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Nordisk kernesikkerhedsforskning
Norrænar kjarnöryggisrannsóknir
Pohjoismainen ydinturvallisuustutkimus
Nordisk kjernesikkerhetsforskning
Nordisk kärnsäkerhetsforskning
Nordic nuclear safety research

NKS-5
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Planer for NKS-programmet 1998 - 2001

Sammenstillet af
Torkel Bennerstedt
NKS

1999-08-02

I denne rapport beskrives det nye firårige nordiske kernesikkerhedsprogram, som er startet i 1998. Programmet skal styrke forståelsen for vigtige aspekter af reaktorsikkerhed og stråleværn i Norden og i vore østlige nabolande.

Det nye program omfatter 7 projekter om reaktorsikkerhed, affald, radioøkologi og beredskab inklusive nordiske trusselsbilleder og information.

Kernesikkerhedsprogrammet finansieres af en konsortialgruppe, som består af:

Beredskabsstyrelsen i Danmark
Handels- och industriministeriet i Finland
Geislavarnir ríkisins i Island
Statens strålevern i Norge
Statens kärnkraftinspektion och Statens strålskyddsinstitut i Sverige

Desuden bidrager nedennævnte organisationer i Norden til finansieringen:

Fortum/IVO; Industrins kraft (TVO) i Finland
Svensk Kärnbränslehantering AB (SKB); Vattenfall AB; Sydkraft AB;
Kärnkraftsäkerhet och utbildning AB (KSU) i Sverige

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Introduction

Torkel Bennerstedt, Secretary General of NKS

The present report is a comprehensive compilation of the adopted NKS project plans for the sixth four-year period, 1998 – 2001. Most of the plans are in English. One is in both English and Danish. One is in Norwegian, with a brief summary in English. Only two of the six appendices are in English. In spite of this, it is believed that the report will serve as a valuable source of information not only to those actually active in or closely following the NKS work, but also the international scientific community, e.g., within EU and in the Baltic States.

The research program incorporates reactor safety, radioactive waste, emergency preparedness, radioecology, cross-disciplinary studies, and information issues. The necessary administrative support program, including the NKS Secretariat, is not described herein. Neither is the aim, scope or organization of NKS, since this has been covered elsewhere.

The work to develop new project plans started with an evaluation of the 1994 – 1997 research program and subsequent discussions regarding the findings of the evaluation. At the same time, suggestions and proposals for the new program were invited, both on a national level and from involved organizations and researchers. A special program group was established to find a coherent project structure based on the more than 200 suggestions that were received. The NKS Board then decided to carry out a number of pre-projects and feasibility studies under the supervision of a reference group. The pre-project leaders and reference group members appointed by the Board covered relevant national needs and technical/scientific aspects to the greatest extent possible. Draft final reports of the pre-projects were presented to and discussed by the Board. The versions compiled here have been revised according to the decisions taken by the Board at its meeting in February, 1999. At that meeting, decisions were also made on budgets, time schedules and project leaders. Since then, the actual work has begun in accordance with the accepted plans.

The final report of the program group (mostly in Scandinavian languages) was published as report number NKS(98)1. The directives for the work of the reference group (in Swedish) are attached as Appendix 1 and the final report of the reference group (in Danish) as Appendix 2. The directives guiding the pre-project work are presented in Appendix 3 (in Swedish) and the pre-project participants in Appendix 4.

During the pre-project phase, some major changes were made in the structure suggested by the program groups. The most important changes are that:

- a total of seven projects are proposed in that the cross-disciplinary studies are divided into two projects instead of just one, namely one project on nuclear threats in Nordic surroundings, and one on information issues
- Nordic exercises have been moved from the cross-disciplinary studies to emergency preparedness

- whole-body measurement and dietary studies that were earlier divided between two projects have now been gathered in the radioecology project

The seven ongoing projects have been grouped in three categories:

SOS	Technical Safety and Radiation Protection (Säkerhet och strålskydd)
BOK	Emergency Preparedness and Radiological Consequences (Beredskap och konsekvenser)
SBA	Cross-Disciplinary Studies (Säkerhets- och beredskapsrelaterade aktiviteter)

The titles and project leaders of the seven projects are:

SOS-1	Safety Assessment and Strategies for Safety (Säkerhetsvärdering och strategier för säkerhet Kjell Andersson, Karinta-Konsult, Sweden)
SOS-2	Reactor Safety (Reaktorsäkerhet) Kaisa Simola, VTT Automation, Finland
SOS-3	Radioactive Waste (Radioaktivt avfall) Karin Brodén, Studsvik RadWaste, Sweden
BOK-1	Nuclear Emergency Preparedness (Beredskap) Bent Lauritzen, Risø, Denmark
BOK-2	Radiological and Environmental Consequences (Miljökonsekvenser) Sigurður Emil Pálsson, Geislavarnir ríkisins, Iceland
SBA-1	Nuclear Threats in Nordic Surroundings (Nuleära hot i Nordens närområde) Inger Margrethe H Eikelmann, NRPA, Norway
SBA-2	Information Issues (Informationsfrågor) Vibeke Hein, DEMA, Denmark

The project leaders report directly to the NKS Board at every Board meeting. In addition, a midway seminar and project evaluation will be arranged in mid or late 2000. At that point the Board will decide on any changes it finds necessary for the remaining part of the four-year period.

Starting a couple of years ago, NKS has kept relevant representatives of the European Commission updated on ongoing NKS work and obtained results. At the same time, NKS has received information on the Commission's ongoing and future framework programs. This mutual, very informal exchange of information is foreseen to continue throughout the present NKS research program. The NKS and EC summaries of a joint workshop in Brussels in July, 1998 are presented in Appendices 5 and 6.

Since the budget for the NKS work will be decided by the Board on a yearly basis, and not for the entire period, no numbers are given here. Please refer to relevant NKS documents as they appear for an update on project budgets.

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SOS-1

Safety Assessment and Strategies for Safety

Lennart Hammar
ES-konsult

1998-12-07

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Summary

The project SOS-1, *Safety Assessment and Strategies for safety,* is proposed to form part of the Safety and Radiation Protection (SOS) programme under the Nordic Nuclear Safety research (NKS) planned for the years 1998-2001. The SOS programme will comprise, in addition, a project on Reactor Safety, SOS-2, and another on Nuclear Waste Safety, SOS-3.

The project SOS-1 aims primarily at promoting, among the "target group" - educated public, media people, and decision makers, as well as the technical experts in the various related fields, - enhanced understanding and rationalised views in regard of managing nuclear risk and safety by lending transparency to related, commonly complicated issues.

The approach consists for large part in organising well-prepared workshops on a number of the truly basic issues concerning risk and safety with broad participation of laymen as well as experts. The issues include risk perspectives and perception, principal safety concepts and safety culture as well as the related management aspects and questions in regard of making proper as well as transparent assessments
The project will draw from the results of the other SOS projects and include further research in selected areas. When successful the project would provide, in practice, improved means of communicating more easily within the target group as required to achieve the common understanding aimed at.

To be successful, the project requires dedicated participation on a broad basis. The pre-project has indicated, in general, genuine interest among the authorities and the utilities and clear willingness to participate to the extent possible. However, it seems to remain to gain enhanced appreciation of the concept on part of the public relations staff.

The pre-project group unanimously recommends the project for execution according to proposed lines while continuing the efforts to ensure the broad participation to be desired.

1. Introduction

The proposed project, NKS/SOS-1, forms part, together with the projects NKS/SOS-2 on Reactor Safety and NKS/SOS-3 on Nuclear Waste Safety, of a Safety and Radiation Protection (NKS/SOS) programme under the Nordic Nuclear Safety Research (NKS) programme being planned for the period 1998-2001. The programme comprises in addition other research in related fields, as shown in Table 1-1, of which an activity on public communications in matters of nuclear risk and safety is of particular interest in the present context.

NKS	**Nordic Nuclear Safety Research 1998-2001**
SOS	Nuclear safety and radiation protection
SOS-1	*Safety assessment and strategies for safety*
SOS-2	Reactor Safety
SOS-3	Nuclear Waste Safety
BOK	Preparedness and environmental Consequences of nuclear accidents
SBA	Related activities: Risk exposure in the Nordic countries from foreign nuclear activities; Nuclear Emergency exercises; Public communications

Table 1-1: Context of the SOS-1 project

A description of the project is given below in view of objectives and main approaches (section 2), scope and activities (section 3), and planning including required resources and costs (section 3). Finally, comments are made in regard of meeting the NKS quality criteria with the proposed project (section 4) and on the conduct of the pre-project (section 5).

Acknowledgements

Valuable advice was obtained, in preparing this report, from the members of the pre-project group, many of those from the authorities and the nuclear utilities intending to participate in the project as well as from the proposed project leader of the SOS-1 project, Kjell Andersson, Karinta Konsult.

2. Objectives and main approach

The main question concerns to what extent it can be assured, in an understandable way also to the educated layman, that the nuclear safety requirements can be met in practice, in view of the complexity of the art and as necessary in regard of the risk potential.

The project aims primarily at promoting, in the *target group* (cf. below), necessary understanding and rationalised views in regard of nuclear risk and safety by lending transparency to the related issues. It is a follow-up of previous NKS research on fundamental aspects of safety assessment [1]. The question of transparency was recently subject to an international study on safety and environmental impact assessment in the nuclear waste area [2] and a Swedish study on general approaches to safety assessment [3].

The target group consists of the educated public, media people and politicians together with decision-makers, experts, public relations people and advisors active in the nuclear community.

The aim is to be reached for most part through *well-prepared discussions* between selected representatives of the target group to take part in workshops organised by the project. Participation by members of the boards of the Nordic safety and radiation protection authorities and of various nuclear safety advisory boards and committees will be sought. The results achieved in the project would thus be expected to support, in turn, improving the communications within the entire target group do deepen the understanding of the nuclear safety issues among the public as well as among those concerned with management of the safety.

Subordinated or additional objectives to those mentioned above thus are:

- to carry out well prepared and interesting workshops on relevant issues;
- to establish well considered views in regard of the relevant issues among the experts in the nuclear community;
- to propose general guidelines for communication with the public on relevant issues;
- to summarise and highlight the results of all research to be conducted under the SOS programme (including the projects SOS-2 and SOS-3) in a particularly transparent way, consistent with the objectives of the SOS-1 project.

3. Aspects and issues to be addressed

The project consists of two parts of which one is concerned with the *assessment of safety* and the other with the *safety strategies*.

3.1 Fundamental aspects of nuclear safety assessment

3.1.1 Risk perspectives and assessment of risk

Risk assessment is a prerequisite for providing appropriately for the safety. Safety assessment, on the other hand, aims at finding out if the safety provisions will reduce the risk as required by society. When the safety requirements are met, “residual risk” should be synonymous with “tolerable risk”.

Although "risk" most commonly refers to possibilities of sudden accidents, the concept borders on unforeseen impacts of, e.g., industrial projects or undertakings such as building facilities for nuclear waste disposal, power up-rating of nuclear power plants or decommissioning of nuclear power plants for replacement with other power generation. Environmental impact assessment (EIA) is thus of interest in the present context. EIA in regard of waste safety was subject to studies in the previous NKS programme (AFA-3 in 1994-97) which are planned to continue in the present programme (SOS-3.1).

Unlike safety assessment, typically a task for experts, risk assessment commonly suffers from great deal of prejudgement and lacking regard to proportions in accounting for different types of risk and environmental impact. This makes it difficult to establish unified views in the society as to what is safe enough.

The project will address

- *the practicability of understanding "risk" as the probability of accidental loss of value (as life, health, well-being, property), or loss of environmental and social qualities on long range perspectives as being considered in EIA;*
- *current views in regards of aversion and tolerance of risk and of environmental impact from nuclear and other industrial activities by exploring common approaches to risk assessment and EIA in selected fields, significance assigned to various types of factors and possibilities of bringing together various perspectives;*
- *aspects on assessment of environmental impact (EIA) as should be done before permanent shut-down of nuclear power plants.*

Planned activities

A workshop titled "The assessment of risk and environmental impact from nuclear and other industrial activities". Participation of well-known researchers in the field of risk and risk perception will be sought with the aim to propose a Nordic view on the subject based on currently available knowledge;

Follow-up of and participation in SOS-2 project studies and activities, which provide direct input to the SOS-1 studies (particularly the studies of EIA applied to radioactive waste management).

3.1.2 Technical bases for the assessment of safety

The project will address fundamental approaches to assessing nuclear safety in regard of the strengths and the limitations of typical arguments as are usually put forward in support of the safety assessments.

Meaning of safety. Safety goals

While, in the view of the expert, "safety" is a *technical quality* of, e.g., a nuclear plant or activity, the practical significance of the word is rather one of *perception* on part of the observer. Difficulties in understanding technical safety assessment tend to promote the latter view, especially in regard of nuclear plants, claimed to be extremely safe, seen to operate for long times without severe incidents but nevertheless known to cause scaring consequences in the event of a severe accident.
This would suggest emphasising, in communicating between the experts and the laymen, the *general safety principles* as being applied (easier to understand than detailed technical arguments) together with *demonstrating* advanced safety culture, high competence in managing the safety matters and successful general performance[1].

The safety work should be governed by distinct safety goals (targets) in order to enable verification that the safety provisions of the nuclear plant meet the requirements. International practice in this regard is rather varying, from merely considering fulfilment of certain basic safety requirements as constituting the safety goal to goals more clearly related to the desired level of safety, e.g. probabilistic safety goals.

The project will address

- *questions relating to creating a perception of nuclear safety among the public which corresponds to the intended safety, as reflected by current safety rules and practices;*
- *the view that safety goals, for desired benefit, should be chosen in regard of the extent to which they contribute to the required awareness about essential prerequisites for safety (awareness goals), i.e.:*
- *insight and understanding in regard of the situation in regard of the nature of risks and of what is required to ensure safety and,*
- *assurance, that all requirements accordingly called for are indeed, at all times, fulfilled (i.e. appropriate quality assurance).*

Proven approaches and technology - Safety principles

Technically, safety is established through adhering to safety principles and sound safety practices which all represent comprehensive, well-established experience. The safety principles mainly consist in generalised design rules to ensure that required performance is within the scope of the natural properties and abilities of the means provided (e.g., in regard of strength, stability, redundancy, diversity, etc.). The safety principles include, e.g., the rule placing the ultimate responsibility for the safety on the plant owner, the single failure criterion, certain autonomy rules (e.g. the 30-minutes rule), etc

[1] This question is partly related to the quality requirements in regard of nuclear activities to be discussed in the project (cf. paragraph on **Quality assurance (QA)**, page 8).

"Inherent safety" and "passive safety functions" relate to safety principles subject to increasing attention, which present interesting questions in regard of the assessment of advanced nuclear safety concepts.

An interesting question is whether it might be possible to demonstrate "practical elimination" of certain particularly serious accident sequences, as discussed in developing the European Utility requirements for LWR Nuclear Power Plants (EUR).

The project will address, in this part, the validity, the trustworthiness and the limitations of safety arguments in terms of adhering to typical safety principles and safety practices.

Quality assurance (QA)

The importance of QA in regard of safety has been emphasised above through the proposed "awareness" concept. The complexity of the art in combination with the possibly severe consequences in case of an accident, indeed require it to be convincingly demonstrated that the safety requirements pertaining to nuclear power production can be met in practice - at all times.

Input to assessing the situation in regard of QA is expected from the SOS-2 project in which aspects of quality assurance applied to operating, maintaining and backfitting of the nuclear reactors will be studied.

The project will address, in this part, questions concerning the need of quality assurance in operating the nuclear installations, also in the long-range perspective, and what can realistically be achieved.

Operating experience

General operating experience contributes largely to forming a common perception of the safety of the nuclear plants. There are presently some 6.000 (or more) of reactor operating years representative of western types of reactors with only one core melt accident with very minor environmental impact (TMI-2). It should be realised, however, that the validity of any conclusions to be drawn in regard of the possibility of accidents with severe environmental consequences is limited as

- the safety of any specific reactor depends for great part of how it is operated from one day to another;
- there are usually differences even between reactors from the same vendor at different plants, particularly in regard of the way they are operated;
- the required statistics to allow verification of the high safety level aimed at is in any case very far from being met.

Operating experience as obtained by systematically collecting all data on *component failures* and *various types of incidents* is, on the other hand, a well-known and important basis for assessing and further improving the safety of the plants (cf. following paragraph on Safety analysis).

The project will, in this part, address questions in regard of judging the safety of the currently operating reactors on the basis of general operating experience including occurrences and accidents in the past and propose a Nordic view in regard of possible conclusions.

Safety analysis

Safety analysis aims at enabling safety cases to be checked in regard of complying with the accepted, basic safety principles. *Deterministic analysis* is used in order to analyse a single event path of the reactor for a particular set of "possibilities", each represented by a an initiating event followed by a specific set of successive failures or successes of safety functions subject to demand. *Probabilistic analysis* (PSA) is used to allow identification and assigning importance to safety of each one of all such possible event paths.

Input on the subject will be obtained from the project SOS-2.1 on PSA.

The project will, in this part, address questions in regard of the capabilities and the limitations offered by combining deterministic and probabilistic safety analysis.
Particular aspects to be covered include

significance and limitations of currently available reliability data;

depth and the scope of the PSA studies;

the uncertainty of PSA as made at certain time in regard of on-going developments of data bases, scope and depth;

criteria for "practically ruling out" certain types of catastrophic events (cf. Proven approaches and technology – Safety principles, page 7).

Planned activities

A workshop titled "The assessment of nuclear safety" covering above aspects (section 3.1.2) except for leaving most part of the aspects on QA to be discussed separately (below). To be conducted in close co-operation with SOS-2 (SOS-2.1). A few prominent representatives of other industry may be invited;

A workshop titled "Quality assurance for nuclear safety – What is required?". To be conducted in close co-operation with SOS-2 (SOS-2.2). Prominent representatives of other industry may be invited;

Follow-up of and participation in SOS-2 project studies and activities that provide direct input to the SOS-1 studies.

3.1.3 Safety culture

While numerous characteristics of safety culture have been proposed (e.g. in INSAG-4), only few appear to constitute true and basic *prerequisites* for safety culture. Safety culture would thus be understood essentially as a quality of organisations and individuals concerned with safety in regard of awareness and understanding of what safety requires, competence in managing the safety accordingly and dedication to the safety objectives.

It is to be noted that the scope for common dedication to matters of safety may be severely reduced by any worries related to various competing concerns, e.g. in regard of the prevailing working conditions at the utility, inadequate leadership, degraded economy etc. While dedication to safety lost for such reasons may be fairly easily recovered once acceptable working conditions have been restored, dedication lost for reasons of complacency, relating to intrinsic lack of safety culture in terms of understanding, may require longer times to remedy when affecting large groups of staff.

The project will address the notion of safety culture with regards to:

- *the practicability, in view of fostering safety culture, of considering as its essential characteristics and prerequisites:*
  - *awareness and understanding of what safety requires;*
  - *competence in regard of the safety issues;*
  - *dedication to the safety objectives*
- *possible ways of ensuring people's dedication to safety, particularly in the presence of external pressures causing competing concerns;*
- *assessing "essential" safety culture in view of commonly existing cultural differences between, e.g., different utilities or countries;*
- *principal requirements applying to practically applicable indicators of safety culture*[1]*;*
- *the extent to which "safety culture" is presently established in the industry together with impact seen on safety in practice. Currency of the concept "safety culture" outside the nuclear industry.*

[1] Difference should be made between standardised safety culture indicators used routinely and "indicators of safety culture", i.e. general characteristics of safety culture.

Planned activities:

Survey (aimed also for the workshop on ”Fostering and maintaining safety culture”, section 3.2.2 on page 13):

- Management approaches and practices, in the nuclear industry in the Nordic countries and abroad, which are expressly aimed at fostering safety culture and safeguarding it under the influence of external pressures (economic or others). Currency of the concept “safety culture” and manifestations in other industry;

A workshop titled “Recognising and assessing safety culture” covering above aspects. Prominent representatives of industries outside the nuclear field to be invited.

3.1.4 Safety performance and safety culture indicators

Safety indicators (or safety performance indicators) may be defined as specifically designated performance characteristics of reactor operation in regard of safety. Many safety indicators bear in addition some reflection of the safety culture and some may deserve to be called “safety culture indicators”.

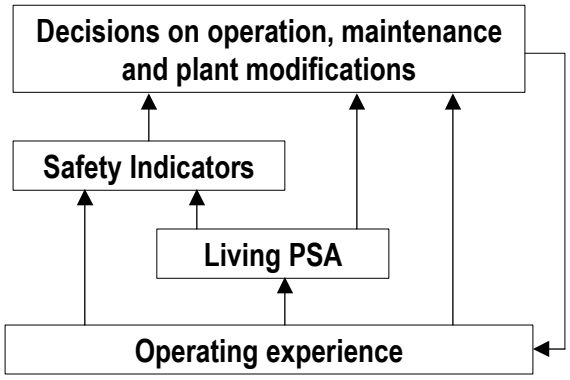

Figure 3-1: The role of safety indicators and LPSA in the safety work. NKS/SIK-project 1990-93

The use of safety indicators in combination with living PSA was subject to study in the NKS programme during the period 1990-1993 (cf. Figure 3-1). The practices have been subject to a great deal of further developed since then. Furthermore, there is at present a common interest in developing means of monitoring safety culture.

The project will thus address
recent developments and current practices in using safety performance and safety culture indicators in the nuclear industry, in particular in the Nordic countries;

experience from the use of such indicators with regard to correlations seen between monitoring records obtained with different indicators as compared with other measures of safety performance (e.g. the number of reported occurences and failures);

experience in regard of the capability of the indicators of providing for "early warning";

general impact in regard of the operational safety of the use of safety indicators.

Planned activities

A survey of developments, practices and experiences gained with regard to using safety indicators and safety performance indicators;

A workshop titled "Safety performance and safety culture indicators" covering above aspects.

3.2 Strategies for safety

3.2.1 Ensuring efficiency and reliability in safety assessment

Ensuring reliability of safety assessments, constituting for great part the practical nuclear safety work on parts of the nuclear utilities, their contractors and vendors and of the safety authorities, is a matter of crucial importance to nuclear safety. Many difficulties are encountered, however, in ensuring desired reliability and efficiency of required safety assessments, as could be concluded from a seminar in 1997 under the previous NKS Nordic Nuclear Safety Research programme [4]. Specific areas of interest with regard to safety assessment have been pointed out by the Forsmark utility [5].

"Safety assessment" is understood, in the present context, as including required inspection.

The project will address
prospects in regard of the growth of needs for conducting safety assessments in the future and the implications in regard of management;

questions of approaches to safety assessment in order to ensure cost efficiency and efficient use of available resources. The questions include defining 1) suitable scope for independent safety assessment and 2) balancing the emphasis placed on assessing the quality of the procedures and processes used in making the safety provisions, vs. the emphasis on assessing the quality of the safety provisions in themselves;

questions as above in particular regard of the safety assessments made by the authorities:

- *ensuring on one hand that all vital safety matters will indeed be thoroughly and reliably assessed and that use is made of opportunities for the safety authority to get reasonably involved to gain necessary experience for development of his competence, while*
- *allowing on the other hand the utility to experience its undivided responsibility for the safety;*

organisational issues in regard of assigning responsibilities for 1) the quality achieved in operations and 2) assessment of the quality as achieved;

ensuring required dedication to safety assessment in view of the common preference for "operational" tasks before reviewing other people's work;

ensuring adequate competence for independent safety assessment.

Planned activities

A scoping survey for update on current safety assessment practices in the Nordic Countries and abroad;

A workshop titled "Ensuring efficiency and reliability in safety assessment – Meeting future needs"

3.2.2 Fostering and maintaining safety culture under unfavourable conditions and pressures

As described above, safety culture may degrade under pressures resulting in worries and concerns competing for the scope available for concerns about the safety. Conflicting concerns may, e.g., relate to economic pressures due to the de-regulation of the electricity markets, which is presently affecting the Nordic nuclear utilities. The recently reported, unfortunate decline of the safety culture at Ontario Hydro in Canada causing shutdown of eight reactors is likely to have been caused mainly due to economic pressure.

In Sweden, the nuclear industry is subject in addition to considerable pressure in conjunction with the political decision to commence shutting down of the operating reactors.

A particular concern relates to maintaining under such conditions adequate competence for ensuring safe operation at the plants until they are all ultimately shut down.

The project will address
the current situation in the Nordic countries and abroad in regard of the availability and the growth of competence in the nuclear field and trends seen under the different conditions and prospects (economic and political) for the future in the different countries;

questions in regard of the generally expected increase of the economic pressure on the nuclear utilities due to the on-going de-regulation of the electricity markets and approaches taken or to be considered in order to enable safeguarding the safety culture;

experience gained at the Barsebäck nuclear plant following the decision by the Swedish government to commence shut-down of the Swedish reactors at this utility in regard of the impact on the safety culture at the plant, measures taken be the plant management and attitudes taken by the regulatory authority.

Planned activities

(The surveys planned under "Safety culture", section 3.1.3 on page 10, are relevant also in this part.)

A workshop titled "Fostering and maintaining safety culture under unfavourable conditions and pressures".

3.2.3 Combining safety and occupational dose targets

This part of the project concerns the question of how hardware inspection, maintenance, renovation and backfitting of the ageing reactors may be managed in order to combine meeting the safety requirements and required ALARA of the occupational radiation exposures to concerned personnel (ALARA). The question has important practical implications, as there are growing concerns in regard of the increasing occupational doses as the reactors grow older. There may also be benefits gained from possibly further improved co-ordination between regulatory supervision in regard of safety vs. radiation protection.

The project will thus address
experience in the matter as gained in maintaining and renovating the Finish and Swedish nuclear plants, with regards in particular to major projects involving inspection, renovation and backfitting;

possible means of reducing major contributions to the occupational exposures;

procedures for ensuring proper attention to cases of considerable importance in regard of safety or radiation exposure.

Planned activities

A preparatory workshop (e.g. an extended project group meeting) for an introduction to the issue by experienced utility and regulatory staff; preliminary discussions and planning of further activities;

Survey of practices and experience gained at Finnish and Swedish nuclear plants, as described above, covering the recent five years. Working out proposals to be discussed at the final workshop;

Final workshop titled "Combining safety and occupational dose targets".

4. Plan of execution

4.1 Activity plan

The connections between the various activities in the SOS programme and the SOS-1 project is shown in Figure 4-1: The SOS-1 activity plan. A number of activities in the SOS-2 and SOS-3 projects provide important input to SOS-1. A logical order for conducting the workshops is proposed as indicated by arrows.

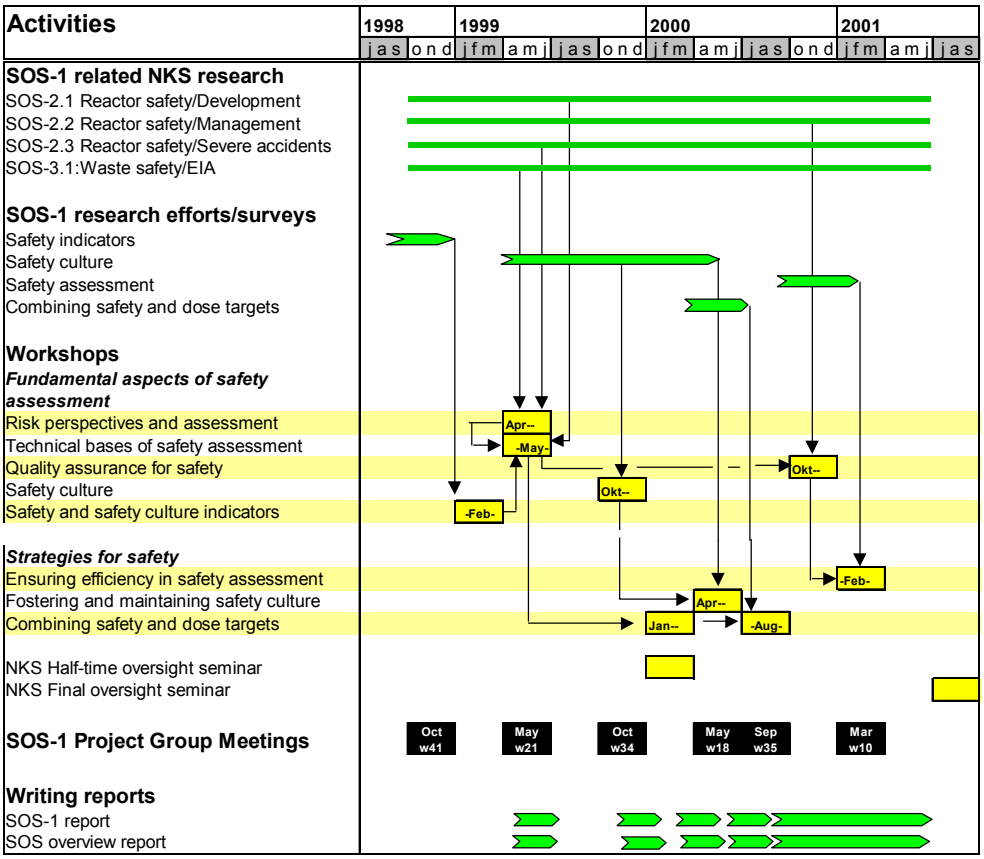

Figure 4-1 The SOS-1 activity plan

4.2 Organisation of the project

The project group should consist of about 10 members selected to gain a reasonably broad participation from the financing parties and the end users. It should include representatives of the SOS-2 and SOS-3 projects and the SBA-1.2 project on information matters. The representatives should be chosen to reasonably cover all aspects to be addressed in the SOS-1 project, including those concerned with achieving transparency in the communication of information about risk and safety. In order to keep the project group as small and efficient as possible, the concerned parties should consider selecting to some extent joint representatives in the project group.

The main tasks of the project group will be to

- assist the project leader in the detailed planning and in the preparations for the research activities and the workshops
- assist the project leader in the follow-up of the work in the SOS-2 and SOS-3 project
- form a "kernel" among the participants to the workshops to ensure continuity in the project
- take part in forming conclusions from the workshops
- take part in the work in reporting from the project

As a great deal of the work will be performed in workshops, the concerned parties are expected to commit themselves to reasonably dedicated and lasting participation in these activities as required to gain the intended benefits from the project.

4.3 Expected participation and manpower contributions

The interest among the authority and utility organisations for participating in the project group and in various parts of the project was explored through an enquiry. The response obtained was generally positive and most parties have indicated that they will be prepared to take active part in the project. The response obtained from the information departments was weaker, however, indicating that it may remain to gain enhanced appreciation of the concept on part of the public relations staff.

4.4 Estimated costs

Following costs and needs of financing of the SOS-1 project are estimated (Table 4-1):

	Total cost per year, 1000 DKK				Total
	1998	**1999**	**2000**	**2001**	
To be financed by NKS	240[1]	900	980	330	**2450**
To be financed by the participating organisations in the Nordic countries (cost for working time spent in all participation in the workshops included)	100	1800	1800	600	**4300**

Table 4-1: Project costs and financing

The estimated cost to NKS for the whole period, 1998-2001, stays within the budget proposed for the project by the NKS Programme Group (February, 1998).

5. Conformance of the proposed project to the NKS quality criteria

Criterion	Comment
Of common Nordic interest	The main goal - improved understanding and rationalised views in regard of nuclear risk and safety by lending transparency to the related issues - should indeed be of interest for all Nordic countries which either use nuclear power or are affected by such use in other countries.
Of high international technical / scientific value	The proposed approach - to critically view the fundamental questions relating to nuclear safety in a shared perspective of experts and educated laymen as well as the possible outcome of such undertaking in practice - should definitely be of international interest.
Novelty value	The goal defined for the project represents a further step, consistent with recent approaches taken in order to effect broadened and more informed participation by the society in the decision making processes concerning nuclear safety which have for large part been obscured, as viewed by non-experts, due to complexity and limited transparency.
All questions being addressed to form part of a clear context	The context is clearly visible from the main goal of the project as referred to above.

[1] Exclusive of the SOS-1 pre-project.

Criterion	Comment
Of value to the end users and the financing organisations	The main goal is clearly consistent with the working goals set by the nuclear industry and the nuclear safety and radiation protection authorities.
Of practical use	The main goal is clearly a practical one.
Emphasis on dissemination of the results	The proposed working form - for large part well-prepared workshops on the related important issues - ensures already in itself efficient dissemination of the results.
Cost effectiveness, distinct goals, efficient working forms	All this has been specifically aimed at.
Co-ordination with EU and other international work	The project has been presented to the EU. In the fist instance it should be conducted in Nordic co-operation, however, in order to avoid in the first instance difficulties related to cultural differences which are likely to prevail when extended international co-operation is attempted.
Co-operation with East European Countries	The results of the project are likely to be most useful with regard to the on-going efforts from the Nordic countries to gain understanding of their views and safety culture in the on-going co-operation with the Easter European countries in matters of nuclear safety.

6. Notes on the conduct of the pre-project

6.1 The pre-project group

The pre-project group consisted of following members: Lousie Dahlerup, Beredskabsstyrelsen, Lennart Hammar, ES-konsult (project leader), Mikael Jensen, SSI, Kurt Lauridsen, Risø, Bo Liwång, SKI, Lasse Reiman, STUK, and Björn Wahlström, VTT.

6.2 Comments in regard of the report by the Programme Group

The proposed project is essentially consistent with the report by the Programme Group. However, the study on "Ensuring efficiency and reliability in safety assessment" (section 3.2.1), proposed in that report to be conducted in the SOS-2 project was moved to the SOS-1 project as agreed between the SOS-1 and SOS-2 pre-projects.

6.3 Certain views and proposals presented in regard of the project

While the proposed workshops and research efforts are basically intended to cover all general aspects of nuclear risk and safety, the proposed perspective with regard to those parts of the project which are concerned with the assessment of safety has been largely confined to matters of reactor safety in order to limit the scope of project. It has been proposed, however, to widen the perspective somewhat to radioactive waste safety in order to emphasise the generalities. It is proposed that the project group consider whether this would be possible within the proposed budget and otherwise advisable

It has further been proposed that even greater emphasis would be placed on the research efforts planned together with the workshops. It is recommended that complementary research be undertaken to the extent it would obviously serve the purpose of the project and national financing may be obtained.

7. Recommendations

The pre-project group unanimously recommends the project for execution according to proposed lines while continuing the efforts to ensure the broad participation to be desired.

It is further recommended that Kjell Andersson, Karinta Konsult be appointed project leader.

References

1 Previous NKS-research on fundamental aspects of the assessment of nuclear risk and safety include the projects SÄK in 1981-1985 (PSA and human reliability), RAS in 1986-1989 (PSA and risk philosophy), SIK in 1990-93 (Living PSA and safety indicators), and RAK (Strategy for reactor safety). in 1990-93

2 K Andersson, P Espejo and C-Otto Wene: "Building channels for transparent risk assessment". Final report RISCOM pilot project. SKI Report 98:6, SSI Report 98-4, January 1998.

3 K Andersson, J Andersson, L Carlsson, A_M Ericsson, L Gunsell, R Olsson and C-O Wene: "Kärnteknisk säkerhet. Hur värderas den" (Nuclear safety. How to assess?)

4 L Hammar, ed.: "Seminarium om granskning för säkerhet och kvalitet – Strategi och praxis." (Seminar on assessment of safety and quality – Strategy and practices.) Rapport NKS/RAK-1(97)R3. 1997-07-10.

5 Meeting minutes (Swedish): L Hammar, Kaisa Simola: Anteckningar från möte den 19 maj 1998 på FKA angående NKS/SOS-1 och SOS-2. 1998-05-20, rev. 1998-09-03.

nks

Nordisk kernesikkerhedsforskning
Norrænar kjarnöryggisrannsóknir
Pohjoismainen ydinturvallisuustutkimus
Nordisk kjernesikkerhetsforskning
Nordisk kärnsäkerhetsforskning
Nordic nuclear safety research

SOS-2

Reactor Safety

Kaisa Simola
VTT Automation

1998-12-01

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Summary

The aim of NKS/SOS-2 project "Reactor Safety" is to obtain a shared Nordic view in regard of key safety issues pertaining to the operating nuclear power plants in Finland and Sweden. The project consists of three sub-projects:

SOS-2.1	Safety Development
SOS-2.2	Management of Plant Maintenance and Renewal
SOS-2.3	Severe Accidents

The objectives of SOS-2.1 "*Safety Development*" are to develop, promote and compare the use of novel approaches in the daily work of Nordic nuclear safety authorities and power companies. The work concentrates in the problem areas of PSA, and in applications of PSA in safety management. The sub-project is divided into two task:

1) Uncertainty in safety analyses and
2) Risk informed principles in safety management.

The objective of SOS-2.2 "*Management of Plant Maintenance and Renewal*" is to develop methodologies for better quality assurance of maintenance works and for improvement of maintenance strategies. The sub-project is divided into four tasks:

1) Quality of operability verification,
2) Maintenance decisions,
3) Human aspects of maintenance and
4) Plant modernisation and information systems.

In sub-project SOS-2.3 "*Severe Accidents*", issues of particular interest and importance to the reactors of the Nordic countries in the field of severe accident research are studied. The sub-project is divided into three tasks:

1) state-of-the-art of severe accident research field from a Nordic perspective,
2) Formation and behaviour of organic iodine, and
3) Hydrogen issues.

Abbreviations

APRI	Accident Phenomena of Risk Importance, Swedish severe accident research project
BKAB	Barsebäck Kraft AB
BWR	Boiling Water Reactor
CCF	Common Cause Failure
CFD	Computational Fluid Dynamics
EU	European Union
IFE	Institutt för Energiteknik, Institute for Energy Technology, Norway
ISA	Integrated Sequence Analysis
IVO	Imatran Voima Oy
KTH	Kungliga Tekniska Högskolan
KTM	Finnish Ministry of Trade and Industry
MTO	Människa-Teknik-Organisation, Man-Technology-Organisation
NDT	Non Destructive Testing
NKS	Nordic Nuclear Safety Research
OKG	Oskarshamn Nuclear Power Plant
PSA	Probabilistic Safety Analysis
PWR	Pressurised Water Reactor
RAK	NKS projects in the field of reactor safety 1994-1997
RCM	Reliability Centred Maintenance
SADT	Structured Analysis Design Technique
SKI	Statens kärnkraftsinspektion, Swedish Nuclear Power Inspectorate
STUK	Säteilyturvakeskus, Finnish Radiation and Nuclear Safety Authority
TVO	Teollisuuden Voima Oy
VTT	Valtion teknillinen tutkimuskeskus, Technical Research Centre of Finland

1. Introduction

This report contains a proposal for NKS project in the area of reactor safety. The objective of NKS/SOS-2 project is to obtain a shared Nordic view in regard of key safety issues pertaining to the operating nuclear power plants in Finland and Sweden. Main issues will be the safety of the reactors as designed and operated, safety of the reactors as maintained and modified, and mitigation of severe reactor accidents. Although the project deals with power reactors only, some of the expected results may be applicable to research and similar smaller reactors, too.

The planning of this project is based on the project proposals sent to NKS secretariat, the final report of the NKS programme group, and discussions with financiers and representatives of nuclear industry. Furthermore, there has been a close co-operation with the planning of SOS-1 project in order to identify links between these two projects.

The final report of the programme group summarised the project proposals reflecting the interests of both research organisations and nuclear regulators. The main task of the SOS-2 pre-project was to reduce the scope of the project plans by concentrating to tasks that are most essential for financiers and end users, with the emphasis on Nordic co-operation. In a pre-project group meeting, the topics having most support were identified. These topics have been further elaborated, and the interest of financiers and possible participants, and support of utilities have been investigated. The resulting proposal consists of three sub-projects having tasks which are supported at least by Sweden and Finland. In each sub-project, at least three Nordic countries are expected to participate.

The project SOS-2 focuses on central aspects of nuclear reactor safety having common interest in Nordic countries, and it is divided into three sub-projects:

SOS-2.1 Safety Development
SOS-2.2 Management of Plant Maintenance and Renewal
SOS-2.3 Severe Accidents

The structure and general contents of the project are basically in accordance with the final report of the programme group. In the following, the general contents of each sub-project are described, and the differences between this plan and the final report of the programme group are explained.

Sub-project SOS-2.1 concentrates on development of safety analyses. Tasks are related to some specific areas of interests, such as uncertainties in analyses and risk informed safety management. Use and interpretation of PSA models and results are also included in the sub-project. Topics related to modernisation and plant information systems, which were originally suggested to be included in SOS-2.1, are moved to SOS-2.2.

Sub-project SOS-2.2 is focused on questions related to maintenance and renewal of nuclear power plants. The quality assurance of maintenance is addressed by studying the quality of operability verification after outages. Development of maintenance strategies from a decision analytic perspective is considered. One important issue is the study of human aspects in maintenance actions. In this sub-project, also a seminar on status of plant modernisation and plant information management in Nordic countries will be arranged. Topics related to safety wok and safety evaluation that were originally suggested to be included in SOS-2.2 are moved to SOS-1.

Sub-project SOS-2.3 deals with severe accidents. The aim is to focus on specific questions related to selected topics such as the hydrogen issue and organic Iodine. Furthermore, the state-of-the-art of severe accident research and its impact on accident management in Nordic countries is reported. The task are defined so that they have particular Nordic interest and are not overlapping with other studies in this area (e.g. APRI-project or international research programmes).

Compared to the previous NKS-programme (1994-1997), this SOS-2 project covers the subjects of both RAK-1, strategies for reactor safety, and RAK-2, severe accidents. The results of previous projects have been considered when planning the new project proposal. A summary of links between RAK-1&2 and SOS-2 are provided in Table 1.

Table 1. Summary of links between RAK projects and SOS-2.

RAK	SOS-2
RAK-1.1 Safety Work	Continuation in SOS-1
RAK-1.2 Estimation of LOCA Frequencies	In SOS-2.1, uses of risk informed safety management approaches are considered. These include risk based in-service inspections, where information from PSA and fracture mechanistic calculations are used. Another closely related topic is a study of human reliability in non-destructive testing in SOS-2.2.
RAK-1.3 Integrated Sequence Analysis	In SOS-2.1, a case study of integrated analysis of commission errors is planned in connection to studies of uncertainties in probabilistic safety analyses.
RAK-1.4 Maintenance Strategies	A continuation for RAK-1.4 with the aim of application of reliability centred maintenance approach is planned in SOS-2.2
RAK-1.5 Plant Modifications and Modernisation	Similar modelling technique is planned to be applied in SOS-2.2 for the verification of preparedness for operation. A seminar on progress of plant modernisation is planned to be held in SOS-2.2.
RAK-2	Selected severe accident research topics suggested in RAK-2 final report with emphasis on containment phenomena are considered in SOS-2.3.

2. Project description

2.1 SOS-2.1 Safety development

2.1.1 Introduction

The earlier NKS research projects on PSA have concentrated on the areas such as common cause failures, human errors, uncertainty and sensitivity analyses, optimisation of safety related technical specifications, living PSA and safety indicators, and integrated accident sequence analysis. Some of the above issues require still further research.

Sub-project SOS-2.1 concentrates on development of safety analyses, such as PSA, and their applications. Tasks are related to some specific areas of interests, such as uncertainties in analyses and risk informed safety management. Use and interpretation of PSA models and results are also included in the sub-project.

2.1.2 Objectives

The general objective of the suggested sub-project is to develop, promote and compare the use of novel approaches in the daily work of Nordic nuclear safety authorities and power companies. On one hand, the problem areas of PSA are studied, and on the other hand, applications of PSA in spite of the problematic issues are considered. This sub-project will be divided into two task: 1) Uncertainty in safety analyses and 2) Risk informed principles in safety management. The tasks are described in more detail below.

The specific objectives of the first tasks are to perform various uncertainty analyses connected to PSA and deterministic safety analysis models, create a taxonomy of uncertain issues in safety analyses and give recommendations on how to use, interpret and communicate the results of safety analyses. The second task aims at the comparison of Nordic activities and views on application of PSA results in regulation and operation of nuclear power plants, and at the development of specific PSA techniques for this purpose.

2.1.3 TASK 1. Uncertainty in safety analyses

The work in this task aims at a classification and characterisation of uncertain issues related to risks of operating nuclear power plants, and recommendations for elaborating each issue. Furthermore, the interconnection between the level of details of PSA models and uncertainty analyses will be evaluated. Furthermore, a critical evaluation of the usefulness and value of information from uncertainty analysis is made. In this connection, recommendations on how to interpret, use and present the results of PSA analyses are given. The results of this work can also be utilised in the SOS-1 project, where the uncertainties of safety analyses and risk communication to public are discussed.

The above aims will be reached by performing case studies. Methods for qualitative and quantitative uncertainty analyses are applied and the documentation of the analysis is developed (application to a Swedish PSA). Further, approaches for analysing uncertainty of deterministic PSA models are compared and evaluated, and the uncertainties related human reliability analysis are covered.

The impact of uncertainties on the final result of PSA is studied qualitatively and the uncertainties in assumptions are documented. Following the principles of traditional uncertainty analysis, the parametric uncertainties are quantified and sensitivity studies are made in connection of a ongoing PSA-project. The study will be financed by SKI and NKS. Vattenfall Energisystem is interested to participate in this work. The work begins in 1999.

A survey and evaluation of the methodologies suitable for analysing the uncertainty of deterministic PSA models will be made as a case study. In this connection, also the approaches of so called model uncertainty analysis are considered. This relates the sub-project SOS-2.1 with the sub-project SOS-2.3 , which deals with severe accident analysis. The study is financed by Finnish Ministry of Trade and Industry (KTM) and NKS.

The concept of integrated sequence analysis (ISA) was developed during the NKS/RAK-1 project to widen the human reliability analysis perspective. ISA was defined as analysis with participation of many scientific disciplines. In SOS-2, ISA principles will be applied and developed further in the analysis of commission errors. Methods to identification, modelling and probability assessment of commission errors will be exploited and applied in cases studies selected in the course of the project. The goal is to form interdisciplinary views about the principles of commission error analysis and to form a basis for regulatory requirements for the analysis of commission errors in PSA context. The study will be financed by NKS, SKI, STUK and by participating power companies. Participation of IFE can also be expected.

2.1.4 TASK 2. Risk informed principles in safety management

One of the most recent PSA applications is so called risk informed inspection or risk informed regulation. It aims at more rational inspection policy, which is based on the results of plant specific PSA. Safety authorities and power utilities both in Sweden and Finland have established programs for implementing risk informed inspection principles, and there is a need to compare and evaluate the approaches.

This task in the SOS-2.1 sub-project deals with the risk informed principles, such as risk based in-service inspections, risk monitoring and risk informed evaluation of technical specifications. This task has a connection to the sub-project SOS-2.2 dealing with development of maintenance strategies by means of PSA and decision analysis.

The development of risk informed regulation principles and their adaptation in the regulatory work both in Finland and Sweden are reported. Furthermore, some methodological issues of risk informed inspection are studied in more detail, connected to the use of risk importance measures, which should be specified for this purpose. The aim of this sub-task is to develop procedures for their calculation and evaluate their properties and efficiency in selecting inspection policies.

A workshop on risk informed safety management will be arranged during 1999. The objectives of the workshop are

1) description of the risk informed inspection policies in Nordic countries
2) the comparison of the policies
3) identification of method development needs
4) recommendations for future work in the area

The participation of both the authorities (STUK and SKI) and power utilities is essential for the workshop. Possibly also experiences outside the nuclear industry, especially from Nordic off-shore industry are invited to participate. The results of the workshop will give recommendations for the work in this area for the second half of the SOS-2 project.

The task will be financed by KTM, STUK, SKI and NKS. Nuclear industry has expressed their interest to contribute by participating in the seminar.

2.1.5 Time schedule

Proposed time schedule for SOS-2.1 is presented in Figure 1.

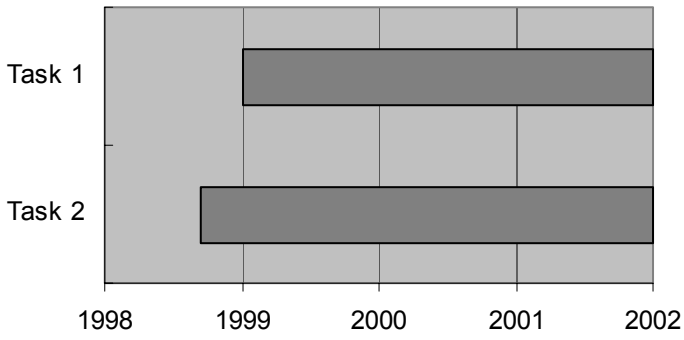

Figure 1. Proposed time schedule for SOS-2.1.

2.2 SOS-2.2 Management of plant maintenance and renewal

2.2.1 Introduction

The significance of maintenance to the safe and economical operation of nuclear power plants has been identified in several studies. The maintenance issues include a variety of problems: quality of maintenance depends on human and organisational factors; poor quality of maintenance may results to latent failures preventing the operation of safety systems; the ageing plants require well targeted maintenance strategies and properly defined modification programmes. In addition, the modernisation of the ageing units calls for a complicated transfer of the organisation and routines from the "operation culture" to a "construction culture" at the sites and authorities.

Sub-project SOS-2.2 is focused on questions related to maintenance and renewal of nuclear power plants. In the previous NKS/RAK-1 project, maintenance related issues were studied in several sub-projects. These studies covered selected topics in maintenance strategies, modification and modernisation works, and reliability of non-destructive testing. SOS-2.2 intends to utilise these results of RAK-1 in further development of approaches to study maintenance related problems. The sub-project aims at giving recommendations which can lead to improved safety and economy in maintenance work.

2.2.2 Objectives

The objective of this sub-project is to develop methodologies for better quality assurance of maintenance works and for improvement of maintenance strategies. The sub-project is divided into four interrelated tasks: 1) Quality of operability verification, 2) Maintenance decisions, 3) Human aspects of maintenance and 4) Plant modernisation and information systems.

In the first task, quality assurance of maintenance is addressed by analysing occurred maintenance errors, especially identified in connection to the plant start-up after outages. The second task focuses on decision making of maintenance and modifications when different objectives have to be considered, and developing supportive condition displays for improving maintenance related decisions. The third task aims at analysis of professional skills of maintenance personnel. As the fourth task seminar on status of plant modernisation and plant information management in Nordic countries is arranged.

2.2.3 TASK 1. Quality of operability verification

Operational experience has shown that failures have passed start-up tests and inspections. The causes of these failures have often been complex event sequences, involving human and organisational factors. In this task, practical case studies on deficient operability verifications are performed. The issue is analysed from two viewpoints: 1) risk analysis of the impact of inefficient operability verification,

and 2) analysis of operating experience. The work of this task is related to SOS-1-project, which aims at the analysis of safety culture.

The risk analysis aims at identification and quantification of weaknesses in operability verification and their impact on plant safety. The analysis utilises PSA-models and sensitivity studies in identifying the deficient operability verifications, which contribute most on the core melt frequency. The most important deficiencies are analysed in more detail, in order to define preventing measures.

The analysis of operational experience identifies events and their root causes related to deficient operability verifications from occurrence and maintenance reporting. Based on the careful analysis of occurred events, proposals of corrective actions to prevent dependent error causes and strengthen defensive barriers can be developed. Multiple error mechanisms, and failures of operative and organisational defensive barriers are modelled in order to understand the causes of undetected inoperabilities. Cause-effect diagrams or SADT-type analyses, which were applied in NKS/RAK-1.5 project to model modification processes may be suitable modelling techniques for this purpose. The analysis requires focused interviews of maintenance and operation personnel.

In addition, this work generates analysed data for CCFs, CCF models and calculation of risk importance of deficient maintenance and testing not yet adequately covered in PSA studies.

This task will be financed by SKI, STUK and NKS. VTT, Vattenfall Energisystem, Forsmark and OKG, have shown interest to participate in this task.

2.2.4 TASK 2. Maintenance decisions

Needs for changes in maintenance practices may arise from several sources, e.g. learning from operating experience or development of novel condition monitoring techniques. However, operative and strategic decision making of maintenance and modifications is not always straightforward because of different conflicting or even non-measurable objectives.

The aim of this task in SOS-2.2 is to enhance the use of plant information systems and the available expertise for improvement of maintenance strategies. Combination of approaches like Reliability Centred Maintenance (RCM) and Decision Analysis (DA) provides an efficient tool for this purpose. RCM analyses utilising maintenance data bases were introduced in the NKS/RAK-1.4 project, and a project on experience based RCM analyses, completed with structured decision models, is going on at Barsebäck plant.

The identification of decision criteria, estimation of the benefits of maintenance actions, and the use of PSA results are examples of open questions in developing maintenance strategies. In this task, procedures for the practical solution of these problems are developed, e.g. by building a comprehensive decision criteria database. For the applications, some decision cases are selected for analysis, e.g. selection of optimal maintenance and testing intervals, replacement decisions of

ageing equipment by more resistant material or ranking decisions of safety increasing modifications. Furthermore, the Barsebäck RCM-project is followed and reported, and the experiences from RCM application in Forsmark, Nordic oil and gas industry and French nuclear power industry are reviewed.

Besides the issues of strategic maintenance decisions, this task considers also the decision support for operative maintenance actions. In such situations, information is needed about the degradation state of the systems and components. Condition monitoring aims at identifying an optimal timing of maintenance actions. Even if the condition of an equipment cannot be directly monitored, information on degree of degradation can be produced indirectly from process parameters. So called intelligent display systems can utilise this data and provide better information on component degradation which results to improved quality of operative maintenance decisions.

Interested participants are BKAB, Risø, VTT and possibly Halden. Forsmark has also expressed interest to contribute to this task.

2.2.5 TASK 3. Human aspects of maintenance

The professional skills of maintenance personnel are reflected in the quality of maintenance. In the development of professional skills, the understanding of human behaviour plays an important role. In this task, a psychological approach is adapted for analysing maintenance actions.

On-going Nordic studies on human reliability and MTO aspects in non-destructive testing are selected as a starting point in Nordic research in human aspects of maintenance. The reliability of ultrasonic testing has shown itself as rather unsatisfactory and dependent on the capability of the inspector to do correct evaluations. E.g. interviews at Finnish nuclear power plants indicate that the professional orientations of the inspectors's can affect the quality of the inspections. Furthermore, the Swedish Nuclear Power Inspectorate (SKI) runs a large project on MTO aspects on NDT. In this task, a comparative study of the findings in Finnish and Swedish projects is reported. After this work, it will be decided how the studies are extended to other human aspects of maintenance including condition monitoring.

This task is supported by STUK, SKI and NKS. Interested participants are VTT and Stockholm's University (dept. of psychology).

2.2.6 TASK 4. Modernisation and information systems

In this task, a seminar is arranged during the second half of the project. The aim of the task is to review:

- current status of plant modernisation
- development in plant information management

Active participation of both the authorities (STUK and SKI) and power utilities is expected.

2.2.7 Time schedule

Proposed time schedule for SOS-2.2 is presented in Figure 2.

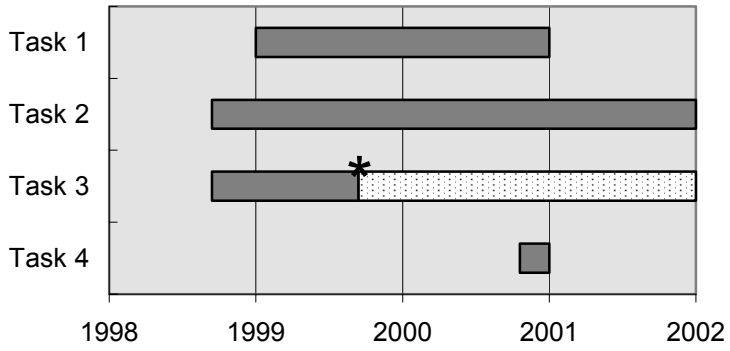

Figure 2. Proposed time schedule for SOS-2.2 (* = break point for evaluation).

2.3 SOS-2.3 Severe accidents

An important task for the pre-project group was to take into consideration what is being done in the severe accident field, e.g. in the Fourth Framework EU research projects and the Swedish APRI project, in order to avoid repetition by the NKS work. Also taking into consideration the general state-of-the-art of severe accident research, the group made an attempt to identify issues of particular interest and importance to the power reactors of the Nordic countries. Most research topics have been proposed/ supported by organisations that have expressed a preliminary interest to finance part of the activities.

This sub-project is divided into three tasks. The first task concentrates on reviewing the current status of severe accident research with the aim to identify needs of Nordic co-operation on specific issues. Specified studies on an agreed topic can be considered later in the project. The two other tasks are focused on issues of particular interest selected by the pre-project group: the behaviour of organic iodine and hydrogen issues.

2.3.1 TASK 1. State-of-the-art of the severe accident research field from a Nordic perspective

In this task, the goal is to identify what issues are still unresolved and to make a judgement as to the importance of these uncertainties to Nordic reactors. A limited effort could be put on summarising insights from e.g. APRI and RAK-2 projects. In addition, following topics should be reviewed and discussed in order to define further issues of common interest in later phase of the project:

- **Effect of research results on severe accident management**. How the results and insights from severe accident research, mainly in Nordic countries but also elsewhere, have affected, are affecting or will affect, the "philosophy" of severe accident management, including Emergency Operating Procedures, and its implementation. One important aspect of this question is instrumentation needed during accident management.

- **In-vessel coolability**. Possible chemical reactions between melt and vessel material could be investigated. Chemical reactions at high temperatures have not been paid sufficient attention to in the past. The studies on the in-vessel coolability and time available to start water supply into the reactor vessel may be based on wrong assumptions. There is interest to continue in-vessel coolability investigations taking into account accident management strategies that can reduce the risk of vessel failure.
- **Ex-vessel coolability**. Maintaining containment integrity in severe accidents is essential. Ex-vessel melt fragmentation, debris coolability and steam explosions are key issues in order to maintain containment integrity in severe accidents. Hydrogen generation in the melt fragmentation process could lead to rapid pressurization of BWR containment, which could result in early release of fission products. E.g. ex-vessel steam explosions could be assessed specifically, through critical review of present knowledge, in the light of the threats to the integrity of containments of Nordic BWRs.

The main financiers would be SKI and NKS. Depending on the direction of the work, additional financing can be expected from KTM and interested participants. Possible participants are KTH, Risø, Vattenfall Energisystem and VTT.

2.3.2 TASK 2. Formation and behaviour of organic iodine

This issue is important to BWRs utilising filtered venting of the containment as a part of their severe accident management strategy. A more accurate modelling approach of the iodine chemistry in the containment could lead to a significantly different containment source term than the design basis of the filtered venting system. Organic (or elemental iodine) is not efficiently scrubbed by the filtering system, such as is the case with iodine in aerosols. Especially in case of possible early release, the issue of formation of organic iodine and elemental iodine and filter efficiency to retain iodine isotopes becomes more important as there is less time for emergency operations. The data of possible formation of organic iodine through reactions of boron carbide with steam and iodine is scarce. Degradation of coating and cable materials would also increase the formation of organic and elemental iodine.

In this task, the work would be mainly aiming to create an understanding of the underlying chemistry and performing experimental work. The experimental work could be of small scale, complementary to the PHEBUS experiments. This topic will be co-ordinate with ongoing iodine research within EU.

This task will be financed by SKI, KTM, NKS and participating organisations. At least TVO, VTT, STUK and Chalmers Tekniska Högskola have expressed interest to participate in this work.

2.3.3 TASK 3. Hydrogen issues

In this task, hydrogen issues of both PWR and BWR are considered:

Hydrogen leaking out of the containment into the reactor building of a BWR. The BWR containment is normally inertized during operation and thus hydrogen combustion phenomena inside containment are prevented. However, during severe accident some of the hydrogen gas would inevitably leak into the reactor building, which is not inertized. The accumulation of hydrogen in reactor building and combustion phenomena could possibly jeopardize the integrity of containment penetrations from outside. The gas flow phenomena in reactor building can be calculated with CFD codes. TVO has already ordered calculations with FLUENT 3D-code from VTT to obtain the hydrogen concentrations in reactor building compartments. The hydrogen combustion phenomena shall be calculated with different methods. The problem is new and has not been investigated before.

Hydrogen mitigation in a PWR containment. In Finland, passive catalytic recombiners will be installed into the Loviisa ice condenser containments in the year 2000. Passive catalytic recombiners are known to very reliably remove hydrogen from the containment atmosphere over a wide range of thermohydraulic conditions. However, it is also important to take into account how the recombiner activity (i.e. the heat production in the recombination) affects the containment conditions, and, thus, e.g. the convective flow pattern. These considerations are very important when deciding the locations of the recombiners in the containments.

This task will be financed by SKI, KTM, NKS and participating organisations. Interested participants are IVO, TVO, VTT and Vattenfall.

2.3.4 Time schedule

Proposed time schedule for SOS-2.3 is presented in Figure 3.

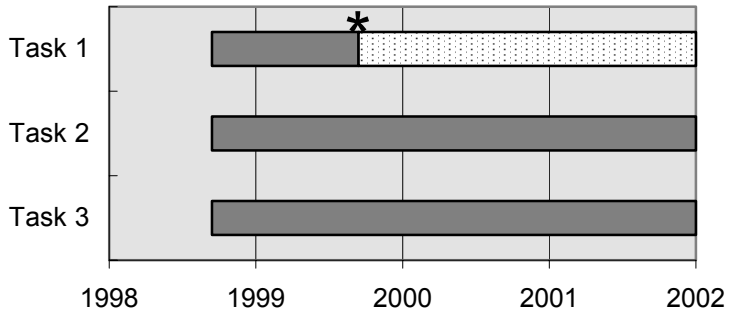

Figure 3. Proposed time schedule for SOS-2.3 (* = break point for evaluation).

3. Financing of SOS-2

The proposed NKS-funding for SOS-2 project is shown in table 2.

Table 2. NKS-funding for SOS-2 project (kDKK)

	1998	1999	2000	2001	Total
SOS-2.1	200	380	380	380	1340
SOS-2.2	200	380	380	380	1340
SOS-2.3	200	380	380	380	1340
Project leader	100	260	260	260	880
Pre-project	350 *)				350
Total	1050	1400	1400	1400	5250

*) The estimated total costs of the pre-project are 350 kDKK instead of planned 500 kDKK. The remaining 150 kDKK is transferred to the project work, since no early activities were started during the pre-project.

In addition to the proposed NKS funding at least same amount of funding is expected from national resources of participating countries. The expected participants and financiers were indicated after each task in the sub-project descriptions.

Appendix 1. Contributors to the planning of the SOS-2 project

Members of the pre-project group:

Wiktor Frid	SKI	
Anders Hallman	SKI	
Bo Livång	SKI	
Jette Paulsen	Risø	
Knud L. Thomsen	Risø	
Petra Lundström	IVO	
Heikki Sjövall		TVO
Lasse Reiman		STUK
Kaisa Simola	VTT	pre-project leader

In addition to the members of the pre-project group, following persons participated actively in the preparation of this report:

Urho Pulkkinen	VTT
Kari Laakso	VTT
Pekka Pyy	VTT

A meeting was held in Stockholm 11.6. together with SOS-1 pre-project with following representatives of Swedish industry:

Nils-Olov Jonsson	ABB Atom AB
Jan-Anders Svensson	BKAB
Göran Hultquist	Forsmark
Dan Wilson	NUSAB (representerar OKG)
Kerstin Gunnarsson	OKG
Stig-Erik Larsson	Sydkraft AB
Ralf Espefält	Vattenfall AB
Jan Holmberg	Vattenfall Energisystem
Bengt Melkersson	Vattenfall Ringhals

Appendix 2. Fulfilment of the NKS project criteria in SOS-2 project

Criterion	SOS-2.1	SOS-2.2	SOS-2.3
Nordic perspective	Participation expected from: FI, SE, NO	Participation expected from: FI, SE, DK, NO	Participation expected from: FI, SE, DK
Of high international technical/scientific value	The proposed research topics in all sub-projects are internationally relevant with specific Nordic interest. The expertise of interested participants is of high level.		
Of current interest	The topics are of current interest for both authorities and utilities, continuing and integrating the earlier results of Nordic projects.		
Wholistic approach	The project concentrates on central aspects related to the reactor safety and safety analysis. There are links between sub-projects.		
Of value to end users and financing organisations	All sub-projects have value for both authorities and utilities.		
Practical results	Recommendations, research reports, seminar	Recommendations, research reports, seminar	Experimental results, research reports
Dissemination of results	The resulting reports are distributed for interested parties, scientific results are published/presented internationally. Results are also presented in planned SOS-2 seminars and partly through SOS-1 project.		
Cost effectiveness, distinct goals, working form	Tasks and goals defined in the project have arisen from existing national research activities and plans of common Nordic interest. The NKS funding is aimed at supporting the national work especially in order to facilitate the Nordic co-operation, and compiling and disseminating the work results. In this way, the cost-effectiveness of NKS financing is maximised.		
Co-ordination with EU and other international work	In the planning of the project, international work has been examined in order to avoid overlapping. In the course of projects, the possibilities of international co-operation are explored.		
Co-operation with East European countries	Not planned.		

nks

Nordisk kernesikkerhedsforskning
Norrænar kjarnöryggisrannsóknir
Pohjoismainen ydinturvallisuustutkimus
Nordisk kjernesikkerhetsforskning
Nordisk kärnsäkerhetsforskning
Nordic nuclear safety research

SOS-3

Waste

Magnus Westerlind
SSI

1998-08-21

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1. Summary

This report presents a proposal for a NKS-project (SOS-3) in the field of radioactive waste for the period 1998-2001. The most import background material for the preparation of the proposal have been the program group's final report [1], the directives for the preprojects [2], and the final report [3] for the waste project in the previous NKS period (AFA-1).

The waste project now being proposed consists of three subprojects. Each of these relates to earlier NKS-work on the management and disposal of radioactive waste.

The first subproject, SOS-3.1, deals with recent international guidance, e.g. Agenda 21 [4], the Espoo-convention [5] and the so-called waste convention [6], and how these have or may influence the management and disposal of radioactive waste in the Nordic countries. The use of Environmental Impact Assessment (EIA) in the Nordic countries is an important issue in SOS-3.1. Thus, the subproject is a natural continuation of the subproject on EIA (AFA-1.3) in the previous program period.

In NKS's latest waste project two subprojects (AFA-1.1 and 1.2) dealt with waste categorisation and performance analysis of the near-field of repositories for low and intermediate level waste. As a continuation of this work it is now proposed (SOS-3.2) to assess actual experiences of the storage and disposal of low and intermediate level waste in the Nordic countries. In both Norway and Sweden there is ongoing work with sorting and re-conditioning of old wastes. These wastes are often insufficiently documented. Similar work has previously been done at, for example, Risø. A systematic and critical assessment of these experiences is expected to result in recommendations concerning suitable conditions for storage and disposal, including documentation.

Clearance of radioactive material, in particular scrap metal, is a quite important issue, nationally as well internationally. For example, the IAEA, OECD/NEA and EU are active in this field. The principles of clearance have also been studied by NKS [7]. However, the knowledge of the level of contamination in commercially available metals is limited. It is thus proposed (SOS-3.3) to measure the level of radioactivity in steel and aluminium. This investigation will be valuable when assessing the radiological consequences of clearance and recycling of scrap metal.

2. SOS-3.1 International guidance

2.1 Objective

The management and disposal of radioactive waste is governed by national legal framework and international requirements and guidance on e.g. EIA. The purpose of this subproject is to investigate differences and similarities between the Nordic countries' views on relevant international documents. The work will contribute to the mutual understanding of possible between the countries. Furthermore, the results will be useful further national work, e.g. in the adaptation and reporting to conventions.

2.2 Introduction

Agenda 21 from the UN conference on the environment and development (UNCED) in Rio de Janeiro 1992, deals with safety and environmental aspects of radioactive waste management (chapter 22). In this subproject it is studied how Agenda 21 can, or has been, considered in the field of radioactive waste. Other sections of Agenda 21 should be included as well, even if they are not explicitly addressing the management and disposal of radioactive waste. For example, those sections dealing with the integration of environmental considerations in decision-making. In radiation protection the environment has traditionally been considered as protected if the human health is protected. The protection of the environment itself is now given more attention and criteria for its protection must be developed.

On IAEA's initiative a joint convention on the safety of spent fuel management and on the safety of radioactive waste management was finalised and opened for signature in 1997. It is expected that the convention will enter into force within a few years. In SOS-3.1 the impact the convention may have in the Nordic countries will be analysed and thus contribute to national preparations.

EIA has become increasingly important in the Nordic countries, as well as in many other countries, during recent years. A number of documents on EIA and related topics have been produced, e.g. two EC directives [8] and the so-called Espoo-convention from 1991. The importance of EIA can be clearly illustrated by the ongoing processes in Finland and Sweden for siting a repository for spent nuclear fuel, and by the recently completed siting and construction of the combined storage and repository for radioactive waste in Himdalen in Norway.

In order to study the coupling between the international general guidance and concrete national projects it is proposed to study how some specific issues have been dealt with. It will be studied how some aspects of the biosphere, have been handled in the EIA, safety analyses and licensing of some specific facilities. A current case is the Finnish EIA for disposal of spent nuclear fuel. In accordance with the Espoo-convention Finland has notified the EIA-program to Estonia, Russia and Sweden. This is the first time the convention is applied in the field of

radioactive waste. The actual EIA will be made during this NKS period and can be used in this subproject.

Within AFA-1.3 in the previous NKS program period three seminars on EIA were arranged. These were an efficient, and appreciated, way to deepen the knowledge of the use of EIA in the Nordic countries. The seminars had a broad participation, including municipal politicians and officers. AFA-1.3 has created a common basis of understanding which will facilitate the work to be done within SOS-3.1. Since issues related to EIA are rapidly evolving, nationally as well as internationally, it is proposed that the seminar series continue.

2.3 Content

As indicated in the introduction subproject SOS-3.1 contains three tasks:

a. International guidance
Documents to be considered are identified, e.g. Agenda 21, the Espoo-convention and the waste convention. Material from the Nordic countries on the use of the documents and on preparatory work to implement them are compiled. IAEA is currently working on indicators for chapter 22 in Agenda 21, and should be contacted. The compilation (together with material produced within task b described below) will be used as background material for a workshop. The workshop must be carefully planned in order to get the right participants and to identify key issues for discussion. Proceedings from the workshop are produced and summarised in the final report.

b. Case studies
Issues and material to be analysed are identified in parallel with task a, and will be used at the workshop. Examples on issues are the treatment of the biosphere and critical group in different timeframes, and environmental protection. Actual cases to be studied include the safety assessments of SFR, the repositories at Olkiluoto and Loviisa, the combined storage and repository at Himdalen, SKB's and Posiva's research programs and work with EIA.

c. EIA-seminars
The series of EIA-seminars continues in October 1998 in Norway. The seminar will focus on the experiences with the combined storage and repository at Himdalen. The need for and interest in future seminars, and possible topics, will be discussed with the participants. Thus, it is presently not possible to make any detailed plans for the future. However, it is tentatively proposed to arrange a seminar in 1999 and possibly in 2001. (A seminar in 2000 is replaced by the workshop described above).

If the work reveals that terms and definitions are used or interpreted in different ways in the different countries, a vocabulary could be produced. A vocabulary would facilitate future work, and could be used in many situations. A possible need for a vocabulary should be evaluated at a later stage, e.g. in the review of the NKS program after 1999.

The subproject is proposed to run until the spring 2001. This fairly long period of time is believed to be needed for two reasons. Firstly, the subproject deals with issues that are evolving and it is of interest to follow this development. Secondly, time is needed to allow for a careful review of the material to make sure that views and positions of different countries and/or organisations are used and reflected correctly.

2.4 Target group

The target group is primarily authorities and decision-makers. Organisations managing waste should also be interested since they will have to comply with requirements that may result from the international guidance. The experience from AFA-1.3 in the previous program period showed that there is a great interest also in municipalities.

Many of the issues in the subproject concern fundamental principles and their application, e.g. Agenda 21. Thus, the subproject should be relevant for all Nordic countries.

2.5 Information

SOS-3. has both information value and need for access to information competence (see also section 5.4).

2.6 Time schedule

Collection and compilation of material for task a and b during 1999 and spring 2000. Workshop early fall 2000. EIA-seminars in October 1998 and tentatively in 1999 and 2001. The subproject is finalised during the winter/spring of 2001.

3. SOS-3.2 Experiences of storage and disposal

3.1 Objective

The objective is to analyse Nordic experiences of storage and disposal of low and intermediate level waste, and to give recommendations on suitable storage conditions. The results can be used by authorities and industry in the assessment of existing and planned storage and disposal facilities.

3.2 Introduction

Low and intermediate level wastes have been stored in different ways in the Nordic countries. There is old waste at Risø which has been stored in concrete silos. At Kjeller waste is stored in temperate storage buildings. At Studsvik several thousand old waste drums have been stored in non-temperate buildings. The experiences of the different storage conditions, and how these affect the containers and their content, are valuable to both authorities and industry when assessing and planning future storage facilities.

Radioactive wastes have been disposed of for many years in the Nordic countries. For example, at Kjeller waste drums have been deposited in a shallow land burial. However, it has been decided to retrieve the drums and condition them for storage or disposal at Himdalen. When retrieving the drums it is possible to study their condition after having been buried for many years. The experiences of the conditions in the burial and its safety assessments will be useful for assessing other disposal sites.

3.3 Content

Subproject SOS-3.1 contains three tasks:

a. Experiences of storage
The principles for existing and previous storage of radioactive waste are compiled, including descriptions of conditions in the storage, the environment, and surveillance and monitoring procedures.

In the light of this background the quality and degradation of waste containers are described.

Risø's and Studsvik's experiences of improving storage conditions and conditioning of degraded waste containers are described, including working conditions and doses to workers.

Documentation of waste will be exemplified. Present and earlier requirements in different countries are compared.

Suitable conditions for storing radioactive waste will be recommended.

b. Experiences of disposal
An overview of the principles for disposal of radioactive waste in the Nordic countries is made.

The shallow land burial at Kjeller is described, including disposal method, waste volume, activity content and surveillance procedures. The documentation of the waste drums is discussed in relation to current requirements.

Methods for surveying dispersion of radionuclides within and out of the burial at Kjeller are discussed, as well as results of measurements.

The waste containers are investigated (surface dose rate, corrosion, deformation and marking), and the results are compared with estimates and assumptions in the safety assessments of the burial.

c. Experiences of retrieving waste drums
The method for digging out the drums at Kjeller and the workers radiation protection are described, and actual doses are presented.

The handling and possible methods for the conditioning of the waste drums and contaminated soil are described.

Estimated doses from the burial are studied and discussed in relation to doses received during the digging operation.

3.4 Target group

The target group is primarily authorities and organisations managing waste. The results are presumably useful in other countries as well, e.g. the Baltic States.

3.5 Time schedule

The following reports will be produced:

1999	Experiences of storage
2000	Experiences of disposal
2001	Experiences of retrieving buried waste drums.

4. SOS-3.3 Contamination levels in metals

4.1 Objective

The objective is to investigate contamination levels in commercially available metals. This will provide a basis for assessing the radiological consequences of clearance and recycling of scrap metal. Criteria used for and the extent of clearance of contaminated scrap metal in the Nordic countries will be summarised.

4.2 Introduction

Previous NKS-projects, and other international work, have discussed the principles for clearance and how they are applied to scrap metal from nuclear installations.

The volume of scrap metal cleared for recycling is expected to increase as the nuclear installations grow older and the need for refurbishment and modernisation increase. Recycling of scrap metal is a part of the management of natural resources. However, the level of contamination in commercially available metals increases to a certain extent. Controlled clearance is not the only source to radionuclides in materials and products. Other sources are naturally occurring radionuclides, licensed use of radiation sources in blast-furnaces, accidental smelting of radiation sources, fall-out from nuclear tests etc. It is important to authorities to know the distribution of radioactive substances, naturally occurring as well as those originating from nuclear installations. The knowledge is needed for assessing the radiological consequences of the present situation and changes expected to occur in the future.

The knowledge of contamination levels in metals is quite limited and a systematic measurement would be of international interest, for example to EU, NEA and IAEA, which all have ongoing activities regarding clearance.

Even though the principles, and their application, for clearance are documented there is no overview of the amount of material actually cleared. It is part of subproject SOS-3.3 to produce such an overview.

Since smelting facilities cannot be expected to be familiar with radiation and radiation protection, it is desirable to put clearance and recycling of metals in perspective by including an overview and of the principles for clearance, and background information on contamination levels in various materials and products in the final report.

4.3 Content

As indicated in the introduction subproject SOS-3.3 contains two tasks:

a. Investigation of contamination levels
The first step in the subproject is to formulate a program for measuring material from smelting facilities, with focus on γ-measurements on (stainless) steel and aluminium. Co-60, which can originate from both nuclear reactors and radiation sources (e.g. smelted indicating sources in furnaces). Some nuclides, like cobalt and nickel remain in the metal after smelting while other nuclides, e.g. Cs-137, predominantly end up in the slag. The γ-measurements will cover both Co-60 and Cs-137. In case of aluminium the presence of uranium can be traced by γ-measurement of Th-234 (E_γ=92 keV). Measurements will be carried out in each country and an intercalibration is required.

Smelters will also be contacted during the first step since their co-operation is a necessity. Their requests must then be considered, e.g. concerning the origin of the scrap metal, the destination of the smelted scrap, anonymity etc. It might also be that the smelters have data that can be useful in this subproject. Many smelters

have installed frame monitors for checking incoming goods. This can assist in establishing which levels of contamination that might be possible.

It is hard to tell for how long period of time measurements need to be carried out. Instead data should be evaluated regularly and the measurements are interrupted when sufficient data have collected. It is tentatively assumed that measurements are made during 1999 and the beginning of 2000.

b. Overview of current practice for clearance etc.
An overview of the amount of material that is cleared, and its activity content, in the Nordic countries will be made. The overview will be based on existing data available via the competent authorities.

To give perspective and background on clearance and recycling of scrap metal, the overview will also summarise the principles for clearance and information on contamination levels in various materials and products.

4.4 Target group

The target group is authorities, nuclear installations and smelters.

4.5 Time schedule

A program for the measurements is formulated and contacts are taken with smelting facilities in the fall/winter 1998/99. It is tentatively assumed that measurements are made during 1999 and the beginning of 2000. Data and information for the summary of current practice for clearance etc. are gathered during the first half of 2000. The final report is then written and the subproject is completed by the end of 2000. A seminar to present the results could possibly be arranged in 2001.

4.6 Information

In addition to the final report a seminar, to which also smelters should be invited, could be considered. However, this depends on the results of the subproject and on the general interest at that time. Thus, this decision should be made at a later stage. As a reminder, a seminar is indicated in the budget for 2001 (section 5.3).

As described above the results are expected to be of interest to smelters, which cannot be expected to have detailed knowledge of neither clearance nor radiation. Thus, the final report must be carefully and pedagogically written. For this reason the subproject needs access to information competence, at least in the later stage (see also section 5.4).

5. Budget

The project is assumed to be supported by national contributions in addition to the NKS financing. The national contributions may be economical, manpower, facility and administrative resources. In total, the national contributions should be at least the same amount as the NKS financing.

There are three major categories of expenses: Project management, travel costs and salaries (assignments to institutions, fees to consultants etc.). It is proposed to engage Karin Brodén, Studsvik RadWaste, as project leader. The cost for the project management will include some of the Swedish shares for the project. However, this have to be negotiated by the proposed project leader, NKS and additional financiers for the project management. This arrangement is similar to the one used for AFA-1 in the previous program period.

In total, the NKS share for SOS-3 is about 3700 kDKK, including the preproject in 1998. The annual cost is summarised in the table below.

	1998	**1999**	**2000**	**2001**	**Total**
Preproject 1998	340				340
Project management	100	325	325	325	1075
SOS-3.1	270	295	185	170	920
SOS-3.2		280	280	280	840
SOS-3.3	90	130	240	50 - 100	510 - 560
Total	800	1030	1030	825 - 875	3685 - 3735

The next three sections give a breakdown of the proposed NKS financing for the three subprojects, respectively. The project management is not included in this breakdown.

5.1 Cost estimates for SOS-3.1

	1998	**1999**	**2000**	**2001**	**Total**
Travel	40		40		80
Salaries		125	125		250
EIA-seminar travel	40	50		50	140
EIA-seminar salaries	180	100		100	380
EIA-seminar various	10	20		20	50
Workshop various			20		20
Total	270	295	185	170	920

For 1998 it has been approved by the preproject reference group to use up to 100 kDKK for planning and preparations for the EIA-seminar in Himdalen in October 1998. The EIA-seminars in 1999 and 2001 are apparently somewhat cheaper. However, much of the planning and preparations in 1998 take place in

the preproject and thus the salaries is higher (some of this planning will be included in the project management for the years 1999-2001).

It should be noted that the need for and interest in future EIA-seminars will be discussed at the seminar in Himdalen. Thus, the budget for 1999-2001 may need to be revised based on the outcome of these discussions.

5.2 Cost estimates for SOS-3.2

	1998	1999	2000	2001	Total
Travel		40	40	40	120
Salaries		240	240	240	720
Total		280	280	280	840

The work in 1999 is an analysis of the experiences in the Nordic countries with experiences of storage of radioactive waste. For the following years the focus is on assessing the work being carried out at Kjeller.

5.3 Cost estimates for SOS-3.3

	1998	1999	2000	2001	Total
Travel	40		40		80
Salaries, incl. measurements	50	130	150		330
Misc.				50-100	50-100
Total	90	130	190	50-100	460-510

The salaries in 1999 dominated by cost for measurements of samples from participating smelting facilities. The cost for measuring (γ-spectroscopic measurement) one sample has been assumed to be approx. 700 DKK.

It is essential to prepare a final report, or version of the final report, which is suitable also for a broad audience without detailed knowledge of radiation and radiation protection. Thus, the cost for the year 2000 is dominated by preparing this report (approx. 100 kDKK out of the total salary of 150 kDKK).

This sub-project is of to concern to all Nordic countries, and indeed organisations in all countries have already expressed an interest to actively participate and contribute. For example, SIS, Geislavarnir, Strålevernet, STUK, Ringhals nuclear power plant and SSI.

The cost for the year 2001 is put in the table to indicate that it might of interest to arrange a seminar presenting the results to a broad audience. However, this cannot be decided at present time.

5.4 Information

As described above both SOS-3.1 and 3.3 have a need for information competence. To meet this need an information officer, specialised on nuclear waste management, from SSI/SKI will participate in the project. A preliminary estimate corresponds to 40 – 50 kDKK per year in the form of work.

5.5 Additional information, January 1999

The budget proposals were assessed based on needs for the subprojects proposed. However, the total project budget settled at a NKS board meeting in February 1998 is lower. The project plans have to be reduced if no extra funds are given. Therefor, a request for increased funds will be made to the NKS board.

One of the subprojects, SOS-3.3, includes measurements on metal samples. These are very expensive and even the figures for SOS-3.3 in the budget proposals are low since a large portion of the costs are foreseen to be covered by national funds. These funds are so far not available.

National funds have been received for part of the costs for the project leader (650 kSEK from SSI and 500 kSEK from SKB).

6. Overview of time schedule

	1998		1999				2000				2001			
	Qt. 3	Qt. 4	Qt. 1	Qt. 2	Qt. 3	Qt. 4	Qt. 1	Qt. 2	Qt. 3	Qt. 4	Qt. 1	Qt. 2	Qt. 3	Qt. 4
3.1		EIA seminar[1]	Compilation of material and planning of the workshop						Work-shop		Final report			
3.2						Report on storage				Report on disposal		Report on retrieval		
3.3		Program for measurements & contacts		Measurements						Final report				
						Overview of practice, amounts etc.								
3						Annual report				Annual report			Final report	

1. Further EIA seminars are possible. Tentatively in 1999

7. NKS's project criteria

In the preparation of this project proposal NKS's project criteria [9] have been considered. The table below shows qualitatively to which extent the criteria are met. Some criteria are not directly relevant in the planning but are applicable when carrying out the project.

Criterion	SOS-3.1	SOS-3.2	SOS-3.3
Nordic perspective.	Yes.	Experiences exist in DK, FI, NO and SE	Yes. Scrap metal is recycled in all countries. Clearance is regularly made in FI and SE.
Og high international technical/scientifi c standard.	Yes, but the target group is the Nordic countries.	Yes.	Yes. Systematic measurements are asked for.
Of current interest.	Great, particularly in FI and SE.	To specialists.	Yes.
Holistic approach.	Continuation of previous work. Links to other fields (e.g. EIA).		Yes. Relates to some issues in SOS-3.1 (management of natural resources)
Of value to end users and financiers.	Yes, in particular authorities.	Yes, both industry and authorities.	Yes, also international users expected.
Practical results.	Seminars and workshop.	Reports and recommendati ons.	New data and reports.
Dissemination of results.	Seminars and reports. A broad target group for some tasks.	Reports.	Reports and possibly seminar. Broad target group.
Cost effectiveness, distinct goals, working form.	The preproject is focused on defining objectives and tasks to be carried out.		
Co-ordination with EU and other international work.	To large extent based on international documents.	N.A.	Tasks are defined to avoid overlapping activities.

Criterion	SOS-3.1	SOS-3.2	SOS-3.3
Collaboration with East European countries.		The results may be useful to states with ”historic” waste or states now planning their waste management system.	

8. References

1. NKS-program 1998 – 2001. Final report from the Program Group, NKS (98)1.
2. Directives for the preprojects 1998, NKS (98)4.
3. Final report for NKS/AFA-1: Safety in final disposal of radioactive waste. Draft 1998-01-16.
4. UN’s conference on environment and development (UNCED), Agenda 21, Rio de Janeiro 1992.
5. Convention on environmental impact assessment in a transboundary context, United Nations 1991.
6. Joint convention on the safety of spent fuel management and on the safety of radioactive waste management, IAEA 1997.
7. E. Ruokola, Guidance on clearance from regulatory control of radioactive materials, NKS KAN-1.1, TemaNord 1994:559.
8. Council Directives 85/337/EEC and 97/11/EC on the assessment of the effects of certain public and private projects on the environment.
9. Criteria for NKS-projects, NKS 95(8) rev. 1996-03-17.

Annex 1. Participants in the preproject

Preproject participants appointed by the financing organisations:

Magnus Westerlind	SSI, project leader
Stig Wingefors	SKI
Malgorzata Sneve	Statens strålevern
Steinar Backe	IFE Kjeller
Evelyn Foshaug	IFE Halden
Vesa Tanner	VTT
Esko Ruokola	STUK
Knud Brodersen	Risø
Steen Carugati	Risø

Karin Brodén, Studsvik RadWaste, has also contributed to the preproject.

Annex 2. Comments to the program group's proposal

The basis for the project described in this report has been the program group's proposal for the period 1998-2001. The aim for the preproject has been to refine this proposal. Some parts of the proposal have been left out or been given a slightly different direction. This applies in particular to SOS-3.1.

SOS-3.1 International guidance

A simplified summary of the program group's proposal is:

1. the Nordic countries' view of e.g. the waste convention and Agenda 21,
2. balancing of risks in EIA, presentation of EIA and the use of EIA in the Nordic countries,
3. consideration of the biosphere in long timeframes,
4. performing a safety assessment and EIA of a suitable disposal facility, e.g. a one of the Swedish shallow land burials.

It should be emphasised that the group's proposal did not consist of four separate tasks. On the contrary, there was a clear relation between the different issues.

The preproject has considered it too ambitious to carry out issues 2-4 in full within SOS-3. Furthermore, there are ongoing national and international work on these issues. Instead the first issue has been elaborated and is now the main task for SOS-3.1. It is also suggested to study some specific issues in a few concrete Nordic projects, which to some extent is a modification of issues 2-4. SOS-3.2 also covers some aspects of the fourth issue.

SOS-3.2 Experiences of storage and disposal

Subproject SOS-3.2 close follows the ideas put forward by the program group. The only change is that the quality assurance aspects are less pronounced. However, recommendations aiming at achieving high quality of storage an disposal will be given.

SOS-3.3 Contamination levels in metals

SOS-3.3 coincides with the program group's proposal.

nks

Nordisk kernesikkerhedsforskning
Norrænar kjarnöryggisrannsóknir
Pohjoismainen ydinturvallisuustutkimus
Nordisk kjernesikkerhetsforskning
Nordisk kärnsäkerhetsforskning
Nordic nuclear safety research

BOK-1

Nuclear Emergency Preparedness

Per Hedemann Jensen og
Bent Lauritzen
Forskningscenter Risø

1998-12-15

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Summary

The proposed BOK-1 project *Emergency and Preparedness* includes the following six sub-projects:

BOK-1.1		Laboratory measurements and quality assurance
BOK-1.2		Mobile measurements and measurement strategies
BOK-1.3		Field measurements and data assimilation
BOK-1.4		Countermeasures in agriculture and forestry
	(a)	Agricultural countermeasure strategies
	(b)	Data bases on dose reduction and waste treatment operations
BOK-1.5		Emergency monitoring in the Nordic and Baltic Sea countries
BOK-1.6		Exercises

The objectives of the ***Laboratory measurements and quality assurance*** sub-project are:

> *to establish quality assurance and quality control of laboratory measurements; to perform intercomparison of sampling techniques and γ-spectrum analysis software; and to improve co-operation concerning laboratory procedures, and work on accreditation*

The objectives of the ***Mobile measurements and measurement strategies*** sub-project are:

> *to investigate the feasibility of integrating different field measurements, mainly mobile equipment (carborne and airborne), in the early phase of a nuclear emergency situation; to participate in a large European exercise on mobile γ-spectroscopy with the aim of achieving experience in applying the results for emergency response purposes*

The objectives of the ***Field measurements and data assimilation*** sub-project are:

> *to develop a data assimilation system, which integrates field measurements in real-time emergency response so an improved prognosis for the consequences in the early phases of an accident can be achieved; to investigate how measurement strategies can be optimised with the aim to assist early countermeasures*

The objectives of the ***Countermeasures in agriculture and forestry*** sub-project are:

> *to prepare a Nordic data base (handbook) on agricultural countermeasures and clean-up operations; to develop guidance on the application of data bases in optimisation of dose reduction by clean-up; to investigate the feasibility of different waste treatment operations following clean-up of contaminated areas; and to exchange Nordic views on agricultural countermeasures with*

regards to applicability and discussion whether different measures should apply to the Nordic countries

The objectives of the ***Emergency monitoring in the Nordic and Baltic Sea countries*** subproject are:

to collect and examine emergency monitoring strategies and methods used in all Nordic and Baltic Sea countries; and to make updated information available on the Internet

The objectives of the ***Exercises*** sub-project are (provisional):

to plan and participate in Nordic and international exercises with the aim of improving emergency plans in the Nordic countries

The sub-projects BOK-1.5 and BOK-1.6 are new compared to the proposed activities from the Programme Group. The content of the sub-project BOK-1.4 (a) still needs to be worked out in more details. Comments to this activity is given in Annex B based upon the experience gained in the EKO-3.4 project from the previous NKS programme. In general, the sub-projects all need to be adjusted and worked out in more detail, to make sure that they fit together, are adjusted to the current state of development in the different Nordic countries, and to ensure the maximum benefit of the BOK-1 project. This task will be carried out within the sub-project workgroups.

The proposed NKS funding for the years 1998 - 2001 is in total 5,880 kDKK with a suggested annual distribution from the Programme Group as:

1998	1999	2000	2001
1,130 kDKK	1,650 kDKK	1,650 kDKK	1,450 kDKK

The pre-project group has proposed an alternative distribution of this funding due to the fact that only a small part of the budget for 1998 can be used in 1998:

1998	1999	2000	2001
440 kDKK	1,790 kDKK	1,930 kDKK	1,720 kDKK

For 1998 activities have been proposed with NKS funding of 440 kDKK out of the total budget of 1,130 kDKK leaving 690 kDKK to be transferred to the BOK-1 project for the period 1999 - 2001. The NKS Board has approved a total budget of 2,230 kDKK for the period 1998 - 1999. The distribution between the six sub-projects is shown in the table below. The budget proposal for the time period 2000 - 2001 has not been approved by the NKS Board and the budget distribution on sub-projects for the period 2000 - 2001 should be seen as indicative only.

Project	Work activity	BOK-1 budget (DKK)			
		1998	1999	2000	2001
BOK-1.1	Laboratory measurements and quality assurance	170000	315000	315000	205000
BOK-1.2	Mobile measurements and measurement strategies	40000	300000	350000	350000
BOK-1.3	Field measurements and data	0	210000	240000	240000
BOK-1.4	Countermeasures in agriculture and	15000	175000	415000	340000
BOK-1.5	Emergency monitoring in the Nordic and Baltic Sea		50000		
BOK-1.6	Emergency exercises	50000[1]	250000	300000	300000
Miscellaneous		45000	290000	110000	85000
Project management		120000	200000	200000	200000
Grand total		440000	1790000	1930000	1720000

Co-ordinating laboratories have been suggested for each of the sub-projects and activities. National participants from each of the Nordic countries have not yet been appointed. The co-ordinating laboratory for each of the sub-projects/activities should organise Nordic project groups rather quickly so these groups can begin their work already in the year 1998.

[1] An additional 150 kDKK is transferred from the EKO-4 project of the previous NKS period. This amount is *not* included in the table.

Foreword

In the final report from the NKS Programme Group (NKS(98)1) a proposal for the structure and content of the BOK-1 project was presented. Based on this report and the NKS Directive for the pre-project work (NKS(98)4) draft proposals for activities in the Nordic NKS project BOK-1, *Emergency and Consequences* (***B**eredskab **O**g **K**onsekvenser* in Danish) for the time period 1998 - 2001 have been prepared. NKS appointed a pre-project group to take the responsibility of preparing a report on the BOK-1 work for the period 1998 - 2001. The pre-project group has the following members:

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Pre-project participants were asked to prepare written comments to the BOK-1 proposal from the NKS Programme Group. These comments were used as input for discussions at a pre-project meeting held at Risø from 26 - 27 May 1998; further details of the pre-project were discussed at the meeting. As a result of the discussions at the meeting a first pre-project report draft was prepared (17 July 1998). Written comments to the draft from pre-project group members and others were used for preparing a second (28 August 1998), and third draft (14 September 1998). Decisions taken at the NKS board meeting in Helsinki (17 September) was incorporated into the fourth draft (20 October 1998), while views from beneficiaries presented at a meeting at Beredskabsstyrelsen (30 October 1998) have been included in the final version.

The Programme Group has proposed the following structure of BOK-1 (NKS(98)1):

BOK-1.1 Measuring techniques and quality assurance

BOK-1.1.1 Field measurements

BOK-1.1.2 Laboratory measurements

BOK-1.2 Countermeasures

BOK-1.2.1 Measurement strategies

BOK-1.2.2 Impact modelling

BOK-1.2.3 Dose reduction

It was further suggested that the sub-project *Emergency exercises* should be transferred from the SBA project to the BOK-1 project. In the final BOK-1 project proposal the activities on internal dose assessment and whole body measurements has been transferred to the BOK-2 project as a result of the discussions at the NKS Board meeting in Helsinki the 17 September. Furthermore, the NKS Board has suggested a new sub-project on *Emergency monitoring of artificial radioactivity in the Nordic and Baltic Sea countries* to be included in BOK-1. The final BOK-1 structure has therefore been proposed as:

BOK-1.1 Laboratory measurements and quality assurance

BOK-1.2 Mobile measurements and measurement strategies

BOK-1.3 Field measurements and data assimilation

BOK-1.4 Countermeasures in agriculture and forestry

(a) Agricultural countermeasure strategies

(b) Data bases on dose reduction and waste treatment operations

BOK-1.5 Emergency monitoring in the Nordic and Baltic Sea countries

BOK-1.6 Emergency exercises (transferred from SBA-1.3)

The sub-project BOK-1.5 should be seen as a study to update the previous NKS-study BER-2 on the monitoring in the Nordic countries as well as an extension with regard to the monitoring in the Baltic countries. At the meeting at Beredskabsstyrelsen, it was decided to postpone the activity BOK-1.4 (b) for start-up in the year 2000.

1. Introduction

In the event of a nuclear accident or radiological emergency resulting in the dispersion of radioactive materials into the environment, the effective implementation of protective measures to mitigate the consequences of the accident will largely depend upon the adequacy of *advance* preparation, including the preparation of an *emergency response plan*. Accident assessment based on monitoring and modelling form the basis for such interventions. Since the aim of the assessment process is to provide information required for decisions regarding the implementation of protective measures, the requirement is for the earliest practicable acquisition of data that are relevant, accurate and complete.

The role of monitoring

A radiological monitoring programme will be established, properly equipped and organised, to determine the level and extent of the off-site contamination. Priorities and courses of action are dictated by the nature of the accident and the resources available. The number of monitoring teams needed for initial field measurements will be depend on the population density around the site. A high population density will normally require a greater density of monitoring points than a low population density.

Many different methods and techniques can be used to monitor the radiation and activity in the environment. These include (1) mobile monitoring of radiation and contamination levels, (2) fixed monitoring of radiation and contamination levels, (3) aerial survey of radiation levels by use of aircrafts, (4) environmental sampling, (5) personal monitoring of doses and bioassays, (6) laboratory measurements of collected environmental samples, and (7) whole-body measurements including field measurements of iodine in the thyroid.

Field measurements can be carried out using mobile and/or stationary equipment. The mobile equipment comprises airborne equipment or equipment carried by automobile or other means of transportation intended for surveying large areas. Stationary equipment or emergency systems with predetermined positions for measurements are primarily intended for early warning and measurements during the first phases of a nuclear emergency. There is a need for continued analysis and development of the field measuring processes in order to achieve the best possible use of the available technology and to prepare for inter-Nordic co-operation on measurements in an emergency situation. Airborne measurements are of particular interest, as these may provide rapid means for surveying large areas. Optimised measurement strategies (type, position and time of measurement) will form an important input to model calculations of radiation doses to the affected population.

The role of modelling

Radiological monitoring will give rise to a large number of measurements made in different phases and at different times, and appropriate environmental models will be required to interpret these many data and predict future doses to the population. Models may be of a wide range of complexity, ranging from very simple environmental models to complex atmospheric dispersion models and dynamic food chain models.

In order to improve model predictions of radiation doses to the population, every effort should be made to validate existing models using monitoring data. The accident assessment process is an iterative one in which knowledge and appreciation of the radiological situation is constantly being refined, updated and reconstructed. As more results come from the field measurements and from laboratory analysis and more information is received from the facility, the raw data are collated, compiled and compared with results from models to produce a composite picture of the radiological situation off-site. Data assimilation is here a tool that can be used in an iterative way in order to improve model prognoses of early radiological consequences. The final aim of the assessment is to facilitate decision making on the implementation of any needed protective measure to achieve an optimised protection of the population affected by the accident.

2. Content of BOK-1

The increasing demand for documented quality assurance in all branches of measurement services is well founded. In the field of nuclear preparedness systems, the aim is to obtain measurements that are mutually comparable and readily applicable as basis for decisions in emergency situations. *Field measurements* aim at the determination of environmental dose rates, activity concentration in air and contamination levels on surfaces and on people. *Laboratory measurements* aim at the analysis of environmental and foodstuff samples. There is a need for standardised descriptions of measurement procedures and capabilities and for a development of a common scheme of inter-Nordic exchanges of measurement data in case of a nuclear emergency. In particular there is a need to perform intercomparisons on a regular basis.

The introduction of *countermeasures* for protection of the population at risk from a release of radionuclides to the environment will be based upon measurements and model calculations of doses to the exposed (or potentially exposed) population groups. An iterative process of combined calculations and measurements can give a better dose prognosis than either measurements or calculations alone and thus a better basis for the introduction of protective measures, especially in the early phase of the accident. The level of intervention for optimised protection of an affected population, *e.g.* decontamination of urban or forest environments and agricultural countermeasures will depend on a number of factors like monetary costs and treatment of contaminated waste emerging from clean-up.

The BOK-1 project deals with many aspects of measurement techniques and quality assurance relevant to an emergency preparedness programme, including β-measurements of ^{90}Sr and γ-spectroscopy. It also deals with modelling aspects and the interaction between measurements and model calculations as well as with the data that are necessary for decisions on the introduction of countermeasures to obtain an optimised dose reduction. The proposed content of BOK-1 is summarised below:

BOK-1.1 *Laboratory measurements and quality assurance*

BOK-1.2 *Mobile measurements and measurement strategies*

BOK-1.3 *Field measurements and data assimilation*

BOK-1.4 *Countermeasures in agriculture and forestry*

(a) Agricultural countermeasures strategies

(b) Data bases on dose reduction and waste treatment operations

BOK-1.5 *Emergency monitoring in the Nordic and Baltic Sea countries*

BOK-1.6 *Emergency exercises*

2.1 Laboratory measurements and quality assurance (BOK-1.1)

The main objective of the suggested sub-project BOK-1.1 is:

- *to establish quality assurance and quality control of laboratory measurements, to perform intercomparison of sampling techniques and γ-spectrum analysis software; and to improve co-operation concerning laboratory procedures, and work on accreditation*

For emergency preparedness purposes it is vital that the authorities can have full confidence in the results submitted by domestic laboratories and by authorities abroad. Increased emphasis on quality assurance and accreditation is a big step forward in this respect, especially on the following topics:

- improve and demonstrate sufficient quality in gamma spectrometric measurements
- improve and demonstrate sufficient quality in measurements of β-emitting radionuclides, especially ^{90}Sr
- investigate the use of alternative methods for measuring long lived radionuclides, e.g. mass spectrometry

The need for quality assurance has also been stressed in various other suggestions put forward for project work in the next NKS period.

Quality assurance, QA, of radioactivity measurements is an important issue in case of a release of radioactive material. QA makes measurement from different laboratories compatible and achieves a range of benefits:

- results become comparable in all (Nordic) countries
- it opens up for assistance across borders
- cost effective to produce common measurement data

First step is to ensure that the same results are obtained when analysing the same samples. This can be demonstrated through intercomparison exercises. Further benefits can be obtained by harmonisation and standardisation of measurement procedures. As far as practical, common Nordic measurement procedures should be developed.

The aim of this project is to maintain, extend and improve the Nordic competence and quality for laboratory analyses of radioactivity. Laboratory measurements are performed on a variety of environmental samples and foodstuff samples. Measurements of activity by γ-spectroscopy are usually performed directly on the sample, while α- and β-activity measurements require radiochemical processing. Thus, both sampling procedures and sample preparation are integral parts of the measurements. One of the conclusions of the EKO-1 programme was that there is room for significant improvement of the analytical quality for many Nordic laboratories covering important nuclides such as ^{137}Cs (γ-spectrometry), ^{90}Sr (radiochemistry and β-counting) and transuranics (radiochemistry followed by α-spectrometry or mass spectrometry).

It has been decided to combine the work on QA for radioactivity measurements in this project. This means that both measurement and analysis techniques relevant for emergency situations (BOK 1) and for evaluation of long term effects (BOK 2) are included in this project.

The activities in the present project will concentrate on intercomparison exercises designed to test quantitatively the analytical performance of the participating laboratories combined with seminars where results are discussed and reasons for differences identified. The analytical quality of the participating laboratories including improvements during the project period will be documented from repeated intercomparisons. The BOK-1.1 sub-project will contain the following three activities:

(a) Quality assurance of radioactivity measurements
(b) Quality assurance of software for γ-spectrum analysis
(c) Improvement of sampling and measurement techniques

main tasks within these three activities are presented in the following. It is emphasized
The main tasks within these three activities are presented below. It is emphasized that the activities should not be seen as independent sub-tasks, and a close collaboration between the activities is needed. The work should build on the results obtained in the EKO-3.2 project of the previous NKS programme. The detailed planning is to be carried out by the BOK-1.1 sub-project group to make sure that the work-plans allow both meet professional requirements of the participating organizations as well as the needs of the nuclear emergency authorities. The activities described are therefore to be seen as input for further discussions.

(a) Quality assurance of radioactivity measurements

The main method for QA will be intercomparison of measurements on environmental samples. Several intercomparisons have been performed during earlier NKS projects, but the follow-up on these has been limited. In order to ensure that the results of the intercomparison actually leads to an improved quality of measurements, two intercomparisons on radioactivity in environmental samples will be carried out during the project period. The results of the first intercomparison can then be discussed and improvements suggested. For this purpose there will be a seminar between the first and second intercomparison. In the second intercomparison it will then be possible to see if improvements actually have been achieved.

The intercomparisons will cover a range of sample types and radionuclides. Sample types may include dry milk, grain, meat, fresh water, bone, precipitation, soil, sediments, grass, aerosols, seaweed and seawater. Radionuclides to be determined include γ-emitters, ^{90}Sr, ^{99}Tc and transuranics. Samples containing appropriate levels of the nuclides of interest will be collected and homogenised. Hereafter, samples will be distributed to each of the participants. Each participant will receive enough sample material to make the all the types of analysis (^{90}Sr, ^{239}Pu/^{240}Pu) they want to do.

Due to the time involved in preparation of the first intercomparison it is important to begin the work as soon as possible. Firstly, a questionnaire has been circulated among potential participants and shown the interests in sample types and radionuclides, and, secondly, suitable environmental materials will be collected and prepared (drying and homogenising) prior to distribution. A preliminary plan for the type of samples that will be distributed for each type of analysis is presented in Table 1.

Table 1. Suggested analyses for each sample type based on the response to the questionnaire.

Sample	Gamma	^{90}Sr	^{99}Tc	Transuranic
dry milk	yes	yes	no	no
grain	yes	yes	no	no
meat(beef)	yes	no	no	no
fresh water	yes	yes	no	no
sediments	yes	yes	no	yes
grass	yes	yes	no	no
aerosols	yes	yes	no	yes
seaweed	yes	yes	yes	yes
seawater	yes	yes	yes	yes

Some activities should be executed already in 1998:

- identification of the participating laboratories and their interests
- determine the kind of samples that shall be distributed
- decide on the type analysis that shall be performed for each (beta, gamma, etc.)
- find suitable materials containing adequate amounts of activity
- start collecting and preparing the samples (drying, homogenising, testing the homogeneity, etc.)

(b) Quality assurance of software for γ-spectrum analyses

The current situation regarding γ-spectroscopy measurements is not satisfactory and the need for improvements is commonly underestimated. This has been demonstrated in NKS laboratory intercomparisons that have demonstrated that many laboratories have difficulties in measuring ^{137}Cs with high accuracy, let alone nuclides with more complex decay schemes. Participation in intercomparisons by itself does not lead to any improvements, and some further action is needed. Another problem is making a realistic assessment of the uncertainty of the measurements.

The survey on the use of γ-spectrometric analysis software within the EKO-project showed that users of commercial software often found important features missing, especially the ability to correct for differences in density of samples and filling height of containers. This shortcoming can be serious for laboratories, especially when they should demonstrate the quality of their measurements and that they are able to measure a wide range of different samples.

No single program may be the best solution for all, but it is vital to have a forum for comparing the merits of the different types of software available. The intercomparison made within the EKO-project has already shown that even in peak area determinations the results reported by most software product are not consistent with the uncertainty reported. Other aspects of quality assurance in γ-spectroscopy are:

- the usefulness of a set of Nordic reference geometries for sample containers
- efficiency calculations using computer methods
- nuclide identification methods and detection limits

There is already considerable Nordic expertise in this field. Further work within the NKS could assist those who are developing their own program codes, but it would also be valuable for putting needed joint pressure on commercial vendors of software and sample containers. Work on the quality of software for γ-spectrum analysis will be continued based on more recent and more realistic test spectra than were used in the EKO-project. Such spectra are available from the IAEA. Other spectra containing fresh fission products may be obtained during the project and used to test the software quality of nuclide identification. The work would be carried out during the first half of the project period. The participants will come from several laboratories in the Nordic countries.

(c) Improvement of sampling and measurement techniques

Sampling is an important part of a 'fast response' after a release of radioactive materials to the environment. Analysis of samples gives a more detailed picture of the nature of the fall-out than a survey by car or aeroplane. A harmonisation of sampling methods in the different Nordic countries should be aimed at, so that data can be easily exchanged. These techniques should include procedures for determining unit area deposition for example by cutting a grassed area. Other techniques to be included are soil and sediment sampling techniques.

For comparison of the current methods the work could include a sampling intercomparison exercise. This could be achieved in connection with the first seminar discussing the results of the intercomparison of laboratory measurements. Sampling techniques concerning grass and soil might be tested at a suitable location. Participants should bring their own sampling equipment, and analyse their own samples after return to their laboratories. The results would be discussed and conclusions drawn at the second seminar planned. During the project and in connection with the seminars other topics of relevance will be discussed and experience exchanged. These topics include special measurement techniques (e.g. use of mass spectrometry for long-lived radionuclides), γ-spectrometry (e.g. corrections for sample density, correction for coincidence loses, optimal sample geometry), and work on accreditation of laboratories. Another issue is harmonisation of sample container geometries. A set of Nordic reference geometries for sample containers based on considerations of quality assurance and the ability to exchange samples between Nordic laboratories in emergency situations will be considered.

A suggested timetable for the work activities in BOK-1.1 is indicated in Table 2.

Table 2. Time schedule for the BOK-1.1 activity.

Work activity	1998	1999	2000	2001
Sample preparation				
Laboratory analyses				
Evaluation				
Peak analysis software and uncertainty analyses				
Nordic reference geometries				
Efficiency, nuclide identifica-tion and detection limits				
Intercomparison of sampling techniques				
Special measurement techniques				
Seminars				
Preparation of final report				

The participants will come from several laboratories in all the Nordic countries. Baltic laboratories will be invited to participate in the intercomparisons, but will have to seek separate funding for their participation in the seminars. Potential Nordic and Baltic participants can be found in the attached address list, Annex A. It is suggested that NRPA/GR will be the co-ordinating laboratory for the activity BOK-1.1.

Expected results for the BOK-1.1 activity

The results of the activities will be presented in technical reports covering each of the activities (a) - (c). A seminar/workshop is planned for in each of the years 1999 and 2001 for discussions and presentation of the results achieved. Expected major results are:

- documented quality of measured activity content of γ-emitters, ^{90}Sr and ^{99}Tc, and transuranics in different sample types and evaluation of reasons for differences between results
- proposal for a set of unified sampling procedures and sample preparations in order to improve the quality of Nordic laboratory analyses of radioactivity
- documented quality of different software for γ-spectrum analyses and a documentation of positive and negative features of each of these software systems with special emphasis on uncertainty analysis and detection of nuclides
- proposal for important requirements of γ-spectrum software to be used in an emergency situation based on documented analyses of test spectra of fresh fission products and its ability to make corrections for differences in density and volume of the measured sample
- proposal for a set of Nordic reference geometries for sample containers based on considerations of quality assurance and the ability to exchange samples between Nordic laboratories in emergency situations

2.2 Mobile measurements and measurement strategies (BOK-1.2)

In the early phases of a nuclear accident or radiological emergency there is only a short time available to make decisions on the introduction of countermeasures. This phase of an accident is a critical period because of the need to make rapid assessments of the impact on the affected population and the need to implement countermeasures when there is only limited amount of reliable data regarding source term and duration of a release. Monitoring and modelling are supplementary and cannot fully replace each other; however, a combination of model predictions and early monitoring data can give a more coherent picture of the radiological situation but any such method can be developed only from a well designed and optimised monitoring strategy.

The main objectives of the suggested sub-project BOK-1.2 project are:

- *to investigate the feasibility of integrating different field measurement mainly mobile equipment (carborne and airborne) in the early phase of a nuclear emergency situation; to participate in a large European exercise on mobile γ-spectroscopy with the aim of achieving experience in applying the results for emergency response purposes*

Off-site monitoring in emergency situations will often be a combination of fixed and mobile monitoring. Mobile monitoring can give important complementary information about the release and about the concentration fields in air and on surfaces. Mobile equipment to be used includes β-/γ-dose rate in air, air sampling of particulates and iodine, gross β-measurements of air samples, and γ-spectroscopy on air samples. An important difficulty is that the concentration of particulates and iodine in air cannot directly be correlated with the dose rate in air

because the noble gas concentration is unknown. Therefore, in-situ uncollimated γ-spectroscopy might be used for monitoring the plume in real-time to give direct information of the release composition, if correlated with the measured γ-dose rate. However, investigations remain necessary to implement this methodology in a practical way. After plume passage β-/γ-dose rate measurements and in-situ collimated γ-spectroscopy can be used to estimate the surface contamination density of deposited activity on the ground. To aid inter-Nordic co-operation in an emergency, standardised measurement procedures and data formatting is a prerequisite. The first stage of this project is therefore to investigate the current status and the possible common procedures for mobile measurements.

Within the latest ten years great advances in measuring and data processing techniques have been achieved within the above-mentioned areas. It is a general feeling/assumption that the measuring methods would/should support and supplement each other. The items listed above cover a wide area and they cannot all be included. It is suggested that the activities mainly should concentrate on the preparation of and the participation in a major international exercise on mobile measurements (primarily γ-radiation measurements) that is planned for in the year 2000. It is expected that the exercise will include the following measurement methods:

(1) airborne γ-spectroscopy; NaI(Tl) detectors and germanium detectors
(2) carborne γ-spectroscopy (and dose rate), NaI(Tl) detectors, germanium detectors, and dose rate meters (or air-kerma rate or ambient dose equivalent meters)
(3) in situ measurements of dose rate (etc.) and ground level surface contamination density (germanium detectors)
(4) other field measurements (GM-counters, α-spectroscopic measurements)

Practical experiences indicate that *in general* each of the methods work with acceptable accuracy and reliability within its “own area". However, very little effort have been done in order to integrate the measurements and the results; probably no one has ever tried to examine in any detail the problems one will encounter during an integration. Specific topics for an investigation are listed below.

Integration of mobile measurements for contamination and dose rate mapping
After the plume has passed which would either be determined at the plant or from in situ measurements the following topics should be addressed:

(1) integration of airborne and carborne measurements in uninhabited areas; examination of how (or whether) one could integrate airborne measurements in/above inhabited areas with e.g. carborne and in situ measurements
(2) calibration of airborne and carborne equipment for ground level contamination
(3) investigate the influence of topology

Preparation for major international exercise
It is suggested that the preparation for the international exercise in 2000 should include some introductory examinations of the problems and possibilities by performing a minor Nordic exercise mainly on carborne measurements in 1999. These measurements and previous measurements should form the basis for the first attempts on integrating different mobile measurements.

Including further measurements methods
It is tentatively suggested that an investigation of the possibilities for including also other types of measurements could be performed in 2001. The decision on actually starting this activity should not be taken before 2000 and it should consider both the results of integrating mobile γ-radiation measurements as well as the economical possibilities.

Work activities in 1998
A symposium on *Recent Applications and Developments in Mobile and Airborne Gamma-Spectroscopy* was held at the University of Stirling, Scotland from 15 - 18 June 1998 with 44 participants from European countries and 4 participants from North America. One of the outcomes of the Symposium was that European mobile and airborne γ-spectroscopy groups decided to plan for a large European exercise on mobile and airborne measurements in the year 2000.

The planning of the exercise has been started immediately after the Symposium. A group of four persons was appointed to do the preliminary work. In the autumn 1998 all European groups will be asked to submit proposals for topics that should be included in the exercise. The exercise could be considered as the next generation RESUME-95. There are also plans for a small-scale exercise in the Gävle area in Sweden in 1999 with only Nordic mobile units (mostly from cars). The aim is to achieve integration with the recent measurements over the Gävle area with the Airborne Gamma-ray Spectroscopy System.

Work activities in 1999 - 2001
Based *inter alia* on the outcomes of the exercises the main project should examine the problems in details, elaborate on theory and experiments (RESUME-95 data may also give some of the input) and develop solutions. A "background aspect" of all investigations should be a wish of being able to get mutual Nordic assistance in case of an accident mostly hitting one or two countries. Possible demands for standards on how and what to be measured (dose rates, in situ γ-spectroscopy, air samples etc.) as well as software and available data formats should be investigated/described. At the end of the project great effort should be put into producing "manuals" with practical advice.

Co-ordination with OECD project on measurement strategies.
Work is ongoing within the OECD/NEA on environmental measurement strategies after nuclear accidents. SSI is participating in the project. The BOK-1.2 activity should as far as possible be co-ordinated with the OECD work.

A detailed description of activities within BOK-1.2 and a tentative budget proposal for the project period 1998 - 2001 is given below.

Work activity	Time period	Budget (kDKK)
Preparation of a large European exercise begins; SSI has a member of the organising committee.	1998	40
Nordic meeting with planning of the Gävle mini exercise.	late 1998/early 1999	10 - 20
Co-ordination work on RESUME-2000 continues. SSI is representing NKS.	1999	60
Mini-exercise with carborne γ-measurements (and maybe other types of measurements) in Gävle.	summer 1999	10 - 20
Research project on evaluation of the Gävle data (and perhaps RESUME-95 data). The carborne (and possibly also others) measurements are to be compared with recent Swedish AGS measurements. Differences and similarities should be investigated and understood. Methods for integrating all data should be examined. A final part of this activity could be to examine and describe in some detail the possibilities for mutual Nordic assistance with γ-measurements and data processing. (Conclusive results would hardly be found until after RESUME-2000).	1999 - 2000	200 - 250
Continued planning of RESUME-2000.	2000	60
Other activities on the planning for RESUME-2000.	2000	40
RESUME-2000. Economic support for running the exercise.	2000	150
Post-processing of RESUME-2000 data.	2000 - 2001	50
Seminar with presentation and discussion of results from RESUME-2000.	early 2001	80
Research project with further evaluation of RESUME-2000 data. Can be a pure Nordic activity (i.e. a continuation of the post-Gävle activities) or a part of a common EU activity. The content of the RESUME-2000 exercise has not yet been defined. Therefore, the research project may have to be redefined in 2000. In addition to technical reports describing data and results, a handbook on “standard” methods should be developed (good practice for γ-measurements, data processing, and for integration of different data if/where possible).	2000 - 2001	200

Work activity	Time period	Budget (kDKK)
If the economy and the results of the Gävle and RESUME-2000 activities allow/support it, a pre-project on the integration of further types of data together with "mobile γ-measurements" should be initiated in 2001. The activity should be an open mind evaluation of possibilities and difficulties. The investigation should reach a conclusion whether it is advisable to include a major project within that area during the next NKS programme period. A decision on this should not be taken before mid or late 2000, but some resources (≈ 100 kDKK) might be set aside for the task (administration, travelling and meetings).	2001	100
Total	1998 - 2001	1,000 - 1,070

The work activity indicated above is summarised in Table 3 and the distribution of the suggested budgets is shown in Table 10.

Table 3. Time schedule for the BOK-1.2 activity.

Work activity	1998	1999	2000	2001
Mini exercise, Gävle				
Evaluation of mini exercise (and RESUME-95)				
RESUME-2000				
Seminars				
Evaluation of RESUME-2000				
Preparation of manuals and final report				

The participants will come from several laboratories in the Nordic countries. It is suggested that SSI in Sweden will be the co-ordinating laboratory for BOK-1.2.

Expected results for BOK-1.2 activity

The results of this activity will be presented in technical reports. Participation in an exercise on mobile measurements is planned for in 2000 and a seminar/workshop is planned for in each of the years 1999 and 2001. Expected major results are:

- preparation for and participation in a large European exercise on mobile γ-spectroscopy in 2000 with the aim of achieving experience in the use of mobile equipment in an emergency situation and experience in applying the results for emergency response purposes
- the preparation for a large European exercise should include processing of existing data eventually supplemented with a minor amount of new data; the goal is to perform an analysis of how to integrate and interpret the results (carborne and airborne) in a complex geometry
- preparation of a manual with detailed guidance on where and how to interpret and integrate the results of mobile γ-radiation measurements (airborne, carborne etc.)

2.3 Field measurements and data assimilation (BOK-1.3)

The main objectives of the sub-project BOK-1.3 are:

- *to develop a data assimilation procedure which integrates field measurements in real-time emergency response so an improved prognosis for the consequences in the early phases of an accident*

can be achieved; to investigate how measurement strategies can be optimised with the aim to assist early countermeasures

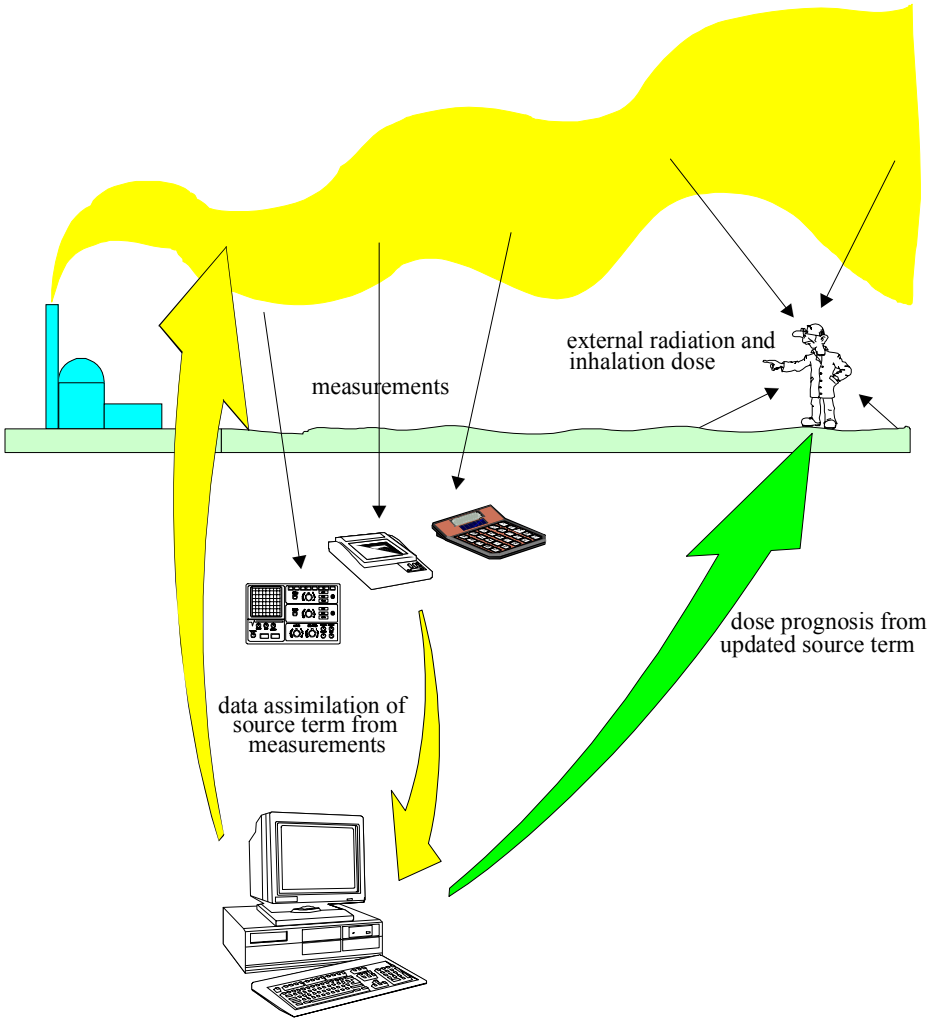
During a nuclear emergency where radionuclides are likely to be released to the surroundings it is of utmost importance to assess the radiological consequences to the population as soon as possible in order to implement optimised and rapid protection of the population through relevant countermeasures. By combining real-time environmental measurements and dispersion model calculations, e.g. via computer networks, improved consequence prognoses in the early phases of an accident will be achieved.

This sub-project aims at investigating practical methods to use monitoring data and in real-time to assess the consequences of a release of radionuclides to the atmosphere. The ultimate goal is to give a detailed overview of the actual and future radiological situation based on a proper combination of modelling and off-site measurements.

However, a number of practical difficulties and limitations exist. Lack of knowledge of the source term will in the beginning of the accident constitute the major source of uncertainty in the model predictions of contamination and radiation fields. Although the meteorological data, including forecasts are available in Scandinavia on line and in real-time, the amount and composition of radionuclides in the release as well as the plume height are unlikely to be known in the very early phase of a release. Another problem is the contribution to radiation doses that might originate from unmonitored release pathways. Differences in the interpretation of the first off-site monitoring data and early model predictions might lead to conflicting conclusions which could adversely influence the decision making on the introduction of urgent countermeasures.

The aim is to develop generic data assimilation procedures that can be interfaced to the different atmospheric dispersion model tools used in the Nordic countries. Since such procedures have not yet been described in any detail, it is emphasized that detailed planning is to be carried out by the BOK-1.3 sub-project group.

The principles of field measurements and data assimilation are illustrated simplistically in the figure below. The measurements include external γ-dose rate, γ-spectroscopy and activity concentration.



The concentration field from a release of activity to the atmosphere will be proportional to the magnitude of the release. To determine the extent and magnitude of a concentration field a sufficient number of simultaneous concentration measurements are needed. The stochastic and ever changing nature of weather systems will result in large time variations of the concentration field, which will call for time integration in measurements of concentration fields (air sampling over 5 - 10 minutes). Due to the long range of photons in air (mean free path of the order of one hundred meters) the γ-dose rate field will be smoothed spatially, compared to the concentration field. The sensitivity of the measurement position in relation to the position of the plume is thus lower which would make a comparison between model calculations and γ-measurements easier than for concentration measurements.

However, a sufficiently fast and accurate numerical algorithm is needed to perform iterative predictions of doses based on measurements. Such measurements should include simultaneous data sets of γ-dose rate, air concentration and γ-spectroscopy measurements all integrated over short time intervals of some five to ten minutes with measurement points located with a sufficient angular resolution across the major wind direction. Both air sampling

of particulates and in-situ γ-spectroscopy measurements are by nature time-integrating systems.

The project will:

- study the measurement/modelling topic theoretically and use this study to develop a fast algorithm that can handle sets of simultaneously measured time-integrated γ-dose rates, in situ γ-spectroscopy measurements of nuclide specific concentration, and gross particulate activity concentrations in air, and
- conduct a full-scale experimental validation concerning data assimilation on the local scale by measuring the γ-dose rate during controlled releases of ^{41}Ar from a nuclear research reactor.

To benefit the practical application of the data assimilation project, it should be based on generic methods such that data assimilation modules could be incorporated into existing decision support systems using different atmospheric dispersion modules

It is important that there is a close collaboration between participants in the BOK-1.2 and BOK-1.3 projects. Therefore, common seminars for the two sub-projects are proposed. Close contact should be established with the EU-RODOS-project group to exchange information and to adapt already developed computer modules. A suggested timetable for the BOK-1.3 work activity is indicated in Table 4.

Table 4. Time schedule for the BOK-1.3 activity.

Work activity	**1998**	**1999**	**2000**	**2001**
Study of data assimilation of field measurements		■	■	
Development of a data assimilation system		■	■	■
Seminars		■		■
Preparation of final reports				■

The participants will come from several laboratories in the Nordic countries. It is suggested that Risø will be the co-ordinating laboratory for BOK-1.3.

Expected results for BOK-1.3 activity

The results of this activity will be presented in technical reports. A seminar/workshop is planned for in each of the years 1999 and 2001 for discussions and presentations of results. Expected major results are:

- a feasibility study of the usefulness of different types of environmental measurements in the early phase of an accidental release of radionuclides to the atmosphere with respect to an early consequence assessment; and a study of which input parameters to atmospheric dispersion models that can be used to assess the release rate and nuclide composition
- development of fast computer based algorithms for real-time assimilation of environmental measurement data; existing atmospheric data assimilation modules developed in the framework of the EU-RODOS system will be used as far as possible; the modules will be integrated into existing dispersion/dose models available to Nordic emergency preparedness systems
- experimental validation of the data-assimilation algorithms on a local scale

2.4 Countermeasures in agriculture and forestry (BOK-1.4)

After a nuclear accident or radiological emergency where radionuclides are dispersed into the environment there is a need for immediate and qualified response to mitigate the consequences of the accident. Important protective measures are clean-up of contaminated areas and agricultural countermeasures with the purpose of reducing the population doses originating from contaminated foodstuffs. Remedial measures both in the early and in the later phases of an accident will be based on the measurements/model calculations with parameters like *e.g.* monetary costs, countermeasure efficiency and treatment of waste originating from the implementation of the countermeasures.
The main objectives of the sub-project BOK-1.4 are:

- *to prepare a Nordic data base (handbook) on agricultural countermeasures and clean-up operations; to develop guidance on the application of data bases in the optimisation of dose reduction by clean-up; to investigate the feasability of different waste treatment operations following clean-up of contaminated areas; and to exchange Nordic views on agricultural countermeasures with regards to applicability and discussion whether different measures apply to the Nordic countries*

(a) Agricultural countermeasure strategies

In the previous NKS programme (EKO-3.4) a number of recommendations were made regarding a continuation of the work within the next NKS programme. Some of these recommendations are summarised below:

- emergency planning regarding agricultural activities should be directed towards an improvement of the operational emergency
- in case of a nuclear accident a forum of agricultural and foodstuff experts should be part of the emergency organisation to exchange views and introduce countermeasures in collaboration with radiation protection experts
- in each of the Nordic countries a handbook on consequences and possible agricultural countermeasures should be available; such a handbook should be prepared during the next NKS programme (1998 - 2001)
- Nordic agricultural and foodstuff authorities should influence the nuclear emergency exercise programmes towards a higher content of agricultural related issues

The foundation laid down in the EKO-3.4 project will be continued with the purpose of achieving a common Nordic view on agricultural countermeasures, both with regards to the applicability of various countermeasures and the reason for why different countermeasures might be recommended in the Nordic countries. The aims of this work are: (i) to continue developing the network between those persons within the Nordic agricultural and food authorities and the radiation protection authorities who will be engaged in the mitigation of a nuclear accident; (ii) that the knowledge within the Nordic countries on agricultural and food countermeasures are being supplied to the Nordic food and agricultural authorities and that views on problems with and feasibility of different countermeasures are exchanged; (iii) to achieve an improved understanding of differences between Nordic countermeasure strategies and to be able to explain such differences; (iv) to document countermeasure strategies in a Nordic handbook with background information on goals and the applied organisation within the agricultural and foodstuff area; and (v) to work for that the recommendations made in the final EKO-3.4 report are being implemented.

A suggested timetable for the work activity BOK-1.4 (a) is indicated in Table 5.

Table 5. Time schedule for the BOK-1.4 activity (a).

Work activity	1998	1999	2000	2001
Exchange of Nordic views on agricultural countermeasures				
Preparation of Nordic data-base (handbook)				
Group meetings and workshops				
Major seminars				
Preparation of final report				

The participants will come from both radiation protection and agricultural/foodstuff authorities. It is suggested that Jordbruksverket in Sweden will be the co-ordinating organisation for BOK-1.4 (a).

(b) Data bases on dose reduction and waste treatment operations

Remedial measures may be required to reduce the long-term exposure of an affected population after an accidental release of long-lived radionuclides to the environment. The introduction of such measures should be optimised so as to achieve the maximum net benefit to the affected population. This requires that a series of parameters relating to the different feasible measures that may be implemented are accessible in a well-arranged format. These parameters comprise estimated dose reduction efficiencies, monetary costs, social costs, requirements/constraints, impact on the way of living, etc. In current Nordic preparedness there is a lack of such compiled data, particularly concerning the rural and forest environments. It is here important to incorporate the practical experience obtained in EU programmes, such as in the ECP4 project, which had Nordic participation, and Nordic-CIS collaborative projects, where both external and internal dose reductions were investigated.

Concerning the rural environment, the optimisation parameters will be investigated for a series of different feasible methods to reduce internal and external doses. The data for the different methods will be presented in a catalogue with a uniform format, which facilitates methodological intercomparison, and separate chapters will give guidance on the use of the catalogue and the implementation of the methods in an optimised strategy.

The waste potentially generated through some of these operations must be considered in the identification of the optimal strategy. It is thus a part of the dose reduction process, and should not be considered in the same way as waste originating from practices. This means that the demands to the construction of the waste repositories have to become much less strict. Some simple and inexpensive, yet sufficiently safe repository designs have previously been

outlined for this type of waste, but other methods must be considered and the data must be arranged consistently.

Concerning the forest environment, a number of dose-reducing techniques will be evaluated and the relevant parameters for optimisation will be deduced, e.g. from the ECP4 work. Various options for handling and use of the large amounts of removed bio-mass will be discussed. For instance, extraction of radioactive contamination by special wood pulp treatment in paper mills will be considered. Another possibility, which has attracted attention in for instance Sweden and Belarus, is the application of the bio-mass in environmentally acceptable electricity and heat production. An analysis of the feasibility of this scheme will be made. The relevant data and analyses will be presented in a catalogue on forest dose reduction issues. A suggested timetable for the work activity BOK-1.4 (b) is indicated in Table 6.

Table 6. Time schedule for the BOK-1.4 (b) activity.

Work activity	**1998**	**1999**	**2000**	**2001**
Identification of optimisation parameters for rural areas				
Preparation of rural dose re-duction catalogue/users guide				
Identification of optimisation parameters for forest areas				
Investigation of handling and use of forest bio-mass				
Preparation of forest dose re-duction catalogue/users guide				
Identification of waste treat-ment options				
Seminars				
Preparation of final report				

The participants will come from several laboratories in the Nordic countries. It is suggested that Risø will be the co-ordinating laboratory for the activity BOK-1.4 (b).

Expected results for BOK-1.4 activities (a) - (b)

The results of the activity will be presented in technical reports. Major seminars are planned for in each of the years 1999 and 2001 for discussions and presentation of the results achieved. Expected major results are:

- exchange of information on different agricultural countermeasures in the Nordic countries to obtain a common view on their applicability and to document different views that can justify the use of different countermeasures in the Nordic countries
- preparation of a handbook on different agricultural countermeasures that can be implemented in the different Nordic countries with information on their dose reducing effect and their economical and social impacts
- preparation of a data base with procedures and data for use in the optimisation of clean-up of rural and forest environments with information on the dose reducing effect and the monetary costs of different clean-up methods
- proposal for methods and procedures for treatment of waste originating from environmental clean-up

2.5 Emergency monitoring in the Nordic and Baltic Sea countries (BOK-1.5)

The main objective of the suggested sub-project BOK-1.5 is:

- *to collect and examine emergency monitoring strategies and methods used in all Nordic and Baltic Sea countries*

The project should be seen as a follow-up of the BER-2 project, but now including the Baltic Sea countries Russia, Estonia, Latvia, Lithuania, Poland and Germany. The project will be carried out in close collaboration with the Working Group A (WGA), established within the frame of the "Reference Group for Baltic Sea States". The time schedule of the activity has not been decided upon, but the main part of the work might be carried out during the first half of the four-year period, *i.e.* before the end of 1999. A tentative budget proposal for BOK-1.5 is given in Table 10. The budget will be re-examined, pending the results accomplished during the 1998 - 1999 period.

Table 7. Time schedule for the BOK-1.5 activity.

Work activity	1998	1999	2000	2001
Compilation of information on radiometric services				
Preparation of final report				
Preparation of web-site				

The participants will come from several laboratories in the Nordic countries. It is suggested that SSI will be the co-ordinating laboratory for BOK-1.5.

Expected results for BOK-1.5 activity

Expected major results are:

- to prepare a joint NKS-WGA report on emergency monitoring strategies and methods covering all Nordic and Baltic Sea countries
- to provide an updated data base of radiometric services in the Nordic and Baltic Sea countries

2.6 Exercises (BOK-1.6)

A sub-project on exercises has been transferred from the SBA-project to the BOK-1 project. The transfer and the content of this sub-project have so far not been discussed within the pre-project group and it remains to be decided upon its content. The sub-project is related to the EKO-4.2 sub-project of the previous NKS period.

According to the proposal for activities within SBA-1.3 sub-project from the Programme Group the following activities have been proposed:

- preparation of a handbook on the planning of exercises focussing on (a) pre-planning of exercises, (b) execution of the exercise, (c) evaluation of the exercise, and (d) follow-up and recommendations for improvement of the emergency plan
- execution of two common Nordic emergency exercises (in 1999 and 2001) involving the responsible emergency preparedness authorities and experts from the Nordic countries
- execution of functional exercises on single topics or a combination of topics to test technical systems, *e.g.* models and information systems, and to practice the co-operation between specialists in the Nordic countries
- to improve the systems for exchange of information at different levels, *e.g.* transfer of data from the accident site to authorities and transfer of operational information between countries

The details of this project must be worked out by the BOK-1.6 sub-project group, in close collaboration with the Nordic authorities on nuclear emergency preparedness. This is important in order to achieve efficient and structured progress in the project offering the best tools for improving emergency preparedness in the Nordic countries.

As an argument in favour of the transfer of exercises to BOK-1, it was suggested that exercises primarily should be seen as a mean for developing emergency preparedness. With the exercises being transferred from SBA-1 to BOK-1 the project group should prepare a tentative catalogue on exercises and a program for the further development of exchange systems. A suggested timetable for the work activity BOK-1.6 is indicated in Table 8.

Table 8. Time schedule for the BOK-1.6 activity.

Work activity	1998	1999	2000	2001
Preparation of Nordic exercises handbook		■	■	
field measurements				
Participation in INEX-2-HUN	■	■		
Participation in INEX-2-CAN		■	■	
Nordic exercises			■	■
Exchange of information		■	■	■

The participants will come from several laboratories in the Nordic countries. It is suggested that STUK/NRPA will be the co-ordinating laboratory for BOK-1.6.

Expected results for BOK-1.6 activity

The results will be presented in form of a Nordic exercise handbook and evaluation reports on the exercises. Expected major results are:

- preparation of a Nordic handbook covering the planning, execution, evaluation and follow-up phases of nuclear emergency exercises, as well as recommendations for improvements of emergency plans
- planning and execution of Nordic functional exercises and participation in the INEX-2-HUN and INEX-2-CAN exercises
- development of operational exchange systems aiming at information exchange at multiple levels

3. Comparison with final report from the Programme Group

In the final report from the Programme Group (NKS(98)1) the BOK-1 project was subdivided into the two sub-projects - *Measuring techniques and quality assurance* (BOK-1.1) and *Countermeasures* (BOK-1.2). The structure proposed by the Programme Group included a further sub-division of the two main sub-projects BOK-1.1 and BOK-1.2. The present proposal has changed this sub-division and simplified the programme structure as shown in the table below.

PROGRAMME GROUP	PRE-PROJECT GROUP
BOK-1.1 Measuring techniques and quality assurance BOK-1.1.1 Field measurements BOK-1.1.2 Laboratory measurement **BOK-1.2 Countermeasures** BOK-1.2.1 Measurement strategies BOK-1.2.2 Impact modelling BOK-1.2.3 Dose reduction	**BOK-1.1 Laboratory measurements and quality assurance** **BOK-1.2 Mobile measurements and measurement strategies** **BOK-1.3 Field measurements and data assimilation** **BOK-1.4 Countermeasures in agriculture and forestry** **BOK-1.5 Emergency monitoring in the Nordic and Baltic Sea countries** **BOK-1.6 Emergency exercises**

Both original sub-project proposals did include field measurements, the first sub-project with reference to quality assurance and the second with reference both to measurement strategies in the environment following a nuclear accident and to data assimilation. Hence, activities involving field measurements were somewhat disengaged from each other. That was somewhat unfortunate since the activity of field measurements is closely related to data assimilation. In the present proposal, *field measurements* (with its component of quality assurance and exercises), *measurement strategies* and the *data assimilation* activity (part of *impact modelling*) have been merged into two new sub-projects, BOK-1.2 and BOK-1.3. In BOK-1.2, *mobile measurements and measurement strategies*, the major activity is participation in European and Nordic exercises. In BOK-1.3, *field measurements and data assimilation* the major activity is investigation on how data assimilation modules can be integrated into Nordic decision support systems.

The *laboratory measurements* project has in the present proposal been renamed to BOK-1.1, and whole-body measurements no longer appears as an activity within this sub-project, but has been transferred to the BOK-2 project. The activity of *dose reduction* has been assigned the more descriptive name of "*countermeasures in agriculture and forestry*" (BOK-1.4). This activity is the continuation of the previous EKO-3.4 and EKO-5 projects. Finally, two new sub-projects are included in the present proposal. BOK-1.5 is a continuation of the previous BER-2 project dealing with emergency monitoring, while BOK-1.6 (*emergency exercises*) has been transferred from SBA-1.3.

The activities within BOK-1.1 and BOK-1.2 as proposed by the Programme Group (NKS(98)1) have all been addressed below in relation to the proposal from the pre-project group.

Recommended activities from Programme Group on field measurements (BOK-1.1.1)

(i) Assurance that the equipment is adequate for the nuclear emergencies considered. This includes an analysis of the present and future role of air sampling as part of the field measurements during the early phases of a nuclear emergency situation.

(ii) Development of a quality assurance method for emergency measurement systems. This includes the adoption of a standardised description of calibration and measurement procedures and a harmonisation of data formats for field measurements (geographical position, time, duration, type of instrument, results etc.).

(iii) Mobile equipment, which is deployed in the early phases of a nuclear emergency, faces the risk of contamination. This potential problem should be analysed in order propose solutions.

(iv) The establishment of regular Nordic intercomparisons of mobile measurements. The intercomparisons should include the conversion of mobile spectral data to surface activity concentration.

Comparison of proposal from Programme Group to proposal from pre-project group

Proposal from Programme Group	*Proposal from pre-project group*
BOK-1.1.1 activity (i)	Has not been addressed directly as an activity but it will most likely be considered both within the proposals BOK-1.2/1.3
BOK-1.1.1 activity (ii)	Will be covered by the proposal BOK-1.2
BOK-1.1.1 activity (iii)	Has not been included in the proposals
BOK-1.1.1 activity (iv)	Will be covered by proposal BOK-1.2

Recommended activities from Programme Group laboratory measurements (BOK-1.1.2)

(i) Intercomparison exercise designed to test possible effects of different sampling techniques used by different laboratories (e.g. sampling of soil, grass, sediment, and air).

(ii) Quality assurance of gamma-spectrometry including analysis of the measurement procedures. The work may include a benchmarking of the quality of the software for peak-area calculations (continued work from EKO 3.2), corrections for sample density and loss of coincidence, and studies of optimal sample geometry.

(iii) Quality assurance of gross beta counting and alpha spectrometry including analysis of the measurement procedures. There is room for improvement both of the capabilities and the analytical quality of the analysis of ^{90}Sr and transuranics among Nordic laboratories.

(iv) Intercomparison exercise covering analysis of gamma emitters (^{137}Cs), the analysis of ^{90}Sr and of transuranics on several sample types (e.g. soil/sediment, milk powder, grass, and meat)

(v) Mass spectrometry. Development of radiochemical procedures suitable for analysis of long-lived nuclides (e.g. ^{99}Tc, ^{129}I, ^{237}Np, ^{238}U, ^{232}Th) by mass spectrometry (HR-ICPMS or other MS-techniques), and verification of the results using radio-analytical determinations.

(vi) Whole-body measurements. Continued work from EKO-3.2.6 on improving the quality of whole-body measurements in Nordic laboratories e.g. based on intercomparisons, interpretations of data for dose estimates etc. The dose estimates require additional information on the distribution of radionuclides within the body or on the body surface, thus depending on the exposure pathways and the chemical forms of the radionuclides.

Comparison of proposal from Programme Group to proposal from pre-project group

Proposal from Programme Group	*Proposal from pre-project group*
BOK-1.1.2 activity (i)	Will be covered by proposal BOK-1.1 (c)
BOK-1.1.2 activity (ii)	Will be covered by proposal BOK-1.1 (b)
BOK-1.1.2 activity (iii)	Will be covered by proposal BOK-1.1 (a)
BOK-1.1.2 activity (iv)	Will be covered by proposal BOK-1.1 (a)
BOK-1.1.2 activity (v)	Will be covered by proposal BOK-1.1 (c)
BOK-1.1.2 activity (vi)	Will be transferred to BOK-2

Recommended activities from Programme Group on measurement strategies (BOK-1.2.1)

(i) Where and when to measure. The number of measurements needed e.g. to provide the basis for decision making on intervention, taking into account the limited time frame, especially for early countermeasures. Measurement strategies in rural versus urban areas.

(ii) Optimal use of airborne equipment. For instance, using helicopters to monitor contamination levels or, given the limited resources, simply to

localise the plume. The interplay between airborne and automobile measurements should be identified.

(iii) Design of procedures for measurements and decontamination of a large number of people.

(iv) Strategies for handling large data sets including presentation of data for the benefit of decision-making. Format and methods for the exchange of data in the early phases of an emergency.

Comparison of proposal from Programme Group to proposal from pre-project group

Proposal from Programme Group	*Proposal from pre-project group*
BOK-1.2.1 activity (i)	Will be covered by proposal BOK-1.2 and BOK-1.3
BOK-1.2.1 activity (ii)	Will be covered by proposal BOK-1.2
BOK-1.2.1 activity (iii)	Will be transferred to BOK-2
BOK-1.2.1 activity (iv)	Has not been addressed directly

Recommended activities from Programme Group on impact modelling (1.2.2)

(i) Preparation of standard release scenarios for the use in real-time dispersion models.

(ii) Model validation and parameter sensitivity analysis. Previous intercomparison exercises (EKO-4.1) have revealed large variation between the results of long-range atmospheric transport calculations, and also indicated that the real-time atmospheric dispersion models used in the Nordic countries may not be operational.

(iii) Identification of common Nordic interests regarding data and software exchange with the EU RODOS system. Many of the modules developed for RODOS may, with a small effort, be adapted for application within the decision support systems in the Nordic countries. Standard parameters may need to be adjusted to reflect Nordic conditions.

(iv) Data assimilation. To allow (in an iterative way) for the incorporation of the environmental measurement data into the atmospheric dispersion model, in order to improve early prognoses.

Comparison of proposal from Programme Group to proposal from pre-project group

Proposal from Programme Group	*Proposal from pre-project group*
BOK-1.2.2 activity (i)	Has not been addressed
BOK-1.2.2 activity (ii)	Has not been addressed

BOK-1.2.2 activity (iii)	Will be covered by BOK-1.3
BOK-1.2.2 activity (iv)	Will be covered by BOK-1.3

Recommended activities from Programme Group on dose reduction (BOK-1.2.3)

(i) Preparation of data sheets for dose reduction in agricultural areas.

(ii) Preparation of data sheets for decontamination in forests.

(iii) Establishing guidelines for global (cost-benefit) optimisation of dose reduction, combining expert judgements with existing data sheets on the effect of dose reducing actions.

(iv) Continuation of the EKO-5 project on decontamination in inhabited areas by inclusion of long-term countermeasures, as well as doses received from locally produced food.

(v) Generation and treatment of radioactive waste in the decontamination process. Preparation of data sheets of types, amounts, possibilities for storage, etc. of waste generated by different decontamination procedures.

Comparison of proposal from Programme Group to proposal from pre-project group

Proposal from Programme Group	*Proposal from pre-project group*
BOK-1.2.3 activity (i)	Will be covered by BOK-1.4 (b)
BOK-1.2.3 activity (ii)	Will be covered by BOK-1.4 (b)
BOK-1.2.3 activity (iii)	Will be covered by BOK-1.4 (b)
BOK-1.2.3 activity (iv)	Will be covered by BOK-1.4 (b)
BOK-1.2.3 activity (v)	Will be covered by BOK-1.4 (b)

It appears from the comparisons that nearly all the activities proposed by the Programme Group have been included in the activities proposed by the pre-project group.

4. Comparison with NKS project criteria

The project criteria has been specified by the NKS Board and they are stated below:

(a) the Nordic perspective should be considered throughout the project
(b) the content of the project should have a high international standard
(c) the project should contain some new issues
(d) each project should have a main thread
(e) the project results should be of practical value for users and financiers

(f) the project should result in:
   - recommendations
   - manuals, handbooks, checklists
   - seminars, reports, scientific articles

(g) the project should give widespread results

(h) the project should be cost-effective, have clear goals and an effective economy follow-up

(i) the project should be co-ordinated with EU and other international research programmes

(j) if possible, the project should be performed in collaboration with Eastern countries

(k)

These NKS project criteria have all been addressed below for the BOK-1 project.

Criterion (a)	All the Nordic countries will benefit from the BOK-1 project
Criterion (b)	The scientific content of some of the sub-projects could be characterised as being in the frontline
	Several new research themes are included in the project
Criterion (c)	The project has as its main thread the common Nordic response to and analysis of the consequences of a nuclear
Criterion (d)	accident, both regarding field measurements in the early phase as well as for laboratory measurements in later phases
	The results of the project will be valuable for authorities, decision makers and the management for nuclear
Criterion (e)	installations
	Several of the sub-projects will result in databases, manuals, data sheets and computer programmes; several
Criterion (f)	seminars are planned for during the project period
	The results of the project will be published as articles in scientific journals, reports and web-sites
Criterion (g)	The project goals have been clearly defined and the planned seminars will ensure an effective way of collaboration and follow-up
Criterion (h)	Some of the research themes within the project should be co-ordinated with the ongoing work within the EU research programmes (see below)
	Persons from the Baltic countries are supposed to be
Criterion (i)	participants in the sub-project on internal dose assessment
Criterion (j)	

5. Relation to other NKS-projects and to EU-programmes

The present BOK-1 project has links to projects in past NKS-programmes and to the projects within the NKS-programme for the time period 1998 - 2001.

In the previous NKS-programme for the period 1994 - 1997 the overall objective of the project EKO-3 *Emergency Strategy and Procedures* was to assist the Nordic authorities to improve their emergency response and international co-operation in selected issues. The project was divided into several sub-projects of which *mobile measurements*, *quality assurance in sampling and analysis*, and *intervention issues in agricultural and food chains* are directly related to the present BOK-1 project proposal through some of the conclusions from the EKO-3 sub-projects given below:

- comparison of software for γ-spectrum analysis showed considerable differences in their quality of peak area estimates and it is therefore recommended to continue quality assurance work within this field
- a survey of measurement geometries used in the Nordic countries revealed a variety of sample containers for γ-spectroscopy measurements and it is recommended that Nordic laboratories seek to standardise these containers which would make intercalibration easier and also make it possible to exchange samples in emergency situations
- the lessons learned from the RESUME95 exercise on mobile field measurements indicate a need for further operational exercises with respect to *e.g.* repeatability and influence of positional errors on the response of different measurement systems
- with regards to operational intervention levels it is recommended that a probabilistic approach should be developed as a tool for optimised measuring strategies in terms of type and number of measurements and time scheme for deployment of mobile measurement units
- many differences exist regarding the agricultural situation in the Nordic countries and it is therefore recommended that a joint Nordic manual should be prepared containing detailed information on the radiological consequences of different contamination situations and how the consequences can be reduced by dose reducing measures

In the proposal from the Programme Group there are two projects to which BOK-1 is somewhat related, namely the BOK-2 project, *Consequences* and the SOS-2 project *Reactor Safety* which is a part of the SOS project, *Safety and Radiation protection.*

A part of the BOK-2 project is the sub-project BOK-2.1 focusing on the transfer of radionuclides through Nordic food chains comprising important exposure pathways for the evaluation of the consequences of radioactive contamination of the environment. With regard to BOK-1 the following topics in BOK-2.1 are of interest:

- identification and quantification of the contributions from dominating foodstuffs and evaluation of long-term trends
- increase understanding of factors (site specific and generic) which affect the behaviour of radionuclides in the terrestrial environment and to describe the behaviour in a quantitative manner as far as possible
- obtain better knowledge of the geographical distribution of the factors which affect the behaviour of radionuclides in the Nordic food chain

The topics listed above are specifically related to the sub-project BOK-1.4 on agricultural countermeasures and in general to model calculations of ingestion doses from accidental releases of radionuclides to the environment. Contact should therefore be established between the project group in BOK-1.4 and BOK-2.1 for mutual information.

The BOK-2 project, *Consequences*, includes aspects of quality assurance and is related to the BOK-1.1 sub-project, *Laboratory measurements and quality assurance*. Close contact between the two projects is desirable.

A part of the SOS-2 project is the sub-project SOS-2.3, *Large accidents* which deals with heavy damage to the reactor core that can result in relatively large releases of radionuclides to the environment. The sub-project includes recommendations on strategies for remediating the accident based on monitoring of different parameters in the damaged reactor and studies on the system for ventilated and filtrated pressure relief from the containment. It also includes PSA-studies on containment damage states and the corresponding release fractions of fission products to the environment. The topics on containment damage and source term evaluations are related to the activities within the BOK-1.3 sub-project on data assimilation of source terms from measurements in the environment after a nuclear accident. Although the main focus of SOS-2 is preventive safety issues there are some points of interests for BOK-1.3 and contact should be established between the project groups in BOK-1.3 and SOS-2.3.

Within the EU-project RODOS data assimilation methods are under development to assess the radiological situation in real-time in case of an accidental release of radionuclides from a nuclear installation. RODOS is designed to aid the decision-maker on the introduction of countermeasures based on a thorough analysis of the actual and expected exposure of the affected population, covering all the time and distance scales relevant to the accident. The BOK-1.3 sub-project should therefore identify common Nordic interests regarding data and software exchange with the RODOS-project. Many of the modules developed within RODOS may, with a small effort, be adapted into the BOK-1.3 project although standard parameters should be adjusted to reflect Nordic conditions.

Within the OECD/NEA the international exercises INEX-2-HUN and INEX-2-CAN are executed. The Nordic preparedness organisations participate in these exercises and BOK-1.6 concerns Nordic aspects of the exercises. Also, within OECD/NEA work is ongoing on environmental measurement strategies. The activity BOK-1.2, *Mobile measurement and measurement strategies*, should be co-ordinated with the development within the OECD/NEA project.

6. Potential participants in BOK-1

The Nordic organisations that are potential participants in the activities within the BOK-1 sub-projects are listed in Table 9 (proposed co-ordinating organisation in bold face type). The project leader for the BOK-1 project is - together with the sub-project co-ordinators - responsible for the management of the scientific activities including preparation of annual reports and final project report. The project leader is also responsible for the management of resources, both the funding from NKS and the national contribution which is supposed to be at least of the same magnitude as the NKS contribution. Finally, the project leader is responsible for establishing contacts between BOK-1 and related projects both within the NKS-programme and the EU-framework programme.

Table 9. Suggested participants in work activities in BOK-1.

Project	Work activity	Suggested participating organisations
BOK-1.1	Laboratory measurements and quality assurance	**NRPA/GR**, STUK, Risø, SSI
BOK-1.2	Mobile measurements and measurement strategies	**SSI**, DTU, Risø, SIS, BRS, FOA, STUK, VTT, NRPA, NILU, IFE
BOK-1.3	Field measurements and data assimilation	**Risø**, BRS, IFE, NRPA, NILU, SMHI, FOA, VTT, FMI
BOK-1.4	Agricultural countermeasure strategies (a)	**Jordbruksverket (S)**, SSI, STUK, NRPA, GR, Nordic agricultural
	Data bases on dose reduction and waste treatment operations (b)	**Risø**, NRPA, SSI, STUK
BOK-1.5	Emergency monitoring in the Nordic and Baltic Sea countries	**SSI**, BRS, NRPA, STUK, GR
BOK-1.6	Emergency exercises	**STUK/NRPA**, VTT, SSI, FOA, BRS, SIS, Risø, IFE
Project leader for BOK-1		**Risø**

7. Financing of BOK-1 projects

In the report from the Programme Group there was a proposal for the NKS funding of the different projects. It is emphasized that the national funding of the activities is expected to be at least of the same magnitude as the NKS contribution. The proposal from the Programme Group has been split-up on the different proposed activities as shown in Table 10.

Table 10. Suggested distribution of NKS funding on work activities in BOK-1[1].

Project	Work activity		BOK-1 budget (DKK)			
			1998	1999	2000	2001
BOK-1.1	Laboratory measurements and quality assurance		170000	315000	315000	205000
BOK-1.2	Mobile measurements and measurement strategies		40000	300000	350000	350000
BOK-1.3	Field measurements and data assimilation		0	210000	240000	240000
BOK-1.4	Countermeasures in agriculture and forestry	(a)	15000	175000	175000	175000
		(b)	0	0	240000	165000
BOK-1.5	Emergency monitoring in the Nordic and Baltic Sea countries		0	50000	0	0
BOK-1.6	Emergency exercises		50000[2]	250000	300000	300000
Miscellaneous			45000	290000	110000	85000
Project management			120000	200000	200000	200000
Grand total			440000	1790000	1930000	1720000

The budgets are supposed to cover the following types of costs:

- manpower for research
- laboratory expenses
- travelling costs
- project meetings
- production of reports
- project management

[1] The NKS Board has approved a total budget of 2,230 kDKK for the period 1998 - 1999. The budgets for the period 2000 - 2001 should be considered as tentative and based on the total budget in the report from the Programme Group for the period 1998 – 2001

[2] An additional 150 kDKK is transferred from the EKO-4 project of the previous NKS period. This amount is *not* included in the table.

Annex A. Address list of Nordic and Baltic laboratories for radioactivity measurements

Risø National Laboratory
P.O. Box 49
DK-4000 Roskilde
DENMARK

Institute of Physics, Tartu University
Riia 142
EE-2400 Tartu
ESTONIA

Frodskaparsetur Föroya
Noatun
FR-100 Torshavn
FAROE ISLANDS

Radiation and Nuclear Safety Authority
P.O. Box 14
FIN-00881 Helsinki
FINLAND

Radiation and Nuclear Safety Authority
Louhikkotie 28
FIN-96500 Rovaniemi
FINLAND

Iceland Radiation Protection Institute
Laugavegur 118
IS-150 Reykjavik
ICELAND

Laboratory of Nuclear Reaction
Miera street 31
LV-2169 Salaspils
LATVIA

Latvian Environmental Data Centre
Osu street 5
LV-2015 Jurmala
LATVIA

Radiation Metrology Laboratory
LV-2169 Salaspils
LATVIA

Department of Radiological Protection
Kalvariu 153
LT-2042 Vilnius
LITHUANIA

Joint Research Centre, Env. Prot. Ministry
A. Juozapaviciaus 9
LT-2602 Vilnius
LITHUANIA

Institute of Marine Research
P.O. Box 1870, Nordnes
N-5024 Bergen
NORWAY

Institutt for Energiteknikk
P.O. Box 40
N-2007 Kjeller
NORWAY

Lab. for Analytical Chemistry, Agric. University
P.O. Box 5026
N-1432 Ås
NORWAY

Norwegian Radiation Protection Institute
P.O. Box 55
N-1345 Österås
NORWAY

Dept. of Radiation Physics
Lasarettet
S-221 85 Lund
SWEDEN

Dept. of Radiation Physics, Lund University
Malmö Almänna Sjukhus
S-205 02 Malmö
SWEDEN

Dept. of Radioecology, Agricult. Univ. of Sweden
P.O. Box 7031
S-750 07 Uppsala
SWEDEN

Inst. of Earth Sciences, Uppsala University
Norbyvägen 18 B
S-752 36 Uppsala
SWEDEN

Swedish Radiation Protection Institute
S-171 16 Stockholm
SWEDEN

Danish National Institute of Radiation Hygiene
Frederikssundsvej 378
DK-2700 Brønshøj
DENMARK

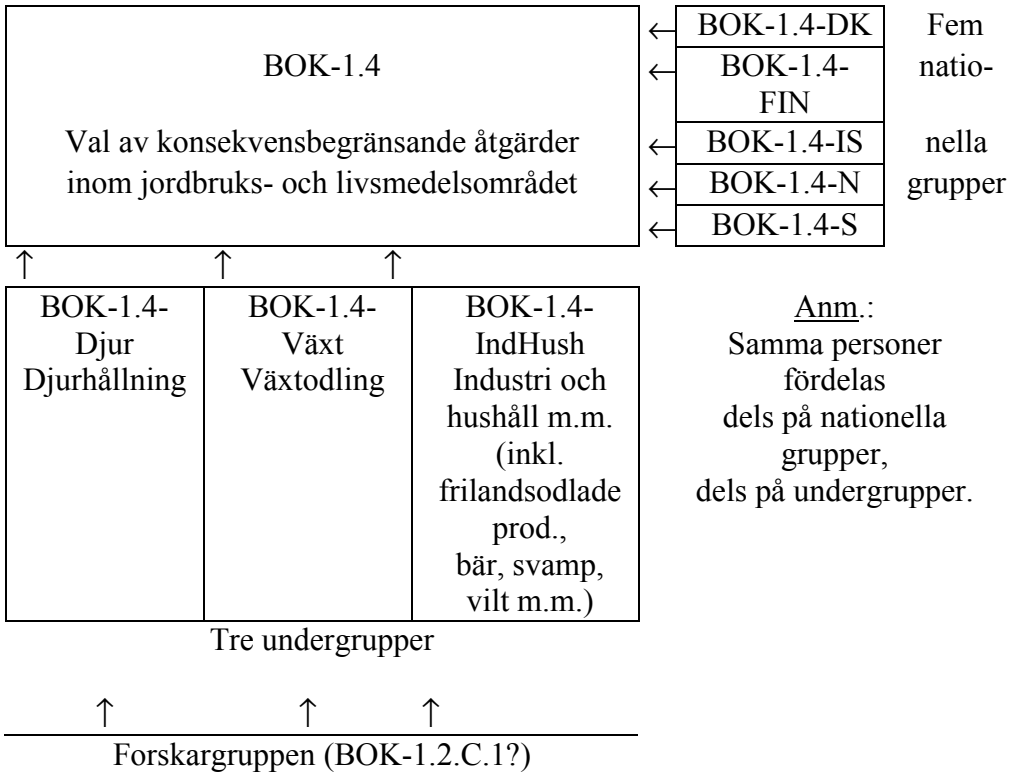
University of Helsinki
Lab. of Radiochemistry
Dept. of Chemistry
P.O.Box 55, FIN-00014 University of Helsinki
FINLAND

Annex B. Comments from Jan Preuthun, Jordbruksverket

Nordiska synpunkter på val av konsekvensbegränsande åtgärder inom jordbruks- och livsmedelsområdet samt behovet av beslutsunderlag

1. Sammanfattning av organisationen

Organisationen kan sammanfattas i följande figur:



2. Syfte

BOK-1.4 är begränsad till jordbruks- och livsmedelsområdet (inte vatten, inte fisk) och är en direkt fortsättning på det tidigare EKO-3.4 och syftar till:

1. att vidareutveckla ett nätverk mellan de personer vid de nordiska jordbruks- och livsmedelsmyndigheterna samt strålskyddsmyndigheterna som engageras vid en kärnenergiolycka,
2. att till jordbruks- och livsmedelsmyndigheterna sprida den kunskap som finns i Norden och att utbyta synpunkter om problem, behov av beslutsunderlag och om olika konsekvensbegränsande åtgärders lämplighet,
3. att sträva efter en ökad förståelse av motiverade skillnader i handlingsstrategier och en förmåga att kunna förklara dessa,
4. att i en nordisk handbok dokumentera handlingsstrategier och motiv för dessa men även bakomliggande mål och utnyttjad organisation inom jordbruks- och livsmedelsområdet samt
5. att verka för genomförandet av de förslag som EKO-3.4 lämnat i sin rapport och att vidareutveckla förslaget om ”ett forum där de jordbruks- och

livsmedelsexperter, som vid en kärnenergiolycka ingår i beredskapsorganisationen, har möjlighet att tillsammans med strålskyddsexperter utbyta synpunkter om de problem som uppstår och om olika konsekvensbegränsande åtgärders effekt och tillämpbarhet".

3. Motiv

Huvudmotiven bakom respektive syfte är:

1. EKO-3.4 har i sin rapport, avsnitt 4.1 föreslagit att "vid en allvarlig kärnenergiolycka skall jordbruks- och livsmedelsmyndigheterna i de nordiska länderna diskutera behovet av och valet av konsekvensbegränsande åtgärder med varandra". Ett väl utvecklat nätverk är en förutsättning för effektiva diskussioner.
2. Särskilt inom jordbruksområdet är det väsentligt att ha kunskap om ett nedfalls konsekvenser och om olika åtgärders effekt under nordiska förhållanden. Detta mot bakgrund av jordbruksproduktionens beroende av bl.a. klimat och jordar, vilket dessutom även påverkar inriktningen av växtodling och djurhållning.

   Det är inte kostnadseffektivt att varje land för sig tar fram fullständig kunskap utan möjligheterna att ta del av varandras kunskap måste tas till vara. Det är inte heller tillfyllest att kunskapen når strålskyddsmyndigheterna utan den måste nå jordbruks- och livsmedelsmyndigheterna eftersom dessa skall ta beslut inom sitt område. EKO-3.4 framhåller i sin rapport, avsnitt 4.2 att "beredskapsorganisationen har i huvudsak en samordnande roll" och att "beslut fattas av varje enskild myndighet" men "i Norge har dock det s.k. Kriseutvalget fullmakt att under ett akut skede införa vissa restriktioner".
3. En väsentlig erfarenhet efter Tjernobylolyckan är att s.k. dubbla budskap måste undvikas om inte tilltron till myndigheternas kompetens allvarligt skall ifrågasättas. Med dagens kommunikationer får detta inte heller innebära att jordbrukare och andra uppfattar att exempelvis "det som är sanning på Sjælland är lögn i Skåne".

   Vi måste verka för att skillnader i agerandet mellan länderna är sakligt grundade och följaktligen kan motiveras. Det kan exempelvis vara så att skillnaderna är motiverade på grund av olika inriktning av jordbruksproduktionen och av skillnader i konsekvenser om inte en viss produktion kan upprätthållas.
4. EKO-3.4 föreslog att gruppen under nästa NKS´ program skulle utforma en nordisk handbok om konsekvenser, konsekvensbegränsande åtgärder m.m. Kompetensen i grupper som EKO-3.4 och BOK-1.4 medför att en sådan handbok bör begränsas till i huvudsak handlingsstrategier och motiv för dessa. Data om olika åtgärders kostnader och effekt liksom beskrivningar av hur de genomförs bör tas fram av en eller flera grupper med forskare.
5. Utöver det nämnda förslaget i EKO-3.4:s rapport, avsnitt 4.1 om diskussioner mellan de nordiska jordbruks- och livsmedelsmyndigheterna vid en allvarlig olycka och om ett forum har EKO-3.4 i kap. 10 föreslagit att "beredskapsverksamheten inom jordbruks- och livsmedelsområdet främst inriktas på att förbättra handlingsberedskapen" och konstaterat att "därvid är kunskapsuppbyggnad mycket väsentlig liksom utbildning/övning och

informationsförberedelser". Som ambitionsnivå för jordbruks- och livsmedelsmyndigheterna anger EKO-3.4 att "skapa en anpassningsbar beredskapsorganisation, som snabbt och effektivt kan vidta de åtgärder som behövs". Beträffande övningar föreslår EKO-3.4 "att övningar blir mera inriktade på jordbruks- och livsmedelsområdets problem, att för jordbruket och hemodlingen intressanta tidpunkter under året väljs, att agerandet i hotskedet och den mera långsiktiga verksamheten övas och att representanter för de andra nordiska ländernas motsvarande jordbruks- och livsmedelsmyndigheter erbjuds att närvara som observatörer eller utvärderare vid övningar av den egna kärnenergiberedskapen".

4. Skillnader mellan BOK-1.4 och EKO-3.4

1. En väsentlig förändring gentemot EKO-3.4 är att mätstrategier inte skall behandlas i BOK-1.4. I den senare diskuterar man visserligen behovet av beslutsunderlag och kan komma att uttrycka vissa synpunkter på behovet av mätningar som ett beslutsunderlag men mätstrategier och mätmetoder behandlas i andra grupper inom BOK-1.

   Huvudskälet till detta är att erfarenheterna från EKO-3.4 visar att det inte, utan att gruppen blir alltför stor, är möjligt att från alla fem länderna inkludera den kompetens som fordras för att behandla mätstrategier och än mindre mätmetoder. Dessutom torde beslut om sådana frågor inte komma att tas av jordbruks- och livsmedelsmyndigheterna utan komma att tas av strålskyddsmyndigheterna.

2. På grund av vidgningen även organisatoriskt till att omfatta hela den s.k. livsmedelskedjan blir BOK-1.4 en något större grupp än EKO-3.4. För att hinna med arbetet och undvika alltför resurskrävande möten bör arbetet delvis ske parallellt i flera undergrupper
3. För att både förbättra underlaget för BOK-1.4 och effektivisera arbetet i den eller de grupper (fortsättningsvis kallad forskargruppen), som kan betraktas som en fortsättning på och utvidgning av EKO-5, bör BOK-1.4 och forskargruppen knytas närmare till varandra. De kan däremot inte sammanslås eftersom de kräver helt olika kompetens.

   En närmare knytning skulle i hög grad kunna bidra både till informationsöverföring från forskare till myndighetsrepresentanter och till att skapa ett nätverk som blir värdefullt om något händer. Omfattningen och inriktningen av det framtida arbetet kan också i hög grad komma att påverkas av att forskare får en realistisk uppfattning om myndigheternas beslutssituation och myndighetsrepresentanterna en uppfattning om vilket bidrag forskningen kan ge för att förbättra beslutsfattandet. Se vidare under 8. Forskargruppen!

5. Nationella grupper

Liksom EKO-3.4 består BOK-1.4 av fem nationella grupper, var och en sammanhållen av en s.k. koordinator. Med tanke på att verksamheten skall vidgas till åtgärder i hela den s.k. livsmedelskedjan bör utöver representanter för de myndigheter för strålskydd, livsmedel, växtodling och djurhållning som anges i EKO-3.4:s rapport, avsnitt 4.1 även jordbruksnäringen och livsmedelsindustrin vara representerade i de nationella grupperna exempelvis enligt följande:

	Danmark	Finland	Island	Norge	Sverige
Strålskydds-myndigheten	Statens institut for stråleygiejne (SIS)	Strål-säkerhets-centralen (STUK)	Geislavarnir ríkisins (Statens institut for strålehygiene)	Statens strålevern	Statens strålskydds-institut (SSI)
Livsmedel	Veterinær- og Fødevare-direktoratet	Livsmedels-verket (EV)	Hollustuvernd ríkisins (Miljø og næingsmiddel-tilsynet)	Statens nærings-middel-tillsyn (SNT)	Statens livsmedels-verk (SLV)
Växtodling inkl. foder till djur	Plante-direktoratet	Jord- och skogsbruks-ministeriet	Rannsóknastofnun landbúnaðarins (Landbruketts forsøgsinstitutt)	Landbruks-departementet	Statens jordbruks-verk (SJV), växtavd.
Djur-hållning	Veterinær- og Fødevare-direktoratet	Jord- och skogsbruks-ministeriet	Landbúnaðaráðuneytið (Landbruks-ministeriet)	Landbruks-departementet	Statens jordbruks-verk (SJV), djuravd.
Jordbruks-näringen	?	Landsbygds-centralernas förbund r.f.	?	?	Lant-brukarnas riksförbund
Livsmedels-industrin	?	Livsmedels-pol.	?	?	Livsmedels-industrierna

Varje land bör självt bestämma vilka myndigheter och organisationer, som skall inbjudas att ingå i deras nationella grupp och bör därvid ta hänsyn till att lämplig representation kan fås i undergrupperna (se senare i avsnitt 7).
Varje nationell grupp har på egen bekostnad så många möten som de anser behövs för att föra interna diskussioner inför BOK-1.4-möten och för att mera

detaljerat diskutera tillämpningen i respektive land av olika motåtgärder. De verkliga beslutsfattarna på tjänstemannanivå vid jordbruks- och livsmedelsmyndigheterna bör personligen delvis delta i sådana nationella möten. Den ”grundsyn” som successivt utvecklas under arbetet kan dessutom underhand behöva förankras på politisk nivå.

6. Inriktning av arbetet på olika betnings- och odlingssäsonger

Liksom för EKO-3.4 bör arbetet hela tiden ske kopplat till tillkomsten av den nämnda handboken i form av en NKS´ rapport. För att handboken skall vara komplett skall även sakinnehållet i EKO-3.4:s rapport ingå utom kap. 9 om mätningar samt bilagorna.
Medan mycket av arbetet i EKO-3.4 kom att gälla sådant som mål, gränsvärden, organisation och strålningens grunder kommer BOK-1.4 att koncentrera sig på konsekvensbegränsande åtgärder under olika skeden.
En översyn kommer att ske av kap. 5 och 6 i EKO-3.4:s rapport:

- hotskedet, dvs. från larmet om en möjlig olycka (ett utsläpp har skett eller kan komma att ske) till nedfallet börjar,
- i anslutning till nedfallet, men framförallt kommer verksamheten att koncentrera sig kring åtgärder:
- innevarande betnings- och odlingssäsong,
- inför och under nästa säsong samt
- vid nedfall under vintersäsongen.

7. Uppdelning av arbetet på undergrupper för i huvudsak olika produktområden

Arbetet sker parallellt i undergrupper för motåtgärder avseende:

- djurhållning (inkl. får, get och ren),
- växtodling,
- livsmedelsindustri och hushåll m.m. inkl. frilandsodlade produkter (t.ex. grönsaker), bär, svamp, vilt m.m.

Ansvaret att leda sådana undergrupper fördelas lämpligen på deltagare från olika länder. Om exempelvis BOK-1.4 leds av en svensk kan undergruppen avseende:

- djurhållning ledas av en norsk,
- växtodling ledas av en dansk,
- livsmedelsindustri och hushåll m.m. ledas av en finländare.

Indelningen i undergrupper innebär att framtagandet av underlag och preliminära diskussioner sker i undergrupperna men avslutas med hela BOK-1.4, som också tar det slutliga ställningstagandet till innehållet i rapporten.
Det har övervägts att skapa en speciell undergrupp för ”produkter från utmarker m.m.” men gränsdragningen mot de två grupperna för ”djurhållning” och ”växtodling” torde bli alltför oklar.
Utgående från att varje land utsett en person inom vardera strålskydd, livsmedel etc. kan dessa exempelvis fördelas enligt följande på undergrupper:

	Djurhållning	Växtodling	Industri och hushåll m.m.	Totalt
Strålskydd	2	2	1	5
Livsmedel	1	1	3	5
Växtodling	-	5	-	5
Djurhållning	5	-	-	5
Jordbruksnäringen	2	2	1	5
Livsmedelsindustrin	1	1	3	5
Summa	11	11	8	30

Det kan dock tänkas att Island väljer att, liksom under EKO-3.4, begränsa antalet personer i den nationella gruppen, vilket i så fall medför en minskning med 1-2 personer i vissa undergrupper. Fördelningen på undergrupper och utseendet av ledare för dessa bör beslutas av BOK-1.4.

8. Forskargruppen

Eftersom det är jordbruks- och livsmedelsmyndigheterna som skall utnyttja de förslag till motåtgärder inom jordbruks- och livsmedelsområdet som forskargruppen kan lämna skulle en hård knytning med forskargruppen underordnad BOK-1.4 kunna vara rimlig. Eftersom detta förefaller vara oacceptabelt för forskarna bör det åtminstone i uppdraget till forskargruppen påpekas att den:

- inom jordbruks- och livsmedelsområdet i NKS-rapporter skall dokumentera de motåtgärder, vars användning den bedömer att de nordiska myndigheterna har anledning att ta ställning till samt
- skall för BOK-1.4 successivt presentera dessa motåtgärder och vara beredd att skriftligt och muntligt göra detta vid möten med BOK-1.4 och dess undergrupper. Åtminstone i sina kontakter med BOK-1.4 bör den vara beredd att delas upp i enlighet med undergrupperna inom BOK-1.4.

Inledningsvis bör myndighetsrepresentanterna få tillfälle att ge forskarna synpunkter på inriktningen, strukturen och omfattningen av forskarnas kommande redovisning och rapporter. Forskarna bör också reservera tid för de önskemål om studier av motåtgärder som myndighetsrepresentanterna kan komma att lämna under arbetets gång. Mer omfattande önskemål kan av tidsskäl och ekonomiska skäl behöva skjutas till nästa NKS-program.
Även om forskargruppen är parallellställd med BOK-1.4 behövs ingen organisatorisk samordning mellan forskargruppen och BOK-1.4 utöver projektledaren för BOK-1. Att tillsätta ytterligare någon person med uppgift att samordna BOK-1.4 och forskargruppen skulle innebära en överorganisering, som dessutom skulle skapa oklara ansvarsförhållanden och kunna leda till det principiellt felaktiga att en grupp myndighetsrepresentanter (= avnämare av forskningsresultaten) underordnas en forskare.

BOK-1.4 har dessutom en sådan representation att en i sakfrågorna fristående ställning är nödvändig. Ledaren för BOK-1 bör därför - liksom ledaren för EKO-3 gjorde - begränsa sin ledande roll till att avse formella och administrativa frågor - främst att se till att de ekonomiska ramarna inte överskrids.

9. Kostnader

De sammanlagda kostnaderna 1998-2001 uppgår till 665 000 DDK, dvs. 11 % av BOK-1:s totala budget:

Möten	**1998**	**1999**	**2000**	**2001**
• **Koordinatorer och ordf. i undergrupper**	15 500	15 500	15 500	15 500
• **Undergruppen "Djurhållning"**	-	31 500	31 500	31 500
• **Undergruppen "Växtodling"**	-	31 500	31 500	31 500
• **Undergruppen "Industri och hushåll m.m."**	-	32 000	32 000	32 000
• **BOK-1.4**	-	80 000	80 000	80 000
Oförutsett	1 600	19 100	19 100	38 100
Summa	17 100	209 600	209 600	228 600
varav: resor för interna deltagare	15 000	62 800	62 800	62 800
resor + arbetstid för externa deltagare	-	25 000	25 000	25 000
kost och logi	500	90 500	90 500	90 500
oförutsett	1 600	19 100	19 100	38 100
Summa avrundad	**15 000**	**210 000**	**210 000**	**230 000**

Kostnaderna har beräknats utgående från:

1. Eftersom de myndigheter och organisationer, som är representerade i BOK-1.4, är de som har störst nytta av resultaten förutsätts de bidra ekonomiskt genom att:
   - svara för kostnaderna för deltagarnas arbetstid och den nationella gruppens verksamhet,
   - svara för kostnaderna för deltagarnas resor med undantag för 1-2 isländska deltagare och 0-1 deltagare från STUK per möte,
   - alternera som värdmyndighet för möten och därvid svara för kostnaderna för sammanträdeslokaler, kontorsmateriel, kopiering m.m. samt att
   - en myndighet i Danmark, Finland, Norge respektive Sverige var och en ställer till disposition en ledare för BOK-1.4 eller en ordförande i en undergrupp och svarar för kostnaderna för vederbörandes arbetstid och resor.
2. Forskargruppen svarar för kostnaderna för arbetstid m.m. och resor vid deltagande i möten med BOK-1.4, dess undergrupper eller koordinatorer.
3. I BOK-1.4:s möten deltar varje gång två och i undergruppernas möten varje gång en person för vilken arbetstid och resor betalas med ca 5 000 DKK, t.ex. en forskare utanför forskargruppen.
4. Koordinatorerna har ett planeringsmöte 4 kv. 1998 och därefter har koordinatorer tillsammans med undergruppernas ordförande ett separat en dags planerings- och samordningsmöte varje år. I dessa möten bör även ledaren för forskargruppen delta.
5. BOK-1.4, liksom varje undergrupp, har årligen 1999-2001 ett två dagars internat. I internaten med BOK-1.4 deltar 30 personer (varav två från Island

och en från STUK). I internaten med undergrupperna för ”Djurhållning” och ”Växtodling” deltar 11 personer (varav en från Island). I internaten med undergruppen för ”Industri och hushåll m.m.” deltar 8 personer (varav en från Island och en från STUK). Antalet deltagare är inkl. deltagande forskare både ur och utanför forskargruppen.

6. Kostnaderna vid ett möte uppgår per person till:
   - 10 000 DKK för resa t.o.r. Island,
   - 5 000 DDK för resa t.o.r. Helsingfors,
   - 100 DKK för kost vid ett en dags möte samt
   - 1 500 DKK för kost och logi vid ett två dagars möte.
7. Övriga kostnader inkl. oförutsedda samt översättning, tryckning m.m. av rapport anges med 10 % de första åren och 20 % det sista året avrundat till närmaste 100-tal.

10. Finansiering

10.1 NKS

Till de sammanlagda kostnaderna enligt kap. 9 åren 1998-2001 på 665 000 DDK bidrar förhoppningsvis ÄK/LIVS med minst 70 000 DDK. Kostnaderna för NKS skulle i så fall uppgå till 595 000 DDK.

10.2 Deltagande myndigheter och organisationer

Beaktas dessutom alla de kostnader för resor och arbetstid, som inte medräknats i kap. 9, finner man att den övervägande delen av kostnaderna betalas av de deltagande myndigheterna och organisationerna, som sammanlagt torde svara för mer än 80 % av kostnaderna.
Utgår man exempelvis från att resekostnaderna för varje deltagare utanför värdlandet uppgår till 5 000 DDK, så kommer de bara i resekostnader att bidra med 615 000 DDK:

	Antal möten	**Antal interna resande personer**	
		Per möte	**Totalt**
• **Koordinatorer och ordf. i undergrupper**	4	3	12
• **Undergruppen ”Djurhållning”**	3	7	21
• **Undergruppen ”Växtodling”**	3	7	21
• **Undergruppen ”Industri och hushåll m.m.”**	3	4	12
• **BOK-1.4**	3	19	57
Summa			123

Arbetstiden bara för möten motsvarar mer än 1½ årsarbetskraft. Härtill kommer arbetstiden för en ledare för BOK-1.4, koordinatorer och tre ledare för undergrupper, vilken överslagsmässigt torde motsvara ungefär två årsarbetskrafter sammanlagt under 1998-2001.

nks

Nordisk kernesikkerhedsforskning
Norrænar kjarnöryggisrannsóknir
Pohjoismainen ydinturvallisuustutkimus
Nordisk kjernesikkerhetsforskning
Nordisk kärnsäkerhetsforskning
Nordic nuclear safety research

BOK-2

Radiological and Environmental Consequences

Sigurður Emil Pálsson
Geislavarnir ríkisins

1999-06-15

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Summary

NKS/BOK-2 Radiological and Environmental Consequences

The BOK-2 project, *Radiological and Environmental Consequences,* focuses on the consequences of releases of man-made radionuclides to the environment. Emphasis is mainly on methods of dose estimation (individual and collective doses), including assessment of the vulnerability of different regions to radionuclide deposition. The effects of releases of man-made radionuclides to the environment can also be a cause of concern due to social or economical reasons, even when the health effects are not considered to be serious. The BOK-2 project therefore includes studies on the behaviour of radionuclides in the environment, where individual doses are regarded as negligible but knowledge about the transport mechanisms is considered to be of relevance.

The project includes the following two sub-projects:

BOK-2.1 Important Nordic food chains
BOK-2.2 Radioactive tracers in Nordic sea areas

BOK-2.1 Important Nordic food chains
The BOK-2.1 sub-project is divided into two main sections:

a) BOK-2.1.1 Radioecological vulnerability
b) BOK-2.1.2 Internal doses

The BOK-2.1.1 involves the compilation and evaluation of old and new data using traditional models as well as modern dynamic ones. Data will also be evaluated with respect to radioecological vulnerability. This aspect of the work is closely related to an ongoing EU project, SAVE. Contacts with SAVE were established in the BOK-2 planning phase. In order to improve the available data sets some specific studies will also be undertaken. These are very limited in scope and will include: transfer of Cs-137 to lamb meat, plutonium in forest ecosystems and foodstuffs of wild origin, radionuclide transfer in freshwater ecosystems and transfer of Sr-90/Cs-137 to milk.

BOK-2.1.2 aims at a better understanding of the connection between the important Nordic foodchains and the internal doses originating from these foodchains. The reasons for differences in internal dose estimates depending on the methods used - whole body counting or dietary surveys - will be investigated. Another aim is to give advice on equipment that can be used for direct measurement of people in emergency situations and to prepare a handbook.

BOK-2.2 Radioactive tracers in Nordic sea areas
The BOK-2.2 sub-project is divided into two components:

a) BOK-2.2.1 Sea water transport
b) BOK-2.2.2 Biological and biogeochemical processes

This does not reflect a further division into sub-projects, both topics will be covered by the same research groups and dealt with at the same project group meetings within BOK-2.

BOK-2.2.1 will focus on these following two main factors:

- Re-evaluation of transfer factors for Tc from Sellafield to Nordic marine areas. Comprehensive sampling has been planned by all of the participating countries. Seaweed samples will be collected from various locations as well as sea water.
- Study of uptake mechanisms and concentration factors for Tc-99 to seaweed and possibly lobster, crabs, fish, mussels and other relevant foodstuffs. Seasonal effects will be included where appropriate.

BOK-2.2.2 aims at a rather comprehensive assessment of processes in the Baltic Sea and its catchment and adjacent areas. This wide scope is made possible by using to a large degree already available data.

It is proposed to give the participating countries an equal chance for receiving available NKS funding for their BOK-2 research.

1. Foreword

1.1 Development of the BOK-2 project plan proposal

The first steps were taken at the NKS final seminar at Saltsjöbaden (March 11-12 1998). At that time the members of the BOK-2 pre-project planning group had not been nominated, but participants in the discussion group on BOK-2 were asked to list which topics described in the Programme Group's final report they would like to see prioritised. These results did not have a formal influence on the development of the project plan, but they served as a useful indicator of where the best potentials for project work could be.

After the BOK-2 pre-project planning group had been nominated the formal work began. The project plan was developed in an open fashion with the aim of giving all interested parties a chance to influence the development work. A BOK-2 World Wide Web (WWW) web site was set up and used to distribute information during the development stage. Those wanting to send in comments were asked to use the final report of the NKS programme group as a starting point. A compilation of submitted comments was put on the mini-web before the BOK-2 seminar was held at Sorø, Denmark, May 13th - 15th. The seminar was an open one where all those who wanted and had the possibility could attend.
Subsequently a draft project plan was written based on the outcome of the seminar and additional material submitted afterwards by members of the pre-project planning group and participants at the seminar. This draft project plan was presented to the NKS Reference Group at its meeting in Stockholm, June 4-5, 1998.

The writing of the work plans for each county has been ongoing since beginning of June (some even started earlier). The summer vacations have however made it difficult to get response from some of those involved in the project work. Throughout the project plan development process draft versions of the project plans and work plans have been made accessible on the WWW. Group e-mail messages have been sent out a few times to all who had been nominated to work on BOK-2 or had even shown some interest in the project.

1.2 Comparison with the final report of the NKS Programme Group and the NKS project criteria

The final report of the NKS Programme Group, NKS(98)1, and the NKS Directive for Pre-Project Work, NKS(98)4, have been used as guidelines throughout the development of the project plan. Text from these documents were placed on the BOK-2 WWW with permission and all contributors to the project were requested to use them as their starting point. No deliberate deviations have been made in this report from the aims and main ideas suggested in the final report of the NKS Programme Group. The same applies concerning the NKS project criteria. Not every single detail suggested has been included in this report and it was not the intention of the Programme Group that it should be done. The

pre-project planning groups were supposed to narrow the choice from what was described in the Programme Group's report.

1.3 Detailed work plans

Detailed work plans have already been produced describing proposed project work in all of the participating countries. Space restrictions concerning the size of the reports of the pre-project planning groups make it impossible to reproduce the text of the plans in this report. The work plans can however be currently accessed and read on the World Wide Web (WWW). The plans can be found at:

http://www.gr.is/bok-2/

1.4 List of participants in BOK-2 pre-project planning group

Sigurður Emil Pálsson, GR, was appointed as leader of the BOK-2 pre-project planning group. The following other persons were also officially nominated to participate in the group:

- Henning Dahlgaard, Risø
- Sven P. Nielsen, Risø
- Mette Øhlenschlœger, SIS
- Steen Hoe, BRS
- Seppo Vuori, VTT
- Aino Rantavaara, STUK
- Erkki Ilus, STUK
- Elísabet D. Ólafsdóttir, Gr
- Jóhann Þórsson, RALA
- Ingar Amundsen, NRPA, replaced by Lavrans Skuterud, NRPA, due to a temporary change of job
- Anne Liv Rudjord, NRPA
- Tone D Bergan, IFE
- Knut Hove, NLH - withdrew from pre-project group, represented by Ingar Amundsen, NRPA (and later Lavrans Skuterud)
- Leif Moberg, SSI
- Per Roos, Lund University

2. Introduction

2.1 Proposed main emphasis with in BOK-2 project

The BOK-2 pre-project planning group used the final report of the NKS Programme Group as its starting point in developing the BOK-2 project plan further. It is proposed to keep the division of the NKS Programme Group's report and divide the project into two sections:

BOK-2.1 Important Nordic food chains
BOK-2.2 Radioactive tracers in Nordic sea areas

The pre-project planning group decided to propose that the work in this period should mainly be focused on large scale assessments in both of these sections. In the BOK-2.1 the focus would be on estimation of radiological sensitivity in the Nordic countries, combining old and new data, using traditional dynamic and modern dynamic models. There is also proposed a special study aimed resolving the common apparent difference in estimates of internal doses, depending on whether the estimate is based on whole-body measurements or diet investigations. In BOK-2.2 the focus would be on radionuclides processes in the Baltic Sea and its catchment and adjacent areas. It is also proposed to make use of the recent large increase in release of Tc-99 to the Irish Sea, to use it as a tracer for transport from the Irish Sea to Nordic waters, including the Baltic Sea.

A detailed description of the proposed work in BOK-2.1 can be found in chapter 0,*Content of BOK-2.1 – Important Nordic food Chains*, a corresponding description for BOK-2.2 can be found in chapter 0, *BOK-2.2 – Radioactive tracers in Nordic sea areas*.

2.2 New possibilities in large scale data analysis

In recent years there has been a rapid development in the use of computer software that can analyse simultaneously a wide range of data sets with geographical co-ordinates. These are the so called *geographical information systems* (GIS). The combined analysis of many different data sets makes it possible to draws conclusions on a larger scale that previously possible and get results for whole areas, not just individual experimental stations.

Starting empty handed and using GIS to analyse data covering whole regions and countries requires far greater resources than are within the scope of an NKS project. In many countries, however, considerable work has already been undertaken to collect various types of data into GIS. If the relevant data sets are already available, or just a modest addition needed, then GIS can be applied very successfully for radioecological assessments, e.g. identifying vulnerable areas.

The pre-project planning group recommends that geographical information systems (GIS) should be used wherever appropriate in the project work

3. Content of BOK-2.1 - Important Nordic food chains

3.1 Introduction

The Nordic countries have a long tradition of assessing the effects of the spread of man-made radionuclides into the environment, both individually and collectively, e.g. within the framework of NKS and its predecessors. The NKS work has sometimes focused on knowledge gaps, and at other times on overall assessments.

It has been know for a long time that the sensitivity of different areas to the fallout of radionuclides can vary a great deal, as well as being dependent upon time. This was clearly demonstrated in numerous Nordic studies after the atmospheric nuclear weapons tests in the early sixties and after the accident at the Chernobyl Nuclear Power Plant. It is essential for nuclear emergency preparedness planning to be able to take this variable sensitivity into account in a quantitative manner and to identify those areas most vulnerable.

The project focuses on the transfer of radionuclides through Nordic food chains, which comprise important exposure pathways for the evaluation of the consequences of radioactive contamination of the environment. Many studies have already been done in the Nordic countries concerning the impact of fallout from the nuclear weapons testing in the sixties (long term fallout) and the Chernobyl accident in 1986 (short term fallout). A synthesis of these data, comparing these two types of fallout, has not been carried out in a systematic way in the Nordic countries. Furthermore, many of the previous studies give results that are only applicable for certain locations, and not necessarily for whole regions or those areas that would be most vulnerable to radioactive contamination. Increased interconnectivity of available large data sets combined with GIS makes it now possible to do studies on whole areas, even countries.

Internal doses to populations can be estimated from estimated intake of radionuclides (through diet studies and measurements of radionuclide concentration in food). Another form of estimation is by using whole-body measurements. There has, however, been generally noted a discrepancy between these two methods, the food intake based studies generally giving higher values by a factor 2 - 3.

3.2 Main aim

The main aim of the BOK-2.1 project part is to attempt to present an overall view of the experience concerning fallout nuclides gained during the last decades in the Nordic countries and to undertake limited additional studies so that past experience can be best utilised for assessing the possible impact of fallout in the future. This is to be achieved by concentrating the research on two main topics:

a) **BOK-2.1.1: Radioecologcal vulnerability**
b) **BOK-2.1.2: Internal doses**

BOK-2.1.1 Contents Summary
The aim is to produce a synthesis of fallout data collected from the fifties to the present time. The focus would be on the behaviour of those man made radionuclides giving the main contribution of doses to the Nordic population through the food chain, but studies on other radionuclides may be included, provided the information gained is considered to be important and the studies are limited in scope. Most of this will be done by compiling data already available (in each country and in Nordic databases e.g. at Risø) and analysing it using various types of models. Another major component of this work will be undertaking limited studies on radioecologically vulnerable areas with systematic

categorisations of regions, in most cases using geographical information systems (GIS). This can e.g. include combining data on soil classification, vegetation, production and measurements of radionuclide concentrations. Limited studies on long term trends in semi natural ecosystems (transfer of radiocaesium to lamb meat) will be included. Some work on transfer to milk may be included as well on the distribution of plutonium.

BOK-2.1.2 Contents Summary
The sub-project BOK- 2.1.2 *Internal doses* is divided into the following four main fields:

3.1.2.4 Exercises on internal dose calculations
3.1.2.4 Calibration and intercalibration of in vivo iodine measurements and whole-body measurements
3.1.2.4 Rapid monitoring of people and preparation of handbook for emergency situations
3.1.2.4 Comparison of methods of estimating internal doses to Nordic populations- whole-body measurements and diet investigations

These tasks are described in more detail in section 0.

3.3 Relationship of BOK-2.1.1 to the European Union's project SAVE

Within the Framework Programme 1994-1998 of the European Union there has been a project, *Spatial Analysis of Vulnerable Ecosystems in Europe: Spatial and dynamic prediction of radiocaesium fluxes into European foods* (SAVE). The SAVE project aims to identify areas and communities in western Europe which are vulnerable to radiocaesium contamination, and conversely those areas/communities which are resilient to radiocaesium contamination. The SAVE project aims e.g. to quantify variation in plant uptake of radiocaesium from major European soil types; to integrate dynamic models of transfer of radiocaesium to food products with spatially varying data in a GIS; to produce time-dependent maps for contamination of major food products considering spatial variation in soil to plant transfer and land cover; to produce critical load maps indicating deposition at which intervention levels will be exceeded; to describe variation in general dietary habits; provide data on home- production and production of food from semi-natural ecosystems; and to compare the usefulness of countermeasures with regard to spatially varying parameters. All of this is in the end to be integrated in a user-friendly system for decision makers enabling them to identify areas most vulnerable to radiocaesium deposition and to identify priority areas for the application of countermeasures.

There is clearly a very similar emphasis in SAVE and BOK-2.1, even though the latter is far more limited in scale. This is all the more interesting, since during the early stages of BOK-2.1 development, nobody in the pre-project planning group had any direct contact with SAVE and most knew little if anything about it. This indicates the general interest in this type of work.

Direct contacts have now been established between SAVE and BOK-2.1. Harmonisation and even co-operation will be attempted where appropriate. One participant in BOK-2.1 has already decided to express the mobility of radionuclides in soil in terms of *radiocaesium interception potential* (RIP) as is done in SAVE. This makes intercomparison of results on a European scale much easier. Other participants will probably follow.

SAVE will formally come to an end next year (1999). It is however most probable that more work along similar lines will continue within EU's next Framework Programme. Work of a similar type as outlined in BOK-2.1 has thus the potential for providing the ground for future co-operation with the EU.

3.4 BOK-2.1.1, Radioecological Vulnerability

The components within BOK-2.1.1 are closely related. The general analysis of fallout data will e.g. provide information on regional radioecological characteristics which is of use in the study on radioecologically vulnerable areas. Radioecological vulnerability can be defined using many different criteria. In some semi-natural ecosystems with highly organic soil the transfer rates to a wide range of foodstuffs can be very high. Some food products are vulnerable if they can easily get contaminated by radionuclides and they play a large role in the human diet. The results from the limited special studies will also be included in the general data compilation, as appropriate. The division into components does not reflect any into smaller sub-projects. The components are integrated parts of the same project part and will be supervised by the same project group. The relative emphasis on the different components varies however from country to country.

3.4.1 Re-evaluation of fallout data (from the fifties to the present) using various types of models for dose estimation

Previous NKS projects on terrestrial radioecology have dealt with the impact in the Nordic countries of the Chernobyl accident (the RAD programme, 1990-1993) and long ecological half lives in Nordic semi-natural ecosystems (the EKO-2 project, 1994-1997). These projects have provided a reasonably detailed overview of the impact of the Chernobyl accident in the Nordic countries.

The atmospheric fallout from the nuclear weapons testing in the sixties generally caused higher doses to the populations in the Nordic countries than the Chernobyl fallout. A corresponding overview of the impact of the nuclear weapons testing is not available. Recently, data on this fallout have become declassified and it is of interest to compile existing data on fallout from the sixties and carry out a systematic reconstruction of doses in the Nordic countries from the atmospheric nuclear tests. This would provide information of use to the general public, radiation protection authorities and NKS participants, and an interesting and relevant comparison for the doses from the Chernobyl accident. Such a comparison has not been carried out previously in the Nordic countries, and it will

provide an overview and a new perspective on the lessons learned from the Chernobyl accident in the Nordic countries.

The work will start by collating existing Nordic data, particularly from the 1960's and after the Chernobyl accident, on contamination of dominating foodstuffs (e.g. milk, grain and meat). The radionuclides considered are Sr-90, Cs-137 and I-131. The data will be analysed with different types of radioecological models (traditional UNSCEAR models and more recent dynamic models) which will be obtained and adjusted to represent Nordic conditions. Possibly the work would also involve measurements of additional samples where it was considered needed. This could include old relevant samples in specimen storages (e.g. bone samples for Sr-90) and could also involve field sampling.

3.4.2 Radioecologically vulnerable areas

Many site specific factors affect the behaviour of radionuclides. Individual radioecological studies are often quite narrow in scope and limit themselves to investigating the distribution of radionuclides and model their behaviour under given conditions. A compilation of parameter values in radioecological models often show a distribution of the values spanning orders of magnitude. The distribution can be compressed by taking the effects of site specific factors better into account. It is important to study the, magnitude of and main reasons for, variability of radioecological parameters in the Nordic countries and the most important factors. Questions can also be raised on how representative for a whole region or country are results carried out at individual experimental farms. It is essential for emergency preparedness planning that experience gained from individual sampling or test sites can be converted to values representative for whole regions. By using Geographical Information Systems (GIS) it is possible to combine knowledge on site specific factors (soil type, amount of precipitation, types of vegetation etc.) with specific models describing the behaviour of radionuclides. The Arctic Monitoring and Assessment Programme (AMAP) is a good example of a what can be achieved on a large geographical scale when data from different sources and periods is combined. Much needs also to be done on a smaller scale, e.g. within the Nordic countries.

(Text from the final report of the NKS Programme Group)

How vulnerable an area is with respect to radioactive contamination depends on a range of factors. Firstly, meteorological conditions make some areas more vulnerable than others, e.g., because of predominant wind directions and precipitation. After fallout has occurred, differences in transfer to different plant species due to geographical differences both in soil types and vegetation species, will contribute to differences in vulnerability. Furthermore, food production and production methods differ between areas. Finally dietary habits may differ across different regions. These are all examples of factors that make some areas more vulnerable to radioactive contamination than others. The geographical perspective

make the use of Geographical Information System (GIS) an invaluable tool in analyses of vulnerability.

The work proposed within BOK-2.1 will be based on ongoing studies in each participating country. As a rule the use of a geographical information system (GIS) is assumed. Studies not using such a system will however not be excluded. It would be completely out of the scope of an NKS project to develop a Nordic GIS for radionuclide data. The first task would therefore be a survey of the ongoing and planned activities in each country that could be used as a basis for NKS work. Much is already undertaken and other activities are planned using national resources. Some of these studies may require field- and laboratory work where essential data is judged to be missing.

The analysis will also provide a basis for evaluating the need for adjusting existing radioecological monitoring programmes in the Nordic countries in terms of sample types, and density and frequency of sampling. This topic could e.g. be taken up during a set of seminars in the project period.

The European Union (EU) project SAVE *(Spatial Analysis of Vulnerable Ecosystems in Europe)* deals also with radioecologically vulnerable ecosystems. It is on a far bigger scale than what could be accomplished within an NKS project, but the general ideas are the same. The project SAVE is therefore of direct relevance for BOK-2.1 and the work will be co-ordinated with SAVE work to the degree that is practical.

3.4.3 Long term trends in semi-natural ecosystems (lamb project)

Previous NKS projects on radioecology have illustrated the importance of time series of data on environmental radioactivity. These time series illustrate the temporal development of levels of radioactivity in different environmental compartments, which are very different between the various ecosystems found in the Nordic countries. One such example is the so-called lamb project (RAD-3 and EKO-2.1) which illustrates the transfer of radiocaesium through the soil-grass-lamb food chain from 1990 to 1997 and shows very different rates of transfer for the different study sites. These differences contribute to the variabilities of the radiological sensitivities across the Nordic countries, and once quantified they may be incorporated into radioecological models and used for predictive purposes.

The aim with this task is to continue the time series obtained from 1990 to 1997 on a very limited scale. The proposed project work involves keeping a limited number of sheep at the same experimental farms as has been done before and to collect samples of vegetation and soil in autumn before slaughter along with lamb meat. The data required are the same as were requested for the EKO-2.1 model work on transfer of radionuclides from soil and vegetation to lamb meat.

Interest has been shown in Denmark, Iceland, Norway, Sweden and the Faroe Islands to participate in this study and work plans have been submitted. All these institutes participated in the corresponding work during the previous two periods.

In order to get data for all the four years of the project the work has to start as soon as possible (in most cases it should already have started), since the sheep and pasture areas have to be reserved for the study, even though the actual sampling will only need to take place in autumn. In most cases this study will also be coupled with a national research project involving more sampling.

3.4.4 Milk studies (transfer of strontium, high transfer rates under special conditions)

Milk (and milk products) are very important parts of the human diet. Any factors that influence the transfer of radionuclides to milk can therefore greatly affect the vulnerability of the area to radionuclide fallout. Considerable knowledge has already been acquired in most of the Nordic countries concerning the transfer of Cs-137 to milk, even though systematic studies have not been undertaken in some areas which have shown very high transfer rates (e.g. Iceland). Less information is available for Sr-90, at least for many areas. Norway and Iceland have shown greatest interest in undertaking some form of limited studies of the transfer of radionuclides to milk, Norway putting most emphasis on the Sr-90 studies, being a supplement to Cs-137 studies already done at the same sites. In Iceland the emphasis would be on investigating the factors leading to the high transfer rates for Cs-137. The study would just run for a limited time, e.g. two years. Details remain to be worked out, but other Nordic countries have shown interest in joining to some degree. The study in Norway is planned to start already this summer.

3.4.5 Plutonium in Forest Vegetation and Foodstuffs of Wild Origin

In Norway and Finland missing information concerning plutonium will be collected. In Finland the emphasis is on plutonium in forest vegetation and foodstuffs of wild origin whereas in Norway the aim is to determine the level of Chernobyl Pu fallout. Samples from high deposition areas and Arctic areas in Norway will be used.

3.4.6 Lake systems

Experience has shown considerably high concentrations of radionuclides in freshwater fish in some lakes due to radioactive fallout. Lakes, rivers and their catchment areas, are also important for understanding the influx of radionuclides into seas, e.g. the Baltic Sea. Some studies on lakes will be included within BOK-2, e.g. in Norway and Sweden, but the limited funding available puts constraints on the scope of work.

3.4.7 Work plans for BOK-2.1.1

The submitted work plans can currently be found on the BOK-2 web pages: http://www.gr.is/bok-2/

The following institutes have at the time of writing declared that they intend to participate in BOK-2.1a and almost all have submitted plans for their proposed work.

Participating institutes (as of August 14th):

National Institute of Radiation Hygiene[1,2] (DK)

Risø National Laboratory[1,2] (DK)

University of the Faroe Islands[1,2] (FO)

Faroese Natural History Museum[1,2] (FO)

Radiation and Nuclear Safety Authority[1,4] (FI)

Icelandic Radiation Protection Insitute[1,2,3] (IS)

Agricultural Research Institute[1,2,3] (IS)

Norwegian Radiation Protection Authority[1,2,3,4] (NO)

Institute of Energy Technology[1,2,3,4] (NO)

Agricultural University of Norway[1,2,3,4] (NO)

University of Oslo[5]

Swedish Radiation Protection Institute[1] (SE)

Swedish University of Agricultural Sciences[2*] (SE)

Lund University[5]

University of Uppsala[5*] (SE)

1: Participates in data compilation / vulnerability study

2: Participates in lamb study

3: Participates in milk studies

4: Participates in Pu studies

5: Participates in lake studies

*: Due to the limited funding available in BOK-2, the level of participation of the Swedish University of Agricultural Sciences and University of Uppsala is uncertain at the time of writing.

3.5 BOK-2.1.2 Internal Doses

Aim: To improve methods for dose calculations based on dietary surveys (indirect method) and whole-body counting (direct method)

BOK - 2.1.2 aims at a better understanding of the connection between the important Nordic foodchains and the internal doses originating in these foodchains. The reasons for differences in internal dose estimates depending on the methods used - whole-body counting or dietary surveys will be investigated. The discrepancies were demonstrated in the earlier project (1990- 1993) on internal doses to the Nordic populations. The reason for discrepancies still is an open question also internationally. In this project we want to use existing material as well as collect some new by measurements in Finland and Sweden. People consuming much produce from nature will be whole-body counted and their diets surveyed. This investigation will be done on an individual basis as opposed to the earlier one in which statistical data on diets were used

Another aim is to give advice on equipment that can be used for direct measurements of people in emergency situations and to prepare a handbook to be used in such situations. The intention is also to train experts in internal dose calculation and to calibrate and intercalibrate equipment which is an important aspect of quality assurance. All this aims at better handling of emergency situations and comparable internal radiation dose estimates.

The project BOK -2.1.b will be of interest to all Nordic laboratories studying seminatural foodchains and their influence on internal radiation doses on a long-term basis. Training in dose calculation is scarcely available and often open only to a specially selected group of experts. It is extremely valuable to give this opportunity to increase the competence especially of young Nordic scientists

The sub-project BOK- 2.1.2 *Internal doses* is divided into the following four main fields:

2.1.2.1 Exercises on internal dose calculations
2.1.2.2 Calibration and intercalibration of in vivo iodine measurements and whole-body measurements
2.1.2.3 Rapid monitoring of people and preparation of handbook for emergency situations
2.1.2.4 Comparison of methods of estimating internal doses to Nordic populations- whole-body measurements and diet investigations

The first three were originally planned to be within the BOK-1 project, because the emphasis is more on measurement techniques and quality assurance. These three fields were however moved to BOK-2 following the decision of the NKS Board in September 1998. Subsequently the tasks have been integrated into one sub-project.

Since the work within BOK-2.1.2 is in some ways of a different nature than the other work in BOK-2 and rather specialised (e.g. whole-body measurement techniques), it was decided to appoint a sub-project leadership for BOK-2.1.2.

The work is lead by Tua Rahola (STUK, FI) and Rolf Falk (SSI, SE), with Tua Rahola acting as the formal sub-project leader.

4. BOK-2.2 - Radioactive tracers in Nordic sea areas

4.1 Introduction

The BOK-2.2 is divided into two sections:

a) **BOK-2.2.1 Sea water transport**
b) **BOK-2.2.2 Biological and biogeochemical processes**

These two sections are related, e.g. when Tc-99 is used as a tracer in the Baltic Sea. Both of these topics should be dealt with by the same project group and a further division of the sub-project should be avoided. Some of the proposed work plan take this into account and do not divide the planned work into these two sections.

4.2 BOK-2.2.1 Sea water transport

The recent increased release of Tc-99 into the sea has caused considerable public concern in some of the Nordic countries. Even though the doses resulting from this are minor, there is a strong demand for more information about the behaviour of Tc in Nordic marine ecosystems. This recent release also offers a good opportunity to learn more about how radionuclides spread from the Irish Sea to Nordic sea areas.

The proposed study will focus on these following two main factors:

- Re-evaluation of transfer factors for Tc from Sellafield to Nordic Marine areas
- Study of uptake mechanisms and concentration factors for Tc-99 to lobster, crabs, fish, mussels, seaweed and possibly other relevant foodstuffs. Seasonal effects should be included where appropriate.

The results will be presented using a graphical information system (GIS) if found appropriate. The collection of samples (e.g. at sea) and the measurements of Tc-99 are demanding tasks and expensive. The extent of project work is therefore deliberately kept limited in this section, although the most of the funding will come from non-NKS sources.

4.2.1 Technical training course - seminar - quality assurance

The measurement of Tc-99 by β-radiation requires a very thorough and reproducible removal of all other β-emitters. There have been suggestions that new developments in mass spectrometry, notably HR-ICPMS, might solve some of these problems and even reduce detection limits considerably. The use of mass spectrometry introduces however new problems due to interference from nuclides

even multi-atomic species with a similar mass (e.g. Ru-99). It is therefore suggested to have a work shop / technical training course / methodological seminar early in the project period, even late this year (1998). Follow-up work on quality assurance, e.g. through intercomparisons, is essential.

4.2.2 Tc-99 studies - detailed description

Introduction

Although there is a substantial reported knowledge on the behaviour of Tc-99 in the environment most of these reported data concerns laboratory experiments and not real field observations. Even if laboratory models are extremely valuable in testing various hypotheses they must always be tested and validated in the real world or otherwise only be considered as laboratory data. In the case of terrestrial systems there may be some difficulties in finding sufficient levels of Tc-99 (except in the vicinity of some gaseous diffusion plants) to perform such studies. For marine systems, however, the supply of Tc-99 from the Sellafield reprocessing plant to the Nordic Seas has however provided sufficient levels in the mid/late seventies to validate some existing laboratory studies. Very few were however performed, mostly because of the rather few laboratories engaged and the relatively short duration of the releases but partly also due to problems with separation chemistry, field sampling (few suitable yield tracers) and too low sensitivity of the analysing equipment. Above all the released Tc-99 during the seventies was used as a tracer for water movement and provided very valuable data on transit times to several locations from the Irish Sea.

Due to high Tc-99 releases from Sellafield in later years a second opportunity has now arrived to study the behaviour of this element in the sea. This time the chances are much greater than the last time to be able to test some of the laboratory findings reported earlier. The reason for this is mostly because of the various ICP-MS techniques that have become accessible to a broader range of laboratories than last time. The use of, especially, HR-ICP-MS may reduce detection limits one or perhaps two orders of magnitude than compared to conventional beta counting. This technique also enables corrections for interfering elements which, especially for low activities, is very difficult with the beta counting technique. Chemical separation techniques and field sampling techniques have also become more widespread since the seventies/eighties which will result in more laboratories becoming engaged in the sampling.

As stated earlier the proposed study will focus on these following two main factors:

- Re-evaluation of transfer factors for Tc from Sellafield to Nordic Marine areas
- Study of uptake mechanisms and concentration factors for Tc-99 to lobster, crabs, fish, mussels, seaweed and possibly other relevant foodstuffs. Seasonal effects should be included where appropriate.

Seaweed can be a very efficient collector of Tc. In most of the Nordic countries there are already some monitoring programmes which involve the collection of seaweed, e.g. for monitoring the concentration of Cs-137 and some other

radionuclides. With some harmonisation these monitoring networks could be used to compile information concerning the distribution of Tc-99 and the data could also be used for uptake studies.

The Tc-99 studies are very expensive and they have to be based to a large degree on national resources.

4.3 BOK-2.2.2 Biological and biogeochemical processes

The aim with this part of the BOK-2.2 project is to present an overall view over radionuclide processes in the Baltic Sea and its catchment and adjacent areas. Most of this analysis will be done using data already available. Some tasks will however require field and laboratory studies.

The main emphasis in this section would be on the use of Cs-137 and Sr-90 as tracers for outflow of contaminated water masses into, in and out from the Baltic Sea (e.g. along the Norwegian coast) and for determining residence times for Cs-137 and other radionuclides in the Baltic Sea and its drainage area. Additionally a set of specific issues would be dealt with.

The two types of studies described above can be linked. The work plans for both of them are therefore presented here together.

4.3.1 Task list

The following list of tasks is does not describe independent topics, it is rather a checklist of factors to include in the study.

The relationship of the tasks can be structured in the following manner:

- Use of Cs-137 and Sr-90 as tracers
    - for outflow of contaminated water masses from
        - rivers into the Baltic Sea (the importance of mires in the drainage area of export to lakes and the Baltic Sea).
        - Gulf of Bothnia and Gulf of Finland into the Baltic Proper
        - the Baltic Sea (outflow) into the North Sea and the Cs-137 trace along the Norwegian coast
    - for determining residence times, f.x. for Chernobyl caesium, fall-out caesium and other radionuclides (f.x. Pu) in the Baltic Sea and its drainage area
        - the residence time in lake water rel. hydraulic residence time in mire lakes - important long term reservoirs for draining into the Baltic Sea.
- Synthesis of data collected from the 1950's to the present
- Assess the dynamic distribution over long time following contamination of the Baltic Sea and its catchment area
- Effects of organic material for runoff of radionuclides into the Baltic Sea
- Remarkable seasonal variations f.x. temperature, biological production, ice conditions, etc. affecting the radionuclide processes

- Proportion of sedimentation in the total inventory of Chernobyl caesium in the Baltic Sea
- Use of Tc-99 as tracer for Sellafield discharges in different regions of the Baltic Sea (cf. Tc part of the project)

4.4 Work plans for BOK-2.2

The submitted work plans can currently be found on the BOK-2 web pages: http://www.gr.is/bok-2/

The following institutes have at the time of writing declared that they intend to participate in BOK-2.2 and all have submitted plans for their proposed work.

Participating institutes (as of August 14th):

Risø National Laboratory[1,2] (DK)

University of the Faroe Islands[1] (FO)

The Faroese Fisheries Laboratory[1] (FO)

Radiation and Nuclear Safety Authority[1,2] (FI)

Icelandic Radiation Protection Institute[1] (IS)

Norwegian Radiation Protection Authority[1,2] (NO)

Institute of Energy Technology[1,2] (NO)

Agricultural University of Norway[1,2] (NO)

Institute of Marine Research[1,2] (NO)

Lund University[1,2] (SE)

1: Participates in Tc-99 study
2: Participates in Baltic Sea study

5. Proposed organisation of project work

5.1 Project group meetings

It is planned to hold project group meetings twice per year, and when possible in connection with other events such as seminars. It has been suggested to hold the first project group meeting in November this year.

5.2 Seminars

Seminars will be held in a similar manner as was done within the EKO-1 project within the previous period. The experience gained then will be used to make them as cost effective as possible.

5.3 Distribution of information - Use of the WWW

The World Wide Web (WWW) has been used extensively during development of the project plans. This has enabled the group to develop the plans in an open manner giving as many as possible a chance to comment on the proposals at the various stages of development. It is proposed that the WWW should be used further during the project period to:

1. Distribute information within the project group
2. Make information on the project available to others, e.g. participants in other NKS projects or possible co-operation partners in the Baltic States or the EU.

5.4 Quality Assurance - Links with work within BOK-1.1

The use of geographical information systems (GIS) to make assessments for large regions using many different types of data sets has been rapidly expanding. This has lead to the increased exchange of data. It is even more important than before that the submitted data is of good quality since a small number of poor data sets can corrupt a large number of analyses. It is therefore highly desirable that the NKS puts even more emphasis on quality assurance than has been done before. This should involve:

1. improvement of current measurement techniques
2. intercomparisons to check status and whether improvements have been made
3. assistance in adopting and testing the feasibility of using new methods for analysis of radionuclides, e.g. through training or a methodological seminar.

The emphasis on improvements and intercomparisons is fairly self-explanatory. It should be pointed out, however, that "adopting and testing the feasibility of using new methods for analysis of radionuclides" does not mean developing new methods. New methods have been and are constantly being developed. It is important that the Nordic countries keep up with the development and maintain a high standard of analyses on an international scale. Some of these new methods make use of mass spectrometry (MS), which could be a sensitive method for the analysis of some long lived radionuclides. A number of the early problems with interfering nuclides have now been overcome with high-resolution MS. Some problems can still arise, these can depend upon the nuclides, sample matrix and the instrument available for analysis.

Many of the laboratories participating in BOK-2 have indicated their intention to use or test the use of mass spectrometry for the analysis of Tc-99. Other planned applications include measurement of stable Cs and Sr and determination of Pu-

isotope ratios, including 240/239 ratios, for resolving Chernobyl derived Pu from global fallout Pu. In most cases high resolution ICP-MS will be used, but even more sophisticated methods such as Accelerator Mass Spectrometry (AMS). This makes a co-ordinated effort on QA in mass spectrometry all the more important.

According to the suggestions of the NKS Program Group, quality assurance in laboratory measurements will be dealt with in the BOK-1 project. The BOK-2 pre-project group considers this work to be very important and recommends good contacts between the BOK-1 and the BOK-2 projects on this issue. It is essential for the planning work in BOK-2 that it becomes clear as soon as possible what will be done within BOK-1 on quality assurance in laboratory measurements.

5.5 Links with BOK-1.4 Countermeasures in agriculture and forestry

The BOK-1.4 sub-project is summarised in the following manner by the project group:

> *The objective is to create a handbook (data base) on dose-reducing countermeasures in agriculture and forestry. The target group is both authorities and the agricultural and food-industry end-users. The handbook will contain information on dose reduction and economical consequences of various countermeasures, as well as strategic considerations taking into account social factors, international trade, and national economical factors.*

There is an obvious relationship between BOK-1.4 and BOK-2, e.g. BOK-2.1.1 *(Radioecological vulnerability)*. It is therefore preferable that some form of link should be created between these projects.

5.6 Relations to and contacts with work organised by EU and IAEA

The BOK-2 project proposal is related to work done or proposed in other projects, within and outside the NKS. The relationship with the BOK-1 project proposal has already been discussed in the previous section. The relationship and contacts already established with the EU Framework Programme project SAVE were discussed in chapter 0, *Relationship of BOK-2.2.1 to the European Union's project SAVE*.

Many of the participants in the BOK-2 pre-project planning group will be attending an IAEA conference on the marine environment which will be held in Monaco in October this year (1998). Some results of the EKO-1 work in the previous project period will be presented there. The NKS presence would have been greater still if this conference had not been after the end of one project period and when the next one is just to start. This shows the importance of ensuring somehow the continuity from one project period to the next one. This makes it much easier for the NKS to maintain the international profile which is preferable for links to work done on an international basis. The NKS has already

taken certain steps in this direction, e.g. by starting the planning process early and by enabling certain components of proposed projects to start before the project proposals are formally accepted.

5.7 Co-operation with the Baltic States

Representatives from the Baltic States were invited to participate in work on quality assurance in the last NKS period. This could now be extended to joint seminars on selected aspects of radioecology. In recent years there has been considerable growth in this field in the Baltic States and more contacts could be beneficial for both parties. Possibilities of co-operation within BOK-2.1 and BOK-2.2 should be investigated.

6. Budget estimate for BOK-2

The project group has based its project plan on the following preliminary budget estimate originally suggested by the NKS Programme Group:

1998: 1130 kDKK
1999: 1650 kDKK
2000: 1650 kDKK
2001: 1450 kDKK

A budget estimate for possible funding of applied research in each participating country per year was derived in the following manner. The above estimates of NKS funding where used as a starting point. Estimated cost of project leadership was then subtracted as well as the estimated funding for seminars, printing etc. The remaining sum was divided into 5.5 equal shares which represent the available funding for BOK-2 applied research in each country. This amount was then divided into two equal shares representing the amount available for research to each country for BOK-2.1 and for BOK-2.2 respectively.

The resulting budget estimate individual parts of the project work can be seen in the following table

	1998	**1999**	**2000**	**2001**
NKS funding	1130	1650	1650	1450
Project leadership	200	300	300	300
Seminars, printing, etc.	50	30	30	30
Amount left for research	880	1320	1320	1100
BOK-2.1 research in each country (same amount for BOK-2.2)	80	120	120	100

(All amounts are in kDKK)

The figures in this table are not final. They represent estimates based on data available at the time of writing. The assumptions made and possible changes of the amounts are explained in the following paragraphs.

The figures for 1999-2001 were put forward for planning purposes. They do not constitute any commitment by the NKS. Indeed, Torkel Bennerstedt, executive secretary of NKS, has indicated that the budget for NKS projects in general will most likely be less than these figures indicate.

The project group believes that seminars / work shops are an important part of the proposed BOK-2 project. This view was supported at the NKS reference group meeting in Stockholm, June 1998. There it was also suggested that the NKS might actively help to try to obtain outside funding for seminar work. The figures in the table are based on the assumption that some non-NKS financial support can be obtained.

It was decided to give equal support to applied research in each country, provided that satisfactory applications were submitted in the form of work plans in accordance with the project goals. Equal division between BOK-2.1 and BOK-2.2 was also assumed within each country.

It is possible to argue for many different ways of dividing the available NKS funding. All Nordic countries could no doubt produce work plans justifying whatever funding was made available to each. The organisation of radioecological research varies considerably from one Nordic country to another, which makes comparison more difficult. The argument behind the equal division principle was that the funded research should be of similar relevance for all the participating countries. All proposals for work plans, however, are subject to criticism by all members of the pre-project planning group (later the BOK-2 project group) and the NKS reference group as well as other governing bodies of the NKS. A work plan will only receive funding after having been generally accepted as being in line with the BOK-2 aims and up to the standard of work adopted in the project. The equal division principle does therefore not mean an automatic uncritical division of funds. It means an equal opportunity to receive funding.

The method of dividing the available NKS funding was discussed at the BOK-2 meeting in Sorø, Denmark, May 1998. The equal division principle was proposed and accepted without objections. No objections were raised by the NKS reference group either.

The University of the Faroe Islands has participated actively in the NKS projects on radioecology during the previous two NKS periods. It was also invited to send in work plans for the proposed BOK-2 project. Proposals were received for work in accordance with the main aims of both BOK-2.1 and BOK-2.2. It is assumed here that BOK-2 project work in the Faroe Islands will receiving funding corresponding to 50% of each of the five Nordic Countries. Previously Faroese project work has received funding on an equal basis where they have participated. The total amount now is of a similar magnitude as before, but the work covers a much wider field.

The cost of project leadership includes not only compensation to the project leader's institute for the work, but also for various other costs, e.g. travels and communication (internet, maintaining a project World Wide Web server). The

cost of project leadership is a matter of negotiation between the project leader's institution and the NKS. Neither the project group nor the project leader has any formal influence thereon.

It is important to stress however that these proposals reflect considerable cuts compared to the corresponding combined EKO-1 and EKO-2 work in the previous project period. The assumed budget means that various types of previously supported Nordic co-operation in radioecology is not supported. There is therefore the risk of loss of not only Nordic co-operation in these fields, but also loss of competence. The pre-project group hopes therefore that it will be possible to increase rather than cut the BOK-2 project budget.

7. Appendix

7.1 Explanations of some abbreviations used

EU	European Union
FOA	Defence Research Establishment (SE)
GIS	Geographical information system(s)
Gr	Icelandic Radiation Protection Institute
HR-ICP-MS	High resolution inductively coupled plasma mass spectrometry
ICP-MS	Inductively coupled plasma mass spectrometry
MS	Mass spectrometry
NKS	The *Nordic Nuclear Safety Research* co-operation. The abbreviation NKS can cover all activity and persons associated with the Nordic Nuclear Safety Research. However, when a reference is made in this report to the views or decisions of the NKS without further specification, the abbreviation is used to refer to the NKS Board, the executive secretary, the reference group or its chairman, or some other governing body of the NKS.
NRPA	Norwegian Radiation Protection Authority
RALA	Agricultural Research Institute (IS)
SLU	Swedish University of Agricultural Sciences
SSI	Swedish Radiation Protection Institute
STUK	Radiation and Nuclear Safety Authority (FI)
WWW	World Wide Web (on the Internet)

(In some cases the abbreviations refer to words in a Nordic language and may therefore show little connection with the English explanation)

nks

Nordisk kernesikkerhedsforskning
Norrænar kjarnöryggisrannsóknir
Pohjoismainen ydinturvallisuustutkimus
Nordisk kjernesikkerhetsforskning
Nordisk kärnsäkerhetsforskning
Nordic nuclear safety research

SBA-1

Trusselbildet fra nukleære installasjoner i Nordens nærområder

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1999-01-25

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Forord

Programgruppen har foreslått at NKS aktiviteter i kommende periode, 1998 - 2001, samles i to hovedområder, «Sikkerhet og Strålskydd» (SOS) og «Beredskap og Konsekvenser» (BOK). Visse aktiviteter med tilknytning til sikkerhet og beredskap er sektorovergripende i forhold til de to foreslåtte hovedområdene og det er derfor i tillegg foreslått et tverrgående prosjekt «Sikkerhets- og beredskapsrelaterte aktiviteter» (SBA). Slike sektorovergripende aktiviteter er viktige med tanke på å sy NKS-programmet sammen til en helhet. Trusselene fra nuklære installasjoner i Nordens nærområder evalueres ved å følge enkelte scenarier fra kilden til utslipp og fram til eventuelt opptak i næringskjedene og doser til mennseker hvilket fanger opp aspekter gjennom hele programmet.

Trusselbildet fra nukleære installasjoner i våre nærområder

1. Summary

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 be 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 will be to prepare a list of projects and reports that have been produced.

Based on the literature, work shops and seminars will be conducted to discuss the different findings and to aggregate the results.

If gaps of knowledge are identified, the project group may initiate further studies or identify the needs for the consideration of national organisations and authorities.

The project will deal with the geographical area including the north west of Russia and the Baltic states. At a later stage of the project, other areas may be included.

The project will focus on potential events in nuclear installations and the consequences for the Nordic country especially on:

- vulnerable food chains
- doses to man
- environmental
- the emergency preparedness system

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

The nuclear installation that will be investigated in the project are:

- threats from nuclear power plants (Kola NPP, Ignalina NPP, Leningrad NPP)
- threats from ship reactors (icebreakers and submarines)
- threats from storage and handling of used fuel and radioactive waste

Project activities planned are:

- Making a literature list
- Work-shops and seminars on the different subjects
- Making web-sites
- Complementary studies

The project will be organised with a project leader and a project group which will co-ordinate the different tasks and keep the whole project together. Working groups may be established to perform different tasks such as organising workshops, making summary reports and identify gaps of knowledge.

2. Innledning

Det er viktig at de nordiske myndigheter har en god oversikt over trusselbildet for å kunne gi beslutningstagere, almenhet og media en velkvalifisert vurdering ved en hendelse ved nukleære installasjoner i våre nærområder. Faglige diskusjoner om trusselbildet i forkant av en eventuell ulykke er nødvendig for å få avdekket eventuelle ulike nordiske oppfatninger av de nukleære truslene og konsekvensene av dem. Det er svært viktig i dagens samfunn å framstille et troverdig bilde av situasjonen ved en eventuell ulykke og begrunnelse for våre tiltak for å begrense skadevirkningene for samfunnet. Prosjektet vil også kunne bidra til å dimensjonere det enkelte lands atomulykkesberedskap på en optimal måte.

De viktigste nærområdene av denne art er deler av nordvest Russland (Murmansk, Arkhangelsk, St. Petersburg) og Baltikum.

3. Formål

Formålet med prosjektet er å gi en oversikt over de nukleære virksomheter i Nordens nærområder som kan gi negative konsekvenser for det enkelte land og peke på de installasjoner der en ulykke ville kunne gi radiologiske konsekvenser for Norden.

Resultatene skal bli en realistisk, felles nordisk kunnskapsbase som beskriver trusselen i forbindelse med nukleære aktiviteter i NV Russland og Baltikum, herunder også konsekvensene av mulige ulykker. NKS kan være et viktig forum for presentasjon av nasjonale prosjekter som omhandler nukleære installasjoner i våre nærområder og for gjensidig informasjonsutvikling.

Prosjektet tar sikte på å gi en faglig oversikt over tenkelige ulykkesscenarier ved ulike nukleære anlegg og gi en beskrivelse av hvilke konsekvenser disse vil få for hendelsens nærområdene, hvilke påvirkninger den kan få på miljøet på kort og lang sikt og om hvilke konsekvenser disse kan ha for Norden. Det er viktig i denne sammenheng å gi en faglig begrunnelse for at hendelser ved mange nukleære anlegg i våre nærområder ikke vil ha radiologiske konsekvenser for naboland.

Prosjektet er tenkt bygget opp med en rød tråd fra anlegget/kilden og scenario for mulige ulykker med utslipp, via spredningsberegninger gjennom luft og vann og til konsekvens i form av radioaktiv forurensing av miljøet, opptak i næringskjeder og doser til mennesker.

Hovedkilder til utslipp:

Det er ytret ønske om å begrense antall ulike utslippskilder i forhold til programgruppens forslag og en vil i starten av prosjektet fokusere spesielt på :

- kjernekraftverk
- reaktordrevne fartøyer
- lagring og håndtering av brukt brensel og radioaktivt avfall

Det er ofte store usikkerheter i våre estimater av konsekvensene av en ulykke på nukleære anlegg i våre nærområder. Prosjekter innen SBA 1.1 «Trusselbildet fra nukleære installasjoner i Nordens nærområde», kan gi oss en felles plattform for analysen av situasjoner med ulykker ved nukleære installasjoner i våre nærområder som kan resultere i at de enkelte lands faglige vurderinger gir et mer sams bilde av konsekvensene for hvert enkelt nordisk land.

4. Forventede produkter

Gjennom prosjektet skal det produseres en kunnskapsbase over kilder i Nordens nærområder og mulige konsekvenser for de nordiske land. Denne kunnskapsbasen skal settes sammen fra eksisterende undersøkelser, evt. kompletert med nye. I de rapporterte data skal det **ikke** gjøres rangeringer kildene i mellom når det gjelder risiko, men kun presenteres et så godt som mulig faktagrunnlag. Rapporteringen kan skje i form av litteraturoversikter, seminarrapporter og web-sider og skal være i en slik form at den skal kunne brukes av myndigheter, media og publikum.

5. Prosjektets faglige innhold

Prosjektet skal se på helheten og sammenstille undersøkelser av konsekvensene av de nukleære truslene i våre nærområder. Prosjektet bør kommer fram til hvilke potensielle effekter hendelser ved ulike nukleære installasjoner kan få for våre områder og hvilke skadevirkninger som kan forventes.

Det bør spesielt fokuseres på:

⇒ sårbare næringskjeder
⇒ doser til mennesker
⇒ miljøkonsekvenser
⇒ beredskapskonsekvenser

I Norden brukes det ulike spredningss- og deposisjonsmodeller for beregninger av transport og deponering av radioaktive stoffer fra en utslippskilde. De estimerte resultatene kan ofte variere og sammenligning og diskusjon av resultater og metoder er viktige.

De fleste nordiske land har ulike naturtyper som spenner fra produktive tempererte jordbrukssystemer, videre til store skogsområder som lengst mot nord ender i fattige høyfjellssystemer. Radioaktive stoffer i de ulike økosystemene har

svært forskjellig transport- og oppholdstid som dermed vil ha stor betydning for hvilke konsekvenser et radioaktivt nedfall vil få i ulike geografiske områder. Radioaktivt nedfall over landsdeler der bruk av næringsfattige utmarksområder til beitedyr, jakt, fiske, rekreasjon og turisme er viktig vil kunne gi langvarige skadevirkninger.

Arktiske områder er ofte mer sårbare for radioaktiv forurensing enn mer tempererte områder og det kan derfor være behov for supplerende studier næringskjeder i disse områdene.
Prosjektet bør ta for seg transport av radioaktiv stoffer i følgende økosystemer:

- Marine økosysterer
- Akvatiske økosystemer
- Terrestiske økosystemer

Det er svært viktig at det gjennom prosjektet holdes nær kontakt med de øvrige NKS-prosjektene og de miljøer som er representert der.

5.1 Trussel fra kjernekraftverk i våre nærområder

Det er utført en analyse av ulykkessekvenser og konsekvenser for norsk område ved en ulykke ved Kola NPP under ulike meteorologiske forhold. Andre studier av ulykker ved Kola NPP er gjort ved FOA, Umeå. Finske myndigheter har gjort beregninger av konsekvensene for Finland ved ulykker ved andre russiske kraftverk. Studien kan kompletteres med tilsvarende analyser for de andre nordiske land. Tilsvarende studier kan også tenkes gjennomført for Leningrad NPP og Ignalina NPP.

I tillegg til sammenstilling av de undersøkelsene som i dag er tilgjengelig bør det kunne utføres komplementerende nasjonale prosjekter. Finske beregninger som er utført gjøres tilgjengelig for de andre nordiske land ved oversettelser til engelsk.

5.2 Trusselen fra skipsreaktorer i Nordens nærområde

Reaktordrevne fartøyer fra våre naboland kan være en potensiell kilde til radioaktiv forurensing i Norden. Det er gjort en del generiske studier av ulike skipsreaktorer og sikkerheten ved disse. Nye studier har gjort beregninger av utslipp, spredning og konsekvenser ved reaktorhavarier på havet og ved land. Kjente ulykker bør beskrives og kommenteres. Ulike scenarier bør beskrives ut fra fartøytyper, deres tilstand, bruksfrekvens etc.

Ulike kategorier av mulige ulykker kan belyses:

- hendelser forbundet med operative nukleært drevne fartøyer (ubåter, isbrytere)
- hendelser forbundet med nukleære fartøyer under dekommisjonering
- hendelser forbundet med oppbevaring og håndtering av brukt kjernebrensel

5.3 Trusselen ved lagring og håndtering av brukt brensel og radioaktivt avfall

På Kola-halvøya er det en rekke scenarier som inkluderer brukt brensel av ulike slag. Hele problemområdet rundt dekommisjonering av u-båter, opprydding i forhold til tidligere aktiviteter (f.eks. Lepse og Andreevabukta) og handtering av brukt brensel i operativ sammenheng er felter som man kan se på. Det finnes på disse områdene en god del viten, men f.eks. scenarier med kritikalitet i disse sammenhenger er ikke godt utredet, selv om et prosjekt for tiden ser på kritikalitetsforhold i utrangerte u-båtreaktorer. Hovedfokus under dette området bør ligge på mulige kritikalitetsulykker og deres konsekvens for omgivelsene.

Det skjer transporter av brukt brensel til lands og til vanns i området. Dette representerer neppe noen trussel for nordisk område, men bør likevel inkluderes.

Selv om dumpet og utilfredsstillende lagret avfall ikke representerer noen realistiske ulykkesscenarier, bør man sette sammen en vurdering av mulige konsekvenser for overføring av doser til mennesker og miljøkonsekvenser. Spesielt med henblikk på fiskeriressursene, da dette er et svært viktig spørsmål for noen av de nordiske land.

Gjennom en rekke bilaterale og multilaterale assistanse og utredningsprosjekter er det i de ulike nordiske land akkumulert stor kunnskap om problemer knyttet opp mot disse spørsmålene. Prosjektet vil fokusere på å sammenstille den samlede nordiske viten.

6. Prosjektaktiviteter

Det er viktig å få med institusjoner som har kunnskap innenfor de ulike faggruppene. Der kunnskap mangler vil gruppenes arbeid måtte ha basis i pågående eller kommende nasjonale prosjekter, samt initiere framtidige prosjektet etter behov. Resultatene av de ulike delprosjektene sammenstilles og presenteres på et sluttseminar.

Samarbeid med andre sikkerhets-, og beredskapsrelaterte prosjekt innen NKS er også en forutsetning for en vellykket gjennomføring av prosjektet.

NKS arbeider (rapporter, seminarer ol.) som produseres i løpet av prosjektet er til bruk for de nordiske myndigheters beredskapsarbeid. Andre lands myndigheter og hver enkelt nordisk lands samarbeid med andre lands myndigheter skal ikke berøres av prosjektet.

I det følgende er de ulike skritt i prosjektet presentert:

6.1 Litteraturoversikt

I tidlig fase av prosjektet vil det bli laget en nordisk oversikt over prosjekter, rapporter ol. som omhandler nukleære trusler i våre nærområder og da først og fremst NV Russland og Baltikum. Arbeidet ble startet opp i forprosjektet, men for

å få et vellykket resultat er vi avhengig av at forprosjektdeltagerne og andre bidrar med de respektive lands arbeider om tema.

Det vil bli laget en oversikt over de ulike nordiske lands «øst-prosjekter» og planer om framtidige prosjekter.

Litteratur- og prosjektoversikten vil bli presentert på hjemmesiden for prosjektet men kan også gjøres tilgjengelig for andre.

Denne delen av prosjektet vil kunne komme fram til eventuelle kunnskapshull som videre kan initiere nye nasjonale forskningsprosjekt.

Denne aktiviteten videreføres i hele prosjektperioden og det drives en kontinuerlig oppdatering av litteraturoversiktene etter innspill fra deltagerne.

6.2 Work-shops og seminarer

Gjennom arbeidsmøter og seminarer diskuteres oversiktsforedrag og spesialistpresentasjoner innenfor de ulike temaområdene. Resultatene fra disse møtene samles i rapporter som oppsummerer diskusjonen der det gis oversikter over den viten som fremkommer. I et felles, større seminar presenteres totalbildet slik det framgår i prosjektet.

6.3 Hjemmesider

Det utvikles en intern web-side for der de nordiske strålevernsmyndigheter og beredskapsorganisasjonen kan finne informasjon om ulike hendelser og mulige konsekvenser

Det utvikles en åpen web-side med lett tilgjengelig informasjon til journalister, politikere, studenter ol.

Denne delen av prosjektet bør gjøres i nært samarbeid med informasjonsprosjektet.

6.4 Kompletterende studier

Prosjektet skal ikke starte opp komplementerende studier, men kun finne kunnskapshull og derigjennom inisjiere nye nasjonale prosjekter finansiert av andre.

7. Prosjektorganisering

Prosjektet foreslås videreført gjennom en **prosjektgruppe** med prosjektleder og medlemmer fra organisasjoner innen de nordiske land som forventes å ha gode kontakter og oversikter innenfor de berørte fagmiljøer. Det bør være en hovedkontakt fra hvert land. Prosjektgruppen følger opp prosjektets gang, sørger for oppdatering av litteraturlisten og initierer arbeidsmøter og seminarer.

Under prosjektgruppen oppnevnes **arbeidsgrupper** som står for arrangement av arbeidsmøtene og seminarene, oppfølging og rapportering. En egen arbeidsgruppe får ansvar for utarbeidelse og innhold i web-sidene. Arbeidsgruppene rapporterer til prosjektleder.

Det vurderes å gis i oppdrag til en konsulent å stå for den praktiske innsamling av rapporter, samling av summaries og skriving av hovedrapportutkast.

Deltagere i seminarer og arbeidsmøter vil være fra sentrale miljøer hvor man kjenner til de undersøkelser som er gjort.

8. Tidsplan

Tabell 1a: Oversikt for aktiviteter i SBA-1

AKTIVITET	**1998**		**1999**		**2000**		**2001**	
SBA-1: Trusselbildet fra nukleære installasjoner i våre nærområder	1. halvår	2. halvår	1. halvår	2. halvår	1. halvår	2. halvår	1. halvår	2. halvår
A. Trusselen fra nukleære installasjoner i våre nærområder								
A. 1. Trussel fra kjernekraftverk i våre nærområder	S		A	S	A			
A. 2 Trussel fra skipsreaktorer i Nordens nærområde	S		A					
A. 3. Trussel ved lagring og håndtering av brukt brensel og rad. avfall	S			A	A			
B. Kunnskapsbase for nukleære trussler i våre nærområder								
B.1. Litteraturoversikt	XX	XX	X	X		A		A
B.2. Hjemmesider / web	X	XX	X		X	X	X	
B.3. Work-shops / seminarer		A		A		A		
B.4. Komplementerende studier			R		R		R	
Prosjektmøter	X	X	X	X	X	X	X	X
Sluttseminar							S	R

X: Aktivitet A: Arbeidsmøte
S: Seminar R: Rapportering

9. Budsjett

Tabell 1b: Budsjett for SBA-1

Budsjett for SBA prosjektet NKS finansiert i 1000 DKR	**1998**	**1999**	**2000**	**2001**
SBA-1: Evaluering av trusselbildet fra nukleære installasjoner i våre nærområder				
A. Trusselen fra nukleære installasjoner i våre nærområder				
A. 1. Trusselen fra kjernekraftverk i våre nærområder		50	50	
A. 2 Trusselen fra skipsreaktorer i Nordens nærområde		50	50	
A. 3. Trusselen ved lagring og håndtering av brukt brensel og radioaktivt avfall		50	50	
B. Kunnskapsbase for nukleære trusler i våre nærområder				
B. 1. Litteraturoversikt	50	*	*	*
B. 2. Hjemmesider/web	*	*	*	*
B.2. Work-shops og seminarer	50	50	50	
B.4. Komplementerende studier	*	*	*	*
Prosjektledelse/prosjektgruppe **	50	200	150	150
Sluttseminar/rapport ***				300
Sum totalt	150	400	350	450

* Prosjektet er avhengig av tilleggs finansiering fra de enkelte deltagerlandene

** Dekker reiser/opphold i forbindelse med arbeidet i prosjektgruppa og prosjektledelse

*** Dekker utgifter til sluttseminar og trykking av sluttrapport

10. NKS Prosjektkriterier

Kriterium	Oppfyllelse
Nordisk perspektiv	Ja, hele Norden vil kunne ha nytte av prosjektet
Faglig innhold på høyt int. nivå	Prosjektet vil først og fremst sammenstille «state of the art» når det gjelder undersøkelser som er gjort
Nyhetsverdi	En kunnskapsbase av denne art vil være en viktig nyhet
Helhetssyn og rød tråd	Prosjektet er nettop designet for å finne en helhet i vår forståelse av problemstillingene. det gripåer over en rekke fagområder og prøve å avdekke «hull» i vår viten
Verdi for anvendere og finansierere	Ja, viktig kunnskapsbase, spesielt for myndighetene
Praktiske resultater	Anvendelige oversikter gitt ved seminarer rapporter og web-sider
God resultatspredning	Rapporter og websider vil ha en bred målgruppe
Kostnadseffektivitet, tydelige mål, arbeidsform	Arbeidet vil foregå ved arbeidsmøter og seminarer hvor eksperter kan få fram et helhetsbilde og avdekke manglende viten
Koordinering med EU	Man søker så langt som mulig å inkludere resultater fra internasjonale studier som berører Norden, og påse at det ikke gjøres dobbeltarbeid
Koordinering med Øst-prosjekter	Prosjektet vil blant annet utnytte resultater fra forskjellige østprosjekter og om mulig foreslå at det gjennomføres andre. Man prøver å involvere nordiske eksperter med oversikt over østprosjektene i prosjektet

11. Annex

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11.2 Kommentarer til programgruppens forslag

Intensjonene i det forelagte prosjekt følger opp programgruppens rapport og senere arbeid i referansegruppen: Prosjektet skal først og fremst søke fakta og sammenstille dagens viten slik at myndigheter, media og befolkning kan bruke materialet til sine formål.

nks

Nordisk kernesikkerhedsforskning
Norrænar kjarnöryggisrannsóknir
Pohjoismainen ydinturvallisuustutkimus
Nordisk kjernesikkerhetsforskning
Nordisk kärnsäkerhetsforskning
Nordic nuclear safety research

SBA-2

Information

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Beredskabsstyrelsen

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Proposal for Information Projects during the 1998-2001 NKS Period

In the Nordic countries it was, above all, the Chernobyl disaster that opened the eyes of the responsible authorities to the fact that preparedness is not merely a question of technical prowess, of measuring instruments - and results.

Suddenly one was faced with a tremendous information task. About a subject that was difficult to grasp. To an unprepared population, and from an unprepared unpractised sender. With a vague picture of matters of authority. With a confusing, non-uniform nomenclature. With conflicting decisions as to measures to be taken within a few kilometres - in connection with borders in the otherwise quite uniform Nordic countries.

More aspects of this information chaos could be enumerated. But the tendency is clear.

Information *was* given to the population. Sometimes this was not the merit of the authorities. Sometimes the experts took upon themselves to answer the population's questions - at the expense of jobs they should have carried out, as experts within their respective fields.

When the first hectic months had passed, there was no doubt that the information task was one of the areas that had to be looked into. Also in a Nordic context. For part of the experience from these months had to do with the confusion that can arise when diverse measures are implemented in dense geographic areas without anyone being able to explain why.

In October of 1988 a seminar was held under Nordic auspices and attended by representatives of the authorities and by journalists. It was held at Vikersund, Norway, for the purpose of discussing how to improve the handling of information to the public next time it was called for.

This became the foundation for a significant and fruitful Nordic co-operation on how to provide the public with the best possible information regarding nuclear questions.

During the forthcoming project period NKS should continue to focus on matters of a common Nordic interest: how to inform about a difficult subject in a modern society - how to provide advance information - how to inform when the accident has occurred - and how to inform about NKS and projects.
These are some of the crucial subjects that the Nordic authorities need to consider. This may be done separately - but the result will be better if you do it together!

1. How to inform about a difficult subject in a modern society

1.1 Study of the Nordic authorities' strategy and attitude towards information about radiation

The project must map out any potential differences in the authorities' strategy. A similar European study has been carried out involving, i.a., Sweden and Norway. A study covering all the Nordic countries would be interesting and comparable with the results from INEX-2-FIN.
Participants: a Finnish and a Danish consultant.
A rather brief period (months)

1.2 Communicating about risks and in crises, and charting out new channels and target groups

There is a need to determine the factors that influence the perception of danger/risk and how messages are perceived under pressure. All authorities regularly test the known channels of communication - with varying results. Society's increasing access to communication and definitions of target groups must be specified if it is hoped to penetrate the tangle of information.
Participants: information chiefs from the Nordic authorities + SRV, SPF, etc.
This is a multi-annual project.

2. How to provide advance information

2.1 Contact seminar for authorities, the industries, and the media

These seminars are upholding a good tradition (from 1988, 1991, 1993, and 1995). The aim of the work should be to render the results of the NKS projects visible and applicable. Proposed time and place: autumn of 1998 in Norway.
Participants: information chiefs (Carl-Erik Christoffersen is part-project manager).
Planning period: up to the time of the seminar in 1999.

2.2 Sellafield in a Nordic perspective / Fact-finding Mission to Sellafield

Favourable experience from similar trips to, respectively, Forsmark/Sosnovoj Bor and Kola supports the proposal for a trip in, for example, the spring of 1999 - to England.
Participants: the information chiefs and experts from the Nordic authorities (Vibeke Hein is part-project manager).
The planning period will extend up to the time of implementation.

3. How to inform about NKS

3.1 General information about NKS

Maintaining the authorities' list of information material.
The direct mode of information from the authorities to the public is still catered for in the traditional manner via distribution of brochures, videos, and homepages. To ensure that Nordic knowledge of the authorities' information material is widespread (also amongst the authorities themselves), the list must be kept up-to-date at all times.
Participants: information chiefs from the Nordic authorities (Carl-Erik Christoffersen is part-project manager).

Revision of "Basfakta" (basic facts).
"Basfakta" contains a description of basic terminology within the fields of radiation protection, reactor technology, safety, and preparedness. NKS published a version during the 1990-93 project period; it now needs revision.
Participants: information chiefs from the Nordic authorities (Karin Wiklund is part-project manager).
To be carried out, e.g., during 1999.

Workshop for project managers and participants.
Proper information routines should be implemented from the start of the project period, and the new graphic profile for NKS should be presented soon.
Participants: information chiefs from the Nordic authorities (Vibeke Hein is part-project manager).
Should be carried out during the autumn of 1998 + later, as the case may be.

NKS homepages.
It must be ensured, in cooperation with the secretariat of NKS, that NKS' homepages appear professional and attractive.
Participants: the information chiefs and the secretariat of NKS (Vibeke Hein is part-project manager).
This process continues throughout the project period.

Being a multi-subject undertaking, it is natural that cooperation must be established with other projects under SOS and BOK. Certain informational aspects have already been specified. Others - including information tasks in connection with exercises - can be defined only as we go along.

Overall targets for communication and exchange of information in NKS

The overall target of the information projects under NKS is to assist the responsible authorities in the development of efficient and credible communication models for the population by

- enhancing the knowledge of information and communication of project managers and others who are working within the NKS system;
- increasing the familiarity of Nordic journalists with areas such as radiation protection and preparedness;
- implementing knowledge of and research into communication & information theory in the authorities' and NKS' ongoing work with information aspects; and
- strengthening the exchange of information among radiation protection & preparedness authorities as well as other relevant operators in the Nordic countries.

It is also important to strengthen the information about NKS activities, including to support the information aspects of each project. It is assumed that the costs of this part of the activities are incorporated into the individual projects.

Economy

Resources:

Forty "manweeks" have been allocated as work period (corresponding to DKK 320,000) and DKK 250,000 for travelling expenses with the authorities - total grant for the activity: *DKK 570,000.00*.

Activity	National grant	NKS grant	Total cost
1.1 Study of strategy	not calculated	DKK 100,000	DKK 100,000
1.2 Risk and channels	DKK 200,000	DKK 235,000	DKK 435,000
2.1 Contact seminar		DKK 100,000	DKK 100,000
2.2 Sellafield	DKK 80,000	DKK 100,000	DKK 180,000
3.1 General info tasks		DKK 170,000	DKK 170,000
Work hours & travels	DKK 570,000		DKK 570,000
Residual budget		DKK 230,000	
Total	DKK 850,000	DKK 475,000	DKK 1,555,000

1. How to inform about difficult subjects in a modern society

This activitiy has three parts/elements, and the aim is to analyse the demands made by "the new" society on the authorities which must be able to inform about risks with complicated technical installations and to quickly gain the confidence of the people in every possible type of crisis.

Changed media habits and technical innovations make new demands as to the information provided by the authorities.

The specific purpose of the activities is to evaluate and prioritise old and new channels/methods of information to the public, as well as to identify avenues to provide information to different target groups as found in complicated communities like the Nordic ones. In addition, it is desirable for the Nordic countries' radiation protection & nuclear safety authorities to hold certain common basic assessments - having regard to different national conditions.

Chronologically, the activity may be divided into three elements, where the attempt to identify the common basis of assessment is the starting point for the future work:

1.1 Study of the Nordic authorities' information strategy and attitude towards information about radiation and nuclear safety

Activity manager:
Carl-Erik Christoffersen (*Strålevernet*)

Objective:
The project must map out and compare possible differences between the attitudes and strategies of the Nordic authorities towards information on radiation and nuclear safety. A European project, in which Sweden and Norway are participating, is currently being carried out. The NKS project will therefore include Denmark, Iceland and Finland, so that results can be obtained from *all* the Nordic countries. Before an accident occurs it is important to know about the national differences, so as to be prepared to answer questions - also with respect to why it is like that. The questionnaire was drafted by the EU. It is discussed and completed by a consultant together with representatives of the national authorities.

Experience from INEX-2-FIN may be used for comparison. In combination, it may provide the authorities with a clearer picture of existing similarities and differences in attitudes and strategies.

To be carried out in:
1998

Resources:

Payment for working hours, external consultant	4 manmonths	NOK 75,000.00
Administrative costs	35% of 75,000	NOK 26,250.00
TOTAL		**NOK 101,250.00**

1.2 Communicating about risks and in crises, and charting out new channels and target groups

Activity managers:
Anders Jörle *(SKI)* + Karin Wiklund (*SRV*)

Participants:
The information chiefs of the NKS group or key persons in the information departments as well as cooperating authorities. Consultancy work is envisaged.

Objective:
Preparing - by means of current basic research - new strategies for communication with the public during crises. (Contacts regarding this subject have already been established with the EU, in that *Statens Räddningsverk* as well as the Danish Emergency Management Agency are represented on the EU Expert Group on Risk Communication).

Identifying and classifying target groups for communication before, during, and after crises. Identifying new channels for communication and detecting changes in the supply of media which affect the strategies of the authorities.

To be carried out in:
1998 to 2001.

Special importance is attached to communication during uncertain and unclarified events. It is a crucial question if the confidence of the people in the social system is stable or changing - and therefore calls for new strategies.

Method:
The participants will work in the form of seminar with external scientists to identify new strategies for information.
The project will start with a major seminar followed by a number of workshops. Coordination with Part Project 2 must be carried out at the initial seminar. The project is completed with a report to be presented at a seminar to a larger group which is affected by these matters.

Resources:

Consultants' fees, report writing, etc.	DKK 100,000.00
Costs of seminars (incl. speakers' travels)	DKK 250,000.00
Consultancy work and administrative costs	DKK 85,000.00
Total	**DKK 435,000.00**

SRV will contribute at the rate of SEK 200,000 to the activity in 1998.

2. How to provide advance information

2.1 Contact seminar for authorities, the industries, and the media

Activity manager:
Carl-Erik Christoffersen (*Strålevernet*)

Objective:
Creating the best possible basis for cooperation founded on mutual understanding of each other's roles. The need for exchange of information with the outside world about NKS results is great, and it can be properly satisfied by this type of arrangement, where subjects can be explained and placed in an actual context.

To be carried out:
During the project period in Norway, depending on current topics in the outside world or amongst the results of NKS. Possibly, the seminar may be held in combination with the NKS midway seminar, where many ressource persons will be gathered.

The project is a follow-up on earlier seminars between these groups.

Resources:
Budget for direct and indirect costs:

Payment for working hours consumed	2 manweeks @ NOK 5,076.00	NOK 10,152.00
Administrative costs	35% of NOK 10,152.00	NOK 3,553.00
Seminar premises, rent		NOK 130,000.00
Preparing and printing seminar material		NOK 5,500.00
TOTAL		**NOK 149,105.00**
Participation fees		NOK 50,000.00
Total cost to NKS		**DKK 100,000.00 (max)**

2.2 Sellafield in a Nordic perspective / Fact-finding Mission to Sellafield

Activity manager:
Vibeke Hein (Danish EMA)

Participants:
Information chiefs, experts and journalists from all NKS countries.

Objective:
Study tour to Great Britain for the purpose of studying, first and foremost, the waste problem. Discussions in the newspapers will be dealing, not least, with this subject, and it is therefore important that Nordic authorities should have had influence on the arguments and their weight. A visit to, for example, Sellafield and with the English authorities together with well-known representatives of Nordic authorities who can incorporate the information into a Nordic context will be important for the worth of the media coverage.

To be carried out in:
The autumn of 1998.

Resources:
Budget for direct and indirect costs:

Costs of lecturers and transportation	DKK 100,000.00
Premises, materials, and board	DKK 80,000.00
Total	**DKK 180,000.00**

The Danish Emergency Management Agency will contribute at the rate of DKK 50,000 to this activity.

3. How to inform about NKS

3.1 General information on NKS

Maintaining the authorities' list of information material

Activity manager:
Carl-Erik Christoffersen (*Strålevernet*)

Objective:
The project is intended to ensure that, in a preparedness situation, the Nordic authorities are familiar with the other authorities' information material.

Implementation:
The list of the authorities' information material will be revised up to twice every year.

Resources:
Working hours for revision per year: two days x 2 = 4 days.
In direct and indirect costs this amounts to:

Payment for working hours consumed	NOK 846.00 x 4	NOK 3,384.00
Administrative costs	35% of NOK 3,384.00	NOK 1,184.00
Costs of postage for distribution	NOK 8.00 x 300	NOK 2,400.00
TOTAL		**DKK 7,000.00**

Revision of "Basfakta"
Activity manager:
Karin Viklund

Participants:
Key personnel with the affected authorities.

Objective:
Maintaining and developing the common basic terminology already created.

Implementation:
The revision must be ready by year 2000.
This means that results derived from the other projects can be taken into account.

Method:
Each authority will start the work locally. Coordination will be effected at a joint workmeeting after having exchanged contributions.

Resources:
Working hours: **DKK 45,000.00**.

Workshop for project managers and participants.
Activity manager:
Vibeke Hein (Danish Emergency Management Agency)

Participants:
Project managers of and participants in NKS projects.

Objective:
Implementing proper information routines in connection with the carrying-out of NKS projects. Presenting the graphic profile of NKS.

To be carried out:
Early during the project period.

Resources:
Rent payable for premises, board, lecturers: **DKK 100,000.00**.

Homepages
Activity manager:
Vibeke Hein (Danish Emergency Management Agency)

Participants:
The information chiefs and the secretariat of NKS.

Objective:
Developing and making the homepages of NKS functional for the users.

To be carried out:
On an ongoing basis during the project period.

Resources:
DKK 20,000.00.

Participants in the project:

Denmark:
Vibeke Hein, head of information, Emergency Management Agency.

Finland:
Consultative public servant Tiina Peltola-Lampi, Ministry of the Interior.

Helvi Kaijomaa, head of information, *Strålsäkerhetscentralen* (STUK)

Iceland:
-

Norway:
Carl-Erik Christoffersen, head of information, *Statens Strålevern* (NRPA)

Helge Iversen, head of information, *Helsetilsynet*

Sweden:
Anders Jörle, head of information, *Statens Kärnkraftinspektion* (SKI)

Monica Carlson, information specialist, *Statens Strålskyddsinstitut* (SSI)

Karin Viklund, information specialist, *Statens Räddningsverk* (SRV)

Forslag til informationsprojekter i NKS-perioden 1998-2001

I Norden var det ikke mindst Tjernobyl-katastrofen, der fik de ansvarlige myndigheders øjne op for, at et beredskab ikke kun var et spørgsmål om teknisk formåen, om måleinstrumenter og -resultater.

Pludselig stod man med en meget stor informationsopgave. Om et svært tilgængeligt emne. Til en uforberedt befolkning. Fra en uforberedt, urutineret afsender. Med et uklart billede af kompetenceforhold. Med en forvirrende, uens nomenklatur. Med divergerende beslutninger om indgreb inden for få kilometer - i forbindelse med grænser i det ellers så ensartede Norden.

Flere aspekter i dette informationskaos kunne remses op. Men tendensen er klar.

Information kom der ud til befolkningen. Nogle gange var det ikke myndighedernes fortjeneste. Nogle gange tog de tekniske eksperter sig af at svare på befolkningens spørgsmål på bekostning af opgaver, de skulle have varetaget som eksperter på hvert deres felt.

Da de første hektiske måneder var overstået, var ingen i tvivl om, at informationsopgaven var et af de områder, der skulle gøres noget ved. Også i nordisk sammenhæng. For en af erfaringerne fra disse måneder hang sammen med den forvirring, der kan opstå, når der iværksættes forskelligartede indgreb i tætte geografiske områder, uden nogen kan forklare hvorfor.

I oktober 1988 afholdtes i nordisk regi et seminar med deltagelse af myndighedsrepræsentanter og journalister i Vikersund, Norge, for at diskutere, hvordan man næste gang kunne håndtere informationen til befolkningen bedre.

Hermed var grunden lagt til et væsentligt og frugtbart nordisk samarbejde om at give den bedst mulige information om nukleare spørgsmål til befolkningen.

I den kommende projektperiode bør NKS fortsat sætte fokus på spørgsmål af fælles nordisk interesse: Hvordan informerer man om et vanskeligt emne i et moderne samfund - Hvordan informerer man på forhånd - Hvordan informerer man når ulykken er sket - og Hvordan informerer man om NKS og projekter -.

Det er nogle af de centrale emner, som man i de nordiske myndigheder må tage stilling til. Man kan forsøge at gøre det hver for sig - men resultatet bliver bedre, hvis man hjælpes ad!

1. Hvordan informerer man om et vanskeligt emne i et moderne samfund

1.1 Studie af de nordiske myndigheders strategi og holdning til information om stråling

Projektet skal kortlægge eventuelle forskelle i myndighedernes strategi. Der er gennemført en tilsvarende europæisk undersøgelse, hvor bl a Sverige og Norge var involveret. En undersøgelse, der omfatter hele Norden vil være interessant og vil kunne sammenlignes med resultaterne fra INEX-2-FIN.
Deltagere: en finsk og en dansk konsulent
En kortere periode (måneder)

1.2 At kommunikere om risiko og i kriser og kortlægning afnye kanaler og målgrupper

Der er behov for at fastlægge, hvilke faktorer, der har indflydelse på opfattelsen af fare/risiko og, hvordan man kan opfatte budskaber under pres. Alle myndigheder afprøver jævnligt kendte kommunikationskanaler - med skiftende udbytte. Samfundets øgede kommunikationsmuligheder og definitioner af målgrupper må specificeres, hvis man skal gøre sig håb om at trænge igennem informationsjunglen.
Deltagere: informationscheferne fra de nordiske myndigheder + SRV, SPF m fl.
Er et flerårigt projekt.

2. Hvordan informerer man på forhånd

2.1 Kontaktseminar for myndigheder, industri og medier

Der er tale om videreførelse af en god tradition (fra 1988, 1991, 1993 og 1995). Der bør arbejdes med synliggørelse og anvendeliggørelse af NKS-projekternes resultater. Foreslås afholdt i Norge i efteråret 1998.
Deltagere: informationscheferne (Carl-Erik Christoffersen er delprojektleder)
Planlægningsperiode frem til afholdelsen i 1999

2.2 Sellafield i nordisk perspektiv / Fact Finding Mission to Shellafield

Gode erfaringer fra tilsvarende rejser til henholdsvis Forsmark/ Sosnovoj Bor og Kola underbygger forslag om en rejse i fx foråret 1999 - til England.
Deltagere: informationscheferne og eksperter fra de nordiske myndigheder (Vibeke Hein er delprojektleder)
Planlægningsperioden vil strække sig frem til gennemførelsen

3. Hvordan informerer man om NKS

3.1 Generel information om NKS

Vedligeholdelse af myndighedernes informationsmateriale-liste
Den umiddelbare informationsmulighed fra myndighederne til borgerne dækkes fortsat på traditionel vis gennem udsendelse af pjecer, videoer, hjemmesider. For sikre udbredt nordisk kendskab til myndighedernes informationsmaterialer (også blandt myndighederne indbyrdes) skal listen til stadighed holdes a jour.
Deltagere: informationscheferne fra de nordiske myndigheder (Carl-Erik Christoffersen er delprojektleder)

Revision af "Basfakta"

"Basfakta" indeholder beskrivelse af en grund-terminologi indenfor områderne strålebeskyttelse, reaktorteknik, sikkerhed og beredskab. NKS udsendte en version i projektperioden 1990-1993, som trænger til revision.
Deltagere: informationscheferne fra de nordiske myndigheder (Karin Wiklund er delprojektleder)
Gennemføres fx i løbet af 1999

Workshop for projektledere og -deltagere

Gode informationsrutiner bør implementeres fra begyndelsen af projektperioden og den nye grafiske profil for NKS bør hurtigt præsenteres.
Deltagere: informationscheferne fra de nordiske myndigheder (Vibeke Hein er delprojektleder)
Bør gennemføres i efteråret 1998 + eventuelt senere

Hjemmesider om NKS

I samarbejde med NKS-sekretariatet skal det sikres, at NKS-hjemmesiderne fremtræder professionelle og indbydende.
Deltagere: informationcheferne og NKS-sekretariatet Vibeke Hein er delprojektleder)
Der er tale om en kontinuerlig proces gennem hele projektperioden

Som et tværprojekt er det naturligt, at der skal etableres samarbejde med projekter under SOS og BOK. Visse informationsaspekter er allerede specificeret. Andre, herunder informationsopgaver i forbindelse med øvelser, kan først hen ad vejen præciseres.

Overordnede mål for kommunikation og informationsudveksling i NKS

Det overordnede mål med informationsprojekterne i NKS-regi er at bistå de ansvarlige myndigheder med at udvikle effektive og troværdige kommunikationsmodeller til befolkningen ved at

- styrke informations- og kommunikationskompetencen hos projektledere og andre, der arbejder inden for NKS-systemet
- øge kompetencen inden for emner som strålebeskyttelse og beredskab hos nordiske journalister
- implementere kommunikations- og informationsteoretisk kundskab og forskning i myndighedernes og NKS' løbende arbejde med informationsspørgsmål
- styrke informationsudvekslingen mellem strålebeskyttelses- og beredskabsmyndighederne samt andre relevante aktører i Norden

Det er desuden vigtigt, at styrke information om NKS-virksomheden, herunder støtte informationsaspekterne i de enkelte projekter. Udgifter til denne del af aktiviteten forventes indregnet i de enkelte projekkter.

Økonomi

Ressourcer:
Der er afsat 40 "ugeværk" som arbejdstid (svarende til 320.000 DKK) samt 250.000 DKK til rejseomkostninger hos myndighederne - samlet tilskud til aktiviteten: *DKK 570.000,-*

Aktivitet	**Nationalt tilskud**	**NKS tilskud**	**Samlet udgift**
1.1 Studie af strategi	Ikke beregnet	100.000,- DKK	100.000,- DKK
1.2 Risiko og kanaler	200.000,- DKK	235.000,- DKK	435.000,- DKK
2.1 Kontaktseminar		100.000,- DKK	100.000,- DKK
2.2 Shellafield	80.000,- DKK	100.000,- DKK	180.000,- DKK
3.1 Generelle info.opg		170.000,- DKK	170.000,- DKK
Arbejdstid & rejser	570.000,- DKK		570.000,- DKK
Restbudget		230.000,- DKK	
I alt	**850.000,- DKK**	**475.000,- DKK**	**1.555.000,- DKK**

1. Hvordan man informerer om svære emner i det moderne samfund

Aktiviteten har to dele/momenter, og målet er at analysere de krav, som "det nye" samfund stiller til myndighederne, som skal kunne informere om risici med komplicerede tekniske installationer og hurtigt kunne vinde befolkningens tillid ved alle mulige forskellige typer af kriser.

Ændrede medievaner og nye tekniske muligheder stiller nye krav til myndighedernes information.

Aktiviteternes mål er konkret at vurdere og prioritere gamle og nye kanaler/metoder til at informere befolkningen, samt at finde veje til at nå frem med information til forskellige målgrupper, som de findes i komplicerede samfund som de nordiske. Det er desuden ønskeligt om de nordiske landes strålebeskyttelses- og atomsikkerhedsmyndigheder under hensyntagen til nationale forhold har visse fælles grundlæggende vurderinger.

Kronologisk kan aktiviteten inddeles i to momenter, hvor forsøget på at finde den fælles vurderingsbase er udgangspunktet for det fortsatte arbejde:

1.1 En studie af de nordiske myndigheders informationsstrategi og holdning til information om stråling og atomsikkerhed

Aktivitetsleder:
Carl-Erik Christoffersen (Strålevernet)

Mål:
Projektet skal kortlægge og sammenligne eventuelle forskelle i de nordiske myndigheders holdninger og strategier til information om stråling og atomsikkerhed. Der gennemføres i øjeblikket et europæisk projekt, hvor Sverige og Norge deltager. NKS-projektet vil derfor omfatte Danmark, Island og Finland, så man kan få resultater fra *alle* de nordiske land. Det er vigtigt inden en ulykke at vide om de nationale forskelle, så man er forberedt på at kunne besvare spørgsmål også om, hvorfor det er sådan. Det er EU, der har udformet spørgeskemaet. Det gennemgås og udfyldes af en konsulent sammen med repræsentanter for de nationale myndigheder.
Der vil kunne sammenlignes med erfaringer fra INEX-2-FIN. Til sammen vil det kunne give myndighederne et tydeligere billede af, hvor der er ligheder, og hvor der er forskelle i holdninger og strategier.

Gennemføres:
1998

Ressourcer:

Dækning af arbejdstid for ekstern konsulent	4 månedsværk	NOK 75.000,-
Administrative omkostninger	35 % af 75.000,-	NOK 26.250,-
SUM		**NOK 101.250,-**

1.2 At kommunikere om risiko og i kriser og kortlægning af nye kanaler og målgrupper

Aktivitetsleder:
Anders Jörle (SKI) + Karin Wiklund (SRV)

Deltagere:
Informationscheferne i NKS-kredsen eller nøglepersoner i informationsafdelingerne samt samvirkende myndigheder. Konsulentindsatser forudses.

Mål:
At - ved hjælp af aktuel grundforskning - udarbejde nye strategier for kommunikation med almenheden under kriser. (Der er allerede etableret kontakter om dette emne til EU, idet både Statens Räddningsverk og Beredskabsstyrelsen er repræsenteret i EU's Experts Group on Risk Communication.)

Identificere og klassificere målgrupper for kommunikation før, under og efter kriser. Identificere nye kanaler for kommunikation og opfange forandringer i medieudbudet som påvirker myndighedernes strategier.

Gennemføres:
1998 - 2001

Speciel vægt lægges på at kommunikere under usikre og uafklarede hændelser. Et central spørgsmål er, om befolkningens tillid til samfundssystemet er stabil eller forandres og dermed foranlediger nye strategier.

Metode:
Deltagerne arbejder i seminarform sammen med eksterne forskere for at identificere nye strategier for information.
Projektet indledes med et større seminar som følges af et antal workshops.
Koordinering med delprojekt 2 skal foretages ved det indledende seminar.
Projektet afsluttes med en rapport som præsenteres ved et seminar for en større kreds, som berøres af disse emner.

Ressourcer:

Konsulentomkostninger, rapportarbejde mm.	DKK 100.000,-
Seminaromkostninger (inklusiv rejser for talere)	DKK 250.000,-
Konsulentindsats og administrative omkostninger	DKK 85.000,-
Sum:	**DKK 435.000,-**

SRV bidrager med SEK 200.000 til aktiviten i 1998.

2. Hvordan informerer man på forhånd

2.1 Kontaktmøde for myndigheder, industri og medier

Aktivitetsleder:
Carl-Erik Christoffersen (Strålevernet)

Mål:
Skabe det bedst mulige grundlag for et samarbejde bygget på gensidig forståelse for hinandens roller. Behovet for informationsudveksling til omverdenen om NKS-resultater er stort, og det kan hensigtsmæssigt ske ved denne type arrangement, hvor emner kan forklares og sættes ind i aktuelle sammenhænge.

Gennemføres:
I løbet af projektperioden i Norge, afhængig af aktuelle emner i omverdenen eller blandt NKS-resultater. Seminaret kan eventuelt gennemføres sammen med NKS midtvejsseminar, hvor mange ressourcepersoner vil være samlet.

Projektet er en opfølgning af tidligere seminarer mellem disse grupper.

Ressourcer:
Budget for direkte og indirekte omkostninger:

Dækning af medgået arbejdstid	2 ugeværk á NOK 5.076,-	NOK 10.152,-
Administrative omkostninger	35 % af NOK 10.152,-	NOK 3.553,-
Leje af seminar-lokaler		NOK 130.000,-
Udarbejdelse og trykning af seminarmateriale		NOK 5.500,-
SUM		**NOK 149.105,-**
Deltagerafgift		NOK 50.000,-
Samlet udgift for NKS		**DKK 100.000,- (max)**

2.2 Sellafield i nordisk perspektiv / Fact Finding Mission to Sellafield

Aktivitetsleder:
Vibeke Hein (BRS)

Deltagere:
Informationscheferne, eksperter og journalister fra alle NKS-landene

Mål:
Studierejse til Storbritannien med henblik på studier af i først og fremmest affaldsproblematikken. Ikke mindst dette emne vil komme til at præge avisernes diskussioner, og det er derfor vigtigt, at de nordiske myndigheder har haft indflydelse på argumenterne og deres vægt. Et besøg ved fx Sellafield og hos engelske myndigheder sammen med kendte, nordiske myndighedsrepræsentanter, der kan sætte oplysninger ind i en nordisk sammenhæng, vil være af betydning for medieomtalers lødighed.

Gennemføres:
Efteråret 1998

Ressourcer:
Budget for direkte og indirekte omkostninger:

Udgifter til foredragsholdere og transport	100.000,- DKK
lokaler, materialer og forplejning	80.000,- DKK
I alt	**180.000,- DKK**

Beredskabsstyrelsen bidrager med DKK 50.000 til denne aktivitet.

3. Hvordan informerer man om NKS

3.1 Generel information for NKS

Vedligeholdelse af myndighedernes informationsmateriale-liste

Aktivitetsleder:
Carl-Erik Christoffersen (Strålevernet)

Mål:
Projektet skal sikre, at de nordiske myndigheder i en beredskabssituation skal kende til de øvrige myndigheders informationsmateriale.

Gennemføres:
Listen over myndighedernes informationsmateriale bliver revideret op til to ganger hvert år.

Ressourcer:
Arbejdstid til revideringen pr. år: to dage x 2 = 4 dage
I direkte og indirekte omkostninger bliver det:

Dekning af medgått arbeidstid:	kr. 846,- x 4	NOK 3.384,-
Dekning af administrative kostnader	35 % av kr. 3.384,-	NOK 1.184,-
Portokostnader ved utsending	kr. 8,- x 300	NOK 2.400,-
SUM		**DKK 7.000,-**

Revision af "Basfakta"

Aktivitetsleder:
Karin Viklund

Deltagere:
Nøglepersoner hos berørte myndigheder

Mål:
At bibeholde og udvikle den fælles grundterminologi, som tidligere er skabt

Gennemføres:
Revisionen skal være klar i år 2000.
Dermed kan man tage de resultater, som fremkommer af de øvrige projekter, i betragtning.

Metode:
Hver myndighed indleder arbejdet lokalt. Koordinering sker på et fælles arbejdsmøde efter udveksling af bidrag.

Ressourcer:
Arbejdstid: **DKK 45.000,-**

Workshop for projektledere og -deltagere

Aktivitetsleder:
Vibeke Hein (BRS)

Deltagere:
Projektledere og -deltagere for NKS-projekter

Mål:
Implementere gode informationsrutiner ved gennemførelse af NKS-projekter.
Præsentere NKS's grafiske profil.

Gennemføres:
Tidligt under projektperioden.

Ressourcer:
Lokaleleje, forplejning, foredragsholdere: **DKK 100.000,-**

Hjemmesider

Aktivitetsleder:
Vibeke Hein (BRS)

Deltagere:
Informationscheferne og NKS-sekretariatet

Mål:
At udvikle og gøre NKS's hjemmesider funktionelle for brugerne.

Gennemføres:
Løbende under projektperioden.

Ressourcer:
DKK 20.000,-

Projektdeltagere:

Danmark:
Informationschef Vibeke Hein, Beredskabsstyrelsen (BRS)

Finland:
Konsultativ tjänsteman Tiina Peltola-Lampi, Inrikesministeriet

Informationschef Helvi Kaijomaa, Strålsäkerhetscentralen (STUK)

Island:
-

Norge:
Informasjonssjef Carl-Erik Christoffersen, Statens Strålevern (NRPA)

Informasjonssjef Helge Iversen, Helsetilsynet

Sverige:
Informationschef Anders Jörle, Statens Kärnkraftinspektion (SKI)

Informatör Monica Carlson, Statens Strålskyddsinstitut (SSI)

Informatör Karin Viklund, Statens Räddningsverk (SRV)

nks

Nordisk kernesikkerhedsforskning
Norrænar kjarnöryggisrannsóknir
Pohjoismainen ydinturvallisuustutkimus
Nordisk kjernesikkerhetsforskning
Nordisk kärnsäkerhetsforskning
Nordic nuclear safety research

Appendix 1-6

Torkel Bennerstedt
NKS

1998-10-01

Appendix 1. Direktiv för referensgruppen för NKS' nya program

Nordisk kernesikkerhedsforskning
Norrænar kjarnöryggis rannsóknir
Pohjoismainen ydinturvallisuustutkimus
Nordisk kjernesikkerhetsforskning
Nordisk kärnsäkerhetsforskning
Nordic nuclear safety research

NKS(98)3
1998-05-25

Direktiv för referensgruppen för NKS' nya program

Bakgrund

NKS' styrelse och konsortialparter beslöt vid möten den 4 - 5 februari 1998 att starta ett antal förprojekt innan ett nytt forskningsprogram i NKS' regi inleds. Förprojekten ska utifrån föreliggande förslag (se nedanstående lista över referensdokument) till nytt NKS-program konkretisera och föreslå innehåll i de olika projekten.

Referensgrupp

För att följa och stöda det arbete som ska bedrivas i form av förprojekt beslöts att tillsätta en referensgrupp. Medlemmar i referensgruppen utses av konsortialparterna. Ordförande är Sigurður M. Magnússon.

Syftet med referensgruppen är att

- stöda förprojekten (via förprojektledarna) i arbetet med att utarbeta de konkreta projektplanerna (innehåll, budget, tidplaner, deltagare m m)
- vid behov när som helst under förprojektperioden kunna ge klartecken till att inleda vissa begränsade projektaktiviteter. Här avses aktiviteter som inte kräver speciella förprojekt eller är av sådan karaktär att det vore olyckligt om de inte kunde komma igång innan beslut tas om det nya programmet. Styrelse- och konsortialparterna tar vid sina möten i september 1998 (preliminärt datum) ställning till det nya programmet i sin helhet, inklusive de aktiviteter som referensgruppen givit preliminärt klartecken till.

Referensgruppen får arbeta enligt de arbetsformer den finner lämpligt, och insatserna hållas nere t ex genom att e-post utnyttjas i stor utsträckning. Referensgruppen ska hålla tät kontakt med NKS' styrelse och rapportera hur arbetet i förprojekten fortskrider.

Referensgruppens ordförande kallar vid behov till möte mellan referensgruppen och förprojektledarna. Däremellan utväxlas information på annat vis. Ett första

möte mellan referensgruppen och förprojektledarna ska hållas omkring första veckan i juni 1998. Efter mötet ska referensgruppens ordförande informera styrelsen och inhämta dess synpunkter.

Referensgruppen avrapporterar sitt arbete vid nästa styrelse- och konsortialpartmöten, preliminärt i september 1998, varvid gruppens arbete avslutas. Avrapporteringen kan ske muntligt förutom en kort skriftlig redogörelse över aktiviteter (i listform) och ekonomi.

Budget

Referensgruppen får disponera högst DKK 100 000 för sitt eget arbete utöver den budget som avsatts för att genomföra förprojekten. De medel som referensgruppen avsätter för att inleda vissa begränsade projektaktiviteter ska tas ur förprojektens budget.

Beslut om budget för respektive förprojekt fattas av referensgruppen, inom följande maximala ramar:

SOS-1	DKK	340 000
SOS-2	DKK	500 000
SOS-3	DKK	340 000
BOK-1	DKK	460 000
BOK-2	DKK	460 000
SBA	DKK	300 000
TOTALT	DKK	2 400 000

Beloppen ovan ska förutom själva förprojektarbetet även täcka

* förprojektledarnas deltagande i NKS' förprojektsseminarium för styrelsen, preliminärt den 16 september 1998
* sådana reskostnader för förprojektdeltagarna som respektive förprojektledare beslutar att täcka med NKS-medel; stor restriktivitet rekommenderas på denna punkt
* ev aktiviteter som får klartecken av referensgruppen under förprojektperioden

Programgruppens budgetförslag var på hälften av ovanstående belopp, per förprojekt och totalt. I den mån de utökade medlen upp till beloppen enligt konsortialparternas beslut ovan används, avräknas skillnaden mellan det använda beloppet och programgruppens förslag från budgeten för projektarbetet under resten av 1998. Exempel: Programgruppens förslag för SOS-1 var DKK 170 000, och konsortialparternas beslut var upp till högst dubbla detta belopp, DKK 340 000. Om DKK 320 000 förbrukas kommer DKK (320 000 – 170 000 =) 150 000 att tas från resterande projektbudget för SOS-1 för 1998. Skulle förbrukningen bli lägre än programgruppens förslag kommer återstoden att överföras till projektbudgeten för berört projekt under resten av 1998.

Referensgruppen och exekutivsekreteraren övervakar dels att nödvändig balans uppnås i omfattning och budgeterade medel mellan projekten och mellan huvudområdena, dels att den förväntade totala årliga budgetramen på DKK 7 miljoner för projektarbete inte överskrids.

Referensdokument

Detta är NKS, NKS(97)10 Rev, daterad 1997-06-08
Programgruppens rapport, NKS(98)1, särskilt avsnitt 2.8 och bilaga 3.7 om förprojekten
Evalueringsrapporten för perioden 1994 – 1997, NKS(98)2
Kriterier för NKS-projekt, NKS(95)8 Rev, daterade 1996-03-17
Direktiv för förprojekten 1998, NKS(98)4
Medverkande i förprojekten, NKS(98)6
Protokoll (utkast) från konsortialmötet 5 februari 1998, NKS(98)5
Protokoll från styrelsemötet 4 – 5 februari 1998, NKS/RE(98)1
Förteckning över organisationer som bör tillfrågas om nya NKS-programmet, NKS(97)20

Appendix 2. Rapport fra referencegruppen for NKS' nye program

9. september 1998

Sigurður M. Magnússon, Geislavarnir ríkisins, Island

Indledning

Referencegruppen for NKS-forprojekterne, der blev nedsat ved styrelsesmødet i Oslo i februar 1998, har følgende medlemmer: Christer Viktorsson og Ulf Bäverstam fra Sverige, Timo Haapalehto fra Finland, Erling Stranden fra Norge, Bjørn Thorlaksen fra Danmark og Sigurður M. Magnússon, der er ordfører, fra Island.

Direktiv for referencegruppen

Af direktiv for referencegruppen fremgår dennes formål:

- støtte forprojekterne (via forprojektlederne) i arbejdet med at udarbejde de konkrete projektplaner,
- efter behov kunne give klartegn til at indlede visse begrænsede projektaktiviteter

samt at referencegruppen skal rapportere sit arbejde ved næste styrelses- og konsortialmøder, hvorved gruppens arbejde afsluttes.

Referencegruppens arbejde

Referencegruppen har haft et møde med forprojektlederne i Stockholm den 4. - 5. juni. Inden mødet havde forprojektlederne sendt materiale vedrørende egne forprojekter til referencegruppen. Under mødet, hvor alle forprojektlederne, på nær Per Hedemann Jensen, forprojektlederen for BOK-1, kunne deltage, blev hvert forprojekt præsenteret med en efterfølgende diskussion.

Ved mødet blev man enige om formen for det videre arbejde med den nukleare del af SBA-projektet. Mødet viste også, at der var behov for en videre diskussion vedrørende indhold og form af de foreslåede informationsaktiviteter.

Referat fra mødet med forprojektlederne foreligger og er blevet sendt til styrelsen den 25. juni per e-mail. NKS' ordfører er løbende blevet holdt orienteret ved e-mails.

Medlemmer af referencegruppen, samt NKS' ordfører og NKS' eksekutivsekretær deltog i et møde med repræsentanter fra DG XI og DG XII i Bruxelles den 2. juli. Der foreligger separate referater fra de nordiske og EU's repræsentanter ved mødet.

Referencegruppens ordfører og NKS' eksekutivsekretær deltog i møder om de foreslåede informationsaktiviteter med Vibeke Hein i Danmark den 28. juli og Timo Haapalehto og Raimo Mustonen i Finland den 29. juli. Ved mødet i Finland blev man enige om indhold og retning af de foreslåede informationsaktiviteter. Der foreligger referater fra mødet i Finland - godkendte af mødets deltagere.

Ved referencegruppens møde i Stockholm den 4. juni fremkom der ønske om en kontrolstation i sommerperioden for at få mulighed for at se på helheden og balancen i programmet i tilstrækkelig god tid til at kunne påvirke de endelige projektforslag. På denne baggrund blev forprojektlederne bedt om at sende referencegruppens medlemmer udkast til slutrapporter i den foreliggende form den 20. juli. Referencegruppens medlemmer sendte deres kommentarer og synspunkter til gruppens ordfører, som sammen med NKS' eksekutivsekretær skrev en syntese, som blev sendt til forprojektlederne. Projektspecifikke kommentarer blev sendt til hver enkelt forprojektleder inden midten af august. Disse er for en stor dels vedkommende taget til efterretning i de foreliggende udkast til slutrapporter.

Klartegn til visse aktiviteter

Ved mødet med forprojektlederne i Stockholm i juni blev der givet klartegn til følgende aktiviteter:

- SOS-3: DKK 100.000,- til forberedelser op til et MKB temamøde om Himdalen i oktober 1998.
- SBA: DKK 150.000,- (der overføres fra det forsinkede arbejde med INEX-2 / Canada) til arbejde med INEX-2 / Ungarn.

I juli blev der givet klartegn til:

- BOK-2: DKK 245.000,- til prøveindsamling i løbet af sommeren 1998.

Der blev varslet et ønske om klartegn til aktiviteter i andre forprojekter, men referencegruppen fik ikke skriftlige ansøgninger derom.

Budget

Til sit arbejde fik referencegruppen et budget på DKK 100.000,-. NKS' bureau besluttede at bidrage med DKK 75.000,- af NKS' reserve til finansiering af Bruxelles-rejsen i forbindelse med EU/NKS seminaret. De totale omkostninger hertil har været cirka DKK 160.000,-.

Referencegruppens forslag og konklusioner

1. Referencegruppen støtter forslag om, at det tværgående SBA-projekt deles i to separate dele. SBA-1: Nukleare trusler i Nordens nærområder og SBA-2: Informationsspørgsmål.

2. Referencegruppen støtter også forslag om, at øvelser overføres fra SBA til BOK-1.

3. På baggrund af forslag vedrørende SBA-1 og BOK-1, se nedenfor, er der behov for en fortsættelse af referencegruppens aktiviteter indtil det næste styrelsesmøde.

4. Referencegruppen foreslår, at foreliggende projektforslag til SOS-1, SOS-2, SOS-3 samt SBA-2 og BOK-2 godkendes med et passende budget, samt at der udpeges projektledere, og at projektarbejdet indledes.

5. Referencegruppen henviser til mødet i Stockholm vedrørende formen af det videre arbejde i det nuværende SBA-1. Det foreliggende projektforslag afspejler ikke helt referencegruppens intentioner, og der er behov for en revidering af projektbeskrivelsen. Det foreslås, at der nedsættes en arbejdsgruppe bestående af f. eks. Timo Haapalehto, Erling Stranden, Sigurður M. Magnússon og Torkel Bennerstedt som skal tilse, sammen med forprojeklederen Inger Margrethe Eikelmann og eventuelt andre indkaldte eksperter, at projektbeskrivelsen tilpasses til konklusionerne fra mødet i Stockholm og finansierernes behov og interesser. Det foreslås videre, at referencegruppen gives mandat til godkendelse af projektplanen og opstart af projektet med budget indenfor de rammer som styrelsen fastlægger.

6. Referencegruppen foreslår, at der arbejdes videre på det nærmere indhold og retning af BOK-1 projektet samtidig med at de aktiviteter, der vedrører QA og nordisk deltagelse i RESUME 2000, igangsættes. Et gennemarbejdet projektforslag, der er godt forankret hos de relevante myndigheder, skal foreligge i god tid inden det næste styrelsesmøde. Det foreslås, at referencegruppen får mandat til, efter behov, aktivt at bidrage til det videre arbejde i forprojektet og forankringsprocessen ved myndighederne. Det foreslås videre, at referencegruppen gives mandat til godkendelse af projektplanerne og indledning af visse aktiviteter med budget indenfor de rammer som styrelsen fastlægger.

Til sidst fremføres en stort tak til lederne af forprojekterne for deres store indsats i hele forprojektperioden samt til medlemmerne af referencegruppen for konstruktivt og positivt samarbejde som altid.
Til allersidst en meget stor tak til NKS' eksekutivsekretær, Torkel Bennerstedt for hans energiske indsats og engagement i referencegruppens arbejde som i alle andre NKS-anliggender.

Appendix 3. Direktiv för förprojekten 1998

nks

Nordisk kernesikkerhedsforskning
Norrænar kjarnöryggis rannsóknir
Pohjoismainen ydinturvallisuustutkimus
Nordisk kjernesikkerhetsforskning
Nordisk kärnsäkerhetsforskning
Nordic nuclear safety research

NKS(98)4
1998-05-25

Direktiv för förprojekten 1998

Inledning

Konsortialparterna beslöt vid möte i Norge den 5 februari 1998 att tillsätta ett antal förprojekt enligt förslag från NKS' styrelse och baserat på en rapport från NKS' programgrupp (se listan över referensdokument nedan). De sex konsortialparterna utser var sin förprojektledare. Dessutom utser varje land genom konsortialparterna upp till tre deltagare per förprojekt. Arbetet övervakas av en referensgrupp i vilken de sex konsortialparterna utser varsin medlem.

Syfte

Syftet med förprojekten är att utarbeta kompletta projektförslag med tidsplaner och budget för programperioden 1998 – 2001. Planerna ska svara på frågan: "Vem ska göra vad varför när var hur och hur länge till vilken kostnad?"

Delsyften

* Att reducera omfånget i de projektplaner som skisseras i programgruppens förslag genom koncentration på de för användare och finansiärer väsentligaste uppgifterna
* Att i projektplanerna betona kravet på samordning mellan projekten, särskilt inom respektive huvudområde, samt mellan det tvärgående projektet och projekten inom de båda huvudområdena, och att föreslå metoder för att uppnå detta
* Att föreslå metoder att kvalitetssäkra arbetet
* Att explicit lyfta fram utbildningsaspekterna i varje projekt
* Att föreslå en konsolidering inom respektive projekts arbetsområde, det vill säga studera vad som tidigare gjorts av NKS, vilka effekterna hittills varit av det nordiska samarbetet på området (den nordiska nyttan), vilka slutsatser resultats- och effektivitetsmässigt som man kan dra av tidigare insatser inför det fortsatta nordiska samarbetet, vad behovet är i nuläget, jämföra med motsvarande (tidigare, pågående och planerade) internationella studier etc
* Att begränsa alla aktiviteter inom ett projekt till kortast möjliga tid

* Att löpande till referensgruppen föreslå aktiviteter som kan startas relativt omgående
* Att i största möjliga (och för myndigheterna acceptabla) omfattning engagera kraftbolag och andra intressenter i det praktiska projektarbetet
* Att undersöka förutsättningarna (behov och möjlighet) för att knyta en myndighetsinformatör till varje projekt
* Att undersöka förutsättningarna (behov och möjlighet) för att knyta en person i NKS' styrelse som stöd/ referensperson eller mentor till varje projekt
* Att presentera resultaten av förprojekten vid ett seminarium för NKS' styrelse
* Att skriftligen avrapportera förprojektarbetet

Förutsättningar

Projektplanerna ska uppfylla nedanstående projektkriterier och stå i överensstämmelse med intentionerna i dokumentet "Detta är NKS" (se referenslistan nedan).

Den totala budgetramen för de föreslagna projekten får inte överstiga DKK 7 miljoner per år.

Projektkriterier

Projektplanerna ska endast omfatta sådant arbete som behöver utföras – dubbelarbete ska undvikas. Hänsyn ska tas till vilka länder och organisationer som bör medverka och som kan förväntas vara lämpliga att utföra arbetet. Projektarbetet bör leda till förbättrad nordisk samsyn och utveckling av nätverk. Nedanstående kriterier ska beaktas i varje projekt och aktivitet:

* Det nordiska perspektivet ska beaktas i samtliga projekt
* Det fackliga innehållet ska hålla hög internationell nivå
* Projekten bör ha ett nyhetsvärde
* Varje projekt bör ha en helhetssyn, en "röd tråd"
* Resultaten av samtliga projekt ska vara av värde för användare och finansiärer
* Projekten ska ge praktiska resultat i form av
  - rekommendationer
  - manualer, handböcker, checklistor
  - seminarier, rapporter, vetenskapliga artiklar
* Projekten ska präglas av god resultatspridning
* Projekten ska vara kostnadseffektiva och präglas av effektiva arbetsformer med tydliga mål, arbetssätt och effektiv ekonomisk uppföljning
* Projekten ska koordineras med EUs ramprogram och annat internationellt forskningsarbete, där så är lämpligt och möjligt
* Möjligheter till östsamarbete ska tas tillvara i de projekt där det är lämpligt

Arbetsformer

Till varje förprojekt ska knytas en eller vid behov flera kontaktpersoner ur referensgruppen. Förprojektledarna ansvarar för att dessa kontaktpersoner i god tid informeras om kommande arbetsmöten och liknande.

Förprojektledarna ska vidare hålla hela referensgruppen löpande informerad om hur arbetet fortskrider, vilka problem som uppstått etc. Referensgruppernas synpunkter ska beaktas i de utarbetade projektplanerna. Referensgruppens ordförande kallar vid behov till möte mellan referensgruppen och förprojektledarna. Däremellan utväxlas information på annat vis.

Förprojektledarna ansvarar för att arbetet inom respektive förprojekt läggs upp på ett kostnadseffektivt sätt och så att direktiven i detta dokument följs. Arbetet ska utgå från – men inte vara låst av – programgruppens slutrapport. Berörda intressenter (huvud- och tilläggsfinansiärer, användare av resultaten, forskningsinstitutioner, kraftbolagen, kärnkraftanknutna företag etc) ska konsulteras och beredas tillfälle att medverka i delar av eller hela förprojektarbetet, även om de inte finns med i den ursprungliga listan av inbjudna organisationer. Hänsyn ska tas till referensdokumenten i listan nedan.

Förprojektledarna ska hålla löpande kontakt med referensgruppsordföranden och exekutivsekreteraren. Den senare ska inbjudas dels till samtliga arbetsmöten inom förprojekten, dels till alla möten mellan förprojektledarna och referensgruppen. Exekutivsekreteraren ska få allt väsentligt arbetsmaterial för kännedom och ev kommentarer.

Tidsplan

Ett första möte mellan referensgruppen och förprojektledarna ska hållas omkring första veckan i juni 1998. Efter mötet ska referensgruppens ordförande informera styrelsen och inhämta dess synpunkter.

Förprojekten ska skriftligen avrapporteras på danska, norska, svenska, ”skandinaviska” eller engelska till exekutivsekreteraren senast den 14 augusti 1998. Exekutivsekreteraren sammanställer och kompletterar materialet, och genom NKS-sekretariatets försorg distribueras materialet till NKS’ styrelse och förprojektledarna. Förprojektarbetet kan preliminärt fortsätta till den 15 september.

Den 16 september (preliminärt) presenterar förprojektledarna sina projektförslag vid ett seminarium för styrelsen.

Den 17 september (preliminärt) diskuteras projektplanerna av styrelsen, som formulerar en rekommendation till konsortialparterna. Dessa fattar i ett efterföljande möte beslut om projektplaner inkl tidsplaner och budget. Det egentliga projektarbetet för perioden 1998 – 2001 kan därefter börja.

Efter styrelse- och konsortialmötena ska projektplanerna revideras av förprojektledarna och exekutivsekreteraren i samverkan. Därefter publiceras de samlade planerna i bokform av NKS-sekretariatet.

Projekt eller aktiviteter med färdiga arbetsplaner och budgetförslag, och som lämpligen kan eller bör påbörjas före styrelse- och konsortialmötena, preliminärt den 16 – 17 september, får därför temporärt påbörjas när som helst under förprojektperioden efter klartecken från referensgruppen och med en budget som anvisas av referensgruppen. Beslutet kan komma att omprövas vid styrelse- och konsortialmötena i september.

Budget

Beslut om budget för respektive förprojekt fattas av referensgruppen, inom följande maximala ramar:

SOS-1	DKK	340 000
SOS-2	DKK	500 000
SOS-3	DKK	340 000
BOK-1	DKK	460 000
BOK-2	DKK	460 000
SBA	DKK	300 000
TOTALT	DKK	2 400 000

Beloppen ovan ska förutom själva förprojektarbetet även täcka

* förprojektledarnas deltagande i NKS' förprojektsseminarium för styrelsen, preliminärt den 16 september 1998
* sådana reskostnader för förprojektdeltagarna som respektive förprojektledare beslutar att täcka med NKS-medel; stor restriktivitet rekommenderas på denna punkt
* ev aktiviteter som får klartecken av referensgruppen under förprojektperioden

Programgruppens budgetförslag var på hälften av ovanstående belopp, per förprojekt och totalt. I den mån de utökade medlen upp till beloppen enligt konsortialparternas beslut ovan används, avräknas skillnaden mellan det använda beloppet och programgruppens förslag från budgeten för projektarbetet under resten av 1998. Exempel: Programgruppens förslag för SOS-1 var DKK 170 000, och konsortialparternas beslut var upp till högst dubbla detta belopp, DKK 340 000. Om DKK 320 000 förbrukas kommer DKK (320 000 – 170 000 =) 150 000 att tas från resterande projektbudget för SOS-1 för 1998. Skulle förbrukningen bli lägre än programgruppens förslag kommer återstoden att överföras till projektbudgeten för berört projekt under resten av 1998.

Övrigt

Projektplanerna ska inkludera dels en budget för direkta NKS-medel, dels en kostnadsuppskattning för externa insatser (arbetstid, resor, konsulttjänster etc) som ställs kostnadsfritt till NKS' förfogande men betalas av någon annan, t ex en myndighet. Samtliga kostnader ska anges i danska kronor, DKK. Arbetstid får alltså inte anges i antal timmar eller procent av en heltid. För myndigheters och liknande icke kommersiella organisationers arbetstid används gällande interndebiteringstaxa. Kostnader för resor, konsulttjänster och liknande tas upp till sin verkliga kostnad.

Förprojektenas slutrapporter ska sammanställas i en gemensam rapport, med ett inledande bakgrundskapitel och en sammanfattning som skrivs av exekutivsekreteraren. Ett utkast till slutrapporten ska sändas till styrelsemedlemmarna i god tid före styrelse- och konsortialmötena, preliminärt den 16 – 17 september 1998. När rapporten godkänts av styrelsen ska den snarast publiceras i bokform med hjälp av NKS-sekretariatet. Utgivningen bekostas med sekretariatsmedel.

Referensdokument

Detta är NKS, NKS(97)10 Rev, daterad 1997-06-08
Programgruppens rapport, NKS(98)1, särskilt avsnitt 2.8 och bilaga 3.7 om förprojekten
Evalueringsrapporten för perioden 1994 – 1997, NKS(98)2
Kriterier för NKS-projekt, NKS(95)8 Rev, daterade 1996-03-17
Direktiv för referensgruppen för förprojekten, NKS(98)3
Medverkande i förprojekten, NKS(98)6
Protokoll (utkast) från konsortialmötet 5 februari 1998, NKS(98)5
Protokoll från styrelsemötet 4 – 5 februari 1998, NKS/RE(98)1
Förteckning över organisationer som bör tillfrågas om nya NKS-programmet, NKS(97)20

Appendix 4. Medverkande i förprojektarbetet

Nordisk kernesikkerhedsforskning
Norrænar kjarnöryggis rannsóknir
Pohjoismainen ydinturvallisuustutkimus
Nordisk kjernesikkerhetsforskning
Nordisk kärnsäkerhetsforskning
Nordic nuclear safety research

NKS(98)6
1998-05-25

Medverkande i förprojektarbetet

Referensgrupp

Sigurður M.Magnússon, Geislavarnir ríkisins (GR), ordförande
Bjørn Thorlaksen, Beredskabsstyrelsen (BRS)
Timo Haapalehto, Handels – och industriministeriet (HIM)
Erling Stranden, Statens strålevern (NRPA)
Christer Viktorsson, Statens kärnkraftinspektion (SKI)
Ulf Bäverstam, Statens strålskyddsinstitut (SSI)

Övriga använda förkortningar

DNMI	Den Norske Meteorologiske Institutt
DTU	Danmarks Tekniske Universitet
IFE	Institutt for Energiteknikk, Norge
IVO	Imatran Voima Oy, Finland
Lund	Radiofysiska institutionen, Lunds lasarett, Sverige
NLH	Norges Landbrukshøyskole
RALA	Lantbrukets forskningsinstitut, Island
Risø	Forskningscenter Risø, Danmark
SIS	Statens Institut for Stålehygiejne, Danmark
SRV	Statens räddningsverk, Sverige
STUK	Strålsäkerhetscentralen, Finland
TVO	Industrins Kraft, Finland
VTT	VTT Energy eller VTT Automation, Finland

Förprojektledare

SOS-1	Lennart Hammar, ES-Konsult (för SKI)
SOS-2	Kaisa Simola, VTT (för HIM)
SOS-3	Magnus Westerlind, SSI (för SSI)
BOK-1	Per Hedemann Jensen, Risø (för BRS)
BOK-2	Sigurður Emil Pálsson, GR (för GR)
SBA	Inger Margrethe H. Eikelmann, NRPA (för NRPA)

Förprojektdeltagare

Listan över förprojektdeltagare är ännu inte fullständig:

* IFE återkommer med namn inom SOS-2
* Ralf Espefält återkommer ev med namn från industrin

SOS-1 **Lennart Hammar, ES-Konsult**
Kurt Lauridsen, Risø
Louise Dahlerup, BRS
Lasse Reiman, STUK
Björn Wahlström, VTT
Gerd Svensson, SKI
Bo Liwång, SKI
Mikael Jensen, SSI

SOS-2 **Kaisa Simola, VTT**
Jette L. Paulsen, Risø
Knud Ladekarl Thomsen, Risø
Lasse Reiman, STUK
Heikki Sjövall, TVO
Petra Lundström, IVO
Bo Liwång, SKI
Anders Hallman, SKI
Wiktor Frid, SKI (svåra haverier)

SOS-3 **Magnus Westerlind, SSI**
Knud Brodersen, Risø
Steen Carugati, Risø (suppleant för Knud Brodersen)
Esko Ruokola, STUK
Vesa Tanner, VTT
Malgorzata Karpow Sneve, NRPA
Steinar Backe, IFE
Evelyn Foshaug, IFE
Stig Wingefors, SKI

BOK-1 **Per Hedemann Jensen, Risø**
Bent Lauridsen, Risø
Uffe Korsbech, DTU
Kasper Andersson, Risø
Steen Hoe, BRS (kontaktperson för BRS)
Seppo Vuori, VTT (modeller)
Tua Rahola, STUK (mätteknik och strategier)
Sigurður Emil Pálsson, GR
Finn Ugletveit, NRPA

Lavrans Skuterud, NRPA
Anne Liv Rudjord, NRPA
Richard Olsson, SKI
Rolf Falk, SSI
Sven Eric Berg, SRV

BOK-2 **Sigurður Emil Pálsson, GR**

Henning Dahlgaard, Risø
Svend P. Nielsen, Risø
Mette Øhlenschlœger, SIS
Steen Hoe, BRS
Seppo Vuori, VTT (näringskedjor)
Aino Rantavaara, STUK (näringskedjor)
Erkki Ilus, STUK (nordiska havsområden)
Elísabet D. Ólafsdóttir, GR
Jóhann Þórsson, RALA
Ingar Amundsen, NRPA
Anne Liv Rudjord, NRPA
Tone D Bergan, IFE
Knut Hove, NLH
Leif Moberg, SSI
Per Roos, Lund

SBA **Inger Margrethe H. Eikelmann, NRPA**

Povl L. Ølgaard, Risø
Vibeke Hein, BRS
Olli Vilkamo, STUK (Kola)
Riitta Hänninen, STUK (övningar)
Jørgen Saltbones, DNMI
Eldri Naadland Holo, NRPA
Lavrans Skuterud, NRPA (Kola)
Egil Stokke, IFE
Richard Olsson, SKI
Åke Persson, SSI (SBA-1.1, SBA-1.2)
Ulf Andersson, SSI (SBA-1.3)

Appendix 5. Nordic Summary of the EC/NKS Workshop on July 2, 1998

Background

In order to introduce NKS and its research activities to EU, two visits were paid to DG XII during the last NKS period, 1994 – 1997. Also, a joint EC/NKS seminar was arranged at STUK in Finland during that period, where information was shared between EU and NKS, and issues of mutual concern were discussed. It was agreed that this type of information exchange should be continued in the future.

To that end, a joint EC/NKS workshop was held in Brussels on July 2, 1998, with a greater EC attendence than was possible at the STUK seminar a couple of years earlier.

The objective of the workshop was to exchange scientific information and future workplans, identify possible gaps and overlaps in the EU and NKS programs, identify possible fields of cooperation, and lay a foundation for more intensified cooperation in the future.

The scope of the workshop was EU and NKS activities (present and planned) in the fields of reactor safety; radwaste management and decommissioning; radiation protection; radioecology; and emergency preparedness.

NKS participants: Magnus von Bonsdorff, Sigurður M. Magnússon, Erling Stranden, Christer Viktorsson, Torkel Bennerstedt.

EU representatives: Hans Forsström, Georges van Goethem, Gilbert Desmet, Giuseppe Cottone, Bertus Haijtink, Sandro Zero, Henning von Maravic, Gerhard Keinhorst, Neale Kelly, Kurt Flugrad, Alejandro Zurita, Joaquin Martin Bermejo.

The conclusions of the workshop, as expressed by EC, are given *in extenso* in a separate section, together with the agenda of the workshop and lists of Danish, Finnish, Norwegian and Swedish partners in ongoing EC projects.

The following material is the NKS summary of the workshop.

Introduction

Mr Forsström, EC, presented the proposal for the new EURATOM 5th framework program. It comprises two Key Actions: Thermonuclear Fusion; and Nuclear Fission. In addition, generic research on radiation protection is suggested, as well as continued support to the Joint Research Center in Ispra, Italy. The total budget is some ECU 1,5 billion. The program plans and the budget are pending final acceptance by the EU institutions.

For the new 5th framework program the following research areas within the key action Nuclear Fission have been defined:

- Operational safety of existing reactors
- Safety of the fuel cycle
- Safety and efficiency of future systems
- Radiation protection

The objectives of this key action are to:

- Ensure the safety of Europe´s nuclear facilities
- Provide protection of workers and the public
- Achieve safe and efficient waste management and disposal
- Improve competitiveness and prospects for export
- Explore new concepts
- Manitain expertise

The EC representatives then presented the research areas of the present 4th framework program and briefly outlined the plans for the 5th framework program. Presentations and discussions were conducted in the following fields:

- Radioecology, Radiation Protection
- Emergency Preparedness, Information
- Radioactive Waste
- Reactor Safety

Radioecology

Mr. G. Desmet presented the research activities in radioecology within the 4th framework program. There are several projects in the 4th program dealing with terrestrial ecosystems, freshwater and catchments, marine ecosystems as well as environmental management facilitating the use of Enviromental Decision Support Systems (EDSS). Nordic paticipation in these projects is quite extensive and some of the project leaders are from the Nordic countries. These include Asker Aarkrog, Leif Moberg and Matti Suomela who are all active within NKS. The active Nordic participation confirms the extensive cooperation in the field of radioecology between Nordic scientists and scientists from the rest of Europe.

The EC objectives regarding radioecology were presented as follows:

- Essential understanding of the behavior of radionuclides and of the contaminated environment
- Calculation of dose to man and its distribution to critical groups
- Development of adequate environmental management systems
- Preservation of an acceptable level of economic, socio-cultural, and ecological quality of vulnerable regions

The following conclusions and needs for future research in radioecology and enviromental management were presented:

- For the preservation and improvement of the quality of safety standards for the radiological quality of food and goods
- For the parameterization of vulnerability concepts from radiological, technological, economic, ocio-cultural and cological viewpoints
- For assuring the quality of generic environmental management packages fit to be adapted to specific zones in Europe of varying vulnerability
- For the promotion of European concepts on environmental management in countries with clean-up problems (e.g., USA) and in economically emerging countries with nuclear capabilities (e.g., in Eastern Europe and Asia)

The discussion following the presentation focused on possible NKS – EC cooperation. The EC representatives said that there are already good contacts with the Nordic research community in radioecology and mentioned their participation in seminars and conferences in the Nordic countries. They expressed their interest in the NKS/BOK-2 project (radiological consequences). The main scope and structure of BOK-2 seem to be well within the boundaries of EC interest defined by such key words as "vulnerability of ecosystems" and "indicators of vulnerability"; vulnerability being defined as "a complex of interactive factors in the environment determining the amount of contamination (dose) which will affect man in this environment".

Limited information could be provided regarding radioecology in the 5th program since the program has not been accepted and plans have not been finalized. The need for a wholistic approach and cross-disciplinary projects was mentioned. It was indicated that the first call for proposals in radioecology could be made in December 1998.

In conclusion it can be stated that there are already extensive contacts and active participation by Nordic groups in the EC research projects in radioecology. There is every reason to believe that there will be active Nordic participation in the 5th program. Nordic scientists are encouraged to use the NKS project proposals and ideas as a starting point for work on EC proposals with participation of scientists from outside the Nordic countries, since it is very difficult, if not impossible, to combine NKS and EC projects due to formal aspects.

Nuclear Emergency Preparedness

Mr. N. Kelly presented the nuclear emergency preparedness activities within the 4th framework program. He predicted radical change for the new program: more user driven and focused on problem solving. The emergency preparedness issues were discussed, and projects concerning restoration were found to be of interest to EC as well as NKS. In this area, Mr. Kelly felt a need for new technologies and a greater involvement from the industry. Decision making in emergency preparedness is not efficient at the moment, he claimed; it should be made quicker and more effective. Better use should be made of plant data; and models need to be brought in better agreement with data.

Some of the EC representatives expressed the view that there are too many exercises. It was agreed that it is a good idea to combine larger international exercises with national and regional exercises in order to reduce the total number and the work load. The idea of a Nordic emergency preparedness handbook was discussed and found to be a good and practical initiative. The concerted action regarding RESUME 2000 was mentioned as an example of practical cooperation between NKS and EC.

Information Issues

There was of course a large degree of agreement concerning the importance of information, but no concrete proposals for cooperation were given.

Radioactive Waste

Mr. H. von Maravic presented the research activities in waste management. The research is divided into following topics:

- Safety aspects of waste disposal
- Experiments in underground research facilities
- Research on basic phenomena
- Partitioning and transmutation

In the discussion after the presentations, the EC representatives expressed interest in some of the aspects of the NKS waste program. Especially questions regarding implementations of different treaties and conventions were discussed, and EC was interested in what NKS would discuss regarding Environmental Impact Assessments. The NKS plans concerning case studies at Kjeller were discussed as a topic where some activities could be linked to the EC program.

Under EC, no projects with the same scope as the planned NKS/SBA-1.1 activity (nuclear threats in Nordic surroundings) are conducted. The political sides of SBA-1.1 were discussed, and there was an agreement that this study should serve as a data base for consideration by different types of authorities, media and the public; and that it is important that the project does not pretend to rank the threats.

Reactor Safety

The 4th framework program on Nuclear Fission, which still continues, basically comprises two areas of interest as regards reactor safety, namely area A: ”Exploring Innovative Approaches”; and area B: ”Reactor Safety”. Area A should ”contribute to the development of new concepts for improving the safety of reactors and fuel cycle, giving priority to problems of generic nature”. Nordic participation in activities in this area is limited. Within the new 5th framework program, these activities will be placed under ”Safety and Efficiency of Future Systems” as a part of key action #2. Preliminary objectives will be to undertake research on means to reduce the radiotoxicity and the lifetime of radioactive waste; and to develop an inherently safe and cost effective reactor, generating a minimum of long-lived, high-level radioactive waste.

Area B: ”Reactor Safety” is of more direct interest to NKS and was therefore emphasized in the presentations given by EU officials. Mr. van Goethem introduced the area by explaining the strong focus in the 4th program on severe accidents and that approximately 35 projects were on-going divided into the following clusters:

- in-vessel core degradation and coolability
- ex-vessel corium behavior and coolability
- source term
- containment performance and energetic threats
- accident management measures and ageing as so called supporting activities

Mr Keinhorst, EC, explained in more detail the first four issues above and said that Nordic participation exists in several of the above areas. As far as the 5th program is concerned, very little was said from the EC officials as the program was not yet finally accepted. The area of severe accidents was, however, going to be de-emphasized and included in “Operational Safety of Existing Reactors” with focus on prevention and mitigation.

Mr Keinhorst also introduced activities related to ageing and mentioned that the main research topics were

- neutron irradiation and dosimetry
- neutron irradiation induced materials degradation
- structural integrity of components and welds

Limited Nordic participation was experienced in this area. He hoped for more BWR oriented projects in the next program, which according to plans will place more emphasis on effects of ageing.

Finally, Mr. Bermejo, EC, explained the activities in the supporting activity of accident management and mentioned that Nordic participation exists here also. Within the new 5th framework program, these activities will be placed undr “Operational Safety of Existing Facilities”.

In the discussion following the EC and NKS presentations in the area of reactor safety, it was evident that a lot of cooperation already exists between researchers from the Nordic countries and the rest of Europe. NKS could, however, contribute to an even more active Nordic participation in joint EU research in reactor safety. In particular, NKS could assist in promoting Nordic researchers to approach colleagues in the rest of Europe to collaborate on solving joint problems, perhaps with focus on BWR issues. The representatives of the Commission also asked NKS and Nordic organizations to provide proposals on issues such as integrated safety assessment, safety management and safety culture as well as modernization. These are areas were the Nordic profile is high and its reputation good. Important messages to NKS and Nordic researchers are to be active in finding collaborators outside the Nordic countries for preparation on interesting research proposals; and to put more efforts on participation in EU research in order to get easy access to the results produced within the EC program.

Appendix 6. Conclusions of the EC/NKS workshop (Brussels, 2 July 1998)

EUROPEAN COMMISSION
DIRECTORATE-GENERAL XII
SCIENCE, RESEARCH AND DEVELOPMENT
Directorate F - RTD Actions: Energies
Fuel cycle and radioactive waste

Brussels, 13 July 1998
GVG/jl/022001

Mr Magnus von BONSDORFF
TEOLLISUUDEN VOIMA OY
FIN-27160 Olkiluoto

Subject: Conclusions of the EC/NKS workshop (Brussels, 2 July 1998)

Dear Magnus,

Please find enclosed, for your comments and modifications, the "draft" minutes of the abovementioned workshop, which was a very interesting occasion to exchange our different (but complementary) views on nuclear fission safety research needs.

In conclusion of the workshop, it seems to us that the multidisciplinary approach of NKS, with emphasis on global risk assessment, is quite complementary to the more traditional disciplinary approach of the EC, in that it provides a useful tool for a research programme on nuclear fission safety to set a hierarchy of priorities and to identify gaps in the knowledge base. Reversibly, the disciplinary approach is useful to the global risk assessment experts, in that it provides them with the needed expert judgements, numerical values and know-how for detailed phenomena. As a result of the workshop, a series of RTD items of common interest were identified and will be further discussed in the prospective of the Key Action on "Nuclear Fission" in the next Framework Programme.

Looking forward to pursuing our fruitful exchange of information and to meeting NKS representatives on other occasions (such as the coming VTT-NKS-EC workshop organised by Prof. Lasse MATTILA in Helsinki on 24 September 1998), I remain,

Yours sincerely,

Georges VAN GOETHEM
Co-ordinator of RTD Activities in
Reactor Safety

Annex: draft minutes of the abovementioned workshop

cc with annex: NKS delegation + Messrs J Routti, E Andreta and H Forsström

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EUROPEAN COMMISSION
DIRECTORATE-GENERAL XII
SCIENCE, RESEARCH AND DEVELOPMENT
RTD Actions : Energies
Fuel cycle and radioactive waste

Brussels, 13 July 1998
GVG/vl/ D(97)

MEETING REPORT AND LIST OF ACTIONS (Draft minutes)

Subject:	**NKS / EC Workshop (Nordic Nuclear Safety Research)** **Note: NKS delegation led by Mr. Magnus Von Bonsdorff**
Place:	**Brussels - EC building MO 75**
Date:	**2 July 1998 (9h^{00}-17h^{30})**
NKS delegation:	**Messrs. M. Von Bonsdorff (NKS/Finland, chairman of NKS), T. Bennerstedt (NKS/Sweden, secretary general of NKS), E. Stranden (Statens Strålevern/Norway), S. M. Magnusson (IRPI/Iceland) and C. Viktorsson (NKI/Sweden).**
EC participants:	**Messrs. H. Forsström, G. Van Goethem, J. Martin Bermejo, A. Zurita, K. Pflugard, H. Von Maravic, B. Haijtink and G. Cottone from DG XII-F-5 (Fuel cycle and radioactive waste),** **G. Desmet and N. Kelly from DG XII-F-6 (Radiation protection), and** **S. Zero from DG-JRC Brussels (national detached expert).**
Apologies for absence have been received from:	**Messrs. J. Sinnaeve, H. Menzel and Mrs. A. Karaoglou from DG XII-F-6,** **Messrs. F. Ruel from DG XI-C-2, D. Taylor from DG XI-C-3 and C. Waeterloos from DG XVII C-3.**
Distribution:	**Messrs. J. Routti, E. Andreta, M. Poireau, NKS delegation, EC participants + list of absent colleagues + Mrs. S. Frigren from DG XI-C, Messrs. S. Crutzen from DG-JRC/IAM (Petten) and H. Weisshaüpl from DG-JRC/ISIS (Ispra).**
Contact person (organiser): G. Van Goethem, MO75 - 5/27, Tel. 51424	

Background

The Nordic countries (Denmark, Finland, Iceland, Norway and Sweden) have a original tradition of cooperation in a number of fields where they share interests common to at least 3 countries. NKS - which stands for Nordic Nuclear Safety Research - is a voluntary co-operative body funded essentially by national safety authorities, nuclear companies

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and other Nordic organisations and aimed at providing support essentially to governmental organisations in the Nordic Countries. NKS is used to work in four-year research programs, essentially devoted to reactor safety, radioactive waste and environmental impact. The total budget of the just started sixth NKS programme 1998-2001 amounts to about 1 Mio ECU (cash) per year + in-kind contributions (e.g. to finance international emergency exercises).
Projects on reactor safety are focusing on strategies to deal with maintenance, ageing and severe accident management. Projects on waste management concentrate on long-lived low - and medium - level waste. Projects on environmental impact of radioactive releases comprise marine radioecology, including sediment research, and modelling of transfer mechanisms of cesium and strontium. Emergency exercises, using mobile measurements, and information strategies towards the public in event of nuclear accident also are important issues treated by the NKS.

Scope of the workshop

Today's workshop is the first joint NKS/EC meeting with exchange of scientific presentations. Earlier meetings with Messrs. M. von Bonsdorff and T. Bennerstedt (held in 1996, Helsinki, with Messrs. W. Balz and J. Sinnaeve and in 1997, EC Brussels, with Prof. J. Routti) have shown that some research issues in the area of Nuclear Fission Safety could be of common interest to NKS and to EC. The scope of today's workshop is to discuss and to identify precisely research items of common interest which could be proposed for a Community project in the next EC Framework Programme (1998-2002), and to set the basis for a future exchange of results and experience on a regular basis.

Technical presentations

A total of 10 technical presentations of about 1/2 hour, followed by discussions, were made by representatives of the NKS and EC delegations about 3 items (see enclosed Agenda / copies of the transparents are available in my office):

1 - radioprotection and emergency preparedness
2 - radwaste management and decommissioning
3 - reactor safety

It was recalled that the present EURATOM research programme is aimed at providing know-how and technologies, useful to optimise the decision making process for a number of nuclear fission safety related issues, like: radioprotection of man and environment, radwaste management, decommissioning, and either modernising existing nuclear installations or ordering and designing new ones in the coming years. All actors of our society interested in this decision process - governments, manufacturing industry, utilities (acting for example through the EUR initiative of European Utility Requirements), regulatory safety authorities (acting for example through similar European consortia), political and financial organisations, research organisations as well as environmental groups - are expected to take advantage of the results of the Community research in their decision making, while being invited to take themselves an effective part in the Community projects. The interaction between Community research, NKS activities and industrial applications could be particularly useful in the current discussion in Finland about the construction of a possible new nuclear power plant.

To the NKS question about dissemination of Community research results, it was answered that DG XII/F-5 and -6 are organising mid-term and final symposia (usually with full-text printed-out proceedings and with executive summaries), topical workshops, ERPET - and EURO-courses, as well as publications in international conferences and

ERPET - and EURO-courses, as well as publications in international conferences and scientific magazines. To the question about the (commercial) exploitation of Community research results, it was recalled that 'Foreground informations are owned by the contractors generating it" (Article 9 of the General Conditions of the Cost Reimbursement Model Contract). As a consequence the Commission can disseminate the results of the Community multipartner projects but, not being the owner, cannot authorise their exploitation, unless all project partners agree to do so. The rationale behind these rules about Intellectual Property Rights (IPR) is essentially that contracting commercial organisations - who are paying 50% of the total project costs (like every partner except the universities) - wish the results relevant to potential technological developments to be protected, at least within the partnership of their multipartner project.

List of actions

During the panel discussion at the end of the day, it was agreed to remain in touch for the preparation of Community RTD proposals in 4 areas (= 4 actions on NKS and EC):

1. integral risk assessment, with emphasis on the definition of safety indicators (both quantitatively and qualitatively), taking advantage of what is done in the non-nuclear industry
2. safety relevant issues in the modernisation of existing nuclear power plants (repair, back-fitting and up-grading)
3. assessment of efficiency of environmental management support tools, with emphasis on socio-economic impact of remedial actions
4. examination of the vulnerability concept in radioecology and determination of contamination transfer mechanisms and coefficients to man and environment

It was also agreed that the well established NKS experience in scientific co-operation with Russia could be beneficial to the setting up of joint EC / Russian RTD projects of common interest, for example in line with some TACIS assistance programmes.

Conclusions

All doubts about possible duplications between NKS and EC research programmes could be removed. The Nordic multidisciplinary approach of considering all together, on one side, research on reactor safety, waste management, environmental impact studies and, on the other side, practical applications such as international emergency exercises and public information campaigns is of big interest to those who are traditionally more used to the "compartmentalised" disciplinary approach. It was concluded that a synergy of these 2 approaches to nuclear fission safety research could benefit equally to all actors in this area and fits particularly well with the objectives of the next EC Framework Programme 1998-2002.

It was also concluded that a "de facto" co-operation exists between NKS and the EC as a number of Nordic organisations are involved in research projects of DG XII and in expert groups of DG XI and DG XVII. Nevertheless, commitments were taken to further improve there contacts trough regular exchanges of information and, in particular, through a stronger participation of NKS representatives in future EURATOM research projects of common interest. Also it should be expected to have an EC participation in a future European workshop organised by NKS and the Nordic "end-users" in 2000.

AGENDA

Workshop NKS/EC
2 July 1998 (MO75 - R3)

9 h 00 - 9 h 15	Mr. H. FORSSTRÖM Introduction / EC EURATOM framework programme
9 h 15 - 9 h 30	Messrs M. von BONSDORFF and T. BENNERSTEDT Introduction / NKS organisation
9 h 30 - 9 h 45	Mr. S.M. MAGNUSSON (from NKS) Preparing the new NKS programme 1998-2001 Balance of NKS efforts between (i) radioprotection / emergency preparadness, (ii) radwaste management and decommissioning, and (iii) reactor safety

RADIOPROTECTION / EMERGENCY PREPARADNESS

9 h 45 - 10 h 15	Mr. S.M. MAGNUSSON (from NKS) Radioecology and radiological consequences (BOK-2) Mr. E. STRANDEN (from NKS) Emergency preparadness (BOK-1), cross-disciplinary studies, drills and exercises, information issues (SBA)
10 h 15 - 10 h 45	Messrs N. KELLY and G. DESMET (from DG XII/F/6) Radioecology, radioprotection and emergency preparadness
10 h 45 - 11 h 00	Round-table discussion
11 h 00 - 11 h 15	Coffee break

RADWASTE MANAGEMENT AND DECOMMISSIONING

11 h 15 - 11 h 45	Mr. E. STRANDEN (from NKS) Radwaste management (SOS-3)
11 h 45 - 12 h 15	Messrs H. von MARAVIC and K. PFLUGRAD (from DG XII/F/5) Radwaste management and decommissioning
12 h 15 - 12 h 30	Round-table discussion
12 h 30 - 14 h 00	Lunch

REACTOR SAFETY

14 h 00 - 14 h 45	Mr. C. VIKTORSSON (from NKS) Nuclear safety: assessment and strategies (SOS-1); reactor safety (SOS-2)
14 h 45 - 15 h 00	Mr. G. KEINHORST (from DG XII/F/5) Ageing of reactors (monitoring + backfitting of reactors)
15 h 00 - 15 h 15	Mr. A. ZURITA (from DG XII/F/5) Severe accidents (phenomenology + mitigation measures)
15 h 15 - 15 h 30	Mr. J. MARTIN BERMEJO (from DG XII/F/5) Advanced reactor concepts (evolutionary + revolutionary)
15 h 30 - 16 h 00	Coffee break
16 h 00 - 17 h 00	Round-table discussion (identification of RTD areas of common interest)
17 h 00	Closure of the meeting

NUCLEAR FISSION SAFETY FI4 (F5 & F6)

Total of contracts: 203
Swedish participation: 84 times, included 8 as co-ordinators
Swedish partners involved in 61 contracts of total EC contribution: 52,8 MECU

NAME OF SWEDISH PARTNERS AND NUMBER OF PARTICIPATIONS

MASTERING EVENTS OF THE PAST (C)	
Karolinska Institute	1
INNOVATIVE (I)	
Chalmers University of Technology AB	2
Kungliga Tekniska Högskolan	1
Uppsala University	2
RADIOPROTECTION (P)	
Forsmarks Kraftgrupp AB	1
Handelshögskolan i Stockholm	1
Karolinska Institute	4
Linköping University	2
Lunds Universitet	5
National Chemicals Inspectorate	1
National Defence Research Establishment	1
Statens Strälskyddsinstitut	9
Studsvik Eco & Safety AB	2
Swedish Meteorological and Hydrological Institute	2
Swedish Nuclear Power Inspectorate	1
The Swedish University of Agricultural Sciences	3
University of Göteborg	1
Uppsala University	6
Västernorrland County Council	1
SAFETY (S)	
Karinta Konsult HB	1
Kungliga Tekniska Högskolan	8
Studsvik Eco & Safety AB	1
Studsvik Material AB	1
Swedish Nuclear Power Inspectorate	3
Sydkraft Konsult AB	2
Vattenfall Energisystem AB	4
Vattenfall Utveckling AB	1
WASTE (W)	
Chalmers University of Technology AB	1
Clay Technology Lund AB	2
Conterra AB	2
Kungliga Tekniska Högskolan	2
Lunds Universitet	1
Stockholms Universitet	1
Studsvik Material AB	1
Svensk Kärnbränslehantering AB	5
Terralogica AB	1
Uppsala University	1
TOTAL Swedish participation	**84**

SWEDISH CO-ORDINATORS, AREAS AND NUMBER OF CONTRACTS	
Clay Technology Lund AB	W
Handelshögskolan i Stockholm	P
Karolinska Institute	C
Kungliga Tekniska Högskolan	I, S
Swedish Nuclear Power Inspectorate	S (2)
Uppsala University	P
TOTAL	**8**

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NUCLEAR FISSION SAFETY FI4 (F5 & F6)

Total of contracts: 203
Finnish participation: 81 times, included 5 as co-ordinators
Finnish partners involved in 57 contracts of total EC contribution: 36,1 MECU

NAME OF FINNISH PARTNERS AND NUMBER OF PARTICIPATIONS

MASTERING EVENTS OF THE PAST (C)	
STUK - Radiation and Nuclear Safety Authority	2
INNOVATIVE (I)	
Lappeenrannan Teknillinen Korkeakoulu	1
Technical Research Centre of Finland	3
Imatran Voima OY	1
RADIOPROTECTION (P)	
Finnish Cancer Registry	1
Finnish Environmental Institute	2
Finnish Meteorological Institute	
Helsinki Institute of Physics	1
Helsinki University of Technology	1
STUK - Radiation and Nuclear Safety Authority	14
Technical Research Centre of Finland	2
The Finnish Forest Research Institute	1
University of Helsinki	1
University of Kuopio	1
SAFETY (S)	
IVO (Power Engineering) International Ltd.	8
STUK - Radiation and Nuclear Safety Authority	2
Technical Research Centre of Finland	20
WASTE (W)	
Fintact Ltd.	1
Geological Survey of Finland	1
IVO (Power Engineering) International Ltd.	1
Kivitieto Oy	1
Posiva Oy	2
STUK - Radiation and Nuclear Safety Authority	1
Technical Research Centre of Finland	10
Teollisuuden Voima Oy	1
University of Helsinki	2
TOTAL Finnish participation	**81**

FINNISH CO-ORDINATORS, AREAS AND NUMBER OF CONTRACTS	
Geological Survey of Finland	W
Helsinki Institute of Physics	P
STUK - Radiation and Nuclear Safety Authority	P (2)
Technical Research Centre of Finland	I
TOTAL	**5**

FINOIS.XLS

NUCLEAR FISSION SAFETY FI4 (F5 & F6)

Total of contracts: 203
Danish participation: 25 times, included 5 as co-ordinators
Danish partners involved in 21 contracts of total EC contribution: 25,4 MECU

NAME OF DANISH PARTNERS AND NUMBER OF PARTICIPATIONS

MASTERING EVENTS OF THE PAST (C)	
Risø National Laboratory	1
Danish Cancer Society	1

RADIOPROTECTION (P)	
Århus Kommunehospital	1
Århus Universitet	1
Danish Cancer Society	1
Danish Meteorological Institute	2
Ministery of the Interior, Emergency Management Agency	1
Risø National Laboratory	8

SAFETY (S)	
Risø National Laboratory	2

WASTE (W)	
Århus Universitet	1
National Environmental Research Institute - Ministry of Environment and Energy	1
Risø National Laboratory	1

TOTAL Danish participation	21

DANISH CO-ORDINATORS, AREAS AND NUMBER OF CONTRACTS	
Risø National Laboratory	C, P (2)
Danish Cancer Society	C
Århus Kommunehospital	P

TOTAL	5

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NUCLEAR FISSION SAFETY FI4 (F5 & F6)

Total of contracts: 203
Norvegian participation: 15 times, NONE as co-ordinators
Norvegian partners involved in 12 contracts of total EC contribution: 13,1 MECU

NAME OF NORVEGIAN PARTNERS AND NUMBER OF PARTICIPATIONS

MASTERING EVENTS OF THE PAST (C)	
Institute for Energy Technology	1
Norwegian Radiation Protection Authority	1
Agricultural University of Norway	1

RADIOPROTECTION (P)	
Agricultural University of Norway	1
Institute for Energy Technology	1
Institute of Transplantation Immunology	1
Nord-Trondelag College	1
Norges Teknisk-Naturvitenskapelige Universitet	1
Norwegian Institute for Air Research	1
Norwegian Radiation Protection Authority	4
University of Oslo	1

SAFETY (S)	
Institute for Energy Technology	1
TOTAL Norvegian participation	**15**

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