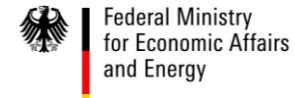
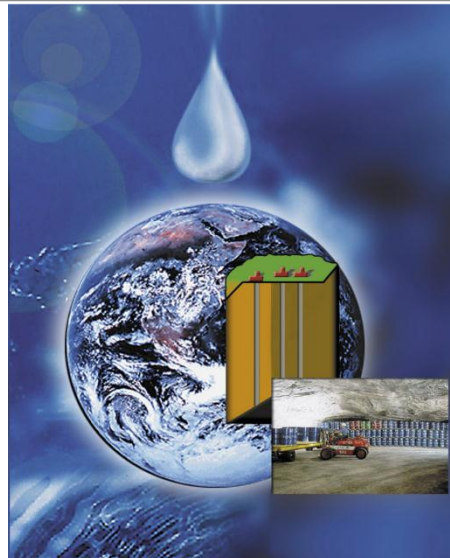


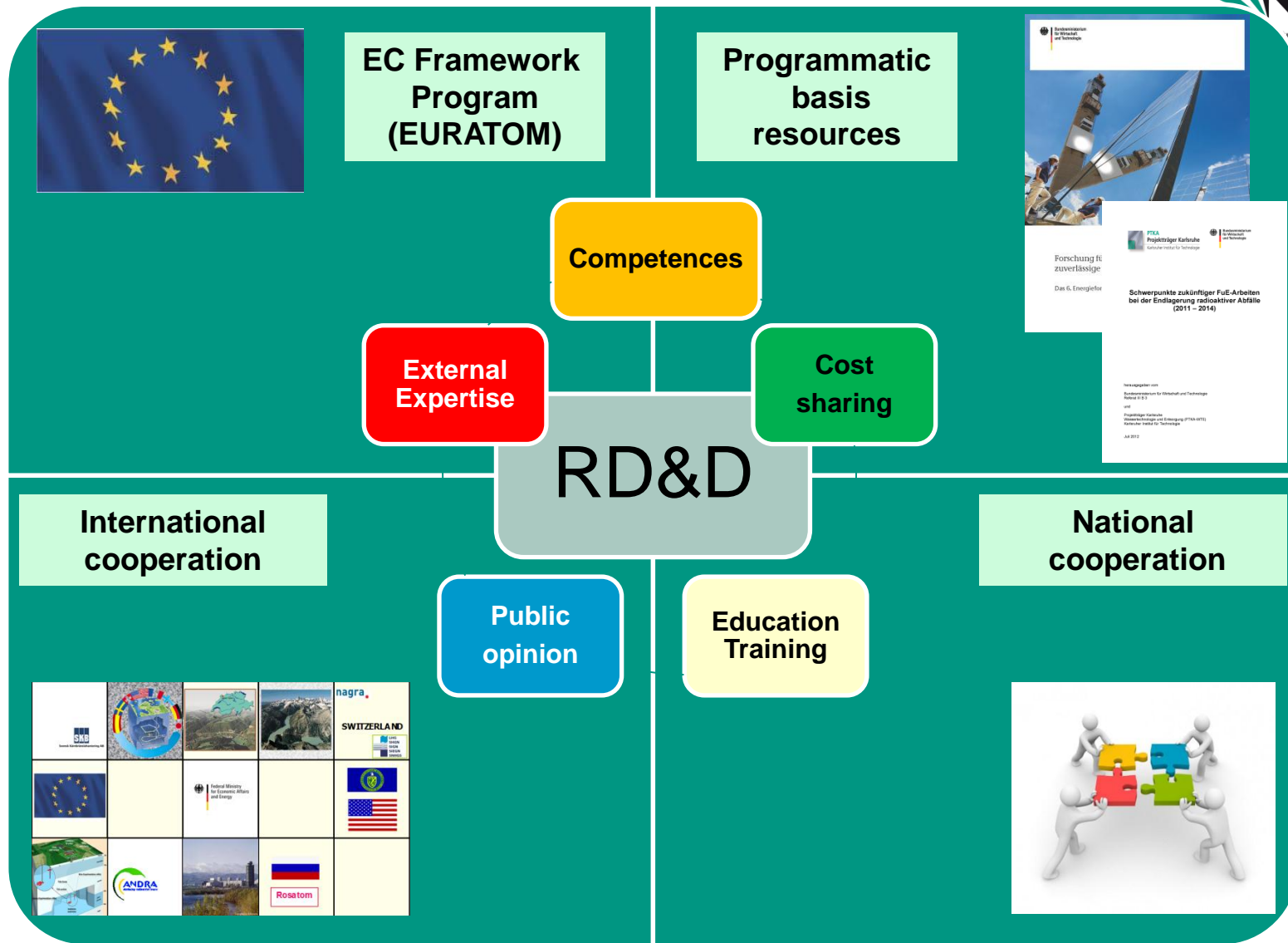
# Die Technologieplattform *Implementing Geological Disposal* - ein wichtiges Werkzeug der internationalen Kooperation

ESK-Workshop zur deutschen Endlagerforschung  
BMUB, Bonn  
20. – 21. Januar 2015

PROJECT MANAGEMENT AGENCY KARLSRUHE  
WATER TECHNOLOGY AND WASTE MANAGEMENT (PTKA-WTE)



**Einleitung**  
**Internationale Kooperation**  
**Technologieplattform**  
**IGD-TP**  
**Zusammenfassung**



# INTERNATIONAL COOPERATION

## Objectives

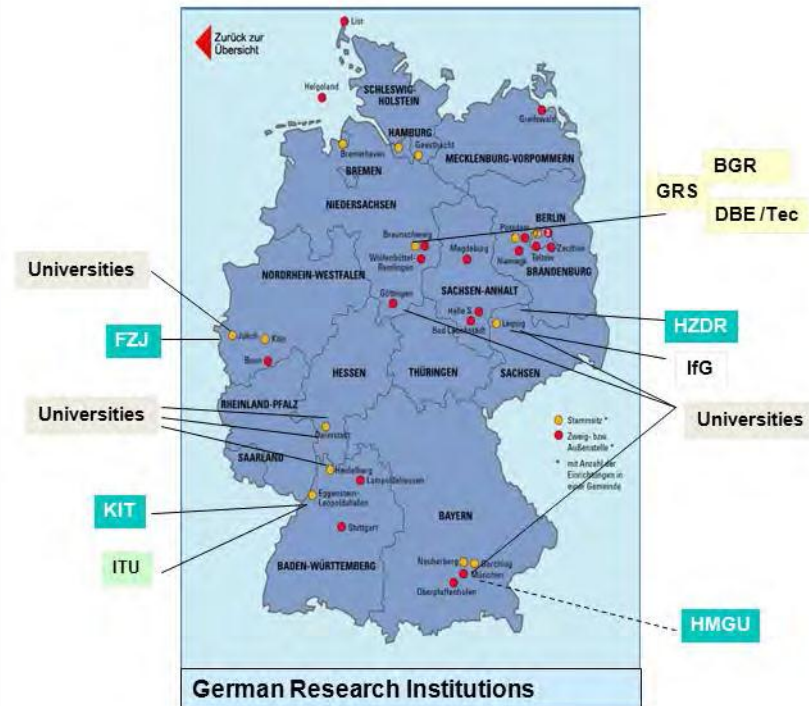
- to identify parameters of potential host rocks
- to develop and to test investigation methods and models to demonstrate their applicability and transferability
- to **exchange experiences and know-how**
- to acquire the essential expertise and knowledge to **make science-based recommendations** on the pros and cons of different host rocks
- to maintain flexibility with host rock options
- Quality assurance, best practices approaches
- Peer reviewing, intercomparisons
- Information of non-technical stakeholders

**Bilateral Agreements** (NAGRA, SKB, ANDRA, US DOE)

**WTZ-Agreements** (Russia)

**Financial support of consortium members**  
(Mt. Terri)

**Contractual agreements** (SKB, Prototype Repository, Task Forces EBS & GW&Transport)



# INTERNATIONAL COOPERATION

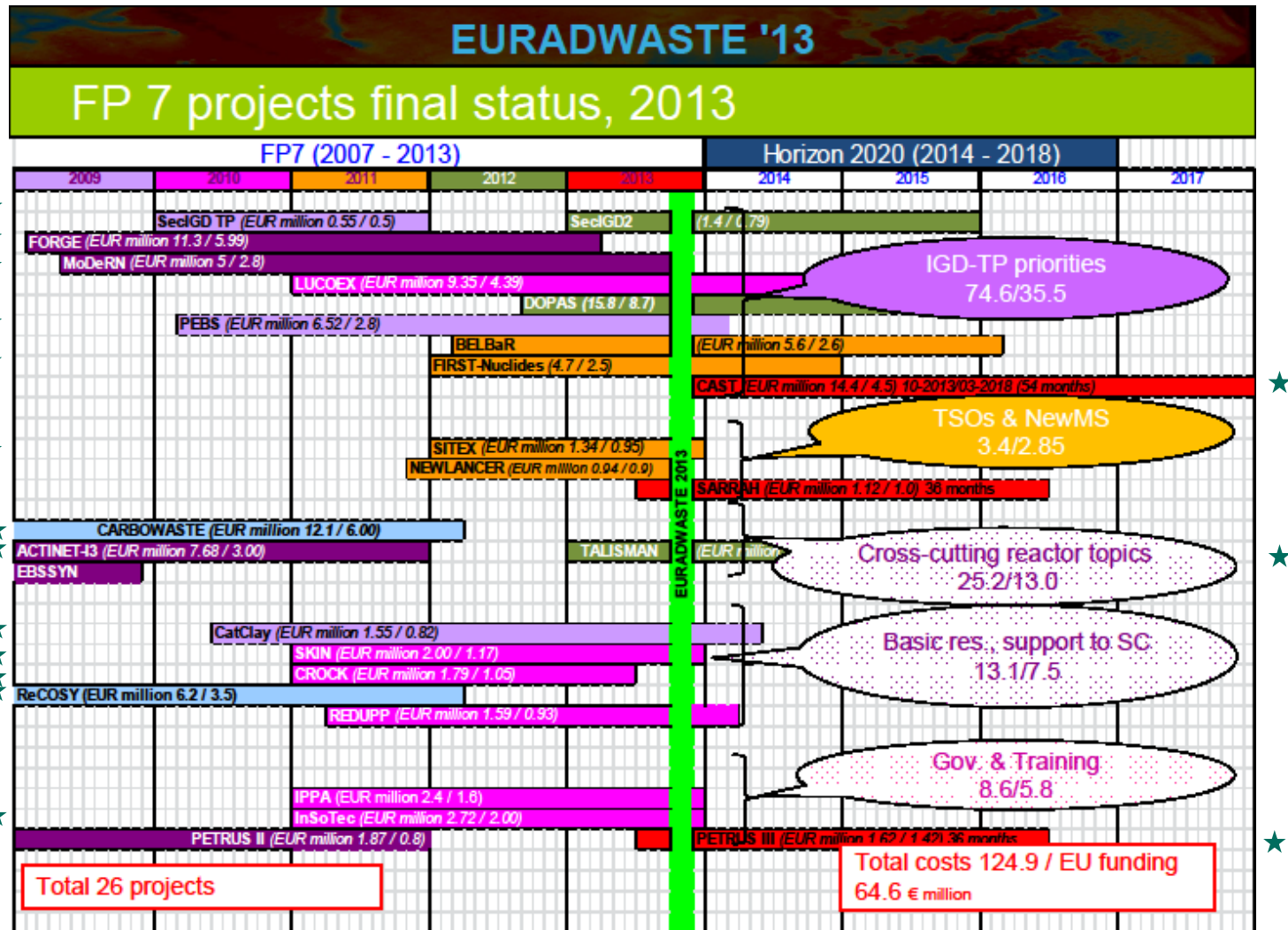


<p>since 1995: Crystalline</p>  <p>Svensk Kärnbränslehantering AB</p>				<p><b>nagra</b></p> <p>since 1983: Crystalline Since 1998: Clay</p> <p><b>SWITZERLAND</b></p> 
 <p><b>EURATOM</b></p> <p>Frameworkprograms</p>		 <p>Federal Ministry for Economic Affairs and Energy</p>	<p>since 1970 / 2008: rock salt</p>	 
	<p>since 1991: <b>Clay, Crystalline</b></p> 		<p>since 2001: Crystalline</p>  <p><b>Rosatom</b></p>	

**OECD/NEA**  
Salt Club & Clay Club

**Workshops / joint activities (NAWG)**  
China (BRIUG), Tschechien (SURAO, UJV)





Quelle: Christophe Davies, EC

## Council decision 2006/976/EURATOM

- *Euratom research should be **implementation-oriented**, R&D activities on all **remaining key aspects** of deep geological disposal*
- ***Demonstration** on the **technologies and safety**, to underpin the development of a common European view on the main issues related to the management and disposal of waste*

## European Technology Platforms

- ✓ framework for stakeholders (**led by industry**) to define research and development priorities, timeframes and action plans on a number of **strategically important issues**, (competitiveness and sustainability objectives)
- ✓ play a key role in **ensuring an adequate focus of research funding** on areas with a high degree of industrial relevance, mobilizing public authorities at national and regional levels.
- ✓ to contribute significantly to the renewed Lisbon strategy, (ERA of knowledge for growth)
- ✓ powerful actors in the development of European research policy, in particular in orienting the 7 FP to better meet the needs of industry
- ✓ Support all aspects of European competitiveness

# TECHNOLOGY PLATFORMS



1. R&D stakeholders, led by “end users”, come together around a common vision for the technology
2. SH define a Strategic Research Agenda setting out medium to long-term research priorities to realise the vision
3. SH implement the SRA with the mobilisation of significant human and financial resources (“Deployment Strategy”)
  - Better align EU research priorities to end users’ needs
  - Positive impact on Europe’s growth, competitiveness and sustainability
  - Increased efficiency & effectiveness and reduced fragmentation of R&D efforts
  - Mobilisation of public and private funding sources





## Net.Excel – Project (FP5, 1998 - 2002)

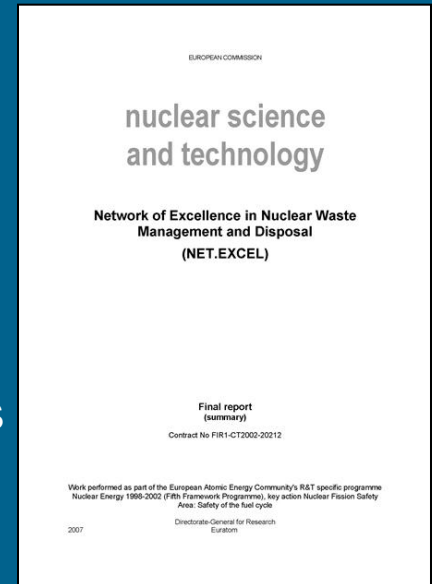
### Objective

Address the present status of RTD and important future RTD issues related to final disposal of radioactive waste in deep geological formations in order to:

- **benefit from close interaction** between European organizations for a future efficient use of European resources in RD&D of safe methods for final disposal of long-lived nuclear waste
- **form a network** for analyzing the present status and future needs in RD&D for the three rock media salt, clay and clay sediments, and crystalline rock.

### Work performed:

- definition of the highly prioritized issues in the participants' programs
- identification of highly ranked issues (so called 100th list)



## TOWARDS IGD-TP (2)

- Net.Exel gave important input for CARD (*Coordinated Action on Research, Development and Demonstration priorities and strategies in geological disposal*) which paved the way to create the TP for Geological Disposal
- CARD provided the basis for IGD-TP (concerning **content** and **organizational** issues )
- SKB and Posiva volunteered to support the continued work to draft the Vision Report (drafting team from SKB, Posiva, ANDRA, and BMWi)
- Preparation of the Vision Report draft and consultation of the draft
- Preparation of a project proposal for a Secretariat (SecIGD)
- Formation of an Interim Executive Group (IEG)
- **Official start of IGD-TP Nov. 12, 2009**





## WHAT IS IGD-TP (1)

Based upon a common vision and a commitment, IGD-TP serves as a tool to support the confidence-building in the safety and implementation of deep geological disposal solutions

### Objectives

*to define, prioritize, initiate, and carry out European strategic initiatives that will facilitate the stepwise implementation of safe, deep geological disposal of spent fuel, high-level waste, and other long-lived radioactive waste by addressing the remaining scientific, technological and social challenges, and to support the waste management programs in the Member States.*

IGD-TP is driven by organizations responsible for implementing a waste management program (WMO) or being formally responsible for the RD&D program needed for implementation



## WHAT IS IGD-TP (2) – VISION & COMMITMENT

*Our vision is that by 2025, the first geological disposal facilities for spent fuel, high-level waste, and other long-lived radioactive waste will be operating safely in Europe.*

Our commitment is to:

- build **confidence in the safety of geological disposal solutions** among European citizens and decision-makers
- encourage the **establishment of waste management programmes that integrate geological disposal as the accepted option** for the safe long-term management of long-lived and/or high-level waste
- facilitate **access to expertise and technology** and maintain **competences** in the field of geological disposal for the benefit of Member States



## WHAT IS IGD-TP (3)

> 117 participants committed by the vision (as of Dec. 2014)

- 25 countries (EC & Switzerland & Canada & Japan)
  - ✓ Waste Management Organizations
  - ✓ Academia
  - ✓ (Nuclear) Research Centers
  - ✓ Consulting companies
  - ✓ Syndicates
  - ✓ Utilities





## WHAT IS IGD-TP (4) AIMS AND PRIORITIES

- Strategic Research Agenda / Deployment Plan:
  - ✓ RD&D priorities shared by „end users“ (e.g. mirrored in BMWi-FöKo)
  - ✓ **Beneficial for all disposal programs**
  - ✓ Benefits and **cooperative** added value (information, knowledge exchange)
  - ✓ Balance between **basic science and implementation-driven** RD&D,
  - ✓ safety case support & demonstration of technologies
- Contribution to a sound, shared and transparent scientific and technological basis for geological disposal
- Serves as a basis for the EURATOM program
- Pooling of resources (Joint activities), Competence Maintenance, E&T (CMET)
- Networking (WMO, TSO, NMS, SNETP, IAEA, OECD/NEA, EC, etc.)
- Synergies with other international fora (ENEF, ENSREG, etc.)



## BENEFITS TO ALL RD&D STAKEHOLDERS - 1

IGD-TP benefits **all of its participants** irrespective of timescale differences in European waste management Programs

- Share the **remaining RD&D needs** to foster implementation
  - ✓ Offer opportunities to carry out joint RD&D (reducing overlapping work)
  - ✓ Foster pooling of resources (joint work, use of resources, use of experimental facilities, e.g. URLs, existing competence & research infrastructures, savings in total costs of RD&D and implementation)
  - ✓ Networking
- Create **synergies & co-ordination**, while avoiding duplication
  - ✓ with EC R&D Euratom Framework Programs
  - ✓ with activities taking place in other TP's
  - ✓ with other international co-operation forums
  - ✓ with regulators/TSOs



## BENEFITS TO ALL RD&D STAKEHOLDERS - 2

- **Build competence** in geological disposal
  - ✓ Develop joint strategies
  - ✓ Share information (e.g. information centre, competences mapping)
  - ✓ Maintain continuity and critical mass in expertise
  - ✓ Technology transfer
  - ✓ Training
  - ✓ Dissemination
- **Build trust** between members
  - ✓ esp. between EG members (exchange of information, Exchange Fora)



# ORGANIZATION OF IGD-TP

## IGD-TP's Founding Documents

*Vision*  
*Strategic Research Agenda (SRA)*  
*Deployment Plan (DP)*

### IGD-TP's Exchange forum

*Exchange of information, advice,  
questions discussion and proposals*

### IGD-TP's Executive Group

*Initiates, decides, steers, funds and directs  
IGD-TP and its collaboration and its  
strategic documentation ( updates of SRA,  
DP), establishes Working groups and,  
organizes information exchange*

### IGD-TP Secretariat

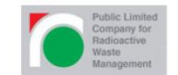
*Support and catalyses the IGD-TP's activities and organisational evolution  
Acts as a communication and information centre  
Follow up the deployment of joint activities and updates the Master Deployment Plan  
Organizes Exchange Forums and maintains web site and extranet  
Reports to the EG*

**Joint Activity Types  
for Deployment**  
ORWG, TSWG  
IEP, TEP, TT  
according to Master  
Deployment Plan

**Terms of Reference  
(ToR) of  
IGD-TP**

**IGD-TP's Working  
Group**  
SRA  
DP  
IWG  
CMET

**Coordination  
with EC**  
Euratom  
Framework  
programme





## TP'S STRATEGIC DOCUMENTATION

The Vision Report is the **general basis for the TP**, served as founding document and outlines aims, mission, benefits and organizational issues

Strategic Research Agenda serves as a **strategic tool** to reach the “Vision 2025” (time scale 2011 – 2025)

The Deployment Plan is an **operational management tool** to organize the topics (limited to a 5 year term). The Master Deployment Plan is continuously updated by minor updates or with additional topics by the EG and the SecIGD)



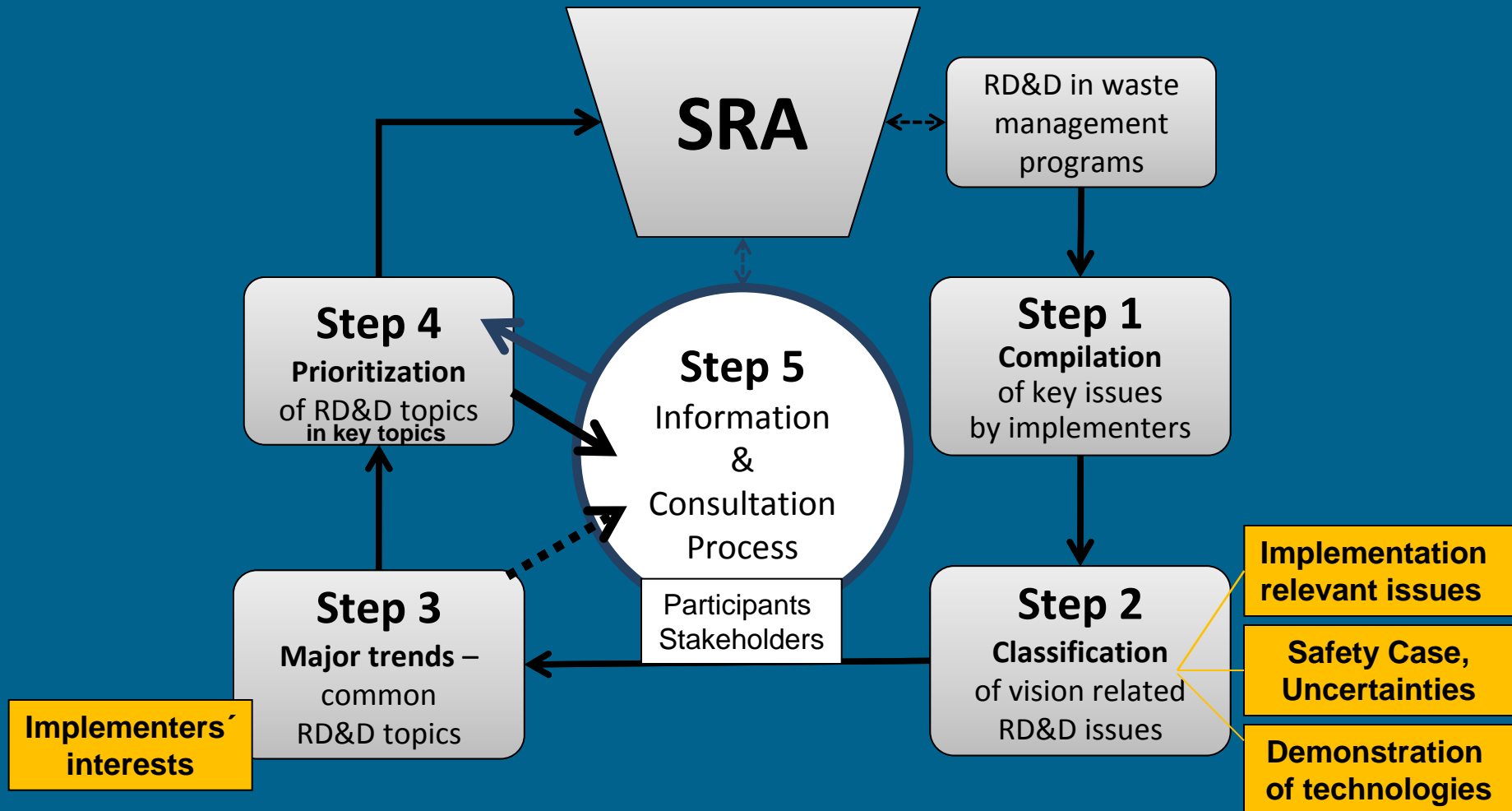




## DEVELOPING THE SRA (1)

- Focus on RD&D needs for countries “closest” to licensing
- shared by all implementers → of benefit to **all** disposal programs (**all** host rock types)
- with clear added-value from **multilateral cooperation**
  - ✓ Joint Activities (not limited to EC projects)
  - ✓ Synergies with other existing international for a
- Specific issues intentionally left at national level e.g.
  - ✓ Site characterization
  - ✓ Transportation
  - ✓ Requirement management systems
  - ✓ Waste acceptance (quality assurance, safeguards, ...)
  - ✓ Economics of funding and planning

## DEVELOPING THE SRA (2)





## DEVELOPING THE SRA (3)

### KEY TOPICS AND X-CUTTING ISSUES

- Key topic 1: Safety case
- Key topic 2: Waste forms and their behavior
- Key topic 3: Technical feasibility and long-term performance of repository components
- Key topic 4: Development strategy of the repository
- Key topic 5: Safety of construction and operations
- Key topic 6: Monitoring
- Key topic 7: Governance and stakeholder involvement

X-cutting: Dialogue with the regulators, Competence maintenance, E&T (CMET), Knowledge management, Communication



## DEVELOPING THE DEPLOYMENT PLAN (1) INSTRUMENTS

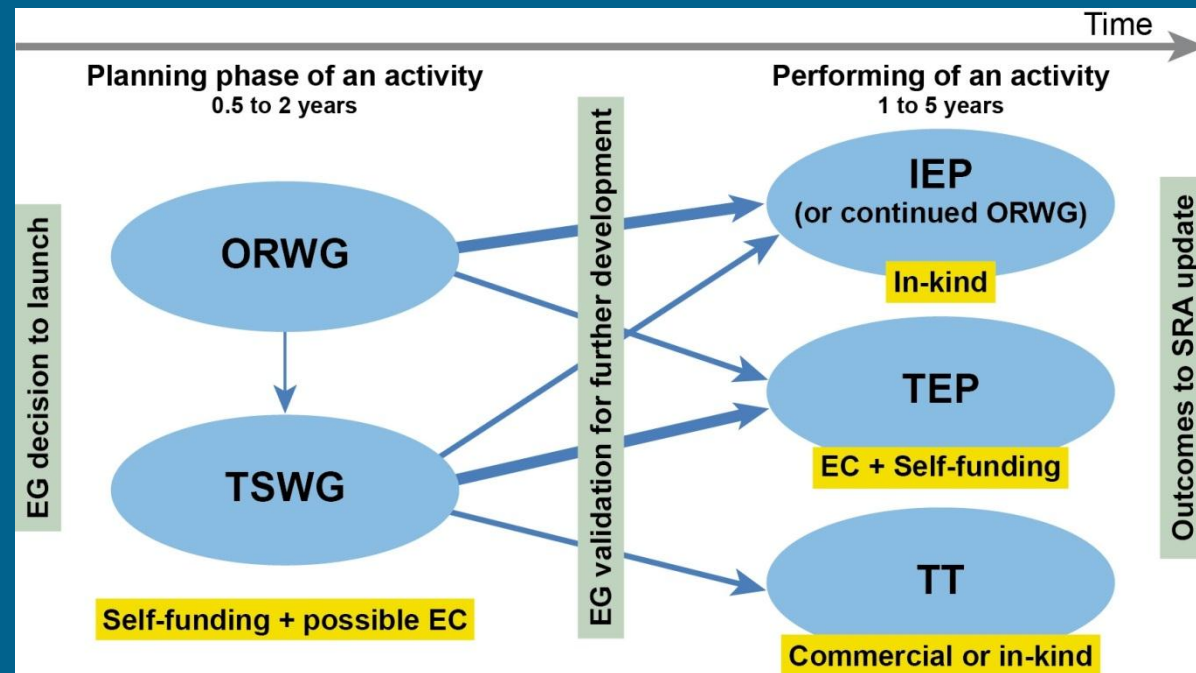
ORWG:  
organizational working group

TSWG:  
technical/scientific working group

TEP: Technical Project

IEP: information exchange platform

TT: technological transfer





# DEVELOPING THE DEPLOYMENT PLAN (2) MASTER DP



Community research



SecIGD2

(Contract Number: 323260)

## Master Deployment Plan and Joint Activities Outline 2014

### DELIVERABLE (D-Nº: 1.5.1)

Author(s): .....

Reporting period: e.g. 01/01/2013 – 30/06/2014

Date of issue of this report: 30/06/2014

Start date of project: 01/01/2013

Duration: 36 Months

Project co-funded by the European Commission under the Seventh Euratom Framework Programme Research & Training Activities (2007-2011)		
Dissemination Level		
PU	Public	X
PP	Restricted to other programme participants (IGD-TP participants by ProjectPlace) including the Commission Services	
RE	Restricted to a group specified by the partners of the SecIGD2 project	
CO	Confidential, only for partners of the SecIGD2 project	

SecIGD2



D1.5.1.  
IGD-TP Master Deployment Plan 2014

Written: IGD-TP Secretariat  
Organisation: IGD-TP  
Editor: J. Delay  
Issued: 2014/06/30  
Number: 3.0  
Version: 3.0  
Page(s): 9 (87)



D1.5.1.  
IGD-TP Master Deployment Plan 2014

Written: IGD-TP Secretariat  
Organisation: IGD-TP  
Editor: J. Delay  
Issued: 2014/06/30  
Number: 3.0  
Version: 3.0  
Page(s): 16 (87)

Table 3-1: List of the Key Topics and related Topics<sup>2</sup> with their foreseen start and outcome - dates, and indication of their priority (H: high, M: medium, L: low)<sup>3</sup>.

Nº	List and Contents of the Topics for a given Key Topic <sup>4</sup>	Start date	End date	Priority within the Key Topic
1	<b>Key Topic 1: Safety case</b>			
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
2	<b>Key Topic 2: Waste forms and their behaviour</b>			
2.1	High burn-up fuels: rapid release fraction and matrix dissolution	2015	2020	H
2.2	Release from ILW and their detailed characterization	2012	2016	H
2.3	MOX fuel: relation between structure and dissolution	2022	2028	M
2.4	High burn-up fuels and criticality	2015	2020	M
2.5	Improved data on vitrified HL waste	2012	2015	L
3	<b>Key Topic 3: Technical feasibility and long-term performance of repository components</b>			
3.1	Full-scale demonstration of a HLW container (from manufacturing to emplacement)	2015	2020	H
3.2	Buffer and backfill emplacement	2016	2020	H
3.3	Construction of underground facilities: Confirmation of rock properties for detailed repository design	2012	2018	H
3.4	Repository layout design including operational safety, reversibility and retrievability concerns	2015	2020	H
3.5	Pilot demonstration of repository operation	2011	2017	H
3.6	Full-scale plugging and sealing experiments and demonstrations	2012	2018	H
3.7	Non-destructive testing information exchange	2013	2019	L
3.8	Knowledge preservation	2016	2023	L
3.9	Long-term stability of bentonite in crystalline environments	2011	2017	H
3.10	Long-term behaviour of seals and plugs	2011	2017	H
3.11	Evolution of cement-based seals	2015	2023	M
3.12	Interaction of cement with clays	2016	2024	M
3.13	Optimisation of low pH cements	2016	2022	M
3.14	Salt backfill	2012	2018	M
3.15	Iron-bentonite interaction	2015	2023	M

<sup>2</sup> Based on the contents of the SRA<sup>3</sup> IGD-TP DP2011 - IGD-TP Implementing Geological Radioactive Waste Technology Platform - Deployment Plan 2011-2016<sup>4</sup> The SRA text describing a Topic may differ from the one given here

SecIGD2 (D-Nº: 1.5.1) - IGD-TP Master Deployment Plan 2014  
Dissemination level: PU  
Date of issue of this report: 30/06/2014

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Dissemination level: PU  
Date of issue of this report: 30/06/2014

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## 1 Master Deployment Plan of the SRA 2012-2016

Table 1-1: Master Deployment Plan

JA	Joint Activity	EURATOM FP7 Project	2011	2012	2013	2014	2015	2016	On-going Activity
JA1	Waste forms and their behavior (TSWG)	First Nucleides Start date 2012-01-01 Duration 36 months REDUPP Start date 2011-04-01 Duration 36 months							
JA2	Full scale demonstration of Plugging and Sealing (TSWG)	DOPAS Start date 2013-09-01 Duration 48 months							
JA3	Waste forms and their behavior - C-14 (TSWG)	CAST Start date 2013-03-01 Duration 51 months							Generation of C14 Species from radioactive waste - launched in 2013 - and in 2018
JA4	Monitoring the Environmental Reference State (TSWG)	Environmental Monitoring Proposal H2020 Start in 2017							Decision TSWG in EG 12 Proposal to be submitted for the first H2020 call
JA5	Safety of constructions and operations (COWG)								Working Group with 7 Partners - Pilot Project on needs and common interest group
JA6	Conference on waste management codes; Materials interactions (TSWG)	PEBS Start date 2010-03-01 Duration 48 months Cement Proposal H2020 CEBAMA							Proposal to be submitted for the first H2020 call Cement Proposal H2020 CEBAMA
JA6a	Cement-organics/radionuclides interactions (TSWG)								TSWG Started in 2014 (Decision EG 13)
JA6b	Microbiological issues (TSWG)								TSWG Started in 2014 (Decision EG 13)
JA6c	SAFEROCK (TSWG)	SAFEROCK Proposal H2020 Call							TSWG Started in 2014 (Decision EG 13) Proposal to be submitted for the first H2020 call
JA7	Monitoring programme (TSWG)	MC2020 Start date 2009-05-01 Duration 66 months							Proposal to be submitted for the first H2020 call Monitoring Proposal H2020





## SRA KEY TOPICS AND EXAMPLES OF DP ACTIVITIES

### KT 1: ***Safety case***

- ✓ Handling of uncertainties (BMW i)

### KT 2: ***Waste forms and their behavior***

- ✓ IRF esp. from high burnup fuels (EC project FIRST-NUCLIDES)
- ✓ Generation and migration of C-14 species (EC project CAST)
- ✓ New waste forms (interaction with SNETP)

### KT 3: ***Technical feasibility and long-term performance of repository components***

- ✓ Full-scale demonstration of plugs and seals (EC project DOPAS)
- ✓ Long-term performance of EBS (EC Project PEBS)
- ✓ Long-term stability of bentonite in crystalline environments (EC project BelBar)
- ✓ Cement interaction (proposed to EC, CEBAMA)



## SRA KEY TOPICS AND EXAMPLES OF DP ACTIVITIES

### KT 4: ***Development strategy of a repository***

- ✓ Adaptation and optimization (in preparation – SURAO)

### KT 5: ***Safety of construction and operations***

- ✓ Forum for return of experience, comparison of approaches, ... (NAGRA)

### KT 6: ***Monitoring***

- ✓ Technical and stakeholders' approaches (EC project MODERN)
- ✓ Environmental Reference State (ANDRA)

### KT 7: ***Governance and stakeholder involvement***

- ✓ Interface scientists and stakeholders (EC INSOTEC project)
- ✓ Coordination with European Economic and Social Committee



## X-CUTTING TOPICS AND EXAMPLES OF DP ACTIVITIES (2)

- ***Dialogue with regulators / technical supports***
  - ✓ Establishing a common knowledge base, while maintaining independency (in preparation of EC H2020)
  
- ***Competence Maintenance, Education and Training (CMET)***
  - ✓ State-of-the-art in education and training in geological disposal produced
  - ✓ Development strategy (in preparation)



## X-CUTTING TOPICS AND EXAMPLES OF DP ACTIVITIES (2)

- Knowledge Management (incl. memory keeping)
  - ✓ Knowledge mapping & data mining (in preparation)
    - Most data are public but not easily reachable
    - Also a first step to technology transfer
- Dissemination / Technology transfer (Communication)
  - ✓ Working Group supporting networking, structuring and developing RD&D competences in countries with less advanced geological disposal programs (NDA)
    - international scientific conferences
    - common knowledge basis
    - should avoid duplication of errors made in the past
- IEPs: Communication with SNETP, Analogues



## IGD-TP MAJOR ACHIEVEMENTS TO DATE

- **Well established forum**
  - ✓ Quoted in Directive 2011/70/Euratom as a tool to facilitate access to expertise and technology
  - ✓ SRA is one of the bases of the Euratom R&D calls
- **In line with the SRA Key topics and DP**
  - ✓ 12 of 16 Joint Activities already launched
  - ✓ 13 EU project launched or to be launched (Modern2020, CEBAMA, MIND, SafeRock)
  - ✓ 9 projects followed up by IGD-TP EG (Lucoex, First-Nuclides, REDUPP, DOPAS, PEBS, MoDeRn, BELBaR, CAST, and SecIGD2)
- 5 Exchange fora organized
- Geodisposal Conference in Manchester organized (280 participants, 57 oral presentations, 129 posters)





## IMPORTANCE OF PARTICIPATING IN THE IGDTP (1)

1. Several EU Members are **close to implementation** of geological repositories
  - shift towards demonstration i.e. operational issues, industrialization, optimization, etc. (RD&D), expertise
2. **Numerous new EU Members (newcomers)** and **new starters** are at early stages of program development
  - need to build their own expertise while maximizing the transfer of knowledge from more advanced programs
3. Increasing awareness of the **need to continue RD&D well after licensing**
  - Evolving safety & regulatory concerns
  - Expectation of state-of-the-art sciences and technologies use
  - Optimization of repository, i.e. return of expertise, test new devices / designs,...
  - Safety case / license updates
  - Preparation of (partial) sealing and closure



## IMPORTANCE OF PARTICIPATING IN THE IGDTP (2)

4. Shift in **R&D multilateral cooperation mode**
  - from national based projects to shared priorities, pooling of human and research resources as well as to reducing overlapping work
5. **High risk of a shortage**, at European level and at short to medium timescales, **of skilled human resource**
  - not only for the waste management organizations but also authorities, research organizations, TSOs, academia and supplier industries
  - probably one of the most acute challenges
6. Acknowledgement of the need **to involve the public** as early as possible, i.e. in the definition of R&D activities

- Internationale Kooperation ist ein Schlüsselmerkmal eines jeden RD&D-Programms
- Internationale Kooperation hat in deutschen Forschungseinrichtungen eine lange Tradition (Forschungsrahmenprogramme, bilaterale Maßnahmen, URL)
- exzellentes Knowhow ist verfügbar, deutsche Expertise ist im Ausland gefragt
- Der Nutzen internationaler Kooperation ist eindeutig
  - ✓ wissenschaftlich-technische Aspekte (Konzepte, Fragen der FuE)
  - ✓ sicherheitsbezogene Fragestellungen (Harmonisierung von Sicherheitsstandards)
  - ✓ finanzielle Synergien
  - ✓ Informations- und Erfahrungsaustausch, Evaluierung des Wissensstandes
- spiegelt sich in der IGD-TP und ihrer Aktivitäten ([www.igdtp.eu](http://www.igdtp.eu))
- IGD-TP ist ein exzellentes Werkzeug zur Umsetzung zielorientierter RD&D
- die Umsetzung der SRA-Key Topics in Joint Activities ist erfolgreich und vielversprechend für die Zukunft
- IGD-TP wichtig für fortgeschrittene Endlagerprogramme als auch für “junge” Programme
- die Mitarbeit deutscher Forschungseinrichtungen ist notwendig (Einbringen deutscher Expertise, Kompetenzerhalt, etc.)

## Acknowledgement:

Jacques Delay, Secretary General IGDTP, Monica Hammarström, Chair IGDTP, Torsten Eng, SKB International, Colleagues of EG, Bundesministerium für Wirtschaft und Energie