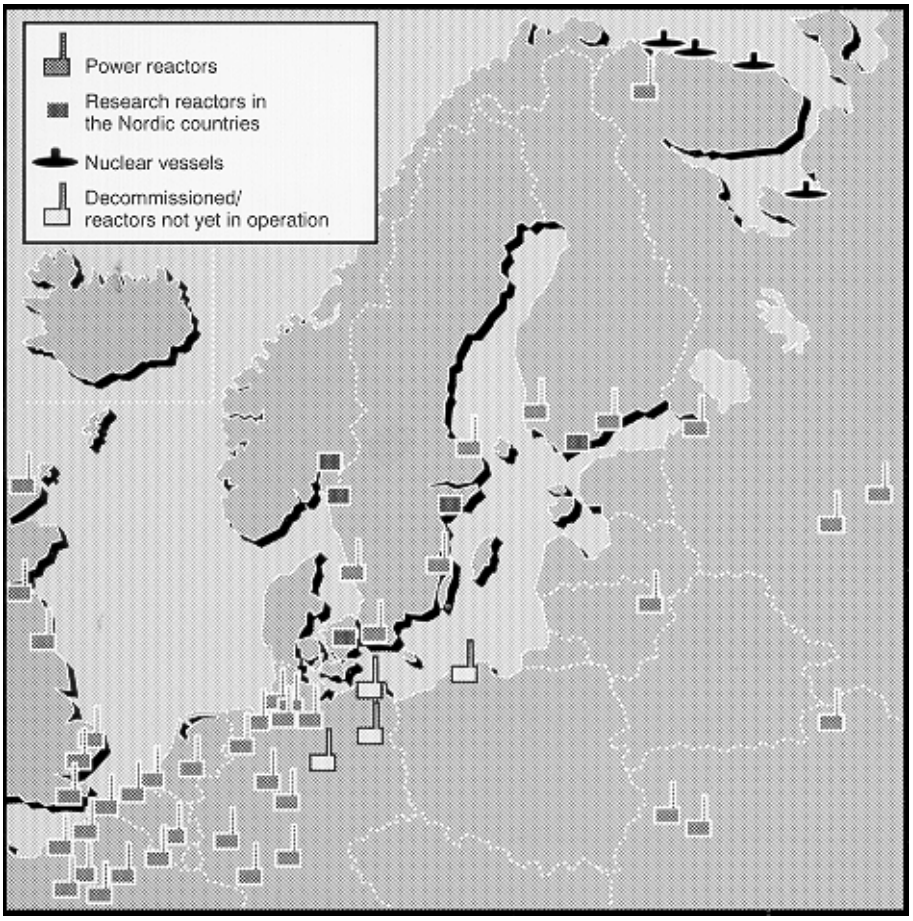
Emergency exercises and information exchange. Does practice make perfect?



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

To that end, the results of the fifth four-year NKS program (1994 – 1997) are herewith presented in a series of final reports comprising reactor safety, waste management, radioecology, nuclear emergency preparedness and information issues. Each report summarizes one of the ten projects carried out during that period, including the administrative support and coordination project. A special Summary Report, with a brief résumé of all ten projects, is also published. Additional copies of the reports on the individual projects can be ordered free of charge from the NKS Secretariat.

The final reports – together with some technical reports and other material produced during the 1994 – 1997 period – have been collected on a CD-ROM, also available free of charge from the NKS Secretariat.

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Emergency exercises and information exchange. Does practice make perfect?

Final Report of the Nordic Nuclear Safety Research Project EKO-4

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September 1999

This is NKS

NKS (Nordic Nuclear Safety Research) is a scientific cooperation program in nuclear safety, radiation protection and emergency preparedness. Its purpose is to carry out cost-effective Nordic projects, thus producing research results, exercises, information, manuals, recommendations, and other types of background material. This material is to serve decision-makers and other concerned staff members at authorities, research establishments and enterprises in the nuclear field.

The following major fields of research are presently dealt with: reactor safety, radioactive waste, radioecology, emergency preparedness and information issues. A total of nine projects have been carried out in the years 1994 - 1997.

Only projects that are of interest to end-users and financing organizations have been considered, and the results are intended to be practical, useful and directly applicable. The main financing organizations are:

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

Additional financial support has been given by the following organizations:

In Finland: Ministry of the Interior; Imatran Voima Oy (IVO); Teollisuuden Voima Oy (TVO)
In Norway: Ministry of the Environment
In Sweden: Swedish Rescue Services Board; Sydkraft AB; Vattenfall AB; Swedish Nuclear Fuel and Waste Management Co. (SKB); Nuclear Training and Safety Center (KSU)

To this should be added contributions in kind by several participating organizations.

NKS expresses its sincere thanks to all financing and participation organizations, the project managers and all participants for their support and dedicated work, without which the NKS program and this report would not have been possible.

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Abstract

This project has covered a series of exercises and exercise like activities, in addition to a survey of scenario development tools and development of a suggestion for a Nordic system for data and information exchange. The results from the activities are presented in this report in a methodical perspective. The results reveal three similar components in almost all exercise activities: tools and methods to be used in an emergency situation need further development, systems for communication and information exchange should be developed and implemented, and the format and content of the information to be exchanged in an emergency situation should be agreed upon. Recommendations for future tasks regarding Nordic exercises are given according to this methodical approach. A major aspect here is to develop strategies for the over-all emergency planning. Such strategies should include the use of systematically chosen exercise types to improve the emergency response in a systematic way.

Key words

Nuclear emergency preparedness; exercises; data and information exchange; scenario development; exercise methodology; drill; table top exercise; decision conference.

Summary with conclusions and recommendations

The objectives of the project

The objectives of the EKO-4 project have been to contribute to competence development of personnel in emergency organisations, draw attention to and further develop contingency plans for nuclear accidents, contribute to joint professional evaluations and co-ordination between the Nordic countries and improve the understanding of various types of action and decisions taken in neighbouring countries through joint Nordic exercises and an improved system of exchange of information and data between the Nordic countries.

Exercises are arranged frequently in order to validate plans and procedures. However, no joint contingency plans exist between the Nordic countries. The basis for the Nordic exercises is *inter alia* agreements regarding early notification and exchange of information, and acknowledgement that we can better develop the nuclear emergency preparedness in the event of the occurrence of a nuclear accident jointly rather than singly.

Exercises are recognised by the fact that they is scenario-based activities each having a different scope, and containing three phases: planning, execution and evaluation. The activity can be executed in real time or independent of time. Exercises require resources at all phases, and arranging joint Nordic exercises can be cost effective.

Implementation of the results of an exercise are not regarded as being part of the exercise, and implementation of the exercise results have therefore not been an objective of this project.

Activities during the project period

During the project period 1994-1997, several functional exercises or activities similar to exercises have been arranged within the different professional areas:

- evaluation of accidents/analysis of the source term (seminar, 1997)
- atmospheric dispersion (exercises and seminars, 1995 and 1996)
- dose calculation (exercise and seminar, 1995)
- clean-up actions in an urban environment (decision conference, 1995)
- information exercise in connection with RESUME95 (exercise, 1995)

After the series of functional exercises, a large-scale exercise was arranged in which Nordic objectives were linked to the international exercise INEX-2-FIN (arranged by OECD/NEA).

Parallel to the exercises, work has been ongoing with charting the requirements of different groups for tools for scenario development, as well as what tools are

available, because the planning phase of an exercise usually requires large resources.

The work with the proposal for a Nordic system for exchange of data and information has been ongoing independent of the exercise activity.

Results

The results of the different exercise activities coincide in part. This is positive, because it is the different groups which have participated in exercises in different areas and conclusions which coincide are useful as a joint lift in the continuing work with nuclear emergency preparedness. The conclusions are summarised below, together with concrete examples from some of the exercises:

- There is a requirement for **further development of methods and tools**. Comparison of atmospheric dispersion models have already been carried out several times in the Nordic countries, but areas which need improvement can still be identified, *inter alia* work can still be done on the uncertainty of the models. The exercise with dose calculation showed that the tools which are in use are so different that it is difficult to compare the results, and a harmonised further development is desirable. Where evaluation of accidents and source term is concerned, the tools are still not completely developed, but exchange of information about the tools which are available was useful both for countries with nuclear power, and the other Nordic countries. Such exchange of information can also contribute to harmonisation in the development work.

- There is a requirement for **further development of systems for communication and exchange of information**. After INEX-2-FIN, the large exercise, it was recommended that a more detailed study be performed of the different channels of communication in order to chart more efficiently how they can be utilised. During the decision conference on clean-up actions in an urban environment, the need for good communication between experts and decision-makers was pointed out, while the information exercise focussed on the need for communication between experts, information staffs and the media. In this project a proposal was also prepared for a Nordic system of exchange of data and information. Work with further developing such systems in the Nordic countries can be based on this proposal and similar work which is ongoing internationally.

- There is a requirement to work more with **the content of the information which is exchanged**. A joint format for presentation of the results of the atmospheric dispersion models had already been proposed in the previous NKS period, but this format was not implemented. This work can be continued. As regards evaluation of accidents and source term, there is a requirement to work

with what type of information concerning the status at the plant and assessment of source term which is, and ought to be, exchanged and at what point in time. This was also a lesson learned from INEX-2-FIN, where it was pointed out that work should be continued with what type of information which should be exchanged at any time («key information»).

- As regards the more methodic aspects of arranging exercises, some results can be obtained and areas for follow-up suggested on the basis of the activities which have been ongoing in the project, *inter alia*:

- When planning exercises, **scenarios** must be developed. Different groups have different requirements as regards details included in the scenario, and this ought to be elucidated upon in order to evaluate if one should allocate more resources for development of tools such that exercise scenarios can be more easily generated. A survey conducted in this project showed that a range of tools are available and that the present technical potential is probably not utilised.

- There is a **risk** involved with exercises, and one must ensure that the security of the plant and safety of personnel is not weakened by exercises. There is also a risk involved with exercise scenarios since these can contribute to generating myths in the contingency planning work. It looks as though there is a tendency in Nordic exercises to choose scenarios with very serious consequences. Scenarios should not contribute to creating myths regarding what type of situation an organisation should be able to handle, which groups need exercises, etc. Neither should the choice of scenario contribute to experiences from exercises being uncritically used as objectives and strategies for contingency planning if the establishment of such objectives and strategies was not the object of the exercise. For example, no conclusions can be drawn as to what type of information exchange is desirable or possible in an early phase of an accident on the basis of what type of information exchange one achieved in a given scenario.

- At present there is no clear terminology or strategy linked to exercises in the Nordic countries. There is a requirement for further development of joint **terminology and methodology** for exercises. Further work with development of scenarios has already been mentioned, but there is also a requirement to look at how both accomplishment (for example further development regarding the use of decision-making conferences) and evaluation of exercises which can be made more efficient. In addition, there is a requirement to see how experiences from exercises can effectively be implemented in planning and in organisations.

Conclusion

The exercises which are carried out during the project period have provided useful knowledge and many proposals for the further development of nuclear emergency

preparedness in many different professional areas, both nationally and jointly in the Nordic countries. However, there appears to be a requirement to develop more long-term plans and strategies for Nordic contingency planning and Nordic exercises, as well as a greater awareness of what is an appropriate exercise format to achieve a given objective. This can contribute to reduce costs and optimise the benefits of the exercises which are arranged.

Exercises can be regarded as a **means** to develop, harmonise and validate plans, procedures and tools, but work with exercises can also be regarded as an **objective** in the sense that it can contribute to optimise the use of resources allocated for exercises. Increased awareness of *inter alia* these problems will be advantageous to continuing work with Nordic exercises. Increased awareness will also be able to contribute to practice makes perfect.

Sammendrag med konklusjoner og anbefalinger

Målsetning for prosjektet

EKO-4-prosjektet har hatt som målsetting å bidra til kompetanseutvikling for personell i beredskapsorganisasjonene, synliggjøre og videreutvikle atomulykkesberedskapen, bidra til felles faglige vurderinger og koordinering mellom de nordiske land og bedre forståelsen for ulike tiltak og beslutninger i naboland gjennom felles nordiske øvelser og et bedret system for utveksling av informasjon og data mellom de nordiske land.

Øvelser arrangeres ofte for å validere planer og prosedyrer. Mellom de nordiske land finnes det imidlertid ingen felles beredskapsplaner. Grunnlaget for de nordiske øvelsene er bl.a. avtaler om varsling og informasjonsutveksling og en erkjennelse av at vi sammen kan utvikle atomulykkesberedskapen bedre enn hver for oss.

Øvelser kjennetegnes av at de er scenarie-baserte aktiviteter med ulikt omfang som har tre faser: planlegging, gjennomføring og evaluering. Aktiviteten kan gjennomføres i sann tid eller uavhengig av tid. Øvelser er ressurskrevende i alle faser, og det å arrangere felles nordiske øvelser kan være kostnadseffektivt.

Implementering av resultatene fra en øvelse regnes ikke som en del øvelsen, og implementering av øvelsesresultatene har derfor heller ikke vært et mål i dette prosjektet.

Aktiviteter i prosjektperioden

I prosjektperioden fra 1994-1997 har det blitt arrangert en rekke funksjonsøvelser eller øvelsesliknende aktiviteter innenfor ulike fagområder:

- vurdering av ulykker/analyse av kildeterm (seminar, 1997)
- spredning i luft (øvelser og seminarer, 1995 og 1996)
- doseberegning (øvelse og seminar, 1995)
- senfase-tiltak i urbant miljø (beslutningskonferanse, 1995)
- informasjonsøvelse i tilknytning til RESUME95 (øvelse, 1995)

Etter serien av funksjonsøvelser ble det arrangert en større øvelse der nordiske målsettinger ble koplet til den internasjonale øvelsen INEX-2-FIN (i regi av OECD/NEA).

Parallelt med øvelsene har det pågått et arbeid med å kartlegge ulike gruppers behov for verktøy for scenarie-utvikling, samt hvilke verktøy som er tilgjengelige, fordi planleggingsdelen av en øvelse vanligvis er svært ressurskrevende.

Arbeidet med å foreslå et nordisk system for data- og informasjonsutveksling har pågått uavhengig av øvelsesaktiviteten.

Resultater

Resultatene fra de ulike øvelsesaktivitetene er til dels svært sammenfallende. Dette er positivt, fordi det er ulike grupper som har deltatt i øvelser på ulike områder og sammenfallende konklusjoner er nyttig for et felles løft i det videre arbeidet med atomulykkesberedskap. Konklusjonene er oppsummert i det følgende, sammen med konkrete eksempler fra enkelte av øvelsene:

- Det er behov for å **videreutvikle hjelpemidler, metoder og verktøy**. Sammenlikning av spredningsmodeller er allerede gjennomført flere ganger i Norden, men områder for forbedring kan fortsatt identifiseres, bl.a. kan det arbeides mer med usikkerhet i modellene. Doseberegningsøvelsen viste at de verktøy som er i bruk er så ulike at det er vanskelig å sammenlikne resultatene, og en harmonisert videreutvikling er ønskelig. Når det gjelder vurdering av ulykker og kildeterm, er hjelpemidlene ennå ikke ferdig utviklet, men utveksling av informasjon om de verktøy som finnes var nyttig både for kjernekraftlandene og de øvrige nordiske land. Slik informasjonsutveksling kan også bidra til harmonisering i utviklingsarbeidet.

- Det er behov for å **videreutvikle systemer for kommunikasjon og informasjonsutveksling.** Etter INEX-2-FIN, den store øvelsen, ble det anbefalt å gjennomføre en mer detaljert studie av de ulike kommunikasjonskanaler for å kartlegge bedre hvordan de kan utnyttes. Under beslutningskonferansen om senfase-tiltak i urbant miljø, ble det pekt på behovet for god kommunikasjon mellom eksperter og beslutningstakere, mens informasjonsøvelsen fokuserte behovet for kommunikasjon mellom eksperter, informasjonsstaber og media. I dette prosjektet ble det også utarbeidet et forslag til et nordisk system for data og informasjonsutveksling. Et arbeid med å videreutvikle slike systemer i Norden kan baseres på dette forslaget og liknende arbeider som pågår internasjonalt.

- Det er behov for å arbeide mer med **innholdet i den informasjonen som utveksles** til enhver tid. Allerede i forrige NKS-periode ble det foreslått et felles format for presentasjon av spredningsmodell-resultater, men dette formatet ble ikke implementert. Dette arbeidet kan videreføres. Når det gjelder vurdering av ulykker og kildeterm, er det behov for å arbeide med hva slags informasjon om status på ulykkesstedet og vurdering av kildeterm som skal og bør utveksles til hvilken tid. Dette var også lærdom etter INEX-2-FIN, der det ble pekt på at det bør arbeides videre med hva slags informasjon som skal utveksles til enhver tid («nøkkelinformasjon»).

Når det gjelder de mer metodiske sider ved det å arrangere øvelser, kan man på bakgrunn av de aktiviteter som har pågått i prosjektet trekke fram noen resultater og antyde områder for oppfølging, bl.a:

- Ved planlegging av øvelser må det utvikles **scenarier**. Ulike grupper har ulike behov for detaljer i scenariet, og dette bør utredes nærmere for å vurdere om man bør avsette mer ressurser til utvikling av verktøy for enkelt å kunne generere øvelses-scenarier. En undersøkelse gjennomført i dette prosjektet viste at en rekke slike verktøy er tilgjengelige og at det tekniske potensialet pr. i dag trolig ikke er utnyttet.

- Det er **risiko** forbundet med øvelser, og man må sørge for at sikkerheten ved anlegg og sikkerheten til personell ikke svekkes ved øvelser. Det er også risiko knyttet til øvelses-scenarier da disse kan bidra til å generere myter i beredskapsarbeidet. Det ser ut til å være en tendens i nordiske øvelser til at man velger scenarier med svært alvorlige konsekvenser. Scenariene bør ikke bidra til å skape myter om hva slags situasjoner en organisasjon skal kunne håndtere, hvilke grupper som trenger øvelser osv. Valg av scenario bør heller ikke bidra til at erfaringer fra øvelser ukritisk videreføres som mål og strategier for beredskapsplanleggingen dersom etablering av slike mål og strategier ikke var målet med øvelsen. Eksempelvis kan man ikke konkludere med hva slags informasjonsutveksling som er ønsket eller mulig i en tidlig fase av en ulykke på bakgrunn av hva slags informasjonsutveksling man fikk til ved et gitt scenario.

- Det finnes i dag ingen entydig terminologi eller strategi knyttet til øvelser i de nordiske land. Det er behov for å videreutvikle en felles **terminologi og metodikk** for øvelser. Videre arbeid med utvikling av scenarier er allerede nevnt, men det er også behov for å se på hvordan både gjennomføring (for eksempel videreutvikle bruk av beslutnings-konferanser) og evaluering av øvelser kan gjøres mer effektivt. I tillegg er det behov for å se på hvordan erfaringer fra øvelser effektivt kan implementeres i planverk og i organisasjoner.

Konklusjon

Øvelsene som er gjennomført i prosjektperioden har tilført nyttig lærdom og mange forslag til videreutvikling av atomulykkesberedskapen på mange ulike fagområder, både nasjonalt og felles nordisk. Det synes imidlertid å være behov for å utvikle mer langsiktige planer og strategier for nordisk beredskapsplanlegging og nordiske øvelser, samt en større bevissthet rundt hva som er hensiktsmessig øvelsesformat for å nå en gitt målsetning. Dette kan bidra til å redusere kostnadene og optimalisere utbyttet av de øvelser som arrangeres.

Øvelser kan sees på som et **middel** for å utvikle, harmonisere og validere planer, prosedyrer og verktøy, men arbeid med øvelser kan også sees på som et **mål** i den forstand at det kan bidra til å optimalisere ressursbruken knyttet til øvelser. En økt bevissthet rundt bl.a. disse problemstillingene vil være fordelaktig i et fortsatt arbeid med nordiske øvelser. Økt bevissthet vil kunne bidra til at øvelse helt sikkert gjør mester.

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1 Introduction

Nuclear accidents may have very serious national consequences but also the international, transboundary consequences may be considerable. To reduce the consequences of nuclear accidents emergency planning in a vital emergency response organisation is of major importance both in countries with major nuclear sources and in countries without such sources. To improve the emergency planning and response, exercises have also been regarded important to the emergency organisations both nationally, internationally and inter-Nordic.

On this basis, a joint Nordic nuclear emergency exercise programme for the period 1994-1997 was established through the Nordic Nuclear Safety Research project EKO-4. A series of nuclear emergency preparedness exercises of different kinds was planned in the Nordic countries, focusing the needs of the authorities. A major objective of the project was to contribute to reduced costs in exercise planning and performance. In addition joint exercises give valuable insight in the different organisations and special arrangements in each of the Nordic countries.

The Nordic countries have more or less developed national exercise programmes and plans reflecting different internal and external motivations for arranging exercises. In addition, there is a joint legal or agreed basis for exercises between the Nordic countries:

- International conventions and bilateral agreements on early notification and information exchange have been signed between most countries. The EU member countries (Denmark, Finland, and Sweden) have additional obligations on notification and information exchange.
- Between the Nordic countries there is a long tradition for co-operation which has resulted in several «gentlemen's agreements». These informal agreements form a basis for an extensive information exchange.

To practice according to these obligations, to avoid double messages, to achieve knowledge on plans and procedures in the other countries, and to gain an important basis for further development in different fields, joint Nordic exercises have been regarded as important.

In the NKS period 1990 - 1993 the first joint Nordic exercises were arranged. Two large and a couple of smaller exercises (drills) were conducted giving valuable experience for the nuclear emergency preparedness organisations (Bennerstedt 1995, Salo 1993, Salo 1994). In this project period the aim of this project in particular has been to focus on special topics in smaller exercises, forming a basis for a large joint exercise. The methodical aspects of exercising were to be focused in the project and this is reflected in this report. In addition, the project has covered works related to scenario development and data and information exchange sys-

tems. The wide range of topics included in the exercises resulted in a project organisation with several working groups consisting of different people. The project organisation is shown in Appendix 9.1.

In this report some philosophical and methodical aspects of exercising are reflected in the first chapters and brief summaries of the results of the different exercise activities are given thereafter. The results are then discussed in a methodical perspective, and finally recommendations for future work are given at the end.

2 Exercise philosophy and terminology

2.1 Why exercise?

After the Chernobyl accident huge efforts have been put in nuclear emergency planning with the aim of being able to handle both national accidents and accidents in neighbouring countries or even in countries far away.

To keep the plans and the response organisation alive and updated, and to make improvements in the planning and the response to an accident, the plans need to be put into practice using real accident situations or exercises. Thus, the old adage «Practice makes perfect» is an important reason for exercising but there are also more nuanced reasons why to exercise. Exercises have often been seen as a tool to test and exercise various aspects of the existing emergency plans and procedures at different levels in an organisation (IAEA 1985, OECD 1995). However, exercises can be arranged for several different purposes (Epler 1997) and exercises can be motivated by various internal and external benefits (Gillis 1996).

Internal benefits of nuclear emergency exercise activities might be:

- Enhancing the nuclear emergency response programme and capability by e.g. defining milestones for the nuclear emergency planning through exercises.
- Providing a training opportunity for the personnel responsible for handling a nuclear accident or incident on all different levels in the crisis organisation.
- Improving co-ordination and communication during a nuclear emergency situation e.g. between the Nordic countries or within the national organisations.
- Establishing consensus on a particular policy, intervention level or procedure to avoid double messages which create confusion, mistrust in authorities etc.
- Validating[1] the emergency response plans and procedures. This is mainly of importance nationally as joint Nordic plans and procedures are very scarce, cf. Chapter 3.

[1] The term *validating* is often preferable to the term *testing. Testing* tends to imply a pass/fail relationship while exercising activities should measure performance in order to identify areas for improvement rather then to indicate a failure to perform. Thus, *validating* is a better term for measuring the performance through the exercising activities (Gillis 1996).

Similarly, several external benefits of exercising can be mentioned:

- Meeting regulatory requirements. This is relevant for exercises arranged at e.g. the nuclear power plants in the Nordic countries but not so much for exercises arranged for the authorities.
- Responding to political or public pressure. Nuclear industry and potential accidents are topics with which great political and public interest is concerned. However, this should not be a major reason for arranging exercises for the authorities in this field.
- Demonstrating a commitment to preparedness and meeting expectations, e.g. from participants on different levels in a complex organisation.

For the Nordic nuclear emergency management or crisis management organisations, the following joint internal benefits can be regarded the most important for arranging joint exercises in addition to any national benefit achieved by exercising:

- Improvement on co-ordination and communication.
- Establish consensus on particular policies etc., e.g. common understanding in different areas, a basis for harmonisation of response and criteria etc..
- Validation of notification routines and tools in crisis management.

An exercise is a training opportunity for all the participants. A major additional aspect with exercises is that they provide a positive learning opportunity and at the same time, the lessons learned and areas for improvement can be linked throughout the organisation forming a basis for a cycle of continuous improvement that extends beyond the exercise participants (Gillis 1996).

One major disadvantage with exercises is that they are usually expensive to plan, perform and evaluate. These costs do not always balance the benefits of the exercise. However, an objective should be to have a maximum net positive benefit from exercises, i.e. the costs and benefits of exercising should be optimised in an emergency preparedness organisation.

Exercises might also be arranged to study organisational aspects and human factors. This has not been a major aim in exercises for emergency response organisations but has been more elaborated in e.g. control room simulators.

Another argument for arranging exercises from a research perspective, is to explore and develop new concepts and methods, both for arranging exercises and for handling real situations. This has also been done within the Nordic exercise co-operation (French et al. 1993, French et al. 1996).

2.2 Exercise quality

Several aspects are of importance when characterising exercise quality and some of them are mentioned very briefly below:

- Exercises should be arranged without risk for real accidents and risks for the involved personnel (IAEA 1985).
- The resources used in planning, performing and evaluating exercises should be optimised relative to the positive outcome of an exercise.
- Exercise goals should be achieved within the allotted time and the results should be summarised and presented in such a way that improvements can easily be implemented.
- Exercises should not generate myths and false truths.

Especially optimising the costs of an exercise to the benefit is a complicated task and to some extent also depends on the success of the other aspects mentioned above. The costs can easily be counted in man hours and monetary units, but the benefits are less quantifiable. This is a major challenge in exercise planning. E.g. systematic ways of choosing the optimum format and exercise methodology for specific objectives should be focused and developed.

2.3 Different types of exercises and exercise like activities

There are different types of exercises and exercise like activities and different terminology in use but the common basis in all kinds of exercises is that personnel in the emergency preparedness organisation are involved in some kind of scenario-based activity performed to achieve some goal. Exercises consist of three phases, the planning, the performance and the evaluation. Implementing the results of an exercise is not generally regarded a part of the exercise.

Exercises may be named according to who or what function is being exercised (e.g. communication exercise, dose calculation exercise) or according to characteristic aspects of the arrangement itself (e.g. real time exercises, small exercise). A survey of the exercise terminology used within the Nordic countries revealed a different understanding of the typical aspects of the different exercise types, see Appendix 9.2 for details. Especially the term «table top exercise» is given different interpretations with respect to the time format and the degree of involvement of manual activities in this kind of exercise.

Seminars, training courses, simulator training etc. are aimed at enhancing the emergency response programme and capability, but in general, such activities are not scenario-based. Neither are mobilisation of personnel and equipment required. Such exercise-like activities are still aimed at increasing the organisations individual and team knowledge, skills and capabilities.

Exercises may also be characterised as activities addressing human behaviour and human factors. Applying this limitation e.g. inter-comparisons are not to be regarded as exercises.

Precise and agreed definitions of exercise types are rare but some civil approaches have been identified (IAEA 1985, Gillis 1996, Epler 1997). Within the military system (e.g. NATO) work is also being done in this field.

An overview of exercise terminology is given in the following paragraphs together with some other exercise terminology related matters as a basis for the results and for further discussions. In general, exercise activities provides an opportunity for players to train and practice emergency and crisis management skills, and such activities provides a method to evaluate the player's ability to meet emergency and crisis management requirements and responsibilities.

2.3.1 Exercises

Exercises are scenario based and they are designed to mirror real-life incidents as realistically as possible and enable an organisation to validate a multitude of functions, e.g. performance, integration and co-ordination (Gillis 1996), and teams (Epler 1997). Exercises involve simulation of non-participating parties. The size, scope, number of participants, amount of resource mobilisation and level of interaction and co-ordination are broad. Exercises are used to demonstrate knowledge and skills of individuals and teams and the extent of the organisation's capability. Exercises require specifically trained personnel to control, evaluate and simulate participant activity.

Exercises are demanding both in scope and in terms of what is required from the participants (IAEA 1985). Two different categories of exercises have been described by IAEA:

- **Partial exercises** are a combination of basic operations or tasks designed to develop or test the interaction between tasks and/or organisations.
- **Integrated exercises** are the most exhaustive test of emergency response capability, involving full participation by all on-site and off-site response organisations.

The IAEA characteristics of different exercises do not reflect the terminology used in the national crisis management organisations in the Nordic countries.

Exercises can be arranged according to different time scales, e.g. in real time, in compressed time scale and in expanded time scale, but in general, IAEA recommends a real time mode (IAEA 1985).

2.3.2 Drills

Smaller exercises are often referred to as drills. Drills are usually focused (Gillis 1996) and limited in scope, but they involve scenario based response activities and contain simulation activities of non-participating parties. They may involve a limited amount of mobilisation of personnel and equipment and require specifically trained personnel to control, evaluate and simulate participant activity. Drills enable an organisation to validate key functions and demonstrate individual and team knowledge, skills and capabilities (Epler 1997). Drills are conducted to develop and maintain skills in certain basic operations or tasks (IAEA 1985).

An exercise for the staff in the nuclear emergency preparedness organisation might be regarded as a drill when the objective is to exercise specific staff functions. However, an exercise for the staff aiming at testing out new concepts in the crisis management should rather be classified as a table top exercise.

Other examples of drills are e.g. communication and notification tests, dose calculation and dispersion modelling. Field exercises are another type of exercise which fall under the umbrella *drills.* An example of a field exercise is the Nordic mobile measurements exercise, RESUME95 (Hovgaard 1997).

2.3.3 Command post exercises

The international exercises INEX-2 have been classified by OECD/NEA as command post exercises (CPE). A CPE is one in which the participants of various organisations activate and staff all appropriate regulatory authority, local and national government, off-site emergency facilities (Command centres, data acquisition systems/facilities, etc.) to deal with a simulated accident situation. Field teams are generally not activated. CPE's are an attempt to examine the process of responding to a nuclear accident using planned procedures, personnel and equipment in real-time.

A CPE is often referred to as a combination of a table top activity and a drill (Gillis 1996).

The term *simulation* might be included, normally reflecting the fact that the conditions are artificially produced (Gillis 1996). As an example, the exercises at the Kalininskaya nuclear power plant in 1994 and at the Kola peninsula in 1995 were classified as command (and) post simulation exercises (Galushkin et al. 1995).

2.3.4 Table top exercises

Scenario based discussions taking place in a conference room setting to establish policies, develop procedures and clarify roles and responsibilities are often referred to as table top exercises. Such discussions may be arranged as role plays with participants accurately reflecting the composition of decision makers or others on a specified level in the crisis. Table top exercises may also be performed by

involving personnel and teams handling their responsibilities in the real crisis organisation.

Table tops may be performed in real time, but are defined as exercises not being performed in real time (Epler 1997). Table top exercises require no mobilisation of equipment or personnel and utilise specifically trained personnel to facilitate discussion and evaluate performance.

Table top exercises might also be considered as «table top drills», i.e. limited in number of participating groups and/or topics to be discussed.

Table top exercises are performed by arranging participants from different organisations in one room according to organisation or response facility. Scenario based discussions take place among the participants to ensure that procedures and (interfaces among) interfaces among organisations are appropriate and to solve the problems presented using the resources available to the participants. The arrangement require trained personnel for planning, conduct and evaluation. Table tops are arranged without concern for time pressure, stress or the need to operate emergency centres or use communication systems. The OECD/NEA international exercise series INEX-1 are examples of table top exercises (OECD 1995).

2.3.5 Methods to guide decisions

Table top exercises can be performed by using different techniques for assisting the decision making process. One example of a decision aiding technique is decision analysis, which is an analysing and thought guiding method for the definition of objectives and comparison of options.

More specifically, decision conferencing is a socially interactive approach to group decision making. The objective is to generate shared understanding of a problem and produce a commitment to action. The format of a decision conference is a two-day workshop supported by a facilitator and analyst. The decision making is supported by a decision analysis built entirely within and largely by the group. The facilitator and analyst do not contribute to the discussions of the content of the problem but attend to the process of decision making, helping the decision makers to achieve a shared understanding of the issues (French et al. 1996).

2.4 Scenario development

Scenarios form the basis for all kinds of exercises. In many cases, the «scenario» is interpreted as the event sequence or the detailed event description. However, according to IAEA, a scenario generically consists of the title, instructions to umpires and evaluators, response description, event sequence, detailed event description (technical data, messages and maps and plans), and evaluator's check-lists (IAEA 1985). A successful scenario reflects and supports the various objectives

(on-site objectives, off-site objectives, national objectives, international objectives, joint objectives) of an exercise.

Scenarios should in general be realistic (Gillis 1996, IAEA 1985). I.e. they should not only be perceived as being realistic by the participants or the outer world but also realistic from a physical point of view. The realism and amount of details should, however, reflect the purpose of the exercise (the objectives) and the tasks of participants. As an example, an exercise for a nuclear emergency response organisation based on an accident scenario with a release from a foreign nuclear power plant requires less details about the plant status and development than an exercise for national nuclear safety authorities with an accident at a national nuclear power plant. Also, for a dose calculation drill a true location of the release source might not be of importance.

The event sequence for a hypothetical accident at a nuclear power plant should reflect the nature and the time sequence of potential events leading to a hypothetical, but still physically and chemically possible source-term or to no release at all. In addition, the dispersion of the hypothetical release should be realistic. This can be interpreted in several ways, e.g. one can choose to use «mean conditions» or typical weather conditions or one can choose to use real but extreme weather situations as a basis for the dispersion which leads to a description of the fall-out. Inputs from different organisations, individuals, media etc. should also be aimed at reflecting a real situation as realistically as possible.

Development of detailed scenarios takes a lot of resources. Therefore, it would be useful and cost-effective if scenarios to a larger extent could be used several times. Alternatively, the level of detail needed in the scenario should be considered carefully, and maybe spontaneous inputs in the event sequence, particularly from organisations, media and the public should be used to a larger extent.

2.5 Exercise policies and plans - status in the Nordic countries

National exercises are arranged regularly by the nuclear safety, radiation protection and emergency preparedness authorities in the Nordic countries (Mærli 1996). These are however in many cases advisors to the real decision makers who are found on the governmental level or on the regional or local level, depending on the country and the accident scenario. In Finland and Sweden the emergency preparedness organisations are involved in and to a varying degree participate in the annual exercises at the nuclear power plants. Danish authorities participate in the Swedish exercises at Barsebäck nuclear power plant. The Norwegian organisation mainly exercises according to far-field scenarios, as do the Icelandic authorities. All the Nordic countries normally participate in international exercises.

Within the Nordic countries there are separate programmes for drills, e.g. national notification drills, test of communication equipment, dose calculation etc. Between

the Nordic countries and also within EU different types of communication drills are arranged regularly.

A survey revealed that none of the Nordic radiation and nuclear safety authorities or the nuclear emergency preparedness organisations have established multi-year exercise plans or strategies for exercising the nuclear emergency preparedness organisation. Detailed results of this survey is given in Appendix 9.3.

3 Important tools for validation in exercises

Several tools have been developed in emergency planning. The importance of some of these tools as subjects to be validated during exercises and in facilitating exercise arrangements is discussed below.

3.1 Plans and agreements

Each one of the Nordic countries has planned for nuclear accidents. However, on the Nordic or international level, joint plans do in general not exist. Some background for harmonised plans is however available. The IAEA convention on early notification has been ratified by all Nordic countries. In addition, bilateral agreements have been signed between several of the Nordic countries but the network of agreements is not complete.

The Nordic authorities on radiation protection, nuclear safety and emergency preparedness have also established «gentlemen's agreements» through close daily cooperation. It has e.g. been agreed to immediately inform the other countries about topics of common interest. This reflects a lower threshold for information exchange than what is agreed in the bilateral agreements. It has also been agreed to keep a 24-hour fax service for this information purpose. Regular availability of monitoring data from automatic stations in all Nordic countries has also been agreed. These agreements form an important basis for the joint Nordic exercises and they are typical areas for validation through joint drills.

3.2 Models and computational tools

The nuclear emergency response organisations in the Nordic countries have developed or made different tools available for assessing consequences of accidents. Finnish and Swedish authorities in particular are developing tools to rapid severe accident assessment and source term estimation. All the Nordic countries have dispersion models available. In the process of national development, attention has been given to problems of major concern in each country. Proximity to the potential sources seem to have been into account when the range of the models have been clear. In addition, all countries have some form of computational tool to assess doses from cloud shine and fallout.

These tools reflect the special interest of each country and they have not been developed in parallel. Making the model results transparent by discussing their input, limitations and outcome is of importance for a harmonised[2] approach to a nuclear accident. Like preparedness plans, these tools are typical objects to be validated through exercises or drills.

3.3 Systems for exchange of information and data

Other important tools in emergency response are the systems for exchange of information and data. The systems are here to be interpreted as both the technical solutions and the more administrative aspects of communication, i.e. what kind of information to communicate to whom at what time, according to which criteria and in what format. Today, notification is based on fax communication and both fax and telephone are important in the process of exchanging information. However, new technology has been developed and is ready to be taken into use more thoroughly. This development makes communication systems even more important as a basis for joint Nordic drills and exercises.

4 Overview of results

EKO-4 consisted of several sub-projects on exercise-like activities in addition to development of a Nordic system for exchange of information and data and a survey of exercise scenario tools. The objectives and results of each task is given in the sections below. This overview is generally based on the reports from each task and further details are given in these reports.

At the end of the chapter the lessons learned in the exercise like activities in particular are summarised.

4.1 Nordic system for information and data exchange (EKO-4.2)

The purpose of the EKO-4.2 sub-project, Nordic system for information and data exchange, was to study how the information exchange between the Nordic countries, which today is mainly based on telefax, could be transformed into a system using computer Internet technology. Different approaches to setting up a new reliable system between the Nordic countries were investigated.

The information exchange should be based on bulletin board systems in the different countries. It was required that the system should not put any restriction on type of data or information to be exchanged, nor should it involve any standardisation of data, and above all, it was not intended to be used for notification. A bulletin

[2] Harmonised is used in the sense making the same assumptions and taking the same conditions as a basis, but not necessarily ending up at the same conclusions.

board system is passive in the sense that no information is actually sent, instead it is the receiver who is responsible for approaching the information and transferring it to his own system. This feature makes the system unsuitable for notification purposes.

Since a potential system would have to be implemented by the authorities in the respective countries, the first part of the project was to survey their interest and emphasis. This was done through meetings in the different countries. The conclusion from these meetings was an overall interest in establishing a system as described and several requirements concerning security and reliability of the system were proposed (Walderhaug 1998):

- The **security** of the local network must not be compromised.
- The **security** of the information and the information server host computer must be ensured.
- The **confidentiality** of the information must be ensured.
- The system must allow **access restriction** with discretionary access control.
- The system must be highly **available and reliable**.
- The system must be **easy to use**.

The implications of the requirements by the authorities were discussed and a practical solution of an information exchange system based on the World Wide Web (WWW), the File Transfer Protocol (FTP), and the Internet was outlined in the detailed report.

A possible continuation of the project could be based on operable servers in the different countries. The configuration and connection with the local network should be the responsibility of the institution owning the server. The selected system would depend on the hardware and on the overall security policy of the institutions involved. Further work could concentrate on testing of the system, standardising server user interfaces and testing encryption software for transfer of passwords. This part was not completed within the frames of this sub-project. All future work should be done in close co-operation with the involved authorities.

Since this sub-project was finalised, development in this field has also taken place internationally, e.g. by OECD, and the progress in this international approach should be considered before any Nordic continuation of this project is started.

4.2 Exercise scenario development tools (EKO-4.1.2)

Planning and performing exercises requires a considerable amount of resources. A large fraction of these resources are spent creating the exercise accident scenario and presenting it as realistically as possible. The aim of this sub-project has been to study potential improvements in exercise scenario development:

- How can scenario development work be rationalised.
- How can the realism of the exercise scenario be increased.
- How can the presentation of postulated accidents be improved.

In this sub-project focus was put on the events creating the basis for the scenario and not on the instructions to evaluators etc. (cf. Chapter 2.4). Primarily it has been focused on giving an overview of the available tools to assist scenario development in the nuclear power plant, in the environment and in the society.

A survey was performed to identify available tools and the needs for such tools. The results of this survey are given in a separate report (Sjöblom 1998). The conclusions and some recommendations for further work are summarised below:

- There are different needs and different tools available in the **nuclear and non-nuclear countries**. Since national authorities in nuclear countries need to exercise together with the plant, accident scenarios which include development on the plant, are required. Plant scenario development tools are already available but this motivates further development of such tools. The needs of the non-nuclear countries are more in the off-site area, e.g. simulation of radiation monitoring systems, giving a more realistic accident consequence presentation. However, also authorities in non-nuclear countries need a good understanding of nuclear power plant accident types and dynamics, justifying simpler plant scenario development tools also in these organisations.

- The **technical potential** of the available tools has developed rapidly and in many respects exceeds the reasonably justified needs of the exercising organisations. However, the survey revealed that the availability of nuclear power plant process simulators is better than the availability of tools for simulating environmental and societal aspects of a potential accident situation.

- The **needs at the nuclear power plants differs from the needs of the authorities or the rescue teams**. The opportunity to mitigate an accident in a simulator during an exercise increases the motivation plant personnel's motivation for exercises while e.g. rescue personnel do not need the same level of details in the plant scenario.

- Exercise modes for **off-site radiation monitoring** systems should be developed or made available. The use of real weather conditions during exercises also requires fast calculation methods and/or data transmission of simulated measurement results to field monitoring teams.

- Simulation tools for the **in-plant radiological situation** are available, but further development and tailoring are needed. Similarly, radiological models

should be included in full-scale control room simulators. The simulators should also be developed and improved with respect to simulation of severe accident phenomena.

- **Society** has so far not been modelled in any specific tool. Simulation of the external world could very well be increased in exercises and it might be beneficial to collect inputs from exercise scenarios for later use, but this is probably to be done nationally.

4.3 Results and recommendations from exercise activities

4.3.1 General

In this chapter the results from the drills, table tops and combinations/exercise-like activities performed within the frames of EKO-4 are presented along the lines of a potential accident situation development, i.e. from source term assessment via dispersion modelling to dose calculation, countermeasures in the late phase and public information. Results from the Nordic/Baltic annex to the exercise INEX-2-FIN are presented at the end.

Details about each activity have been given in separate reports and only the following aspects are covered in this chapter:

- The objectives of the exercise activity.
- A summary of the activity with respect to scenario, timing and format.
- Conclusions and recommendations for future work.

4.3.2 Early estimation of source terms (EKO-4.1.1.a)

Since the Chernobyl accident most countries have spent substantial resources on improving the emergency preparedness both before and after a release of radioactivity. The national aims have been to develop simple pragmatic ways to assess the emergency situation and decide on protective actions to limit the health consequences of an accident. The need for prompt assessment of if and when a release will take place, how large the release will be and how long it will last as a basis for calculation of consequences makes the nuclear power plant where this information originates and the local or national emergency management centre important sources of information. Supporting organisations are the regulatory and executive authorities. International organisations and neighbouring countries are users of this information as well.

The information about the emergency should be efficiently distributed both nationally and according to bilateral agreements. The information must also be well understood by the receivers to initiate the actions appropriate to the emergency scenario at the optimum time. Thus, a meeting between these main actors to harmonise the expectations on the demand and supply of information about the plant status and development in an accident situation was regarded useful.

State of the art within this field was presented in a seminar in Helsinki on the 5th and 6th March 1997. The objective of the seminar was to present the on-going work in the Nordic countries. Experts in plant status assessment and nuclear emergency preparedness from the nuclear power plants and the authorities in the Nordic countries participated. The seminar also had participants from Eastern countries and IAEA as it was arranged in connection with a STUK/IAEA workshop on emergency preparedness and emergency planning. The second day of the seminar was an emergency demonstration where the participants could follow the work at STUK's emergency centre during the development of an exercise scenario at Olkiluoto nuclear power plant.

The current status of the efforts spent in Finland and Sweden showed that effective tools and methods to cope with most phases of an emergency are being developed. The IAEA approach within the InterRAS project has been developed along the same lines (IAEA 1997).

The presentations given in this seminar were very congruent in the sense that they focused on the acute phase of an emergency situation to be able to launch off-site protective actions timely to avoid deterministic health effects. Crucial in the early phase of an accident is the early identification of the degree of emergency. This calls for stringent plant status assessment schemes linked to clearly defined alarm levels. The early notification before the radioactive release or even before the radioactive emission from the core, provides the time needed to allocate the available resources within the emergency organisation. To be able to keep pace with the developing emergency scenario the assessment of source terms, time projections, dispersion and consequences have to be pre-calculated to some degree. The use of a simple formalism to choose among pre-calculated emergency case studies gives an adequate accuracy for the first prognosis upon which decisions about off-site early protective actions like evacuation and sheltering in or near the emergency planning zones could be based. When time and resources allow detailed methods can be applied in the assessment cycle to improve the quality of the assessments.

The seminar showed an increased interest in the activities related to emergency preparedness and planning. The importance of seminars like this to adjust national approaches to a joint line for structured information exchange should not be neglected.

From the presentations and discussions, the following conclusions and ideas for further development are worth mentioning (NKS 1998):

- **Tools:** Emergency preparedness and response has improved greatly in recent years. However, there is still room for improvements. Existing methods and tools to assess the emergency and the timing, size and duration of the imminent or ongoing release of radioactivity covers all phases of an emergency. To serve

the situation a fully integrated set of methods would be fruitful and speed up the reassessment cycle and facilitate adoption to unforeseen changes or deviations from the pre-calculated scenarios.

- **Rapid exchange of structured information:** Emergency planning and response involves many fields of science and technology and also many organisations with the demand for mutual co-operation and understanding. To communicate process parameters of the complex phenomena of a rapidly changing emergency to several receiving organisations might detract the resources at the nuclear power plant from the attempts to restore safety. The receiver of this complex information might also not be able to use it properly for implementing protective actions. This calls for the rapid exchange of structured information to avoid errors caused by misunderstandings as time is limited and stress level high. The preparation of information based on concept definitions as morphemes could secure that the information is given rapidly and that it leads to appropriate reactions in the receiving organisations. This calls for further development of the basis for the information exchange, increased knowledge about the demand and possibilities for supply of information, improved channels for information exchange and education and training within all participating organisations.

- **Joint development:** In an accident situation neighbouring countries are involved in the information exchange through international and bilateral agreements on early notification. Further joint development of the methodology and the information to be exchanged gives room for a fruitful co-operation between neighbouring countries in applying the same methods and in validating and exercising the emergency communications.

4.3.3 Long range dispersion modelling (EKO-4.1.1.b and EKO-4.1.1.g)

Nordic drills or exercises based on atmospheric dispersion models have been arranged earlier within the NKS (Tveten 1994). The main objectives during the previous exercises have been to test how long range dispersion models and their users functioned under simulated emergency conditions without comparison with coexisting dispersion measurements.

The joint European long range diffusion test ETEX (European Tracer Experiments) was conducted in October 1994. A gas was released and concentration data were collected through an official tracer measuring network operated by the EU Joint Research Centre in Ispra, Italy. At the same time, the dispersion was modelled. The official ETEX data were released about one year after the trials, during a meeting in Prague in October 1995.

4.3.4 First Nordic ETEX-evaluation (EKO-4.1.1.b)

During the ETEX experiments a special real-time tracer gas measuring station was operated by the Danish National Environmental Research Institute (DMU). Air samples were taken from the pier of the Risø National Laboratory's harbour, located in the Roskilde Fjord, Denmark. The data from this measurement station were analysed immediately after the ETEX experiments as opposed to data from the official tracer network.

This situation with real concentration data was a unique opportunity to perform not only an inter-comparison of the different models used in the Nordic countries but also a partial validation of the emergency long range atmospheric transportation/dispersion forecast models presently used in the Nordic countries. To take advantage of these circumstances a drill was conducted with participating institutes from Norway, Denmark, Sweden and Finland. The participants performed their dispersion and concentration calculations at home.

To present and discuss the results, a meeting was arranged at Risø National Laboratory (Risø) and at the co-located National Environmental Research Institute (DMU) on the 6th and 7th June 1995. During this meeting DMU first presented their real-time measurement result, and subsequently each of the participating Nordic institutions presented their models and corresponding model predictions of the measurements at the Risø site from the ETEX cloud passage.

From the results and the general discussions, the following aspects and areas for further work are worth mentioning (Tveten &Mikkelsen 1995):

- **Uncertainty:** Do the uncertainties in the results mainly come from the meteorological model or from the dispersion module? This important question was raised along with a second, related question: How can one discriminate between advection and diffusion uncertainty?

  All six participating institutes had made use of a combination of an advecting wind-field (calculated by a European or a Global scale meteorological weather prediction model, e.g. HIRLAM or ECMWF), in combination with a dispersion module which is either of Eulerian type (a K-model), or of Lagrangian type (i.e. either a puff or a trajectory type model). In order to properly inter-compare the different dispersion models in this drill, calculations should have been based on a single meteorological model. And vice versa, in order to inter-compare the meteorological models, calculations should also have made use of the same dispersion model.

  A more detailed model inter-comparison test along these lines could be one of more tasks to be undertaken during a continuation of this inter-Nordic co-operation. Such a study would be important to discriminate the uncertainty and

the modelling differences and relate them to the two different types of models involved.

- **Resolution:** The potential of increasing the model accuracy by increases in space and time resolution in the models was discussed. It is possible to increase the spatial and temporal resolution. One drawback of increased resolution is of course the larger demands on data storage and transfer times in case of on-line data transmission. Transmission times are important in a nuclear accident situation. Performance of a cost-benefit assessment with increased resolution, both for the meteorological and for the dispersion part is an important item that is relevant for further investigation.

- **Uncertainty from increased forecast period**: A study of the deterioration in prediction ability with increased forecast period is an important item for further investigation. This drill was for all parts based on «analysed» meteorological fields, i.e. the best meteorological fits to actual observations. Evaluation of the additional uncertainty coming from the forecasting itself is therefore eliminated. Therefore, it is worthwhile to investigate the additional uncertainty resulting from the prolongation of the forecast periods.

- **HIRLAM forecast data:** Norway, Sweden, Finland and Denmark are now using HIRLAM weather forecast data as a basis for the dispersion modelling but if the computer is down in one of the countries, it is impossible to use the data from one of the other countries. The different versions of HIRLAM have small differences that make exchange impossible. These problems are related to the file-structure for the output. It should be discussed if HIRLAM forecast data should be on-line interconnected between the meteorological institutes in the Nordic countries.

- **Model development:** At least in this kind of situation the Gaussian plume model is no longer a satisfactory model alternative. The trajectory models also seem to be inadequate, as the trajectory model result presented at this meeting were rather different from the dispersion model results.

4.3.5 Second Nordic ETEX evaluation (EKO-4.1.1.g)

Based on recommendations from the previous meeting, a second meeting was held at the Finnish Meteorological Institute (FMI) in Helsinki on the 4th and 5th December 1996. For the first time, Veðurstófa, Iceland, participated, together with a specially invited representative from the UK Meteorological Office who had shown strong interest in this form of Nordic co-operation.

No specific tasks were given to the participants this time. The objective of the meeting was to discuss new calculations related to the ETEX-experiment. The

meeting also addressed model development and related efforts and useful information was exchanged between dispersion modellers and persons more generally involved in emergency preparedness.

Simulations of the atmospheric transportation and dispersion of the ETEX-release, carried out by a number of institutions in the Nordic countries and UK were presented. In addition, recent modelling developments and current development plans were presented, as well as some Chernobyl-related simulations. A presentation of the future European forecasting system RODOS was given and two additional presentations described exercises, one with Nordic participation (EKO-4.1.1.e) and one with European participation. Several institutions also demonstrated impressive animated computer displays of the results.

There were 16 presentations at this two-day meeting. It was obvious that the rate of model development since the first meeting, less than eighteen months ago was impressive. Several new models had been developed or were in an advanced stage of development. Generally the agreement between the simulations from the different institutions were better than at the first meeting of this kind; though it may be argued that this is not unexpected, since the ETEX measurement results were now known by the participants.

From the extensive discussions throughout and at the conclusion of the meeting, several recommendations emerged (Tveten 1997). The most important ones are summarised below:

- **Harmonisation of presentations:** The progress in modelling has greatly outstripped that in application and operational structures. Results from calculations for the same accident situation performed by different institutions may look confusingly dissimilar; even though the result actually turn out to be in excellent agreement upon closer inspection. It is recommended that the efforts on harmonisation of result presentation initiated in the former NKS project BER-1 (Tveten 1994) are revitalised within the next NKS programme.

- **Communication and information exchange:** The mode of communication is a matter of grave concern. The exchange of results between Nordic institutions at present, at least in the emergency exercises that have been carried out, is mainly via fax machines, and the transfer is not all satisfactory. Efforts to find a standard way of communicating have been made and it is important that the meteorological institutes are involved in these efforts in the future.

- **Baltic region:** Expanded contact with the Baltic states in the meteorological area is highly desirable and ought to be an area of interest within the next NKS programme.

- **Nordic meetings on dispersion modelling:** Meetings like this are presently seen as an important supplement to the international works, e.g. ETEX meetings, as the discussions in the Nordic meetings naturally are more focused on problems related to the particular models adopted for use by the institutions in the Nordic countries.

4.3.6 Dose assessment in an early phase of an accident (EKO-4.1.1.e)

A joint Nordic drill for the dose assessment functions in the national emergency preparedness organisations was arranged. Besides training the dose assessment staff, a main objective was to compare the results and the tools used in each country.

The drill was designed as a sort of national home-work and was conducted during the spring of 1996. A potential release to the atmosphere from a fictitious Swedish PWR reactor was used as a scenario. Each country provided its participants with the same, one year old, real weather data. The scenario is given in detail in Appendix 9.4.

The exercise was divided into two parts where the objectives were to produce short (0-50 km) and long distance (0-500 km) dose prognoses. Only Finland performed all tasks associated with the exercise. Norway was unable to participate due to technical problems. The results from the exercise were presented and discussed at a seminar in Stockholm, 20th and 21st May 1996. Results from the second part concerning long distance dispersion models was also presented at the EKO-4.1.1.g meeting in Helsinki, December 1996.

Even though the results from the drill were not complete, some conclusions can be drawn and several lessons can be learned from this drill (Wiklund 1998):

- **Calculated doses:** The doses resulting from the short range modelling differ at most by a factor five which can be regarded as reasonable considering the differences in the countries dose assessment models. Denmark, Finland and Sweden performed the task of locating the plume at various times after end of the release. The maps produced were in fairly good agreement.

- **The homework drill concept:** The concept of an exercise performed in a «homework» manner was highly appreciated by the participants. It provided a certain flexibility in selecting participants and when to perform the exercise. The amount of preparatory work was limited (except for technical problems concerning upgrading of computerised tools etc.) and there were relatively few people involved in the exercise as a whole, which made the exercise very cost efficient.

- **Systems for dose assessment:** Results from different dose assessment models are very difficult to compare without detailed specification of assumptions and parameters used in the models. Questions concerning the user-friendliness of the systems used and the presentation of calculation results were raised and should be discussed further.

- **Future drills and areas of interest:** Future work in this field could e.g. be to design a drill where dose calculations are based on measured values. The issue of calculating averted doses and their relation to intervention levels could also be a part of such a task. It would also be of relevance if dose assessments like those performed in this drill or dose calculations on measured data were made part of large Nordic exercises whenever possible.

4.3.7 Decision making in a late phase of an accident (EKO-4.1.1.c)

Issues concerning clean-up strategies in an urban environment after a hypothetical and very severe reactor accident were discussed in a joint Nordic table top exercise or meeting. A decision conference was organised on the 30th and 31st August 1995 in Stockholm, Sweden. The conference was designed to be attended by those responsible for planning and deciding on protective actions in the Nordic countries after a nuclear accident.

The objectives of the conference were to provide a shared understanding between the decision makers and the radiation protection community on concerns and issues related to decisions on protective actions after a nuclear accident. Furthermore, to identify the values/attributes to be considered in setting intervention levels for clean-up actions in an urban environment and to demonstrate and explore the use of decision conferencing as a tool for decision making on protective actions.

The conference was planned to have two phases. On the first day persons with special technical expertise in preparedness planning and in assessing the consequences of an accident and protective actions met to share their common understanding of the problem. On the second day those responsible for deciding on protective actions joined the meeting to discuss issues laid down by the groups and to produce a commitment to actions in the given scenario.

The discussion on the second day did much to address the first objective of the decision conference, namely the development of a shared understanding between government officials and the radiation protection community. There was much communication between the two groups with regard to the other's viewpoint. Many participants made remarks about the need for many more such meetings to ensure the continued growth of this shared understanding.

In terms of the second objective, to identify the values/attributes, the conference was less successful. Although it was clear that decision making would be based upon factors in addition to radiation protection issues and predicted health effects, it was not possible to elicit weights and value scales to articulate these additional factors explicitly. The model focused the discussion and clarified these issues, but it was not fully explored.

The following recommendations were given (French 1996):

- **Advice on early grass cutting:** As soon as the plume has passed and the radiological situation has become clear, emergency planners should consider advising the public to cut their grass, prune bushes and remove small plants in those regions where it is safe to do so.

- **Communications between experts and decision makers:** The format of the meeting seemed effective in communicating the issues between the technical experts and the decision makers. However, it was clear that the decision makers would have taken the final decision away from the meeting in the light of the understanding they had obtained.

  Attention should be given to ensure that modes of communication between experts and decision makers include a clear and unambiguous statement of the uncertainty of data and predictions, both the uncertainty stemming from natural randomness and that arising because experts may quite genuinely hold different opinions about, for instance, the effectiveness of countermeasures in particular circumstances.

- **Large volumes of contaminated material:** Some investigation should be made of the feasibility in social terms of burying a considerable volume of contaminated material that would be created by several of the clean-up actions.

- **Future conferences:** New conferences should be held involving national representatives and technical experts only.

4.3.8 Public information (EKO-4.1.1.d)

Nordic and other international systems for mobile measurements during and after nuclear accidents were tested in Finland 15th-18th August 1995. This field exercise, or drill, RESUME95 (Rapid Environmental Surveying Using Mobil Equipment), was arranged by EKO-3 and the results have been reported separately (Hovgaard 1997).

In connection with this a drill was arranged for personnel within the information staffs in the nuclear emergency preparedness organisations in the Nordic countries. The objectives were to train establishment of press contacts and arrangement of

press meetings. To make the drill realistic, media were invited. Media representatives from Denmark and Finland participated and the media involvement resulted in several newspaper articles and TV-reports.

The following experiences was made and are worth mentioning (NKS 1996):

- **Structured involvement of media:** There was established a secretariat which produced media information during the exercise. Press meetings were arranged by the information staff. The involved experts appreciated the structured involvement of media which was achieved through the arrangement of this drill. In this way they could spend their time on the measurements and not on planning e.g. the press meetings in which they participated.

  The press meetings showed that explanation of technical results for journalists are difficult, even when they are aided with good maps. However, it was made clear to the media that if an accident happens with radioactive contamination across borders, there will be a need to compare measuring results between countries. There may also be a need to perform measurements in another country as assistance. This exercise showed the media representatives that this is possible.

- **Handling international media and experts:** The involved information personnel found the drill useful. The experiences from handling international experts and media and the lessons learned about the different mobile measuring equipment were all important.

4.3.9 The Nordic/Baltic annex to INEX-2 in Finland (EKO-4.1.3)

OECD's Nuclear Energy Agency (NEA) have arranged a series of international exercises, INEX-2, from 1996 to 1999. These international exercises have had 3 objectives:

- Decision making based on plant conditions.
- Real-time information exchange.
- Public information.

A Nordic/Baltic exercise was arranged as an annex to the second of these OECD exercises. Neither Nordic nor Nordic/Baltic exercises can be arranged to test out joint plans and procedures since these do not exist. The focus therefore must be on improving co-ordination and communication between the countries and the implementation of results will in most cases be a national task.

A working group defined Nordic objectives for the exercise of which one objective (N4) was a joint Nordic/Baltic objective:

- N1: Estimation and assessment of the situation in real time in the threat phase, release phase and by prognoses for the following day.
- N2: Follow key information in the Nordic countries.
- N3: Co-ordination of recommendations.
- N4: Baltic-Nordic co-operation.
- N5: Journalists in Finland reporting back to national media.

Details on the objectives and the participants in the Nordic/Baltic exercise annex is given in Appendix 9.5.

The INEX-2-FIN exercise took place on the 17th April 1997 and all Nordic and Baltic countries participated both in the OECD exercise and in the Nordic/Baltic annex. Most countries carried out simultaneous national exercises as well. The exercises had a severe accident at Loviisa nuclear power plant in Finland as a scenario. The number of participants more or less involved in the exercise from the Nordic/Baltic countries was about 700.

An independent evaluation group consisting of a chairman and representatives from all Nordic and Baltic countries was established to evaluate according to the Nordic/Baltic objectives. The results from the evaluation group were presented in a seminar in Helsinki 29th - 30th September 1997. The conclusions and recommendations from the exercise are presented in detail in the evaluation report (Salo 1998) and summarised below:

- **Exercise methodology:** The Nordic/Baltic exercise directive (cf. Appendix 9.5) only described the objectives of the exercise and the central participating organisations. A more comprehensive Nordic/Baltic directive is recommended for future exercises to outline the common basis, limitations of the exercise and advance preparations necessary in the participating countries. Details on the implementation of the objectives should be kept apart. The directive should be distributed to the participants or inserted into the national directives and briefings should be given to all the participants on the content well in advance.

  Exercising with the real weather is vital for involving the meteorological services. However, choosing the real weather of the day leads to an uneven distribution of work load for other organisations and functions to be exercised. It is recommended that in future exercises, depending on the objectives and the organisations/functions to be exercised, either real weather of the day or of some other suitable day is selected.

  The seriousness of the accident scenario was challenging for all participants, including media.

- **Means of communication:** Concerning the communication channels between the authorities involved, special assessment (and planning) should be carried out to find out:
  - the speed of various channels to transmit the information from country to country down to the recipient needing/using that information,
  - ways and means to improve the quality of the messages so that the text is intelligible, the message in the figures and maps clear,
  - ways to limit unnecessary duplicates of messages blocking the channels, but ensuring that sent messages reach the goal,
  - dedicated technical solutions for channelling most important messages concerning the accident and meteorological information, and
  - possibilities to extend the use of teleconferences in communication between the countries.

  Attention should be paid to logging of the time correctly and in a harmonised way (e.g. using UTC time).

- **Objective N1:** The objective to **estimate and assess the situation** and to make prognoses was well met partially based on good communication between the accident country and the other Nordic countries and partially on independent but similar technical and meteorological assessments carried out in the Nordic countries. However, the questions put to the participating organisations were either regarded too informal or not suitable for common Nordic concern and the response to these questions therefore not necessarily revealed the organisations ability to make estimates and prognoses of the situation in real time.

  It is recommended that in emergency organisations in all Nordic countries experts on reactor technology and meteorology are present to interpret, evaluate and explain such information.

- **Objective N2:** The **exchange of key information** between the Nordic countries based on bilateral agreements was good, as regards the timing and not changing the contents of the messages. However, one exception was noted: Information about the release having started was unnecessarily delayed by waiting for information on its composition and magnitude. It is recommended that information which is critical for further assessments in other countries, e.g. fuel damage and release having started, should be transmitted without delay. Meteorological information also belongs to this category.

  Regarding the transmittance of information via IAEA and EU some problems in changing the contents were spotted.

  The necessity to be precise with units, radionuclides and reference times, even when the assessed quantities may not be precise was emphasised by the evaluators.

E-mail has been used increasingly and it is likely that the use will still increase. Logging of communication should cover better all types of channels in the most suitable way, because logging is not only important for evaluation but it may also have legal implications. Co-operation between the countries is recommended when improving the logging techniques.

- **Objective N3:** The questions asked concerning travelling, air traffic etc. were maybe not suitable to reflect the authorities ability to **co-operate on decisions**. Differing views were taken in the Nordic countries concerning these topics. In the accident country there is no time to make contacts on non-central issues. Other countries tried to make contacts but did not succeed. It is emphasised that creating a common basis for decisions and confidence on each others judgements in advance is particularly important for the early phase after an accident. For a later phase means should be sought for improved communication with neighbouring countries. Teleconferences would be one possibility for simultaneous contacts between several countries.

- **Objective N4:** Overall, the objective concerning **Nordic-Baltic co-operation** was met satisfactorily, because contacts, mainly faxes, between the Baltic and other Nordic countries functioned. However, direct contacts to Estonia from Finland, based on bilateral agreements, were unsatisfactory due to technical weaknesses.

  There is a great need to improve contacts between the emergency organisations in the Baltic countries, in particular the Lithuanian. Also contacts between other corresponding authorities in the Baltic countries need to be improved.

  Bilateral agreements should be established between countries where they do not yet exist.

- **Objective N5:** A general recommendation in this field is one of sophisticating and systematising **journalistic participation** in the exercises. The time available for journalistic processing of information has been dramatically reduced. For the authorities to make sure that information is spread though the media channels in an optimum way it is important that authorities and media develop and test modes of communication. Journalist participation in this exercise revealed e.g. a large need for maps and graphics. Journalist participation in future exercises can contribute to the clarification between the operative and the journalistic roles in a real crisis. This is of importance for the emergency response organisations. However, these benefits can only be achieved if the exercises are kept at a level likely to attract and keep the interest of the media.

In order to increase the realism of future exercises, and at the same time creating a better foundation for analysis of media-related elements of the exercises, it is further recommended that some centre is assigned the task of real-time reception and subsequent analysis of the resulting media products.

4.4 Summarising the lessons learned

Summing up the experiences from the exercise and exercise like activities in EKO-4, three major conclusions are reflected in most of the activities:

- **Tools and methods** used in different areas of emergency response need further development. Joint approaches can be useful within many of these areas.
- Tools for **communication and information exchange** should be developed and optimised. This task should be solved in a general way and not with specific solutions for each area of emergency response.
- The **content of the information** to be exchanged and the timing of the information exchange should be developed jointly and discussed and agreed before an accident happens, at least for the early phase of an accident.

These conclusions are given different weight in the different exercise activities. This probably reflects the fact that some areas , e.g. dispersion modelling, have been subject to several exercise like activities already, while other areas not have been exercised in joint Nordic exercises or drills before.

5 Discussion

5.1 Exercise methodology

Looking through the existing material on Nordic exercises and drills, one discovers that when planning and performing Nordic exercises and drills the focus has in general been on either the specific topic of interest (e.g. dispersion modelling), the format of the exercise itself (e.g. the decision conferences), or the event, the joint exercise or the inter-comparison itself. Further, exercise objectives have not always been well defined. The evaluations after the exercises and dills have often been performed very conscientiously but the results do not seem to have been properly utilised for implementation of improvements within the exercised organisations. This probably reflects that exercises have not been regarded and used as a systematic way of making improvements within the nuclear emergency preparedness and response organisations.

The history of joint Nordic exercises and drills is not extensive as the first joint Nordic exercises and drills were arranged last NKS-period. This fact may partly explain why there seems to have been little awareness regarding the choice of exercise methods in different areas and exercises. So far it seems to have been most

important to find out if joint Nordic exercises and drills would bring any benefit to the national organisations at all.

Another explanation might be that at least the Nordic exercises have been co-ordinated mainly by persons or organisations with interests in specific topics related to handling an emergency situation. This has probably influenced the focus in exercises towards either the format of the exercise activity or the specific topics which have been subject to exercise activities and not towards using exercises as a tool for structured development of the emergency preparedness .

The question can be raised whether one in national exercises chooses the way of exercising to optimise the outcome of the exercises or if exercises are arranged e.g. because they are required by law or expected by politicians or media. Further investigations are needed to find an answer to this question.

However, the major question here is if one can gain something by choosing the format of the exercises in a more structured way. A more structured approach is regarded as important especially to improve the implementation of the results from exercise activities. Since there are no joint Nordic plans and procedures except for different agreements, exercising to test Nordic plans and procedures only has limited value. This kind of exercises are often performed in real time and should maybe be limited to cover the content of the agreements (i.e. drills). At the same time all Nordic countries have a need to know about the organisations and similarities and differences in the other countries to be able to understand e.g. differences in implementation of countermeasures and to react in a harmonised way in an accident situation when that is appropriate. This is very well achieved through participation in exercise planning and evaluation. It is also partly achieved through real time exercises but one should consider if this can be achieved even better in e.g. table top exercises not taking place in real time or through other activities. Maybe the time has come to be more aware regarding the choice of exercise method or format, based on the experiences already gained.

5.2 Exercise scenarios

The scenarios played in Nordic exercises have varied. During the last NKS period 2 exercises were arranged, namely NORA and ODIN. In NORA (Salo 1993) there were rumours (later proven to be true) of a collision between two nuclear vessels off the Norwegian coast. The vessels were travelling in opposite directions, thereby creating problems for all Nordic countries. The exercise covered the threat and very early phase. In ODIN the late phase handling of a situation was focused (Salo 1995) and the source of the release was not described in detail or given a location. The hypothetical accident was classified as INES 6. In INEX-2-FIN (Salo 1998) the hypothetical accident at Loviisa nuclear power plant in Finland was in the early phase classified as INES 3 but later the situation was classified as INES 5.

In the Nordic drills, several scenarios have been played. These drills were first arranged in the last NKS period and e.g. in the BER-1 dispersion modelling drill (Tveten 1994), the Chernobyl accident was taken as the scenario. In this NKS-period, RESUME95 (Hovgaard 1995) and the connected information drill were based on Chernobyl fallout and sources in the field, but no accident scenario had been created. In BER-3 in last NKS-period, a decision conference was arranged (French 1993). The scenario was a severe accident in Lithuania which resulted in plume passage and fallout in Gotland and the conference concentrated on countermeasures in the early phase (French 1993). The decision conference which took place in this NKS period (French 1996) was a hypothetically severe release from Loviisa nuclear power plant but the conference focused on the late phase countermeasures. The Loviisa scenario was also used as a basis for the early phase dose calculation drill but this time the plant was located in Sweden in a point suitable to the weather situation. In the dispersion model inter-comparisons performed within the frames of this project the release was not radioactive but it is anyway comparable to a severe accident. Also the seminar on plant assessment arranged in this programme period focused on handling and assessing accident development in severe accidents.

Summarising, one discovers that most of the Nordic exercise scenarios have been severe accidents or threats of severe accidents in nuclear power plants. Still, INEX-2-FIN was found to have been even more interesting if there had been radiological consequences in the other Nordic countries.

In their emergency planning guidelines, IAEA states that emergency planning should include a wide range of scenarios covering scenarios unlikely to require off-site actions, scenarios with minor off-site consequences and scenarios with significant off-site consequences. The level of detail should however correspond to the probability of occurrence (IAEA 1994). Another and totally different approach to emergency planning would be to plan in most detail for the situations causing the largest consequences or maybe also the largest risks.

At last in Norway and probably also in the other Nordic countries, the emergency planning is in practice performed according to the IAEA guidelines. That is to say, the emergency response organisation and the contingency plans are established to be flexible and adjustable to any potential situation under development and the level of detail in the planning reflects the probability of a specific action needed to be taken in the early phase. Exercises should, at least when the objective is to validate plans and procedures, be adapted to the level of detail in the plans and thus maybe less severe accident scenarios are reasonable as well, at least for national exercises. But also in combined national, Nordic and international exercises the less severe accident scenarios should be considered more frequently since validating information exchange routines can very well be performed with less dramatic scenarios.

On the other hand, severe scenarios are motivating for the participants in an exercise and they give an opportunity to involve many persons in an exercise at the same time which can be of importance in itself. Severe accident scenarios are also regarded necessary to engage journalists or higher level decision makers in exercises. This might also contribute to increased understanding and better exercises.

Looking into the scenarios which have been used during Nordic exercises and drills again, it is clear that the majority of the scenarios have covered the early phase after an accident, i.e. the threat phase, the release phase and the phase immediately after the release have taken place. Anyway, the balance between the different phases in the exercise scenarios seems to be in reasonable accordance with the level of detail in the preparedness planning, as the early phase requires the most detailed preparedness planning.

Anyway, scenarios should be realistic in the sense that they should reflect the exercise objectives which again should reflect potential problems and a realistic level of the crisis. This again links to the risk picture. Risks consist of two components, probability and consequence. The weighting of these two components when assessing the risks can be done in different ways in different countries. Still, looking into the scenarios used in joint Nordic exercise activities, one might conclude that the consequences have been heavily weighted and one can ask if this actually harmonises with the actual planning basis in the different countries. Joint planning principles have not been stated between the Nordic countries but one can still ask the same question.

The level of detail in the event sequences of the different Nordic scenarios has been very different, mainly depending on if there is any nuclear facility involved and participating in the exercise. If the plant has been participating, like in INEX-2-FIN, the event sequence has been very detailed. However, from a neighbouring country the playing participation of the facility itself is not of major importance to achieve a realistic scenario. The advantages when the facility is participating is that national exercises between the nuclear facilities and the authorities will have to take place anyway and putting exercises together might reduce the number of exercises and thereby also reducing the costs. Still, this should not exclude the possibilities of exercising with other sources of contamination.

Detailed technical scenarios can easily be developed using different kinds of scenario tools. Investing in and developing such tools might in the long run contribute to cheaper exercise planning and in that way also making more exercises possible at the same cost. The costs and benefits of such developments should however be considered carefully.

Exercising with real weather conditions in real time makes the exercise a challenge also to the meteorological institutes but at the same time influences the work load

in the other participating organisations in a very unpredictable way. Using real weather conditions is preferable as this facilitates the use of different software tools etc. which have been developed within the different organisations. Using real **historical** weather one can plan in more detail for the workloads. However, exercising with real historical weather more or less excludes the meteorological institutes from participating in the exercises as this requires a reasonable amount of preparatory work. If the development of the tools had been harmonised to some extent (e.g. standardised input data format for the dispersion models), preparatory work could be done more efficiently by only one institute and the other ones could have been participating in the exercise. In other areas the same benefits might be achieved but this is not as obvious as for the meteorological offices, which are totally dependent on their data tools.

5.3 Exercise risks

An important aspect of exercise quality (cf. Chapter 2.2) is that exercises should be arranged without risks, that is to say exercises should not increase the risk for real accidents or the risks for the involved personnel (IAEA 1985). However, the term risk can and should be interpreted in a broader sense. In such a perspective, there is a risk that one establishes myths through exercises. Some examples of this will be discussed below.

After the large Nordic exercises there has been established an uncertainty about to which level communication and harmonisation can be achieved in the very early phase of an accident because the communication during the exercises has been limited. There is a danger that facts from the exercise performance which have been pointed out in the evaluation are transformed into myths. This seems to be a problem when the desired level of emergency response capabilities have not been defined. Before arranging more exercises where the level of early phase communication and harmonisation is validated, it is important to clarify the desired level of such communication and harmonisation.

Another example is that different groups are exercising frequently, less frequently or not at all. Some groups might regard their daily job as daily exercises and thus feel that additional exercises are not needed. Other groups, e.g. dispersion modellers, which are the group in the Nordic countries which have performed most drills or drill-like activities, have found drills useful to improve modelling tools and thus are very motivated for further activities along the same lines. This does not reflect the different groups' unbiased need to exercise, even though it can easily be interpreted like that. Probably, this rather reflects either that the different groups have achieved a different level of readiness to exercise and feel the need for exercises different, or that some topics are more suitable for joint Nordic exercises than others. This is a challenge in the overall exercise planning in the future.

As a final example, the exercise scenarios are discussed. Choosing severe accidents with a low probability of occurrence in most exercises might contribute to creation of an unrealistic picture of what kind of situations the different organisations and the outer world will have to cope with if an accident really happens. There is a risk that this contributes to overestimating or overreacting in smaller accidents with higher probability. This may in turn lead to mistrust in the authorities.

Concerning exercise risks, one should also be aware of the continued need for renewal in exercise objectives and scenarios to make sure that all potential problems are covered and that exercises reflect the overall development of the emergency preparedness. This is a challenge e.g. when one considers development of tools for scenario development in a broader sense.

5.4 Exercise activities as means or objectives

So far, most of the Nordic exercises have been - if rather unconsciously - to a large extent regarded as the objective themselves and not as tools for improving the emergency preparedness. This may partly explain why results are not always sufficiently followed up and improvements implemented, either nationally or jointly by the Nordic countries. This is a major challenge for the future development of the nuclear emergency preparedness and response.

An understanding of both the current skills and the desired level of emergency response capabilities should be closely linked to both emergency planning and exercises. In the Nordic exercises where joint plans are scarce, the overall objective of joint exercises should maybe be changed towards focusing more on harmonisation and development of policies and joint procedures rather than validating the non-existing procedures. This should be done by gathering relevant people for scenario based discussions rather than involving emergency preparedness facilities and communications systems. However, the optimum exercise strategy and its elements should be considered in detail.

Co-operation between groups who do not work closely together daily should be an important aspect of exercising. Because of the unconscious choices of methodology these aspect have probably not been fully covered in Nordic exercises so far.

The aspect could be improved by seeing the exercises as tools or milestones in the process of developing the emergency preparedness, and less as separate goals.

5.5 Costs

The budget frame for this project from NKS was in total about DKK 4 million over the 4-year period. In addition came national funding about which details are not available but it certainly exceeds the same amount of money. E.g. in the Nordic

annex to INEX-2-FIN, approximately 700 persons from the Nordic and Baltic countries were more or less involved. Based on rough information from the Nordic countries after this exercise one can very roughly estimate that the national costs of this exercise annex for the Nordic countries far exceeded the cost of one man year. In addition comes travelling expenses. This was meant to be a less costly exercise as it was arranged as an appendix to an international exercise.

The seminars and drills arranged within this project have all had a NKS frame budget of about DKK 150 000. This is only just sufficient to arrange such activities and a large amount of national funding is needed.

Exercises are costly in planning, performing and evaluation. These costs should preferably be balanced against the benefits of the exercises and the use and implementation of the result. In planning exercises one should be more aware of the costs in relation to the size and format of the exercise. To keep the costs on an optimum level according to what one wants to achieve, exercises in smaller groups and not in real time should be considered more often, both nationally and inter-Nordic.

5.6 Implementation of results

The direct benefits of arranging an exercise are the learning by the planners, the player and simulators, and the evaluators during the process of planning, playing and simulating, and evaluating. These benefits should not be under-estimated, but at the same time one should not forget the benefits gained by implementing the exercise results.

In many cases the implementation of results seems to be inappropriate since the same remarks are given after several exercises. The benefits of the exercises are thus not optimised. In this project the implementation of exercise results was not a scope. This was rather left as a national responsibility. However, this is not always sufficient. One might claim that organising a project with the major aim of arranging exercises does not support obtaining maximum benefits from the exercises.

What seems like a major problem regarding implementation of exercise results is that the evaluation is time-consuming and the evaluation reports are not finalised before the involved participant's engagement and motivation for improvements have more or less vanished.

At the same time, awaiting the evaluation one might start making improvements which are not based on a thorough analysis of what happened during the exercise but only on personal experience. There is a risk that this kind of improvements are not optimised. Additionally, they are probably not discussed or harmonised between the Nordic countries.

In addition, the frequency of Nordic and international exercises has been quite high in recent years, reducing the time to make improvements a minimum. Thus, e.g. specific tools and communication systems have not been developed in a suitable way between the large exercises. Especially the communication systems are vital in real time exercises and the possible outcome of the exercises due to lack of system development might have been reduced.

6 Recommendations and conclusions

6.1 Strategy development

Summing up the experiences from the activities in EKO-4, there is an extensive lack of awareness regarding why and how to exercise. It is suggested that the development of exercise strategies should be considered, both for national exercises in the Nordic countries and for joint Nordic exercises.

The exercise strategies should be based on a strategy for emergency planning. This is particularly important for the joint Nordic exercises, as there are no joint plans or objectives for the planning but bilateral, multilateral and inter-Nordic agreements are included in national plans.

In an exercise strategy (or even handbook) the question why to arrange joint Nordic exercises should be considered, as well as the suitability of different kinds of exercises for different purposes. A multi-year exercise plan focusing on the goals of exercising would also be important, both from a national, Nordic and international point of view.

Attention should also be given to the number of exercises and the balance between the emergency planning, the exercises and implementation of exercise results in the emergency planning. Additionally, one should also plan carefully to avoid exercise risks.

The balance between different scenarios should also be considered and a strategy should give some guidelines or thought about the use of accident scenarios with very severe consequences compared to accident scenarios with higher probabilities and smaller consequences. This should be related to the goals of the different exercises.

Also, the principles in exercise planning should be stated, e.g. to what extent exercises should be realistic.

Exercise strategies should include all areas where exercises are relevant. This might imply an expansion relative to what is regarded as exercises today. E.g. in-

ter-comparisons should be subject to the same structured arrangements with planning, performance and independent evaluation as drills and exercises are today.

6.2 Exercise methodology development

Another aspect of exercise which should be subject to further development is the exercise methodologies. First of all, methods to reduce cost in planning and evaluating exercises appear to be areas for improvements. It might be useful to look into other areas of training and exercising to learn from the development done here. In simulator training methods and tools for validating the performance have been developed, and the usefulness of such concepts should be considered.

Another important area of improvements is the range of exercise formats, which can probably be nuanced and developed further to form a useful basis for optimum exercise arrangements according to different goals. Within the Nordic co-operation, different kinds of exercises and drills have been arranged. One special concept for the table top exercises has been the arrangement of decision conferences. Testing out the usefulness of concepts and methods like this could very well be done in future Nordic co-operation.

6.3 Other areas for future development

As mentioned in Chapter 4 the different areas in which exercises and drills have been arranged appear to need further development and implementation of the exercise results. In particular, the systems for information and data exchange should be developed. This has to be done in line with development taking place internationally. However, one should be careful arranging exercises which make use of existing tools before some progress have been made. The authorities need an overall solution for information exchange both during normal work and during nuclear accidents.

6.4 Practice makes perfect

«Practice makes perfect» is obviously true only if the different aspects of an emergency situation are practised in appropriate ways. As has been discussed in this report, there is room for improvements in the way of exercising in the Nordic countries. These potential improvements consist of at least a more structured approach to exercises and exercise topics, and an acknowledgement that exercises can be the goal themselves but for improving the emergency preparedness they should rather be regarded as useful tools along with other such tools. This hopefully can contribute to a larger outcome and implementation of the exercise results.

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9 Appendices

9.1 Overview of the project-structure within EKO-4

EKO-4 consisted of two sub-projects, one related to exercises and one about data and information exchange.

EKO-4.1, Exercises and scenario works, was again divided into sub-tasks with one responsible person for each task. EKO-4.1 consisted of tree sub-projects: drills, scenario development and a large Nordic exercise.

EKO-4.1.1, Drills, consisted of the following task:

EKO-4.1.1.a	Severe accident assessment and source term estimation, arranged and reported by Timo Karjunen, STUK and SKI (represented by the consultants Kjell Johansson and Christer Calmtorp).
EKO-4.1.1.b	Dispersion modelling, co-ordinated by Torben Mikkelsen, Risø.
EKO-4.1.1.c	Interventions in urban area. Decision conference. Working group chaired by Kari Sinkko, STUK.
EKO-4.1.1.d	Information aspects, co-ordinated by Vibeke Hein, Beredskabsstyrelsen.
EKO-4.1.1.e	Dose calculation, working group chaired by Åsa Wiklund, SSI.
EKO-4.1.1.f	Harmonisation of intervention levels (cancelled during project period)
EKO-4.1.1.g	Dispersion modelling, co-ordinated by Ulf Tveten, IFE.

Most activities were planned and performed with participants from all Nordic countries. Separate reports are written from most of the activities.

EKO-4.1.2, Scenario development, was done and reported by Klaus Sjöblom, IVO/Loviisa nuclear power plant.

EKO-4.1.3, Nordic objectives of INEX-2-FIN was planned by a group of authority representatives chaired by Åke Persson, SSI. An evaluation group chaired by Anneli Salo made an evaluation report after the exercise.

EKO-4.2, Nordic system for data and information exchange, was suggested by representatives form Nordic authorities. Tord Walderhaug, Geislavarnir Ríkisins co-ordinated the work and wrote the report.

«Beredskapshåndboken» was revised by Morten Bremer Mærli, Norwegian Radiation Protection Authority. Other small tasks, like developing a Nordic exercise calendar, were performed by the project leader, Eldri Naadland Holo.

9.2 Exercise terminology

A survey of the exercise terminology used in the radiation protection and emergency preparedness authorities in the Nordic countries and in NEA was performed in early 1998. The terminology used within the Nordic countries was given in comparison with the characteristics given by Epler (see Ch. 2.3). The results are summarised in the table below:

	Danish	Finnish	Icelandic	Norwegian	Swedish	NEA
Table top exercise	skribords-øvelse[3]	harjoitus[4]	æfing[5]	skrivebords-øvelse	applikatoriskt exempel	Table top exercise
Drill	funksjons-øvelse[6]	harjoitus	æfing	funksjons-øvelse[7], (drill)	spel, kombinations övning[8]	Command post exercise[9]
Exercise	øvelse	harjoitus	æfing	øvelse	totalövning	Field exercise[10]

[3] An exercise not involving activities on a manuel level, such as sending out measuring teams. An example of such exercises in Denmark are called «baggrundsscenarieøvelser» with the objective of validating principles in new plans and guidelines. Another example are «stabsøvelser» when these are aimed at training staff personnel in e.g. decision making (not including manual activities).

[4] In Finnish, there is a common word for all exercises, sometimes with an additional word describing the scope of the exercise but usually the purpose of the exercise and how it will be carried out is described in detail in the exercise documentation. The terms can however be translated: «karttaharjoitus» (table top exercise), «johtamisharjoitus» or «toimintaharjoitus» (drill), «toimintaharjoitus» (exercise)

[5] In Icelandic this seems to be the most important term but other expressions are also being used, e.g. «skrifborðsæfing» (table top exercise), «heildaræfing» (full exercise), lítilæfing (small exercise, drill), «stóræfing» (large exercise).

[6] Training of specific activities, e.g. exercises for measuring teams or users of computer systems. «Stabsøvelser» involving manual activites (e.g. log keeping) are also examples of drills.

[7] A "stabsøvelse" might be a drill.

[8] A «spel» takes place in a constructed environment while a «kombinationsövning» as far as possible is arranged in the normal working conditions for the participants. Other examples of exercises which may be classified as drills are «delövningar» which aim at validating knowledge and skills within a part of an organisation (e.g. field exercise, «stabsövning»). The term «funktionsövning» is also used.

[9] Involves mobilisation of the centre of emergency operations (affected site and/or national level)

[10] To test field teams or coupled with a command post exercise to test the liaison between field teams and their command centres.

9.3 Exercise strategies and plans in the Nordic countries

The survey of exercise terminology and strategies in the radiation protection and emergency preparedness authorities in the Nordic countries also contained questions related to exercise strategies and plans. The answers to these questions are summarised below:

a) Have you described the objectives for your emergency preparedness organisation and/or the desired level of capabilities for the organisation? Please enclose relevant document(s).

Country	Answer
Denmark[11]	No. There is a strategy to arrange exercises but it is not described. Exercises are arranged when they are needed and personal resources are available.
Finland[12]	Ministry of Interior have made a guide concerning response during radiological emergency. This document is not yet printed. Also, the YVL-guide 7.4, called «Nuclear power plant emergency preparedness and response» covers these aspects.
Iceland[13]	Yes.
Norway[14]	No, but ongoing work on plans will probably also include these aspects.
Sweden[15]	Yes. «Plan för beredskapsorganisation och krigsorganisation» includes descriptions of the objectives for the preparedness organisation as a whole as well as objectives for the different parts of it.

b) Have you established a plan or strategy to fulfil the objectives, i.e. a strategy for exercises for the nuclear emergency preparedness organisation and/or your institute?

Country	Answer
Denmark	No. However there is an intent to make a strategy this year.
Finland	Yes. A plan for exercises at the nuclear power plants exists, also describing STUK's participation. County level exercises are described in the training programme issued by the Emergency Services College.
Iceland	Yes.

[11] Danish Emergency Management Agency
[12] STUK
[13] Icelandic Radiation Protection Institute
[14] Norwegian Radiation Protection Authority
[15] Swedish Radiation Protection Institute

Norway	No. A draft version of an exercise policy for civil emergency preparedness is available, but nothing particular exists for nuclear accidents.
Sweden	No, not yet. SSI is working on a strategy for education and training of SSI personnel in the emergency organisation.

c) Do you have a plan for exercises this year (1998)?

Country	**Answer**
Denmark	There is a plan for exercise participation this year.
Finland	Yes. The relevant documents are mentioned above.
Iceland	Yes.
Norway	There is a plan for nuclear emergency preparedness exercises this year but it is not described in one separate document.
Sweden	There exists an idea of to what extent there will be exercises but this has not been described.

d) Do you have a multi-year exercise programme?

Country	**Answer**
Denmark	No.
Finland	Yes. The relevant documents are mentioned above.
Iceland	No.
Norway	No.
Sweden	No, not documented.

9.4 Scenario for the dose calculation drill (EKO-4.1.1.e)

9.4.1 Scenario

A serious accident resulting in substantial atmospheric releases of radioactive material occurs at a fictive nuclear power station outside Munkfors in Värmland County, Sweden.(Lat 59°50´N Long 13° 30´E)

A malfunctioning, possibly leading to a core-damaging accident, has been identified on 8 May 1995. The reactor, a 2000 MW(th) PWR is shut down on 8 May 1100 hrs. (UTC). The reactor inventory is listed in Chapter 9.4.4.

8 May 1600 hrs. (UTC): It is found that a substantial atmospheric release is imminent and the dose assessment group is requested to prepare a preliminary forecast of the possible short-term radiological effects within a 50 km distance from the site, **PHASE 1**. It is estimated that a first part of the release will last about 1 h followed by a slower release lasting about 9 h.

8 May 2000 hrs.(UTC): The atmospheric release occurs. It is found that the release behaves as anticipated.

8 May 2100 hrs.(UTC): The release is brought under partial control. It is anticipated that the release rate subsequently will lower by a factor of ten.

8 May 2300 hrs. (UTC): The dose assessment group is requested to estimate the possible radiological effects in south-west Scandinavia, **PHASE 2**.

9 May 0600 hrs.(UTC): The situation is brought under control and the atmospheric release ends.

9.4.2 Exercise phase 1

Phase 1 refers to the time from shut-down up to 6 hrs. after end of release.

It had been desirable to let the dose assessment groups determine the dispersion parameters based on reported weather conditions. In order to make the results from the different groups comparable it is necessary to use common parameter values for the Phase 1 exercise.

Parameter values:

Wind direction:	NE
Wind speed:	4 m/s
Pasquill category:	E
Depth of mixing layer:	400 m
Effective release height:	150 m

Dry deposition velocities:

Iodine, inorganic:	10 mm/s
Iodine, organic:	0.1 mm/s
Other:	3 mm/s

Wet deposition coefficients:

Iodine, organic:	2E-6 s^{-1}
Other:	1E-4 s^{-1}

Predicted release fractions:

Nuclide group	Release first hour	Release next 9 hours
Noble gases	0.5	0.5
Iodine, inorganic	0.015	0.015
Iodine, organic	0.015	0.015
Cs, Rb	0.0125	0.0125
Te, Sb	0.005	0.005
Sr, Ba	2E-4	2E-4
Ru, Mo, Tc	8E-6	8E-6
La, Ce etc.	2E-5	2E-5

The dose assessment group is requested to estimate:

1a) **Cloud dose, inhalation dose (dose equivalent and thyroid) and external dose rate** at distances at 5, 10, 20, 30, 40, 50 km from the site along the central parts of the plume. External dose rate should be estimated 6h after end of release
Answer with figures. A map could also be added to the answer.

1b) **External dose (unshielded)** from deposition up to 1, 7, 30 and 365 days after end of release at distances 5, 10, 30 and 50 km from the site along the path where the central parts of the plume have passed.
Answer with figures.

1c) **Areas** where **30 days external dose (unshielded)** exceeds 1, 3, 10, 30 and 100 mSv.
Answer with isolines on a map.

1d) **External dose rate** up to a distance of 50 km from the site along the central parts of the plume considering precipitation (wet and dry deposition) in the affected area. It should be estimated 6 hrs. after end of release.
Answer with figures. A map could also be added to the answer.

A short **description of your dispersion model** is also requested, including the considerations taken into account for this particular exercise.

NOTE that 1c) is not compulsory.
NOTE that all requested doses are effective doses to adults.

9.4.3 Exercise phase 2

Phase 2 refers to the time after end of release. The weather is the real weather the 8-11 May, 1995. Each country provides its own weather data.

The dose assessment group is requested to estimate:

2a) **Localisation of the plume** 12, 24 and 36 hrs. after end of release.
Answer with a map/maps.

2b) **Distribution of cloud dose and external dose (30 d unshielded)** in the central parts of the plume, 36 hrs. after end of release.

Answer with figures. A map could also be added to the answer.

A short **description of your dispersion model** is also requested, including the considerations taken into account for this particular exercise.

NOTE that all requested doses are effective doses to adults.

9.4.4 Reactor inventory in TBq per MW (th)

1	Kr-85	6.5	5	Te-127m	11.1
2	Kr-85m	261.	6	Te-129	381.
3	Kr.87	522.	7	Te-129m	63.
4	Kr-88	762.	8	Te-131m	152.
5	Xe-133	1894.	9	Te-132	1415.
6	Xe-133m	57.	1	Y-90	46.
7	Xe-135	392.	2	Y-91	1415.
1	I-131	979.	3	Zr-95	1741.
2	I-132	1415.	4	Zr-97	1742.
3	I-133	2002.	5	Nb-95	1741.
4	I-134	2220.	6	Nb-97	1742.
5	I-135	1763.	7	La-140	1850.
1	Rb-88	762.	8	Ce-141	1741.
2	Cs-134	89.	9	Ce-143	1524.
3	Cs-136	35.	10	Ce-144	1001.
4	Cs-137	57.	11	Pr-143	1524.
1	Co-58	9.1	12	Nd-147	718.
2	Co-60	3.5		Np-239	19588.

3	Ru-103	1306.	1	Sr-89	1088.
4	Ru-105	849.	2	Sr-90	44.
5	Ru-106	305.	3	Sr-91	1306.
6	Rh-105	588.	4	Ba-140	1850
7	Mo-99	1850.	1	Pu-238	1.3
8	Tc-99m	1630.	2	Pu-239	0.28
1	Sb-127	12.7	3	Pu-240	0.31
2	Sb-127	59.3	4	Pu-241	56.
3	Sb-129	381.0	5	Cm-242	15.
4	Te-127	59.3	6	Cm-244	0.91

9.5 Objectives for the Nordic/Baltic annex to INEX-2-FIN (EKO-4.1.3)[16],[17]

9.5.1 Three different exercises

The INEX-2-FIN exercise is arranged by OECD/NEA on (the) 17th April 1997 and has three international objectives:

1. Decision making based on plant conditions.
2. Real time information exchange.
3. Public information.

These objectives are described in detail in other documents (i.e. NEA-INEX-DOC(96)2 rev. 1) and will not be evaluated from a Nordic point of view. National summary reports will however be produced and presented internationally.

In addition to the OECD/NEA INEX-2 objectives, several Nordic objectives have been agreed upon, forming a basis for a joint Nordic evaluation of the exercise. These objectives are described in detail in this document.

In addition to this, each country might define specific national objectives which are evaluated nationally.

9.5.2 Purpose and distribution of this document

This paper has been written for several purposes:

- To describe the Nordic objectives in order to clarify the national planning required.
- To establish a basis for the work to be performed by the Nordic evaluation group.
- To describe who are participating from the Nordic and Baltic countries in the different exercises.

This paper should not be distributed to any of the players. It should be kept between the members of the Nordic planning group, the Nordic and Baltic national exercise co-ordinators and the Nordic/Baltic group of evaluators.

9.5.3 Participants in the different countries

The following table shows the participating organisations which in some way are assumed to make contacts to other participants in the different exercises. Those

[16] This document was restricted and not to be published by the players.

[17] The objectives were written by: Åke Persson (SSI), Åsa Wiklund (SSI), Richard Olsson (SKI), Ritta Hänninen (STUK), Jørgen Holst-Hansen (DEMA), Vibeke Hein (DEMA), Elisabet D. Olafsdottir (GR), Finn Ugletveit (NRPA), Eldri Naadland (NRPA).

participating in the international exercise also participate(s)>ut in the Nordic and national exercises.

	INTERNATIONAL	+ NORDIC	+ NATIONAL
Denmark	Beredskabsstyrelsen	SIS DMI	
Estonia	Radiation Protection Centre (EKK) National Rescue Board (PA) Institute of Hydrometeorology (EMHI)		
Finland	STUK	FMI	
Iceland	Geislavarnir Ríkisins		
Latvia	Civil Defence Centre of Latvia State Hydrometeorology Agency Radiation and Nuclear Safety Inspectorate		
Lithuania	Civil Security Department Hydrometeorological Center (under Ministry of Environmental Protection) State Nuclear Safety Inspectorate (VATESI)		
Norway	NRPA	DNMI and the other participants in the em. prep. organisation	«Fylkesmenn» in some counties. Press and public information service.
Sweden	SSI SKI SMHI	Statens jordbruksverk (SJV) Statens livsmedelsverk (SLV)	«Länsstyrelsen» in some counties.

9.5.4 Introduction to the Nordic objectives

This paper contains the specific Nordic objectives for the INEX-2-FIN exercise. There are five such objectives, numbered N1, N2, N3, N4, and N5. In the text, there are also inputs to be used during the exercise. Three inputs are connected to N1 and are numbered N1a, N1b and N1c. Three inputs are related to N3, numbered N3a, N3b and N3c.

All the inputs have to be translated into the language of your own country. Those responsible for translating the questions should bear in mind that the responses to the inputs are to be compared and the content should therefore not be changed. Some of the geographical information has to be added on the evening before the

exercise (words in italics will either be re-written or added) by the exercise direction in each country. The exercise direction in Finland will provide the information to be added before the exercise. When translating, the times should be given in local time if most appropriate.

Finnish time has been used throughout the document, with UTC in brackets. The times given here are preliminary and may be changed when the scenario is completed.

9.5.5 N1: Estimation and assessment of the situation in real time

Description One of the most important aspects of managing a nuclear emergency is the ability to continuously have updated information on the current status of the accident and be able to estimate promptly and adequately the consequences of the accident and make prognoses for what is going to be the result. The intention is to evaluate the Nordic countries response to certain important questions and see whether they give consistent answers or not. If not, the reasons will be examined.

Purpose Evaluate the understanding of the situation and the assessments made in the Nordic countries at three different times during the exercise (threat phase, release phase and post release phase). The intention is to see whether they reach consistent conclusions and if not, examine and explain, if possible, the reasons for differences.

How At the same time at 3 times during the exercise (pre release phase, release phase and post release phase), all Nordic countries will get the similar questions from the national exercise directions. The information will have to be requested by some member of the Government/Ministry with extended responsibilities in the field of radiological emergency response in order to get the necessary realism into the exercise and to ensure that an answer will be given.

Pre release phase
This fax is presented at 11.30 Finnish time (0830 UTC) to the players from one of the high ranking representatives from the competent authority (e.g. SSI, NRPA) who is at a meeting in Murmansk:

Input N1a *Dear BOB (use real name at competent authority)*
As you know, I'm in Murmansk attending a meeting of the «Barents Sea Committee» together with representatives from all Nordic countries, Russia, USA and Canada. Our Minister of the Environment, who is also attending, has asked me for a personal update on

the situation and I therefore urgently need some information from you.

Rumours here in Murmansk say that the situation at Loviisa is similar to the TMI accident in 1979 and that a reactor core damage of the same magnitude is expected. Please send immediately your comments on this, an update on the situation in Finland, i.e. a description of the event, core- and containment status and prognosis, and countermeasures taken or planned to protect the public.
Please send the information to me as soon as possible at fax no: ..... (use real (national exercise direction?) number) - it is not possible to get through on the phone.

Release phase

Same procedure as for the threat phase. This following fax shall be sent at 1500 Finnish time (1200 UTC):

Input N1b *Hello again BOB*
Rumours here in Murmansk now claim that the situation at Loviisa has developed to the worse and that there is a release. Our Minister wants another personal update. Do you have any information about the magnitude and composition of the release? Please send promptly your comments on this and the latest information you have on the situation in Finland, i.e. a description of the event, core and containment status and prognosis, and countermeasures taken or planned to protect the public. How do you assess the consequences for our country and the situation in Finland?
Please send the information to me at fax no: ..... (use real number).

Prognoses for the next hours

The day before the exercise we will identify a place and time where the plume is expected to be approximately 5 hours after the release stopped.

Towards the end of the exercise at approximately 1800 hrs. Finnish time (1500 hrs. UTC) the same question is put to all Nordic countries officially from the office of the prime minister who is to be interviewed on TV in one hour and therefore wants some assistance from the radiation protection authorities:

To prepare for this question, the Norwegian news agency will send out a news telegram through the media channels at 1700 Finnish time (1400 UTC) containing the following information:

The results published by the University of Oslo are:
1. The estimated maximum dose rate outdoors in the ..... area at 2100 Thursday and 0900 Friday Finnish time (1800 UTC and 0600 UTC):
2 500 000 nGy/h and 18 000 000 nGy/h.
2. The estimated maximum air concentration of ^{131} I in the ..... area at 2100 Thursday and 0900 Friday Finnish time (1800 UTC and 0600 UTC): 500 000 000 Bq/m^3 and 370 000 000 Bq/m^3
3. The estimated maximum ground contamination of ^{137} Cs in the ..... area at 2100 Thursday and 0900 Friday Finnish time (1800 UTC and 0600 UTC: 190 000 000 Bq/m^2 and 300 000 000 Bq/m^2

The following request is sent from the Prime Minister's office at 1800 Finnish time (1500 UTC), with the news telegram from Norway enclosed:

Input N1c: *The Prime Minister will give an interview on (national broadcast agency news bulletin). He will certainly be asked to comment on the calculations published by the University of Oslo (enclosed) on the consequences of the nuclear accident in Finland and the lack of official national calculations of this kind. From what we can understand, the results are alarming. We don't know exactly who made these calculations, but we need official assessments as soon as possible to meet these allegations and avoid the authorities being accused of holding back information.*

The calculations have been made for (a place to be decided later), where the Ministries of Foreign Affairs of EU and Nordic countries at the moment are discussing the nuclear co-operation with Russia and the Baltic countries and made a point out of this. The results are quite alarming and you are kindly asked to assist during the interview and present your own assessments and estimate the corresponding results so that we can convince the press and the media that official calculations of the same quantities as published by the University of Oslo (see enclosure) are available and that no information is held back. Could you therefore please estimate the following at 2100 hrs. UTC today and at 0900 hrs. UTC tomorrow morning?:

1. Estimated maximum dose rate outdoors in the ..... area?
2. Estimated maximum air concentration of ^{131} I in the ..... area?

3. Estimated maximum ground deposition of ^{137} Cs in the ..... area?

Please send the name of your representative and the answers as soon as possible to the Office of the Prime Minister to the following fax no:.....(use real number). If you have two pieces of useful graphics where the numbers are shown, please bring them to the interview which takes place in the Office of the Prime Minister at 1700 hrs. UTC (2000 hrs. Finnish time). We will contact you and confirm the time later.

Evaluation The evaluators will collect the results and answers given and subsequently compare the results submitted by the Nordic countries. The evaluators should make sure they receive enough information to make a comparison. The evaluators will also analyse the results in order to examine the reasons for differences between the countries.

9.5.6 N2: Follow key information in the Nordic countries

Purpose and description To follow the distribution of key information to, from and within each of the Nordic countries in order to assess the efficiency of the distribution and compare the different channels that are being used. The timing of the messages as well as if the messages have changed content will be examined.

Concerning the information made available to the public, a comparison should be made of how the accident phases were described through the media to the public in the different Nordic countries. A comparison should also be made of how the technical issues were made available to the public by the authorities.

How We identify beforehand important information regarding the accident and follow this information from the source to relevant authorities in all Nordic countries through all relevant channels and further on to regional authorities, media and public. This is achieved through subsequent examination of the respective log books in the different countries, comparing the time of sending (and receiving, if relevant), from whom, to whom and which communication channel(s) were used.

The following is regarded as «key information»:

1. First notification from competent authority about any incident/ accident.
2. First rumours about incident/accident in Finland.

3. First official information about established fuel damage.
4. First official information about a release having started.
5. First measured composition of the release.
6. First message about the magnitude of the release.
7. First message about the release having stopped.
8. First message about off site countermeasures.

Evaluation Evaluation is performed through examination of the log books and the transmitted material in all Nordic countries after the exercise. This material is then put together and the key information is followed step by step to all the Nordic countries, within the countries and to the public. Media information is evaluated from the point of view of timing, consistency, comprehensibility and completeness.

The information to follow and compare with respect to changes in content should be in written form, i.e. log books, telefax messages, phone notes, e-mail etc. Videotapes and tape recordings should not be compared from a Nordic point of view.

9.5.7 N3: Co-ordination of recommendations

Purpose and description The purpose of this objective is to study to what extent contacts between the Nordic countries are made regarding recommendations on actions or non-actions related to issues where the situation is comparable in all Nordic countries. If no contacts are made, the causes for this should be examined.

How Analyse the radiological advice and recommendations given by the authorities, the content, what kind of assessment they are based on, when they are announced, to whom etc.

Examine the Nordic co-ordination and contacts made before each country announce their interventions and recommendations. Examine also why Nordic contacts may not have been made.

This examination is limited to three questions put to all five countries simultaneously, one question at a time. They should be posed in such a way that the top level of the national nuclear emergency organisations are the ones responsible for answering. All the question material has to be translated and re-written by the exercise direction in each country.

At 1130 Finnish time (0830 UTC) the following fax should be sent:

Input N3a *Our company, NOKIA, is arranging an important head of staff (or representatives) meeting Friday and Saturday at a leisure centre in Borgå, approx. 40 km west of Loviisa. Representatives from all Northern Europe with their families will be attending. Our representatives here in .....(name of country) are now worried about the situation. Should we cancel the trip for ourselves or our families? Please advise us on what to do.*

Air flight companies/Airport managers in each countries are contacting the authorities about the risk of flying to *Helsinki, St Petersburg or over the affected area* at 1445 Finnish time (1145 UTC).

Input N3b *«Due to the accident in the Finnish nuclear power plant we need to know if we should re-schedule any of the flights crossing the affected area or go on as normal. We get a lot of questions from anxious passengers and our crew members about how safe/dangerous it is to fly across south-east of Finland. What should we tell them? Please answer promptly.»*

At 1730 Finnish time (1430 UTC) a national dance company submits their question by fax:

Input N3c *We are a senior year class from the national dance academy (an appropriate company should be used for each country, Åbo or Rovaniemi dance company when question to Finnish authorities) going to Helsinki this evening for a guest performance at the opera in Helsinki. Is it safe to travel there or should we postpone the trip? The organisers say «the show must go on» but we are hesitant. Please reply as soon as possible.*

Evaluation Examination of the recommendations concerning travelling to Finland. Examination of what information/recommendations are distributed to each country's embassy in Helsinki by Finland and the countries themselves.

It should also be examined to what extent contacts were made before announcing these recommendations to the public and if these announcements were co-ordinated with respect to time. The evaluation can be achieved by examining the log book and the written answers to the questions presented. After the exercise, the evaluators can, if needed, ask players whether Nordic contacts were taken or not.

Whether co-ordinated information was given to the public about the recommendations decided can be examined from the log books, from press releases or other written journalism productions.

9.5.8 N4: Baltic-Nordic co-operation

Description Co-operation between the Nordic countries in emergency situations has been tested earlier in the Nordic exercises as well as in real small «fuss» situations. The Nordic co-operation with the Baltic countries has not yet gained the same standard. The same applies to co-operation between the Baltic countries. It is of common interest to examine the contacts taken and information sent between the Nordic and Baltic countries and also between the Baltic countries themselves. The main purpose of this objective is to give a status report of co-operation and communication during an emergency situation.

Purpose The purpose is to test and evaluate communication between the Nordic and Baltic countries in a nuclear emergency in order to gain experience and develop it further and to test the communication between the Baltic countries themselves.

How Examine contacts taken and information sent and received between the Nordic and Baltic countries, as well as between the Baltic states themselves, during the exercise.

Examined areas:
- which route the information is taking (who is contacting who)
- when is the information sent or received
- what method is used to send the information (fax, telephone, e-mail)
- whether the information received was sent upon request or sent spontaneously
- whether there are requests left unanswered

The following is regarded as «key information»:
1. First notification from competent authority about any incident/ accident.
2. First rumours about incident/accident in Finland.
3. First official information about established fuel damage.
4. First official information about a release having started.
5. First measured composition of the release.
6. First message about the magnitude of the release.

7. First message about the release having stopped.
8. First message about off site countermeasures.

Evaluation After the exercise, the national evaluator follows up the country's log book and evaluates the communication concerning the issues mentioned above.

It is essential that every country can present a well-kept log book.

9.5.9 N5: Journalists in Finland reporting back to national media

Purpose and description To compare the accident picture given through the journalists using the Finnish authorities as source with the picture given through the national authorities/media. To examine if information was given in an understandable language.

How A journalist from each of the four Nordic countries (Denmark, Iceland, Norway, Sweden) reports from Finland (they can stay at STUK) back to national media/simulated news agency. The Nordic journalists collect information from different sources, make interviews and participate in press conferences in Finland.

Evaluation The evaluation will include examination and comparison of the written media information products, the Finnish press releases compared with press releases or the like from the four other countries. It should be examined if the public profit from the Nordic co-operation between the authorities and if the authority information was co-ordinated. The evaluation can be supplemented by examining the log book.