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Organisation de Coopération et de Développement Économiques  
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**English - Or. English**

**NUCLEAR ENERGY AGENCY  
RADIOACTIVE WASTE MANAGEMENT COMMITTEE**

## **Integration Group for the Safety Case (IGSC)**

### **Summary Record of the 14th Meeting of the IGSC**

**Held at the OECD Conference Centre in Paris, France  
8-10 October 2012**

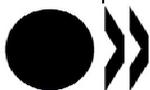
*This summary record of IGSC-14 has been approved by the members at the IGSC-15 in 2013.*

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## INTEGRATION GROUP FOR THE SAFETY CASE (IGSC)

### Summary Record of the 14<sup>th</sup> Meeting

OECD Conference Centre, Paris, October 8-10, 2012

The 14<sup>th</sup> meeting of the Integration Group for the Safety Case (IGSC) took place at the OECD Conference Centre in Paris on October 8-10, 2012. This summary record reviews the main items and decisions. Annex 1 presents the list of participants. All materials will be posted on the IGSC internal webpage.

#### 1.0 Opening Remarks

##### 1.1 Welcome Note

K. Röhlig welcomed the participants and delivered the apologies on behalf of the absent delegates. A list of participants is provided in Annex 1.

U. Yoshimura gave a brief update of recent NEA activities:

- M. Siemann is the new Head of the Radioactive Waste Management and Decommissioning Division;
- ICGR 2012, held on October 1-3, in Toronto revealed the latest approaches and practices used in different countries for repository development. Programmes that are reaching industrial implementation also discussed their challenges and foreseeable operational issues;
- Russian membership with the NEA will commence in January 2013;
- China has recently contacted the NEA and preliminary membership issues were discussed.

##### 1.2 Objectives of IGSC-14 and approval of agenda

- The proposed agenda was accepted without changes.

##### 1.3 Approval of IGSC-13 Summary Record

The summary record of IGSC-13 was approved in principle with 3 changes to be incorporated:

- Section 3.1: word changes as requested by M. Capouet of Ondraf/Niras related to the cAt A Project;
- FEP database: remove the names of the task group;
- Participant list: Brittain Hill is a representative of the USA.

**Decision:** Summary records of future meeting will be brief, capturing only the key points/decisions.

## 2.0 Activities of International Organisations

### 2.1 EC Developments (Christophe Davies)

- FORGE Symposium, to be held in Luxembourg, on Feb 05-07, 2013, is requesting IGSC members to volunteer as rapporteurs in the 5 working groups;
- MoDeRn, a conference on Monitoring, will be held on March 19-21 2013, also in Luxembourg;
- Euradwaste 13, to present the achievements of Euratom FP7 and also to cover EU Waste Directive 2011, has been scheduled for October 14-16, 2013, in Vilnius, Lithuania.

### 2.2 IGD-TP (Philippe Lalieux)

- Planned or ongoing Joint Activities (JA): (i) JA1 Waste forms and behavior – FIRST NUCLIDES and REDUPP; (ii) JA2 Full Scale Demonstration of Plugging and Sealing (DOPAS); (iii) JA10 Long-Term Stability of Bentonite in Crystalline Environments (BELBaR); and (iv) new SeclGD2 project including 2 public dissemination events in 2014 and 2015;
- Proposed a benchmarking project on integrated models; co-operation from the IGSC is required specifically on uncertainty and sensitivity analyses;
- Other activities on (i) operational and construction safety (JA5) and (ii) efficient peer review and related QA process (JA8);
- P. Lalieux also stated that IGD-TP is opened to all stakeholders although some regulators may prefer to participate as observers or via other forum (e.g., SITEX).

### 2.3 SITEX (Christophe Serres)

- C. Serres presented the key objective of SITEX is to establish a coordinated European or international workforce to ensure expertise in radioactive waste management can be maintained and sustained. Work areas include harmonization, optimisation of resources (R&D), training, and involvement of stakeholders.
- The structures of the 6 work packages were also outlined.

### 2.4 EC ENER Programme (Christina Necheva)

- C. Necheva reported detailed guidelines on the content of the national reports are currently being developed under the 2001 Waste Directive. A unified radioactive waste classification system is also under development;
- She also noted the inconsistent scopes of safety assessment (SA) and peer reviews (PR) under the Nuclear Safety Directive and the Waste Directive. Joint peer review or “mutualization” of peer reviews is considered as optimal solution.

### 2.5 IAEA activities of interest to the IGSC (Kai Moeller)

- 2 new “Predisposal” Safety Standards, GSR Part 3 and SSG-15, and one new “Disposal” Safety Standard, SSG-23 (formerly DSS 355 on safety case and safety assessment) have been published;
- The technical meeting on human intrusion has resulted in the launching of a new project HIDRA – human intrusion in the context of disposal of radioactive waste. The

- project covers both near-surface and deep disposal;
- PRISM project: the last plenary meeting is scheduled for December 3-7, 2012;
- GEOSAF II aims to further evaluate the transition/interface between operational and post-closure safety.

## **2.6 European Pilot Study (Frank Lemy)**

- Comments received from 11 countries and international organisations;
- Report completion has been postponed to mid 2014 with a workshop currently planned for near the end of 2013;
- An overall perspective on the regulatory expectations on waste acceptance criteria will also be included.

## **3.0 NEA Projects**

### **3.1 SKB Safety Case Review (Allan Hedin)**

- SKB finds the major peer review results supportive of their license application;
- Other key findings and suggestions are considered constructive and useful in continuing their repository development;
- SKB considers the NEA peer review thorough, useful and positive;
- SSM has indicated in a letter that the work performed by the review team is thorough and completed with great expertise. The SSM letter can be found on the IGSC-14 web page ([http://www.oecd-nea.org/download/igsc/IGSC-14\\_000.htm](http://www.oecd-nea.org/download/igsc/IGSC-14_000.htm)).

### **3.2 Belgian Safety Case Review (Peter De Preter)**

- Ondraf/Niras considers the NEA peer review an important tool to confirm the soundness and robustness of their safety case;
- The review team, organised by the NEA, provided an in-depth evaluation of various safety aspects of the cAt A project;
- A series of actions/elements to revise the safety case for license application has been identified based on the review findings.

### **3.3 TDB Project (Jane Perrone)**

- Global consensus to continue the TDB Project after Phase IV;
- Programme of Work of Phase V was discussed in the 9<sup>th</sup> meeting of the TDB Executive Group in June 2012. Phase V will focus on the update of the actinides and organic volumes. 3 state-of-the-art reports on (i) cements, (ii) high ionic strength systems; and (iii) extrapolation to high temperatures will also be developed. ;
- Final budget to be approved by the TDB Management Board in November 2012.

### **3.4 Expert Group on Assay Data of Spent Nuclear Fuel (Franco Michel-Sendis)**

- The Expert Group is developing a prototype database to provide raw experimental data to the involved communities ;
- NEA Data Bank anticipates to distribute SFCOMPO 2 database tool to the Expert Group in January 2013.

## 4.0 RWMC Activities and NEA Overview

### 4.1 RWMC Activities (Michael Siemann)

- The International Conference of Geological Repository (ICGR) was hosted by the NWMO of Canada, on Oct 1-3, 2012, in Toronto. More than 200 participants attended the conference;
- NEA RWMC and CRPPH held a joint topical session on March 21, 2012 in Paris. It discussed the radiological protection aspects of long-lived radioactive waste management as recently revised by the ICRP;
- The Strategic Plan of the RWMC has been issued. In addition, a collective statement on: National commitment, local and regional involvement has been released.

### 4.2 ICRP task group activities (C. Pescatore)

- The ICRP new guidance on geological disposal will be published in December 2012 as ICRP Publication 122. It is an update of ICRP-81;
- The Commission introduces the concept of oversight – direct and indirect – in order to support s protection criteria in the lifetime of a deep geological repository.
- The ICRP is also considering issuing guidance for near-surface repositories.

### 4.3 Joint RF/IGSC Workshop (C. Pescatore)

- NEA RF and IGSC jointly held a workshop on “Preparing for construction and operation of deep geological repositories” on January 25-27, 2012;
- The workshop evaluated the challenges faced by implementers and regulators when preparing for constructing and operating a DGR. Viewpoints from local communities were also discussed;
- Main findings are published in [NEA/RWM/RF\(2012\)2](#);
- The workshop noted interest in future work on several topics including optimization, oversight in different time frames, and safety of the operational phase;
- A flyer entitled “The construction and operation of geological disposal facilities for high-level radioactive waste and spent fuel – challenges and opportunities” has been finalized with the help of the IGSC Core Group.

### 4.4 Relevant activities of the RWMC-RF (C. Pescatore)

- The brochure entitled “Evolving role and image of regulator: trends over two decades” was approved and soon to be published. It is an update of the 2003 brochure;
- The RF held their meeting in March 2012. Regulatory positions on retrievability and its demonstration was discussed in the topical session. A document on retrievability with the regulatory point of view will be produced.

### 4.5 Relevant activities of the FSC (C. Pescatore)

- The FSC provides the first draft for the RWMC Collective Statement on “National Commitment, local and regional involvement”.
- A glossary will soon be published examining major concepts in stakeholder involvement and the evolution of their understanding within the FSC;

- The 2011 annual meeting (FSC-12) discussed various topics including reversibility and retrievability, anticipating change, models for early involvement, transparency: why and how?
- The 8<sup>th</sup> National Workshop and Community Visit, held in Sweden, discussed the topic of “Actual Implementation of a Spent Nuclear Fuel Repository: Seizing Opportunities” and had 90 participants, representing 13 countries. The Proceedings of the 8<sup>th</sup> National Workshop and Community Visit have been published;
- The 2012 annual meeting, FSC-13, has been scheduled for Oct 22-24, 2012 in Czech Republic. The meeting is immediately followed (24 October) by the 9<sup>th</sup> Community Visit and National Workshop, which has a focus on “Deliberating together on geological repository siting – expectations and challenges in the Czech Republic”. It is anticipated that 50 delegates representing 16 countries will attend this workshop. A panel discussion will focus on expectations for various roles (e.g. regulators, local elected authorities) in assuring safety.

## 5.0 IGSC Activities

### 5.1 Safety Case Brochure (Abe Van Luik)

- The IGSC was asked to consider the following questions in finalizing the brochure:
  - Is the word “optimization” correctly used in the brochure?
  - Is the usage of “containment” and “confinement” in the brochure consistent and clear?
  - Is the usage of “precaution” and “protection” consistent and conform to international usage?
  - Is the text from the MeSA report currently placed in Section 5.2 adequate in explaining the top down/bottom up FEP approaches?
  - Does the IGSC agree with the editorial changes made to Figures 1 and 2?
  - Does the IGSC agree to not mention 1 million years?
  - Is the justification for using alternate safety/performance indicators correct in Section 5.3?
  - Does the IGSC consider the deletion of epistemic and aleatory uncertainty in Section 5.4 acceptable?

**Decision:** The IGSC will provide final comments to the writing group and the NEA Secretariat in 10 business days. The writing group indicated that the major differences between this update and the version of 2004 will be described in the introduction section in order to show how the concept has evolved.

### 5.2 Safety Case Symposium (Klaus Röhlig)

- The 2013 Symposium will be held on October 7-9 at the OECD Conference Centre. The annual meeting, IGSC-15, will immediately follow the Symposium on October 10-11 at the NEA Headquarters in Issy-les-Moulineaux. No topical session is foreseen for IGSC-15;
- The 1<sup>st</sup> Programme Committee meeting held on August 2 had modified the structure of the Symposium. The new structure was described and discussed;
- Proceedings of the symposium will be issued in NEA R-type (non glossy) brochure format. The agenda with links to presentations, extended abstracts, and session summary will be published on the NEA website;
- The IGSC was encouraged to provide comments/suggestions of the Symposium

structure, agenda, and plan. Members are encouraged to volunteer as session chairs and rapporteurs.

- The 2<sup>nd</sup> programme committee meeting will take place on October 10, 2012, immediately after the IGSC meeting.

### **5.3 Salt Club (Abe Van Luik)**

- The IGSC approved the Salt Club in IGSC-13. The main objective of this project is to encourage timely and cost-effective information exchange of rock salt as a geological repository host rock formation;
- Current participating nations include: Germany, USA, Poland and the Netherlands. Membership is open to any interested nation;
- The Salt Club held its 1<sup>st</sup> meeting in April 2012 and since then has achieved the following:
  - Developed a draft Salt Compendium;
  - Held a workshop on natural analogue (more details in below Item 5.4);
  - Proposed a preliminary structure of a salt knowledge archive.
- A. Van Luik will inform the IGSC about the negotiation results of gaining access to the SMRI database;
- The IGSC agreed to provide input on salt archive keywords to A. Van Luik and G. Kwong;
- A 2<sup>nd</sup> meeting has been scheduled for Dec 4, 2012. Next activity of the Salt Club is a US-German video-conference to discuss the creation of a common FEP database for a HLW repository in rock salt.

### **5.4 Salt Club Natural Analogue Workshop (U. Noseck)**

- The workshop was hosted by PTKA-WTE, GRS on Sept 4-5, 2012 in Braunschweig which included a visit of ERAM on Sept 6;
- 37 participants attended the workshop representing 8 countries. Various aspects of natural analogue were observed in the workshop and they include:
  - Natural analogues are an essential part of a safety case (as in Finland and Sweden);
  - Natural analogues, if used properly, can enhance confidence in a safety case as additional evidence;
  - Most existing natural analogues are on the integrity of salt. Further analogues on geotechnical barriers are required;
  - Proceedings of the workshop will be issued in NEA R-report format;
- Phase II of the German ISIBEL Project will explore the applicability of natural analogues in a safety case.
- Contribution from the FSC on the natural analogue concept was noted. The IGSC suggests that the FSC looks similarly to the concept of safety indicators.

### **5.5 FEP Database (Manuel Capouet)**

- Since IGSC-13, the task group, with assistance of a consultant (Quintessa), has reviewed 10 project FEP lists obtained from 9 countries. Results of this review are documented in a technical note – Quintessa TN1 (posted on the IGSC-14 web page).
- Based on the review outcomes, revision to the NEA 2000 IFEP list to cover 355 FEPs (versus 150 FEPs in the 2000 IFEP list) has been proposed. Proposed details are described in a separate technical note – Quintessa TN2.

- The project anticipates implementing the updated IFEP list into a prototype web-base database starting in April 2013, with possible further database enhancement in 2014.

**Decision:** The IGSC agreed that all users shall have access to read the database. Contributing organisations will be able to upload their FEP lists. The IGSC is aware that further financial support is required in order to continue with the 2<sup>nd</sup> phase of this project. Quintessa will outline workscope and provide a cost estimate. The IGSC further agreed to enlarge the task group to include a granite expert. IGSC members are encouraged to participate in the task group.

### 5.6 Gas Migration (Manuel Capouet)

- The IGSC paper will be presented as a discussion paper at the 2013 FORGE conference;
- The current draft paper has already been commented by the IGSC Core Group. It will be further revised to address comments received from other IGSC members. The authors (Manuel Capouet and Ulrich Noseck) anticipate to complete the revision by end of November;
- A final position paper will be developed, based on the discussion paper and the results of the FORGE conference. A 2-page flyer will then be developed based on the final paper.

### 5.7 Monitoring (Lumir Nachmilner)

- L. Nachmilner presented a brief overview of repository monitoring and post-closure safety. An overview report is currently being developed and will be provided to the IGSC for comments later. It is planned that applicable results from the MoDeRn conference will also be covered in the overview report.
- The NEA Secretariat invites the IGSC to use this report as an initial tool to consider future activities in this area.

### 5.8 Operational Safety (Fabrice Boissier)

- F. Boisser outlined ideas for a project on operational safety as many national programmes are approaching implementation. The project will initially focus on operational safety issues faced by implementers. Dialogues with regulators and technical research institutes will occur when specific operational safety issues are identified. The 1<sup>st</sup> workshop has been planned for on October 11. Aim is to share experience on operational safety related issues and also to identify issues of common interest among the participating organisations;
- The IGSC Core Group will determine the path forward of the project after evaluated the outcomes of the 1<sup>st</sup> workshop. Formal project proposal and approval will take place after the 1<sup>st</sup> workshop.

### 5.9 IAEA Human Intrusion Workshop (Lucy Bailey)

- The IAEA held a technical workshop on “Human Intrusion” on Sept 24-28, 2012;
- In the workshop, it was determined that a new project HIDRA (**H**uman **i**ntrusion in the context of **d**isposal of **r**adio**a**ctive waste) will be launched;
- The HIDRA project aims to address (i) how scenarios regarding future human

actions are used in the process of siting, designing and developing WAC; (ii) regulatory considerations; (iii) how to handle probabilities; and (iv) public perception of intrusion;

- The project will consist of 3 working groups, WG1 to assess technical aspects; WG2 to evaluate societal aspects and WG3 to address design aspects. Results will be integrated with the safety case.
- The project will address all types of radioactive waste disposal.

#### **5.10 Preliminary Gorleben Safety Assessment ( VSG) (Martin Navarro)**

- The VSG is a preliminary safety assessment to assess the suitability of the Gorleben site. 80 scientists from 9 German institutes participated in the project;
- Key objectives of VSG include: (i) to evaluate the assessment basis and its suitability for developing the current repository concept; (ii) perform a detailed safety analysis and check if the same methodology can be applied in safety cases for salt and clay sites;
- The project is ongoing until March 2013. Preliminary results show that detailed information already exists in many key areas. For areas with limited knowledge (e.g. significance of hydrocarbons, characteristics of the long-term technical barrier), results were analysed through expert judgment and further analyses will be carried out in future to confirm their appropriateness.

#### **5.11 Data Management (Zoltan Nagy)**

- Z. Nagy proposed a new project on data management. A working group was suggested to be formed to develop a database, including meta-data, for preserving essential records and data up to the closure phase of a repository;
- Many members expressed interest and agreed to confirm with their organisations. They include: US-DOE WIPP, US EPA, Andra, BfS, SKB, JAEA, NDA, and NWMO;
- The Secretariat is to coordinate initial work with Z. Nagy once confirmation of commitment is received. Initial work will include reviewing the types of radioactive waste data and the methods to preserve them in various national programmes;
- The development of this database will also be coordinated with the RK&M project of the NEA.

#### **5.12 Scenarios (Lise Griffault)**

- A questionnaire aims at reviewing the current status on how to handle issues related to scenario development has been drafted by Andra and commented by the Core Group;
- 4 organisations have agreed to test the questionnaire: NRG (A. Poley), Andra (L. Griffault/F. Boissier), Ondraf/Niras (M. Capouet) and JAEA (H. Makino). Volunteered members agreed to provide their replies by January 2013;
- Anticipate to complete analysis of the trial in June. Trial results will determine whether funding is required for analyzing and documenting the responses of the questionnaire. In such case, potential linking with the funding for the FEP database work may be possible.
- A workshop on scenario development and analysis is planned for by the end of 2013.

### 5.13 Organisational Issues (Hiroyuki Umeki)

- H. Umeki explained the pilot study launched since IGSC-13 and suggested the Argumentation Model (AM) approach to be further tested by volunteer organisations. The IGSC is therefore asked to respond to the following questions in 4 weeks (i.e. by November 10):
  - Is your organisation interested or available to test the AM?
  - What tools or methods does your organisation use to address organisational issues in building confidence?
  - Is your organisation interested in a workshop or a topical session in 2014?
- Linkage between this study and the project on data management (Item 5.11) was observed.

### 5.14 IGSC Outreach (Gloria Kwong)

- G. Kwong summarized that 2 flyers have recently been published: (i) “Construction and Operation of a DGR”; and (ii) “Underground Research Laboratories, URLs”;
- The IGSC is encouraged to suggest topics for future flyers;
- The Secretariat also informed the IGSC that the webpage has been revised and all inputs are welcomed.

## 6.0 Topical Session: Management of Uncertainty

- A summary of the key issues discussed in the topical session is provided in Annex 2.
- The IGSC agreed to develop a flyer on the topic of uncertainty, specifically from the perspective of confidence. A. Van Luik, C. Pescatore, L. Bailey and K. Röhlig volunteered to be the authors.

## 7.0 Country Reports

- Country reports on recent national developments relevant to safety case development are available on the IGSC-14.
- [http://www.oecd-nea.org/download/igsc/IGSC-14\\_000.htm](http://www.oecd-nea.org/download/igsc/IGSC-14_000.htm)

## 8.0 Other IGSC Business

### 8.1 Outcomes of RK&M workshop (Claudio Pescatore)

- C. Pescatore reported the major outcomes of the 2<sup>nd</sup> RK&M workshop held on Sept 12-13, 2012;
- The workshop was attended by a wide range of attendees covering regulators, operators, community groups, academics, technical experts, artist, and archivists;
- The workshop evaluated the concept of “safety story” which is particularly important in the long term, when indirect oversight by both society and regulators will take place.
- The workshop observed that RK&M is not a safety requirement; however, in a safety case RK&M is assumed to exist for a few hundred years and that it can

reduce the risk of human intrusion. The RK&M project will be able to better support that safety-case assumption.

## **8.2 Other business**

- No other businesses were identified.

## **9.0 Chairman's meeting summary**

- K. Rohlig summarized key issues discussed and major decisions and actions in his presentation.
- Available at :[http://www.oecd-nea.org/download/igsc/documents/9\\_Roehlig\\_IGSC-14chairm\\_summary\\_version01.pdf](http://www.oecd-nea.org/download/igsc/documents/9_Roehlig_IGSC-14chairm_summary_version01.pdf)

## **10.0 Next meeting**

- Next IGSC meeting will be held on October 10-11, 2013, in Issy-les-Moulineaux.

**Annex 1:**  
**List of Participants**

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## ANNEX 2: Summary of the Topical Session on “Analysing and Addressing Uncertainties and Sensitivities”

Chair: Lucy Bailey, NDA, UK

Rapporteur: Klaus Röhlig, TU-Clausthal

*The Topical Session and this summary report were prepared by Lucy Bailey (NDA, UK, session chair), Allan Hedin (SKB, Sweden) and Klaus-Jürgen Röhlig (TUC, Germany, session rapporteur).*

### 1 Background

Uncertainties are an inevitable feature of producing an assessment of the evolution of a geological disposal facility for radioactive wastes over a timescale of hundreds of thousands of years. The recently completed NEA MeSA project<sup>1</sup> identified that internationally, there is now consensus on the types and sources of uncertainty in safety assessments; and such uncertainties are typically classified into scenario uncertainties, model uncertainties and data and parameter uncertainties. However, it is important to note that these uncertainty classes are related to each other, rather than being mutually exclusive, so that in practice particular uncertainties can be handled in different ways, as one or more of these classes.

The MeSA project also confirmed that strategies for treating uncertainties within the safety assessment are well established, generally falling into one or more of the following five categories:

1. Demonstrating that the uncertainty is irrelevant to safety;
2. Addressing the uncertainty explicitly;
3. Bounding the uncertainty;
4. Ruling out the uncertain event or process;
5. Using an agreed stylised approach to avoid addressing the uncertainty explicitly.

There is a variety of methods and techniques for implementing these approaches to addressing uncertainties and for analysing the sensitivity of the safety assessment outcome to specific uncertainties, including those developed in the EC PAMINA project and subsequent NEA MeSA project.

### 2 Aims and scope of the Topical Session

The topical session explored examples of methods and techniques to addressing uncertainties and sensitivities, discussing their relative strengths and weaknesses, with a view to assessing their value in building confidence in the safety case. The aims of the topical session were to:

- Share recent developments regarding addressing and analysing uncertainties and sensitivities in all aspects of the safety case (including R&D, construction, assessment methodology, etc.);
- Share and discuss actual experiences in applying a range of methods, techniques and analytical tools for managing uncertainties in the safety case;
- Discuss the role of regulatory guidance and constraints regarding the treatment of uncertainty in the safety case;

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1. Methods for Safety Assessment of Geological Disposal Facilities for Radioactive Waste. Outcomes of the NEA MeSA Initiative. OECD, Paris 2012, NEA No. 6923, ISBN 978-92-64-99190-3. <http://www.oecd-nea.org/rwm/reports/2012/nea6923-MESA-initiative.pdf>

- Discuss how we can have confidence to make decisions in the presence of uncertainties and how best to communicate this confidence to those outside the safety case community;
- Consider the value of producing an NEA IGSC position paper or flyer on the management of uncertainties in the safety case.

### 3 Presentations

Presenters were asked to discuss real examples that have been (or will be) applied in support of a safety case as far as possible, and to describe what worked well and what worked less well, together with any lessons learned. They were further asked to focus on building confidence in the safety case and communicating that confidence to different audiences (for example regulators and stakeholder communities). The issues and key questions to be addressed by the topical session presenters (if possible/where appropriate) were communicated as follows:

- Please use real examples as far as possible.
- Please report what worked well and what worked less well with regard to (i) safety case compilation and (ii) communication to different audiences.
- If possible, provide examples about decisions in the presence of uncertainties (what was “good enough” for you?).
- Specify the uncertainty (-ies) to be addressed in your talk, its nature and source(s). If possible, use the terminology of the MeSA report.
- Describe the analytical means to address the uncertainties and the strengths and weaknesses of the approach.
- Summarise the results and implications for repository development activities such as site investigation, R&D, repository layout, etc.
- Provide a statement of confidence: What has been achieved by the approach described? What questions are left open and how significant are they?
- Explain how you arrived at conclusions regarding overall performance and safety in the light of all the various aspects of uncertainty addressed in the safety case.

The following presentations were given:

- Regulatory Guidance for Deep Geological Disposal Facilities (UK): Managing Uncertainties.  
*Doug Ilett, Environment Agency, UK*
- Uncertainty Treatment in the Waste Isolation Pilot Plant (WIPP) Safety Case  
*Abraham Van Luik, Carlsbad Field Office, US Department of Energy*
- Uncertainty management tools to steer the RD&D of a geological disposal programme  
*Manuel Capouet, Christophe. Depaus & Marten Van Geet, Ondraf/Niras, Belgium*
- Strategies for addressing Model Uncertainty  
*Lucy Bailey, Alex Carter & Mike Poole, NDA-RWMD, UK*
- Management of Uncertainties  
*Fabrice Boissier & Lise Griffault, Andra, France*
- Repository layout accounting for uncertainty concerning the location and size of fractures. Establishing the link between assessment and engineering  
*Allan Hedin & Raymond Munier, SKB, Sweden*
- Analysing sensitivities: Sophistication of mathematical tools versus practical application  
*Klaus-Jürgen Röhlig, Elmar Plischke, Sebastian Kuhlmann, TUC, Germany*

- Addressing Uncertainties in Geologic Disposal: A WIPP (Primarily) Perspective *Thomas Peake, US EPA*

## 4 Observations from the presentations and the ensuing discussion

In the following, only a selection of issues is addressed (generally the ones the discussion was focused on and for which new aspects arose). For further details, the full set of presentations can be found at [http://www.oecd-nea.org/download/igsc/IGSC-14\\_000.htm](http://www.oecd-nea.org/download/igsc/IGSC-14_000.htm).

### 4.1 Systematic, traceable and transparent approach to confidence building during programme evolution

In the UK, compiling a “register of significant uncertainties” is a regulatory requirement to direct the implementer towards establishing a systematic, traceable and transparent approach to confidence building during programme evolution as well as enhancing stakeholders’ confidence in the strategy for addressing outstanding issues (e.g. by R&D) (see presentation by Doug Ilett, [http://www.oecd-nea.org/download/igsc/documents/6-a-2\\_Ilett\\_2012.pdf](http://www.oecd-nea.org/download/igsc/documents/6-a-2_Ilett_2012.pdf)). This requirement had been “tested” during the compilation of NDA’s recent generic Safety Case and will be further developed as the disposal facility development programme progresses and a site-specific safety case starts to be developed. In Sweden, where this idea had also been raised, the regulators, in their review of the Swedish SR-Can assessment, jointly decided after consideration not to require such a register of uncertainties because no obvious advantage was identified to justify the required effort. Rather, the regulators pointed to the importance of justifying and explaining methods to handle different uncertainties in the different phases of the safety assessment, and that it is clear where in the safety report the different uncertainty analyses are documented.

The discussion focused on the pros and cons of compiling and maintaining such a register. It was noted that such a register could be a good tool for demonstrating a systematic approach and to record and demonstrate evolution and progress when addressing uncertainties in a programme. On the other hand, a thorough register would require considerable resources, and the decision about which issue is to be considered ‘significant’ might not always be easy. Also, the ‘significance’ of an issue or an uncertainty might change over time with programme evolution and is a subjective judgment upon which stakeholders might not agree.

There was unanimous agreement that establishing and documenting a systematic, traceable and transparent approach to confidence building throughout the programme evolution is an indispensable element of safety case development which is needed to aid the developer’s work as well as to inform stakeholders. Several existing and potential tools were mentioned (e.g. issues registers, process registers, safety functions, safety statements) which might be, or are already, helpful for directing and documenting the confidence building process. Studying such tools more systematically might be beneficial. It was also observed that the term ‘register’ might create too formalistic an impression which could be detrimental.

### 4.2 Complexity as a specific challenge

It was noted that complexity of systems (or models) is, despite all attempts to keep systems (and models) robust and thus simple, an often inherent feature which is related to, but not the same as, uncertainty. Being a potential source for uncertainties, complexity issues might lead to needs for R&D or for design optimisation. However, the level and kind of awareness concerning complexity issues is not necessarily the same for different staff members (modellers, developers). Appropriately communicating the nature of the problem(s), the need for systematic identification and analysis, and ways of addressing them in a repository programme between different specialist teams is essential. Some national programmes have

developed and applied various tools and procedures for establishing efficient internal and external communication of such issues, e.g. safety functions and statements (Andra, Ondraf/Niras), audits and data clearance systems (Nagra), but further development may be beneficial (see for example, the presentations by Manuel Capouet: ([http://www.oecd-nea.org/download/igsc/documents/6-a-4\\_\\_\\_Capouet\\_Uncertainty\\_mgt\\_IGSC14\\_D.pdf](http://www.oecd-nea.org/download/igsc/documents/6-a-4___Capouet_Uncertainty_mgt_IGSC14_D.pdf)) and by Lise Griffault ([http://www.oecd-nea.org/download/igsc/documents/6-a-6\\_\\_\\_Boissier\\_Andra\\_uncertainties\\_management.pdf](http://www.oecd-nea.org/download/igsc/documents/6-a-6___Boissier_Andra_uncertainties_management.pdf))).

The presentation by Allan Hedin ([http://www.oecd-nea.org/download/igsc/documents/6-a-7\\_\\_\\_Hedin\\_IGSC-2012\\_HedinMunier.pdf](http://www.oecd-nea.org/download/igsc/documents/6-a-7___Hedin_IGSC-2012_HedinMunier.pdf)) can be seen as an example for which, in order to address the specific problem of avoiding inappropriate locations for emplacement boreholes, such communication worked well in both ways: Developers were informed by modellers about the nature of the problem, a layout approach was developed and risk reduction as a result of applying this approach was demonstrated.

### 4.3 The role of conservatism

Modelling, especially when aiming at compliance demonstration, might cover complex issues by taking approaches erring on the conservative side. Such conservatism often serves well but its usefulness depends on the stage of repository development and lifecycle. Often, dependent on the purpose of the analysis and on the component to be studied, but especially when options are to be compared for optimisation purposes, moving towards less conservative approaches, which are closer to our understanding of the system and its details, is necessary. Such less conservative approaches are often, also amongst specialists, called “realistic”. It was, however, noted that the antonym of “realistic” is not “conservative” but “unrealistic” and that the use of the term “realistic” is not the best way of expressing what is meant. Alternatives such as “best guess” or “best estimate” were briefly discussed but no firm conclusion about a better term was reached. It was also observed that moving to a less conservative approach during programme evolution – possibly accompanied by decreasing estimates of risks – might by some be perceived as dubious or unsound. In any case, and independent of the degree and kind of conservatism introduced, it is essential to communicate clearly the level of understanding for each process at stake – be it internally, for the purpose of regulatory review, or to wider audiences. Having done this, it becomes more straight-forward to recognise and to explain conservatisms applied.

### 4.4 Modelling

The presentation by Lucy Bailey ([http://www.oecd-nea.org/download/igsc/documents/6-a-5\\_\\_\\_Bailey\\_modelling\\_strategies\\_presentation.pdf](http://www.oecd-nea.org/download/igsc/documents/6-a-5___Bailey_modelling_strategies_presentation.pdf)) focused on confidence building in models and their applications. NDA uses two approaches (bottom-up and top-down) to develop a model hierarchy (of process – component – total system models) from two different viewpoints. The bottom-up and top-down models have different uses (e.g. process understanding versus system description) and can be seen as related to different psychologies of cognition. In the discussion, related issues such as “code uncertainty” and “code bias” were raised but not fully explored. It was concluded that, again, robustness is key for addressing uncertainties related to conceptual understanding, modelling and coding, and data. Modelling is now recognized as having several roles, for example to aid process and system understanding, inform R&D and optimisation, in addition to calculating risks; and it has now found its appropriate place in safety case development and presentation.

### 4.5 Communicating confidence building

The discussion briefly touched upon, but did not thoroughly address, communication issues. The challenge of communicating the concept of decision making in the presence of

uncertainty, or, in other words, the iterative process of confidence building, was addressed. In particular, the point was raised that non-specialists tend to see a system as per se either “safe” or “unsafe” and that it is sometimes hard to communicate that a programme can and has to move forward despite the existence of uncertainties. It is essential to communicate open issues honestly and, at the same time, to communicate clearly the way to address each issue (e.g. by R&D). Instead of allowing the presence of uncertainties to be perceived as a lack of safety, it should be communicated that the process of identifying open issues and challenging assumptions is part of optimising the system, building confidence and thus achieving safety. It is especially important to communicate that safety will not rely on model assumptions. Rather, understanding and its communication comes first.

#### **4.6 Terminology issues**

It was observed that terminology should be used with care; the examples of the usage of terms such as “register of significant uncertainties” or “realistic modeling” (cf. above) show that even “internally” (i.e. amongst specialists) there is potential for confusion and misunderstanding. This is all the more valid when communicating approaches or results to non-specialists.

#### **4.7 Role of, and methods for, sensitivity analysis**

In the presentation by Klaus-Jürgen Röhlig ([http://www.oecd-nea.org/download/igsc/documents/6-a-8\\_\\_Roehlig\\_\\_Analysing\\_sensitivities\\_version02.pdf](http://www.oecd-nea.org/download/igsc/documents/6-a-8__Roehlig__Analysing_sensitivities_version02.pdf)) a number of approaches to sensitivity analysis were introduced which, despite being able to detect sensitivities which will remain hidden when applying the more widely used methods, and despite efforts undertaken e.g. in the EU PAMINA project (<http://www.ip-pamina.eu/downloads/pamina2.1.d.1.pdf>) are hardly ever used in “real” safety assessments. It was also noted that the claim often made that sensitivity analyses can help identify R&D needs, is lacking in substantiating examples. However, in the discussion the point was made that sensitivity analyses can contribute to confidence building by confirming what was assumed about sensitivities or lack thereof. Instead of identifying R&D needs they may support the safety case by confirming that uncertainties are not sensitive with regard to safety. However, it should be kept in mind that sensitivity by nature is about models rather than about systems. If a process is not mapped or conservatively simplified in a model, sensitivity analyses will hardly reveal sound information about its importance. Additionally, if a model does not account for a relationship (e.g. a non-monotonic one or a parameter interaction), sophisticated methods able to identify such a relationship are of no use. In general, it was observed that the simpler, mostly regression or rank regression-based methods presently being applied usually serve their purpose well. The value of more sophisticated methods for waste disposal safety assessment remains still to be shown. The same applies for the possibility of applying sensitivity analyses to process models and safety function indicators.

## **5 IGSC flyer on confidence building**

The IGSC agreed to produce a flyer about the process of confidence building during the evolution of the safety case. Several issues addressed at this topical session will find their way into the flyer which will, however, maintain a generic level. A drafting group consisting of Lucy Bailey (NDA), Claudio Pescatore (NEA), Klaus-Jürgen Röhlig (TUC) and Abe van Luik (DOE/WIPP) will initiate the development of the flyer during which the discussion within IGSC, e.g. on terminology, might be commenced.