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

Chair: Prof. Wernt Brewitz

IGD-TP Exchange Forum
November, 29 2011
Helsinki

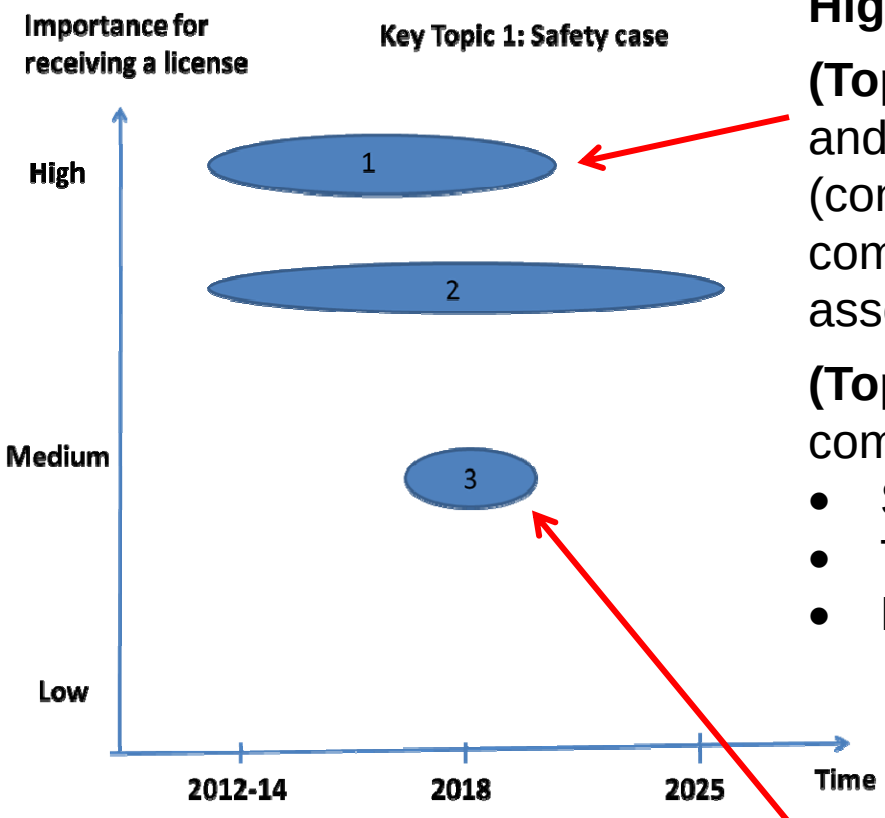
The topic to be discussed in this work group

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.

	Key Topic 1: Safety case			
1.1	Increase confidence in, and testing and further refinement of the tools (concepts, definition of scenarios and computer codes) used in safety assessments	2012	2020	H
1.2	Improve safety case communication. This includes safety case communication on: Short-term safety of construction and operations, the transient phase, long-term safety.	2012	2025	H
1.3	Increase confidence in and further refinement of methods to make sensitivity and uncertainty analyses.	2015	2020	M



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 todays 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

European Pilot Study on The Regulatory Review of the Safety Case for Geological Disposal of Radioactive Waste - Case Study: Uncertainties and their Management (2007)
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.

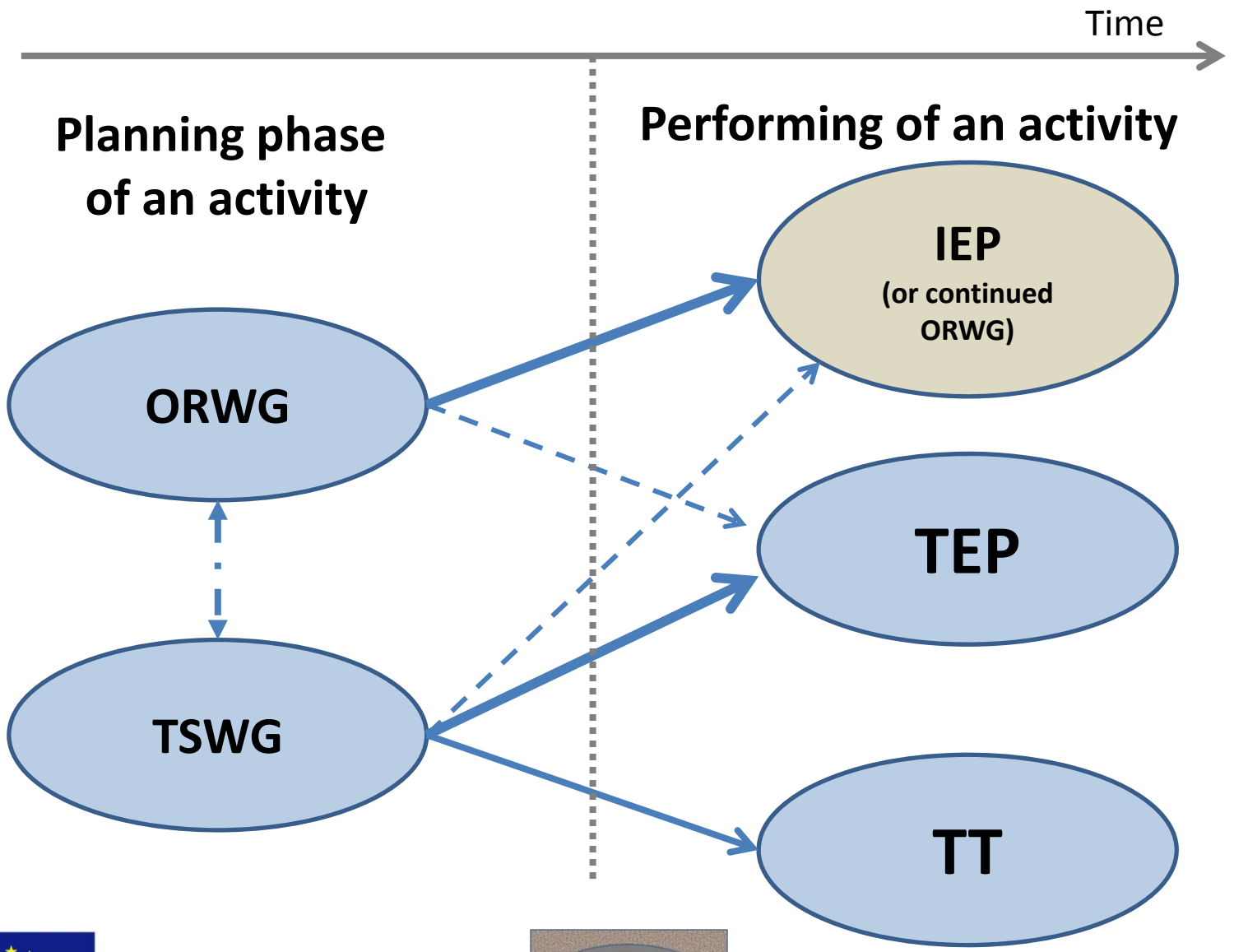
	Scientific basics	Technical feasibility	Site properties	Safety case
Uncertainties	Borders of knowledge not defined	Engineering standards for limited time frame	- Heterogeneity of geologic formations - Future evolution	Framing of uncertainties & scenarios
Activities in progress	Hypothesis testing Works on models & analogues	Large scale in situ tests & demonstration	Site survey & data compilation Data synthesis & evaluation Site modelling	Sensitivity analysis Performance assessment models
Current status regarding licensing by 2025	Sufficient basis exists for safety case & repository design	Testing in URLs in progress	Sufficient knowledge exists for safety case & repository design	Sufficient safety potential & safety margins Further reducing of uncertainties
Vision related aims	**Underpinning the robustness of theories and models**	**Establishing safe disposal technologies on industrial level**	**Increase of confidence in long-term safety**	

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.


Time
Planning phase of an activity
Performing of an activity
IEP
(or continued ORWG)
ORWG
TEP
TSWG
TT

Back to Topics 1.1 and 1.3

SRA Key Topic : Safety case (1)	**SRA topic:** Increase the confidence in testing and further refinement of the tools used in safety assessments (1.1)	**SRA priority:** High for both
Type of activity of work : A technical working group for the first	**Expressed interest :** ANDRA, SKB, BMWI	
Product: For the first: a report giving the results of the benchmarking exercise of material interaction models.		
Proposed title: Confidence increase		
Timetable: For the first : 2012-2020		
Explanation of the contents of the project:		
Short description of project: For the first 1. Agree on scope of work 2. Definition of the benchmark context (on what calculation cases will the codes be compared ?) 3. Study of the different calculation cases (2013) 4. Discussion and presentation, writing of the final report (2014)		

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SRA Key Topic : Safety Case (1)	**SRA Topic:** Increase confidence in and further refinement of methods to make sensitivity and uncertainty analyses (1.3)	**SRA priority (H/M/L):** Medium
Suitable type of activity TSWG		**Expressed interest for the activity by** BMWi**,** ANDRA, SKB and others
Product/Result from the activity: 1. Compilation of principles and methods for obtaining confidence in the long-term safety of geological disposal. 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.

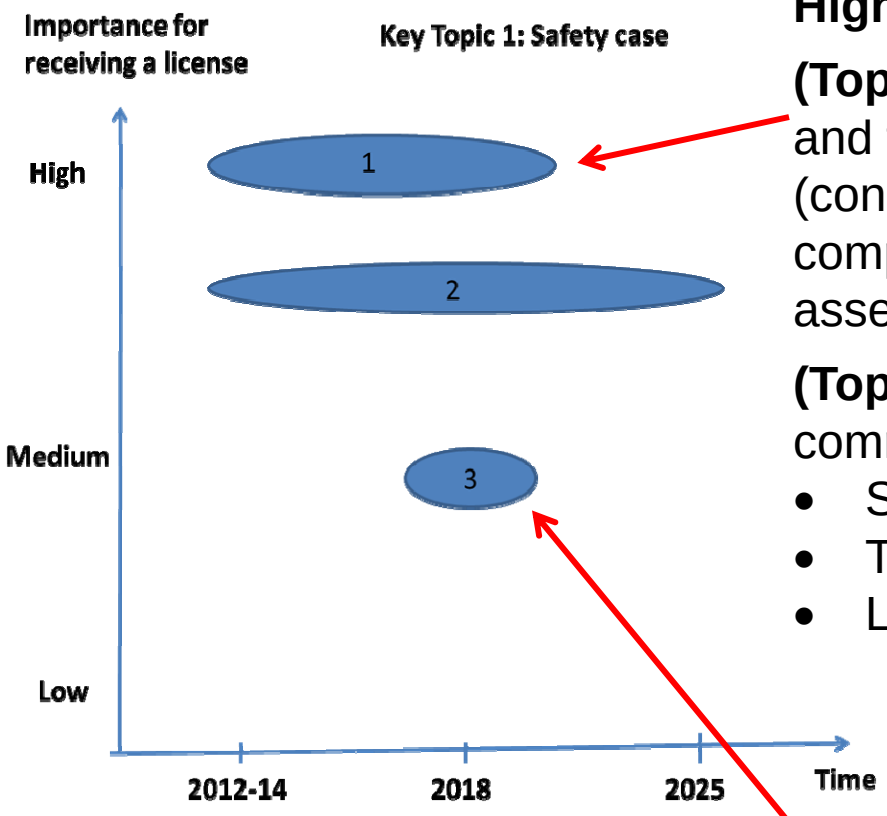
Current on-going work on the topic (through EC, IAEA, bilaterally…)**:**

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:

1. IAEA (1994). Safety Indicators in Different Time Frames for the Safety Assessment of Underground Radioactive Waste Repositories.
2. IAEA (2002). Issues relating to safety standards on the geological disposal of radioactive waste: Proceedings of a specialists meeting held in Vienna, 18-22 June 2001 (IAEA-TECDOC No. 1282).
3. IAEA (2011). Disposal of Radioactive Waste, Specific Safety Requirements (No. SSR-5).
4. Karlsson, F. (1992). Validation of Models for Safety Assessment of HLW-Disposal in Sweden.
5. Larsson, A. (1997). The International Intraval Project, Phase 2, Summary Report.
6. Lemons, J. (1996). Scientific uncertainty and environmental problem solving. Cambridge, Mass.: Blackwell Science.
7. OECD/NEA (2002). *Integration Group for the Safety Case (IGSC).*
8. OECD/NEA (1999). *Confidence in the Long-term Safety of Deep Geological Repositories: Its Development and Communication.*
9. OECD/NEA (1992). *Systematic Approaches to Scenario Development.*
10. OECD/NEA (1997). *Lessons Learnt from Ten Performance Assessment Studies.*
11. OECD/NEA (2004). *The Handling of Timescales in Assessing Post-closure Safety.*
12. OECD/NEA (2000). *Safety report 97: Post-closure safety of a deep repository for spent nuclear fuel in Sweden: An international peer review.*
13. OECD/NEA (2002). *An International peer review of the Yucca Mountain project TSPA-SR: Total system performance assessment for the site recommendation (TSPA-SR).*
14. OECD/NEA (2004). *Post-closure Safety Case for Geological Repositories.*
15. OECD/NEA (2010). *Regulations and Guidance for the Geological Disposal of Radioactive Waste.* Review of the Literature and Initiatives of the Past Decade (No. 6405).

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.



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Medium importance and urgency Topics

(Topic 3) Increase the confidence in and further refinement on how to make sensitivity and uncertainty analyses.

Now, lets 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 probabalistic assessments
- Report on alternative ways for reasoning in safety assessments (a report on different ways to make assessments and **why**)
- Communication with the regulators

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.