done. In that respect we were not able to contribute as expected to the discussions on the basis of empirical material. This is an area in which future effort and resources needs to be directed. It is also clear that it took more time than anticipated to get to the core issues at the centre of the field of final disposal, mainly because of the wealth of material uncovered. In order to be able to immediately 'see the wood from the trees' one needs to know the field more intimately than we then did. From the material that we did gather however we quickly became aware of the fact that material of a rather more systematic and comparative nature (relating to both empirical and theoretical issues, and to practical experiences) in relation to Impact Assessment processes and communicative planning as regards EIA processes for final disposal of spent nuclear fuel, were either non-existent or un-available. It is this gap in the literature that we have attempted to fill in the composition of this study, with particular reference to the Swedish case. In this respect we find that this study does contribute to the overall discussion of the design and implementation of such processes.

The report

The report consists of six chapters:
The *first chapter* gives a background to the study and also presents the methodology applied for realization of the literature study and the main sources of references.

The *second chapter* gives an overview of the main international organizations operating within the field of nuclear waste disposal and international law and conventions applicable in the field of nuclear waste disposal.

The *third chapter* gives an overview of the experience of handling nuclear waste in five countries: Finland, France, UK, USA and Canada. The countries' systems and the main

lessons from their application are compared and the lessons for the forthcoming Swedish process are considered.

The *fourth chapter* presents some recent lines of thought based on planning theory and empirical research. So called best EIA practice is briefly presented. Finally experiences of EIA in the planning and decision processes of some large Nordic development projects are summarized.

The *fifth chapter* describes the Swedish situation. The main steps of the decision making process are examined and the roles of the stakeholders in the process with regards to the past experience and future application.

The *sixth chapter* presents our conclusions. We have compared the different "knowledge areas" presented in the report on one hand with our perception of the expectations concerning the forthcoming process put forward by different Swedish actors on the final disposal of nuclear waste arena on the other hand. A number of issues and questions are outlined for which we find reason to give special attention in the design and implementation of the forthcoming planning and EIA process in Sweden.

2 The international legal and regulatory framework

International organisations

Research into the field of radioactive waste management started more than 40 years ago. Since the early days of this work the field has benefited from a large component of international co-operation. Such co-operation has been both bi-lateral, or state-to-state, and multilateral, in the context of a number of different international organisations. The aim of such co-operation has been to establish common views and to develop the basic principles to be adhered to, as well as to develop knowledge and capabilities across participating states (Forsström, 2000).

For topics such as management of spent nuclear fuel, the significance of international co-operation is particularly high. There are several international organisations' 'expert groups' that work towards the safe handling of spent nuclear fuel in individual countries. The most important of these are as follows: IAEA, NEA, EU and ICRP.

The **IAEA** (International Atomic Energy Agency) is the United Nation's international organization for nuclear energy. The main role of the organization is to establish guiding principles and standards for radiation protection and safety as well as that of having a controlling role in relation to the non-proliferation treaty (NPT) on nuclear weapons. The IAEA has, since 1988, prepared a series of safety documents regarding the handling of radioactive waste. In the context of their 'Radioactive Waste Safety Standards' they have formulated recommendations as to the necessary standards and criteria for the handling and final disposal of spent nuclear fuel and radioactive waste. One of the main documents in this regard is - The Principles of Radioactive Waste Management from 1995 - which forms a basis for the 1997 convention regarding safety with the handling of spent nuclear fuel, and on safety with regard to the handling of radioactive waste (SKB, 2000).

Within the framework of the **OECD** (Organization for Economic Co-operation and Development) a nuclear section operates known as the **NEA** (Nuclear Energy Agency). The NEA provides both an advisory and a support role for its member states with regard to questions concerning the handling of radioactive waste in general, and the development of strategies for the handling of radioactive waste in particular with regard to the handling of spent fuel, and long-lived waste. Furthermore, the NEA is involved in the assembling of information on the influence of nuclear waste on health and the environment, and on developing methodologies and strategies for safety analysis. In recent years the organization has expanded its activities towards addressing the societal aspects of the disposal of spent nuclear fuel and has subsequently established a *Forum for Stakeholders Confidence*, in addition to organizing conferences etc. Furthermore the NEA has issued a report "The environmental and ethical basis of geological disposal" which presents a consensus position in the form of a Collective Opinion of the Radioactive Waste Management Committee (RWMC) of the OECD Nuclear Energy Agency. The report addresses the strategy for the final disposal of long-lived radioactive wastes seen from an environmental and ethical perspective, including considerations of equity and fairness within and between generations. It is based on recent work reported from NEA countries and on extensive discussions held at an NEA workshop organized in Paris in September 1994 on the Environmental and Ethical Aspects of Long-lived

Radioactive Waste Disposal. Of particular importance in these discussions was the participation of the OECD Environment Directorate, and of independent experts from academic and environmental policy centers.

Within the **European Commission** there are a number of services concerned with aspects of radioactive waste management, both as regards member and non-member countries.

Nuclear Safety Unit of DG-Energy and Transport. The Unit has responsibilities in the fields of nuclear installation safety, radioactive waste management and decommissioning of nuclear facilities. Setting up and encouraging co-operation, co-ordination and information exchange between the various bodies and organizations involved in radioactive waste management is an integral part of the Unit's activities within the Community. Furthermore, the Unit's activities are also increasingly oriented towards the major problem areas of radioactive waste management, namely; stimulating and raising the level of the debate on such topics as siting, safety cases, environmental impact assessment, and public involvement, information and acceptance.

Extensive research in the field of nuclear waste has been carried out under the auspices of **DG Research**. The Fifth Framework Programme covers research and training activities in the nuclear sector. Studies and projects financed under the fifth framework program include those concerned with the management of used radioactive sources, environmental impact assessment and geological repositories.

The **ICRP** (International Commission on Radiological Protection) is an independent experts association that develops recommendations for radioactive protection (many of which have been adopted by organs such as the IAEA and the EC as well as by individual countries). Among its publications are, *Radiological Protection Policy for the Disposal of Radioactive Waste* and *Radiation Protection Recommendations as Applied to the Disposal of Long-lived Solid Radioactive Waste*.

International law

Conventions

International cooperation in the field of nuclear energy has been conducted within the framework of established organisations since the 1950s when the EUROTOM Treaty was drawn up and the first states ratified the Statue of the IAEA.

Following the Chernobyl incident however the shortcomings of such 'ad hoc' international cooperation became clearer thus demonstrating the need to strengthen international environmental law regarding such nuclear activities. There is however no international legislative authority in the field (SKB, 2000) and the tools of international law continue to be applied through the medium of international conventions pertinent to this area, both in the field of nuclear activities, and in that of environmental conventions. However, such conventions are binding only on those countries that have signed and ratified them.

Within the framework of IAEA four conventions in the area of Radiation and Waste Safety currently have legal force. They are:

The **Convention on Nuclear Safety** (1994, in force since 1996) establishes an international co-operation mechanism to maintain safety in nuclear installations. The convention enjoins the partners to introduce precautionary measures and to develop legislation for nuclear technological developments.

Two conventions were introduced in the wake of the nuclear accident at Chernobyl:
The **Convention on Early Notification of a Nuclear Accident** (1986) establishes a notification system for nuclear accidents that have the potential for an international transboundary release of radiological material that could have safety considerations for other States.
The **Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency** (1986) sets out an international framework for co-operation among concerned Parties and the IAEA to facilitate prompt assistance and support in the event of nuclear accidents or radiological emergencies

The **Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management**. The convention was adopted and opened for signature at a Diplomatic Conference in September 1997 and entered into force on the 18 June 2001. The Joint Convention is the first legal instrument to directly address these issues on a global scale. The Joint Convention applies to spent nuclear fuel and radioactive waste resulting from civilian nuclear reactors and applications, and to spent fuel and radioactive waste from military or defense programs, if and when such materials are transferred permanently to and managed within exclusively civilian programs, or when declared as 'spent fuel' or as 'radioactive waste' for the purposes of the Convention, by the Contracting Party. The Convention also applies to planned and controlled releases of liquid or gaseous radioactive materials from regulated nuclear facilities into the environment. The obligations of the Contracting Parties with respect to the safety of spent fuel and radioactive waste management are based, to a large extent, on the principles contained within the IAEA Safety Fundamentals document entitled "The Principles of Radioactive Waste Management", published in 1995.

Other conventions include the Non-proliferation treaty on nuclear weapons, the convention on compensation in the nuclear energy field, the convention on compensation regarding sea transport of nuclear substances as well as conventions that apply in geographically specific areas, such as the OSPAR Convention (1992) that applies to the North-East Atlantic, the Treaty on the Antarctic, and the global dumping convention or the 'London convention' that prohibits the dumping of radioactive substances into the sea.

The Rio Convention, United Nations Sustainable Development, Agenda 21. Section II contains the programme area: *Promoting the safe and environmentally sound management of radioactive wastes.* The objective of the programme area is to ensure that radioactive wastes are safely managed, transported, stored and disposed of, with a view to protecting human health and the environment, within the wider framework of an interactive and integrated approach to radioactive waste management and safety. Measures introduced in the convention include the promotion of policies and practical measures to provide for the safe processing, conditioning, transportation and disposal of spent nuclear fuel and radioactive wastes and the promotion of planning, including the ***environmental impact assessment*** where appropriate, of safe and environmentally sound management of radioactive waste.

Other relevant legislation

Other relevant legislation with respect to the decision making processes and the management of spent nuclear fuel include:

- **EU Directive on Environmental Impact Assessment (EIA)**

The EU directive on Environmental Impact Assessment, 85/337/EEC amended 97/11/EC. According to this directive, an environmental impact assessment must be carried out for all major development projects prior to their implementation. The directive contains a list (Annex 1) of types of projects that always require an Environmental Impact Assessment in accordance with Article 4(1) of the directive. Included in this list is the mandatory requirement of an EIA for installations designed:

- for the processing of irradiated nuclear fuel or high-level radioactive waste,
- for the final disposal of irradiated nuclear fuel,
- solely for the final disposal of radioactive waste,
- solely for the storage (planned for more than 10 years) of irradiated nuclear fuels or radioactive waste in a different site than the production site (Annex 1, 97/11/EC).

The directive identifies several steps in the EIA procedure that must be followed by the member states, including screening, scoping, review, consultation and public participation. Furthermore, minimal requirements are introduced for the contents of an Environmental Impact Statement (EIS).
All the Nordic countries must comply with this directive, Denmark, Finland and Sweden through their membership of the European Union, and Iceland and Norway through their membership of the European Economic Area (EEA). EIA was introduced into national legislation in the Nordic countries during the period 1987 – 1994, either through separate legislation and regulations, or by inclusion in other acts.

- **EU Directive on Strategic Environmental Assessment of certain plans and programmes**

A new EC directive has been adopted on the Environmental Assessment for certain plans and programmes. The directive was adopted by the European Parliament on the 31. May 2001 and by the European Council on the 5. June 2001.

The purpose of the SEA-Directive is to ensure that the environmental consequences of certain plans and programmes are identified and assessed during their preparation, and thus before their adoption. The public and environmental authorities can lodge opinions, with all results being integrated and taken into account in the course of the planning procedure. After the adoption of the plan or programme, the general public is then informed of the decision, and of the way in which it was made. In cases where there are likely to be transboundary effects of significance, the affected Member State is publicly informed, and thus also have the possibility to make comments which are also integrated into the national decision making process.
The Directive will enter into force after its publication in the Official Journal. Afterwards, Member States will have three years to integrate the new instrument into their national systems. Programme initiated after the Directive entered into force, and prior to the requirements of the directive being enacted into national legislation, may, it should be noted, be subject to the requirements.

- **The ESPOO Convention**

Furthermore, an international convention exists on this topic; namely, the Espoo convention, formulated by the United Nation's Economic Commission for Europe in

1991, which entered into force in 1997. The general objective of the directive is to prevent or reduce the adverse transboundary impacts of proposed activities. The convention lists projects where an Environmental Impact Assessment shall be carried out, where such projects are considered likely to have considerable cross boundary effects. Among such cases are those activities that involve nuclear technology. The convention also lays out a set of minimum requirements for what the Environmental Impact Statement shall contain. The Convention requires extensive levels of cooperation between the countries involved. An important principle of the convention being that the authorities and the general public in countries neighbouring the country where the development takes place, are given the opportunity to participate in the EIA process, in addition to the authorities and the general public in the countries in which the development actually takes place.

- **The Aarhus Convention**

The Aarhus Convention concerns access to information, public participation in decision making and the right to trial regarding environmental issues.
The goal of the convention is to enable the public to gain access to information and to participate in the decision making process on issues regarding environmental issues. The convention contains a list of activities to which such provisions apply. Different types of nuclear activities are included in these lists, including spent nuclear fuel disposal.

3 International experiences – achievements and obstacles in the search for a solution to nuclear waste disposal

This chapter seeks to give an overview of the experiences of processes for final disposal of nuclear waste in a number of selected countries. An overview of what the important challenges are in this respect will serve as an introduction to the chapter.

Introduction

The issue of the disposal of nuclear waste is an international phenomenon and a common challenge for all countries using nuclear power and thus who are consequently struggling to find a solution to the problem of nuclear waste.

The problem has a clear political aspect in that it is essentially interlinked with discussions over the use of nuclear power, and it has even been identified as having the ability to become the 'Achilles Heel' of the nuclear power industry, as the seeming inability to successfully address this issue constantly undermines public confidence in the use of nuclear power (Lidskog and Litmanen 1997). Furthermore such matters are loaded with ethical issues such as those concerned with the taking of responsibility for outcomes connected to the use of nuclear energy and the 'opportunity costs' of nuclear energy use. Furthermore, such issues go to the ethical concerns of inter-generational justice (i.e. the present generation enjoys the benefits of energy produced by use of nuclear power, and thus has the responsibility of solving the problem of what to do with its waste by-product. At the same time, voices are often heard to the effect that it is important to give scope to the ability of future generations to solve such issues in the way they consider most suitable).

The technicalities surrounding safety and the risks involved in disposal raise the sensitivity of the issue as a whole. It is however argued that technical solutions have now been found as regards disposal of nuclear waste. As yet however public support and public 'acceptance' of such findings are more difficult to achieve.

"Nuclear power itself seems to generate more fear about democracy versus state control over people and the environment than other environmental issues" (Blowers and Peppers 1987 in Lidskog and Litmanen 1997). The siting of nuclear power plants has been accomplished with only symbolic input form the public. While procedures for siting nuclear power plants seem unclear to many observers and critics, radwaste repository siting procedures are even more ambiguous (Solomon and Shelley 1988, in Lidskog and Litmanen 1997).

A modern society demands both formal and informal ways of involving the general public in complicated decision making processes. The decision on waste management policy and the siting of waste management facilities is thus no exception. The combined effects of the negative image of nuclear waste (related to nuclear weapons and anti-nuclear energy campaigns, and the perceived secrecy of the handling of all matters connected to nuclear waste, and general levels of secrecy in the nuclear energy sector

throughout the 1980s), reflect the reality of long-time perspectives and technically complicated issues, and call for transparency and openness in order to receive the public support necessary to implement a waste disposal scheme and to alleviate the negative perceptions often held by the general public in connection with nuclear waste.
The decision making for a repository is a long and difficult process which raises a lot of debate and concern among the general public. Among the possible reasons for this is simply the intrinsic and intangible hazard associated with anything nuclear, the obvious connection to nuclear weapons and the elongated time frames within which such processes are carried out (Forsström and Taylor 2000). A further reason for negative public reaction regarding nuclear waste disposal is the perceived secrecy of the nuclear industry and the historic legacy of non-communication. (Forsström & Taylor 2000, Falkemark 1995). This raises the issues of democratic legitimacy in the nuclear waste discussion.
The entrenched fear and mistrust of the nuclear technology 'the dread factor' is identified in the experience of the Canadian Environmental Assessment Panel as an important element in decision making processes concerning nuclear matters as it will affect public confidence in the results from such processes.

> *"Perceptions run this business. They brought it to its knees. So now you're going out and distributing this thing and saying in case this accident happens …"(Nuclear Regulatory Commission 1997).*

The project will have effect over a long time, which is a cause for uncertainty, both technical as well as societal (changes in attitude and perception that may change over time). The long time frame of the project also gives rise to ethical considerations, as the decision will have a significant effect on future generations.
Studies show that there was declining support towards nuclear waste from the end of the 1970s to the beginning of the 1980s, so that in almost every opinion poll the in Western Europe the majority of citizens were against the siting of nuclear waste facilities (Litmanen, 1999). The reasons for the declining local acceptance of nuclear facilities is considered be closely linked to the nuclear accidents in Three Mile Island and in Chernobyl and the public's perceptions or risks attuned to radioactive waste (Allègre, M. 1999). The negative reactions of local residents towards the possible siting of a nuclear waste facility is classified under the NIMBY (not-in-my-backyard) phenomenon that is familiar to every country which has nuclear power plants.
The change in attitude has been particularly dramatic in the proposed host communities as the examples of unsuccessful siting proposals in the 1980s demonstrate. Studies carried out in Finland and the USA illustrate the potential for opposition to nuclear waste facilities where the majority of citizens said no to nuclear waste. The results from those communities in Washington and Nevada that were located close to the siting place were however quite supportive of the plan. Such communities have been termed 'nuclear oases,' where the industry has provided the basic livelihood for the residents for decades and therefore attitudes there are different form those in other places. (Litmanen, 1999). These examples identify the need to contextualise the residents' concern by embedding their attitudes in those historical and geographical circumstances from which they have arisen. Although it is emphasised that communities have different ways of defining risks, different ways of giving priority to risks and different ways of dealing with risky activity, it is to some extent a collectively shared risk perception. It is also important to recognise however that local concerns are also linked to wider national and international structures (Litmanen, 1999[2]).

Change in emphasis

*"It is becoming clear that societal acceptance will be more difficult to achieve than scientific and technical acceptance"(*Canadian Nuclear Fuel Waste Management and Disposal Concept Environmental Assessment Panel, 1998).

At the beginning of the search for a solution to the nuclear waste issue, the main emphasis was laid on finding a technical solution to the problems faced, and concentrating on the safety aspects of the disposal. When trying to implement those proposals, public objections to governmental plans led to changes in legislation and to the abandonment of plans that were already developed which can have costly consequences both financially and time wise, and the need for the systematic involvement of the general public gradually grew in recognition (*Forsström & Taylor, 2000).* After the experience of searching for a solution to the issue of nuclear waste disposal over the last decade, authorities in the field, waste producers and decision makers alike have all realised that the importance of public support on the issue is paramount, in order to overcome prevailing negative public attitudes, and thus to be able to implement the projects, in the context of identifying better solutions and establishing public acceptability of the project. Furthermore, there is growing recognition that a decision regarding nuclear waste repositories will only be made after a lengthy, fully open, and democratic process accessible to all stakeholders, including politicians, scientists, local communities and associations (Allègre, 1999).

This change in outlook regarding public involvement in the decision making process surrounding nuclear waste is illustrated in the following passage, where a social psychologist gives her impression of the NEA/OECD FSC (Forum on Stakeholder Confidence) workshop in August 2000 and compares it to her impressions of an OECD-NEA international workshop in March 1992 on "*Public participation in the decision-making process in the nuclear field*":

> *"At that time, according to her notes, presentations spoke of a number of legal mechanisms by which members of the public could seek to influence decisions. However, there appeared to be a great deal of regret in some quarters that public opinion did not limit its expression to those outlets. [..]*
> *At the FSC workshop in 2000 the discourse and attitude of institutional attendees appeared to this observer to be very different. There was recognition that existing consultation mechanisms are probably insufficient or sometimes inadequate, and that it is a real challenge for organizations and individuals to find new manners of communicating and receiving input. [..]*
> *They called for clarification of roles in decision making and in implementation, in the expectation that the clarification will not only result in better decisions, but globally in societal learning about risk management. Generally, to the eyes of the observer, attendees seemed to embrace a broader, more realistic view of decision in society, far removed from the technocratic position seen at the beginning of the decade."*

Consequently, the technical side of waste management is no longer of exclusive importance, and the organisational ability to communicate and to adapt has thus gained in importance. *"The obligation to [conduct] dialogue and to demonstrate to the stakeholders that their input is taken into account raises the questions of who can take*

on the role of communicator, what skills and training are needed, which tools should be developed, and what organisational changes are necessary" (NEA, 2000[1]).

Overview of national development

The prospects for the future use of nuclear energy differ in different parts of the world. In ***Western Europe*** the peak has been reached and almost no new nuclear reactors have been put into operation during the last decade, with emphasis turning to ways of carry through a nuclear phase-out (SKB, 2000). Examples of this can be seen in Sweden and in Germany, where the government and four nuclear energy companies have reached agreement that the reactors shall gradually be phased out.

In the former ***Eastern bloc*** countries the improvement of safety has been emphasised, both with regard to the nuclear installations themselves, and to the disposal of nuclear waste. However, financial constrains make this work difficult whilst reactors are being closed down due to insufficient safety levels. Moreover, some new construction is taking place in Russia, the Ukraine and the Czech Republic.

The situation in ***North America*** is similar to that of Western Europe. The number of reactors in the USA has remained stable during the last few years, and Canada is in the middle of closing down eight of its twenty-two reactors.

As to ***South America***, in Mexico, Argentina and Brazil there are no extensive plans for construction of new nuclear energy plants, although a new reactor came on-line in Brazil in the autumn 2000. ***Asia*** is the only region in the world where the use of nuclear energy is on the increase; this can be linked to rapid economic development and population increase. Most reactors are being built in China, with additional high peaks of activity in South Korea, Japan and India, all of whom have plans for new construction.

Legislation in the OECD countries establishes the set of overall principles to be applied in the disposal of radioactive wastes. Such legislative guidelines have been designed within the framework of advice from the IAEA and, in Europe, the European Commission. The legislation also determines the organization responsible for developing and operating disposal facilities, and those responsible for regulating the operation and safety of such facilities. The level of requirement regarding implementation of the processes and relationship to other planning processes however differs across national legislative systems.

The methods that have been selected for managing and disposing of spent nuclear fuel and nuclear waste also vary to some degree across different countries.
In this overview most emphasis will be placed on describing and then comparing solutions for disposal of spent fuel and high-level[1] radioactive waste in Western Europe and North America, the status update and experience hitherto in each country and the main actors involved in the process.

[1] medium level waste in the UK case.

Finland

The Nuclear Energy Act and its accompanying Decree provide a distinct framework for the implementation and research of waste management in Finland. According to the legislation, the producers of nuclear waster are responsible for all measures needed for disposing of the waste in a safe manner, and for the costs involved. The nuclear energy operators have established a common company, Posiva that is responsible for both the siting and operation of geological disposal.

On the basis of the Nuclear Energy Act, the Council of State regulates the use of nuclear energy in Finland, the Ministry for Trade and Industry (KTM) grants the required license and the Finnish Center for Radiation and Nuclear Safety (STUK), supervises the safety of the use of nuclear energy.
For the construction of a final disposal facility a decision in principle (DiP) is needed from the Council of State. In its decision the Government shall consider whether the construction project is in line with the overall interest of society. In particular the Government shall pay attention to the need for such a facility, to the suitability of the proposed site and to the environmental impacts from the proposed practice (NEA, 2000[2]). The decision needs to be ratified by Parliament before it is enforced. Apart from the decision in principle, separate construction and operating permits are needed for the encapsulation plants, and for the final disposal repository at a later stage. Prior to obtaining a decision in principle, an agreement is needed from STUK on the final disposal system and an approval from the municipality in which the facility is to be constructed.
The supervising state authorities; Ministry of Trade and Industry and the Finnish Center for Radiation and Nuclear Safety (STUK) have financed an independent, publicly administered research programme (JYT) on nuclear waste management. Three programs were carried out. The first set of programs were designed to provide the authorities with information and research results relevant to ensuring the safety of nuclear waste management, though the third program also emphasized not only technical planning and safety requirements, but also independent evaluations of the societal, socio-psychological and communicational aspects of final disposal.

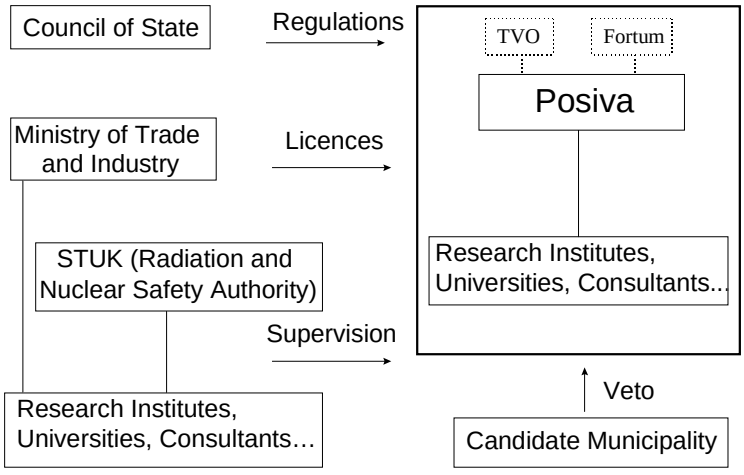


Figure 1: Main actors in Finnish nuclear waste management.

The siting process was started at the beginning of the 1980s when an extensive survey was carried out on bedrock conditions, resulting in a large number of prospective areas for repository being identified. By 1987 field research had been started at five sites and detailed investigation was underway by 1993 in four areas: Romuvaara in Kuhmo, Kiveety in Äänekoski, Olkiluoto in Eurajoki. Hästholmen in Loviisa entered the process at a later stage. An EIA process was carried out in all the four candidate municipalities and the EIA programme was completed in 1998. The EIA report was submitted to the Ministry of Trade and Industry in May 1999.

Recent development

In May 1999 a contract was established between Posiva and Eurajoki municipality regarding the construction of a repository in connection with the nuclear factory in Olikiluoto, on the proviso that the government and the local authority both gave permission. Subsequently, in May 1999 Posiva filed an application for a policy decision (Decision in Principle, DiP) on the final disposal facility for spent fuel for the Olkiluoto site in the municipality of Eurajoki. STUK issued a favorable statement on the application on 11 January 2000, where it stated that all the necessary safety criteria were met. The municipal council of Eurajoki took a decision supporting the selection of Olkuluoto as a repository site on 24 January 2000. The votes in the municipal council were 20 in favour and 7 against. (Posiva 2000 in Hokkanen, 2001). Thus, Eurajoki is the very first municipality in the world to approve of the final disposal of high-level nuclear waste within it own boundaries (Hokkanen, 2001). In February 2000, two appeals were made to the Administrative Court against the decision of Eurajoki Municipality. The court dismissed both appeals in May of the same year, stating that it could not find any errors in the decision making process of Eurajoki Municipality. The appeals were then filed in the Supreme Administrative Court in June 2000, though here to the Court rejected the appeals on 17 November 2000 (NKS, 2001).
On 21 December 2000 the Council of State made the Decision in Principle (DiP) and on 18 May the Finnish Parliament ratified the Decision in Principle on the final disposal facility for spent nuclear fuel in Olkiluoto, Eurajoki.

The construction of the final disposal facility is scheduled to begin after 2010, with the facility becoming operational in 2020.

The application of EIA to the process

Posiva's EIA for the final disposal of nuclear waste covers the four candidate municipalities where the possibilities of final disposal of spent fuel were being investigated. The implementation of the EIA stands out as something "beyond the norm" and has indeed been dubbed "the EIA of the century" in Finland (Hokkanen, 2001). The plan was lodged within the EIA process for almost three years.
In accordance with the Espoo Convention, the EIA report was also submitted for review by neighboring countries, to Estonia, Russia and Sweden.

Main actors identified in the Finnish EIA process:

The *developer* of the EIA process, Posiva Oy that was responsible for the EIA programme and the EIA report on the final disposal of nuclear waste.

The *competent authority* for the EIA process for the final disposal of nuclear waste is the Ministry of Trade and Industry (KTM).

The Finnish Center for Radiation and Nuclear Safety (STUK). Although STUK retains an important status in nuclear waste management in general, it plays a minimal role in the EIA process. (Hokkanen, 2001).

During the EIA process STUK's role is limited to advising KTM on the EIA programme and EIS. After the EIA process, STUK's role becomes more prominent regards safety issues.

The *municipalities* have participated in the EIA process in many ways, through statements on the EIA programme and the report, as well as meetings with Posiva and the design of the nuclear waste research programme.

The *inhabitants of candidate municipalities* have also had a prominent role in the process.

	EIA ACT	NUCLEAR ENERGY ACT
1998	EIA programme public hearing statements and written addresses statement of the Ministry of Trade and Industry	
1999	EIA report public hearing statements and written addresses statement of the Ministry of Trade and Industry	application for a decision in principle (including the EIA report) public hearing statements and written addresses statement of the candidate municipality (right of veto) safety statement of STUK (tentative)
2000	the choice of the site of the final disposal	a decision in principle of the Council of State ratification by Parliament
2000-2010	underground shaft and supplementary research	
		construction permit (Council of State)
2010-2020	construction stage (encapsulation plant and final disposal repository)	
		operation permit (Council of State)
2020-	operation stage	

Figure 2: Decision making process for the final disposal of nuclear waste in Finland.

The EIS was submitted as part of the application for the DiP, with the Ministry of Trade and Industry issuing a statement on 5 November 1999 that the EIS had indeed fulfilled the requirements set for the assessment. A more detailed analysis of the experience from the EIA process in Finland is given in chapter 5.

Great Britain

In Great Britain, discussion is mainly centered on the development of methods and the selection of sites for disposal of low and intermediate level waste. The active search for a deep disposal site and for a repository for high-level radioactive waste should however be put on hold for a period of fifty years whilst the waste itself will be kept in intermediate storage at the power plants and at Sellafield (KASAM, 1998).

The *Secretary of State at the Department of the Environment* and the *Secretaries of State for Scotland and Wales* are responsible for the development of policy questions that concern the management of nuclear waste. The government also has an advisory committee, the *Radioactive Waste Management Advisory Committee* (RWMAC) at its disposal that was established in 1978 to offer independent advice to Ministers on radioactive waste management issues.
The *NII* (Nuclear Installation Inspectorate), the *Environmental Agency* and the *SEPA* (Scottish Environment Protection Agency) are the authorities regulating the storing of radioactive waste in the nuclear plants in the UK.

NIREX, an organisation established by the nuclear industry at the beginning of the 1980s, has the responsibility of developing facilities and systems for the storage of low and medium-level nuclear waste. The handling of high-level nuclear waste is outside the bounds of NIREX's area of responsibility. NIREX's area of concern thus focuses on the search for a place to deposit low and medium level radioactive waste from the reprocessing plant at Sellafield, which is comparable to that which is deposited in the Swedish repository for radioactive operational waste, SFR, in Forsmark.

In 1989 NIREX presented two candidate sites and in 1995, an application was submitted for planning permission to construct a research laboratory at a prospective repository site at Sellafield in Cumbria. The facility itself was simply one step in the overall investigation of the site's suitability as a repository, "*and can be most closely compared with the detailed characterization stage of the Swedish programme*" (KASAM, 1998).
Cumbria County Council reviewed the planning application and refused planning permission in 1995. Among the criticisms seen to emerge from Cumbria County was that insufficient consideration had been paid to the general public in the conduction of the siting process. Nirex appealed the decision to the Secretary of State for the Environment. A Planning Inquiry ensued, which included prolonged negotiations with the local authority and the general public on the siting process and the location. In March 1998, the Secretary of State rejected the appeal to build a Rock Characterisation Facility beneath Sellafield in Cumbria on the grounds that the site was not considered suitable for the intended purpose.
The decision however placed UK policy back to square one in respect of its plans for the disposal of intermediate level radioactive waste. (Beveridge and Curis, 1998).

The UK nuclear waste programme was evaluated by a House of Lords Select Committee on Science and Technology that resulted in a report entitled, "The Management of Nuclear Waste" published on 10 March 1999.

The conclusions of the House of Lord Select Committee report included:

- The major problem of nuclear waste management in the United Kingdom is the legacy from the past. The legacy has to be dealt with, whether there are future programmes or not.
- The current United Kingdom strategy for management of long-lived wastes is fragmented. An integrated strategy is needed for all long-lived wastes and decisions are needed soon on which materials are to be declared wastes.
- Of the many methods for the long-term management of nuclear wastes that have been suggested and studied worldwide, only two are now being advocated (see Chapter 3). We found that the majority view from the scientific and technical community is that wastes should be emplaced in deep geological repositories. The minority view, held particularly by members of environmental pressure groups, is that wastes should be stored on or near the ground surface indefinitely, while a research and development programme is conducted to find the best means to manage them in the longer term.
- The Committee concluded that the preferred approach is phased geological disposal in which wastes are, following surface storage, emplaced in a repository in such a way that they can be monitored and retrieved. The repository would be kept open while data are accumulated, and only closed when there is sufficient confidence to do so.
- Public acceptance of a national plan for the management of nuclear waste is essential and it has to be achieved at the local level (i.e. close to potential repository sites), as well as within the country as whole.
- Openness and transparency in decision making are necessary in order to gain public trust, but they are not in themselves enough. Mechanisms must be used to include the public, or groups within it representing a wide spectrum of views, in decision-making.
- At the local level, offering compensation for blight and benefits in exchange for hosting a national disposal facility would do much to achieve acceptance.

The RWMAC reviewed the process and issued its findings in a report *"The Radioactive Waste Management Advisory Committee's Advice to Government on: Establishing Consensus on the Results of Science Programmes into the Disposal of Radioactive Waste"*, issued in May 1999. Among the issues identified by the RWMAC in order to improve future processes were:

- A more appropriate organizational structure and planning framework
- Greater Government commitment to dealing with the long-term problem of radioactive waste, notably with regard to the securing of a deep repository solution
- More openness and transparency at every stage of the planning process
- More clearly defined responsibilities and accountabilities.

A further issue complicating the planning process was the need to further clarify who takes what decision and at what time on the basis of what remit, and in light of what evidence. Potential conflict remains between national and local decision making systems. Furthermore the RWMAC expressed a concern over the competence of local level staff, i.e. whether a local planning inspector has the expertise necessary to evaluate adequately the issues relating to the safe siting of a national radioactive waste repository.

On 25 October 1999 the Government issued its response to the House of Lord's report. Among the findings of the response was that the Government agreed that identifying and implementing a management option for radioactive wastes, which commands

widespread public support, would be a long process. It notes that in the model proposed by the Committee it would take about four years to gain agreement on policy and a further twenty years after that for a repository, the Committee's chosen solution, to come into operation. The government emphasises the importance of widespread public support and an open and transparent decision making process. The subsequent steps will be decided upon as a result of consultation with those involved in various management options for radioactive waste.

France

In France the approach to nuclear waste management is to reprocess all spent fuel and dispose of vitrified high-level waste. Responsibility for the nuclear waste programme is held by a governmental agency, ANDRA. In the late 1980s, ANDRA identified four candidate sites for a repository following a systematic selection procedure. The plans for site investigation were met by extensive protests in the selected areas and the government stopped the site selection programme and introduced in 1991 new legislation where disposal of nuclear waste was abandoned. According to the new legislation however future research should concentrate on identifying ways of conducting the disposal of high-level radioactive waste, and by 2006 should sufficient background material be assembled, it is hoped that the government could make a decision on the most suitable alternative. Furthermore, two sites for underground laboratories should be identified, one of which may later be developed into a repository. An important element of the new legislation was the notion that future activities ought to be based on the voluntary participation of the municipalities involved. A Member of Parliament was identified as a mediator in identifying such sites. Furthermore, he had the authority to offer the municipalities a sum of around 10 – 15 million francs in financial compensation per year. The site investigation process was re-launched and three sites were proposed. ANDRA held hearings with local politicians and the general public from the candidate and neighbouring communities.

Recent experiences

In 1999 the government granted ANDRA permission to develop an Underground Research Laboratory (URL) in Heute-Marne. As a part of the construction process, the municipality receives fiscal support of 60 million francs per year. At the same time the French government rejected the application for a research laboratory in Vienne. As part of the search for a new location for the underground laboratory 15 granite areas were identified on scientific grounds and approved by the National Review Board (CNE) in September 1999. In accordance with the law of December 1991, installation of a nuclear laboratory is subject to a consultation with the elected officials and populations of the sites concerned. A three-member notation committee (composed of a prefect and two engineers, mandated by the Government) was appointed by government in November 1999 to meet with elected officials in the locations in question. “The aim of the mission was not to convince people to accept a laboratory, but to inform local populations on the project in order to gather their opinions” (Merceron, 2000). The meetings were met by extensive local opposition and only three visits were made. Furthermore national opposition to the underground laboratories, including the Green party, organised protest meetings, the General and Regional Councils carried motions against the URL project as well as hundreds of mayors within the 15 selected areas joined the opposition to the URL. In early June the government ordered the mission to halt its consultations (Merceron, 2000). The government has stated that it will pursue

the construction of underground laboratories, but the new methods need to be found for consultation and to create a local dialogue.

USA

Background

In the USA it has been decided that nuclear waste shall be disposed of in a deep geological repository. The US policies governing the permanent disposal of high-level waste are defined by the Nuclear Waste Policy Act of 1982 (NWPA), the Nuclear Waste Policy Amendments Act (NWPAA) of 1987, and the Energy Policy Act of 1992. These acts specify that the high-level waste will be disposed of underground, in a deep geologic repository.

Three federal agencies are responsible for disposing of spent fuel and high-level radioactive waste:
The *US Department of Energy* (US DOE) is responsible for developing the deep geologic repository which has been authorized by Congress for disposing of spent fuel and high level waste. It is also responsible for determining the suitability of the proposed disposal site as well as for developing, building, and operating the geologic repository.
The *Nuclear Regulatory Commission* (NRC) is responsible for licensing the repository and ensuring that the DOE's proposed repository site and design comply with EPA's standards.
The *Environmental Protection Agency* (EPA) is responsible for developing environmental standards that apply to both DOE-operated and NRC-licensed facilities. Other key actors include *Office of Civilian Radioactive Waste management* (OCRWM) within the U.S. Department of Energy (DOE) and the *Nuclear Waste Technical Review Board* (NWTRB) and the *Department of Transportation* that is responsible, along with the NRC, for regulating the transportation of these wastes to storage and disposal sites.

Congress decided in 1987 to designate Yucca Mountain as the single candidate site for characterization as a potential geologic repository. This does not mean that Yucca Mountain has been selected for a repository, but that it will be the only site thoroughly examined at this point in time for site characterisation. Following the site characterisation, the DOE is required to prepare a recommendation for a potential site as a candidate for a geological repository, and to submit it to the President and then to Congress. The DOE's recommendation shall include preliminary comments from the NRC concerning the extent to which site characterization and the waste form proposal for the recommended site seem sufficient for inclusion in any potential license application. The Nuclear Waste Policy Act directed both the Environmental Protection Agency (EPA) and the NRC to publish standards and criteria for the storage and disposal of high-level radioactive waste. The NRC's role in licensing a geologic repository has two objectives. The first is to ensure that the DOE has complied with the applicable standards, and the second is to ensure that public health and safety have been adequately protected. The Energy Policy Act directed the EPA to contract with the National Academy of Sciences (NAS) to provide technical input into the provision of standards in this area. The financing of the operation is conducted through the use of a special 'nuclear waste fund' that the waste producers are required to pay into in order to finance the management of the spent nuclear fuel.

Draft Environmental Impact Statement

The DOE published a draft EIS for public comment for a Geological Repository on Spent Nuclear Fuel and High-Level Radioactive Waste in August 1999. The draft EIS provides information on the potential environmental impacts that could result from the proposed action to construct, operate, monitor and eventually close a deep underground repository at Yucca Mountain, in Nye County, Nevada. The draft EIS also analyses an alternative to the proposed action: namely a non-action alternative. The EIS further analyses the potential impacts of transporting spent nuclear fuel and high-level radioactive waste to the Yucca Mountain site from 77 sites across the United States. The analysis also includes the use of active institutional controls (controlled access, inspection, maintenance etc.). The DOE has held 21 public hearings where the report has been presented. The period for submitting comments closed in February 2000 and the DOE is in the process of reviewing the input and will prepare a Final EIS in 2001.

On the 4th of May 2001, the OCRWM initiated the public comment period on the Secretary's consideration of the Yucca Mountain site for possible recommendation to the President. As well as the Draft Environmental Impact Statement, the Department has issued the Yucca Mountain Science and Engineering Report, which summarises the scientific and technical information developed through more than 20 years of studies on the site. Furthermore, the OCRWM has issued a Supplement to the Draft Environmental Impact Statement, which updates the information presented in the 1999 Draft Environmental Impact Statement.

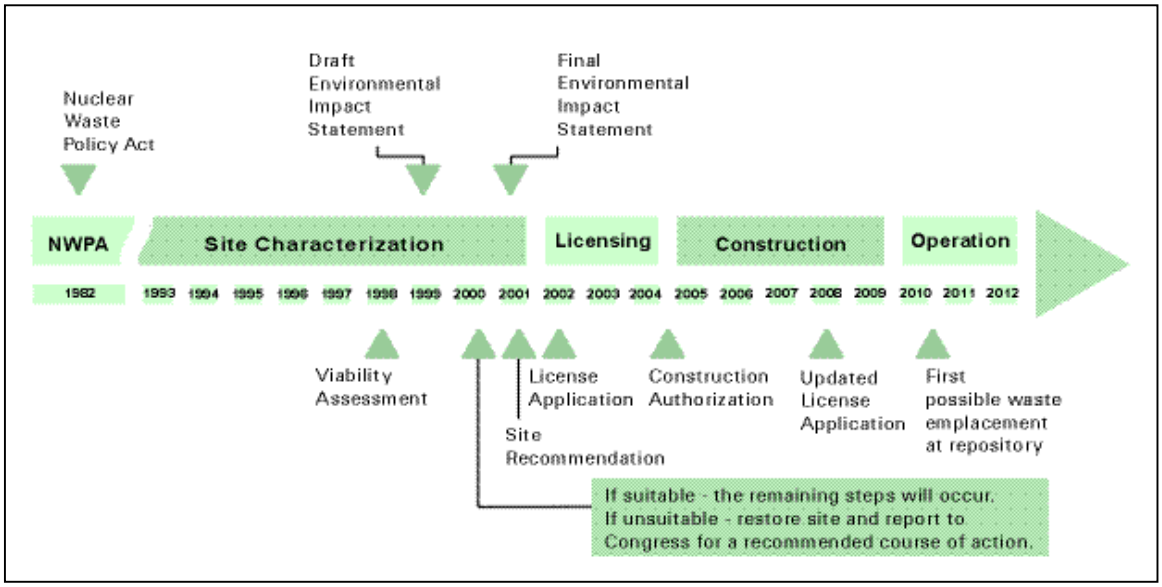


Figure 3: Timeline in the EIA process in Yucca Mountain (from the DOE web-site)

Canada

The official strategy for the disposal of nuclear waste in Canada is deep geological repository in granite. The Canadian government runs three separate organizations that address policy issues and deal with the legislation that is relevant to nuclear safety and radiation protection and research and development regarding the storage of nuclear waste; NRCan (Natural Resources Canada), CNSC (Canadian Nuclear Safety

Commission) and the AECL (Atomic Energy of Canada Limited). The last one is responsible for conducting research in relation to nuclear waste and developing workable solutions.

The research phase, including field studies and the construction of an underground laboratory was concluded in 1992, and an Environmental Impact Assessment was produced on the methods of disposal that were submitted to the authorities in 1994. In 1989 the Canadian Environmental Assessment Agency Panel was established by the Canadian government and given the task to review the storage concept. This body was made up of experts in the fields of technology and sociology. The procedure also encompassed a system by which non-governmental organizations and the general public could apply for funds to enable them to be able to offer an informed viewpoint on the AECL's report. The panel operated over a period of almost ten years, and in this time oversaw a series of hearings in several places across the country. The hearings were conducted in three phases; the first phase addressing socio-political questions, the second pertaining to technology, and the third phase which entailed the setting up of a number of local hearings throughout Canada.

The Panel's final report, based upon the results from this stage, states that the AECL's concept holds, from technical viewpoint, though public support is still lacking for the nuclear waste process. The panel gave the following recommendations to the government, namely:

- Creating an independent agency for managing nuclear waste
- Review the requirements issued by the safety authority
- Change and develop the siting process so it takes public opinion into greater consideration and establishes a plan for public participation
- Developing a procedure for ethical and social assessment
- Developing and comparing other alternatives for managing the spent nuclear fuel.

Moreover, it was the Panel's opinion, that in the period preceding the implementation of these measures the siting process should be halted.

In the light of this experience, Canada is developing a new approach in the siting work and the old legislation has been revised.

In December 1998 the Canadian government gave a response to the panel's report where it stated that it agreed with most of the panel's recommendations. Among the points made by the government was that the responsibility for the final disposal and financing of the management of the spent fuel shall rest with the producers themselves. Thus it became necessary for the energy company to establish a separate organization to take care of all aspects of policy regarding the final disposal of nuclear waste. The energy companies shall establish a specific fund to take care of the financial aspects of disposal, and they shall present their approach to the government, including a comprehensive public participation plan.

Cross-national similarities and differences

The issue of nuclear waste is an international phenomenon. It is a topical issue for all countries using nuclear power and consequently struggling with nuclear waste issues.

The problem of nuclear waste is however no longer seen merely as a problem for technical specialists alone, but increasingly as a social problem, demanding the attention of politicians, activists and civil society more generally.

On the basis of the review of the national experiences related to finding a solution to the nuclear waste disposal issue that have been outlined above, substantial differences are evident. These differences relate both to the methods used to address the issue of nuclear waste, and to the priority given to finding a permanent solution, as well as to the decision making process of nuclear waste disposal, and the organisation of the process and the allocation of responsibilities.

The discussion over the choice of method for nuclear waste disposal is closely linked to that of the priority given to finding a permanent solution to the nuclear waste issue, and to the issue of time spectrum also. In the ***United States*** the issue of nuclear waste has been identified as being one of high priority, and according to current plans the repository will be in operation as soon as 2010. In ***Finland*** and ***Sweden*** the search for a solution to the nuclear waste disposal issue has been afforded a high political priority with emphasis firmly on finding a permanent solution. In ***France*** the search for a site for geological repository for spent nuclear fuel was abandoned by a new legislation in 1991, after extensive protest in the late 1980s. The recent development to locate underground research laboratories has furthermore been met by local and national opposition. In the ***UK*** it has been decided that active measures related to deep disposal and to the search for a site for the repository site for high-level radioactive waste shall be put on hold, and thus that the highly active waste shall be stored, at least for a period of 50 years (SKB 2000). The work carried out hitherto has primarily focused on the final disposal of low to medium-level radioactive waste, as detailed studies have been carried out on the deep disposal of low and intermediate level waste. In ***Canada*** substantial preparatory work has gone into finding a suitable solution to the issue of high-level nuclear waste, underground research studies have been conducted since the 1980s. However, with regard to the latest developments concerning the final geological disposal of high-level nuclear waste and spent fuel, which as yet have not been approved, the timeframe for the work naturally remains unclear.

Current situation

The process of the permanent disposal of nuclear waste has not as yet begun in any country, though the countries that have progressed furthest down this policy road towards a solution to the issue of nuclear waste disposal are Finland and the USA. Indeed, furthest progress in terms of the model of a deep geological repository has been made in Finland, where the selection process has been completed, as has the Environmental Impact Assessment process, where an agreement has been reached with a host community and the government has approved the proposals. In the USA the method for waste disposal has also been decided upon, and preparation work has been undertaken in applying to the President for final decision. A draft Environmental Impact Statement has been prepared and circulated across the state, and the final EIA is under preparation. France, Canada and Great Britain have all experienced substantial setbacks in their initial approaches leading to the re-evaluation of their procedures. In France such difficulties were met by changes in the legislation and by the creation of a new decision making structure along with new opportunities for public influence. In Canada the method of nuclear waste disposal has been challenged, whilst in Great Britain such complications predominantly relate to the identification of a suitable site. In all such

cases however, the main criticism related to aspects of the decision making process, in particular to the lack of public access to the process and thus to the demand for increased opportunities for participation and influence.

Common to the experience of all these countries is the fact that finding a solution to the nuclear waste issue is no longer viewed as solely a technical issue, but rather has now assumed a political magnitude such that it has engaged politicians, activists and civil society more generally.

What shall be done with the nuclear fuel?

The fundamental question is what shall be done with the nuclear fuel? This decision is normally reached at national level by government, after extensive technical and scientific investigations have been carried out. Several options have been discussed and applied in both Western Europe and North America including the long-term storage of nuclear waste, methods of reprocessing the nuclear waste as well as solutions relating to the final disposal of the waste itself. The structure of the decision making process, relating to the level of government and actors involved, in particular the extent to which the municipalities and /or local population is involved, differs markedly across national borders.
The notion of regarding the spent fuel as a resource that can be reprocessed on commercial grounds, is particular prominent amongst the larger producers of nuclear waste, e.g. Japan, Germany, France and the UK, as well as some of the smaller producers such as Switzerland. The reprocessing takes place in UK or France with the prime aim being to utilise the energy resources that remain contained in the uranium and plutonium found in the spent fuel. However, the end product of this process itself still requires a disposal solution, and all the countries interested in this reprocessing process have considered the option of deep geological repository for the end product. The comparative overview of the various national approaches that follows will not however cover the technicalities associated with disposal, but will rather focus on the broad approach selected by each country. The methods for the management and disposal of spent nuclear fuel have already been selected in most cases, and thus applied research and development is under way in most cases. In some instances moreover programs have already been launched to select a suitable site for the deep repository.

In France, the decision to dispose of nuclear waste in a deep geological repository was reached by a governmental committee, established for the purpose of deciding upon the method of waste disposal. Drilling was however met by extensive protest at the municipal level. As a result, the site selection programme was abandoned and new legislation was adopted. According to the new legislation, future activities ought to be based on the voluntary participation of the municipalities involved. The method for waste disposal was moreover reconsidered, and shall now be ultimately decided upon in 2006. Furthermore, a financial compensation package is now offered to participating municipalities. In Canada the method of nuclear waste disposal was held open to extensive public presentation and debate. In Sweden, the decision was taken with the Nuclear Act to attempt to find a final (long term) disposal solution to nuclear waste. However, the method for waste disposal has not, as yet, been finally decided upon, and other alternatives are being kept open for consideration in the wider consultation process which remains ongoing.

The solution of the waste disposal issue can moreover be seen as either a step-by-step process or as a combination of different methods, where different solutions are viewed as appropriate for the various steps of the process. One example of which being the question, is temporary surface and/or shallow storage a necessary step in the process for high level and long-lived waste to allow a sufficient temperature decrease before disposal underground?

Responsibility in the process

Each national set-up is unique in this regard. The responsibility for finding a solution to nuclear waste, and for initiating and conducting the process differs across the countries concerned. The level at which effective decision making takes place, and the role that the different actors are allocated in that respect differs across national systems. As does the level of influence allocated to the various stakeholders in terms of national legislation or regulations. Such differences relate to the level or tier of government at which decisions are made, as well as to the role of the nuclear energy companies and the various interrelations between tiers of government, and the regulatory and private sectors.
In some countries semi-independent governmental agencies have been established to deal with disposal issues and to take over the issue of negotiating with the regulatory authorities and the municipalities on behalf of the government or the owners of the nuclear plants. In France there is a governmental board (ANDRA) and a governmental committee responsible for conducting the site selection process. After legislative reforms regarding the disposal of nuclear waste, a member of parliament was given the responsibility of coordinating negotiations with the municipalities, including the potential to undertake the provision of financial compensation packages to the municipal level. In Canada a government owned agency, AECL – Atomic Energy of Canada Ltd is responsible for developing proposals for the methods to be used in waste disposal. In other countries the nuclear industry have themselves established agencies that are responsible for finding a solution to the nuclear waste disposal issue and for conducting the process as a whole, such countries include the UK (Nirex), Finland (Posiva) and Sweden (SKB).

Identification of suitable sites

Technical considerations are naturally an intrinsic part of the process, for instance, what sites are feasible for the disposal? Indeed, the technical and socio-political aspects of identifying or selecting a location for nuclear waste disposal are mutually -supportive. As outlined above, the importance given to local and public support varies across countries. When the overall process of identifying sites that fulfil the technical and functional purposes of disposal have been completed, the social and human factors increase in weight and importance. In particular the importance of negotiations with the local authorities grows in importance.

According to the Finno-Swedish ‘model,’ willingness to participate is a prerequisite for further work, hence, the municipalities enter the process on a voluntary basis, and have the right to withdraw from negotiations (veto rights) right up to the final stages of the process. On the other hand in USA the siting decision is reached at federal level, when a suitable site is identified. Few countries have as yet gone so far as to begin detailed negotiations with the municipalities. The structure of cooperation or negotiations can also differ, depending on whether a top-down approach is adopted, or whether the

initiatives come from the local level. Examples of such active participation with the local municipalities can however be found in Finland and Sweden.

According to Lidskog and Litmanen the search for a suitable site for a high-level nuclear waste disposal facility has given birth to disputes and organized protest groups in the municipalities under consideration. In their study on the process in two different locations in Finland; Kuhmo and Äänekoski it was clear that the same issues could provoke rather different responses. The outcome of such discursive processes can be linked to the socio-spatial identity of the area. The examples of Kuhmo and Äänekoski illustrated the difference between rural and urban surroundings, as well as the importance of differing economic bases. Moreover, the same siting can portray different meanings to different groups and professions in the same locality.

The role of different actors - legitimacy and trust in the process

Legitimacy and trust in the process were identified as important factors in all of the countries involved, whilst misgivings over such issues were identified as fundamental to the desire to re-design national processes. The responsibility for leading the programme, e.g. state organisation or the nuclear sector, and the role of the different stakeholders can also be a potential factor to the level of public confidence in which the programme is held. In particular the need for stakeholders to have clearly defined roles in the decision making process has often been highlighted.
The relationship between the different tiers of government is an intrinsic part of the nuclear waste process, as though finding a solution to the problem is of national interest, it requires a local solution in each case. A working relationship between government at national and local levels is therefore a prerequisite for success. Furthermore, the local population and organisations must be viewed as important stakeholders. Moreover, the working relationship between the government and other governmental agencies and regulatory authorities is also a fundamental factor in the outcome of the process.

Role of the regulatory authorities

The actors involved in the process at the national level include nuclear industries/waste producers, national governments, state organisation and regulatory authorities. In the countries where the waste disposal process is carried out by the nuclear power sector, the national government intervenes in the last stages and gives its final permission regarding the disposal of nuclear waste. Conversely, the regulatory authorities have direct responsibility throughout the process to ensure that the permission seeking organisations fulfil the requirements made in the legislation regarding the disposal of nuclear waste. In some instances the regulatory bodies have taken on an advisory role, both with regard to the energy producers and to other actors involved in the process (e.g. the municipalities, where the nuclear waste repositories are proposed).

The regulator's role in the process, such as the level consultation and dialogue and hence a potential influence on the proponents programme, is partly formed by the legislation.
In Sweden, there is a legal requirement for the regulator (SKI) to comment periodically on the proponent's (SKB) research and development programme RD&D. In the USA, the regulator (NRC) is required to comment on (DOE) the proponent's site selection and characterisation plans. In contrast, in the UK, the Environment Agency currently has no regulatory locus until the proponent submits an application to dispose of radioactive

waste at a particular site. Any other involvement prior to this is discretionary. (Wilmot and Galson, 1999). According to Wilmot and Galson (1999) does Finland follow a model where there is relatively little formal dialogue with the regulators during the process and the regulator process is largely driven by review of major documents produced by the proponent, who is furthermore responsible for the scope and extent of the safety case. The success of this model is dependant on the degree of trust that society places in the proponent. Furthermore, the absence of formal dialogue does not mean that the regulator is not informed of the proponent's programme, as representatives of the regulator (STUK) were invited to meetings at all stages of the proponent's (POSIVA) site assessment programmes. According to Wilmot and Gaslon (1999) "…the major challenges with regards to the regulator's role is ensuring that the regulator remains independent of the proponent, and is seen to be independent by stakeholders".

Role of the waste producers (energy companies)

The issue of legitimacy is a constant bone of contention across the differing sets of national practices reviewed above, indeed it is one of the major criticisms, relating to, for example issues of transparency within systems, and public trust in the role of the energy companies as a whole. According to Carter (in Lidskog and Litmanen, 1997), Swedish policy for radwaste management is characterised by "a far-reaching delegation of responsibility to the owners of nuclear plants, a solution that is in line with the preferences of these companies". The result is that all of the important choices in Swedish radwaste management have been made by the plant owners themselves – admittedly at some distance form the political establishment, but always with its tacit acceptance (Lidskog and Litmanen, 1997).

Among the main criticisms forwarded by the Seaborn Panel's Conclusion in 1998 (responsible for conducting the public review of the AECL's concept in Canada) were that although the disposal concept was found to be technically safe, it was not demonstrated to have a broad public support. The Panel's principal recommendations were that a "*separate arm's-length government agency*" be created to manage Canada's next nuclear waste management activities which would be fully funded by waste producers and owners and subject to multiple federal oversight mechanisms.
The role of the Finnish nuclear energy company Posiva was among the criticisms of the conduction of the Environmental Impact Assessment on nuclear waste disposal in Finland. Posiva were considered to have too dominant an effect on the participants' involvement at the meetings (Hokkanen, 2001).
As regards the disposal of medium active nuclear waste in the UK, NIREX was responsible for submitting the application to the County Board and of undertaking an EIS as part of the application process. Cumbria County Council however refused to grant a permit to the application on the grounds that insufficient consideration had been given to the public in the carrying out of the siting process. Among the conclusions available on the UK experience in this regard is that the process fundamentally contributed to the polarisation of the relationship between industry on the one hand, and the local authorities and environmental groups, on the other (Wilmot R.D. and Galson, D.A, 1999).

Role of the municipal governments

The role and involvement of governments at regional and municipal levels varies across countries. In Finland and Sweden, participation of municipal government is an important element of the process, and the willingness of the local municipalities to participate is a prerequisite for the site selection process. This includes both the notion that the municipalities enter the process willingly, and that they can withdraw from it at any stage. A fundamentally different approach is used in the USA, where the State of Nevada was identified as a suitable candidate by the federal government after the most suitable method had been identified. Common to all countries is the fact that though decisions may have been reached at the national level, the municipalities have been designated an increasingly important role as regards communicating with the citizens (examples from USA, Finland, Sweden), with the waste disposal discussion even functioning as a tool promoting transparency within the process as a whole. In Sweden the municipalities have taken on the role of increasing the transparency of the process, demanding greater levels of communication and information for the general populace. At the same time as the ongoing technical research and feasibility studies, the municipalities have undertaken their own process regarding information flow. In certain local authorities general discussion has triggered a deeper debate on the development of initiatives at the municipal level to promote an increased level of transparency in the authorities' decisions[2].

Lessons to be learned from other countries' experiences?

Although some of the countries highlighted in this section of the report have not come as far as Sweden in finding a permanent solution of spent nuclear fuel disposal, some lessons can be learnt from each for the next steps in the Swedish process.
In considering how the experiences learned from other countries can be applied to the current Swedish situation it should be kept in mind that the formation and basic characteristics of each system are reflected in the political, social and cultural circumstances in which each has developed. Furthermore, public reaction to the waste disposal plan needs to be understood in relation to a complex of general and specifically local circumstances.

The Finnish solution most closely resembles the approach chosen in Sweden. Both countries are working towards technically similar solutions. Several potential host municipalities were considered, whilst acceptance of the host municipalities was seen to be a fundamental priority of the process. However, in the site selection process Finland has from the outset given a priority to geological characteristics, whereas Sweden has emphasised "engineered barriers and later also social criteria (such as local willingness), claiming that suitable geological environment is possible to find in almost all Swedish municipalities…" (Lidskog and Litmanen, 1997).

In both the Swedish and the UK 'models' there is an organization, owned by the nuclear operators that is responsible for the solutions regarding nuclear waste. However, the way in which these organizations work differs considerably especially in relation to basic working process and as regards the involvement of affected stakeholders in the

[2] An example of such initiatives is the MKB-forum in Kalmar län.

process. The UK experience illustrates the centrality of two major aspects; the importance of acceptance at the local level, and also that of the clear allocation of accountability as regards the role of regulatory authorities in this respect.

The process in the US differs markedly from that in most other countries in that the congress stipulated the siting of the deep geological repository and the state authorities did not have a right to veto the proposal. Consequently, the technical and scientific research and experimental drillings have been limited to only one site. The Environmental Impact Statement was prepared at the stage prior to the final decision on the site and to the license application for the geological repository. The state authorities had a chance to comment as part of the EIA process, as well as during the NOI (Notice of Intent) process for the preparation of an EIS, and at the presentation of the draft EIS. Furthermore, extensive public participation processes has been conducted as part of the presentation of the draft EIS.

Canada has put great efforts into opening up a discussion on the alternative methods available for finding a solution to the nuclear waste issue. This is however an issue that has yet to be decided upon in the Swedish context, though it will form part of the alternatives considered in the Environmental Impact Assessment. The Canadian example failed to gain local support thus illustrating the problems associated with presenting such ideas and their expected constructive input at the conceptual stage, where the potential location for the nuclear waste disposal has not yet been identified. Although the approach is currently being re-evaluated, the Canadian approach provides useful examples of how EIA can be applied to the process, relating both to the technical as well as socio-political questions. The outcome (failure) of the experience provides an example of the possible challenges linked to discussing and expecting commitment to different methods where possible sites have yet to be identified.

4 The experience of EIA in relation to major development projects

Most of the Swedish actors responsible for the process of final disposal of nuclear waste seem to agree on the need for the thorough design of the forthcoming planning and decision making processes. The older DAD view – Decide, Announce, Defend (Lidskog 2000) – seems to have become outdated because of negative experiences with public opposition to localisation projects. The need to take care of public opinion and the various perspectives put forward during the planning process has been recognised as an important way in which to create processes that make way for a more socially acceptable project implementation. This understanding also mirrors the over all change in the academic perceptions of how planning actually functions in practice, and how it is expected to function. This shift is reflected in the evolution of new planning processes, as in the inclusion of new perspectives in planning theory.

There are many perceptions amongst different planning actors on how ideally planning processes should work. Reality does not however often coincide with the ideal perceptions and expectations. Both theoretical research on how planning should work in an ideal world, and actual empirical research during the last 40 years has changed the research view from an instrumental one to one more attuned with what is called the communicative rationality. In practice though both of these lines of thought have their advantages, and thus prove useful. In this chapter is presented some recent lines of thought based on planning theory and empirical research. So called best EIA practice is briefly presented. Finally experiences of EIA in the planning and decision processes of some large Nordic development projects are summarized. The aim with this chapter is to provide additional ground for the identification of unresolved issues and challenges in the coming planning and EIA process for final disposal of nuclear waste in Sweden.

The rationality of planning processes

Two distinctly different rationalities can be recognised in the planning theory literature – instrumental and communicative rationality. These lines of thought are often also found in practical planning – though they are rarely expressed in such terms.

Instrumental rationality is ‘goal oriented’ and tells us how to combine the means to achieve the ends where no preferences are attached to the means. In planning with this kind of rationality one is preoccupied with choice among alternatives for a given set of goals (Sager, 2000). Planning is perceived as moving along a linear line of action, full information, assessment of alternatives and impacts and in the end, when all is said and done, the best and most rational choice is made. Applying analytical techniques falls squarely into the instrumental rationality camp. Instrumental rationality gives little space for the consideration of values and ethics. Planning that is in line with this type of instrumental rationality is sometimes called synoptic planning (op cit).

The synoptic planning view dominated until the end of the 1950s and when it was challenged by the “science of muddling through” with the incremental approach put forward by Lindblom in 1959 (op cit). Incrementalism assumed that planning works by essentially ‘muddling through’ – that is to say, by reconciling means and ends not in a linear fashion, but rather by going back and forth or even simultaneously, ends are

indefinitely explored, objectives can change and analysis and policy making are remedial; they move away from ills rather than towards known objectives (op cit). Incrementalism can be seen as a developed form of instrumental rationality since it does not prescribe communication approaching dialogue, according to Sager (2000).

The intellectual critique of 'instrumental rationality' has been ongoing since the 1960s and the main points have been put forward by Lawrence (2000), they are as follows:

- Autocratic tendencies (experts dominate the process with only a peripheral role for the general public);
- Fails to consider resource and cognitive limits;
- Overestimates ability to predict and control environment (weak on implementation);
- Insufficient consideration of extra rational (creativity), of synthesis (compared to analysis) and of non technical and non scientific knowledge, experience and wisdom (scientific, technical and quantitative bias);
- Fails to adequately consider the collective nature of planning and the central role of dialogue;
- Fails to consider inequities and the political nature of planning (may reinforce inequities); and
- Fails to integrate substantive issues (e g social and environmental needs) and to design the process to suit contextual characteristics.

The concept of Communicative rationality was developed by Habermas (1971, 1984 in Alvesson, 1991), which emerged at the beginning of the 1970s, as a critique of the instrumental rationality concept. Habermas' ideas have, during the 1990s, been used as the basis for development of communicative planning theories. Communicative rationality, according to Habermas, is based on the communication between people and the assumption that agreement, on how things are, and what should be achieved, can be reached through dialogue. The ideal communication is based on the power of good and well founded arguments – not on power, status, prestige, ideology, manipulation, expert ruling, fear, misunderstanding etc. Open democratic processes based on dialogue between citizens are manifestations of this rationality. Communicative rationality becomes relevant when mutual understanding, coordinated action and socialization are needed (Habermas 1990 in Sager, 2001). A view that consensus can be reached through dialogue between people is the basis for this line of thought.

Today attempts are taken, in such different contexts as land use planning and firm management, to apply insights from planning and organisational theory, psychology and empirical research and experience, to design planning arenas and processes that are adapted to the context. Judging from the literature in general, and the current situation in Sweden, there seems to be a clear understanding of the need for both instrumental and communicative rationality in the planning process for final disposal of nuclear waste.

Planning arenas – meeting points for different perspectives

All types of processes where people participate can be viewed as meeting points, arenas, where different actors table their differing perspectives. From an international point of view, difficulties have emerged in creating arenas where all stakeholders have the

ability to take part, where a constructive dialogue can be established, and where good arguments are both articulated and discussed and thus able to make a direct impact on the decision process. The results from a study of the management of nuclear waste in 10 countries by Lidskog and Andersson (Lidskog, 2000) shows that all waste companies and authorities in the countries studied ostensibly view public participation in a positive way. At the same time many of them consider it unfortunate when such participation impacts upon their initial plans. The process is, in such cases, not designed to be flexible, but constitutes rather a pre-designated scheme where the aim of public participation is mainly to give legitimacy to the decision, and to create local acceptance for the proposal and to enable an efficient implementation process to take place from the developers point of view. As such, communicative rationality is, in such cases, viewed predominantly from the developer's perspective.

We see what we want to see. We all recognize different things even if we are observing the same object (a house) or question (final disposal of nuclear waste)– we have different perspectives. A perspective can be based in your profession, your position in work and of course in your personal experiences. Your perspective can be more or less conscious or unconscious. To have different perspectives means interpreting reality in different ways – this can be pictured as a situation where we all have glasses on but they all have different "filters". We "understand" and interpret the reality in different ways – for example the issues in an EIA process and what is perceived as a problem (the issue of perspectives is described in Skantze 2001).
It must be remembered that a planning and EIA process is never a neutral arena (Asplund and Hilding-Rydevik, 2001). The relevant legislation lays down certain rules, though. But the participating actors and their positions will also influence the arena. An arena can be described with the following wording (Asplund and Hilding-Rydevik, 2001):

> "*On these arenas an interaction takes place between different professional, public and political perspectives through the participating actors."*
>
> *"Communication of information, derived from the different knowledge fields represented by the actors, together with their arguing for the legitimacy of their opinions constitutes the interaction on the arena. The interaction also includes a sometimes conscious and sometimes unconscious struggle for the privilege of defining problems, tasks, important questions, who/which are "aloud" to participate in the different phases of the planning process etc. When different perspectives meet it can also be pictured as a struggle to get acceptance for your own group perspective that are derived from the embedded group culture and perspectives. All actors on the arena have different status even if the differences in status can vary over time. A "pecking order" does easily develop*."

The design of any planning or EIA process will thus influence power relations and the possibilities of influence the process. The design also has direct impact on which issues actually are possible to get into the planning arena. The understanding, analysis, identification and communication of different perspectives are certainly an important and crucial part of this "design".

EIA rationality – best EIA practice

What kind of rationality does the EIA arena provides? It is important to understand this point in order to bring EIA potential into line with expectations and to be able to adjust such shortcomings as are apparent on the Swedish EIA process. The answer to the EIA 'rationality question' can be viewed from three angles in a Swedish context:

- What are today considered to be the internationally acceptable 'best practice' standards for EIAs, describing exactly how the EIA is expected to work.
- The Swedish EIA legal framework and regulations.
- Swedish planning culture, and implementation of the national legal EIA framework.

The two last bullet points above with be dealt with later in the context of this report. The focus here will be on the first bullet point: to relate what is considered to constitute best EIA practice and to give some examples of the role EIA plays in major development projects as a basis for discussion of possible ways in which the Swedish system should be designed, including the attention given to the overall planning process and the planning arena, in relation to the EIA process itself.

Before best EIA practice is referred to here, it should be noted that the aim of all EIA work must be put forward. Numerous references could be given here from experts all over the world, though the approach of Munn (1979) is preferred here:

> *EIA is a process for identifying the likely consequences for the biogeophysical environment and for mans health and welfare of implementing particular activities and for conveying this information, at a stage when it can materially affect the decision, to those responsible for sanctioning the proposal.*

Step by step with the increase in experience gained, the notion of EIA as being solely an analytical tool has been superseded by the notion that it is, in addition, also a planning and public participation process. Through more than 30 years of EIA implementation across the world, a number of well-defined steps have evolved that are accepted among EIA professionals in order to promote best EIA practice. National legal and practical implementation of such steps - their existence, content and order - can however in practice vary considerably. The general steps described below are taken from Glasson, Therivel and Chadwick (1999).

- *Project screening* narrows the application of EIA to those projects that may have significant environmental impacts. Screening may be partly determined by the EIA regulations operating in a country at the time of assessment.
- *Scoping* seeks to identify at an early stage, from all of a project's possible impacts and from all the alternatives that could be addressed, those that are the crucial, significant issues.
- *The consideration of alternatives* seeks to ensure that the proponent has considered other feasible approaches, including alternative project locations, scales, processes, layouts, operating conditions and the "no action" option.
- *The description of the project/development action* includes a clarification of the purpose and rationale of the project, and an understanding of its various characteristics including stages of development, location and processes.

- *The description of the environmental baseline* includes the establishment of both the present and future state of the environment, in the absence of the project, taking into account changes resulting from natural events and from other human's activities.
- *The identification of the main impacts* brings together the previous steps with the aims of ensuring that all potentially significant environmental impacts (adverse as well as beneficial) are identified are taken into account in the process.
- *The prediction of impact* aims to identify the magnitude and other dimensions of identified change in the environment with a project/action, by comparison with the situation without that project/action.
- *The evaluation and assessment of significance* assesses the relative significance of the predicted impacts to allow a focus on the main adverse impacts.
- *Mitigation* involves the introduction of measurers to avoid, reduce, remedy or compensate for any significant adverse impacts.
- *Public consultation and participation* aim to ensure the quality, comprehensiveness and effectiveness of the EIA, and that the public's views are adequately taken into consideration in the decision making process.
- *EIS presentation* is a vital step in the process. If done badly, much good work in the EIA may be negated.
- *Review* involves a systematic appraisal of the quality of the EIA, as contribution to the decision making process.
- *Decision making* on the project involves a consideration by the relevant authorities of the EIA (including consultation responses) together with other material considerations.
- *Post-decision monitoring* involves the recording of outcomes associated with development impact, after a decision to proceed. It can contribute to effective project management.
- *Auditing* follows from monitoring. It can involve comparing actual outcomes with predicted outcomes, and can be used to Asses the quality of predictions and the effectiveness of mitigation. It provides a vital step in the EIA learning process.

The general role of EIA can be expressed thus, (Sager, 2001):

- Environmental protection and democratic stimulant,
- An analytic technique in supporting instrumental rationality when there are uncertainties, conflict and shortage of problem solving resources,
- A vehicle for public involvement to promote dialogue between stakeholders and the general public. EIA is used to enhance public participation, communicative planning and fairness in the planning process.
- Providing input to the political and administrative decision process.

But the preferred and actual role of EIA will differ according to the nature of the concomitant legislation and the needs and purposes of different actors in a process. In the Swedish context it must be assumed that the role of the EIA process is expected to be different from the perspective of for example the developer SKB, the authority SKI, the municipalities involved, and for the general public. When designing and planning for a future EIA process these differential roles, expectations, purposes and experiences must be analysed, and explicitly laid out for the coordinator of the whole process. Such a process will hopefully help participants to overcome, to a greater degree than was hitherto possible, the pitfalls of the process caused by the inevitable clash between differing expectations. Such differing needs and expectations are exemplified in the sections that follow below.

One crucial issue in relation to the design of the EIA process is recognition of different views on what conflicts are about in relation to the final disposal of nuclear waste. "*Any conflict involves assumptions about what the basic problem is and what is required to solve it. From this point of view, a siting conflict is primarily a struggle about which definition should become accepted and spread.*"(Lidskog and Litmanen, 1997). In accordance with the different views of the conflict, be they scientific-technical, economic or political – held by the different actors – implicit answers will be given to the truthfulness and legitimacy of participating actors. This was clearly demonstrated from the experiences of the Finnish process.

It is important also to understand the prerequisites needed for the EIA process to fulfil its expected role. EIA is a tool used to assist and improve decision making, not the arena in which the main decisions usually are taken. The EIA processes include value judgements, just as any other decision making processes and thus they cannot simply be regarded as 'objective' or 'technical'. Although the principles of EIA 'best practice' can be applied to a process, the standard framework of EIA needs to be adjusted to the specific circumstances pertaining to the situation. In order to clarify expectations of the EIA process, it is necessary to consider the 'added value' of the EIA process, and what elements are better suited to be included under other aspects of the process at hand.

Experience of the role of EIA in major development projects

Viewed from a global perspective the need for, and success of, the EIA process is unquestionable. As was described above, a vast wealth of experience exists upon which to base the proposed EIA 'best practice' scheme. When however EIA practice is scrutinized and evaluated there are of course both successes and failures to be reported. This is particularly so when it comes to major development projects. It would seem, given a number of examples, that high political and economic stakes can easily distort the 'best practice' approach of both planning and EIA processes. Examples of cases where such distortions have taken place can be found in a Nordic comparative study where experiences from EIA processes in relation to major development projects have been analysed (Hilding-Rydevik, 2001). The cases covered are as follows: the final disposal of nuclear waste in Finland (Hokkanen, 2001), the process of locating the main national Norwegian airport Gardermoen (Stenstadvold, 2001), the process of locating and constructing the railway tunnel through the 'Hallandsåsen' ridge in Sweden (Wallentinus and Päiviö, 2001), the process relating to the siting of an aluminium smelter in Iceland (Theodórsdóttir and Sigurdardóttir, 2001) and the upgrading of the railway link between Fredericia and Århus especially the section between Horsens and Skanderborg, in Denmark (Kjellerup, 2001). All these cases represent nationally important, economically substantial and politically highly interesting, even controversial, projects. In the cases of Gardermoen and Hallandsåsen, severe environmental impacts occurred despite the inclusion of EIAs in the overall project process. In Iceland, the EIA work received major political and public attention, though the process has not gone far enough for one to be able to judge upon the role of EIA in the whole planning process. The Finnish case set down several important experiences of the role of EIA, and as such, emphasis will be put on this case. In Denmark the communicative rationality of the EIA process is dominant and the process led to an abandonment of the project both on environmental and economic grounds. Sager (2001)

has evaluated these Nordic EIA cases in relation to the above EIA functions. His analysis is the basis for what follows.

Summary of the experiences of the role of EIA in the final disposal process of nuclear waste in Finland

Finland will be one of the first countries in the world to make the decision, in principal, to opt for the final disposal of nuclear waste. The EIA legislation in Finland has been implemented in connection with this project and it has been called "the EIA of the century". EIA processes have been carried, over a three-year period, in four candidate municipalities, with the processes being completed by the beginning of 1998. In May 1999, the EIA report was submitted. On January 24, 2000, the municipality of Eurajoki was approved as the host for the final disposal of nuclear waste facility.

This localisation process in Finland has been the focus of several research projects. Nordregio allotted the task to Hokkanen, on the basis of the research results, to analyse in particular, the experiences of and role played by the EIA in this Finnish planning and decision process. The following summarizes the main experiences as they were expressed principally by Hokkanen (2001).

1. The implementation of the EIA process showed that the general aims of the legislation were not easy to fulfil.
2. No great conflicts occurred during the EIA process. The conflicts that did occur concerned the role of the developer Posiva Oy, the competent authority and the Vuojoki agreement. The following three points describes these factors more closely.
3. The developer, Posiva Oy, became too dominant an actor in the process. This was criticized by civil movements and by environmental groups. Many actors, mainly opponents of the plan, felt that a legitimate EIA process was impossible to achieve because of Posiva's dominant role. Posiva's dominant role did also probably steer the design of the EIA process towards their own needs relating to obtaining local acceptability for the plan.
4. The competent authority for the EIA process of final disposal of nuclear waste in Finland is the Ministry of Trade and Industry. Their competence and neutrality was questioned by other actors, primarily because of the Ministry's sectoral identity as the principal promoter. This fact also contributed to diminishing the legitimacy of the EIA process.
5. Financial compensation was promised by Posiva Oy, the developer, to the municipality of Eurajoki if they received a positive localisation endorsement via the public participation process. This extra 'process', dubbed the 'Vuojoki agreement', caused much bitterness in the other three municipalities. As such, many actors felt that this agreement was not in line with the 'EIA rules of the game'.
6. The EIA should thus be seen as part of a political process. The EIA process can thus be used as a powerful tool of execution. In Finland however the status of the EIA process as regards final disposal of nuclear waste, is low compared to traditional forms of representative power and mechanisms of policy making. In reality, the EIA process is basically used only for plan adjustment and project legitimation.
7. A further important element in the attempt to solve the nuclear waste problem can be encapsulated in the attempt to unravel the endless struggle between scientific data and basic human common sense.

8. The struggle between sentimentality and rationality stimulates polarisation of attitudes, generating stereotypes of the rational supporter and the emotional opponent.
9. The EIA process was used by the developer to gain acceptance for the project.
10. The EIA process functioned as the administrative instrument through which the municipalities committed themselves to the plan.
11. No analyses of more basic final disposal alternatives have been made to date, partly because of the legislation. This led to public distrust and critical attitudes towards the plan and the EIA process as a whole.
12. The process of analysing and discussing technical alternatives would have benefited from the incorporation of ethical points of view.
13. The EIA process and the political process concerning the decision in principle ran concurrently. This led to much confusion and to a decrease in public participation in the EIA process.
14. Technical assessment of the suitability of each of the four municipalities showed only minor differences between them. All four applicants were deemed suitable. The ultimate reason for choosing Eurajoki probably related more to the issue of waste transportation, and the already positive attitude for the scheme given by its inhabitants. A nuclear plant is already sited here, so even if they are not positive the local inhabitants are at least used to the pros and cons of related types of facilities. Higher levels of anxiety and fear were reported from the public participation reports in the two municipalities without nuclear power plants.
15. The net economic benefit of accepting the facility for final disposal of nuclear waste varied quite substantially across the four municipalities.
16. During the EIA process the level of public participation varied quite considerably – both in relation to which actors participated and in terms of the intensity and level of their participation. As a whole however, participation levels decreased during the process. An 'elite' group of 'professional' participants however noticeably emerged.
17. People experienced a lack of transparency in the process, and also claimed that there were too long distances between the input from participation and the actual impact on the EIA process.
18. There was insufficient time available to familiarise oneself with the research results presented in the EIA process. Moreover such materials were often too complicated for laypersons to readily understand. Little pedagogic effort was however taken to render the results easier to understand. The EIA programme and the EIA report itself were each the focus of two month long public hearings.
19. The public was confused by the different planning arenas in connection with the disposal process. The EIA arena was just one of many where the possibility existed of putting forward ones opinions.
20. Public movements were organised both for and against the localisation of the disposal facility in each of the municipalities.
21. The formal EIA process was not the only, and indeed not even the best arena for expressing opposition towards the localisation of the facility. Several other arenas, such as the media, and normal political channels were also used. It is for this reason therefore that it is important to lodge the design and construction of the EIA process within the overall context of planning and political life.
22. The expectations of the various actors as they pertained to the functioning of the EIA process as an instrument of policy making and influence, were in retrospect generally felt to be unrealistic.
23. The EIA on final disposal of nuclear waste in Finland was done in accordance with the necessary legal requirements, though the EIA process seems to have had a

minimal impact on decision making. The prevailing economic reasons for accepting the facility seem to have played a predominant role in Eurajoki's acceptance of the plan.

24. Overall conclusions of the EIA process for final disposal of nuclear waste in Finland areas follows: The EIA process was in many parts well performed and was a success in the sense that it identified, predicted and evaluated the likely environmental impacts. There were problems though with EIA as a tool for policy making. For Posiva, the developer, the EIA process was a success. They obtained acceptance for the project in the targeted municipality. The EIA did provide a useful mechanism for managing the worries, hopes and fears of the citizens whilst also providing an efficient route for disclosing them to the authorities and to the developer. The usefulness of the EIA process for decision makers remains however unclear as the process appears to have had little impact on decision making *per se*. For citizens and civil movements in general, the EIA presented only one of several means of participation. For the general public then, the EIA offered a way in which to exert influence, albeit at a very late stage in the process.

Several of the Nordic case studies report difficulties in the handling of uncertainty and risk.

In the context of the Swedish process for the final disposal of nuclear waste, the EIA process and the work itself must be adequately designed to cope with risk – in relation to both its analytical and communication segments for example enabling citizens to respond to 'risk'. It is the task of the EIA to report the probability of the various forms of danger, and to describe the consequences should something go wrong. According to Hokkanen, citizens from different municipalities potentially react rather differently to such information. Those accustomed to living with a similar risk - without having experienced a catastrophe - are usually more apt to accept the project. Otway and Wynne (in Sager, 2001) suggest that this is can be viewed as a general observation. The phenomenon of hostile public audiences who read the facts differently from experts is a familiar one to planners (Kartez, 1989). It is a valuable insight that risk is defined differently by lay people and by experts, and that it is perfectly normal and rational for people to view technologies and risks in terms of how their lives are affected, that there is thus no 'correct ' definition of risk.

We assume that the question of 'risk' and public perception of such risk is a well-known issue in the Swedish context. The risk perception question has also been the focus of numerous research projects and articles. The over all knowledge base in theory must therefore be considered as good. The risk issue will be a crucial one in the Swedish EIA dialogues and processes and they must be adapted to the risk perception situation encountered in each of the targeted Swedish municipalities. Experience from the USA (Ibitayo and Pijawka, 1999) suggests that very few states incorporate strategies to deal with risk or the NIMBY syndrome where it concerns the siting of hazardous waste facilities. This lack of strategy use is probably an important explanation for the very low success rate of siting (between 1980 and 1987 only 3% of the applications received resulted in operational facilities, mainly due to the NIMBY syndrome).

The EIA does not seem to have played a significant role in addressing the NIMBY syndrome in any of the Nordic cases.

In the Norwegian case Stenstadvold points out that one-way communication that is strictly limited to informing the stakeholders of decisions that have already taken place easily creates mistrust and loss of confidence in the credibility of the government and the developers. The NIMBY syndrome issue is well known in connection with the siting of hazardous waste and the disposal of nuclear waste. The whole issue of public participation has thus proven to be a crucial issue one in terms of final disposal, which has already been addressed in this report in the section dealing with international perspectives. In the case of the siting of hazardous waste in the USA (Ibitayo and Pijawka, 1999) some common features emerged for the projects in which successful siting was achieved:

- Public trust – especially in the facility developer
- Early and continuous public involvement in the facility siting process
- An adaptive strategy that involves incorporating citizen's concerns into siting and operational decisions

Common to the 21 unsuccessful siting processes was the lack of public trust in the facility developer, the lack of substantive public input, the lack of complete and accurate information on the operation of the facility, the perceived inequities of waste importation, and the lack of an established need for the facility. In the Swedish context for the final disposal of nuclear waste, all of the positive and negative commonalities of these cases must be considered to be important in relation both to the EIA processes themselves, and to overall planning processes.
As pointed out earlier, the need for a healthy measure of communicative rationality in connection to the final disposal of nuclear waste should be considered crucial. The challenge then is how to design processes that complement these requirements and the organisational abilities of the proponent and concerned local, regional and national authorities in Sweden. What action is actually needed? In the USA study (op cit) an analysis was made of what actions were actually taken by those states having successful siting selections. Successful states utilized such factors as:

1. Involving public interest groups and the general public in initiating the states' siting processes,
2. the extent to which the public education programs were established,
3. the granting of local veto rights and
4. the provision of technical assistance or funds to the host community.

In particular it was seen that factors 1 and 2 differed markedly between successful and unsuccessful cases. Successful states also have a close correlation between identified public concerns and specific mitigating actions being taken to alleviate them, such as changes in traffic patterns, providing on site monitors and increasing the number of local residents that served on siting commissions. Most of the unsuccessful states indicated that public concerns were simply incorporated into reports that were handed over to the facility developer for necessary action. No direct links were made between public concerns and specific mitigating activities.

International EIA 'best practice' encompasses the idea of the EIA being a base for the handling of conflicts in a process, where different actors and their perspectives meet.

Openness, participation, impartial analysis, analysis of possible alternatives, fairness, empathy and the public interest are all considered to be important characteristics of well functioning EIA process in this regard. As was shown previously however, in the Nordic cases in question the performance of the EIA process merely mirrored the overall planning context and the way in which the goals of EIA are in practice executed.

The role of EIA from an informational perspective.

In this connection the role of alternatives is important. Kjellerup, who analysed the Danish case, concluded that the successful presentation of alternatives was the main success of the Danish EIA process. In all four of the other Nordic cases only one option was assessed. In a one-solution situation it is obvious that public debate tends to become polarised into 'for-or-against'. Thus leaving little legitimate 'space' for a choice between different lines of development. It is also clear that the legitimacy of the EIA process will be questioned if it is revealed that there is a systematic bias towards certain interests. It is then probably of the utmost importance to explicitly deal with alternatives in the EIA process, particularly from a legitimacy perspective. As was seen in the Finnish case, the absence of alternatives did cause problems in the EIA process.

When planning processes become irrational

In order to learn from past planning and EIA process failures it is relevant here to quote the words of Sager (2001) in commenting on the Norwegian case of the role of EIA in the planning and decision process of localising the major national airport to Gardermoen.

> "*In other words, the boundaries of instrumental and communicative rationality can sometimes reinforce each other throughout the many steps and phases of the planning process and thus arrange for accumulated irrationality in planning. This process is denoted as 'parapraxis' by Sager (1994).*"
> "*Stenstadvold draws attention to the negative impact of severe time constraints. Comprehensive analysis and meaningful citizen participation are time consuming processes. Accelerated pace tends to lower the quality of the EIA as a planning technique as well as a democratic procedure. Hence, time pressure can impose boundaries both on instrumental and communicative rationality, therefore triggering parapraxis.*"

Sager picks out the Norwegian case as a fully-fledged example of parapraxis. The cases from Finland and Iceland clearly illustrate that the EIA process led to a better understanding of environmental impacts.

Public participation

The issue of public participation is considered crucial in the context of EIA processes, as in many other planning processes. Several of the sections above deal with this issue. Some final points will be made here in connection with public participation. In the Finnish and Norwegian cases, the public expressed their dissatisfaction with the public participation processes. In the Danish case, as in their EIA legislation, the public participation process is seen as the backbone of the EIA process as a whole. Participation begins early and the scoping phase is given great emphasis. In the

Icelandic case too, public participation had a significant impact on the EIA process, though such participation came relatively late in the process.
Public participation is about creating an arena in which the needs of the public can be met concerning the dissemination of understandable information, where the general public can table questions and have an impact on the contents of the EIA process. The issue of attaining an acceptable level of communication is therefore central to the process as a whole. In the Nordic cases however a number of communicative distortions can be seen to have occurred (2001).

- Pretending to respond honestly to the demands of opposing stakeholders, while presenting the same information and unadjusted solutions throughout the entire consultation process – Swedish case (Wallentinus and Päiviö, 2001).
- Ignoring the views of affected people when writing the planning documents – Swedish case (Wallentinus and Päiviö, 2001).
- Starting the tasks of the EIA before the draft schedule is back from public review, making it impossible to adjust or expand the tasks in order to accommodate input from the hearings – Norwegian case (Stenstadvold, 2001).
- Pretending to incorporate input from the hearings into the EIA, whilst in reality leaving the analysis unchanged – Norwegian case (Stenstadvold, 2001).
- Falsely indicating that problems will be taken up later in the planning process, thus preventing stakeholders from presenting their worries on occasions where protests may have been effective – Norwegian case (Stenstadvold, 2001).

Among the conclusions to be made from the Finnish case is that the struggle between sentimentality and rationality stimulates a polarisation of attitudes, generating stereotypes of the rational supporter and the emotional supporter. How can these difference and categorisations be avoided, i.e. developing ways and methods of incorporating the different views and stakeholders?

Conclusions – expectations on the role of EIA

In the Nordic cases described above the link between the EIA process and the over all planning process for the projects was analysed. In the majority of projects all over the world the EIA process is separate from the over all project planning. A crucial question is therefore how the results from the EIA work are taken into account in the over all planning and decision making? Does EIA make any difference and if yes in what way? This question is naturally crucial when the effectiveness of the EIA "instrument" is being discussed and analysed. A comparative review of EIA systems in USA, UK, the Netherlands, Canada, Australia, New Zealand and the EU EIA directive summarizes that one of the main weaknesses in the practice of EIA in these countries is the weaknesses in integrating EIA into decision making (Wood, 1995). As seen from the Nordic case studies this has been a problem also in several of these cases.
From the Swedish perspective concerning final disposal of nuclear waste and the design of the forthcoming planning and EIA process it is the intention of SKB that the EIA process is to be the main planning process. The answers to the role of EIA in relation to the over all project planning have been to some extent given in the different sections above in this chapter. Seen from a Swedish point of view the crucial issue is not how to link EIA to the over all planning but instead how to design an EIA process that has the power and legitimacy to be the main process.

5 The Swedish situation

Background

Discussion over how to deal with the issue of nuclear waste disposal has been ongoing in the Sweden since the beginning of the 1970s. The first significant official study, the so-called AKA investigation, was conducted over the period 1973 – 1976. In the light of the results of this study, a Governmental Agency, PRAV (Program Council for Radioactive Waste) was established. The Agency operated from 1975 to 1981, holding the primary responsibility of initiating research in the field of nuclear waste. In 1977 however a new piece of legislation was enacted, the Stipulation Act, dealing with the operation of nuclear reactors. This legislation introduced a new requirement for the charging of new nuclear reactors, inclusive of which was a condition that stipulated that the prospective operators of such reactors must demonstrate that nuclear waste could be disposed of in a safe way (KASAM, 1993). Subsequently extensive research was conducted with a view to developing methods and identifying locations for the disposal of nuclear waste in Sweden.

An important step was taken in the search for a suitable site for a nuclear waste repository in 1992, when the SKB initiated an active siting programme and informed all Swedish municipalities (ca. 280) of the programme, inviting them to participate on a voluntary basis (Jensen, M. et al, 1999). Subsequently, the SKB conducted feasibility studies in eight municipalities. The aim of the feasibility studies was to identify at least two sites that were suitable for the more detailed site investigations to follow. The site selection and detailed site investigations were designed with the view to using the so-called KBS-3 method of waste repository as the main alternative.

Selection of method

Since mid-1980s the focus of the nuclear industry's attempts to find a solution to the question of nuclear waste have been directed towards direct disposal in the bedrock, that is to say, so-called 'deep geological disposal'. The preferred option is the KBS-3 method where the spent fuel is encapsulated in copper canisters (corrosion resistance) with cast iron inserts (for mechanical strength). In the repository, which will be located at a depth of ca. 500 m, the canisters will be embedded in bentonite clay in individual deposition holes. The Act on Nuclear Activities and the Act on Nuclear Protection each set the requirement that a solution must be found to the issue of waste dispose in a safe way by final disposal. The final decision on the method used for the waste disposal programme is to be made by government when the application is submitted.
The Environmental Code requires that various alternative methods are to be considered when identifying a suitable site for waste disposal, including the so called '0-alternative'. This entails that during such considerations, consultations and decision making processes, a number of different alternatives, and their environmental impacts, are considered.

In the SKB's RD&D Programme 98 and the SKB's report entitled, "*Integrated account of method, site selection and programme for the site investigation phase"* (SKB, 2000[i]), three main strategies are presented for the final disposal of nuclear waste. These are reprocessing, surveyed storage of nuclear waste, and the geological disposal of nuclear

waste. Reprocessing is a practice that has been adopted by some of the largest nuclear waste producers in Europe, most notably, the UK, France and Germany. This technique entails reprocessing fissionable materials, in particular uranium and plutonium that can then be used as raw material in the production of new nuclear fuel. According to SKB 2000, the reprocessing for reuse of uranium and plutonium is not a feasible alternative in the Swedish context, for both economic and political reasons. There is also research on transmutation which aims to explore the feasibility to transform long-lived radionuclides to short-lived or stable material.

Surveyed storage has been practised in relation to the handling of spent fuel, using both methods of wet and dry storage. The long-term storage solution meets the environmental, safety and radiation requirements as long as human surveillance and control is sustained. If those are not upheld however, the physical infrastructure is not sufficient of itself to meet the safety requirements. The SKB has also considered using the so-called '0-alternative', that is to say, undertaking to describe the potential impacts should the development or action not be carried out at all. In the SKB's consideration, the 0-alternative is identified as the continuation of current practice, storage of the nuclear fuel at CLAB for a period of 100 – 200 years. A prerequisite for the study is that the operation and maintenance levels of the installation will be kept at the same quality levels as those in operation today. The foreseen consequences of the alternative are the same as that for permanently surveyed storage, and are dependant on that the necessary standards for surveillance and control being maintained.
Despite the fact that the final decision concerning the methods used for disposal of the nuclear waste have yet to be made, the work carried out for the site selection is progressing in accordance with the preferred alternative, namely geological repository, on the basis of the KBS-3 method. This is reflected in the steps of the decision making process, as well as the technical aspects of the process which are designed with strong reference to the KBS-3 disposal method (Nationelle samordnaren på kärnavfallsområdet, 1999).

Alternative methods in the decision making process

In the application process for the detailed site characterisation the SKB shall present a system analysis of the different alternatives for waste disposal. The system analysis shall be presented simultaneously with the results of the site investigations in the municipalities, on which basis the government shall then reach a decision. The SKB has requested that the government and other interested official authorities express their opinions as to the desirability of the KBS-3 method being the main approach to the continuing process of site selection being carried out by SKB (SKB 2000, Nationelle samordnaren på kärnavfallsområdet 1999). Moreover, SKI has also stated that it would be beneficial with a clear statement from the government based on SKI's review findings.

Comments

Keeping the options open concerning the choice of method entails that all aspects of the nuclear waste disposal will need to be examined in the forthcoming site investigations and Environmental Impact Assessment process. Consequently the environmental impacts of more than one option for disposal method will be studied in the EIA process, and the final decision can thus be influenced by the outcome of the EIA process. From a communicative planning process point of view therefore this is to be considered as

advantageous. The disadvantages of not deciding on the method from an early stage are that this might create some complications regarding the legitimacy of the siting process, in particular in relation to the legitimacy of the site selection process itself. The uncertainty regarding the method could also delay and complicate the process, as it is a prerequisite for the municipalities to have clear decision making material upon which to base their decisions, and uncertainty regarding the method could perhaps lead to lack of trust in the process (KASAM, 1997). Furthermore, criticism has been voiced over the fact that the method has not been considered independently, for example by way of a specific environmental impact assessment or strategic environmental assessment of the entire process, covering both the method used for disposal, and the search for suitable sites (KASAM, 1997).
Apart from the discussion over methods, and the site selection for underground construction, the site selection process also needs to consider the nature of the industrial installations, the encapsulation facilities and the canister plant, for which an EIA needs to be carried out. Furthermore, the development of transport links and other ancillary infrastructure issues are in themselves an integral part of the process.
The site selection process and the issues addressed in the feasibility studies have built upon criteria developed by SKB. These criteria were presented in the RD&D programmes and have thus been part of the formal review of the programmes. In the site selection process, these criteria have been weighted and applied in relation to the identification of potential host municipalities.

The main concerns of the feasibility study regarding the location of geological disposal, long-term safety, technical aspects, and health and environmental as well as societal acceptance, are as follows:

- That the deep repository can be built and operated in a satisfactory fashion that meets the requirements for long term, safe storage.
- That the repository meets technical requirements as well as health and environmental protection targets,
- That the municipality concerned, as well as authorities and the government, accepts the location of the deep repository (SKB, 2000).

Identification of these issues illustrates that although the technical and safety aspects have more often than not received the most attention, the necessary social and institutional features are also a prerequisite for the proper conduction of the site selection process. As the waste disposal and site selection programme becomes more tangible, the issues relating to the local circumstances to be encountered become all the more important. At this stage it is planned that the formal EIA process will be in place in order to incorporate local concerns and contributions.
On the basis of these conditions feasibility studies have shown that the possibility of satisfying these requirements at a number of sites are good. Although the SKB's new announcement focuses predominantly on the technical and safety aspects of nuclear waste disposal, without specific reference to public support, or to the social and institutional features to be put in place, such issues are nonetheless a prerequisite for the continuation of the process.

Next steps?

In November 2000, three municipalities were identified as fulfilling the SKB's standards required for hosting a nuclear waste depository for high-level radioactive

waste. Experimental drillings are scheduled to begin in 2002/2003 and the submission of the application for review by the SKI (in accordance with the Act on Nuclear Activities) and the Environmental Court (in accordance with the Environmental Code) is planned around 2007. When permission has been granted, construction is scheduled to begin in 2009, with the disposal operation itself due to begin in 2016.

On the 16 of November 2000 three municipalities were slated for participation in the site investigation process for hosting a nuclear waste repository for high-level radioactive waste. The site investigation involves test drilling before a site can be identified as suitable for detailed site investigations. The municipalities identified in SKB's programme were Oskarshamn, Östhammar and Tierp. The plans also included taking a closer look at the prospects for a siting in Nyköping, though test drilling is not planned there for the time being.

The SKB's report, "*Integrated account of method, site selection and programme for the site investigation phase"* was published and submitted to the Swedish Nuclear Power Inspectorate (SKI) in December 2000. The SKI circulated the report to the municipalities, regulatory authorities, universities, environmental organisations etc for review and comments between December 2000 and April 2001. In June 2001 the SKI will submit a statement on the report to the Government. The Government will then attempt to reach a decision in early autumn of 2001. It is expected that the concerned municipalities will arrive at their decision on whether to participate in the investigation phase in late autumn 2001.
However, the process now launched in the three municipalities will not be concluded with the identification of a single site for the deep repository for at least 5 – 6 years. In the interim, SKB plan to carry out thorough rock investigations in the three municipalities and to prepare detailed proposals for how a deep repository can be built and operated. SKB expects to be able to propose a site for the deep repository and to submit a siting application in around 2007.

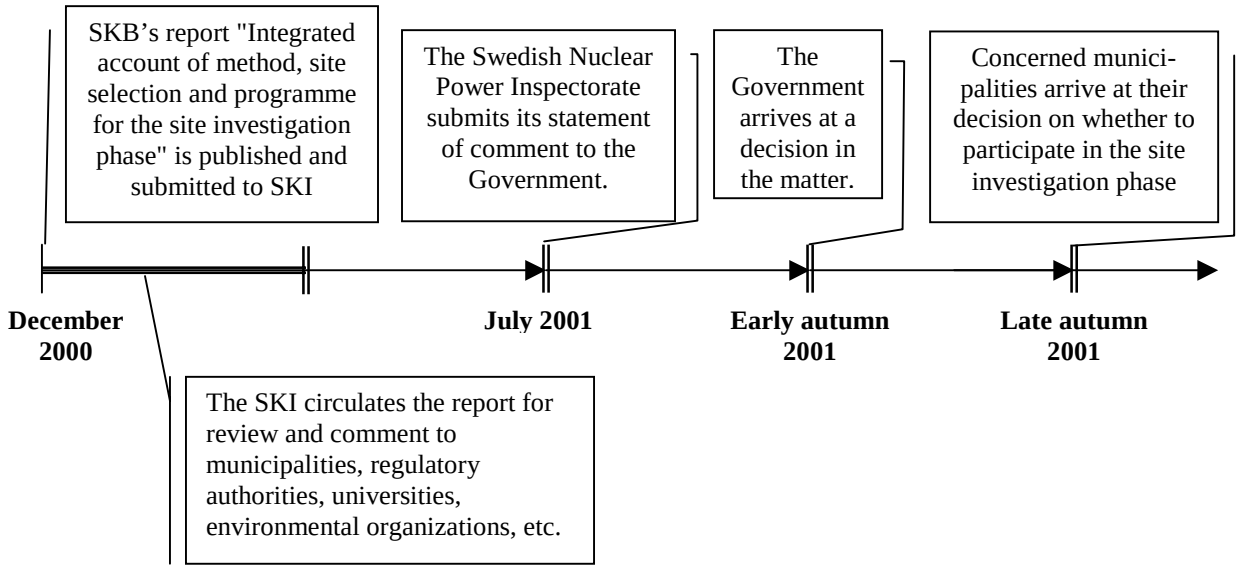


Figure 4: Decision making process December 2000 – late autumn 2001

Legal framework for nuclear waste disposal – the regulatory, legislative and advisory base

Overview of the legislation

Several legal instruments (both legislation and regulations) set the framework for nuclear activities and for the disposal of nuclear waste.
In Sweden, three acts set the legal framework for the disposal of nuclear waste; the Act on Nuclear Activities, the Radiation Protection Act and the Environmental Code.
The contents of each legislative document apply to different aspects of the nuclear waste disposal process, introducing procedures, identifying actors and setting out their roles and responsibilities. Although each piece of legislation applies to clearly defined areas, they do overlap where it comes to the issues addressed, as indeed the application process is merged between the acts. Thus the processing of the application according to the Environmental Code and to the Act on Nuclear Activities will be coordinated, that is to say, consideration of the technical and environmental aspects of the application shall be considered concurrently.

In the table below, the process for an application for disposal of nuclear waste is described according to each requisite portion of the legislative base; namely, the Environmental Code and the Nuclear Act. As can be seen from the comparison, there are a certain amount of similarities, although different actors are responsible for different steps in the process.

Environmental Code (Miljöbalken)	**Act on Nuclear Activity (**Kärntekniklagen)
Application, accompanied by an Environmental Impact Statement (EIS) is submitted to the Environmental Court (following extended consultation).	Application, accompanied by an Environmental Impact Statement (EIS) is submitted to SKI (following extended consultation).
Notification, possibility of giving an opinion on the EIS.	Notification, possibility of giving an opinion on the EIS.
The Environmental Court forms an opinion regarding the EIS.	SKI forms an opinion regarding the EIS.
The Environmental Court consults with specialists, obtains comments etc.	SKI obtains comments from SSI etc.
Inspection, main procedure/hearing	SKI/SSI prepares review report.
The Environmental Court submits the case to the government along with its own statement (Chapter 17 Environmental Code).	SKI submits the case to the government along with its own statement.
The Government decides on permission (provided the support of the municipality has been gained) and resubmits the case to the Environmental Court for examination permission in accordance with chapter 9 (and possibly chapter 11) of the Environmental Court.	The Government decides on permission in accordance with the Act on Nuclear Activities and commissions the SKI to prepare a list of possible further conditions needed to be met before permission can be granted.
New or resumed procedure/hearing.	Consideration by SKI.
Environmental verdict is announced	SKI decides on conditions attached to the granting of the permission.

Table 1: Similarities and differences in the legislation regarding the handling of nuclear waste (Nationelle samordnaren på kärnavfallsområdet, 1999).

Three main pieces of legislation set the requirements for disposal of spent nuclear fuel, namely the Act on Nuclear Activity, the Radiation Protection Act and the Environmental Code.

The ***Act on Nuclear Activity*** (Kärntekniklagen 1984:3) stipulates that the holder of a licence to conduct nuclear activities shall adopt the measures necessary to "in a safe manner, handle and dispose of wastes generated by activity or … nuclear substance which are not re-used" (Jensen, M. et al, 1999). The main aim of the act is to minimise the risk of accidents and the discharge of radioactivity from nuclear facilities, as well as related developments such as safety issues in relation to nuclear facilities with regard to the handling of nuclear substance and nuclear waste. The Act outlines the examination process to be followed in the application of a licence for a nuclear waste repository.

The Radiation Protection Act (Strålskyddslagen 1988:220) contains provisions on responsibility for the conduction of activities involving radiation. According to the Act, those who run an operation from which radiation may arise are responsible for ensuring that the radioactive waste generated by the activity is handled and, when necessary, disposed of in a manner that is satisfactory from the standpoint of radiation protection. Examinations and other inquiries in line with the Radiation Protection Act are normally carried out by the SSI and focus on protection against the harmful effects of radiation.

The Environmental Code (Miljöbalken 1998:899) sets out the requirements for an Environmental Impact Assessment (EIA) to be undertaken in connection to the disposal of nuclear waste. Regarding the conduction of this EIA process, the Environmental Code stresses that the implementer of a project requiring an EIA (in this case the SKB) must consult *"government authorities, municipalities and organizations together with the wider public. Consultation will relate to the localization, extent, design and environmental impact of the measure together with the content and preparation of the environmental impact statement"*

The requirements for and handling of environmental issues was substantially changed with the introduction of the Environmental Code (Miljöbalken 1998:808) in 1999. The code amalgamated several laws that pertained to activities with environmental effects. Furthermore, among the aims of the code is that of promoting sustainable development. However, legislation regarding safety and radioactive protection in nuclear facilities was not included in the act. Furthermore the Planning and Building Act 1987:10, and national culture policy more generally *(Kulturminneslagen 1988:950)* are also pertinent in this context.

Research and development programmes and other studies

Apart from the legal requirements that set a framework for the process, research programmes and studies have been conducted at the national, regional and indeed municipal levels. According to the Act on Nuclear Activities, the SKB must prepare and present a *Research and development programme* (hereafter called a RD&D programme) every third year, and present it to the government. The objective of the preparation of the RD&D Programme and the subsequent review of the report (by SKI with input from the stakeholders) is two-fold, i.e. firstly, to provide an insight into SKB's work (promote transparency) and secondly to provide opportunities for comments and influence on SKB's future work (Jensen, M. et al, 1999). The most recent RD&D

Programme was presented by SKB in 1998. The main issues addressed in RD&D 98 are:

- method used for final disposal
- data needed to start the site studies
- Environmental Impact Assessment for the final disposal of nuclear waste

Review of the RD&D

SKI is responsible for reviewing the RD&D (FUD) Programme and also for circulating this report for review, inviting comments from the main stakeholders. SKI circulated the RD&D programme 98 to 60 organisations, including:

- Other governmental authorities
- The Municipalities involved in the SKB's siting process
- Environmental groups
- Universities etc.

Studies carried out in municipalities

In what follows, we give a brief overview of the studies that have been carried out in the chosen municipalities and an indication of the main findings in relation to the work carried out by the nuclear power promoters (SKB), as well as those of the state organisations that are responsible for measuring and assessing the effects and implications of nuclear waste depositories.

Research projects carried out by the regulators:

Two of the largest studies carried out by the regulators are DIALOGUE and RISCOM. DIALOGUE (1991-1993) both of which aimed at establishing dialogue between the different stakeholders, interest groups and decision makers and to encourage their mutual interaction. "*The intention was to establish a dialogue between different interest groups and to explore mechanisms to enhance transparent and respected decision making process"* (Jensen, M. et al, 1999). Launched in 1996, the RISCOM project consisted of a group of experts in safety assessment, organisational theory, Environmental Impact Assessment and system analysis in addition to the active participation of SKI and SSI. The RISCOM research project was launched with the purpose of supporting the development of transparent decision making procedures. The concept on which the RISCOM project is based is that of achieving a greater understanding of the way in which facts, expert judgements and value judgements interact to form the basis for decision making. On basis of such an understanding it is then possible to develop a transparent and democratic multi-stakeholder process. The need for the clear definition of roles and interactions between stakeholders is particularly important with regard to the participation of the municipalities in the process and their relation to the regulators who have taken an active role in assisting the municipalities' participation in the process[3] whilst at the same time maintaining their integrity as licensing authorities.

[3] The RISCOM project used the concept of stretching to emphasis that transparency that SKB's environment is sufficiently demanding and that SKB can be challenged from different angles.

The main stages in the decision making process

The process of finding a technically and socially acceptable solution for nuclear waste disposal has been ongoing for the last twenty-five years. However, the formal decision making process has in principle already been established in law through various regulations (See Fig. 5).

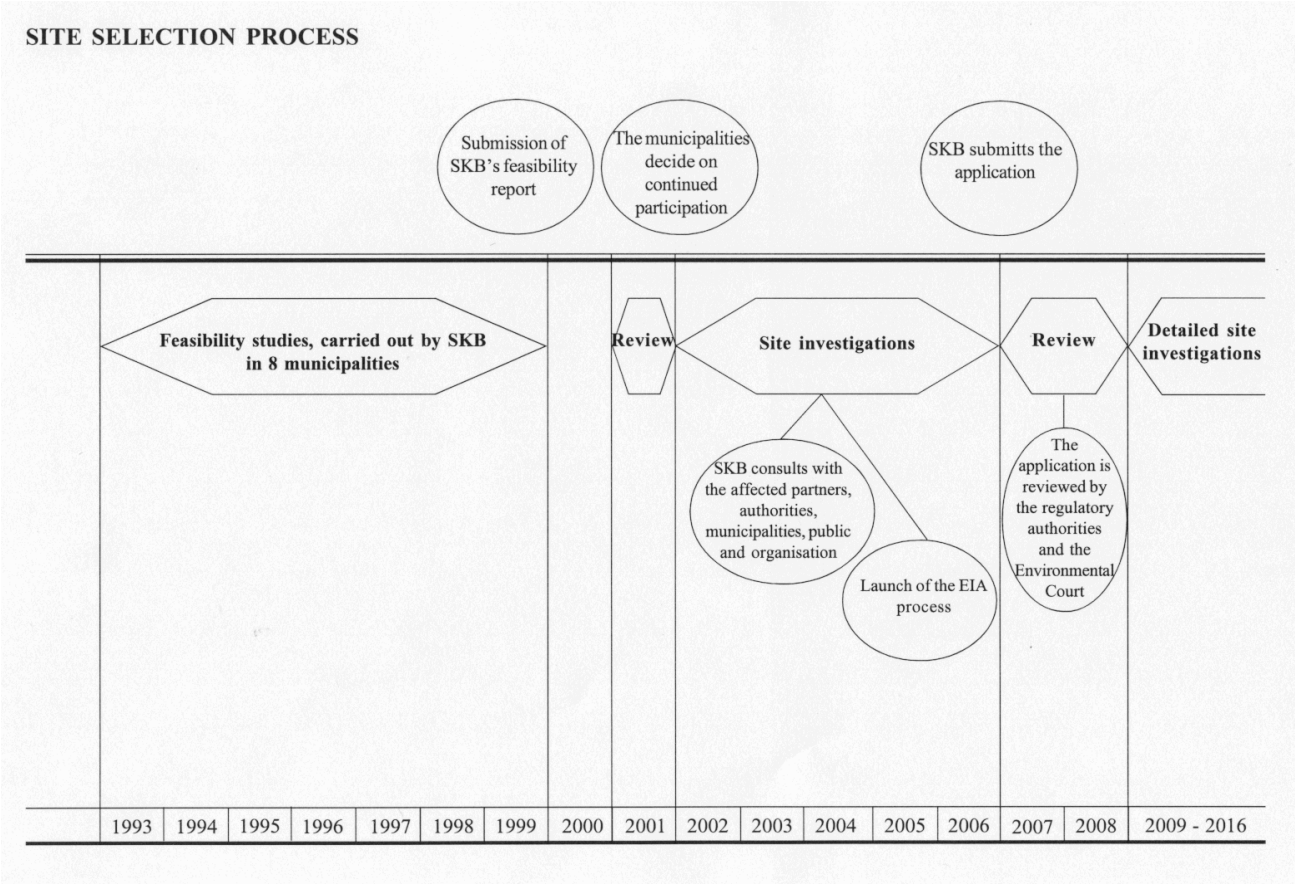


Figure 5: Main steps of the site selection process

The main steps in the decision making process for the selection of sites for detailed site investigation are outlined below. The text is based upon the SOU reports 1999:45 and 1998:68.

The ***first step*** that can be identified as being part of the process is the decision to conduct feasibility studies for the siting of nuclear waste disposal in selected municipalities, and invitation of the municipalities to participate in the programme. The conduction of the feasibility studies is not a legal requirement, but was first presented in the SKB's RD&D programme. SKB has emphasised the importance of the studies being conducted on voluntary basis. Although each municipality participated on a voluntary basis, participation remains a decision with significant political implications. The transparency of what is involved in participation in such a programme, how clear future decision making is at this stage, and what the actual opportunities for influence by the municipality will in reality be, are all questions of significance. Furthermore, participation necessarily implies that the municipality has at its disposal the professional and financial capacities to react accordingly to the various steps of the process as well as the ability to be able to relay information to the residents of the municipality.

The ***second formal step*** in the decision making process occurs when SKB presents the findings of its feasibility study on which the municipalities then need to adopt a position regarding its contents and quality and on the question of whether additional information needs to be included in the study. Secondly, the municipality needs to decide at this stage whether they want, on the basis of the information presented in the feasibility study, to be included in further considerations, and in SKB's identification of the two or three municipalities that will be included in further studies. In two the municipalities included in the feasibility studies, Storuman and Malå, the municipalities decided that a referendum should be carried out when the results of the feasibility studies in the municipalities were completed. On the basis of these referenda, the municipalities withdrew from further involvement[4].

The ***third step*** in the process takes place when the SKB has identified the two or three municipalities that will be included in the detailed site research in preparation for the experimental drilling. The outcomes of the feasibility studies are then outlined in a report prepared and issued by SKB. The report is submitted to SKI who is responsible for its review, and a call for comments is made to universities, organisations and other actors. On the basis of such comments and the internal review process, SKI then submits a statement to the government, which then proceeds to issue a decision regarding the information presented in the report and its proposals. On the basis of this information, the municipalities decide whether they want to be included in SKB's further investigations. However, the municipalities maintain the right to withdraw from the process at any time (SKB, 2000[i]).

The ***fourth step*** begins after the experimental drillings and site investigations have been carried out, and when SKB submits its application for detailed site investigation. In accordance with the Environmental Code, a formal EIA process is required as part of the application for a detailed site investigation. According to SKB (SKB, 2000[i]), the EIA process will be launched as part of the preparation for the experimental drillings. Subsequently, the EIA process will provide a framework for consultation and public hearings (in accordance with the Environmental Code and the Act on Nuclear Activities) as part of the site investigations. The application, including an Environmental Impact Statement, shall then be submitted to the Environmental Court for review (again in accordance with the Environmental Code) and SKI (in accordance with the Act on Nuclear Activities). Both actors refer the application for consideration, accompanied by the EIS, to relevant stakeholders.

The municipality itself is among the stakeholders that review the application and furthermore it has the right to veto any decisions. As siting issues have already been decided on the basis of permission given for detailed site investigation, the main involvement of the municipality in the future process relates to the design and operation of the deep repositories. The detailed site investigation will to a large extent be based on examination of the safety and radiation issues in accordance with the Act on Nuclear Activities.

The new requirements contained in the revised Environmental Code have however enhanced the municipalities' ability to influence the process still further. In particular relating to their role in relation to the formal requirements for consultation as part of the

[4] It shall be noted that municipal referendum are advisory but not binding according to Act 1991:900 (Nationelle samordnaren på kärnavfallsområdet, 1999).

EIA process itself. Furthermore, such early consultation should also enable the municipalities to establish and build a knowledge base in the field that enables them to review the application and take an informed decision.

The major actors (and their roles) in the decision making process for final disposal of nuclear waste.

The major official stakeholders according to the Act on Nuclear Activities and Radiation Protection

In the *Act on Nuclear Activity* the three main official stakeholders in the nuclear waste disposal process are identified. They are: the **waste producers**[5] that have permission to hold and operate nuclear reactors and are responsible for managing the final disposal of nuclear waste that is produced by the activity. This responsibility also encompasses the responsibility for bearing the costs that are intrinsic to the handling of such waste. These companies have established a common actor **Svensk Kärnbränslehantering AB, SKB** that is responsible for initiating the site selection process, preparing the necessary applications and obtaining the necessary permission, including also the preparation of an Environmental Impact Statement. SKB has the primary responsibility over the choice of method and regarding the technical aspects of a repository as well as of finding a suitable location for the repository (Nationelle samordnaren på kärnavfallsområdet, 1999).

The **Swedish Nuclear Power Inspectorate** (Statens Kärnkraftsinspektion) **SKI** has the primary role of ensuring the safety of any nuclear activity on the basis of the Act on Nuclear Activity. SKI prepares the applications for permission in accordance with the pertinent legislation, subsequently submitting them to the government for final decision. Moreover, SKI also undertakes research and development in the field of nuclear safety, in particular with regard to methods for handling waste, and storage of spent nuclear fuel (Nationelle samordnaren på kärnavfallsområdet, 1999).

The role of the **Swedish Radiation Protection Institute** (Statens strålskyddsinstitut) SSI is set out in the pertinent Act dealing with Radiation, and encompasses all activities in which radiation is encountered, for example in industry, the health sector and in research. The primary responsibility of the SSI is to protect human health, as well as animal life and the environment in general against harmful effects of ionising and non-ionising. SSI's role regarding nuclear development encompasses both a preparatory and an overseeing function as regards the preparation and enforcement of the pertinent regulations. Throughout the processing of applications in accordance with the Act on Nuclear Activity moreover, such requirements for radiation protection are also in force, as such, this requires that a close level of cooperation between SSI and SKI be maintained (Nationelle samordnaren på kärnavfallsområdet, 1999).

[5] The four energy companies that this applies to is the state owned Vattenfall AB, its affiliated company Forsmark Kraftgrupp AB and the two privately owned power companies OKG AB and Barsebäck Kraft AB, which both are affiliated companies to Sydkraft AB.

Other official bodies and organisations

The Environmental Code identifies three main actors in the process; the *Environmental Court, National Board of Housing, Building and Planning,* and the *Swedish Environmental Protection Agency.*

The regional **Environmental Court** (Miljödomstolen) reviews the application for a nuclear waste repository, including whether the Environmental Impact Statement fulfils the requirements of chapter 6 of the Environmental Code. The view of the Environmental Court is either made public as a separate decision or in connection with the final decision on the case. The Court's examination of the case addresses all instances of discharges and emissions from the installation, as well as the emission of radioactive substances and ionizing radiation. An important task facing the Environmental Court is thus the preparation of the application for permission (tillåtlighetsprövning) that is lodged with the government. Included in the preparation tasks of the court is the need to assemble comments from the various bodies charged with undertaking this function. As has been stated above, the municipalities hold a special position in this process. Each case will then, after all additional comments have been taken into consideration, be submitted to the government, accompanied by the court's own opinion on the particular case in question (Nationelle samordnaren på kärnavfallsområdet, 1999).

The National Board of Housing, Building and Planning (Boverket), **the Swedish Environmental Protection Agency** (Naturvårdsverket) and other central organisations all have clearly defined roles according to the Environmental Code. The National Board of Housing, Building and Planning, holds a coordinating role for the authority's work regarding the management of land and water resources. Moreover the Board is also responsible for the particular management provisions set out for those parts of the country that are illustrated in chapter 4 of the Environmental Code. The Swedish Environmental Protection Agency maintains the overall responsibility for environmental protection throughout the country. The Agency holds an important position in the examination of permission applications, especially those undertaken in accordance with chapter 17 of the Environmental Code. The Agency is normally a consultative body when the environmental court prepares applications on such issues, also maintaining the right to 'represent' in cases where there is a need to safeguard environmental interest prior to the submission of the application.
Other agencies or organizations may also become involved in the application process, either by submitting comments, or in a number of other ways. This applies, for example to the Swedish Board for Occupational Safety and Health (Nationelle samordnaren på kärnavfallsområdet, 1999).

Levels of government

The conduction of the process involves a number of different levels of government, including organisations and agencies at national level, the County Administrative Boards (Länsstyrelse) as well as stipulating an important role for the municipalities (Kommuner).

The **County Administrative Boards** (CAB) hold a very important role in the counties considered for the siting of a nuclear repository, both with regard to the site selection process as well as the review of the application for the repository. The CABs are

moreover responsible for monitoring the proposed construction in accordance with the Environmental Code. The CAB will be the main counterpart to the operators in the so-called extended consultation, as part of the environmental impact assessment for the proposed project. Moreover, the CABs are statutory consultees to the regulatory authorities as part of the review process.

According to chapter 6 of the Environmental Code the CABs shall compile reports, programmes and other materials that can be regarded as a basis for the decision and that are of importance for the management of ground and water in the County. The Boards shall also make the materials accessible to the municipalities and other organisations and authorities, as well as to those who are responsible for the preparation of the EIS itself (Nationelle samordnaren på kärnavfallsområdet, 1999).

For the **Municipalities** the siting of a nuclear waste repository presents a complex set of issues which require particular input, both at the political and the administrative levels. Predication in the siting process ensures that the municipalities maintain a certain level of political leverage throughout the process, whilst the garnering of local support is ultimately crucial for the final decision when taken. This renders both transparency in the decision making process, and effective public communication, particularly important (Nationelle samordnaren på kärnavfallsområdet, 1999).
The municipalities have a formal channel for making known their opinions in the feasibility study review process. The municipalities that are identified for further study by SKB then proceed with additional work in order to provide information and promote consensus within the municipality in question enabling, through established forums or other types of organised work, that the decision making process ensures that sufficient levels of consultation takes place between the residents and other stakeholders.

Institutional organisations/bodies

Apart from the general involvement of governmental authorities in the process, specific actors have been established to address the issue of nuclear waste.

KASAM, the Swedish National Council for Nuclear Waste (Statens råd för kärnavfallsfrågor) is a committee attached to the Ministry of the Environment. KASAM's mandate is to study issues relating to nuclear waste and the decommissioning of nuclear installations, and to advise the government and certain other authorities on these issues. The members are independent experts within different areas of importance for the final disposal of radioactive waste, not only within technology and science but also within areas such as ethics, psychology, law and the social sciences. (KASAM's web-site, 27th March 2001). Included in KASAM's mandate is the need to present an independent review of SKB's research and development programme (RD&D) for the final disposal of spent nuclear fuel. Moreover, KASAM is also mandated to provide advice to the regulatory authorities within the nuclear field (the Swedish Nuclear Power Inspectorate, SKI, and the Swedish Radiation Protection Institute, SSI) on matters connected with nuclear waste and the decommissioning of nuclear power plants.

The **Special advisor on nuclear waste disposal** operates from the Ministry of the Environment. The special advisor has been assigned the following tasks by a governmental decision of the 5th May 1999:

- Pursue work regarding site selection for spent nuclear fuel and radioactive waste as well as provide advice to the hearing within the Swedish Cabinet Office.
- Coordinate information and review initiatives between the central and regional actors that are affected by the site selection process
- Be prepared to coordinate information and review initiatives in connection with the site selection process where affected municipalities consider this to be desirable.
- Keep close contact with each of the differing organisations that wish to remain active in the site selection process, as well as promote contact between them and the various Government authorities.
- Analyse issues regarding the storage of spent fuel that can be considered to be of general interest, as well as to take other necessary initiatives.

The General Public and interest organisations

A large and diverse actor in this context is of course 'the general public', both as individuals and as 'the organised public', i.e. interest and environmental organisations. Public support is an important aspect of the nuclear waste disposal process and environmental organizations have often taken a critical approach to the operator's aims and activities, often acting as an opponent in the discussion of projects with substantial environmental impacts (Nationelle samordnaren på kärnavfallsområdet, 1999).

One of the aims of the Environmental Code is to enhance the involvement of the general public and other organisations by granting them increased influence in examinations on environmental grounds. According to the Environmental Code, it is the initiator who is required to consult with the public and other organisations during the EIA process. Thus the public and these other 'public' organisations get an opportunity to influence the debate before the final application is submitted, which represents an important change from the previous legislation (Nationelle samordnaren på kärnavfallsområdet, 1999). Moreover, the rights of the general public and the public organisations that are not direct stakeholders in the process are ensured, i.e. they have the same rights as vested stakeholders (*sakägare)* to appeal on environmental judgments. However, the right to plead before court *(talerätt)* is limited to organisations that have been in operation for at least three years and have minimum of 2000 members.
The Aarhus Convention reinforced the rights of the general public in official decision making where those affected by the development in question retain rights to influence and further appeal an environmental decision. There is however no mention of 'the general public' in the Act on Nuclear Activities nor indeed in the Radiation Protection Act.

The debate to be carried out in relation to the final disposal of nuclear waste will not be limited to the political arena, but instead will be opened up to widespread influence through public meetings, hearings etc. Furthermore, experience has shown that such debates are to a large degree carried out in the media, (newspapers, radio and TV) as well as within local organizations and across a plethora of different public for a such as meetings. "The debate has been characterised by active involvement of central environmental organisations, normally to strengthen the local opposition against eventual location within the municipality" (Nationelle samordnaren på kärnavfallsområdet, 1999). On the basis of the experience in Malå and Storuman it has became clear that the general public and interested public organizations can have a direct influence on the development of the nuclear waste discussion and the political end result in the municipality.

Economic support for participating in the process

According to the Act on the Financing of Future Expense for Spent Nuclear Fuel etc. (1992:1537) the owners of the nuclear power plants are financially responsible for the disposal of spent nuclear fuel. The plants pays a fee to the state controlled Nuclear Waste Fund, which has existed in its present form since 1981. Currently money from the fund is available to use by the state, SKB and the municipalities. The municipalities also receive support enabling them to participate in the siting process, including the review of SKB's work, as well as to enable them to distribute information to local residents and to prepare for the political decision making phase. At the beginning of the process no means of financial support were available to the municipalities (e.g. when the work was initiated in Malå and Storuman). Moreover, the issue of financial support for the activities carried out by environmental organisations has been forwarded to the government who subsequently went on record by stating in connection with the review of the RD&D, that it would consider the issue. No decision has been made.

Comments – the identification of the stakeholders

The roles of the actors in the process and their level of involvement are partly set out in the legislation and its attendant regulations. However, no universal definition of the stakeholders and their roles in the nuclear waste disposal process currently exists. Examples of possible stakeholders in the process would be: waste producers, waste management agencies, safety authorities, local communities, elected representatives, and technical intermediaries. The OECD has also addressed the issue of stakeholders and their roles in the process. Among the issues addressed is the definition of the term 'stakeholder' which as yet remains to be clearly identified are; "it can mean someone with a vested interest or preconceived view, or simply someone with a role to play in the process, encompassing international organisations and the regulators" (NEA, 2000[1]).

According to KASAM (KASAM 1998[i]) there remains a need to clarify the potential roles of the state authorities in the Swedish application process, particularly in their relation to the municipalities prior to the launch of the formal application process. In particular they identify the need to better define the roles of the regulatory authorities; SKI and SSI.

The role of the regulatory authorities with regard to the application process is outlined in the Act on Nuclear Activities, the Act on Radiation protection, as well as in the ordinance on nuclear activities and the ordinance on radiation protection, in addition to that of general governmental decision. Simultaneously SKI has a public role giving SKB advice as regards the contents of an EIS. Moreover, SKI has also taken it upon itself to assist the stakeholders, both SKB and the municipalities in 'stretching', that is to say, challenging the SKB's work and developing their capacity to influence and actively participate in the decision making process. According to SKI there are two main channels related to 'stretching', i.e. the Environmental Impact Assessment procedure serves an important function in such 'stretching,' as do public hearings. In that context the EIA can be regarded as an instrument of public participation. One such example of the successful application of the EIA tool in this respect is the EIA-Forum in Kalmar County that was created on the initiative of Oskarshamn municipality, one of the municipalities that participated in the feasibility study.

The most important stakeholder groups identified by POSIVA in the application process for a spent nuclear fuel repository in Eurajoki in Finland (Kurki, O., 2000).

- The municipality of Eurajoki, the decision makers and inhabitants
- The inhabitants of neighbouring municipalities and in the economic zone of the town of Rauma
- The Mass media (local/national)
- The Environmental movement/opponents
- Decision makers at the national level
- The Scientific community
- Regulatory Authorities
- Owner companies

According to the Swedish regulators they see themselves as independent because they need to be able to review the safety assessment put forward by the project developer. However, "as SKB's programme for siting a spent fuel repository progress [..], SKI and SSI are facing increasing requests by municipalities to take an active role in the EIA as 'people's experts'. At the same time they have to maintain their integrity as licensing authorities" (Jensen, M. et al, 1999).

The role of the different stakeholders and their effect on the credibility of the Swedish EIA process for disposal of nuclear waste was criticised in a paper presented at the VALDOR symposium 1999 (Holmstrand, 1999). In this paper Holmstrand argued that responsibility for conducting the process should be divided in a rather different manner, and that at present, SKB holds too dominant a role and thus lacks credibility, and thus an independent authority should control and supervise the EIA process rather than a representative of the nuclear industry itself in order to retain the level of legitimacy and acceptance that is a necessary condition for the completion of a successful EIA process. Furthermore he refers to the outcomes of the DIALOUGE project and to the findings of the Tunnel Commission (Tunnelkomissionen, 1998), which proposes that the dominating position of the operator in the preparation of the EIA should be balanced by a separate EIA authority in a similar way to the Dutch Model of the EIA Commission. Furthermore, the environmental organisations must be representatives of the public and given reasonable conditions and resources with which to take a significant part in the EIA process.

The main stakeholders identified in the nuclear waste disposal process in Malå (KASAM, 1998[ii])

In conjunction with the outcome of the referendum in Malå municipality in 1997, a study seminar was conducted where studies of the process, the different actor roles and their influence on the outcome of the process were presented. One way of categorising the actors is by grouping them in tiers, i.e. national, regional and local actors. The first group, the national actors includes the Swedish Parliament, the government and the national level organisations, i.e. the Swedish Radiation Protection Institute (SSI), Swedish Nuclear Waste Inspectorate (SKI), Svensk Kärnbränslehantering AB (SKB), the environmental organisations Greenpeace, Friends of the Earth (Jordens Vänner) as well as *Avfallskedjan*, all of which have an influence at national level in addition to this group, the organisation *Opnionsgruppen mot transport and lagring av kärnavfall*, i.e. an organisation that explicitly works against the transport and storage of nuclear waste, with members from several municipalities in Malå's vicinity could also be cited. The regional level is represented by the County Administrative Board *(Länsstyrelsen)* and the local level is comprised of the *kommunledningen*, the political parties in Malå, the reference group for the feasibility study, the independent review group, the coordinator, *Opinionsgruppen mot kärnavfall* and the Yes-group (*Ja-gruppen)*.

Environmental Impact Assessment (EIA) and decision making processes

Legal EIA requirements and applications in the waste disposal process in Sweden

The overall legal basis for the conducting of Environmental Impact Assessment is set out in Chapter 6 of the *Swedish Environmental Code (*1998:808), and in more detail in a number of separate Ordinances. The Environmental Code introduced several changes to the management of environmental issues, as well as collating the overall process requirements of the EIA process in one place where they were previously available only after searching through the various pertinent acts.

The Environmental Code outlines

- when a Environmental Impact Assessment is required,
- that consultation is required as a part of the environmental impact assessment process,
- the requirements on what the environmental impact statement shall entail,
- the responsibility for the Environmental Impact Assessment, including costs and
- the connection to the overall project plan, and how the EIA shall be considered in decision making.

Article 3 in *Ordinance 1998:905*, lists the types of developments that always require an Environmental Impact Assessment, including disposal of nuclear waste. Included in the list is a requirement for an Environmental Impact Assessment for radioactive waste. The requirements apply to the construction of facilities for handling, processing, storage and final disposal of spent nuclear fuel, nuclear waste or other radioactive waste according to the Act on Nuclear Activities (1984:3) and the Act on Radiation Protection (1988:22).
The requirements for an Environmental Impact Assessment are also included in Article 5b of the *Act on Nuclear Activities* (1984:3) and Article 14a of the *Act on Radiation Protection* (1988:22).

The responsibility for conducting an EIA process

The initiator is responsible for preparing the Environmental Impact Statement in accordance with the Environmental Code. The developer furthermore bears the financial responsibility for the process. The developer also decides upon the contents of the EIS in cooperation with the authorities responsible for conducting the process. As regards the preparation of an EIS for nuclear waste disposal, the SKI and SSI shall also be consulted on the contents in accordance with the Act on Nuclear Activities and the Act on Radiation Protection. Moreover, the public and organisations affected are given an opportunity to influence the contents of the EIS during consultation. The developer is required to conduct an extended consultation programme with government authorities, the municipalities, the general public and organisations affected by the proposed development, e.g. siting, scale and design. According to the Environmental Code, the developer shall submit the EIS to the County Administrative Board which then issues a public notification of the application and accepts comments on the EIS. The Environmental Courts receive the comments and the results of the consultation by the

County Administrative Boards and decide whether the EIS fulfils the requirements listed in the Code. The Environmental Court therefore issues a specific decision on the EIA, but the EIS however forms part of the application for the repository, and shall be part of the material on which the decision on the repository is made. According to Art. 9 of the Environmental Code, the authorities shall take the results of the EIS and the various consultations into consideration when deciding upon the application.

Screening	The County Administrative Boards (CAB)
Scoping	The developer, ensuing consultation with the CAB and other authorities
Preparation of the EIS	The developer
Notification – making the EIS official and available for comments	The CAB or the Environmental Courts
Review	The CAB or the Environmental Courts
Appeal	The Environmental Courts, the Supreme Environmental Courts and the Supreme Court
Implementation of individual parts of the EIA Procedure	The developer

Table 2: Actors responsible at the various stages of the EIA process as stipulated by the Environmental Code

Contents of an EIS

The requirements for the content of the EIS are made in Chapter 6, section 7 of the Environmental Code. The requirements correspond to Annex IV of the EC directive 97/11/EC.

The Environmental Code includes requirements for the contents of the EIS, including:

- A description of the project, including both the physical characteristics of the project, the site, design and scale
- A description of measures envisaged preventing, reducing and where possible offsetting significant adverse effects on the environment.
- The information necessary to identify and assess the main effects that the proposed project is likely to have on human health, environment or management of natural resources.
- A description of alternative sites and designs (to the extent that this is possible) and studied by the developer and their environmental effects. This shall include a description of the consequences if the operation will not be carried out (0-alternative). The EIS shall furthermore include a statement of the reasons why a specific alternative was chosen.
- A non-technical summary of the information in the previous indents.

According to the Act on Nuclear Activities, the operator is responsible for the way in which nuclear waste or spent fuel is handled and that it is disposed of in a safe manner. The contents of the EIA shall be adapted to what is considered reasonable with regard to the nature and scope of the project. Possible alternatives to the proposed site of the facility or activity, and the consequences of the alternative solutions should be investigated in such a way as to obtain a satisfactory basis for decision making. This also includes a requirement to account for the effect of the option that the project is not carried out, the so-called ‘0-alternative’. This means that it should be possible to make a comparison between the different alternatives and compare them with the likely impacts

had the project not been carried out in the first instance. Among the comments of the government review of the SKB's RD&D 98, a further consideration of the alternative system design was needed, with special emphasis on the 0-alternative. This was moreover one of the main conclusions of SKI's review of the RD&D. As a result, the SKB issued a report in 2000 giving an overview of the different alternatives (SKB 2000[ii]). According to SKB however the 0-alternative (surveyed storage) can only be regarded as a temporary solution. In order to address the 0-alternative, SKB has examined the possibility and consequences of extending the time for CLAB storage from 60 to 100 – 200 years.

Quality control in the EIA process

There is no formal system or process to ensure the quality of the contents of the EIS prior to submission and its consideration by the Environmental Courts. The Environmental Courts shall identify whether the requirements of the Environmental Code are fulfilled regarding the content and the level of consultations carried out when conducting the EIS. The decision of the Environmental Court is made official either by in the form of a separate decision, or in connection with the decision on the case or the measure in question.

1. The application for permission is submitted to the regional Environmental Court in accordance with the Environmental Code. The court reviews whether the EIS fulfils the requirements that are made in the Environmental Code relating to the contents of the EIS, including whether the requirements for consultation have been fulfilled. The decision of the court can either be issued separately or in conjunction with another decision. If the issue were considered to be controversial, a special decision would normally be issued. The examination of the court also includes all discharge and disturbances arising from construction, including the discharge of radioactive material and ionised radiation. Prior to the decision, the Environmental Court holds meetings with those familiar with the subject; as well as with the various authorities who have the right to plead before court, to make comments during consultation of the report and/or who can be further involved as experts. The authorities that have right to plead before court *(talrätt)* in the furtherance of the public interest are the Swedish Environmental Protection Agency, the Swedish Judicial Board for Public Lands and Funds *(Kammarkollegiet)* and the County Administrative Boards. The Environmental Courts have full responsibility for the inquiry and shall see to it that the case gets the necessary level of examination required. An important element of the courts' responsibility is to prepare the case for the governmental consideration and for the application process itself, including the statements made during the review in which the municipalities retain, as was noted above, a special position.
2. The case is submitted to the government with the statement from the Environmental Court.
3. It is to be expected that the initiator has sought permission in accordance with the legislation on nuclear technology. Such an application shall be submitted to the SKI who then submits the application and its statement to the government, following on from a process of consultation and review. The Environmental Code and the Act on Nuclear Technology shall apply in parallel. When applying the nuclear law statutes the contents of the Environmental Code need to taken into consideration, and when examining the case in accordance with the nuclear legislation the rules of the EC apply, such as the requirement to conduct and Environmental Impact Assessment.

Table 3: The application process for final disposal of nuclear waste – i.e. the legally required EIA process (Nationelle samordnaren på kärnavfallsområdet, 1999).

Phase in EIA process	Actors	Activities	Product
EIA pre-study	All stakeholders*	Meeting with EIA forum**. Meetings, hearings etc. on the local level	Advice on the EIA document
Implementers work	Implementer	Project work	Licence application
Continued EIA process	All stakeholders	Hearings, seminars etc.	Understanding
Final phase of EIA = First phase of licensing	Regulator interacting with community	Review and decide Hearings	Improved license application

Table 4: Emerging Swedish EIA Framework (SKI, 1998).
* Stakeholders include implementer, regulator, county, municipality and the general public
** EIA Forum: A group of representatives form each stakeholder

EIA as a tool in decision making

According to the Environmental Code, the purpose of the EIS is to provide a better basis for decisions. The Statements should be included as a part of the basis for the decision and in order to facilitate an overall assessment of the planned operation's effect on the environment, health and the management of natural resources. In order for the EIA to be a satisfactory tool in the decision making process, the structure, scope and presentation of the EIS must be clear. Furthermore it must be clear what the role of EIA is in the process. It is thus important that the EIS is helpful as an overall view of the document, i.e. that the document shall be easy to understand and that it is focused on the most important aspects of the development. This is important from both a decision making point of view (so that the contents can be integrated in a satisfactory way into the decision making process) and from the point of view of the general public, so that they can more easily put forward their views on the document. In Petri (1995), the importance of EIA as a process is stressed: "The EIA should be a process where an open discussion is carried out with those representing different types of expertise and interests and where there should be a willingness to examine alternative solutions". This view is shared by both SKI and SSI, each of whom stress the importance of the EIA process being integrated into the process of identifying a site for the nuclear repository and thus into the final decision making process (Norrby and Larsson, 1999).

Uncertainties and challenges for the future

The EIA on nuclear waste follows the same process as all other projects requiring an EIA. High expectations are however apparent regarding the implementation of the Environmental Impact Assessment process in connection with nuclear waste disposal, the potential role of the EIA to promote open and transparent decision making processes, and the presentation of criteria that will be the deciding factors in the selection of sites for the detailed site investigations. Prior to the Environmental Code there were no comprehensive requirements for the conduction of the EIA process or the contents of the EIS. Although the Environmental Code has introduced clearer guidance on the EIA process, a considerable amount of freedom prevails concerning the formation of the process and the objectives of conducting the EIA process. Beyond the

rather general requirements in the Environmental Code, generic guidelines are being prepared by the Swedish Environmental Protection Agency on the implementation of chapter 6 of the Code, as yet however no guidelines currently exist that apply specifically to nuclear waste disposal. This leaves considerable scope for the contents of the EIS, as well as the consultation during the preparation and review of the EIS. In this respect, the Swedish legislation on EIA differs from that of neighbouring countries', as it allows for more flexibility on the part of the competent authority regarding implementation of the EIA. (Bjarnadóttir, H. (ed), 2001). The ambiguity of the requirements in the Environmental Code moreover gives the County Administrative Boards a great deal of flexibility to adjust the EIS process to the circumstances in each case, revolving around who is involved, and the most suitable timing for the launching of the formal EIA process.

Some answers to the issues of uncertainty are given in the SKB's Research and Development Programmes on the EIA (every 3rd year) regarding when the formal consultation shall start and what this consultation shall entail. Such issues have also been addressed in a memo prepared by the county administrative boards in Uppsala, Kalmar and Södermanland and by the Special Advisor on nuclear waste disposal, regarding the requirements for consultation as a part of the application process for the nuclear waste disposal. Furthermore, a memo has been prepared examining the most suitable time for the start of the regulatory 'early consultation' in line with the stipulations of the Environmental Code.

As a result of the review of RD&D 98, several issues were raised regarding the implementation of the EIA process. The main points of difficulty were highlighted as, relating to the timing and the comprehensiveness of elements that shall be included in the EIA process. In *KASAM's* review of RD&D 98, the main issues of uncertainty in the process were identified. Among these is the need for a stronger standpoint from government regarding the choice of method for the nuclear waste disposal, the application of Strategic Environmental Assessment (SEA), and the need for a definition of the criteria upon which the selection of sites for site investigation will be based (KASAM, 1999).

Application of SEA

In the review of the RD&D, *the Swedish Board of Housing and Planning* and the *Swedish Environmental Protection Agency*, as well as certain environmental organisations, stated that the decision on the selection of the method should be based on some form of ***Strategic Environmental Assessment*** (SEA). Moreover, the environmental organisations (Greenpeace, Opinionsgruppen mot kärnavfall i Malå, Avfallskedjan) have also requested that the choice of method and the site selection process should be separated. The statements refer to the EC directive proposal on 'Environmental Assessment of certain plans and programmes' that has been passed by the European Parliament. Furthermore, the importance of Strategic Environmental Assessment was also highlighted by the Espoo convention that Sweden signed in 1991, and ratified in 1992. What is incorporated into the SEA is not specific to those statements of opinion, but is rather a request for a more thorough assessment of method selection than is currently included in the consultation process on Environmental Impact Assessment stipulated by the Environmental Code (KASAM, 1999).
SKB opposes the initiation of such a process that is not defined nor required by Swedish law or EU directive, claiming that it does not provide additional information from that

already provided by the SKB RD&D. SKI has supported SKB's standpoint, stating that the issues that would be covered according to the SEA directive have already been addressed and reviewed in previous RD&D programmes. (SKI, 1999).
In KASAM's opinion there is no need to "introduce new forms of evaluation and consultation concerning the issues which have been brought to the fore through RD&D Program '98, with respect to method or site selection" and the new regulations in the Environmental Code concerning the evaluation of the EIS and the system involving special public reviews of the nuclear industry's research and development programme (RD&D), in essence fulfils the purpose of Strategic Environmental Assessments (KASAM, 1999).

Timing

Another major point of discussion is the timing of the EIA application for nuclear waste disposal, i.e. when does the formal consultation take place, and how shall it be implemented? According to the Environmental Code, the process shall commence when the initiator has established a sufficient basis to "provide information about the siting, scope and design of the planned activity and of its anticipated environmental impact" (Chapter 6, Environmental Code, art. 4 and 5). By that stage, a considerable part of the process has already taken place, without a clearly regulated framework to guide the process or how its results shall be incorporated in the continued process (Nationelle samordnaren på kärnavfallsområdet, 1999).

However the initiator is able to enter into discussions with the authorities and others affected by the development at an earlier stage. SKI has moreover stressed the importance of the EIA process being introduced simultaneously with that of the start of the site investigation process, as it is an important part of the preparation of the application (Norrby and Larsson, 1999).

In the light of the experience gained from work primarily coordinated by Oskarshamn municipality and the County Administrative Boards of Kalmar County, the idea of an even earlier beginning to the formal consultation process (EIA process) has also been discussed. All the County Administrative Boards involved in the feasibility studies have established forms for consultation and for information. In KASAM's opinion this work weighs in favour of the Government urging SKB to, initiate at this stage, discussions with the County Administrative Boards in the counties where feasibility studies are in progress (KASAM, 1999). Such a dialogue could thus prove to be an important element in establishing whether the national nuclear waste management project has already come so far that an Environmental Impact Assessment, in accordance with the Environmental Code, can be initiated, i.e. whether or not practical conditions now exist for the insight and consultation stipulated by the Environmental Code.

The crucial question however relates to the definition of the EIA procedure according to chapter 6 of the Environmental Code. How can the various initiatives that have been carried out at the municipal and county levels, as well as the consultation work that has already taken place as part of the siting preparation and the feasibility studies, be considered in the forthcoming decision making process? Much of this work has been carried out prior to the introduction of the Environmental Code and thus does not fulfil the requirements of the Code regarding consultations and submission to the appropriate authorities. Can such material therefore be considered to be part of the EIA process and as a step towards the preparation of a nuclear facility? Should the material be examined

as background material for the examination of the siting and environmental impacts according to the Environmental Code and with regard to safety and radiation protection according the Act on Nuclear Activities? According to KASAM it would be "exaggerated formalism to interpret the positions of Chapter 6 of the Environmental Code to mean that the formal EIA should be initiated only when SKB prepares the application for permission to conduct a detailed characterisation" (KASAM, 1999).
How to make the most of initiatives carried out in the 'good spirit' of the EIA.

6 Issues and questions in need of special attention

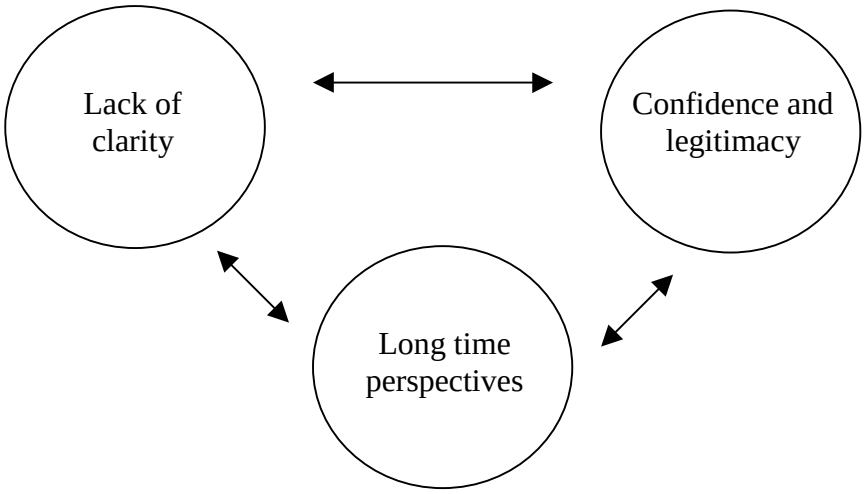
In the previous chapters, a number of Swedish, Nordic and other international experiences were presented. Different experiences of the final disposal of nuclear waste, and cases from other development issues of similar scope, where experiences assumed to be of importance for final disposal of nuclear waste, were highlighted. In addition, issues relating to 'good EIA practice' as well as those relating to some aspects of planning theory have also been presented. The current Swedish situation for the planning and EIA process of the final disposal of nuclear waste has also been summarized. We have compared these different 'knowledge areas' on one hand, with our perception of the expectations concerning the forthcoming process put forward by different Swedish actors in the final disposal of nuclear waste arena, on the other hand. In this respect we have paid particular attention to the latest SKB report (SKB, 2000[i]), as it is assumed to represent the most up to date coverage of the topic in question. This has resulted in the emergence of a number of issues where we find reason for special attention to be paid to the design and implementation of the forthcoming planning and EIA process in Sweden. These issues are presented in what follows of this chapter.

The conclusions put forward here were discussed at a seminar, in April 2001, with representatives from SKB, SKI, SSI, and the special advisor on nuclear waste disposal. The comments from this seminar have been used to further develop the conclusions here.

Much work has been put into exploring the best possible ways of solving the EIA, transparency and public participation aspects of the nuclear waste disposal issue in Sweden. The focus of the work carried out by SKB has developed through time where differing solutions and differing sites for the location of the nuclear waste have been discussed and developed. On reading reports issued by the nuclear waste sector itself, it is clear that the Swedish nuclear developers (through SKB) have come to place increasing importance on developing a transparent decision making process with clear instances for information course, and greater opportunities for public participation and input. The weight that is laid on this development is particularly noticeable in the feasibility studies that were carried out in the municipalities, in the FUD programme (see the 1998 programme) and most recently, the report presenting the results of the feasibility studies: '*Integrated account of method, site selection and programme for the site investigation phase'*, published in December 2000. In the report, the chapter on the site selection process is particularly important as it lays out the prerequisites for the continued work; the division of responsibilities, the role of SKB, information, dialogue and consultation, and the roles of, and dialogue with, the municipalities, County Administrative Boards and the Ministry.
It is stated in the report that the prerequisite for a continuation of the process is the maintenance of both political and public support and confidence. This includes both elected bodies (local and national) as well as the general public, especially those living in close proximity to the installation itself. (The issue is composed of both political and public components). Furthermore, the importance of an open site selection process is stressed in the work, as is voluntary participation from the municipalities and an active dialogue between the SKB and other participating bodies.

Three central issues

Our perception of issues that need attention in the design and implementation of the forthcoming process for the final disposal of nuclear waste in Sweden can be summarized in three distinct, but interlinked, issues namely – uncertainty of how to design the forthcoming planning and EIA-process, how to achieve confidence and legitimacy for actors and processes, and the long time span of the planning process. The issue of uncertainty concerns the high expectations of the forthcoming process in relation to the actual paucity of existing proposals put forward concerning how, in practice, to go ahead with the process. Moreover, it is difficult for an outsider to grasp how the design of the process will come about and what roles different actors will have, on a more practical level, in this process. The general picture though seems straightforward enough. Even if we can assume that the developers have 'good and honest intentions' as regards the forthcoming process, the knowledge level concerning planning processes in general does not seem to match the technical knowledge level as regards physical disposal itself. Thus there seem to be room for further development of this knowledge area in connection with the final disposal of nuclear waste.



Another characteristic aspect of the process is the importance attached to achieving the stipulated levels of confidence and legitimacy, both for the process itself and as regards the different actors participating in the process. The need for trust and legitimacy is naturally important for other planning and EIA processes like for example concerning hazardous waste. But the issue of final disposal of nuclear waste do pose some extra challenges because if the issue at stake and due to for example it's history concerning public opposition and perceived connection to nuclear power.

A third factor that affects both the level of uncertainty (and can thus contribute to uncertainty arising) making the search for confidence and legitimacy more complicated, is the issue of the long time perspectives under which the planning process is to be conducted.

The following questions constitute the base from which we have outlined the three central issues above:

- A plethora of potential EIA processes – risks duplication and a lack of clarity?
- How many different planning arenas, besides those focused on EIA, will there actually be?

- What level of legitimacy is to be expected for the EIA process in relation to other planning- and decision processes?
- Is it possible to design clear and understandable links between the several possible planning processes?
- The three differing roles of SKI – will they in themselves pose a legitimacy problem?
- Is there a major risk that SKB will be perceived to have a too dominant role in the forthcoming process causing negative impacts on the communication process?
- How are inputs from the various actors going to be addressed in the process?
- What level of capacity exists to design, review, coordinate and lead communicative processes, in the municipalities, and at the County Boards, within SKB and SKI?
- How are coordination functions going to be undertaken with regard to already ongoing public consultations in the municipalities, in particular with regard to the forthcoming early consultations in connection with notification to the County Boards?
- The content of the Environmental Impact Statement (EIA document)
- Does the necessary capacity exist to review the EIS at the County Boards, Environmental Courts, at SKI and SSI?
- Why SEA in this context?
- Given the high level of expectation surrounding the EIA process, will transparency and consultation suffer at the hands of the already acknowledged lack of clear guidance in the legislation?

Questions

The bullet points listed above are elaborated upon more fully in the below text. They constitute the questions that we consider, from our point of view, to be in need of special attention in the design and implementation of the forthcoming 6-year process. As SKB has the responsibility of conducting the coming planning and EIA processes we have predominantly focussed on the latest SKB report, *Integrated account of method, site selection and programme for the site investigation phase* (2000), as the basis for our reflections over possible unresolved issues and challenges in the process. Notwithstanding this however there are also other emergent questions as regards the tasks of SKI and the County Boards.

Several potential EIA processes – risks of duplication and a lack of clarity?

Three different pieces of legislation; the Environmental Code, the Act on Nuclear Activity, and the Radiation Protection Act, are pertinent when it comes to the implementation of the Environmental Impact Assessment for the siting of the nuclear disposal facility as regards the construction of such facilities both on, and underground. Unless those processes are coordinated, there is a risk that the same debate will be repeated in different arenas and in types of fora. There is also the potential that the general public in particular may become confused. The trust and understanding of the general public can be affected by the lack of clarity concerning where, when and how it is possible to put forward one's concerns and thus to take effective part in the process. The possibility of overlapping EIA arenas will also affect the perceived efficiency of the planning process, in particular concerning the amount of time and money spent on it.

This predicament of having several EIA arenas is further exacerbated by the forthcoming EU directive, *Effects of plans and programmes on the environment (SEA)* that has been adopted by the European Parliament and the European Council and is expected to come into effect in summer 2001. The directive will undoubtedly encompass plans relating to the Swedish planning and building Act (PBL). After the directive has come into force there is a period of three years available for the EU member countries to incorporate the directive into their own legislation. Temporary regulations have however been discussed which imply that plans and programmes initiated in 2001 will also be included in the directive[6]. There are thus great expectations in the field that the implementation of SEA will deliver a more transparent planning process given the greater levels of public involvement envisaged, and also the integration of environmental issues that it will facilitate.

According to SKI and SKB statements (SKB, 2000[i]) it is planned to coordinate such EIA processes as are carried out in accordance with the Act on nuclear activities and the Environmental Code in a timely fashion. Though as PBL plans will also be part of the process, there will also be EIA processes conducted according to this legislation.

How many different planning arenas, besides those focused on EIA, will there actually be?

The Finnish experience illustrated the importance of the public recognition of EIA as an effective policy instrument. The public view of EIA as an ineffective policy making instrument was thus partly responsible for the low level of public involvement in the later stages of the nuclear waste disposal process. As pointed out above there will be several EIA processes conducted according to the different legislative actions in Sweden. The question therefore arises as to whether other kinds of planning arenas will emerge where different stakeholders will be able to put forward their concerns? If so, then this may be another source of confusion as to where the major debate and decision making fora are actually located. In the case of final disposal of nuclear waste in Finland the existence of several arenas, of which the EIA arena was just one, clearly undercut the legitimacy of the EIA arena as an important one for public participation. The question therefore remains; will this situation be repeated in the Swedish context?

There seems to be a consensus among the main actors that the linked EIA processes in accordance with the Act on nuclear activities and the Environmental Code will be the main planning process that will hold together all other planning processes. This is a good plan, but in order to fulfil it there seems to be ample room for further elaboration on exactly which planning and decision processes will actually come to fruition.

Is there a risk that SKB will be too dominant?

The answer to this is of course in the affirmative. Being the main proponent for the final disposal of nuclear waste, SKB has the responsibility for conducting the planning and EIA processes preceding the application for detailed site investigation and construction of the repository. The role of the proponent in EIA and planning processes is crucial for the legitimacy attached to the various arenas of participation, and thus is directly responsible for the level of trust that is created among participants. Experience

[6] Oral communication with Sten Jerdenius, Environmental Ministry, Sweden.

from all kinds of development issues across the world supports this view. An obvious case in point being that of the final disposal of nuclear waste in Finland, where the too dominant role of the proponent had an especially negative impact on the EIA process. This question is however multi-dimensional, and thus deserves closer inspection.

What kind of rationality and indeed, whose rationality are assumed to lead the process? The general public and other stakeholders in any planning and/or EIA process will always be sensitive to signs that the proponent is working on the basis of limited communicative rationality. By this we mean that the proponent will always be in the 'risk zone' of being perceived as one having an overly narrow single-minded approach based solely on project implementation and thus on designing processes that one way or another limit the possibilities of communication and dialogue in the process. This was how the process was perceived in the Finnish case alluded to above. This in turn affected the level of trust and the legitimacy of different stakeholders in relation to that of the Finnish proponent. In the Swedish case however it is obvious that SKB is of such a mind as to conduct extensive communication, dialogue and consultations with the various stakeholders. Extensive dialogue has so far also been conducted within the municipalities themselves. The clear demand emanating from the municipalities regarding the transparency of the forthcoming planning process can also be interpreted as a wish to make plain across the public domain the role of SKB.

Despite the positive experiences and the good intentions espoused so far, the current authors feel that there is a need to more closely analyse the design of the forthcoming planning and EIA processes in relation to the role of SKB. Both for the sake of SKB itself, and for that of the other stakeholders. All parties need to be clear about their different expectations of the process, and the different roles they have to play in it. The rationality guiding SKB is naturally that of project completion, that is to say, 'instrumental'- basically to gain 'acceptance' for the project as indeed was pointed out in their latest report (SKB, 2000[i]). The need for the localisation process to have a democratic base was however also expressed. The rationality base on which the expectations of the planning and EIA processes rest for the municipalities and for SKI cannot of course be expected to be identical with that of SKB. Such expectations are however currently under discussion as an integral part of SKB's work seeking to outline the forthcoming process more closely.

The three differing roles of SKI – will they themselves pose a legitimacy problem?

SKI being the major public authority concerned with the final disposal of nuclear waste is thus under significant pressure to maintain an independent role in the process for the final disposal of nuclear waste. The mixture of roles played by SKI in the process, namely; scoping the impacts to be studied in the EIS (in accordance with the Act on Nuclear Activities), the body with the task to put forward 'demands' to SKB as well as playing a supportive and advisory role for the municipalities, raises legitimate concerns however regarding the way in which SKI maintains its legitimacy in relation to the different actors and the way it views its own role. The experience from Finland moreover gives cause for concern, as the regulatory authority (STUK) was accused of having too 'cosy' a relationship to Posiva, and was thus deemed unable to maintain the ability to remain equidistant from all concerned parties thus satisfactorily fulfilling its regulatory tasks.

This multi-role situation however appears to be a potential concern for SKI's legitimacy in relation to other actors in the process. The balancing of these roles must therefore be a continuous concern for SKI. The current authors impression is thus that this is the situation as it now stands. Considering the importance of maintaining the legitimacy of each of the different actors in the process, the question of SKI's three roles must therefore be consciously and continuously addressed as part of the forthcoming process.

How are inputs from the various stakeholders going to be addressed in the process?

As was noted above, at the present time of writing, a clear view concerning the implementation and planning of the EIA process does not exist. In the worldwide case studies presented in this report it was moreover stated that experience of the links between inputs from stakeholder participation and the practical outcome of such interventions seem to highlight an important difference between proponents that succeed to gain acceptance for a project from those that do not. This may not however be a problem in the Swedish case. From a simple reading of the SKB report (2000[i]) however it is difficult to judge whether this will be done in practice.

Given that that one of the aims of the EIA process is to promote greater levels of democracy within the decision making process, it is important to attend to ways of more expeditiously including such views and comments in the final decision making process. In particular it should be kept in mind that the comments received during the process, will also include views that are contrary to those in the majority on the decision making body. When the deliberative process is severely restricted this can lead to the creation of a 'democratic deficit' which erodes the legitimacy of the planning process, as was the case for example with the Gardermoen airport project.

The content of the Environmental Impact Statement (EIA document)

Identification of relevant issues

The design and conduct of the scoping process is a major factor in the success of the EIA process, having great relevance for overall perceptions of value and legitimacy surrounding the process. This relates both to the issues of whether important aspects are being addressed in the process, as well as to that of whether the citizens feel that their comments are being given due consideration.

In the Finnish Environmental Assessment process study for nuclear waste disposal, a clear difference in the attitude and requirements of the various municipalities quickly became apparent. As such, citizens in each municipality reacted rather differently to the possible presence of risk, with the people who are presently living near a nuclear power station exhibit a more favourable attitude towards nuclear energy in general as well as towards the building of nuclear waste repository in their locality.

Example
The mismatch between the issues identified in the EIS and the issues considered relevant by the local population was one of the major issues identified in the experience of the Gardermoen case, included in the study *The role of Environmental Impact Assessment in the planning and decision process of large development projects in the Nordic countries* (Stenstadvold, 2001). The EIA process carried out for the project failed to recognise the local interests and concerns as well as the contents of the EIS did present the level of detail required for the decision making which undercut the usefulness of the EIA itself in the decision making process.

Coverage of non-technical information

The basic concerns of citizens and laypeople are often of a non-technical nature, such as concerns over the magnitude of risk, and over various ethical issues. Reponses to such legitimate concerns naturally require that a balance can be drawn between technical and ethical issues.

Example
In the report issued by Oskarshamn on the basis of the feasibility study, it was concluded that too much attention was being given to technological 'nuclear' issues, whilst lay opinion desired a commensurate level of analysis to be laid upon the 'normal' or easily comprehensible environmental issues, which they felt was lacking. Such 'neglected' issues included 'transport', 'noise' and traffic levels. Furthermore, more emphasis should be given to societal issues such as general concern for 'the environment'.

These so-called 'soft issues', ethics, trust, legitimacy etc have however now been recognised by SKB as being of fundamental importance (SKB, 2000[i]), as yet however there seem to exist limited systematic knowledge.

The issue of alternatives

The coverage of alternatives can serve as an important way to increase the legitimacy of both the project and the process. On the other hand, the lack of alternatives can raise objections to the project. If the proposed solution has no alternatives, the future development as it is presented becomes more or less inevitable.
The lack of alternatives emerged as a major source of criticism in the Finnish case, but according to the legislation that applied at the time, coverage of alternatives was not mandatory. According to the study carried out in Finland, the single option analysis was criticised for being fundamental to the decrease in public participation and interest.
The Act on Nuclear Activity calls for the final disposal of nuclear waste. However, the Environmental Code mandates the study of other alternatives, including the so-called '0 alternative'. This raises the question of how realistic the consideration of other alternatives is in this context, and in particular how realistic can consideration be of the '0 alternative'. Are the alternatives covered to the fullest extent possible when it comes to waste disposal projects?
The importance of studying more than one option was amply illustrated by the experience from Hallandsåsen (Päiviö and Wallentinus, 2001) such that when only one option is assessed, the EIA lays itself open to being viewed as simply a legitimating exercise on behalf of the developer.

Review of the EIA document

EIA experiences worldwide have shown that there is often a risk of the EIA document becoming biased towards the issues of importance for either the proponent and/or the issues of interest for the consultants conducting the impact analysis and producing the EIA report. Therefore mechanisms for securing a wide input into discussions on the scope of EIA work and mechanisms for securing an independent review of the EIA document are used in different EIA systems. Judging from the efforts in the Swedish case it seems that the scooping procedures will be based on a broad level of stakeholder participation. The question that thus arises therefore is however, whether the quality of the County Board and the Environmental Courts reviews of the EIA report can be expected to be of sufficient quality to guarantee the desired participatory outcomes?

The EIA review capacity, at the former Water Courts, was considered to be low in 1996 (Riksrevisionsverket, 1996). To what extent has the review capacity been enhanced at the current Environmental Courts? The case today is also that the environmental courts become engaged in the EIA work at a late stage of the process and therefore that environmental courts are under pressure not to reject EIA documents except in the most exceptional and clear-cut circumstances (Naturvårdsverket, 2001). The experience of the County Boards this far is that they do accept bad EIA documents if they consider that they nevertheless know enough to make the decision. Such action can however jeopardize the ability of other stakeholders, such as the general public, of gaining access to quality information (Naturvårdsverket, 2001).

The level of trust in the quality of the review must therefore be considered to be an important issue in creating an EIA process with greater legitimacy.

Also SKI and SSI have the role to review the EIA document. It is therefore relevant to pose the question of their capacity to review the forthcoming EIA documents. So far there has been no indication in the literature to either a positive or a negative conclusion concerning the capacity of SKI and SSI to review EIA documents.

Capacity to design, review, coordinate and lead communicative processes?

Considering the amount of stakeholders, the many possible EIA processes, the character of the issue handled in the EIA processes, the long time frame, the seemingly scattered knowledge of how to conduct communicative processes together with the quite sparse guidance provided in the Environmental Code on the conducting of EIA processes, it seems that the designing of communicative EIA processes is a real challenge, particularly for SKB but also for SKI, the municipalities and the County Boards. Very high levels of expectation do seem to exist that the EIA instrument, in accordance with the Environmental Code, together with greater transparency across the process as a whole, will to a large extent solve this challenge. This conclusion may not be correct, but it appears that this is the case with regard to considerations of the available the Swedish material. The first simple comment here is therefore that the system of Swedish EIA guidance is not a clear enough ground to base the design of communicative processes on. The second is that transparency may not of itself be enough. The question therefore remains does there need to be the possibility within the EIA process of taking backward steps so to say if need be. So can the EIA process be

expected to be flexible enough? And, will the possibility of designing a reversible process be available? And finally, can a need for this be anticipated?

Consultation and public participation processes are already on going in the municipalities. How are these processes to be linked to the early consultations in connection with the SKB notification to the County Boards of the site investigation? This is also one of those situations that may raise the potential for confusion if it is not taken into consideration.

It can be reasonably assumed that the most important aims of the forthcoming process for final disposal of nuclear waste are as follows:

- To gain acceptance for the disposal by managing the "societal issue" (SKB, 2000[i]) in a good manner – the SKB view
- To support the forthcoming process to fulfil the broad aims in the legislation that is going to be implemented, of which broad, democratic participation in the planning and EIA process is an important part – the SKI and County Board view
- To get relevant information for final disposal of nuclear waste and for the municipality presented in such a format, timeframe and in such fora that enables the municipality to have an impact on the design and implementation of the planning and EIA process – the municipality view
- To get information of relevance for final disposal of nuclear waste and for the other stakeholders, such as the general public, presented in such a format, timeframe and in such fora that enables the different stakeholders to have an impact on the design and implementation of the planning and EIA process – the general public's view

Considering the above aims and the questions put forward earlier it is evident that the need for competence in designing, reviewing, coordinating, and leading communicative processes needs to be good in the forthcoming process for disposal of nuclear waste in Sweden. This seems to be a mutual understanding among the main actors concerned with final disposal in Sweden. The question that thus arises here then is whether SKB, SKI, the County Boards and the municipalities consider themselves to have enough competence to manage such processes?

The reasons that this question needs to be raised can be found in the literature, both international and Swedish, which gives a clear impression of interest and great emphasis, as a basis for gaining acceptance, for the importance of communicative processes. But at the same time the knowledge situation in the sector, concerning communicative processes in relation to planning and EIA processes, seem to be 'patchy' and is yet to be systematically explored (see for example NEA, 1999 and 2000[i]).

Is too much time a problem?

Limited material was found, in our study, on the issues of long time constrains in the decision making process. The findings of the Nordic study on large development projects and EIA, together with numerous other studies, illustrate the negative impacts of severe time constrains especially on comprehensive analysis and meaningful citizen participation. In the case of Sweden however, the opposite appears to be true. The planning processes for nuclear waste disposal is planned to last for six years. The EIA process is thus far, meant to be the uniting arena.

The question here is what are the pros and cons when conducting a planning and EIA process over such a long time period. The negative side is that an early input may be simply forgotten long before the issue is approaching the decision stage. This presents a challenge of how to maintain the interest of the participants over a long period. The experience from Kuhmo in Finland showed, where the overall planning process lasted more than 10 years, that the process eventually resulted in a low level of public activity. The question here is how different techniques can be used to give continuity to the knowledge and discussion level. It is probably of importance to create a 'coordinating spot' (for example one home page) where all stakeholders can get continuous information on, the steps and milestones planned, where the process is at the moment, meetings that are planned, meetings that have been conducted, and finally the material available on the issue. Another important issue is that the freedom of action is clearly stated for each step in the process. It is equally important to clearly state which decisions have been taken and where freedom of choice no longer remains. This is often a very difficult balance to make in EIA processes. Formally there may be many options open since formal decisions on different development alternatives (for example location and technology) have not been taken. But in reality choices are already made because of practical and psychological attachments created earlier in the process.

The positive side is that there exists a decent amount of time available for getting communicative processes in the overall planning and EIA context to function. This is very seldom the case for public participation in connection with EIA. And experience shows that trust and dialogue need time to be able to develop. To be able to explore this possibility concerning available time, it is probably of importance to be able to picture clear steps and milestones in the process and to communicate them. This is important in any processes but the long time frame available makes this even more crucial. At the same time the process should not be rigid but flexible. It is a pedagogic challenge to both design, and to be able to make clear for different stakeholders, the intentions of different steps within these circumstances.

Final comments

As seen above, a number of issues have been put onto the table for discussion. We will not put forward recommendations since we find the questions above to be a clear enough input into the discussions concerning the design and implementation of the Swedish process for final disposal of nuclear waste. We will thus conclude this report with just some final comments.

In order to achieve constructive input into the planning and EIA process, participation and possibly acceptance for the identification and selection of a suitable site, the importance of a clear decision making process cannot be emphasised highly enough in literature and other studies on public participation and communicative planning. It is not sufficient that the public or other actors participating in the process get an opportunity to ***see*** what happens, but rather they must be able to understand ***why*** it happens, ***who*** can influence the process and ***how*** and ***when*** the process can be influenced. This requires that the process be designed in such a way that those factors are clear and it is able to react to change and suggestions from the public, as well as other participators. This includes, for example, the local authorities should they have suggestions or recommendations for change.

The level of formalisation needed in planning processes differs between circumstances, type of development and administrative structures, but examples of the components of such a process entail clear milestones throughout the planning process and clearly defined opportunities for the possibility to submit comments or influence the process. In cases where different planning processes take place simultaneously, these aspects become particularly important, as the risk of confusion and the loss of clarity become high. Expectations of the EIA process differ between the different stakeholders. As the roles and expectations differ between contexts, it is invaluable that such expectations and understandings of the process are clear amongst the different stakeholders prior to the launching of the formal process – is there a consensus over what the EIA process shall obtain in the Swedish context? And how would different stakeholders describe their view of a "successful" EIA process?

How to ensure the legitimacy of the planning and EIA process is an issue of fundamental importance. Firstly the question of choice of method is important. The KBS-3 method is the main alternative for disposal but the final decision will not be taken until SKB submits an application for siting and constructing a repository. What effect will it have that the choice of method has yet to be finalised even though the EIA process itself has already been initiated? The second issue is that of governmental comments. The coverage of other methods was among the issues identified by the government at the presentation of the RD&D (FUD) programme. The third question concerns the municipality comments. According to the presentation of the feasibility study in Oskarshamn, it is not possible to separate the issue of choice of method from the feasibility study, although it is not formally included in the study. The municipality calls for a clear standpoint from SKI and SSI and the government on this issue.

Possible ways of changing the balance and gaining greater acceptance could be to ensure an outside review of the EIA report. Other mechanisms include, for example, the hiring of an independent coordinator for meetings. But all measures like this do also have pitfalls and do not pose panaceas. Further development of the criteria used for deciding upon the location of the repository, which has been called for in the review of the FUD programme, are also important.

The issue of the clarity and legitimacy of the process are closely interlinked. The issue of stakeholder participation and their roles in the process is an important aspect, which needs further attention in order to bolster trust and strengthen the legitimacy of the EIA process. (Among the 5 key elements of the municipal policy developed in 1992 in Oskarshamn regarding the participation in the waste disposal process was that there is need to define clear roles for the key parties (industry, competent authority, municipality and government) in the decision making process. The issue of reversibility in the process is also important to consider in this context.

Bibliography

Allègre, M., *The Deep Geological Repository: an Unavoidable and Ethically Correct Solution.* Proceedings of the Twentieth International Symposium held by the Uranium Institute London, September 1999, (CD ROM).

Alvesson, M., *Kommunikation, makt och organisation*. Nordstedts juridikförlag, Stockholm 1991.

Andersson, K. (ed), *Review/Decide and Inquiry/Decide. Two Approaches to Decision Making.* Swedish Nuclear Inspectorate, SKI Report 98:5, Stockholm 1998.

Andersson, K., "On the Legitimacy of Standards and Criteria - And the Authenticity of Radiation Protection Authorities" In: Hultcrantz, K. (ed)., Proceedings of the International Symposium on Radioactive Waste Disposal: *Health and Environmental Criteria and Standards*. Stockholm Environment Institute (SEI), Stockholm, April 1999.

Asplund, E. and Hilding-Rydevik, T., *Arena för hållbar utveckling – processer och aktörer*. Kungl. Tekniska Högskolan, avdelningen för Regional Planering, Trita-IP FR 01-88, Stockholm 2001.

Beveridge, G., Curtis, C., RWMAC 1998. *Radioactive Waste Disposal – Where do we go from here?* Presented at the Nuclear Free Local Authorities Annual Conference at Caernarfon in October 1998.

Bjarnadóttir, H. (ed), *A comparative Study of Nordic EIA Systems. Similarities and Differences in National Implementation.* Nordregio R2001:1, Stockholm 2001.

Brodén, K. et al (ed), *Miljökonsekvensbeskrivningar i Norden, Temamöte, Island, 2 – 6 september 2000.* NKS-24, Roskilde 2000.

Canadian Environmental Assessment Agency, *Nuclear Fuel Waste Management & Disposal Concept*, February 1998.

Canadian Environmental Assessment Agency's web-site, http://www.ceaa-acee.gc.ca, various information.

Department of the Environment, Transport and the Regions. The Government's Response to the House of Lords Select Committee on Science and Technology Report on the Management of Nuclear Waste, 1999. http://www.environment.detr.gov.uk/radioactivity/govtresponse/lords/index.htm

Dougherty, W.W., Powers, V., Johnson, F.X. and Cornland, D., "Standards for High Level Waste Disposal: A Sustainability Perspective". In: Hultcrantz, K. (ed)., Proceedings of the International Symposium on Radioactive Waste Disposal: *Health and Environmental Criteria and Standards.* Stockholm Environment Institute (SEI), Stockholm, April 1999.

Dubreuil, G.H., Schieber, C., Schneider, T. and Viala, M., "Social Transactions with Future Generations for the Management of High Level Radioactive Waste in Deep Repositories: Reflections on Institutional Control and Retrievability". In: Hultcrantz, K. (ed)., Proceedings of the International Symposium on Radioactive Waste Disposal: *Health and Environmental Criteria and Standards.* Stockholm Environment Institute (SEI), Stockholm, April 1999.

Duncan, I., *Some Aspects of the Relationship between Society and the Disposal of Radioactive Waste.* Proceedings of the Twentieth International Symposium held by the Uranium Institute London, September 1999, (CD ROM).

Durbin, N.E. et al., *U.S. Experience with Organizational Issues During Decommissioning.* Swedish Nuclear Inspectorate, SKI Report 98:3, Stockholm 1998.

Falkemark, G. *Demokrati och solidaritet i kärnavfallsfrågan*. SOU 1993:18, Stockholm 1993.

Fleming, P.A. (1999). "Vice and Virtue in Regulating the Disposal of High Level Nuclear Waste". In: Hultcrantz, K. (ed)., Proceedings of the International Symposium on Radioactive Waste Disposal: *Health and Environmental Criteria and Standards*. Stockholm Environment Institute (SEI), Stockholm, April 1999.

Forsström, H., Taylor, D., *Current Policy and Research on Radioactive Waste Management in the European Union*. European Commission, Rue de la Loi 200, B-1049 Brussels; IAEA International Conference on the Safety of Radioactive Waste Management; 13 - 17 March 2000, Córdoba, Spain. Brussels 2000.

Glasson, J., Therivel, R. and Chadwick, A., *Introduction to Environmental Impact Assessment*, UCL Press, London 1999.

Habermas, J., *Toward a Rational Society*, Heinemann, London 1971.

Habermas, J., *The Theory of Communicative Action*. Vol. 1, Beacon Press, London 1984.

Habermas, J., *Moral Consciousness and Communicative Action*, Polity Press, Cambridge 1990.

Hilding-Rydevik, T. (ed), *The role of Environmental Impact Assessment in the planning and decision process of large development projects in the Nordic countries*. Nordregio report, forthcoming, Stockholm 2001.

Holmstrand, O. *Participation of local citizens groups in the Swedish nuclear waste process.* Proceedings from VALDOR, A symposium in the RISCOM Program Addressing Transparency in Risk Assessment and Decision Making, Stockholm, Sweden 13 – 17 June 1999.

Hokkanen, P., "EIA and decision making in search of each other. The case study of final disposal of nuclear waste in Finland". In: Hilding-Rydevik, T. (ed), *The role of Environmental Impact Assessment in the planning and decision process of large*

development projects in the Nordic countries. Nordregio report, forthcoming, Stockholm 2001.

House of Lords Select Committee, *Management of Nuclear Waste*. House of Lord Publications. Website 1999, http://www.publications.parliament.uk/pa/ld199899/ldselect/ldsctech/41/4102.htm

Hultcrantz, K. (ed). *Proceedings of the International Symposium on Radioactive Waste Disposal: Health and Environmental Criteria and Standards.* Stockholm Environment Institute (SEI), Stockholm, April 1999.

Högberg, L., Norrby, S., Dverstorp, B., *SKI synar problematiken kring kärnavfallet*. SKI, Nucleus.

Ibitayo, O. O. and Pijawka, K. D., Reversing NIMBY: an assessment of strategies for siting of hazardous waste facilities. *Environment and Planning C: Government and Policy* 17 (1999) 4, pp 379-389.

Jensen, M., Larsson, C-M., Norrby, S., Westerlind, M. *The regulator's stake in a multi-stakeholder process.* Proceedings from VALDOR, A symposium in the RISCOM Program Addressing Transparency in Risk Assessment and Decision Making, Stockholm, Sweden 13 – 17 June 1999.

Kartez, J. D., Rational Arguments and Irrational Audience. Psychology, Planning and Public Judgement, *APA Journal*, Autumn 1989.

KASAM, *Nuclear Waste method – site – environmental impact*. SOU 1999:67. Stockholm 1999.

KASAM, *Nuclear Waste – State of the Art Reports*. SOU 1998:68, Stockholm 1998[i].

KASAM, *Kampanj med kunskaper och känslor. Om kärnavfallsomröstningen i Malå kommun 1997.* SOU 1998:62, Stockholm 1998[ii].

KASAM och Nationelle samordnaren, *Kärnavfall och beslut*. SOU 1997:180, Stockholm 1997.

KASAM, *Nuclear Waste and the Environment*. SOU 1995:90, Stockholm 1995.

KASAM, *Acceptans, Tolerans, Delaktighet. Rapport från ett seminarium i Saltsjöbaden den 3 – 5 mars 1992.* SOU 1993:18, Stockholm 1993.

Kjellerup, U., "Horsens – Skanderborg rail link in Denmark". In: Hilding-Rydevik, T. (ed), *The role of Environmental Impact Assessment in the planning and decision process of large development projects in the Nordic countries*. Nordregio report, forthcoming, Stockholm 2001.

Kurki, O. "Challenges in the Transition from the Site-selection to the Site-investigation Phase." In: NEA, *Stakeholders Confidence and Radioactive Waste Disposal*. Workshop Proceedings, France August 2000. OECD, Paris, 2000.

Lawrence, D. P., “Planning theories and environmental impact assessment.” *Environmental Impact Assessment Review*, 20 (2000) 607-625.

Lidskog, R. and Andersson, A-K., *Social Aspects of Radwaste Management. Lessons from Ten Countries*. Örebro universitet, Forskningscentrum MTM rapport, Örebro 2001. Forthcoming.

Lidskog, R., ”Social hållbarhet – en fråga om planering, kunskap och demokrati.” *Plan* nr 3, 2000.

Lidskog, R. and Litmanen, T., “The Social Shaping of Radwaste Management: The Cases of Sweden and Finland.” *Current Sociology*, Volume 45, Number 8, 1997.

Linsey, G. “Existing and Future International Standards for the Safety of Radioactive Waste Disposal”. In: Hultcrantz, K. (ed). Proceedings of the International Symposium on Radioactive Waste Disposal: *Health and Environmental Criteria and Standards.* Stockholm Environment Institute (SEI), Stockholm, April 1999.

Litmanen, T., “Cultural approach to the perception of risk: analyzing concern about the siting of a high-level nuclear waste facility in Finland.” *Waste Management & Research* 1999:17:212-219.

Litmanen, T., “From the Golden Age to the Valley of Despair. How did nuclear waste become a problem?” In: *All Shades of Green*. The Environmentalization of Finnish Society. SoPhi, University of Jyväskylä, 1999.

LKO, *Förstudie för slutförvaring av använt kärnbränsle i Oskarshamn. Granskning av svensk Kärnbränslehanterings preliminära slutrapport*. Oskarshamn 2000. Unpublished.

LKO, *Erfarenheter från kärnkrafts- och kärnavfallskommunen Oskarshamn Sverige.* Oskarshamn 2000. Unpublished.

Länsstyrelserna i Uppsala, Södermanlands och Kalmars län. *Frågor om samråd inför tillståndsprövning av slutförvar för använt kärnbränsle m.m.* M:1999:A, Stockholm 2000.

Merceron, T., “A new siting process in France for a URL in Granite: Lessons Learn from the Recent Consultation Mission (January – June 2000).” In: *Stakeholders Confidence and Radioactive Waste Disposal.* Workshop Proceedings, France August 2000. OECD, Paris, 2000.

MKB-Forum i Kalmar län, *Slutförvarssystem i Oskarshamn kommun. Avgränsningar av frågeställningar inför platsundersökningsskedet.* Oskarshamn 2000.

Munn, R. E., *Environmental Impact Assessment: Principles and Procedures.* John Wiley, New York, 1979.

Nationelle samordnaren på kärnavfallsområdet, *Slutförvarning av kärnavfall – Kommunerna och platsvalsprocessen*. SOU 1999:45. Stockholm 1999.

Naturvårdsverket, *MKB under utveckling – tidiga erfarenheter av MKB enligt miljöbalken och förslag på fortsatt utvärdering*, Rapport 5150, Stockholm 2001.

Norrby, S., Larsson, C-M, *SKIs och SSIs ståndpunkter om MKB i slutförvarsfrågan.* Promemoria, SSI dnr 6240/3626/99, SKI dnr 15.2-991427, 1999.

Nuclear Energy Agency (NEA), *Stakeholders Confidence and Radioactive Waste Disposal. Workshop Proceedings*, France August 2000. OECD, Paris, 2000[1].

Nuclear Energy Agency (NEA), *Update on Waste Management Policies and Programmes*. Nuclear Waste Bulletin, No. 14 – 2000 Edition, OECD, Paris, 2000[2].

Nuclear Energy Agency (NEA), *Geological Disposal of Radioactive Waste. Review of Developments in the Last Decade*, OECD, Paris 1999[i].

Nuclear Energy Agency (NEA), *Strategic Areas in Radioactive Waste Management*, OECD, Paris 1999[ii].

Nuclear Energy Agency (NEA), *The Environmental and Ethical Basis of Geological Disposal of Long-Lived Radioactive Waste*. Published on the internet http://www.nea.fr/html/rwm/reports/1995/geodisp.html

Nuclear Regulatory Commission (NRC)'s web-site http://www.nrc.gov. Various documents.

Nuclear Regulatory Commission (NRC), Advisory Committee on Reactor Safeguards (ACRS), 440th Meeting, April 4, 1997, Rockville, Maryland. Official Transcript of Proceedings, Washington DC, 1997.

State of Nevada Notice of Intent Comments – Yucca Mountain Repository EIS. Submitted December 1, 1995. Available on Internet: http://www.state.nv.us/nucwaste/eis/ymr-eis.htm

Olson, M., "Nuclear Waste Isolation Means Zero Release of Radioactivity" in Hultcrantz, K. (ed)., Proceedings of the International Symposium on Radioactive Waste Disposal: *Health and Environmental Criteria and Standards.* Stockholm Environment Institute (SEI), Stockholm, April 1999.

O'Sullivan et al., *Environmental Impact Assessments and Geological Repositories of Radioactive Waste*, Volume 1: Main Report, EUR 19152/1 Luxembourg: Office for Official Publications of the European Communities, 1999.

Otway, H. and Wynne, B., Risk communication: paradigm and paradox, *Risk Analysis* 9(2) 141-145.

Pickett, S., Suzuki, T. and Suzuki, A., "Sociotechnical Considerations of Very Low Level Radioactive Waste: Implications for decommissioning and recycling of material". In: Hultcrantz, K. (ed)., Proceedings of the International Symposium on Radioactive Waste Disposal: *Health and Environmental Criteria and Standards.* Stockholm Environment Institute (SEI), Stockholm, April 1999.

Poumadere, M. and Mays C., *Sociocultural Factors in Public Acceptance: Comparative risk studies involving France, the USA and the UK.* Proceedings of the Twentieth International Symposium held by the Uranium Institute London, September 1995, (CD ROM).

Päiviö, J., *Litteraturgenomgång av material om slutförvar av kärnbränsle*. Nordregio, arbetsmaterial, Stockholm 2001.

Riksrevisionsverket, *MKB i praktiken*, RRV 1996:29, Stockholm 1996.

Rosen, M., *Managing Radioactive Waste: Issues and Misunderstandings* Proceedings of the Twentieth International Symposium held by the Uranium Institute London, September 1998, (CD ROM).

Info from *Särskilde rådgivarens* hemsida

Sager, T., *Communicate or calculate. Planning theory and social science concepts in a contingency perspective.* Nordic Institute for Studies in Urban and Regional Planning. Dissertation 11. Stockholm 1990.

Sager, T., *Communicative Planning Theory*. Aldershot, Avesbury 1994.

Sager, T., *A planning theory perspective on the EIA.* In: Hilding-Rydevik, T., The role of EIA in the planning and decision process of large development projects in the Nordic countries, Nordregio, Stockholm 2001. In print.

Skantze, A., ”Miljön i mitt liv – boendeperspektiv.” In: Asplund, E. and Hilding-Rydevik, T., *Arena för hållbar utveckling – processer och aktörer.* Kungl. Tekniska Högskolan, avdelningen för Regional Planering, Trita-IP FR 01-88, Stockholm 2001.

SKB, *Samlad redovisning av metod, platsval och program inför platsundersökningsskedet*. Stockholm 2000[i].

SKB AB, *Vad händer om det inte byggs något djupförvar? Nollalternativet – förlängd mellanlagring i CLAB*. R-00-31, Stockholm 2000[ii].

SKB AB, *Vad gör andra länder med sitt använda kärnbränsle.* R-00-36, Stockholm 2000[iii].

SKI, *SKIs utvärdering av SKBs FUD-program 98. Sammanfattning och slutsatser.* 99:15, Stockholm 1999.

Special Advisor on nuclear waste disposal’s web-site, http://www.radgiv-karnavf.gov.se/index.html, various information.

State of Nevada NOI Comments -- Yucca Mountain Repository EIS. Notice of Intent - (NOI) for the Environmental Impact Statement (EIS) for a Geologic Repository at Yucca Mountain Submitted December 1, 1995

Stenstadvold, M., “The case of the national Norwegian airport project Gardermoen in Norway.” In: Hilding-Rydevik, T. (ed), *The role of Environmental Impact Assessment*

in the planning and decision process of large development projects in the Nordic countries. Nordregio report, forthcoming, Stockholm 2001.

Söderberg, O., "Encouraging Ethical Considerations - One Important Task for a National Co-ordinator for Nuclear Waste Disposal" in Hultcrantz, K. (ed)., Proceedings of the International Symposium on Radioactive Waste Disposal: *Health and Environmental Criteria and Standards.* Stockholm Environment Institute (SEI), Stockholm, April 1999.

Theodórsdóttir, A.H. and Sigurdardóttir, H., "An aluminium smelter in Reydarfjördur, East Iceland." In: Hilding-Rydevik, T. (ed), *The role of Environmental Impact Assessment in the planning and decision process of large development projects in the Nordic countries*. Nordregio report, forthcoming, Stockholm 2001.

Treichel, J., "Nuclear Waste vs. Democracy" in Hultcrantz, K. (ed)., Proceedings of the International Symposium on Radioactive Waste Disposal: *Health and Environmental Criteria and Standards.* Stockholm Environment Institute (SEI), Stockholm, April 1999.

Tunnelkomissionen (1998). *Miljö i grund och botten – erfarenheter från Hallandsåsen*. SOU 1998:137.

U.S. Department of Energy's (DOE) web-site, http:// http://www.ymp.gov, various information.

U.S. Department of Energy, *Draft Environmental Impact Statement for a Geological Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada,* July 1999.

Wallentinus, H-G. and Päiviö, J., "The Hallandsås railway tunnel project in Sweden." In: Hilding-Rydevik, T. (ed), *The role of Environmental Impact Assessment in the planning and decision process of large development projects in the Nordic countries.* Nordregio report, forthcoming, Stockholm 2001.

Westerlind, M., Hedberg, B., "SKI's and SSI's Experiences from Their Participation in the Siting of a Final Repository for Spent Nuclear Fuel." In: *Stakeholders Confidence and Radioactive Waste Disposal.* Workshop Proceedings, France August 2000. OECD, Paris, 2000.

Wilmot R.D., Galson, D.A., "Working Models for Constructive Dialogue: Lessons Learnt from Experience in Several Countries." In: Hultcrantz, K. (ed)., Proceedings of the International Symposium on Radioactive Waste Disposal. *Health and Environmental Criteria and Standards.* SEI, 1999.

Wood, C., *Environmental Impact Assessment. A Comparative Review*. Longman Group Ltd, Edinburgh Gate, Harlow, 1995.