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English - Or. English

NUCLEAR ENERGY AGENCY
RADIOACTIVE WASTE MANAGEMENT COMMITTEE

NEA/RWM/IGSC(2003)12
Unclassified

Integration Group for the Safety Case (IGSC)

MANAGEMENT OF UNCERTAINTY IN SAFETY CASES: THE ROLE OF RISK

A Workshop under the auspices of the NEA IGSC

Stockholm, Sweden
2 - 4 February 2004

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English - Or. English

Statens strålskyddsinstitut
Swedish Radiation Protection Authority

"MANAGEMENT OF UNCERTAINTY IN SAFETY CASES AND THE ROLE OF RISK"

AT RÅNÄS CASTLE, STOCKHOLM, SWEDEN
2-4 FEBRUARY 2004

A workshop organised by
the OECD Nuclear Energy Agency

and hosted by
SSI

FINAL PROGRAMME

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1. INTRODUCTION

This Workshop on the "**Management of Uncertainty in Safety Cases and the Role of Risk**" is being organised as part of the programme of activities of the Integration Group for the Safety Case (IGSC) of the Nuclear Energy Agency (NEA).

A Workshop on the general theme of risk characterisation was originally proposed by the Swedish Radiation Protection Authority (SSI) at the 3rd IGSC meeting in October 2001. A more detailed proposal was presented and approved at the 4th IGSC meeting in November 2002. Following confirmation of the overall theme as one of interest to IGSC members, a programme committee[1] was convened to plan the Workshop in detail. A meeting of the programme committee in April 2003 developed a provisional agenda for the Workshop based on presentations identified at that time. A further meeting of the programme committee was held in November 2003 to discuss the presentations submitted and to decide on the final agenda.

Section 2 of this document describes the context for the Workshop in terms of why and how uncertainties must be considered in a safety case. Subsequent sections provide further details on the aims and operational structure of the Workshop, and the detailed topics to be considered.

The proposed structure for the Workshop consists of both plenary sessions and working group discussions. The aim of the working groups will be to address a series of key topics and questions. A list of these topics and illustrative questions is provided in Annex 1. The Agenda established by the programme committee is presented in Annex 2.

2. GENERAL CONTEXT

Radioactive waste management involves consideration of the evolution of the waste and engineered barrier systems, and the interactions between these and, often relatively complex, natural systems. The timescales that must be considered are much longer than the timescales that can be studied in the laboratory or during site characterisation. These and other factors can lead to various types of uncertainty (on scenarios, models and parameters) in the assessment of long-term post-closure performance of waste management facilities.

A clear strategy for dealing with these uncertainties will need to be explained within the Safety Case for a waste management facility and in the supporting integrated performance assessment (IPA). The quality of site characterisation data, material properties and other information used in assessments, procedures for the use of these data, and research and development programmes is crucial and must be clearly stated in a dedicated section of the IPA's documentation.

The uncertainties must be appropriately considered and managed throughout a repository development programme. Every national radioactive waste management programme recognises that decisions at each stage of a step-wise development programme should be based on appropriate levels of confidence about the achievability of long-term safety. The current level of technical confidence (established through uncertainty analysis) should be described in a safety case, and the safety case should also discuss the potential for reducing uncertainty in the subsequent development phases.

1. Programme committee: Björn Dverstorp (Chairman, SSI, Sweden), Mikael Jensen (SSI, Sweden), Eva Simic (SKI, Sweden), Juhani Vira (Posiva, Finland), Klaus-Jürgen Röhlig (GRS-Köln, Germany), Patrick J. O'Sullivan (NRG, Netherlands), Philippe Raimbault (DGSNR, France), Sylvie Voinis (NEA, France) and Roger Wilmot (Consultant, Galson Sciences Ltd, UK).

Managing uncertainties and establishing levels of confidence can be approached in different ways. One part of the overall uncertainty management process is a quantitative assessment of system performance, but other issues, including policy, social context, availability of resources and decision-making timetables, also affect choices and the presentation of a safety case.

A safety case will place most emphasis on the evaluation and argumentation of the expected performance of a waste management facility, by taking into account the level of uncertainties at the current stage of development. A safety case will also take into account less likely events and scenarios, but with less emphasis than for the expected evolution. In a number of OECD countries, regulations and regulatory guidance for the management of radioactive waste include criteria that require an explicit calculation of long-term risk. Waste management programmes in these countries therefore need to assess the probability of different features, events and processes affecting a management facility in order to weight the consequences of different potential evolutions; other types of uncertainty may also be expressed as probabilities. The regulators in these countries need to assess the reasonableness of the probabilities and other assumptions made in safety cases presenting risk assessments. Other countries do not have explicit requirements for calculating risk or assessing probabilities, and safety cases and regulatory assessments in these countries adopt other approaches to considering the same uncertainties. The Workshop will provide a forum for debate about these various approaches for uncertainty analysis.

Because risk is a complex concept, and because its use in assessing safety is not universally accepted, there is a range of technical as well as philosophical issues on which debate and discussion between implementers, regulators and outside experts would be of value. The Workshop will provide a forum for this debate.

Compliance with numerical criteria is not the only measure of an acceptable safety case. Multiple lines of arguments, including a clear presentation of the underlying basis and assumptions for the calculations used for numerical comparisons, are important. Assessing various safety arguments allows both implementers and regulators to make decisions on the way forward through an iterative cycle of characterisation, design, analysis and assessment (NEA/RWM/IGSC(2002)16). The way in which numerical criteria, such as risk or dose limits, interact with these other safety arguments, so as to allow decision-making under uncertainty, is a key theme of the proposed Workshop.

An understanding of different approaches to the treatment and assessment of uncertainty will be of value to all programmes, whatever stage has been reached in the development of safety cases or review. In addition, the Workshop will be of particular value to those concerned with the development of new regulations and guidance that address the treatment of uncertainty, and to those developing safety cases under such regulations.

Previous NEA activities have examined some of the issues involved in the treatment of uncertainty. A workshop was organised in 1987 in Seattle, on “Uncertainty analysis for performance assessments of radioactive waste disposal systems”, and one of the conclusions was that uncertainty analysis must be part of an overall system performance assessment and that a systematic approach should be adopted in conducting uncertainty analyses. The Probabilistic Safety Assessment Group (PSAG) discussed issues associated with the use of probabilistic codes to calculate risk, including a series of inter-comparisons between different codes. The Integrated Performance Assessment Group (IPAG) also examined how uncertainties were addressed in assessments, from both a regulator’s and implementers' perspective. The Workshop will not duplicate these efforts, but build upon them and provide an opportunity for a focused discussion on approaches to making decisions under uncertainty. Different strategies and methods for the characterisation of uncertainties in the development of a safety case, including the role of deterministic and probabilistic approaches for calculating dose and

risk, will be discussed. A historical overview of previous NEA activities to give a basis for these discussions will be presented in the plenary session at the Workshop.

Early work on the use of risk for addressing uncertainties in the assessment of post-closure performance of radioactive waste disposal facilities, built upon lessons learned from probabilistic assessments undertaken for the operation of facilities such as nuclear power plants. Since that time, the specific needs and requirements of post-closure assessments have led to new approaches and solutions for assessing uncertainties and making decisions, so that there is less common ground with operational assessments. Nevertheless, assessments of post-closure safety and associated decision-making are made in the same social context as operational safety assessments and other assessments of hazards, so that other approaches to characterising and treating uncertainty will be of interest to those concerned with post-closure safety. A plenary presentation from an active participant in another assessment field is therefore planned for the Workshop.

An important step in the overall management of uncertainties is communicating the basis for the approach adopted to treat uncertainty and the reasons for decisions to other stakeholders. Other international programmes and discussion fora are actively considering the issues associated with risk and safety communication. A plenary presentation from an active participant in one of these activities is planned for the proposed Workshop, but the Workshop will not address this topic in further detail.

3. AIM OF THE WORKSHOP

The title of the Workshop is "Management of uncertainty in safety cases and the role of risk".

The **overall aim of the Workshop** will be to create a platform in order to better understand different approaches to managing uncertainty in post-closure safety cases and regulatory evaluations in different national waste management programmes.

The **principal objectives of the Workshop** will be:

- To identify common elements in different approaches for managing uncertainty
- To facilitate information exchange and to promote discussion on different technical approaches to the management and characterisation of uncertainty and on the role of risk
- To explore the merits of alternative approaches to risk-informed decision-making
- To identify the potential for further developments of methods or strategies to support the management of uncertainties.

4. TECHNICAL TOPICS

Three broad technical themes will provide the basis for presentations in a plenary session and serve as themes for Working Groups to discuss. These key themes are:

- **WG 1: Risk Management and Decision Making**

  This theme will examine what type of safety case would best serve decision-makers. Alternative approaches to risk-informed decision-making, and the role of stakeholders and experts in these approaches, will be discussed. The concept of risk and its different aspects or dimensions (social, technical, mathematical) will be examined. Overall, this theme will consider the management of risks as well as the assessment of risks.

- **WG 2: Regulatory requirements and review of uncertainty and risk in safety cases**

  This theme will examine processes for regulatory assessment of safety cases. Approaches to setting standards and determining appropriate regulatory end-points will be considered. Methods for evaluating the results of, and finding weaknesses in, risk assessments and other assessments of uncertainty will be addressed. Topics such as the role of risk in regulations, the types of information required by regulators, the role of qualitative information in safety cases, and the importance of calculated risk in comparison to other lines of reasoning will be discussed.

- **WG 3: Practical approaches and tools for the management of uncertainties**

  This theme will address issues concerning the characterisation and calculation of risk, and other strategies for the treatment of uncertainties. Topics such as the selection of scenarios and the assignment of probabilities, the use of expert judgements, and the presentation of information on uncertainties and risk will be examined.

If necessary, an additional working group may be established to keep the size of each working group manageable.

5. OPERATIONAL STRUCTURE

5.1 Workshop structure

The Workshop will be organised into plenary sessions and working group discussions:

- The **first plenary session** (Day 1) will focus on establishing a framework for understanding the management of uncertainties and the use of risk. It will comprise oral presentations drawing on a range of experience from both active participants in the development and assessment of safety cases and keynotes presentations by external participants involved in risk management in other sectors.

- The **working group discussions** (Day 2) will cover the three technical themes identified in Section 4. The aim of the working groups is to develop an understanding of the specific issues, and to identify any further activities that will support the development and/or evaluation of safety cases.

- The **round up plenary session** (Day 3) will bring together information and conclusions from each of the working groups. Common elements in the different approaches to

treating uncertainty and risk will be identified, along with potential further developments of methods or strategies to support risk characterisation and assessment. This session will include presentations by rapporteurs from each working group, and an open discussion of the themes and conclusions by all the participants.

5.2 Participation

The workshop is open to representatives of IGSC organisations and individuals from other industries and the academic community nominated by IGSC members and the programme committee. The participation of both regulators and implementers will ensure that regulatory requirements regarding the management of uncertainty can be clarified.

In order to ensure a workable size for the workshop, participation has been limited to 50 persons.

5.3 Proceedings

The OECD will publish proceedings of the Workshop. The proceedings will include:

1. A synthesis of the presentations, discussions and lessons learnt at the Workshop,
2. Written summaries of the working group achievements for each technical topic, and
3. Extended abstracts for all of the presentations.

Each rapporteur of the plenary and working group sessions will provide a summary of the presentations and of the discussions. The summaries of the discussions in the working groups will be structured using the key topics and questions posed, so that answers to the questions, or reasons why the questions cannot be answered, are available. Drafts of these summaries will be reviewed by the session chairperson and then sent to working group participants for agreement before they are forwarded to the programme committee.

The NEA and the programme committee, supported by a consultant, will produce a draft workshop proceedings, with an introduction, broad synthesis of the issues raised and lessons learned, session summaries and extended abstracts.

The overall timescale for production of the proceedings is within six months of the Workshop. Rapporteurs and session chairpersons will compile and review the summaries within four weeks of the Workshop, and the draft proceedings will be available for comment by workshop participants after a further two months.

The final form of the proceedings will be decided by the NEA and the programme committee. At the least, it will be published as a NEA proceeding report.

5.4 The Programme Committee

The Programme Committee will:

- Define the general format of the Workshop, topics and agenda
- Identify the technical sessions and working groups to be convened
- Identify and invite chairpersons and rapporteurs for plenary and working group sessions
- Identify and invite outside experts for the plenary session

- Define lists of questions for presenters and working group discussions to address
- Review extended abstracts (only abstracts proposed for a plenary session)
- Review the proceedings.

The Programme committee comprises Björn Dverstorp (Chairman, SSI, Sweden), Mikael Jensen (SSI, Sweden), Eva Simic (SKI, Sweden), Juhani Vira (Posiva Oy, Finland), Klaus-Jürgen Röhlig (GRS-Köln, Germany), Patrick J. O'Sullivan (NRG, Netherlands), Philippe Raimbault (DGSNR, France), Sylvie Voinis (NEA, France) and Roger Wilmot (Consultant, Galson Sciences Ltd, UK).

5.5 Working Group Chairs / Rapporteurs

The work of a chairperson will be to introduce speakers, keep the session on schedule and motivate discussion among participants. The chairperson will also help the rapporteur to prepare an oral synthesis of discussions for the round-up plenary session and will review the rapporteur's written summary of the session.

Rapporteurs of working group sessions will make an oral synthesis of discussions for the round-up plenary session. Rapporteurs of all sessions will provide a written summary of the presentations and discussions, structured where appropriate, using the key topics and questions posed. The written summary should be reviewed by the working group members.

6. DATES AND LOCATION OF THE WORKSHOP

The Workshop will be a residential workshop that will be held at the **Rånäs Castle**, from Monday – Wednesday **2-4 February 2004.**

The hotel has a large meeting room able to hold 60 people seated at tables facing forward for the plenary session, and three smaller rooms that can be arranged as required for the working groups.

Travel to Rånäs Castle

Rånäs Castle (www.ranasslott.se) is situated approximately 30 km from Arlanda Airport. Participants should plan to make their own arrangements (taxi) for travel to the Workshop. Group transport to Arlanda will be provided by SSI at the end of the Workshop. Detailed information on transportation and the venue is given in Annex 3.

7. WORKING LANGUAGE

English will be the working language of the Workshop and the proceedings.

8. ORAL PRESENTATIONS

The time for plenary presentations in the agenda includes a period of 10-20 minutes for clarification and discussion. Presentations for the working groups are intended to introduce the discussion on one or more of the topics posed for the working group (Annex 1). The working group presentations will be short (approximately 10 min).

For the plenary session, a portable computer projector (for presentations using PowerPoint) will be available as well as an overhead projector. A similar arrangement is planned for the working group sessions, but presenters should ensure that they have OHP slides available in the event that a PC projector is not available.

Presenters are asked to make copies of their presentations (preferably in electronic format) available to the NEA before the Workshop so that a CDROM of the presentations can be compiled.

9. FINANCING OF THE WORKSHOP

SSI will bear the costs of holding the Workshop, including providing meeting rooms, copying facilities and other similar items.

The NEA will provide logistical support for the Workshop, including the handling of registrations, and the receipt and distribution of abstracts and papers.

SSI and SKB will support the Workshop by sponsoring dinners for participants.

Posiva, SKI, SSI, EDF and HSK will all provide support to the Workshop by making funds available for the participation of outside experts.

SKI and SSI will support the Workshop by providing funding for the preparation of the Workshop synthesis and proceedings (consultant costs not covered by the registration fees).

The registration fees of 500 Euro per participant will cover the following expenses:

- A consultant to assist in the preparation of the Workshop synthesis and proceedings,
- Participation at the Workshop of invited experts not supported by IGSC Member Organisations

The NEA secretariat will be responsible for the collection of registration fees and disbursement of funds.

ANNEX 1:

TOPICS AND QUESTIONS FOR WORKING GROUP DISCUSSIONS

This Annex lists the topics intended to form the basis for discussion in the Working Groups. Each topic is illustrated by a set of questions that could be addressed by short presentations, and that could also be used to prompt the discussion.

WG 1: Risk Management and decision-making

This theme will examine what type of safety case would best serve decision-makers. Alternative approaches to risk-informed decision-making, and the role of stakeholders and experts in these approaches, will be discussed. The concept of risk and its different aspects or dimensions (social, technical, mathematical) will be examined. Overall, this theme will consider the management of risks as well as the assessment of risks.

The concept and use of risk

§ Why and where is a concept such as risk needed? What is "risk"? (psychological and mathematical concepts).

§ Is there a role for alternative paradigms of risk (other than the mathematical product consequence times probability)?

Risk management in a societal context

§ How have uncertainties and risk been treated in past/recent decisions on nuclear waste (and, possibly, on other) hazardous waste activities?

§ How can stakeholders be involved in decision-making in the presence of risk?

§ What new developments in risk management could contribute to decision-making?

§ Can the risks of geologic disposal be managed?

Role of the safety case to inform decision-making

§ What kind of information and descriptions of uncertainty and risk in the safety case would best serve different decision-makers at different decision levels?

§ How can different approaches to treating uncertainty be used in decision-making?

§ How can quantitative calculations of risk be combined with qualitative lines of reasoning?

§ How to handle scenarios with low probability and high consequences in a risk assessment ?

WG 2: Regulatory requirements and regulatory review of uncertainty and risk in safety cases

This theme will examine processes for regulatory assessment of safety cases. Approaches to setting standards and determining appropriate regulatory end-points will be considered. Methods for evaluating the results of, and finding weaknesses in, risk assessments and other assessments of uncertainty will be addressed. Topics such as the role of risk in regulations, the types of information required by regulators, the role of qualitative information in safety cases, and the importance of calculated risk in comparison to other lines of reasoning will be discussed.

Approaches to setting standards for the treatment of uncertainty

§ How prescriptive should regulations be on defining how uncertainties are treated?

§ Is there benefit in defining targets rather than limits in establishing risk and dose standards? Is there benefit in defining a threshold below which no further improvements in safety are required?

§ What importance should be attached to quantitative criteria in comparison to other criteria for treating uncertainty?

Determining the scope and end-points in regulations

§ What are the practical implications of different regulatory end-points for the treatment of uncertainty?

§ What does a risk based regulation mean in terms of requirements of probabilistic and deterministic calculations?

§ What is the role of different safety indicators/end-points at different time scales (doses, concentrations, fluxes, etc)?

§ Should the risk assessment address the probability of human intrusion?

§ What is the role of the biosphere in calculating risk over long time-scales?

§ How should probabilities be assigned to a short-term, high consequence event likely to occur at some point over a long period?

The regulatory review process

§ What approaches can be adopted for evaluation of uncertainty and risk in a safety case (e.g., independent calculations or merely review of documents)?

§ How to assess safety case in which conservative and realistic assumptions are mixed in analysis?

§ What importance should be attached to calculated risk in comparison to other lines of reasoning?

§ To what extent should a regulator have an independent capability to undertake a (quantitative) risk assessment?

§ What is the role of bounding calculations of consequences and probabilities?

WG 3: Practical approaches and tools for the management of uncertainty

This theme will address issues concerning the characterisation and calculation of risk, and other strategies for the treatment of uncertainties. Topics such as the selection of scenarios and the assignment of probabilities, the use of expert judgements, and the presentation of information on uncertainties and risk will be examined.

Classifying and characterising uncertainties

§ Are uncertainty classifications useful in determining how to account for uncertainty? How can different types of uncertainties be aggregated / disaggregated in the calculation of risk and in the presentation of results?

§ How can different concepts of probability (frequency, degree-of-belief) be utilised to treat different types of uncertainty? Which uncertainties cannot be represented by probabilities? How can they be handled?

§ How can expert judgements be derived, documented and incorporated into risk assessments?

§ How should probabilities be assigned to a short-term, high consequence event likely to occur at some point over a long period?

§ How can tools and experiences from outside the nuclear waste field be used in the assessment of uncertainties?

Determining the scope of uncertainty analyses and risk assessments

§ How can quantitative calculations of risk be combined with qualitative lines of reasoning?

§ How can you combine conservative and realistic assumptions in a safety assessment? What are the potential problems of using simplified models as opposed to more detailed process models? What is the role of bounding calculations?

§ How can scenarios be defined such that meaningful probabilities can be associated with them? How can a range of potential future evolutions be captured in a limited set of scenarios?

§ How can conditional scenario risks be aggregated to a global/total risk?

§ How to handle uncertainties in the biosphere in calculating risk over long time-scales?

Presenting uncertainty analyses and risk assessments

- What are the benefits and disadvantages of different ways of presenting the results of safety assessments (e.g., aggregated or disaggregated consequence and likelihood calculations)?

- How can difficulties in interpreting probabilistic assessments (e.g., unrealistic parameter combinations; the meaning of high consequence tails) be reduced?

- Is risk dilution a significant issue and how can it be avoided?

ANNEX 2:

AGENDA OF THE WORKSHOP

Workshop on Management of Uncertainty in Safety Cases and the Role of Risk

2-4 February 2004
STOCKHOLM, SWEDEN

DAY 0	**Sunday 1 February 2004**
	Arrival and check-in at Rånäs Castle
	SSI offers a light evening meal

DAY 1	**Monday 2 February 2004**
Please note!	**The meeting will take place in the old mill next to the manor.**
08:30 – 09:00	Registration (in the plenary meeting room in the old mill)
	Introduction
09:00 – 09:10	Welcome address *Lars-Erik Holm (SSI, Sweden)*
09:10 - 09:20	Scope of workshop *Sylvie Voinis (NEA, France)*
	Plenary Session I: Key note presentations *Chairperson: Lars-Erik Holm (SSI, Sweden)* *Session rapporteur: Roger Wilmot (Galson Sciences, UK)*
09:20 - 10:00	Risk in Technical and Scientific Studies: General Introduction to Uncertainty Management and the Concept of Risk *George E. Apostolakis (Massachusetts Institute of Technology)*
10:00 - 10:30	Risk Perception as a Factor in Policy and Decision-Making *Lennart Sjöberg (Stockholm School of Economics, Sweden)*
10:30 - 11:00	Coffee break
11:00 - 11:40	The Collection of Expert Judgments for Environmental Risk Studies *Stephen C. Hora (University of Hawaii at Hilo, U.S.A)*
11:40 – 12:10	Survey of the Role of Uncertainty and Risk in Current Regulations *Roger Wilmot (Galson Sciences, UK)*
12.10 – 12.20	Discussion
12:20– 13.50	*Buffet Lunch*

Plenary Session I (continued)
Chairperson: Hiroyuki Umeki (NUMO, Japan)
Session rapporteur: Roger Wilmot (Galson Sciences, UK)

13.50-14:30	Case Study 1 - Management of Uncertainties and the Role of Risk in Andra's Program *Arnaud Grevoz (Andra, France)*
14:30– 15:10	Case Study 2 – Treatment of Uncertainty in the US Department of Energy's Yucca Mountain Repository Total System Performance Assessment (TSPA) with a risk criterion *Abraham Van Luik (US Department of Energy, Las Vegas, Nevada) and Eric Zwahlen (Golder Associates, Inc., Las Vegas, Nevada) – presentation through speaker phone*
15:10– 15:30	*Coffee break*
15:30 – 16:10	Risk Considerations in the Domains of Protections Against Major Accidents in Comparison with Risk Control for Nuclear Power Plants *Felix Gmünder (Basler & Hofmann Consulting Engineers, Switzerland) and Patrick Meyer (Swiss Federal Nuclear Safety Inspectorate, Switzerland)*
16:10-16:50	Development of Safety Criteria in Germany: Aim, Process and Experiences *Bruno Baltes and Klaus-Jürgen Röhlig (Gesellschaft für Anlagen- und Reaktorsicherheit, GRS, Köln, Germany)*
16:50-17:20	Consideration of Unlikely Events and Uncertainties in the Finnish Safety Regulations for Spent Fuel Disposal *Esko Ruokola (Radiation and Nuclear Safety Authority, Finland)*
17:20-17:50	Enhancing transparency and public participation in nuclear waste management *Magnus Westerlind (SKI, Sweden)*
17:50 – 18:20	Uncertainty Governance: An Integrated Framework for Managing and Communicating Uncertainties *Hiroyuki Umeki (NUMO, Japan), Morimasa Naito (Numo, Japan), and Hiroyasu Takase (Quintessa, Japan)*
18:20 – 18:30	Discussion and conclusions
18:30	***End of session***

Workshop dinner hosted by SSI

19:15	***Refreshment*** *and a presentation of the historical Background of Rånäs Castle (representative of Rånäs Castle)*
19:45	***Dinner*** *Dinner speech by Torsten Carlsson, (former mayor of Oskarshamn municipality, Sweden)*

DAY 2	**Tuesday 3 February 2004**

09:00 – 09:30 Instructions to working groups (in plenary)
SSI

09:30 - 17:30 **Working Group Sessions**
½ hour coffee breaks at 10:30 and 15:20
Lunch Buffet between 12:00 and 13:30
Oral supporting presentations that will be presented at the beginning of each working group session will last 10 minutes each. Should the chairperson decide to increase the duration of the presentation, he/she will contact the speakers.

WG1: ***Risk Management and Decision Making***
Working Group leader: Juhani Vira (Posiva, Finland)
Working Group rapporteur: Harald Åhagen (Municipality of Oskarshamn, Sweden)

Introductory presentations:

- Discussion of Risks in the Context of the Environmental Impact Assessment of the Spent Fuel Repository in Finland
  Juhani Vira (Posiva, Finland)

- Experience of Risk Perception from Oskarshamn Municipality
  Harald Åhagen (Project LKO, Municipality of Oskarshamn, Sweden)

- Concepts of Uncertainty Classification and New Methods of Risk Assessment for the Disposal of Radiaoactive Waste
  Gy.Bárdossy (Hungarian Academy of Sciences, Budapest, Hungary), J.Fodor (Department of Biomathematics, Szent István University, Budapest, Hungary), and F. Frigyesi (PURAM , Paks, Hungary)

WG2: ***Regulatory Requirements and Review of Uncertainty and Risk in Safety Cases***
Working Group leader: Björn Dverstorp (SSI, Sweden)
Working Group rapporteur: Patrick O´Sullivan (NRG, the Netherlands)

Introductory presentations:

- SSI's Regulations in Connection with Post-Closure Radioactive Waste Disposal
  Mikael Jensen (Swedish Radiation Protection Authority)
- The Management of Uncertainties in the French Regulation on Deep Disposal: The development of a Non-Risk Based Approach
  Phillippe Raimbault (DGSNR, France)

- Estimates of Post-Closure Risk in Regulatory Decision-Making: Environment Agency Issues and Options
  S L Duerden, I J Streatfield, and R A Yearsley (Environment Agency, UK)
- Proposed Review of Current Regulatory Safety Criteria for the HLW
  Christian Kirchsteiger and Ricardo Bolado-Lavin (European Commission, DG JRC, Institute for Energy, the Netherlands)

- Use of Risk Information in Regulatory Reviews
  Budhi Sagar, Roland Benke, and Osvaldo Pensado (CNWRA/NRC, USA)

WG3 ***Practical approaches and tools for the management of uncertainty***
Working Group leader: Arnaud Grevoz (Andra, France)
Working Group rapporteur: Eva Simic (SKI, Sweden)

Introductory presentations:

- The Issue of Risk Dilution in Risk Assessments
  Peter Robinson (Quintessa, UK) and Roger Wilmot (Galson Sciences, UK)
- Risk Assessment using Probabilistic Standards
  Rodolfo Avila (Facilia, Sweden)
- Methodology for Risk Assessment of an SNF Repository in Sweden
  Allan Hedin (SKB, Sweden)
- Sensitivity Analyses Methods for Generating Risk Information
  Osvaldo Pensado, Budhi Sagar, and Sitakanta Mohanty (CNWRA/NRC, USA)
- Physically Based Probability Criterion for Exceeding Radionuclide Concentration Limits in Heterogeneous Bedrock
  Anders Wörman (Swedish University of Agricultural Sciences, Sweden), Shulan Xu and Björn Dverstorp (SSI, Sweden)

- Risk and Uncertainty Assessment for a Potential HLW Repository in Korea: TSPA 2006[2]
  Y S Hwang and C H Kang (Korea Atomic Energy Research Institute)

- Uncertainty Propagation in a Radionuclide Transport Model for Performance Assessment of Nuclear Waste Disposal
  Anne Dutfoy and Marie Bouton (EDF, France)[3] (tbc)

17:30 End of session

Social activities and Workshop Dinner hosted by SKB

17:30 – 20:00 Sauna (with refreshments), outdoor hot tub, cool bath in lake and other activities

20.00 Workshop Dinner

[2] Supporting paper for discussion only.

[3] Supporting paper for discussion only.

DAY 3	Wednesday 4 February 2004
08:30 – 09:30	**Working Group Sessions** (continued)
09:30-10:00	*Coffee break*
	Plenary Session II: Working Group Summaries and Final Discussion *Session Chair: Carl-Magnus Larsson (SSI, Sweden)* *Session Rapporteur: Roger Wilmot (Galson Sciences, UK)*
10:00 - 11:30	Working group presentations *WG rapporteurs/leaders 1-3*
11:30 – 12:00	Discussion of Working Group Summaries
12:00 – 13:00	Personal reflections on workshop *Steve Hora (University of Hawaii, USA)*
	Final Discussion
	Closing Remarks *NEA and host*
13:00	End of workshop
13:00 - 14:00	*Lunch*
14.15	Bus transport to airport (Arlanda)

ANNEX 3:

LOCAL ARRANGEMENTS:

Hotel information and travel instructions

Rånäs Slott 1-4 February 2004

Workshop location

The workshop will take place in the Rånäs castle. The castle is situated in the middle of historic Sweden on the northern shore of lake Skedviken. Rånäs Manor is the southernmost Walloon manor in the county of Uppland. Counts, lords and barons have lodged at Rånäs. Here the Oxenstierna,Stenbock, Reuterskiöld and other families have ruled since the 14th century.

Rånäs castle had a charter from 1774 for the yearly production of 1500 ship pounds of bar iron. Under the century-old linden in the alleys of the castle the mighty blows of the hammer mill resounded. In the fields surrounding the manor grain was cultivated and in its wide-stretched forests coal was bunkered. In the long low row of houses lived the working families who were employed at the manor, a position which was considered lifelong.

The castle was designed by the leading architect of the time, professor Per Axel Nyström. Its park and gardens were the most lavish in all of Roslagen. When the lord of the manor himself arrived in his gilded coupé, drawn by a four-in-hand whose horses had silver coated harnesses and two liveried men at the coach-box, it was comparable to that of the king.

Transportation

The castle is situated roughly 30 km from the airport and a taxi ride takes approximately 30 minutes. No transportation will be provided from Stockholm-Arlanda Airport to Rånäs Slott (Rånäs Castle).

Taxi can be pre-booked with Rimbo Taxi, phone +46 175 704 00 or fax +46 175 701 20.

You can also pre-book taxi via the Rånäs Castle reception, phone +46 175 747 00, fax +46 175 614 10 or e-mail info@ranasslott.se. The Rimbo Taxi company has favourable rates for the taxi ride to the castle. Example: 1-4 persons in one car is SEK 460:- (May 2003).

Accommodation

Accommodation will be arranged in the Rånäs Castle and its wings. The Castle reserves the right to charge you for all nights reserved and guaranteed on the registration form, should you check out before confirmed departure date or in case of no-show.

The cost for per person night is SEK 1 657 including lodging in single room, breakfast, lunch VAT and service (Dinners on Monday and Tuesday will be sponsored by the Swedish Radiation Protection Authority and the Swedish Nuclear Fuel and Waste Management Co, respectively).

Contact details for alteration or cancellation of hotel reservation

Congrex Sweden AB	Tel: +46 8 459 66 00
Att: SSI meeting	Fax: +46 8 661 91 25
P.O. Box 5619	E-mail: ssi2004@congrex.se
SE-114 86 Stockholm	
Sweden	

Rånäs Slott	Tel: +46 175 747 00
SE-762 96 Rånäs	Fax +46 175 614 10
Sweden	E-mail: info@ranasslott.se