Nuclear Threats in the Vicinity of the Nordic Countries

Inger Margrethe H. Eikelmann
Norwegian Radiation Protection Authority

November 2002
Nordic Nuclear Safety Research (NKS)

organizes joint four-year research programs involving some 300 Nordic scientists and dozens of central authorities, nuclear facilities and other concerned organizations in five countries. The aim is to produce practical, easy-to-use reference material for decision makers and help achieve a better popular understanding of nuclear issues.

To that end the results of the sixth four-year NKS program (1998 - 2001) are herewith presented in a series of final reports comprising reactor safety, radioactive waste management, emergency preparedness, radioecology, and databases on nuclear threats in Nordic surroundings. Each report summarizes the main work, findings and conclusions of the six projects carried out during that period. The administrative support and coordination work is presented in a separate report. A special Summary Report, with a brief résumé of all projects, is also published. Additional copies of the reports on the individual projects as well as the administrative work and the Summary Report can be ordered free of charge from the NKS Secretariat.

The final reports - together with technical reports and other material from the 1998 - 2001 period - will be collected on a CD-ROM, also available free of charge from the NKS Secretariat.

During the last few years a growing interest has been noted among sister organizations in the three Baltic States, especially in the field of emergency preparedness, radiation protection and radioecology. This has widened the scope of our joint Nordic work and fed new influences and valuable competence into the NKS program. The Baltic participation is therefore gratefully acknowledged.

NKS-65
ISBN 87-7893-120-7

klæbel's offset tryk a-s, 2003

The report can be obtained from
NKS Secretariat
P.O. Box 30
DK – 4000 Roskilde
Denmark

Phone +45 4677 4045
Fax +45 4677 4046
www.nks.org
e-mail: nks@catscience.dk
Nuclear Threats in the Vicinity of the Nordic Countries

Final Report of the
Nordic Nuclear Safety Research
Project SBA-1

Inger Margrethe H. Eikelmann
Norwegian Radiation Protection Authority

November 2002
This is NKS

NKS (Nordic Nuclear Safety Research) is a scientific cooperation program in nuclear safety, radiation protection and emergency preparedness. It is a virtual organization, serving as an umbrella for joint Nordic initiatives and interests. Its purpose is to carry out cost-effective Nordic projects producing seminars, exercises, reports, manuals, recommendations, and other types of reference material. This material, often in electronic form on the official homepage www.nks.org or CD-ROMs, is to serve decision-makers and other concerned staff members at authorities, research establishments and enterprises in the nuclear field.

A total of six projects were carried out during the sixth four-year NKS program 1998 - 2001, covering reactor safety, radioactive waste, emergency preparedness, and radioecology. This included an interdisciplinary study on nuclear threats in Nordic surroundings. Only projects of particular interest to end-users and financing organizations have been considered, and the results are intended to be practical, useful and directly applicable. The main financing organizations are:

- The Danish Emergency Management Agency
- The Finnish Ministry for Trade and Industry
- The Icelandic Radiation Protection Institute
- The Norwegian Radiation Protection Authority
- The Swedish Nuclear Power Inspectorate and the Swedish Radiation Protection Authority

Additional financial support has been received from the following organizations:
In Finland: Fortum (formerly Imatran Voima, IVO); Teollisuuden Voima Oy (TVO)
In Sweden: Sydkraft AB; Vattenfall AB; Swedish Nuclear Fuel and Waste Management Co. (SKB); Nuclear Training and Safety Center (KSU)

To this should be added contributions in kind by all the organizations listed above and a large number of other dedicated organizations.

NKS expresses its sincere thanks to all financing and participating organizations, the project leaders, and all participants, all in all some 300 persons in five Nordic countries and the Baltic States, without which the NKS program and this report would not have been possible.
Disclaimer
The views expressed in this document remain the responsibility of the author(s) and do not necessarily reflect those of NKS.

In particular, neither NKS nor any other organization or body supporting NKS activities can be held responsible for the material presented in this report.

Abstract
The acute phase of a nuclear accident and the possibility of high exposure of the populations are always the most important threats in the emergency preparedness work. Radioactive contamination from an accident can however also cause long term effects for land use and enhanced doses to special population groups and economic problems for agriculture, reindeer industry, hunting, tourism and recreation. For planning purposes it is always valuable to be aware of surrounding radiation hazards and other potential threats. Thus, mapping such threats in a Nordic context is an important factor in emergency preparedness in the area.

This report presents a cross-disciplinary study from the NKS research program 1998-2001. The scope of the project was to prepare a “base of knowledge” regarding possible nuclear threats in the vicinity of the Nordic countries. This base of knowledge will, by modern information technology as different websites, be made available to authorities, media and the population. The users of the websites can easily get information on different types of nuclear installations and threats. The users can get an overview of the situation and, if they so wish, make their own judgements.

The project dealt with a geographical area including North-west Russia and the Baltic states.

The results from the different activities in the project were generated in a web based database called the “the base of knowledge”.

Key words
Nuclear threats, Nordic countries, nuclear power plants, nuclear ship, nuclear waste, literature database, base of knowledge, web-accessed information, atmospheric transport, decommissioning of submarines, nuclear installations, waste management, radioactive contamination in marine environment, radioactive sources, criticality analysis.
Summary

The SBA-1 project was one of the new cross-disciplinary studies in the NKS research program 1998-2001. The main task for the project was to aggregate already compiled knowledge of nuclear threats in the vicinity of the Nordic countries, into a “base of knowledge”, presented by modern information technology. This web based “base of knowledge” will be available to Nordic authorities as a supplement to national emergency preparedness systems. The project focused on potential events in nuclear installations and the possible consequences for the Nordic countries and especially on vulnerable food chains, dose to man, environmental contamination and emergency preparedness. The main nuclear installations focused in the project were nuclear power plants, nuclear powered ships and nuclear fuel and waste storage facilities in the vicinity of the Nordic countries.

The objective of the project was to prepare a “base of knowledge” regarding possible nuclear threats in the vicinity of the Nordic countries. This base of knowledge can, by information technology, be made available to authorities, media and the population. The users of the websites can easily get information on different types of nuclear installations and threats.

Base of knowledge

The first stage of the project was to prepare a list of relevant papers and reports that have been previously produced concerning nuclear threats in the vicinity of the Nordic countries; a literature database. The literature database is presented on a website and as a report with 500 references.

The literature database was created as a part of the “base of knowledge” and is a database with the most relevant publications, papers and reports that have been produced regarding possible nuclear threats in the vicinity of the Nordic countries.

As a summary on the literature in the database there are made two status reports on the most important issues of the project, threats from the nuclear power plants and the nuclear vessels. The reports give an overview of the work done in this matter. The reports are published as NKS reports.

At the Workshop 2000 experts from the different Nordic countries presented each country’s evaluation of the threats against their country. There were presentations from the different Nordic countries concerning the threats from nuclear installations. There were discussions about source term, models and consequences of nuclear threats.

As a result of the discussions at the workshop and the presented literature there are made NKS reports on the threats from nuclear power plants and nuclear powers ships.
During the work four supplementary studies have been added regarding:

The Base of Knowledge - an open database
The objective was to make a structure and guidelines for making the “Base of knowledge” a national open home page. The project was carried out in cooperation between the County governor of Finnmark and NRPA.

Gravitational settling of particles in dispersion model simulations using the Chernobyl Accident as a test case.
Atmospheric emission, transportation and deposition of radioactive particles of different size and density were the main topics of the project. A new source term description of the Chernobyl accident has been put in to the atmospheric dispersion model SNAP. The project was a cooperative effort between DNMI and NLH and the result is presented in the DNMI report No. 131: “Atmospheric Transport and Deposition of large particles released during the Chernobyl accident”.

Nuclear emergency preparedness in the Nordic and Baltic Sea Countries
The object was to update “Håndbok for atomberedskap i Norden”, the nuclear emergency preparedness handbook for the Nordic countries. The new version also includes contributions from Estonia, Latvia, Lithuania, and Poland. The previous issue of this handbook (1996) was only in Norwegian. The new handbook is in English and only in electronic form which facilitates future updates. The work was coordinated by NRPA in cooperation with the participating countries.


The fact that it always takes too long for the authorities to inform the public in emergencies was discussed at this workshop. Other issues were how the authorities can set up independent channels to the media, and information handling during a crisis. The authorities can prepare for this by creating contact networks and using IT.
Sammendrag


Prosjektet har fokusert på å finne fram eksisterende beregninger på konsekvenser av hendelser ved nuklære installasjoner for de nordiske land og fokusere spesielt på sårbare næringskjeder, doser til menneske, miljøforurensing og beredskaps-systemer.

Prosjektet har konsentrert seg om nuklære installasjoner i et geografisk område som omfatter nordvest Russland og de Baltiske stater.

De nuklære installasjoner som er evalueret i prosjektet har vært kjernekraftverk, skipsreaktorer og lagring og håndtering av brukt brensel og radioaktivt avfall.

Kunnskapsbasen

Hensikten med prosjektet var å jobbe fram en "kunnskapsbase" som omhandler ulike nuklære trusler i Nordens nærområder. Denne "kunnskapsbasen" vil i form av moderne informasjonsteknologi som bruk av websider, kunne bli tilgjengelig for myndigheter, media og publikum. Prosjektets hovedmålgruppe var de nordiske lands myndigheter, men prosjektet inneholder også et forprosjekt der det vurderes om websidene kan utvikles til også å være åpne for andre brukergrupper.

Litteraturdatabasen er en del av "kunnskapsbasen" og gir en liste over de viktigste publikasjoner og prosjekter som er produsert i de nordiske land omring problemområdet nuklære trusler i Nordens nærområde. Publikasjoner med nordiske deltagere står for majoriteten av det innlagte datamateriale, men også andre publikasjoner som er relevant innen problemområdet er inkludert.

Det er avhold en workshop i løpet av prosjektperioden der eksperter innen de ulike fagområdene som blir omhandlet i "kunnskapsbasen" kom sammen i Oslo. Det var totalt 35 deltagere fra alle de nordiske land. Det ble presentert ulike undersøkelser innen fagområdet. I tillegg ble det diskutert hvikle kunnskapsshull der finnes innen fagområdet og gitt signaler om innenfor hvilke områder de trengs videre studier og som bør utredes hos nasjonale myndigheter og institusjoner.
Supplerende prosjekter:

Kunnskapsbase - åpen nasjonal database
Hensikten med dette prosjektet var å lage en struktur og prinsipper for å gjøre "kunnskapsbasen" til en åpen nasjonal hjemmeside. Prosjektet ble utført i samarbeid med fylkesmannen i Finnmark og NRPA.

Atmospheric transport and deposition of large particles released during the Chernobyl accident
Atmosfæriske utslipp, transport og deposisjon av radioaktive partikler med ulik størrelse og tetthet har vært hovedtema for dette prosjektet. En ny kildeterm beskrivelse av Tsjernobyl ulykken er satt inn i spredningsmodellen SNAP. Prosjektet var et samarbeid mellom DNMI og NLH og resultatet er presentert i DNMI rapport No. 131: “Atmospheric Transport and Deposition of large particles released during the Chernobyl accident”.

Nuclear emergency preparedness in the Nordic and Baltic Sea Countries

Utgangspunktet for denne workshopen var at det tar for lang tid før myndighetene er i stand til å informere publikum i forbindelse med beredskap. Andre tema var hvordan myndighetene kan sette opp uavhengige kanaler utenom media for å håndtere informasjon i forbindelse med kriser. Myndighetene kan forberede seg ved å bruke nettverk og IT.
Table of contents

This is NKS ................................................................. ii
Disclaimer ................................................................. iii
Abstract........................................................................ iii
Key words ........................................................................ iii
Summary.......................................................................... iv
Sammendrag....................................................................... vi
Table of contents ........................................................... viii

1. Introduction..................................................................... 1

2. Base of knowledge......................................................... 2
   2.1. Literature database .................................................. 3
   2.2. Status reports........................................................... 5
   2.3. Workshop 2000 ......................................................... 6

3. Supplementary studies..................................................... 6
   3.1. Base of knowledge – open webpage .............................. 6
   3.2. Atmospheric transport and deposition of large particles released during the Chernobyl accident ........................................ 6
   3.3. Nuclear emergency preparedness in the Nordic and Baltic Sea Countries .... 7
   3.4. Information preparedness in nuclear emergencies - NKS workshop at the Exercise Barents Rescue 2001 ................................................... 8

4. Conclusions and Recommendations .................................. 8

5. Acknowledgments .......................................................... 10

6. Acronyms ....................................................................... 11

7. References....................................................................... 12

Appendix 1: Participants in the SBA-1 project .............................. 13
Appendix 2: Financing .......................................................... 15
Appendix 3: Base of knowledge – some examples .......................... 16
1. Introduction

The scope of the project was to prepare a base of knowledge regarding possible nuclear threats in the vicinity of the Nordic countries. This base of knowledge is made available to authorities, media and the population so that the users can get an overview of the situation and, if they so wish, make their own judgements.

The first stage of the project was to prepare a list of projects and reports that have been previously produced and published.

Based on the literature, workshops and seminars the different findings were aggregated in a database.

The project dealt with the geographical area including North-west Russia and the Baltic states.

The project focused on potential events in nuclear installations and the consequences for the Nordic country especially as regards:

- vulnerable food chains
- doses to man
- environmental contamination
- emergency preparedness systems

The acute phase of an accident and the possibility of high exposure of the populations are some of the most important factors in emergency preparedness work. Radioactive contamination from an accident can however also cause long term effects for land use and enhanced doses to special population groups and economic problems for agriculture, reindeer industry, hunting, tourism and recreation.

The nuclear installations that were investigated in the project were:

- nuclear power plants (Kola NPP, Ignalina NPP, Leningrad NPP)
- ship reactors (icebreakers and submarines)
- storage and handling of used fuel and radioactive waste
Project activities have been:

- Making a literature list
- Workshops and seminars on the different subjects
- Making websites
- Complementary studies

The project was organised with a project leader and a project group which co-ordinated the different tasks and was responsible for aggregating knowledge from the different Nordic countries. Working groups were established to focus on the different subprojects and perform different tasks such as organising workshops, making summary reports and identify knowledge gaps.

2. Base of knowledge

The scope of the project is to prepare a “base of knowledge” regarding possible nuclear threats in the vicinity of the Nordic countries. This base of knowledge will, by modern information technology as different websites, be made available to authorities, media and the population. The users of the websites can easily get information on different types of nuclear installations and threats. The users can get an overview of the situation and, if they so wish, make their own judgements.
Based on the evaluation of the literature, workshops were conducted to get specialists together to discuss the different findings and to aggregate new knowledge based on these investigations. Whenever gaps of knowledge were identified, the project group initiated further studies or identified the needs for the consideration of national organisations and authorities.

Fig. 2: Base of Knowledge

2.1. Literature database
The literature database will be part of the “base of knowledge”. It is a database with the most relevant publications, papers and reports that have been produced regarding possible nuclear threats in the vicinity of the Nordic countries. Publications by Nordic authors were most highly prioritised, but other relevant publications were also included.
The literature database is presented on a website and as a report with approximately 500 references. The website can be seen below:

![Fig. 3: Literature database](image)

The registration of publications and projects available for this database started in the spring of 1999. The list has been updated regularly. Anyone was welcome to suggest additional information and expansion of the database by filling out a registration form (a Word document). See below. The registration form was sent to the project leader and the paper or report was included in the literature database.
The purpose of the form is to prepare a list of publications that has been produced regarding possible nuclear threats in the vicinity of the Nordic countries (northwest Russia and the Baltic states). Thus, a base of knowledge will be prepared and made accessible to the Nordic (preparedness) authorities through a web-based database.

2.2. Status reports

As a summary on the literature in the database there are made two status reports on the most important issues in the project, threats from the nuclear power plants and...
the nuclear vessels. The reports give an overview of available knowledge in this matter. The reports are published as NKS reports.


2.3. Workshop 2000
In October 2000 the project arranged a workshop in Oslo called Workshop 2000. At the workshop experts from the Nordic countries presented papers concerning the threats from nuclear installations.

At the Workshop 2000 experts from the different Nordic countries presented each country’s evaluation of the threats against their country. There were discussions on source terms, models and consequences of nuclear threats.

Several project meetings have generated discussions on how to focus on the different nuclear threats and the presentation of the results.

3. Supplementary studies
3.1. Base of knowledge – open webpage
The objective was to make a structure and create guidelines for making the “Base of knowledge” into a national open home page. The project was carried out in cooperation between the County governor of Finnmark and NRPA.

3.2. Atmospheric transport and deposition of large particles released during the Chernobyl accident
Atmospheric emission, transport and deposition of radioactive particles of different size and density are the main topics of the report. An important and innovative part of the report is a detailed description of the source term for particles released from the Chernobyl reactor, which is not typical for other studies dealing with simulation of atmospheric transport and deposition.

To assess the environmental impact of radionuclides released to the atmosphere from a known source, information on the source terms, the dispersion pattern and associated deposition pattern are needed. To improve predictions related to areas affected, the source term as input to the atmospheric dispersion model should be relevant. Furthermore, processes influencing radionuclides defined as the source term should be adequately treated in the models. The source term includes information on the activity concentration of released radionuclides, activity or isotopic ratios and the physico-chemical form (speciation). Radionuclides released from
different nuclear sources can be present in different physico-chemical forms, ranging from simple ions or molecules to colloids, particles and fuel fragments (Salbu, 2000).

The source term description led to 12 scenarios for the SNAP model runs, which included four different classes of particle size and three different classes of particle density. The SNAP model, developed originally at DNMI for operational applications, was modified mainly by implementing parameterisation of gravitational settling velocity, the main process leading to dry deposition of larger particles.

The result of the modified model simulations showed that the deposition of radionuclides was dependent mainly on particle size and that particles with a diameter of 10 μm were transported to Norway during the Chernobyl accident. This finding is in agreement with the measurements performed at NLH. Particles with sizes larger than 50 μm are deposited relatively close (less than 100 km) to the source, contributing more to local than regional problems.

This joint DNMI and NLH project produced several interesting results, probably more than expected. On one hand, meteorologist from DNMI modelling atmospheric transport have received an innovative and unique description of the source term for the Chernobyl accident based on detailed observations, which is quite different from the typical data used by most other modellers. On the other hand, chemists from NLH who can see the real particles through their microscopes, need information on transport and deposition pattern of particles to assess the environmental impact. The joint experiments and analysis of the results led to several interesting conclusions and recommendations for future research, which are presented in the project report.

3.3. Nuclear emergency preparedness in the Nordic and Baltic Sea Countries

The aim of the project was to update “Beredskapshåndboken”, a handbook on nuclear emergency preparedness in the Nordic countries, and to include Estonia, Latvia, Lithuania, and Poland in this issue. The previous issue of this handbook (1996) was published only in Norwegian. The new handbook is written in English and will be available only in electronic form, thus allowing easy updates.

The contents of the handbook are measuring resources; the organisation of the nuclear emergency preparedness in each country (including medical emergency); levels of preparedness; early notification; protective measures in case of an accident; dissemination of information; international and national exercises; bilateral agreements; and information on national nuclear installations.
This document is the third of its kind, but the first extended version in English. The first issue was prepared by the former Head of the department at the Norwegian Statens institutt for strålehygiene, Leiv Berteig. The second one was compiled by Morten Bremer Mærli of the Norwegian Radiation Protection Authority in February 1996. Both issues were financed by NKS. The present update is also financed by NKS through the SBA-1 project.

The handbook contains an overview of the emergency preparedness organisation in each country, and how the most important channels for the early notification and information systems function. There are included lists of addresses. They are however by no means complete. Such information gets obsolete very quickly. Different users can also have different needs. As the document is prepared in the electronic version, it will be easy to update it in the future and adjust to best suit the individual user.

3.4. Information preparedness in nuclear emergencies - NKS workshop at the Exercise Barents Rescue 2001

Anders Jörle, head of the information department at SKI, gave a presentation on “Always too late – authorities and information management at the operational level”. The following presentation was “We need information channels independent of mass media” where the information adviser Kirsti Aareth from the County Governor of Finnmark, Norway, gave a talk on regional needs of information.

“IInformation preparedness at the authorities and the possibility to build an information network between the authorities” was the title of a presentation by the Communication Director, Norwegian Directorate for Nature Management Siv Ødegård. She discussed how authorities can do a better job in the future in information preparedness. Anne Weltner, Senior inspector, Radiation and Nuclear Safety Authority in Finland (STUK), presented "Communication between authorities in Finland in a nuclear accident”.

4. Conclusions and Recommendations

The main task of the project was to aggregate already compiled knowledge of nuclear threats in the vicinity of the Nordic countries, into a “base of knowledge”, presented by modern information technology. This web based “base of knowledge” is today available to Nordic authorities as a supplement to national emergency preparedness systems. The users of the websites can easily get information on different types of nuclear installations and threats.

NRPA and STUK have included the home page in their emergency system and are using the information.

Today, NRPA is responsible for the website, which is located at a web server at the Svanhovd environmental centre. The web address is www.svanhovd.no/nrpa/nks
with the passwords svanhovd and nks. The base of knowledge will be updated by the NRPA.

Nationally this base of knowledge can easily be made available to other authorities, media and the population.
5. Acknowledgments

The author wishes to thank all the participants of the SBA-1 project, subproject leaders, researchers, and representatives of the nuclear safety authorities and utilities. I am grateful to NKS and the NRPA who have supported me as project leader. The NKS Board, the NKS Secretariat in Risø and Torkel Bennerstedt supported us all the time with good advice. I want to thank all financing organisations, the other project leaders in the NKS program and it has been a pleasure to be part of the Nordic network. I would like to thank very much all authors and other contributors for providing material and documents, which have made this compilation possible, yielding a description of the emergency preparedness organization in nine Nordic and Baltic Sea countries. Special thanks are due to the following persons for their contribution of the reports from the project: Alicia Jaworska, NRPA, Bredo Møller, NRPA, Povl Ølgaard, Risø National Laboratory, Jerzy Bartinicki, Jørgen Saltbones DNMI, Britt Salbu, NLH, Kirsti Aarseth, County governor of Finnmark.
6. Acronyms
DNMI – Norwegian Meteorological Institute
FOI – The Swedish Defence Research Agency
GR – Icelandic Radiation Protection Institute
IFE – Institute for Energy Technology, Norway
INPP – Ignalina Nuclear Power Plant
KNPP – Kola Nuclear Power Plant
LNPP – Leningrad Nuclear Power Plant
NKS – Nordic Nuclear Safety Research
NLH – Agricultural University of Norway
NRPA – Norwegian Radiation Protection Authority
SBA – NKS Cross Disciplinary Studies
SKI – Swedish Nuclear Power Inspectorate
SNAP – Severe Nuclear Accident Program
SSI – Swedish Radiation Protection Authority
STUK – Radiation and Nuclear Safety Authority, Finland
VTT – Technical Research Centre of Finland
7. References

Reports from this project:


Appendix 1: Participants in the SBA-1 project

The following persons participated in SBA-1 either by contributing actively to the studies summarized in this report, taking part in the sub-project group meetings, or participating in seminars as invited speakers.

Norway:
Anne-Marit Østreng, NRPA
Inger Margrethe H. Eikelmann, NRPA
Ole Harbitz, NRPA
Erling Stranden, NRPA
Carl-Erik Christoffersen, NRPA
Finn Ugletveit, NRPA
Eldri Naadland Holo, NRPA
Malgorzata Sneve, NRPA
Svein Uhnger, NRPA
Bredo Møller, NRPA
Erlend Larsen, NRPA
Merete Halvorsen, NRPA / DNMI
Arnfinn Tønnesen, NRPA
Alicia Jaworska, NRPA
Lise Flø, NRPA / Svanhovd Environmental Centre
Atle Valseth, IFE
Amund Hanevik, IFE
Helge S. Olsen, IFE
Egil Stokke, IFE
Kirsti Aarseth, County Governor of Finnmark
Jørgen Saltbones, DNMI
Jerzy Bartnicki, DNMI
Anstein Foss, DNMI
Brit Salbu, NLH
Ole-Christian Lind, NLH
Siv Ødegård, Directorate for Nature Management

Finland:
Olli Vilkamo, STUK
Jukka Laaksonen, STUK
Hannele Aaltonen, STUK
Leif Blomkvist, STUK
Anne Weltner, STUK
Mikael Björnberg, VTT
Heikki Holmström, VTT
Seppo Vuori, VTT
Denmark:
Povl Ølgaard, Risø National Laboratory
Bent Lauritzen, Risø National Laboratory
Henning Jensen, Danish Emergency Management Agency
Stig Hammerhøj, Danish Emergency Management Agency

Sweden:
Richard Olsson, SKI
Anders Jörle, SKI
Ulf Bäverstam, SSI
Ulf Andersson, SSI
Helene Asp, SSI
Ronny Bergman, FOI
Anna Resjo
Annika Ovegård, SSI
Stig Husin, SSI

Iceland:
Sigurður Emil Pálsson, GR

Estonia
Merle Lust

Latvia:
Uldis Poris

Lithuania:
Darius Janusonis
Violeta Skarzinskiene

Poland:
Maciej Jurkowski
Andrzej Merta

NKS:
Torkel Bennerstedt
## Appendix 2: Financing

Table 1: SBA-1 economy. All amounts in DKK

<table>
<thead>
<tr>
<th>NKS budget</th>
<th>1998</th>
<th>1999</th>
<th>2000</th>
<th>2001</th>
<th>Sum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Base of knowledge</td>
<td>150,000</td>
<td>400,000</td>
<td>350,000</td>
<td>450,000</td>
<td>1,350,000</td>
</tr>
<tr>
<td>Base of knowledge - open</td>
<td></td>
<td></td>
<td></td>
<td>130,000</td>
<td>130,000</td>
</tr>
<tr>
<td>Workshop: Information preparedness (BR 2001)</td>
<td></td>
<td></td>
<td>100,000</td>
<td>100,000</td>
<td></td>
</tr>
<tr>
<td>Atmospheric transport and deposition of large particles released during the Chernobyl accident</td>
<td>150,000</td>
<td></td>
<td></td>
<td>150,000</td>
<td></td>
</tr>
<tr>
<td>Emergency Preparedness handbook</td>
<td></td>
<td></td>
<td>140,000</td>
<td>140,000</td>
<td></td>
</tr>
<tr>
<td>Total budget</td>
<td>150,000</td>
<td>400,000</td>
<td>350,000</td>
<td>970,000</td>
<td>1,870,000</td>
</tr>
</tbody>
</table>

In addition to the NKS budget presented above, the SBA-1 project has received additional in-kind contributions from participating countries and organizations worth at least another DKK 800,000. These contributions, without which the project would not have been possible, are greatfully acknowledged.
Appendix 3: Base of knowledge – some examples
## Russian Icebreaking Ships

<table>
<thead>
<tr>
<th>Name</th>
<th>Displacement (t)</th>
<th>Operational</th>
<th>Reactor power (MW)</th>
<th>Horse Power (shp)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lenin</td>
<td>17 810</td>
<td>1959-89</td>
<td>2x90 (2x135)</td>
<td>44 000</td>
</tr>
<tr>
<td>Ariadne</td>
<td>20 905</td>
<td>1975-</td>
<td>2x171</td>
<td>75 000</td>
</tr>
<tr>
<td>Siber</td>
<td>23 120</td>
<td>1977-7</td>
<td>2x171</td>
<td>75 000</td>
</tr>
<tr>
<td>Rossiya</td>
<td>22 920</td>
<td>1965-</td>
<td>2x171</td>
<td>75 000</td>
</tr>
<tr>
<td>Vernal</td>
<td>~22 000</td>
<td>1992-</td>
<td>2x171</td>
<td>75 000</td>
</tr>
<tr>
<td>Sovetskaya Gorshuk</td>
<td>~22 000</td>
<td>under constr.</td>
<td>2x171</td>
<td>75 000</td>
</tr>
<tr>
<td>St. lat Pobedy</td>
<td>~22 000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Taimyr</td>
<td>20 000</td>
<td>1909-</td>
<td>171</td>
<td>50 000</td>
</tr>
<tr>
<td>Valdaitz</td>
<td>20 000</td>
<td>1900-</td>
<td>171</td>
<td>50 000</td>
</tr>
<tr>
<td>Sevmorput</td>
<td>63800</td>
<td>1980-</td>
<td>135</td>
<td>48 000</td>
</tr>
</tbody>
</table>
Radioactive Contamination

Spent Nuclear Fuel

A large amount of spent nuclear fuel has accumulated at the bases of the Russian Navy, including the Northern Fleet. In 1997 the total amount was about 300 reactor cores or 70,000 fuel assemblies. About half of these assemblies are still in the reactors of decommissioned submarines.

The rest are stored in various storage facilities at the naval bases. There are several reasons for this large amount of spent fuel at naval bases. The transport capacity for the shipment of spent fuel to the Production Association Mayak where the fuel is to be reprocessed is limited to 10-20 cores per year, and the transport costs have increased. Required lifting equipment and transport facilities are not adequate at the naval bases. This means that all storage facilities, whether on land or on ships are full and some of the facilities were not designed for long term storage.

In connection a NATO/NACC/JCMS Pilot Study meeting in February 1996 the Russians published information of the storage of spent fuel at the Northern Fleet. The documents are not dated, but the figures seem to relate to the situation at the end of 1994.

The spent fuel of the Northern Fleet is store at two shore bases, Andreyev Bay and Gremikha and at 6 support vessels.

At Andreyev Bay in Zapadnaya Litsa Bay spent fuel was initially stored in a dry storage pool. However, the pool developed a leak and contaminated the surrounding area. Because of this three large liquid waste storage tanks were converted to dry storage facilities for spent fuel, and fuel was transferred from the pool to these facilities.

The content of these three facilities was given to be as follows:

<table>
<thead>
<tr>
<th>Storage Facility</th>
<th>Number of Carcass</th>
<th>Fuel Assemblies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Facility #1</td>
<td>900</td>
<td>6300</td>
</tr>
<tr>
<td>Facility #2</td>
<td>1021</td>
<td>7147</td>
</tr>
<tr>
<td>Facility #3</td>
<td>993</td>
<td>6951</td>
</tr>
</tbody>
</table>

The three facilities are fully loaded.

At the Gremikha base there are 4 spent fuel storage facilities.

Pool #2 (no longer in operation) contains 95 defective fuel assemblies, which cannot be accepted by Mayak.

Facility #1V contains 5 cores from liquid metal cooled reactors, probably of the order of 500 fuel assemblies. They can not be accepted by Mayak due to their design.

An open-air storage area contains 110 Type 6 containers with a total of 812 fuel elements. They can not be accepted by Mayak due to their
Emergency Preparedness

Click on country to obtain more detailed information about emergency preparedness.

Soon will the document "NUCLEAR EMERGENCY PREPAREDNESS IN THE NORDIC AND BALTIC SEA COUNTRIES" be available in PDF format for downloading.
Nordic Nuclear Safety Research

Search the NKS SBA-1 literature database

The purpose with the database is to make a base of knowledge regarding possible nuclear threats in the vicinity of the Nordic countries. This base of knowledge will be made available to the authorities, media, and the population so that the same can get an overview of the situation.

This database is a part of the NKS SBA-1 project, to get an overview of the project please visit the website: NKS SBA-1 homepage (only in Norwegian).

The registration of publications and projects available for this database started spring 1999 and are at regular intervals updated. Anyone are welcome to add information and to expand the database by filling out the registration form (a word-document). Read the form for more information.

Please enter values for the fields below and press the 'Submit Query' button:

<table>
<thead>
<tr>
<th>Original title:</th>
<th>Begin with:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Author:</td>
<td>All the words</td>
</tr>
<tr>
<td>Year of publish:</td>
<td>(max 2 words)</td>
</tr>
<tr>
<td>Keyword:</td>
<td>All the words</td>
</tr>
<tr>
<td>Summary:</td>
<td>(max 2 words)</td>
</tr>
</tbody>
</table>

Submit query | Reset

This database contains 402 publications.
Last publication was added November 26, 2001.

[How to use this search engine] [View the error-log for this database]
## Nordic Nuclear Safety Research

### Your query resulted in:

6 matches:

<table>
<thead>
<tr>
<th>Original title</th>
<th>Author</th>
</tr>
</thead>
<tbody>
<tr>
<td>Atmospheric Transport and Deposition of Radioactive Material Exposed During a Potential Accident at Kola Nuclear Power Plant</td>
<td>J. Balthesen, J. Bhatnaha (1997)</td>
</tr>
<tr>
<td>Atmosfærisk transport av radioaktivt materiale fra en potensiell drabse ved kjernekraftverket på Kola</td>
<td>J. Balthesen, J. Bhatnaha (1997)</td>
</tr>
<tr>
<td>Correlation analysis as a basis for emergency planning</td>
<td>H. Møller and H. Larsen (1997)</td>
</tr>
<tr>
<td>Sprødent av radioaktivt stråle fra kjernekraftverket på Kola - statusforhold</td>
<td>J. Balthesen, J. Bhatnaha, A. Foss (1999)</td>
</tr>
</tbody>
</table>

[Back to main search page]
Nordic Nuclear Safety Research

You selected the following publication:

### 210

**Original title:** Analysis of Atmospheric Transport and Deposition of Radioactive Material Released During a Potential Accident at Kola Nuclear Power Plant

**English title:** As above

**Authors:** J. Saltines, J. Barbaak

**Published by/tx:** DIME Research Report No. 43 (Norwegian Meteorological Institute)

**Year of publish:** 1991

**Language:** English

**Printing office:** Norway

**Number of pages:** 29

<table>
<thead>
<tr>
<th>Report code / number</th>
<th>-</th>
</tr>
</thead>
<tbody>
<tr>
<td>DEBN</td>
<td>-</td>
</tr>
<tr>
<td>DEIS</td>
<td>9352-9929</td>
</tr>
</tbody>
</table>

**Order from / available at:** Norwegian Meteorological Institute, Oslo, Norway

**Summary:**

An analysis of the potential for radioactive material released during a potential accident at the Kola Nuclear Power Plant to be transported and deposited in the surroundings of the plant was carried out by the Ministry of Foreign Affairs (NORDEA). This analysis was conducted as part of the "Atlantic Plan" (AP) agreement and was part of the follow-up activities initiated by the Ministry of Foreign Affairs. The analysis included the evaluation of the atmospheric transport and deposition of radioactive material released during the accident.

**Keywords:** Emergency response, nuclear accident, long-range transport, trajectory analysis, probabilistic approach, travel-time matrix, selection of impact zones

**Formatter:** -
Title: Nuclear Threats in the Vicinity of the Nordic Countries. Final Report of the Nordic Nuclear Safety Research Project SBA-1

Author(s): Inger Margrethe H. Eikelmann

Affiliation(s): Norwegian Radiation Protection Authority

ISBN: 87-7893-120-7

Date: November 2002

Project: NKS/SBA-1

No. of pages: 30

No. of tables: 1

No. of illustrations: 11

No. of references: 6

Abstract: The acute phase of a nuclear accident and the possibility of high exposure of the populations are always the most important threats in the emergency preparedness work. Radioactive contamination from an accident can however also cause long term effects for land use and enhanced doses to special population groups and economic problems for agriculture, reindeer industry, hunting, tourism and recreation. For planning purposes it is always valuable to be aware of surrounding radiation hazards and other potential threats. Thus, mapping such threats in a Nordic context is an important factor in emergency preparedness in the area.

This report presents a cross-disciplinary study from the NKS research program 1998-2001. The scope of the project was to prepare a “base of knowledge” regarding possible nuclear threats in the vicinity of the Nordic countries. This base of knowledge will, by modern information technology as different websites, be made available to authorities, media and the population. The users of the websites can easily get information on different types of nuclear installations and threats. The users can get an overview of the situation and, if they so wish, make their own judgements.

The project dealt with a geographical area including North-west Russia and the Baltic states.

The results from the different activities in the project were generated in a web based database called the “the base of knowledge”.

Key words: Nuclear threats, Nordic countries, nuclear power plants, nuclear ship, nuclear waste, literature database, base of knowledge, web-accessed information, atmospheric transport, decommissioning of submarines, nuclear installations, waste management, radioactive contamination in marine environment, radioactive sources, criticality analysis.

Available from the NKS Secretariat, P.O. Box 30, DK-4000 Roskilde, Denmark. phone (+45) 46774045, fax (+45) 46774046, mail nks@catscience.dk, www.nks.org.