SRA - Deployment Plan
EF Work Group 6
Overview for the WG participants

Chair: Prof. Wernt Brewitz

IGD-TP Exchange Forum
November, 29 2011
Helsinki
The topic to be discussed in this work group

IGD-TP SRA 2011

Key topic 1: Safety case

Topic 1.3:
Increase confidence in and further refinement of methods to make sensitivity and uncertainty analyses.
<table>
<thead>
<tr>
<th>Key Topic 1: Safety case</th>
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<tbody>
<tr>
<td><strong>1.1</strong> Increase confidence in, and testing and further refinement of the tools (concepts, definition of scenarios and computer codes) used in safety assessments</td>
<td>2012</td>
<td>2020</td>
</tr>
<tr>
<td><strong>1.2</strong> Improve safety case communication. This includes safety case communication on: Short-term safety of construction and operations, the transient phase, long-term safety.</td>
<td>2012</td>
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<td><strong>1.3</strong> Increase confidence in and further refinement of methods to make sensitivity and uncertainty analyses.</td>
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High importance and urgency Topics

(Topic 1) Increase the confidence in testing and further refinement of the tools (concepts, definition of scenarios and computer codes) used in licensing safety assessments.

(Topic 2) Improving safety case communication on:
- Short-term operational safety;
- The transient phase; and
- Long-term safety

Medium importance and urgency Topics

(Topic 3) Increase the confidence in and further refinement on how to make sensitivity and uncertainty analyses.
The handling of uncertainties (SRA, 2011)

All data and arguments supporting the long-term safety of a geological repository have to be checked for their uncertainties. Understanding, evaluation and reduction of the remaining uncertainties require the best scientific knowledge available. In particular, complex scientific issues need an explicit and rigorous treatment. In a decision making process the following types of uncertainties have to be considered:

- Framing uncertainty;
- Modelling uncertainty;
- Statistical uncertainty;
- Decision-theoretical uncertainty.

By nature, there are two categories of uncertainties, the so called epistemic uncertainties, which are essentially knowledge based, and the so called aleatory uncertainties, which are essentially random.

Parameter and model uncertainties can be reduced to a great extent by appropriate RD&D. Scenario uncertainties associated with the development of the disposal system over time are more or less random and basically irreducible.
Uncertainties in geological waste disposal

• There are no “standards” for geological disposal systems!
• Long time-frames are a source of uncertainties!
  (Elements of aleatory and epistemic uncertainties)
• Safety criteria reflect today’s understanding
  of the repository system!
• **PA models deal with probabilities (high, moderate, low)**
• Material properties have to match short-, medium- and
  long-term requirements
• Technical components are designed to engineering standards
• Coupled effects with short-, medium-, long-term consequences
Ways and means to reduce uncertainties

- Criteria based site selection
- Thorough site investigation & characterization
- Adaptation of disposal concept to site conditions
- Experiments on safety related issues
- Investigation of processes relevant to repository performance
- Demonstration of disposal techniques
- Natural analogue studies
- Repository system’s performance analysis
- Scenario based safety assessment studies
J.Vigfusson (HSK), J. Maudoux (FANC – AFCN), P. Raimbault (ASN), K.-J. Röhlig (GRS), R.E. Smith (Environment Agency, UK)

Assessment of compliance in the presence of uncertainty. The approach for compliance assessment differs considerably depending on the country. But whatever the standards, the issue remains that many uncertainties in the post-closure safety case cannot reliably be quantified. Calculated future doses or risks can only be regarded as broadly conservative indicators rather than anything more definite or concrete and, accordingly, additional arguments may effectively contribute to the confidence in safety. Thus, the post-closure safety case will need to be based on multiple lines of evidence.
It is considered that at times longer than those for which the conditions of the engineered and geological barriers can be modeled or reasonably assumed, a formal demonstration of compliance with radiological protection objectives becomes meaningless against the background of uncertainties. Accordingly, the developer may need to fall back on more general lines of reasoning.
Management of Uncertainties (Posiva)

- Posiva’s iterative approach for the management of uncertainties can be summarised in four words: identify, avoid, reduce and assess.
- Identification, description, and where possible quantification of uncertainties, as well a consideration of their potential relevance to safety, represent an essential part of all the reports related to the development of the safety case.
- The development of the disposal system is based on the idea of robustness, which means, where practicable, avoiding concepts and components the behaviour of which is difficult to understand and predict.
- Robustness also means reducing the impact of uncertainties – for example by introducing conservative safety margins in the design of some components.
- Some uncertainties will, however, always remain and have to be assessed in terms of their relevance to the final conclusions on safety.
<table>
<thead>
<tr>
<th></th>
<th>Scientific basics</th>
<th>Technical feasibility</th>
<th>Site properties</th>
<th>Safety case</th>
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<tbody>
<tr>
<td><strong>Uncertainties</strong></td>
<td>Borders of knowledge not defined</td>
<td>Engineering standards for limited time frame</td>
<td>- Heterogeneity of geologic formations</td>
<td>Framing of uncertainties &amp; scenarios</td>
</tr>
<tr>
<td><strong>Activities in progress</strong></td>
<td>Hypothesis testing Works on models &amp; analogues</td>
<td>Large scale in situ tests &amp; demonstration</td>
<td>Site survey &amp; data compilation Data synthesis &amp; evaluation Site modelling</td>
<td>Sensitivity analysis Performance assessment models Sufficient safety potential &amp; safety margins Further reducing of uncertainties</td>
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<tr>
<td><strong>Current status regarding licensing by 2025</strong></td>
<td>Sufficient basis exists for safety case &amp; repository design</td>
<td>Testing in URLs in progress</td>
<td>Sufficient knowledge exists for safety case &amp; repository design</td>
<td>Increase of confidence in long-term safety</td>
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<tr>
<td><strong>Vision related aims</strong></td>
<td>Underpinning the robustness of theories and models</td>
<td>Establishing safe disposal technologies on industrial level</td>
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How do we organize the deployment of activities, projects and technology transfer?

The types of joint activities identified are the following.

1. Information Exchange Platform (IEP)
2. Organizational Working Group (ORWG)
3. Technical/Scientific Working Group (TSWG)
4. Technical Project (TEP)
5. Technological Transfer (TT).

The types of joint activities are not intended to be strict categories and a given joint activity will evolve in their nature over time, e.g. what starts out as a Technical/Scientific Working Group will in most cases become a Technical Project.
Back to Topics 1.1 and 1.3

<table>
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<tr>
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<th>SRA topic: Increase the confidence in testing and further refinement of the tools used in safety assessments (1.1)</th>
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**Suitable type of activity**

TSWG

**Expressed interest for the activity by**

BMWi, ANDRA, SKB and others

**Product/Result from the activity:**

2. Summary of the scientific basis for performance (PA) and safety assessment (SA) (data, models and computer codes).
3. Compilation of evolution scenarios for geological repositories and their application in the safety case approaches in the different WMO programmes.
4. Evaluation of the results of sensitivity analyses with identification of existing uncertainties and proof of repository system robustness.
5. Strategy for further refinement of the PA/SA methods used by the different programmes.
6. Logical framework for the enhancement of confidence in long-term safety and concepts for its communication.

**Proposed title of the activity (as appearing in) Fehler! Verweisquelle konnte nicht gefunden werden.):** Safety case: work on process model benchmarking

**Timetable for the activity (Start/End dates, duration):** 2012 – 2015 (3 years)
Short description of activity (acc.[8]):

**First activity:** Check the identification and conceptualisation of safety relevant features, events and processes; and scenarios (assessment basis).

**Second activity:** Check the appropriate assessment models and their present state as well as the completeness of the required data (how good is good enough).

**Third activity:** Check the assessment capability and the quality management for proper application of methods, models and data bases.

**Fourth activity:** Evaluate the confidence in the calculated long-term safety.

**Fifth activity:** Elaborate a logical framework for all activities required in the course of assessing, evaluating, enhancing and communicating confidence.
Current on-going work on the topic (through EC, IAEA, bilaterally...):

A good basis for starting and structuring the work on this topic are the reports compiled on the matter of building confidence by IAEA and OECD/NEA as well as reports from some WMO’s. Most valuable seem to be the strategic publications by NEA and the working papers of the IGSC. A very first literature review identified the following reports of interest:


Decision of the EG:
Set up an ORWG and later TSWG to prepare an eventual project to be launched in 2015 for benchmarking of models.
High importance and urgency Topics
(Topic 1) Increase the confidence in testing and further refinement of the tools (concepts, definition of scenarios and computer codes) used in licensing safety assessments.

(Topic 2) Improving safety case communication on:
- Short-term operational safety;
- The transient phase; and
- Long-term safety

Medium importance and urgency Topics
(Topic 3) Increase the confidence in and further refinement on how to make sensitivity and uncertainty analyses.
Now, let's work together!

Subjects to be discussed in view of Vision 2025:

• Ways and means for further refinement of PA models
• Methods/models of “concept” related sensitivity analyses
• Identification of remaining uncertainties and methods for reducing uncertainties
• “Benchmarking” of such methods and models
• Interaction of topics 1.1 - 1.3 and correlation of activities
• Possibilities for the transfer of research PA models into the TSPA (simplification without loss in quality)
• Others than numerical methods for reducing uncertainties
What do we expect?

1. Your Vision about these subjects
2. Your ideas about a strategy how to reach this Vision
3. Your interest in participation

THANK YOU
EF Work Group 6
Brewitz (chair), Druyts, Eurajoki, Galson, Graf, Jobmann, Mayor, Noseck, Poley, Rasilainen, Vokál, Wiborgh, Wildenborg, Zänker, Eng

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Vision

• To further build confidence in our Safety assessments and our safety cases.
Work Group discussion
(What should we do)

• The use of PA in decision-making
• Exchange (benchmarking) of methods for probabilistic assessments
• Report on alternative ways for reasoning in safety assessments (a report on different ways to make assessments and why)
• Communication with the regulators

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Work Group discussion
(When and by whom)

When:
All would be done simultaneously during 2012.

Who would be interested:
All participants in the work group expressed interest to participate in a TSWG with the aim to start a TEP.