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D1.2 Project Plan including risk management plan

Author(s) *Posiva Oy, Johanna Hansen*

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ABSTRACT:

DOPAS project plan version 1.0 is a public description of DOPAS project, its content and objectives including DOPAS project schedule and DOPAS risk plan summary. DOPAS Project Plan describes the project management procedures, which aim to support the DOPAS Project Consortium in their daily activities within the DOPAS project.

RESPONSIBLE:

Posiva Oy, Johanna Hansen

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DOPAS 323273 PROJECT PLAN

1 GENERAL

Fourteen nuclear waste management organisations and research institutes from eight European countries are participating in a technology development project for testing plugging and sealing systems for geological disposal facilities for radioactive waste - the DOPAS project ("Full-Scale **D**emonstration **O**f **P**lugs **A**nd **S**eals"). The project is built around a set of full-scale underground demonstrations, laboratory experiments, and performance assessment studies and is jointly funded by the Euratom's Seventh Framework Programme and European nuclear waste management organisations. The project is running in the period September 2012 – August 2016, and is being coordinated by Posiva Oy, a nuclear waste management company in Finland.

DOPAS aims to improve the adequacy and consistency regarding industrial feasibility of plugs and seals, the measurement of their characteristics, the control of their behaviour over time in repository conditions and also their hydraulic performance acceptable with respect to the safety objectives. The DOPAS project addresses the design basis, reference designs and strategies to demonstrate the compliance of the experiments' reference designs to the design basis, for plugs and seals in geological disposal facilities.

This Project Plan is a living document created together with DOPAS Work Package (WP) leaders and experiment leaders and its role is to guide DOPAS project management. This Project Plan integrates the work between demonstration and RTD work packages and experiments (WP2-WP6) and shows how the supporting work packages related to the management and coordination (WP1) and dissemination (WP7) supports the fulfilment of project objectives. This Project Plan is based on the DOPAS Description of Work (DoW) and compiles information also from DOPAS Consortium Agreement (CA). A separate Consortium Budget between DOPAS consortium participants defines the DOPAS Project costs which are excluded from this Project Plan. This Project Plan is included also in the DOPAS Consortium Plan, which is an internal document within DOPAS consortium members.

In addition to this Project Plan each Experiment has a separate, restricted from the public internal project plan with detailed time schedule and detailed risk plan, which is summarized in this Project Plan.

This Project Plan is Deliverable 1.2 of the DOPAS project. It will be published on the DOPAS website and in the Projectplace. It is also recommended that the final and approved version is archived in the Partner organisation's own document handling system.

1.1 Project Plan management

The Coordinator organisation of the project (Posiva) manages the whole project and is a responsible contact toward the European Commission related to the content of this Project Plan. Each Work

Package leader is responsible for reporting and performing the activities described in the Project Plan (Work Breakdown Structure or WBS). The Experiment leaders of each Experiment (FSS, EPSP, DOMPLU, POPLU and ELSA) are responsible for design, testing the materials and methods, constructing, monitoring and testing the Experiments as described in WP3 and WP4.

The General Assembly has the ultimate responsibility for periodic assessment of project status and progress, as well as for periodic and final reports, and reviews the deliverables and approves deliverables that are published. With this mandate the General Assembly also approves changes for this Project Plan. The procedures for decision making in the project is described in the Consortium Agreement.

2 AIM AND TARGET OF THE PROJECT

The project focuses on tunnel seals for clay rock (French and Swiss repository concepts), tunnel plugs for crystalline rock (Czech, Finnish and Swedish repository concepts) and shaft seals for salt rock (German repository concept). Five different demonstration experiments are part of the project and they will take place in Sweden, France, Finland, Czech Republic and Germany. Each experiment represents a different state-of-development. The Swedish demonstrator will be constructed prior to start of the DOPAS project and will basically provide experience on demonstration of compliance of reference design to the design basis. The German demonstrator will be installed after the DOPAS project and will focus on demonstration of suitability by performance assessment. The French, Finnish, Swedish, German and the Czech experiments will address developments in all phases of design basis, reference designs and strategies to demonstrate compliance of reference designs to design basis. The studied concepts will be developed in the DOPAS's five thematic scientific/technological work packages, which each integrate the results of the individual experiments.

The DOPAS project is to be carried out in seven Work Packages of which four (WP2 to WP5) address directly the five demonstration experiments and two (WP6, WP7) address cross-cutting activities common to the whole project i.e. the integrating analysis of results, and dissemination of public results to bring new information developed to the knowledge of other organisations in Europe who work with the development of repositories for nuclear waste disposal. The project's public final report in WP6 will be a compilation of the main outcomes and lessons learned from the experiences of the project and will be based on quality reviewed work package final reports of the WP2 to WP5. Within the different RTD and Demonstration Work Packages, the organisations involved are also engaged in the dissemination of the Work Package outcomes.

WP1 includes project management and coordination and will ensure the coordination and interaction between the work packages. The Management Team is made up of each Work Package leader responsible for integrating the results and working together with the Experiment leader in charge of each of the demonstration experiments. The WP leaders are also in charge of the interim and final reporting of their work packages.

A technical and scientific Expert Elicitation Group includes members representing organisations or persons not participating directly in the project. They will produce formalised project results'

reviews, cross-WP examinations and advice (in WP6) of the public final reports of the Work Packages 2-5 using Expert Elicitation (EE) process[1]. The dissemination activities will address target groups like decision makers, interested citizens and RTD stakeholders. Additional scientific integration will also be accomplished through training as part of the dissemination activities i.e. by training of students and engineers in a training workshop with opportunities for active engagement of organizations from other Member States as defined in WP7. The training process including the planning, implementation and assessment will be reported as part of the WP7.

WP1 – Project Management and Coordination by Posiva (FI)
This work package compiles information from all work packages and creates a tool for all partners in the project to inform about the achievements in the project.
The main objectives are to:

- manage and coordinate the DOPAS project and provide project management coordination support to consortium activities and to oversee the DOPAS work progress in the different work packages;
- steer and support the work package leaders and in the work package planning;
- organise in cooperation with the IGD-TP Secretariat the project website and extranet and publish the public project results with open access on the public website;
- act as an information and communication centre about the public activities of the DOPAS including a project website for open access and a restricted extranet. The Coordinator organisation's other dissemination activities are included in the WP7;
- collect and compile project management information of the DOPAS project to ensure compliance with the requirements set in the ECGA and the Consortium Agreement (CA) and organise for the distribution of EC financial contribution and for collecting audit certificates; and
- provide means of quality assurance and control of project results.

WP2 - Definition of requirements and design basis of the plugs and seals to be demonstrated led by SKB (SE)
DOPAS will develop a complete design basis for the experiments for the engaged waste management programs and thus enhance the prime bases for designs. The prepared design basis will form the guidance for developing future reference designs, i.e. designs, which have the objective of performing in compliance with robust interpretation of results from the assessment of repository long-term safety.
Establishing the strategies for demonstrating compliance of designs to the design basis is expected to guide future work on the development of plugs and seals within Europe and internationally, too.

The main objectives are to:

- compile the design basis for the ongoing and planned five demonstration experiment in DOPAS;
- develop reference designs for the same experiments; and
- establish strategies for demonstrating the compliance of the reference designs to the design basis.

[1] as defined in Posiva Working Report 2008-60 by K. Hukki " A Formal Process for Elicitation and Validation of Expert Judgments for Safety Case in the Context of Spent Nuclear Fuel Management"

WP3 - Design and technical construction feasibility of the plugs and seals led by Andra (FR)
Proposed reference designs must be based on feasible and reliable technologies. In DOPAS new and advanced designs will be developed and the WP3 includes the use of materials and machines in both new and innovative combinations for producing and installing the plugs' and seals' components. These combinations are going to be tested in different ways, from computer simulations to full-scale *in situ* demonstration. The results will expand the present knowledge base and will be of interest not only to the nuclear waste implementers and the other industry actors but also to civil construction.

The main objectives are to:

- (further) develop a comprehensive design basis for the in-situ demonstration experiments planned in the France, Czech Republic, Finland and Germany. The Swedish design basis for DOMPLU has been developed prior the DOPAS project.
- to carry out large/full-scale tests (EPSP, FSS) in underground rock laboratories or mock-up drifts in the Czech Republic and France, and URCF ONKALO (POPLU) in Finland, proving that the stated reference design, which is used as subsystem justification in the license applications for the final repositories fulfils the requirements and can be implemented on an industrial scale;
- to monitor full-scale demonstration (DOMPLU) at Äspö HRL in Sweden; and
- to address seal and plug materials with respect to long-term behaviour, providing experimental data needed for numerical simulations in order to demonstrate material suitability.

WP4 - Appraisal of plug and seal systems' function led by NDA (UK)
A major effort will be made to provide evidence for plugs' and seals' functions. Following construction and installation monitoring systems will generate on-line data and planned experiment dismantling activities will supplement the knowledge base with accurate information on plugs' and seals' initial state and evolution. Data and other achievements will be used in evaluation of the observed performance against the predicted performance. The impact of the applied manufacturing and installation technologies will be evaluated. The work shall besides the main task provide the performance and safety assessment with accurate and robust information input on the reference designs.

The objective of this Work Package is to assess and evaluate:

- the construction methodologies and technologies for plugs and seals (WP3);
- the results of the subsequent monitoring phase and the outcome of the dismantling activities to evaluate the predictions against the actual measured performance;
- summarise the achievements made in design and the industrial scale implementation construction, in the light of the specified required performance of plugs and seals as defined in Work Package 2; and
- to provide a basis and direct input for performance assessment related activities carried out in (WP5).

WP5 – Performance assessment of the plugs and seals systems led by GRS (DE)
The most important means of evaluating the suitability of designs of plugs and seals in a repository is by assessing their components' long-term safety performance. By performing the DOPAS

assessments new and vital information like about preferences of materials and designs will be obtained. The long-term safety assessment methodologies will be further developed and new aspects of modelling will be introduced in the related codes. The results of this work package are cross-cutting to all of the experiments in their nature.

More specifically the objectives can be defined as follows:

- process modelling of the experiments performed in WP3 to gain process understanding
- identify the main processes that are relevant and thus to be considered for predicting the short and long-term behaviour of the plug and sealing systems;
- identify remaining uncertainties and their influence on performance assessment;
- development and justification of conceptual models of plugs and seals for the different disposal concepts and geological environments;
- simulation of processes and their evolution within individual sealing components; and
- further develop and apply the PA methodology and (conservative) PA models for analysing the system behaviour.

WP6 – Integrating analysis including cross-review of each other's work led by Posiva (FI)
This work package produces the final project report. Also it applies the VTT - Posiva developed Expert Elicitation method in the engineering setting as a tool to integrate the results of the project into a formal peer review and to enhance the quality assurance of the outcomes and their integration for a wider use and knowledge building beyond the individual demonstrations. The Expert Elicitation process uses a structured method to combine the views of the specialists around an issue (generally controversial in its nature) and generalists into a common consensus about the issues for further work. This process will be used as means of quality assurance of the final public reports from Work Packages 2-5. The method is first piloted in the context of the POPLU experiments test plan prior its wider application to the final reports. The experts may be the same or differ for the different work package final reports depending on the issue. The approach to DOPAS will be piloted in producing the plug behaviour test plan for the POPLU experiment in WP3. The WP6 includes also a programme of expert staff site visits now foreseen to be organised in Bure, France, ONKALO, Finland and in Josef Gallery in the Czech Republic during the course of the DOPAS project according to the progress in the ongoing experiments at these locations.

The objectives are:

- to review the project results by using EE method and ensure that the quality of the results are assured;
- to provide possibility for expert staff site visits, learning from each others and to enhance the integration between experiments;
- to compile the lessons learned and experiences useful for implementing plugs and seals in various disposal concepts and high-lighting the future open questions related to plugs and seals; and
- to produce the final public DOPAS RTD report.

WP7 - Dissemination led by Posiva (FI)

Dissemination of DOPAS results and providing for learning opportunities (e.g. training) on plug and seal issues are expected to provide enhanced knowledge on design and performance of plugs and seals components in countries engaged in radioactive waste repository development, in particular in European Union Member States and Switzerland to various target groups interested in the outcomes of the RD&D work including political decision makers and general public. For this purpose the WP7 includes various dissemination activities that will be followed up during the project and reported during the different reporting periods. The main objectives of this Work Package are:

- to produce a comprehensive dissemination plan, implement it and carry out an active follow-up of the activities undertaken. Aspects of exploitation of restricted results are to be included into this plan and/or later in the exploitation plan of the project outcomes. As a part of the implementation of this dissemination plan a project description is prepared early in the beginning of the project for the "Euratom FP7 Research & Training Projects" project compendium;
- to set up a training planning group and to organise one plugs and seals training workshop that is open also for participants outside the consortium. The training workshop will follow a well designed learning process capturing the framework of the DOPAS project (Figure 1) and the learning outcomes of the training will be defined so that at a later stage the recognition of the learning outcomes from the training work shop could take place e.g. according to the ECVET approach. The training workshop plan and the training process content are produced as a deliverable of the project and published on the IGD-TP/DOPAS public website. The open access to this material will be studied taking into account the nation and EU wide constraints of IPR on training materials especially if trainers from outside the DOPAS consortium members are used. The training workshop IPR issues will also be included into the DOPAS exploitation plan. The potential of organising also smaller tutorials during the DOPAS project e.g. in connection with the expert visits is also included in this work package;
- to organise in cooperation and produce input for the IGD-TP's full-fledged international seminar in early 2016 focussing on plugs and seals and the lessons learned around the full scale demonstrations from 2012 to 2015. For the seminar a call for papers will be issued and the call and the seminar papers will be published on the IGD-TP/DOPAS website in pdf - format and in a limited number in the form hard copy proceedings (print and/or CD). As a part of the seminar arrangements the IPR of the papers will be addressed to ensure the publication of the proceedings as planned. A programme planning group in cooperation with the IGD-TP will be set up as a task force for planning the programme content (including a plenary, poster sessions and/or workshops, and thematic presentation of submitted papers).
- to set up on the four experiment sites either at the entry of the underground facilities or adjacent to the experiments underground (depending on safety requirements set by each underground facility) posters describing the experiment; and

- to publish and present the DOPAS project's public results by producing scientific/technical papers and conference presentations. For this purpose also regular newsletters of the project's progress are published in pdf-format at 9 months intervals and two 2-page documents summarising the scientific and technical achievements of the DOPAS project will be produced for wider audiences with the assistance of a professional writer or journalist.

The detailed activities are included in the DOPAS deliverable list (Appendix 1) and in the WP7 detailed description (see Chapter 4). A separate Dissemination and Exploitation Plan (DOPAS Deliverable D7.1) describes more detailed the planned dissemination activities within DOPAS. The overall objectives of the DOPAS project, not only the success of the dissemination, will be achieved by:

- Advanced desk studies on the requirements, design basis state-of-the-art, and PA and SA related to plugs and seals to be demonstrated (WP2 and WP5).
- Research and technology development testing and other activities mainly in concrete and clay laboratories but also in other laboratory settings (WP3).
- Development and testing activities for the plug and seal components and structures in small to large scale set-ups and the feasibility of their installation (WP3).
- Demonstration activities on plug performance in medium to full-scale *in situ* demonstration experiments in European underground research laboratories, and in ONKALO underground rock characterisation facility, a part of a future repository (WP3, WP4).
- Coordinated evaluation and assessment of the quality of the project outcome (WP6).

The objectives in measurable and verifiable form are described in more detailed in following Table 2-1.The objectives are described for each WP and described in form of deliverables and milestones when there is relevant connection between them.

Table 2-1. Objectives in measurable form

Objective	Measure of completeness	Deliverable (Outcome)	Timing (original in parenthesis)	Milestone or Target
Project Management and Coordination (WP1)				
Project management and follow up according to the project plan	Minutes are distributed and decisions taken to the further implementation	D1.1 General Assembly meetings and minutes (dates indicative)	M3, M15, M26, M37, M44	MS1 Agenda of first general assembly (M1)
Manage and coordinate the project and support the project leaders	Project plan ready and updated when necessary	D1.2 Project Plan including risk management plan	M7 (M3)	
Act as the projects information and communication centre	Information, reports and other material are updated regularly	D1.3 DOPAS website (public) and Extranet (for IGD-TP)	M3-M48	
Definition of requirements and design basis of the plugs and seals (WP2)				
To develop design basis for three plug types and one seal type	Existing or under development work is available for discussions in the task meeting. Documentation is available for use of consortium	D2.1 Design Basis and Criteria Report	M20 (M18)	MS2 Design basis and reference design task meeting (M6)
To develop reference designs for three plug types and one seal type	Documentation is available for use of consortium for further development.	D2.2 Reference Designs Report	M26 (M24)	
Elaborated strategies of demonstrating conformity of reference design to design basis for four different plug types	Documentation is available for use of consortium.	D2.3 Strategies of demonstrating conformity of reference design to design basis	M38 (M36)	
To present the basis how plugs and seals can be designed taking into account the constraints and requirements	Report is EE quality reviewed and published	D2.4 WP2 Final Report	M43 (M41)	
Design and technical construction feasibility of the plugs and seals (WP3) and Appraisal of plug and seal system's function (WP4)				
To develop detailed design for FSS	Preparation of plug installation location may start	D3.2 FSS tunnel model design report	M8 (M6)	MS7 Detailed design for FSS experiment ready (M8)
To develop detailed design for FSS	Plug components manufacturing may start	D3.3 Report on clayish material definition for FSS	M8 (M6)	

To develop detailed design for FSS	Installation of plug components may start	D3.4 Report on low-pH concrete formulas for FSS	M8 (M6)	
To develop plug component materials for experiment FSS	Plug components manufacturing may start; Report is quality reviewed by Andra and published	D3.5 Lab test report on the performance of the clayish material for FSS	M8 (M6)	MS3 Location for FSS experiment ready (M8)
To develop plug component materials for experiment FSS	Installation of plug components may start. Report is quality reviewed by Andra and published	D3.6 Lab report on the performance of low-pH concrete for FSS	M8 (M6)	
To conduct small scale plug test prior the full-scale FSS experiment assembly and installation	Metric scale tests are assembled and installed. Report is quality reviewed by Andra and published.	D3.7 Test report on FSS metric core emplacement	M11 (M9)	
To conduct small scale plug test prior the full-scale FSS experiment assembly and installation	Report is quality reviewed by Andra and published	D3.8 Test report on FSS cast in-box concrete	M11 (M9)	
To conduct small scale plug test prior the full-scale FSS experiment assembly and installation		D3.9 Test report on FSS test panel for shotcrete	M11 (M9)	
To implement full-scale FSS test (to test the feasibility of construction of the plug)	Site for the FSS is prepared and the FSS -type plug is constructed, installed, instrumented. Documentation exists of the activities.	D3.10 Drift model FSS construction report	(M18) M16	MS9 Installation of FSS experiment complete (M20)
To implement full-scale FSS test	Documentation exists of the activity	D3.11 Report on FSS cast concrete plug construction	M18 (M16)	
To implement full-scale FSS test	Documentation exists of the activity	D3.12 Report on construction of FSS swelling clay core	M18 (M16)	
To implement full-scale FSS test	Documentation exists of the activity	D3.13 Report on shotcrete plug construction	M18 (M16)	
To monitor FSS experiment	Follow up date of FSS experiment interpreted and findings evaluated and documented.	D4.1 Report on qualification of commissioning methods	M18	MS13 Inputs from FSS experiment for WP4 integration report (M32)
To monitor FSS experiment	Follow up data of FSS experiment interpreted and findings evaluated and documented	D4.2 Report on bentonite saturation test	M32 (M30)	
To share the experiences on FSS experiment	FSS experiment report is quality reviewed by Andra and published	D4.8 FSS experiment summary report	M44	

To gain the experiences on plugging and sealing	FSS Experiment is done or the results are frozen for final reporting.	D3.1 FSS Experiment	M42	
To develop detailed design for EPSP	Installation of EPSP plug may start. Design is documented for implementation.	D3.15 Detail design of EPSP plug	M19	MS4 Location for EPSP experiment 2 ready (M5)
To plan the plug component material specifications for EPSP	Readiness to carry out laboratory work on material specifications, plan is quality reviewed by CTU and published.	D3.16 Testing plan for EPSP laboratory experiment	M8	
To develop the plug component materials for EPSP	Readiness for EPSP experiment component installation. Results of testing are documented.	D3.17 Interim results of EPSP laboratory testing	M11	
To summarise all laboratory work done for construction, modelling and understanding the EPSP experiment	EPSP experiment report is quality reviewed by CTU and published.	D3.21 Final laboratory test report of EPSP	M40 (M37)	MS16 Inputs from EPSP experiment for WP4 integration report (M30)
To plan the instrumentation for monitoring the EPSP	Monitoring activities may start. Testing plan is documented.	D3.18 Testing plan for EPSP instrumentation and monitoring	M19	MS11 EPSP Experiment construction and installation (M21)
To describe the construction and installation of EPSP plug on site	EPSP plug experiment is installed and work documented.	D3.19 EPSP Functionalities demonstration	M25 (M22)	
	EPSP plug experiment is installed and the installation work documented.	D3.20 EPSP plug test installation report	M27 (M28)	
To follow-up and learn about EPSP plug behaviour	EPSP monitoring phase is quality reviewed by CTU and published	D4.6 Monitoring data from EPSP plug test summary report	M26	
To share the experiences on EPSP experiment	EPSP experiment report is quality reviewed by CTU and published	D4.7 EPSP experiment summary report	M44	
To gain the experiences on EPSP plugging experiment	Experiment phase is done or the results are frozen for final reporting.	D3.14 EPSP experiment	M42	
To share the experiences on DOMPLU experiment	Report is quality reviewed by SKB and published	D4.3 DOMPLU experiment summary report	M36 (M30)	MS14 Inputs from DOMPLU experiment for WP4 integration report (M23)
To gain the experiences on DOMPLU plugging experiment	Experiment is done or the results are frozen for final reporting.	D3.22 DOMPLU experiment	M42	
To locate the test site by using RSC method	Preparation of plug location and installation may start and site conditions are documented.	D3.26 URCF RSC work memorandum (POPLU)	M14	MS5 Location for experiment 4 POPLU, ready (M12)

To develop detailed design for POPLU	Assembly of components and installation of plug may start. Design documents are available.	D3.24 Detailed design of POPLU deposition tunnel end plug	M12	MS8 Testing plan for POPLU ready (M12)
To develop detailed test plan for POPLU plug behaviour	Pilot EE process carried out for the test plan, test plan published, and installation of plug may start.	D3.25 Test plan for the full-scale test including the instrumentation plan for POPLU plug	M15 (M12)	Test plan submitted for EE process (M9-M10).
To develop detailed material specifications for POPLU	Specifications documented and installation of plug components may start	D3.27 POPLU concrete test memorandum	M14	Concrete specification(s) for POPLU component(s)
To learn and gain experiences on plug construction and installing a testing and monitoring system	Installation of plug is ready and monitoring may start		M21	MS10 Construction of POPLU full-scale plug (M21)
To share the experiences on POPLU experiment	Report is quality reviewed and published by Posiva	D4.5 POPLU experiment summary report	M40	
To gain the experiences on plugging and sealing	Experiment is done or the results are frozen for final reporting.	D3.23 POPLU experiment	M42	MS15 Inputs from POPLU experiment for WP4 integration report (M36)
To summarise the experiences and lessons learned in experiment construction and installing	All experiments are installed, the outcomes submitted to EE review and the report published	D3.30 WP3 Final summary report	M44	Draft report submitted for EE process (M40)
To summarise the achievements made in design and implementation of full scale demonstrations	All experiments outcomes are integrated, a EE review carried out and the report published	D4.4 WP4 integrated report	M40	MS17 Draft WP4 report for EE process available (M36)
To achieve laboratory data for WP5	Results documented.	D3.28 Status report on ELSA related laboratory tests (original D3.28 Status report on ELSA laboratory tests)	M24 (M18)	MS6 Laboratory test plans on materials characterisation and components available (M9)
To summarise laboratory results to be used for future large scale testing	Report quality reviewed by GRS and published	D3.29 Final Technical Report ELSA related testing	M42	MS12 Instrumentation and monitoring plans for experiment (M37)
To summarise laboratory results to be used for future large scale testing	Report quality reviewed by GRS and published	D3.31 Final Technical Report on ELSA related testing of mechanical-hydraulic behaviour of the shaft seal (LASA)	M42	Draft report available M39

To summarise laboratory results to be used for future large scale testing	Report quality reviewed by GRS and published	D3.32 Final Technical Report on sealing behaviour of clay rock (THM-TON).	M42	Draft report available M39
Performance assessment of plugs and seals system (WP5)				
Plans and methodology for FSS PA & SA	Outcomes documented and information is used for FSS	D5.2 Report on Andra's PA methodology for sealing systems	M18	MS18 Input from Andra's PA methodology for sealing systems (M14)
Conceptual model on FSS	Documented	D5.3 Report on Andra's understanding of processes involved in time and space	M18	
Development on process understanding for sealing and plugging on clay rock	Documented	D5.5 Status report on process modelling activities	M24	MS19 Status report on process modelling activities (M24)
Description on conceptual and integrated modelling activities for sealing and plugging on clay and salt rock	Documented	D5.6 Status report on conceptual and integrated modelling activities	M24	MS20 Status report on conceptual and integrated modelling activities (M24)
To continue , to finalise and to summarize the outcomes of the work partly reported in D5.5 and D5.6	Report is quality reviewed by GRS and published. Its content has been used for D5.10.	D5.8 Final report on process, conceptual and integrated modelling activities	M42	Input for WP5 Final integration report draft (M28)
Deepening the understanding of processes related to EPSP and other plugs experiments in crystalline host rocks	Report quality reviewed by RAWRA and published.	D5.1 Modelling plan for EPSP PA	M20	
How to handle uncertainties in PA related to nature, time and scale in clay host rock environment	Documented approach to uncertainties handling	D5.4 Report on approach concerning uncertainties	M24	MS21 Input for WP5 Final integration report (M28)
To collect the EPSP related PA&SA work	Documented work and information is used for EPSP summary report	D5.7 Models and modelling summary report for EPSP	M40	
To summarise all PA and SA information and increased knowledge and new tools for assessing the plugs and seals	The outcomes are EE reviewed and the report is published. Information is analysed.	D5.10 WP5 Final integrated report	M45 (M44)	Draft report submitted for EE process (M42)

To have performance indicators available for wider use	Report is quality reviewed by at least NRG, the report is published and information is analysed.	D5.9 Integration of results of demonstrators in total repository system's PA by special performance indicators.	M42	
Integrating analysis including cross-review of each other's work (WP6)				
To plan the peer review for DOPAS project	Generic plan for Expert Elicitation process of the WP deliverables documented and available	D6.1 Plan for the integrating analysis by experts and selection of experts	M26	MS22 Expert elicitation specialists and generalists for the EE group assembled (M28)
To distribute and change the information on experiments within consortium	Travel reports are ready	D6.2 Expert staff visit travel reports	M36 (M30)	
To quality assure the public reports on DOPAS project	EE process is ready and taken into account in public summary reports quality review.	D6.3 EE documentation (in Work Report format) from Expert Group EE meetings inputs and outcomes	M46 (M43)	MS23 Pilot EE is carried out for the D3.25 (M11) Final drafts of WP2-5 received for the EE process (M36-M38). Quality assurance - Inputs of EE review received for WP2 - WP5 final work package report. (M45)
To assure the results and outcome of DOPAS project is available for audience	Report consortium commented and Posiva quality reviewed and published.	D6.4 DOPAS Final Project Summary Report	M48	MS24 The partner inputs for the preparation of the final project report received by the coordinator (M42)
Dissemination (WP7)				
To ensure wide and high quality dissemination to the identified target groups in a balanced manner for maximum impact	Actions plan is ready for implementation and follow-up	D7.1 Dissemination Plan (incl. exploitation)	M4	MS25 Dissemination plan content drafted (M2)
To ensure wide and high quality dissemination via the EC documentation	Ready	D7.5 Project description for the EC FP7 project compendium	M8 (M4)	
To acknowledge the scope and role of the test on test sites and acknowledge the EC contribution	Experiments posters are available at the sites	D7.7 Experiment poster of DOMPLU with EC acknowledgements at the underground site in Äspö (Sweden)	M7 (M3)	

		D7.8 Experiment poster of POPLU with EC acknowledgements at the ONKALO site (Finland)	M12	
		D7.9 Experiment poster of FSS at the underground site with EC acknowledgements in BURE (France)	M7 (M3)	
		D7.10 Experiment poster of EPSP at the underground site with EC acknowledgements in URC Josef Gallery (Czech Republic)	M8	
To publish and disseminate the project results to a wide audience via the internet	Newsletter and other material distributed	D7.4 Publishing in total six newsletters in pdf-format at 9 months interval on the IGD-TP/DOPAS website	M9, M18, M27, M36, M45, M48	MS26 First newsletter published (M10)
		D7.6 Two journalist edited 2-page summary documents of project's scientific and technical achievement	M47	Foreseen at the mid-term and at the last quarter of the DOPAS project
Networking and training	Workshop organised and reported	D7.2 Plug and Seal Training Workshop planning and implementation report	M39	MS27 Learning and implementation plan for the training workshop (M27)
To organise an international seminar/ conference related to plugging and sealing with call for papers and posters	Review of papers carried out by the programme committee. Proceedings published.	D7.3 Organisation and publication of proceedings in cooperation with the IGD-TP an international seminar/conference in 2016	M44	MS28 First call for the papers and for the international seminar in 2016 announced (M30)

3 MILESTONES AND DELIVERABLES

DOPAS project Milestones and Deliverables are listed here. (Appendix 1 and Appendix 2)

4 WORK BREAKDOWN STRUCTURE (WBS) AND TASKS OF THE PROJECT

4.1 List of Work Packages

The project is divided into the 7 work packages and into the Tasks listed in below:

WP1 Coordination and management

Task 1.1 Organisation of project management meetings

Task 1.2.Coordination of project management with project plan and project risks

Task 1.3 Coordination of project reporting and publications

WP2 Definition of requirements and design basis of the plugs and seals to be demonstrated

Task 2.1 Design basis

Task 2.2 Reference designs

Task 2.3 Strategies of demonstrating conformity of reference design to design basis

Task 2.4 Final reporting of WP2

WP3 Design and technical construction feasibility of the plugs and seals

Task 3.1 Design of plugs and seals

Task 3.2 Laboratory work for materials' characterisation and testing

Task 3.3 Metric scale test

Task 3.4 Installation/construction of the demonstration plug/seal experiments

Task 3.5 Coordination and integration of results – Final reporting of WP3

WP 4 Appraisal of plug and seal system's function

Task 4.1 Mock up test and Full Scale Seal

Task 4.2 EPSP test, loading and monitoring phase

Task 4.3 Pressurisation and monitoring of DOMPLU plug at Äspö

Task 4.4 POPLU plug experiment's leakage measurements and monitoring

Task 4.5 Production of WP4 Integrated Report

WP 5 Performance assessment of plugs and seals system

Task 5.1 Performance assessment of (parts of) the plug and seal systems and identification of the relevant tools for predicting the behaviour of a complete sealing system

Task 5.2 Conceptual models and simulation of relevant processes and their evolution within individual sealing components

Task 5.3 Development of conservative PA methodology and models for analysing the complete system behaviour

Task 5.4 Integration of WP5 task reports

WP6 Integrating analysis including cross-review of each other's work

Task 6.1 Planning for the Integrating Analysis

Task 6.2 Programme on exchange of expert staff

Task 6.3 Expert Group for the peer review using the EE process and its documentation

Task 6.4 Final technical summary reporting of the DOPAS project

WP7 Dissemination

Task 7.1 Dissemination and exploitation plan

Task 7.2 Planning, implementing and disseminating the outcomes of "Plug and seal training workshop"

Task 7.3 Organisation in cooperation with the IGD-TP an international seminar/conference in 2016

Task 7.4 Publishing and presentation of public results of the DOPAS activities

4.2 DOPAS Work Breakdown Structure and content in the tasks

The more detailed content of the tasks are presented below. The Experiments are mainly divided into the WP3 and WP4.

Task 1.1 Organisation of project management meetings

Posiva is the project coordinator in charge of the project management of DOPAS. The Coordinator calls up and organises General Assembly Meeting and other formal meetings according to the Project Plan. It is foreseen that one to two General Assemblies will be organised annually and that the first

meeting would take place within two months from the project's start. These meetings may be combined Management Team Meetings. The General Assembly are intended for dealing with formal project management tasks and with progress reporting and on making decisions related to the project. The Management Team Meetings consisting of WP and experiment leaders are planned to be held regularly with at approximately 9 months intervals on a needs basis. They focus on running the experiments in a coordinated manner and on exchanging information for the improvement of the various project tasks.

Task 1.2.Coordination of project management with Project Plan and project risks

Main part of the project management and the role of the Coordinator are to support WP managers and experiment leaders in their work for planning, implementing and evaluating the work in WP2-WP7 and in full scale experiments providing means of quality assurance and control of project results. In practice this task consists of day to day project coordination, replies to various questions of the consortium on management issue and changing information between partners. Coordinator drafts a Project Plan which details the content and interaction between the work packages and experiments together with sufficient risk plan. These will be updated if necessary.

Task 1.3 Coordination of project reporting and publications

The Coordinator engages in the production and compilation of necessary formal reporting of DOPAS work and activities and thereby has a balancing role to meet the overall objectives of the DOPAS. The Coordinator maintains the Grant and consortium agreements produces progress reporting instructions and compiles the progress and financial reports and the audit certificates from the beneficiaries required to present the CFS. It is foreseen that the progress reporting to the EC takes place after every 18 project months. This task also includes in cooperation setting up, maintenance and management the project website and the virtual extranet (see description below) in cooperation with the IGD-TP Secretariat. The Coordinator oversees that the public project results will be published in cooperation with the IGD-TP Secretariat on the website with open access process. Materials and results that are limited in their dissemination level are distributed internally in the consortium or via the extranet. This task consists of template preparations for project progress, maintenance of the website and extranet, deliverables approval and submissions and carrying out financial follow-up and reporting and compilation of the consortium project reports and financial reports to the EC database.

Task 2.1 Design basis

The design basis is composed of requirements produced for each individual experiment derived from the regulations, short-term and long-term functions of the repository system and the specific role of plugs and seals, properties and conditions of plugs and seals, and technical feasibility of methods for production and installation of plugs and seals. The requirements and prerequisites are described separately for salt, clay and crystalline rock. Specific national conditions are considered in e.g. cases where the national regulations result in specific design premises. Even though all participating organizations don't have their own experiment running in DOPAS; the collected information and experiences can be adopted to their later use.

The design basis will be presented in a uniform way. Differences will be analyzed and the arguments explaining differences will be documented in one compilation report (D2.1).

Task 2.2 Reference designs Reference designs of plugs and seals are developed based on the design basis at appropriate levels of detail. The designs are developed separately for salt, clay and

crystalline rock as well as for the specific national needs, but common design components are defined early and described, applied and documented in a coordinated way. Different designs or components can be derived from constraints related to the site properties like bedrock, hydrogeology, hydrochemistry, fracturing, evolution of site and long term safety requirements may limit the use of different materials like organics, oxidizing compounds, sulphur, and nitrogen and others. What are the factors behind needs to be documented? The different reference designs will be documented in one task report (D2.2).

Tasks 2.1.and 2.2 are implemented in two phases. More advanced WMO's Posiva, SKB and Andra, which has already developed general design basis and reference designs in a systematic way has an opportunity to define the role of plugs and seals according to the procedures applied for other EBS components and gather description in early phase. When describing the design basis and reference designs for the advanced WMO's by the Month 6-9 there will be arranged a Task meeting (Milestone 2.1), where the difference in safety functions, requirements and site conditions between different type of plugging and sealing solutions for waste management programmes of participating organizations are discussed. The aim of the Task meeting is to provide guidelines for organizations, which approach in defining the design basis & reference design is not yet advanced, to continue their work within 2.1. & 2.2. Task 2.1. and Task 2.2. are finished by the Month 26, when other organizations have been able to finalize their design basis and reference designs.

Task 2.3 Strategies of demonstrating conformity of reference design to design basis

The different strategies for demonstrating conformity of reference designs are identified and described. The activities are separately developed for salt, clay and crystalline rock formations, and described for each type of plug and seal, i.e. shaft, ramp, drift and borehole and for each specific location in the concerned geological disposal. The different strategies will be presented and how they are applied in the full- scale experiments being part of DOPAS project. Results are documented in one task report.

Task 2.4 Final reporting of WP2 This task addresses the compilation of all WP2 results in one final WP2 report. The WP2 interacts with all demonstration experiments and feeds directly into WP3 and from there to other work packages. The outputs serve especially the ELSA experiment in its later stages that are carried out after the DOPAS project.

Task 3.1 – Design of plugs and seals
Andra focuses within Task 3.1 on the design of the FSS experiment including engineering work on the drift model (incorporating simulated recesses and over breaks), to make it fit with the experimental needs; engineering on the various work sequences anticipated for swelling clay core emplacement and concrete plug construction; engineering of the specialised handling tools (and installation equipment) manufactured and delivered for the purpose; engineering of the various swelling clay materials and low pH concrete formulations likely to be developed for the application; and on engineering of the commissioning means: tools and methodology.
RAWRA and CTU will focus on preparation of the selected niche for the EPSP experiment; grouting injection works in the vicinity of pressure chamber; characterisation of bentonite based material; production of bentonite pellets for sprayed technology (pellets with crushed ice);

engineering of low pH glass fibre shotcrete; installation of the plug monitoring system; and installation of the pressure and sealing plug.
As part of the design task Posiva will concentrate on developing and testing suitable criteria for selection of plug locations in crystalline rock using RSC- methodology (Rock suitability criteria); the detailed design of the deposition tunnel end plug, based on the design criteria. The work also includes the development of the concrete formulation for the design and the rock mechanical planning of the plug location. A test plan including the instrumentation for the full-scale test shall be compiled by Posiva, VTT and BTECH for the monitoring of plug behaviour and determination of leakage through the plug. The plan for testing plug behaviour will be assessed by using EE process (input around M9) as a pilot exercise before implementing the EE process for critical review of DOPAS project results (described in WP6). The excavation method for the plug location is to be selected during plug design in order to minimise the effect of the EDZ on the rock surface adjacent to the concrete plug. The design of the Swedish full-scale test was already completed by SKB during 2011 and the installation of the SKB full-scale plug demonstration at Äspö HRL was intended to be completed by autumn 2012. The installation of DOMPLU plug was realised in spring 2013 and is not part of WP3.

Task 3.2 – Laboratory work
The laboratory work to be performed is aimed at providing input for the detailed characteristics and properties of the materials applied in the demonstration experiments and providing an experimental database for analysing the capacity of long-term sealing materials. The laboratory work of Andra will include mainly material characterisation, in order to check that the measured performances are in line with the allocated performances for the clay material constituting the swelling core (most likely bentonite pellets and granular/powder bentonite);and the low pH shotcrete and the cast concrete.
With the laboratory program GRS will investigate sealing and backfilling materials planned to be utilised in salt and clay formations. The programme aims at providing experimental data needed for the theoretical analysis of the long-term sealing capacity of these seal materials. According to current R&D work on the salt option, the shaft and drift seal concepts considered in Germany comprise seal components consisting of MgO and cement based salt concrete (concept ELSA).
In order to demonstrate
• hydro-mechanical (H-M) material stability under representative load scenarios,
• the sealing capacity of the seal system and the impact of the EDZ as well as
• hydro-chemical (H-C) long-term material stability in contact with different brines under diffusive and advective condition, a comprehensive laboratory testing programme is carried out. This programme comprises investigations on:
• the mechanical stability of the seal materials and their hydraulic behaviour under representative load scenarios;
• the experimental determination of relevant chemical and hydraulic parameters for the modelling of the corrosion processes of salt concrete and MgO-concrete in contact with different brines under diffusive and advective conditions. This model shall describe in time and space, the corrosion processes in the technical barrier itself and at the interface with the host rock. Similar to the salt option, the host rock is the main barrier in a clay repository. Its damage and re-compaction behaviour under the impact of mining activities and in interaction with sealing components is therefore of uppermost importance regarding the demonstration of the sealing function of plug systems.

The proposed work includes laboratory experiments under representative repository conditions to study the damage/re-compaction behaviour and to provide necessary experimental data for model development/improvement. The investigation programme focuses on:
• the experiments of the damage/re-compaction behaviour under representative repository conditions (mining activities and seal construction/installation),
• involves damage-sealing tests with permeability measurements,
• involves long-term creep tests, and
• EDZ-simulation tests with large hollow cylinders.
Posiva together with VTT and BTECH will contribute to the laboratory work by the defining of concrete formulas or recipes for a plug made of low-pH concrete, which fulfils the tight requirements not disturbing the conditions in deposition tunnels, but also ensure the long term stability for plug. Also pre-tests and material information for ONKALO documentation is required for components remaining into the future repository and some supporting laboratory analyses are needed for that purpose.
Laboratory work of RAWRA and CTU will focus on geotechnical testing of bentonite pellets with crushed ice mixture and testing of low pH glass fibre shotcrete. This primarily focus is on testing domestic materials i.e. bentonite from the Rokle deposit. Further the focus is on laboratory work needed for both modelling and experiment performed by UJV
• comprehensive laboratory testing of materials used in the field scale experiment (WP3 task 3.4.2), including fluid and gas permeability, porosity, diffusivity, swelling pressure, corrosion etc, needed for modelling the performance of the plugs;
• the development of low-pH cement for plugs;
• the simulation of field-scale experiments by laboratory experiments.

Task 3.3 – Metric scale test
Andra will perform intermediate scale field tests which will include the following activities:
• metric tests of concrete formulas in plug component structures (cubic boxes for cast concrete, test panel for shotcrete) where curing parameters of concrete will be evaluated and mechanical performances (including shrinkage values) will be verified,
• granulometry spectrum of pellets will be optimised and accurately measured dry-density values of emplaced material optimised and compared to any pre-existing modelling,
• the samples will be from all cases taken and sent to a laboratory for measurements, inducing a potential iteration loop.
In addition, in the case of the clay for the swelling clay core, a metric box will be filled with the material used for the full-scale construction, applying the full-scale emplacement equipment, for a saturation test. This test aims at improving the understanding of the saturation process in a pellet swelling core and at measuring its kinetics. The test box will be backfilled using the same equipment as that used in the full scale experiment (most likely an auger) in order to obtain the same average dry density. Then a saturation device will be put on the bentonite.

Task 3.4 – Installation/construction of the demonstration plug/seal experiments
Within the framework of the DOPAS Project the construction and installation of 4 major in-situ demonstration projects will be realised. The demonstration activities will take place in (or at the vicinity of) three different underground research laboratories (URL`s) which have been constructed for the specific purpose of developing repository technology under repository-like conditions and the Rock Characterisation Facility ONKALO.

The demonstrations of repository technologies and the industrial scale construction of plugs and seals are important milestones in the view of supporting licence applications for geological repositories.

Experiment 1, Full Scale Seal (FSS)
Andra will be responsible for the Full Scale Seal (FSS) project which will be built inside a drift model fabricated for the purpose.
The main objective of the FSS is technological:
• the construction of a 1:1 scale of swelling core (bentonite pellets) and of low pH concrete plug followed by a partial dismantling of the support drift lining;
• industrial means and methods will be developed and qualified (compliance with design criteria);
• the commissioning means and methods will be developed and qualified to provide confidence in the seals hydraulic performance and hence in performance assessment;
• low pH concrete plugs must comply with the predetermined mechanical performance;
The "drift" should be 7.60 m in diameter (ID) and 35.5 m long. The drift concrete liner (70 cm thick) and the formation break-outs (recesses) likely to be generated by the drift lining deposition (up to 1 m depth at the liner extrados) will be simulated. Representative underground ambient conditions, i.e. temperature around 18-30 °C & hygrometry at 75 %, will be maintained within the drift. Low pH cast-concrete 5 m long plugs will close the volume of the swelling core. The core will be 13.5 m long. The construction methodologies selected for the construction of the various seal components are most likely:
• low pH cast concrete will be poured (if possible) in one continuous pass (to avoid discontinuities),
• low pH shotcrete will be applied in multiple layers, with minimum curing time between two layers,
• the bentonite pellet core should be constructed by using two augers working together, in continuous mode, while residual voids should be backfilled with shotclay.
On the drift perimeter, polycarbonate windows will be provided for observation needs and recesses will be integrated to the model structure for monitoring and coring needs. All the work sequences will be video-taken and a chronogram of operations established to assess the overall time needed for building a complete seal in a real DGR. Nagra will provide its own expertise and experience to the work, gained in particular via its knowledge base acquired in the ESDRED project, which needs to be extrapolated to a much larger scale and to industrial means.

Experiment 2. Experimental Pressure and Sealing Plug (EPSP)
CTU together with RAWRA will be responsible for the demonstration test performed in Josef underground facilities. The Czech concept has similarities to the Swedish or Finnish concepts; there are some important differences, particularly in plugging and sealing materials which will be addressed in the DOPAS project. In the Czech reference concept, bentonite from Czech deposits and new developed low pH–concretes tested by UJV are foreseen.
The Experimental Pressure and Sealing Plug (EPSP) Demonstrator will be constructed and operated in a small niche of the Josef Underground Laboratory. The main objectives of the in-situ demonstration work can be summarised as follows:
• a systematic test and application of Czech based materials and technologies;
• a comparison with the results produced for the consortium members of this project;
• the development and testing of new construction techniques such as sprayed bentonite;
• an application of low pH concrete or shotcrete as structural and sealing materials for the plug;

• comprehensive monitoring programme, which will be pre-assessed during planning phase, of plug and surrounding rock as one basis for its modelling and performance assessment activities.
The plug is built up of several (structural) elements such as the main fibre shotcrete sections; the walls of concrete blocks, a sprayed bentonite pellet section or filter layers. Free space (ca. 30 cm) will be preserved between the experimental plug construction and the face of the niche allowing use of the free volume of the niche created as a pressure chamber. This pressure chamber, built in the testing niche, will be connected with the adjoining technological niche by means of horizontal boreholes. The pressurisation (loading) of the experimental plug with various media (gas, fluid, sealing suspension) will be performed from the technological niche.
The plug, the structural layers and surrounding rock will be fully instrumented in such a way that the processes occurring during the plug's loading may be unambiguously identified, described and assessed. During construction particular attention will be paid to the evaluation of the shotcrete methods. The measurements will provide the data required for the numerical modelling of the processes arising in the plug and its vicinity (data will be used by RAWRA)

Experiment 3 SKB DOMPLU and Experiment 4 Posiva POPLU
SKB and Posiva need improved knowledge on plugging and sealing of deposition tunnels in crystalline rock. The stated reference design (which justifies the license applications for the final repositories in Sweden and Finland) needs to be proven to fulfil the requirements and it must be demonstrated that plugs can be implemented on an industrial scale. For both organisations the main purpose is to carry out a full- scale test at Äspö HRL (Sweden) and at ONKALO (Finland) of the plug in relation to current design criteria for KBS-3V plugs.
SKB`s reference design of deposition tunnel end plugs (corresponding to the DOMPLU experiment) consists of an arched concrete dome, a bentonite seal, filter materials and delimiters. Furthermore, a backfill end-zone has been introduced to take care of the swelling pressure from the backfilling in the tunnel, with the purpose of attaining a more static load on the plug. It has also been proposed to stipulate a rock excavation method for the plug that minimizes the risk of continuous EDZ and that also provides smooth rock surfaces of the concrete dome abutment. At moment, rock excavation by wire-sawing has been assumed functional, but since this has never been done before the specially adapted performance must be developed and trained. Wire-sawing of the DOMPLU test is not included in the scope of DOPAS, but experience from DOMPLU will be used to adjust the rock excavation methods for the POPLU test. Rock excavation is very time consuming, therefore it is essential to develop methods for drilling and sawing resulting in efficient installation of a plug, otherwise it can be critical for the future operation of a facility. In further plug development it is necessary to utilize experience obtained from the planned full scale test DOMPLU in Äspö HRL (2012-2013) to implement for the POPLU test at ONKALO (2013-2014). This also carries over to the selection of instrumentation, grouting, pressurization, performance monitoring and assessment for comparison of the two plug types (DOMPLU and POPLU).
Posiva will demonstrate according to the plan a wedge shaped plug (corresponding to POPLU experiment), potentially with backfill and/or seal layers behind it for generating pressure. These different designs are to account for potentially different environmental (water inflow) scenarios.

The plugs are very much a craft that requires feasible methods on an industrial scale for the purpose of their installation into a final repository tunnels. Material types, detailed measurements of components, fastenings and connections to the surrounding host rock, which varies in Sweden (massive granite) and Finland (anisotropic mica gneiss), contact grouting, mixing, handling and

inspection of concrete are examples of areas that must be evaluated for further optimization. The methods of plugging and sealing need to be improved regarding their reliability to meet the highest requirements. The logistics also need to be adapted and demonstrated as the function of the different access and disposal tunnel sizes used in the underground repositories of Sweden and Finland.
Although a plug is basically designed to meet the highest requirements, it is not entirely clear that a generic design of the plug is always the best solution. DOMPLU and POPLU tests are not replicates but good examples of proposed steps in an orderly development where both options are needed to make a wise evaluation. It is essential that no shortcuts are taken so that we are confident that the next step can be based on the previous one. Sufficient statistics and proofs must be achieved. The water leaking or flowing deposition tunnels require a different type of the plug compared with dry deposition tunnels. An in-situ test at one crystalline test site offers just one type of a host rock environment and therefore several tests helps to understand the behaviour of surrounding rock with different detailed characteristics like different groundwater and flow conditions or different orientation of the bedrock.

Experiment 3 SKB Plug (DOMPLU) at Äspö (monitoring phase)
The design of the Swedish full-scale test was completed during 2011. In 2012 detailed Activity plans are being compiled to be able to install the plug in a controlled manner. The SKB full-scale plug demonstration will take place at Äspö Hard Rock Laboratory (Oskarshamn, Sweden). The preparations prior installation started already in April, 2012. Consequently the installation of DOMPLU is not part of WP3 in DOPAS, but SKB's experiences from installation and monitoring phases will be included in the technical reporting in WP4.
The plug is made in full-scale which mean that it is installed in an SKB-standard deposition tunnel (horse shoe-shaped with dimensions height 4.8 m, width 4.2m). The plug system consists of a concrete dome, with a bentonite seal and a draining filter behind it. In addition, the experimental set-up will include 1 m of backfill (transition zone of bentonite) and an ending layer of concrete at the innermost rock wall. An EDZ-free zone is required for the rock surface at the concrete dome as well as for the bentonite seal. The rock abutment for the concrete dome is excavated by an innovative wire-sawing technique which consequently gives an octagonal concrete dome. In the centre of the dome the diameter will be approximately 8.8 m. Recent theoretical studies (SKB R-11-04) have shown possibilities to use an unreinforced plug made of low-pH concrete as a resistance in the deposition tunnels. However, a full-scale test is vital to validate the assumptions and the performed numerical simulations of the concrete dome.

Experiment 4. POPLU (Posiva) deposition tunnel end plug at ONKALO (construction and instrumentation phase).
The field work is based on the results of Tasks 3.1 to 3.3 the primary objective of Posiva within this task is the construction of a full-scale plug test.
The full-scale plug test is constructed to demonstrate that the plug design can be implemented on an industrial scale and that the design and behaviour of the plug is according to the specifications. Posiva will remain in close contact with SKB, and will learn from their experiences with their more advanced plug experiment. If necessary the implementation of the Posiva plug can be modified based on the lesson learnt from the SKB experiment. SKB will evaluate and review the plans for experiment and will undertake internal peer review feedback in the reporting phase. The Posiva plug test is installed in a Posiva-size deposition tunnel during 2013 and 2014 (M18-24). The

detailed design of the plug is developed in Task 3.1. The plug shall consist of a concrete part and possible adjacent parts such as a bentonite seal and a filter layer. An EDZ-free zone is required for the rock surface at the plug location. The plug needs to be instrumented to be able to follow its behaviour in WP4 and that part of the work is done by VTT and BTECH.
The rock abutment for the plug is excavated by an innovative wire-sawing technique. The introduction of wire-sawing as a rock excavation method for the concrete dome abutment is a unique solution that will be tested for possible industrialisation. Selection of the construction technique has been pre-assessed by SKB. But the use of wire sawing at disposal depth in large scale has not been demonstrated as a method for producing a plug location. If the method used for SKB Plug location excavation (outside the DOPAS) meets the requirements, then no pre-assessment is required. If the method needs to be replaced, a pre-assessment of the method needs to be carried out by Posiva.

Task 3.5 Coordination and integration of results
Final reporting of WP3 (Andra) completes this work package. The report will address the lessons learned from these experiments and their constructional feasibility in an integrated manner. In addition, the experiments themselves will be reported in WP4.

Task 4.1 Mock up test and Full Scale Seal
Andra's FSS demonstration experiment is complemented by a mock-up test at a metric scale (in Task 3.3.) The volume of injected water and the moisture evolution of the bentonite will be monitored as well as the swelling pressure. The data will serve as confirmation and verification of the initially allocated performance assigned to the swelling clay core.
As the main objective of the FSS (Task 3.4) is a technological demonstrator, the FSS is not focused on the phenomenological survey, and thus not providing a forecast on long-term behaviour. However, in particular via the activities carried out in the complementary metric scale test, a key point is the extrapolation of the evolution both in time and scale. The FSS experiment allows for qualification of the commissioning methods of an actual sealing system in the DGR, as built, at the time of industrial operations.
The quality approach anticipated for commissioning consists of:
• measuring the average dry density of emplaced material (pellet weighing and volume 3D scanning);
• video monitoring of backfilling with a focus on the contact quality at the rock/core interface to assess residual voids;
• the qualification of the dry density measurement method will be implemented by using specific tools (e.g. gamma meters).

Task 4.2 EPSP test, loading and monitoring phase
The instrumentation and monitoring installations of the in-situ experiment will allow identification, description and assessment of processes that occur during the plug's loading sequences. The monitoring data will also provide a comprehensive data set for numerical THM modelling.

For the evaluation of the plug system function the following three areas are of particular interest:

• the surrounding rock environment (e.g. stress state changes imposed by loading of the plug;

• the rock contact with the pressure and sealing plug in structural layers (shotcrete and in the shotclay layer);
• the pressure and sealing plug (e.g. penetration of fluids, changes in gas permeability, swelling pressure).
The measured parameters will be evaluated against the prediction made.

Task 4.3 Pressurisation and monitoring of DOMPLU plug at Äspö
Monitoring of the experimental set-up at Äspö HRL will preliminarily include 42 sensors for the concrete dome and 45 sensors for the clay and filter parts. Sensor cables will be led via pipes in the rock to a monitoring station in a nearby tunnel. A pressurisation system will be installed in order to stepwise build up and maintain high pressure according to a defined test programme.
The main goal of the full-scale test at Äspö HRL is to determine leakage through the plug (and the contact surfaces between the rock and the concrete) at the design pressure of 7 MPa. Furthermore, a load-test of the plug up to 10 MPa will be performed within the frame of WP4.
The leakage through the plug will be determined by frequent measuring in a sealed atmosphere just outside the concrete dome. Data from sensors in the full-scale test will be monitored continuously. The test-period starts in late 2012 and continues throughout 2013, data and experience are reported during 2014. Posiva will review SKB plans throughout this work package. In addition SKB will review the POPLU plans for this work package too, and will provide internal peer review for feedback, which will be used in the WP4 reporting.

Task 4.4 POPLU plug experiment's leakage measurements and monitoring
The main goal of the full-scale test is to determine leakage through the plug (and the contact surfaces between the rock and the concrete).
The primary objectives are:
• to evaluate the amount of leakage through the plug and the contact surfaces between rock and concrete, and to compare the leakage value to the estimated maximum allowable leakage;
Reasoning for the acceptability of the measured leakage will be given:
• the leakage measurement equipment is developed further in this work-package if necessary, in order to confirm the validity of the measured leakage values.
With the full-scale plug test constructed during 2013-2014 the testing of the plug will commence according to the test plan outlined in Task 3.1. Water pressure is applied behind the plug at stepwise intervals to simulate the design lifetime. The full-scale plug test will be monitored by the instrumentation installed during the plug construction. The instrumentation used in the monitoring the plug test shall be described in the test plan combined in Task 3.1, including properties of temperature, relative humidity, strain, displacement, swelling- and total-pressure. The monitoring is concentrated on the behaviour of the concrete part and the possible adjacent parts of the plug, and on the determination of leakage through the plug. The experiences on POPLU will be compared and analysed together with DOMPLU related to the behaviour of plug and lessons learned.

Task 4.5 Production of WP4 Integrated Report
NDA and GLS will develop an integrated state of the art report considering the outcomes of this WP and including the main finding of WP2 and WP3 as far as required at this stage of the project. This report will serve as the entry point for WP5. The evaluation and assessment of the plugs seals function within needs a close interaction with WP2 and of course with WP3. This work package is

delivering the basis to WP5. The report draft will be available by the month of 36 in order to review the content by EE process. The final integrated report on WP4 is available by month 40.

Task 5.1 Performance assessment of (parts of) the plug and seal systems and identification of the relevant tools for predicting the behaviour of a complete sealing system

Andra will contribute to this task by describing its PA methodology for sealing systems in clays and summarising the lessons learned from the different PA modelling. Specifically addressed will be:

- phenomenological analysis of repository situations;
- phenomena and their couplings throughout the repository evolution;
- the phases of this evolution from the sealing system's construction up to 1 million years;
- and a timing chart of the various phenomena.

GRS will complement the clay related PA work by modelling of the damage/re-compaction and sealing behaviour of clay rock. The work comprises model development (theories and mathematical formulation of models, determination of associated parameters, implementation and testing of the models in CODE_BRIGHT) as well as numerical modelling to validate the models in use by simulation of the well-defined laboratory tests (WP3 Task 2) and selected examples of the in-situ experiments of WP3 Tasks 3 and 4 as well as to predict THM processes in the EDZ surrounding the repository openings.

For salt formations performance assessment studies of GRS address long-term stable shaft seals in salt formations using process-level models. Models will be improved on the basis of the laboratory data generated in WP3 Task 2 and possible data and modelling gaps will be identified.

Knowledge and data will be derived from WP3 Task 2 concerning the mechanical-hydraulic and the chemical-hydraulic (MH and CH) behaviour of seal components (MgO and cement based salt concrete). Existing PA models will be improved and numerical simulations of a shaft seal conceptualised in the German project ELSA will be performed to assess the seal performance.

DBE TEC is focussing its activities within this task to further improve the understanding of granular materials as backfilling and sealing. Many concepts for the construction of backfilling systems as well as sealing systems for shafts and/or drift seals consider granular materials as a basic component. For example for shaft sealing elements bentonite plugs are often assumed to consist of bentonite pellets compacted during the implementation. Similar concepts are discussed for the construction of sealing elements consisting of crushed rock salt. The granular rock salt for example is foreseen to be implemented as a loose filling, followed by in-situ compaction to a certain material density.

To improve the understanding of compaction processes under in-situ conditions and the resulting parameters like total porosity, pore space geometry, connected pore space available for fluid migration (“effective” porosity) and permeability, the implementation of individual sealing elements and their evolution over time will be simulated and analysed by applying numerical particle codes which use particle arrangements to simulate the material behaviour of a granular material. The above mentioned parameters obtained during these process level computations can then be used as sound input parameters for the Performance Assessment calculations. Material models for particle arrangements representing backfilling and sealing material will be developed, with the main focus on crushed rock salt. Laboratory investigations on crushed rock salt's compaction will be used as a basis for model calibration. The compaction processes of shaft sealing elements will be simulated under in-situ stress conditions and the evolution of relevant parameters like porosity, pore space geometry and permeability over time will be analysed within the sealing

elements. The quality of the compaction depends on the grain size distribution of the granular material. Numerical simulations based on the particle models will be carried out in order to determine the most suitable grain size distribution for in-situ compaction.
RAWRA and UJV will focus on a deeper understanding of processes occurring in plugs and seals of a repository in a granite host rock. For this purpose, UJV will identify and test the tools needed for the prediction of the processes occurring in granite host rock.

Task 5.2 Conceptual models and simulation of relevant processes and their evolution within individual sealing components
Andra will describe the processes involved with time and space, focusing on the relevant coupling and uncoupling (e.g. thermal vs. resaturation, gas migration vs. resaturation) in clays. This work is used to develop conceptual model simulation, in order to assess the long-term behaviour of the seal system.
GRS will evaluate the laboratory work, the demonstration tests, and process-level models developed in task 5.1 on the basis of the experiments performed in WP3. The abstraction process of safety-relevant features and processes used in detailed process-level models with regard to integrated PA models without loss in quality will be considered.
The compilation of national and international safety standards and safety requirements done in WP2 has to be considered, to evaluate their influence on the long-term assessment strategy, model set-up and choice of safety and performance indicators.
The development of a conceptual model for salt based granular backfill material, based on the results of task 5.1, will be performed by DBE TEC. This includes a simplification of the obtained results to get an integrated conceptual model to be used as a sound basis for the performance assessment calculations.
RAWRA will conduct THMC analyses, focussed on bentonite and cement materials. Conceptual models for various processes identified in Task 5.2 will be created. The data obtained in WP3 will be compared with the results from the numerical models. The possible differences will be interpreted and, if required, the conceptual models will be reformulated on the basis of the results obtained.
Posiva will provide input for these analyses and integrate its experiment work with these analyses.

Task 5.3 Development of conservative PA methodology and models for analysing the complete system behaviour
This task focuses on the development of integrated long-term performance assessment methodology to analyse the system behaviour and to demonstrate the contribution of the plugs and seals to the overall safety. The work performed in this task among others includes the following topical fields, each of them dealt with by different organisations, ensuring the necessary integration for these topics:
• Development of integrated models (dealt with by ANDRA and GRS): The models for long-term safety analyses are further developed to reflect the state-of- the -art of process modelling to include sealing systems into the PA in an integrated way.
• Development and application of safety indicators and safety functions (dealt with by ANDRA, GRS and NRG): Safety functions and performance indicators are used to measure the performance and to demonstrate the efficiency of the sealing system.
• Uncertainty and sensitivity assessment (dealt with by ANDRA, GRS and RAWRA/CTU) for identifying and defining the key uncertainties in the PA and their implication on the overall system

performance: The outcomes are expected to emphasise the role and robustness of the plugs and seals system.
In detail the different organisations participating in the Task 3 plan to perform the following work:
In parallel with the work carried out in Task 2 in this WP, Andra will identify uncertainties in processes involved and related to nature, different time scales and scales in size. Further links will be drawn with the safety functions of the seal system producing definitely conservative and reliable models for plugs and seals in clay formations.
Integrated Performance Assessment calculations will be performed for selected scenarios and generic repository systems with the focus on salt and clay formations. These calculations are based on the repository concepts developed within the current German studies. The robustness of the system with emphasis on the role and behaviour of the plugs and seals will be checked by uncertainty / sensitivity analysis. The remaining key uncertainties will be identified and if necessary, methodology for treatment of these uncertainties will be further developed and applied.
Specifically GRS will:
• implement all necessary processes and their interactions in the integrated PA-codes.
• run integrated performance assessment calculations for a generic repository system in rock salt and clay considering selected scenarios,
• apply uncertainty/sensitivity analyses to check the robustness of the system depending on the role and behaviour of the plugs and seals,
• identify remaining key uncertainties and, if necessary, adapt or further develop the concepts and methods to treat these uncertainties.
RAWRA together with UJV will conduct sensitivity analyses of selected plug and seal parameters to determine the importance of a component/process for the concept of spent fuel/carbon steel/bentonite/granite.
The objective of NRG's contribution is to develop and test a methodology that allows the integration of the results of technical demonstrators into the high-level waste Safety Case. Presently the results of PA calculations are used in a Safety Case by as so-called Safety and Performance Indicators (see e.g. the FP6 PAMINA project). NRG aims to develop a strategy for integration of demonstration results by identifying meaningful Performance Indicators that have two characteristics: a) the indicator is directly or indirectly measurable in demonstrators and b) the indicator allows the assessment of the complete system behaviour. The work will be divided into five steps:
1) Development and description of the overall methodology, in particular the extensions needed to include demonstrators in existing methodologies.
2) Identification of (new) indicators that can potentially be measured and analysis of its technical feasibility by interaction with other WPs (in particular WP3).
3) Qualification of the potential weight (or relevance) of the indicator on the (seal's) performance status by discussing its potential impact on the overall safety, e.g. 'confirmation of performance or safety function'.
4) Establishment of a generic demonstrator case, and development and application of a suitable PA model representation (either by NRG in-house tools or use results from other partners in WP5) to derive potential evolutions of the selected indicators in time.
5) Analysis and discussion of the results of the actual demonstrators/experiments performed in DOPAS - as far as available at the end of the project - in the light of the indicator methodology and especially on lessons learned that would be transferable to the crystalline host rock environments.

CTU will focus on providing the EPSP measured data (from WP4) and taking part on continuous analysis and evaluation of the results of the related numerical modelling.
The result from task 5.3 of each step will be reported in DOPAS-internal memorandums. These memorandums used as input to for the Deliverable reports of this WP: the results of step 1, 2 and 3 will be reported in D5.4 "Status report on conceptual and integrated modelling activities" and all results will serve as basis for D5.10 "WP5 Final integrated report".

Task 5.4 Integration of WP5 task reports
As a work package leader GRS will take the responsibility to integrate the task reports to a final WP5 report, which will be delivered in month 42 for EE evaluation and published in M45. The requirement on conceptual and integrated modelling as well as process modelling (WP5) will be checked against the quality of the provided laboratory data of WP3 within the status reports (month 24), including the declaration of further demands. Topics to be dealt with also in respect to their suitability for the entire experiment host rock environments in the WP5 report are
1) Description of safety concepts for the sealing system and their reference designs for each host rock related to the 5 full-scale experiments planned or performed within DOPAS to fulfil the defined safety concepts. (Linked to WP2 requirements and design basis outcomes).
- Timescales over which the function of the sealing system has to be shown
- Commonalities and differences between sealing systems in different host rocks
2) Strategies to demonstrate the long-term performance of the sealing system in PA:
- Overview on processes to be considered in modelling
- Justification of the abstraction from all DOPAS experiments to process understanding and process level modelling (Link to WP3)
- Justification of abstraction from process level modelling to integrated modelling over long time scales
- Both steps should indicate the simplifications and the uncoupling of processes assumed in each step.
This includes the boundary conditions under which the assumptions can be justified.
3) Integrated performance assessment and description of system behaviour based on the information on all
DOPAS experiments
- Indicators allowing for assessment of the system behaviour
- Overview of obtained knowledge on the actual long-term system behaviour
- Uncertainty and sensitivity of the processes involved
- Remaining open questions.

Task 6.1 Planning for the Integrating Analysis in WP6
As part of this work package a preparation for the plan by Posiva and the Management Team and General Assembly for the integrating analysis that will be kicked-off in the form of a pilot action for reviewing the test plan for plug behaviour Posiva's POPLU experiment around months 8-12 and the actual EE process planning, design of the EE tools, and selection of expert group (generalists and specialists) commences around month 24. The experiences from the pilot EE will be used in the planning and implementation of the review process by means of EE. The plan is to be ready by month 30. In the plan the integration of external experts (organised by the WP6 leader) are introduced to the Posiva - VTT methodology of Expert Elicitation (EE) used successfully in review

and results integration work at Posiva. The EE process is a way of producing and documenting expert views on potentially controversial issues in a formalized, traceable and transparent way. Besides Posiva, Andra, GRS, SKB, RAWRA and CTU are foreseen to contribute to the planning of EE process and tool development especially for the questionnaires and descriptions on various issues.

Foreseen draft schedule of the EE activities with responsibilities (the foreseen duration of the EE process for each target is 3 working months in average).

Deliver-able #	Full name	Contact person	Draft for EE ready date	Input needed by date (ref. timetable rev. Feb2013)	Internal QA (I), Publication permit (P) date if available	Final submission date of deliverable (DoW date in parenthesis)
D3.25	POPLU test plan	VTT/Erika Holt	30.5.2013	30.9.2013	30.10.2013	M15 (M12)
D2.4	Work package 2 summary report	SKB/ Behnaz Aghili	2.9.2015	30.11.2015	20.2.2016/ 10.12.2015	M42 (M41)
D3.30	WP3 final summary report	Andra/ Jean-Michel Bosgiraud	15.1.2016	31.3.2016	29.4.2016	M44
D4.4	WP4 Integrated report	NDA/Mark Johnson	31.8.2015	30.10.2015	31.11.2015	M40
D5.10	WP5 final integrated report	GRS/Andre Rübel	28.2.2016	29.4.2016	30.5.2016	M45 (M44)

Task 6.2 Programme on exchange of expert staff

Expert staff exchange (only to consortium) between beneficiaries in different stages of the demonstration implementation to the underground facilities where the experiments at the stage of demonstrating the technical feasibility are in progress (to Bure, ONKALO, Josef Gallery). Duration of 2-4 days exchange is foreseen. The expert visits can take place at different phases of the experiment and a travel report is produced from the expert visit in the relevant work package and distributed to the consortium. The aim of the expert visits is to enhance the integration and learning between the different experiments. Some expert visits can also take place in connection with the WP3.

Andra, Posiva and CTU are expected to contribute to hosting the expert visits as part of their contribution to this task.

Task 6.3 Expert Group for the peer review using the EE process and its documentation (tentatively four experts approved by the General Assembly and the EC)

The General Assembly appoints the members of the Expert Group for the EE process in consultation with the EC project officer given the task to make integrating and critical analyses of the achievements and results and to advice the Management Team and General Assembly in the technical matters using the EE method tentatively on the following alternative topics produced in the DOPAS project. The topics are tentative, since the aim is to use the EE process especially in handling controversial issues as an outcome of the DOPAS process. The end result of the EE will be a consensus view on such issues that need to be taken into account as input in the final public deliverables of the DOPAS work packages WP2, WP3, WP4 and WP5:

- the achievements and results for the chosen plugs and seals (approach, methods and technologies per host rock);
- soundness and relevancy of the technical approach;
- assessment of the scientific and engineering standard of the work carried out;
- review of the produced RTD deliverables especially from WP2, WP3, WP4 and WP5.

The EE meetings are organised in two separate sessions with individual expert work in between. The amount of EE meetings is dependent on the timing of the outcomes of the project for elicitation on the time of processing each topic by the expert group. Half of the experts are foreseen to be selected from within the IGD-TP participants and other experts from outside the IGD-TP. The IGD-TP experts are hoped to provide in-kind contributions for the expert review. The expert selection requires both experts who are either scientific or technical specialists around an issue to be elicited and also radioactive waste management generalists, who have a good understanding of the overall impact of the repository development and on how the safety of the repositories is impacted by the different subsystems of the repository.

The EE process includes a production of structures tools (mainly questionnaires) for the experts' views, contextual and structural descriptions of the issue that is elicited, and a formal documentation of the elicitation outcomes, which is edited by the organisers of the Expert Elicitation (Posiva). The public deliverable (D6.3) of this task includes the tools used in the elicitation (excluding the replies of the individual experts), the consensus views (minutes of the meeting) of the experts on the issue elicited together with the (consensus) contextual and structural descriptions and the recommendation for inputs into the final published reports as the final review outcome.

Posiva will organise, induct and document the EE processes together with the experts. The General Assembly including all beneficiaries together with the EC project officer contributes to the selection of the experts. Posiva also handles the contracting of IGD-TP external experts for the EE peer review from the WP6.

Task 6.4 Final technical summary reporting of the DOPAS project (Posiva, All participants)

Each WP will provide a final report on the results of that particular WP, and the task in Task 6.4 is to combine and merge them after their publication into a final technical summary report (D6.4) giving an overview of the main project results, the lessons learned and experiences useful for implementing plugs and seals in various disposal concepts and high-lighting the future open questions related to plugs and seals. The report takes into consideration the inputs from the EE process if these have not otherwise been integrated to the final reports of the Work Packages 2-5. By definition are all RTD WPs (WP2-WP5) interacting with WP6 and especially all partners interact and contribute to the final public report produced as the result of task 6.4.

Task 7.1 Dissemination and exploitation plan

This task consists of the production of a dissemination plan addressing the identified target groups of DOPAS.

The plan is updated if required at the end of the project concerning the exploitation of the project's foreground and it addresses IPR and potential industrialisation of outcomes, too. The plan describes in greater detail the strategic activities foreseen throughout the project to communicate the project's purpose, progress and results with a view towards confidence building among the key decision makers and the general public. These activities will be carried out in an integrated manner with the IGD-TP and its Secretariat as detailed in the dissemination plan.

The dissemination plan will address the content described for dissemination including success criteria for the dissemination. A major success criterion is the outreach of the DOPAS in relation to its different defined target groups for dissemination (see below) and the number of publications either as project deliverables or as other public documents and presentations. Also the success criteria like the feasibility of implementing the planned experiments will be communicated. Part of the dissemination activities will be carried out in cooperation with the IGD-TP Secretariat, since the DOPAS project is first major IGD-TP Deployment Plan's Joint Activity.

Dissemination activities towards additional target groups beyond the RD&D stakeholders are foreseen as explained in the dissemination plan. The following messages are indicative in relation to each important target group.

Target group 1: General public incl. political decision makers and NGOs should be addressed with the dissemination of general information about the safety of geological disposal, the importance of demonstrating full scale plugs and seals for the safety, and the state of the art and practical implementation of such demonstration work.

Target group 2: Waste management organisations and organisations responsible for the implementation of a waste management programme need to be disseminated and transferred e.g. specific scientific knowledge both public and confidential about the design basis, technical feasibility and technical reliability of full scale plugs and seals experiments among the project's implementing organisations for the advancement the scientific and technical basis of the safety of plugging and sealing in the various repository concepts and for their licensing.

Target group 3: Research institutes and consultants and overseeing authorities/regulators and TSOs need dissemination about the new state of the scientific and technological state-of-the-art (as a starting point for new related research and consultation activities and opportunities and for having new competence in engineering and construction and dissemination of the country specific scientific and technical data and the results of the integrative analysis to the authorities as a part of the bilateral or wider dialogue with the overseeing and licensing authorities (this type of information may be also restricted in nature to the consortium members and their subcontractors in the project). They may also be asked to participate as peer review experts in the EE process defined in WP6.

Target group 4: Universities and new experts and professionals need the dissemination of the non-confidential scientific and technical knowledge to university professors, trainers, professionals with little prior knowledge about the topics from various organisations in the scientific community, industry and authorities, post-graduates (in the first place doctoral students) with an emphasis of widening the scientific and technical body of knowledge about the safety requirements, technical

feasibility and performance assessment related to plugs and seals in geological disposal. This is particularly addressed in Task 7.2.

Task 7.2 Planning, implementing and disseminating the outcomes of "Plug and seal training workshop"

The work package organised together with the consortium and by the planning group aims in its learning outcomes in the plugs and seal training workshop at least to disseminating and root the extended body of knowledge about full scale plugs and seals to universities and professionals working.

The workshop will be organized in the middle of the project (around project month 30-38) and the main alternatives to focus on the content are either to verify the design basis and requirement for such a full scale experiment and the other one on the demonstration of the feasibility of a full scale experiment either in the Nordic countries (Finland or Sweden) or in the Czech Republic. The planning of the learning process despite of the focus selected will address the whole DOPAS framework (Figure 1) to ensure that the learning produces a full picture of the questions that need to be addressed when planning for full-scale demonstrations for plugs and seals in different regulatory and geological environments.

The training activities will be done in interaction with the other work packages (providing trainers and therefore the cost for training is kept in moderate level) and in cooperation with the IGD-TP's CMET working group for ensuring wider knowledge transfer of the public results from DOPAS' scientific and technical work.

The use of external tutors will be defined also during the planning process of the workshop. Efforts will also be made to select post graduate or Master students from applicants to training from Universities in the European Union and Switzerland to participate the workshop and match opportunities for on-site training. No special grants for participants are foreseen, but arrangements by the WP7 to cover some participant groups (e.g. students) accommodation and boarding costs remain an option depending on the final cost of the training. The participants from the industry to the training are expected to cover their own travel and subsistence costs.

Task 7.3 Organisation in cooperation with the IGD-TP of an international seminar in 2016

A full- fledged international seminar would take place during the last project month in 2016. It is planned to be organised by the WP7 leader in cooperation with other participants at location to be proposed by the WP7 leader and the IGD-TP Secretariat. The event is foreseen to have at least the following purposes: exchanging information among the participants and their core of professional network and to disseminate information on results to a broad public of technically trained persons. The international seminar will focus on plugs and seals and the lessons learned around the full scale demonstrations from 2012 to 2015. For the seminar a call for papers will be issued and the seminar papers will be published on the IGD-TP/DOPAS website in pdf -format and in a limited number in the form hard copy proceedings (print and/or CD). As a part of the seminar arrangements the IPR of the papers will be addressed to ensure the publication of the proceedings as planned. A programme planning group in cooperation with the IGD-TP will be set up as a task force for planning the programme content (including a plenary, poster sessions and/or workshops, and thematic presentation of submitted papers). International organisations and waste management and research organisations outside DOPAS consortium will be invited to join to the planning group and a general rapporteur independent from the research organisations involved in DOPAS will be nominated by planning group to produce an overall seminar summary.

The contributions to this work package task come mainly from Posiva (as Posiva is the responsible organisation for seminar arrangements) , GSL and NDA with contributions also from the IGD-TP Executive Group and the Secretariat (run by NDA at the time of the call of papers) and from the other consortium members.

Task 7.4 Publishing and presentation of public results of the DOPAS activities
Each Work Package is expected to produce results which are of interest to share with worldwide experts in order to foster an international dialogue and to expose finding and conclusions to in-official reviews and in-official comments. Each Work Package 2-4 leader will address this issue by proposing suitable means of publication of results in professional journals, as oral or poster presentations at seminars or conferences, where the majority of the participants are regulators like e.g. the annual “Eurosafe” conference. This activity targets to the political and governmental decision makers and regulators is potentially coordinated together with the Secretariat of the IGD-TP. The aim is to produce and publish in total at least five papers of the experiments (SKB, ANDRA, GRS, POSIVA, and RAWRA) within the DOPAS project. Further the consortium intends to be an active presenter in seminars and other venues throughout the project duration.

A project description is prepared early in the beginning of the project for the "Euratom FP7 Research & Training Projects" project compendium and two 2-paged documents will be written about the scientific and technical achievement of the DOPAS project at the end of the project. These documents are aimed foremost for the technical community and for the general public and decision makers respectively. This task 4 also includes the production of regular electronic newsletter about the DOPAS progress and achievements at 9 months intervals, the preparation of four experiment specific posters acknowledging the EC contribution to the DOPAS and placed on the four experiment sites or in their direct vicinity at Äspö, ONKALO; Bure and URC Josef as soon as the experiment locations are known at each site.
The input directly to this task is provided by Posiva and the other three organisations running the experiments: SKB, ANDRA and CTU.

5 OUTCOME OF THE PROJECT

The successful implementation of a repository programme relies on both the technical aspects of a sound safety strategy, and scientific and engineering excellence as well as on the social aspects like stakeholder acceptance and confidence. Demonstration experiments performed in underground research facilities are a key element in demonstrating feasibility of engineered barrier systems (EBS), plugs and seals being an integral and important subsystem of EBS. The analysis and knowledge dissemination of the state-of-the-art of such repository components will increase the overall possibility for implementing geological disposal facilities in Europe.

Five different designs of plugs and seals systems for different types of host rocks and for different purposes are the target and their experimental set-up is demonstrated wholly or partly in DOPAS. Although the plugs and seals concepts differ between salt, clay and crystalline host rocks, there are many issues the different designs have in common, like materials, manufacturing methods, transports and installation methods and machines. DOPAS develops design basis, reference designs and strategies for verifying the compliance of designs to the design basis and collects jointly the

demonstration experiences so that the information can be applied in the different plugs and seals concepts involved now as well as in the future. Without this project and European funding the Member State level concept development will continue separately and the information and knowledge sharing will be limited despite the IGD-TP's efforts.

The project deploys the main objective of the Implementing Geological Disposal of Radioactive Waste Technology Platform (IGD-TP), which has the overall objective to initiate and carry out European strategic initiatives to facilitate the stepwise implementation of safe, deep geological disposal of spent fuel, high-level waste, and other long-lived radioactive waste by solving the scientific, technological and social challenges, and to support the waste management programmes in the Member States. The platform intends to constitute means to further build confidence in the solutions, for reducing overlapping work, to produce savings in total costs of research and implementation, and to make better use of existing competence and research infrastructures. Other waste management organisations can be expected to benefit from the work completed through participation in Workshops and access to the published information.

The experiences from the demonstrations successful or not contribute towards the expected impacts listed in the work programme by:

- Establishing requirements on plugs and seals in different European countries based on a common view on the influences from national and general factors respectively.
- Establish design basis for different types of studied plugs and seals.
- Develop designs for such plugs in tunnels and for various shaft seals.
- Develop strategies for demonstration of design compliance with design basis.

The impacts can be realized from demonstration testing and improving of

- Safe and feasible construction of plugs in tunnels
- Manufacturing and plugs and seals components.
- Efficient installation of plugs and seals.
- Enforcement of accurate control methods for evaluating results versus design basis.
- Verification of design compliance to design basis.

The main outcome of the project is the full scale demonstrators, which will be planned, constructed, tested and assessed within the DOPAS project. The full scale experiments are mainly implemented within Work Package 3 and Work Package 4, where the main outcome is deliverables describing the different phases for implementation and commissioning of full scale tests. Work Package 2 increases the understanding of background for selecting a proper plug and seal design, which is appropriate for different geological environment and fulfils the different stakeholder requirements. Therefore the state of the art for design basis and reference designs will be collected prior construction phase of the demonstrators. The Work Package 5 evaluates the performance assessment (PA) and long term safety related aspects of the plugs and seals implemented within DOPAS Work Packages 3 and 4, but also the generic PA aspects for plugs and seals.

The confidence among decision makers and the public is built by arranging international workshops and technical visits to the demonstration test for invited groups (including for example

governmental regulators). The international seminar will be arranged in 2016 and its main target is to collect the lessons learned from the demonstration tests. The presentation of the results of the DOPAS project included compiling a public summary report from each work package. Also the experiments carried out will be reported. All the main findings and experiences will be collected and discussed in a final technical summary report.

The outcome is compiled into the Deliverables, which are listed in Appendix 1

6 MANAGEMENT STRUCTURE, RESPONSIBILITIES AND DECISIONS

The management of DOPAS project is described in Figure 1. The overall responsibilities and obligations of the consortium are defined, in addition to the EC-GA, in the consortium's Consortium Agreement (CA).

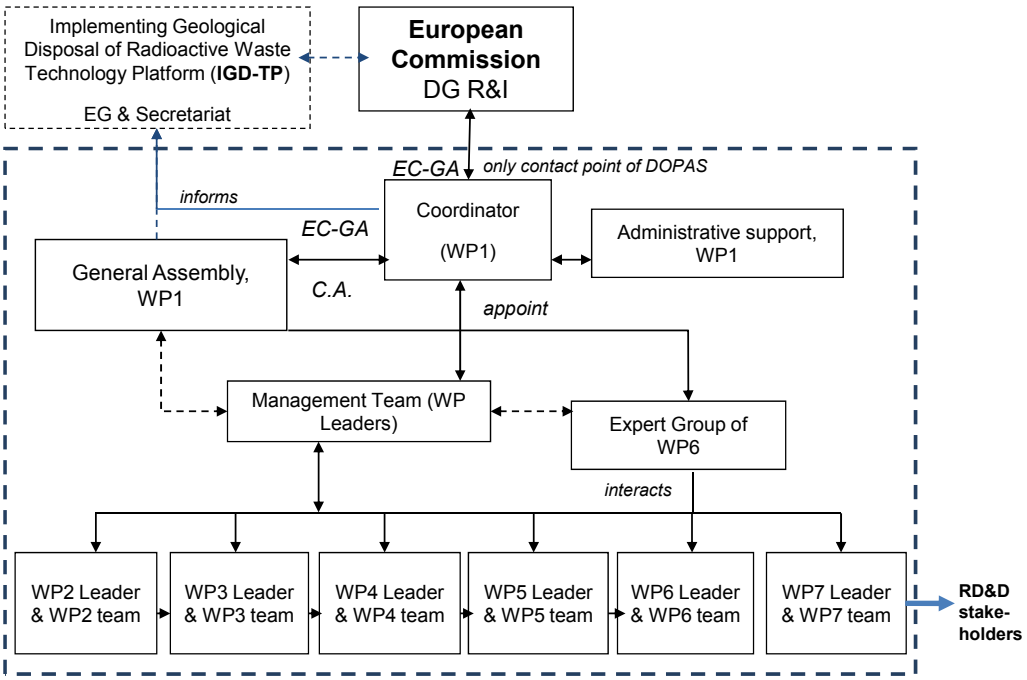

Figure 1.DOPAS Project management

6.1 General Assembly

A General Assembly is established for governing the work consisting of one official representative of each per Beneficiary. Other expert representatives (especially IGD-TP EG members) from the

beneficiaries and third parties can participate in the General Assembly meetings as observers and advisers in a steering role.
The Coordinator, Posiva, calls the General Assembly meetings and chairs them. Posiva convenes the first General Assembly Meeting as a kick-off for the project within 75 days from the fixed start date of the project. In addition, the project coordinator informs to the IGD-TP Executive Group via its Secretariat about the progress of the DOPAS project.
The General Assembly will provide technical guidance and is responsible for the management and financial control, through the Coordinator, who is supported by administrative staff and co-coordinator. The General Assembly has the ultimate responsibility for periodic assessment of project status and progress, as well as for periodic and final reports, and reviews the deliverables and approves deliverables that are published (PU level). Other items such as the dissemination of results, intellectual property rights, and legal regulations are included in the Consortium agreement and the consortium agreement stipulations will be complemented with the General Assembly. The European Commission project officer is invited to General Assembly Meetings.

6.2 Coordinator

The Coordinator is solely responsible for liaison between the DOPAS project and the European Commission. The Coordinator reports to the European Commission according to the EC-GA and interacts with the General Assembly according to the EC-GA and the Consortium Agreement.
The Coordinator is responsible for carrying out the tasks defined by the EC-GA and the CA (see WP1) and for overseeing the overall progress of the DOPAS project according to the Project Plan and the Risk Management Plan included into the Project Plan. The Coordinator is to have the casting vote in the General Assembly and in Management Team Meetings.

6.3 Management Team

The Management Team, consisting of Coordinator (Chair), each Work Package leader and RAWRA's Experiment Leader and potentially other Experiment leaders coordinates the work across Work Packages. The Coordinator may call other people to assist her in these management team meetings, which are also called technical project meetings. The Management Team can also invite experts from the WP6 Expert group and other experts to their meetings in agreement with the consortium members and within the project's budget in cooperation with the WP6 leader.
The Management Team assesses the status and progress of each WP. The Management Team shall meet at appropriate intervals and at the request of Coordinator or at any other time when necessary at the request of one of the Management Team participants.
The Management Team shall seek consensus among the Parties and monitor the effective and efficient implementation of the Project. In addition, the Management Team shall collect information on the progress of the Project, examine information to assess the compliance of the Project with the Project Plan and ECGA Description of Work (DoW) and, if necessary, propose modifications of the Project Plan to the General Assembly. Management team meetings will be held in conjunction with General Assembly meetings when possible and some main subcontractors are invited to the meeting to present their experiences for a wider audience when considered appropriate for consortium.

Work Package Leaders are appointed by the leading participants in the respective WP, and are responsible for the work in the respective Work Package. The WP leading participants, who also provide the scientific management of the respective Work Package, are listed below:

Participants and persons responsible for leading the Work Packages

Partner in lead	WP1	Work Package leader
Posiva	WP1	Ms. Johanna Hansen
SKB	WP2	Ms. Behnaz Aghili
Andra	WP3	Mr. Jean-Michel Bosgiraud
NDA	WP4	Mr. Mark Johnson
GRS	WP5	Dr. André Rübel
POSIVA	WP6	Ms. Marjatta Palmu
POSIVA	WP7	Ms. Johanna Hansen
Major assistance to Work Package management in the following WP		
RAWRA	WP4	Ms. Markéta Dvořáková

Participants and persons responsible for the underlying demonstration experiments

Partner in lead of experiment	Number and acronym for test	Experiment leader
Andra	**1 (FSS)**	Mr. Régis Foin
CTU	**2 (EPSP)**	Prof.Ing. Jaroslav Pacovský/ Ms. Markéta Dvořáková
SKB	**3 (DOMPLU)**	Mr. Pär Grahm
Posiva	**4 (POPLU)**	Mr. Petri Koho/Ms. Erika Holt
DBETEC	**5 (ELSA)**	Dr. Michael Jobmann

6.3.1 Work Package Leader

A Work Package Leader is responsible for the overall heading, planning, implementing, running, evaluating, discussing and reporting of the work in the respective Work Package within given mandates as define in the ECGA. They will specifically:

- convene meetings for the Work Package,
- supervise the production of draft WP deliverables,
- steer and oversee the work's progress (in close collaboration with the Coordinator) and the timely production of deliverables,
- supervise the production of draft WP deliverables and their quality assurance,
- assist in the integration of their work package with other work packages and the on-going experiments requiring their work package's outputs and in using other work packages outcomes (especially in/with WP's 4, 5 and 6),
- follow-up and alert on the risk management activities related to their work package as defined in the DOPAS risk management plan.

- provide management progress reports as scheduled and other project-related reports on request from the Coordinator in a way that is compatible with the reporting in the other Work Packages,
- assess the status and progress of its WP for presentation to Management Team Meetings and at other occasions requested by the General Assembly.

It is expected that each Work Package leader will arrange meetings in addition to their internal coordination meetings with other DOPAS beneficiaries involved in the Work Package work and will invite relevant participants from the other work package teams so that areas of mutual interest can be discussed and data/information transfer between work packages facilitated. Work Package leaders will be responsible for the technical/scientific management of their work packages and will also have responsibility for ensuring that all management related reports and documentation needed, including progress reports, financial statements, contracts etc for all the collaborators in their work package are prepared and submitted to the co-ordinator as required so that timely on-ward project management reporting can be carried out for the General Assembly and the European Commission.

6.3.2 Experiment Leader

An Experiment Leader is responsible for overall heading, planning, implementing, running, evaluating, discussing and reporting of the work in the respective Experiment within given mandates. They will specifically:

- provide engaged personnel and consultants with necessary data and other types of information relevant to the Experiment according to the EC rules e.g. on procurement of goods and services for which co-financing is received from the EC grant,
- manage procurement of services, equipment and consumables within given mandates and presenting other items to superiors in their own organisation for their signature,
- manage personnel engaged in the Experiment,
- work in cooperation with the Work Packages requiring inputs from the experiments
- provide progress reports as scheduled and other project-related reports on request from the Work Package Leader in a way that is compatible with the reporting in the other Experiments,
- supervise the production of draft Experiment deliverables.
- inform the Coordinator and work package leaders and of any significant delays or other events that could jeopardize the implementation of the Project Plan or its parts.
- follow-up and alert on the risk management activities related to the experiments as defined in the DOPAS risk management plan.

Each Experiment Leader will be provided the mandate, in accordance with the practice of the Beneficiary, being in charge of the specific Experiment, regarding procurement and administration of issues with impact on economy, QA/QC, environmental management and personnel management. They interact with both their organisation's representative in the General Assembly and with the Work Package leaders as needed to produce the Work Package outcomes and to report the experiments. The Experiment leaders are included in the Management Team part of the DOPAS organisation.

6.4 Expert Group for Expert Elicitation process

Beneficiaries together with the European Commission's Project Officer propose experts for the Expert Elicitation Group that is assembled for the Expert Elicitation process under WP6 for the WP2-WP5 reports. The General Assembly appoints the members of the EE Group based on the proposal made by the WP6 leader after the consultation. The Expert Elicitation Experts will make integrated and critical analyses of the achievements and results of the Work Package 2-5 final draft outcomes and advice the Management Team and General Assembly in controversial scientific or technical matters based on the outcomes of the EE process. Prior the start of the project such controversial issues are mainly foreseen to be around the:

- integrated critical analyses of the achievements and results for the chosen plugs and seals (approach, methods and technologies per host rock),
- soundness and relevancy of the technical approach,
- assessment of the scientific and engineering standard of the work carried out,
- quality assurance and consistency of deliverables produced in general.

Individual EE Group members may be invited to participate in the possible joint event (DOPAS and IGD-TP event) and the last international seminar. The EE group meets for an introduction session and for a consensus session around one or several WP reports subject to the elicitation process depending on the timing of the WP2-WP5 report drafts (see table in WP6). In the EE process, the use of the tools by the experts is carried out as office work and the consensus meetings of the elicitation outcomes require face-to-face work shop meetings. For the pilot elicitation for POPLU a more limited scope of mainly national experts will be used in the EE pilot process. The EE process and its needs are described in more detail in WP6 description.

6.5 Decision making in the General Assembly

All major decisions concerning the work package activities is the responsibility of the General Assembly (within given time plans and budgets), who is also responsible for coordinating and enforcing the necessary quality assurance, quality control and environmental management measures. The voting rights of the General Assembly representatives are defined in detail in the Consortium Agreement. The decision making in relation to the project management and project budget are made on equal basis, but the specific needs and voting rights may be different for the different Work Packages and Experiments as they depend strongly on the requirements of the WMO / WP leaders' organisation. Each Beneficiary running an experiment underground will have the right to veto decisions of the General Assembly affecting the technical part of their Experiment. Other rights to veto are defined in the Consortium Agreement. Decisions on the integration work using the results in the respective Experiment will be taken on a consensual basis. The General Assembly propose modifications of the DOPAS' work programme and initiate reallocation of EC grant contribution between the different tasks and consequently between partners. Financial statements will be made in accordance with European Commission guidelines, needs and requirements.

6.6 Decision making in Work Packages and Tasks

Since the ultimate decision making organisation in DOPAS is the General Assembly the Work Package leaders takes decisions to implement the WPs according to the DOPAS Project Plan (Chapter 4 WBS of Tasks) and compile the status and possible change request in work content, schedule or budget to be decided by General Assembly. WP3 and WP4 Tasks are organised to be consistent with the DOPAS experiments and their daily project activities are supervised by Experiment leaders in their own organisations. Experiment leaders reports toward WP leaders according the DOPAS Project Plan (Chapter 4 WBS).

The practical guidance for daily work within DOPAS is described in Chapter 7.

7 PROJECT MANAGEMENT PROCEDURES INCLUDING REPORTING AND OUTPUT

7.1 Meetings

The official meeting for the consortium is the General Assembly meetings (once or twice a year) and Management Team meetings at nine month intervals with every second meeting held in connection with the General Assembly if possible. The procedures for General Assembly (GA) meetings are described in a separate Consortium Agreement. The Management Team meetings are organised in conjunction of GA meetings or nearby the end of the interim reporting period or reporting period when there is appropriate date and location available. Management Team is organised according to the description on Chapter 6 and consists of WP leaders, Experiment leaders and Coordinator. The Coordinator invites and chairs the Management Team meetings. The proposed dates for General Assembly meetings and Management Team meetings are indicated in DOPAS project schedule (Appendix 5). Tentative schedule for DOPAS meetings is available in Projectplace under WP1. General Assembly and Management Team meeting minutes are also DOPAS Deliverables (RE).

In addition within DOPAS separate WP meetings are organised to discuss the progress, WP reporting and exchange of information between Participants. The WP meetings are organised and chaired by WP leaders. When considered to be appropriate contact persons from WP in question according to the Contact person phonebook, which is available at Projectplace under WP1 and other experts will be invited to the WP meetings. Coordinator will be informed about WP meetings. WP3 and WP4 Work Package meetings are held together. WP meeting minutes should be archived at Projectplace as information within consortium and some of them will be extra Deliverables to be added to the SESAM database.

For all meetings the principle is to have a similar procedure as described in Consortium Agreement for GA meeting related to the notice of a meeting, meeting agenda, minutes of a meeting and representation in the meetings. Management Team meetings and WP meetings does not have the official DOPAS decision mandate and therefore the meeting procedures are more flexible.

7.2 Documentation management system in DOPAS

There are four official places for DOPAS project documentation.

EC Sesam database

The official DOPAS project periodic and financial reports and official project Deliverables will be uploaded into the Sesam database.
The Coordinator compiles and feeds in the periodic and financial reports according to the reporting periods. The information is collected in addition in the midterm of the reporting period internally to follow up the project progress and guarantee a high quality progress reports. The reporting needs to be submitted to the SESAM within 60 days from the end of reporting period. The Beneficiaries must provide the Coordinator with all progress information related to the reporting period in the SESAM database and all financial information with the specified explanations via the FORCE database on the respective form C's at latest 4 weeks before the submission date of the periodic report. Also either signed hard copies of the C-forms or an electronically signed C-form needs to be submitted by each Benefiary to the Coordinator by this deadline C-forms with no cost claims cannot be amended at the later reporting periods.

Project deliverables are feed in to the EC Sesam database by the responsible person of the Deliverable and approved by the Coordinator (see also Chapter 7.3. & 7.4) as they become available but latest at the agreed delivery date. Project deliverables shall be written in English and shall undergo a separate approval process within each organisation, which is responsible for the deliverable. When the report content handles work or results from several organisations the publication times and rules for dissemination activities

- The notice period for *dissemination* activities shall be reduced to 30 days.
- The period within which *beneficiaries* may object shall be reduced to 15 days are also valid before the approval process for publication from the responsible organisation.

Publications and Dissemination activities can be uploaded into the SESAM database by each responsible author throughout the DOPAS project and the Coordinator validates the activities in to the database after their upload.

Projectplace (IGD-TP Projects and Working Groups)

Projectplace is used for sharing internal consortium material including WP and Task plans, meetings and meeting material, dissemination material including the copy rights of the material, outputs of the Work Packages and Tasks. Also the Deliverables will be collected here. The access into the DOPAS folder in Projectplace is in all persons mentioned in DOPAS phone book, other key persons in Partner organisations, in IGD-TP Secretariat members and EC Project officer.
Work Package leaders are responsible to maintain Work Package subfolders in Active DOPAS folder. Other part of the DOPAS folder is maintained by Coordinator.

Under IGD-TP there is a separate folder "Project Place Events & Announcements" and all invitations outside DOPAS consortium members are added there as information in addition to the DOPAS folder.

Public Internet (The website **www.posiva.fi/dopas)**

The DOPAS website is located under Posiva's homepage and from IGD-TP site there is a link into the DOPAS website. The website **www.posiva.fi/dopas** is an open website for public use and

information on all Work Packages is available via menu bar in front page and information on Full-scale Experiments is available in menu bar under WP3.
DOPAS website is used for the sharing of progress of DOPAS project for public including pictures and presentations (there can be working material, which is not published in DOPAS Project deliverables). The public deliverables will be available via DOPAS website. DOPAS website works also as an information channel for events within DOPAS Project.

The Coordinator is responsible for maintaining the Public Website and all Work Package leaders and Experiment leaders are responsible to provide information to the DOPAS website via Coordinator.

Archive in Beneficiaries organisations
Coordinator archives all Agreements and official letters also the electronic mails between European Commission and Coordinator and between Beneficiaries and Coordinator according to the archiving rules valid at Coordinator organisation.

Other Beneficiary organisations archives the project information according to their rules and practices, but the recommendation is that all Experiment related information like plans, memos, minutes, letters, reports etc are archived in the organisations responsible for experiment and WP related information like plans, memos, minutes, letters, reports etc are archived in the organisations responsible for that WP.

7.3 Preparing the Deliverables in DOPAS

The Deliverables are divided in following groups
- Plans and Reports
- Travel reports, proceedings etc.
- Dissemination material
- Other

The organisation responsible for Deliverable is also responsible for producing the Deliverable in planned schedule so that Deliverable is ready to be uploaded to the SESAM database latest in the end of Month given in DoW or in the DOPAS Project schedule. The list of responding dates for the Months are presented in Projectplace under WP1. All Deliverables needs to be reviewed and approved before uploading.

Deliverables like plans, meeting minutes or memos should use the DOPAS template as much it is reasonable, but also the templates of the responsible organisations are allowed. Deliverables like reports should be written according to the format and reporting instructions in each organisation. To all Deliverables a Euratom cover page by the responsible author needs to be added (the template is available in Template Folder in Projectplace) and cover page includes the information on author, review and approval and date for issue and a short abstract of Deliverable in question. The name of the Deliverable needs to be exactly the same as in DoW. The responsible author take care that Deliverable is approved according the approval process described in Chapter 7.4. A good practice is to send the Deliverable to the Coordinator after its review process before uploading it to the

SESAM database to ensure that the edition is done according the EC rules. When the Deliverable is ready and approved by the internal or external review the Author compiles it to one pdf (including cover page and all Annexes) and uploads it to the SESAM database and informs Coordinator that there is an uploaded Deliverable to be submitted. Guidance for using SESAM database is available at EC Research Participant portal SESAM-UMD-QUE-FP7-v2.0.0_en.pdf.

7.4 Approval of Deliverables in DOPAS

RE Restricted Deliverables
Published in SESAM database and in IGD-TP Projectplace DOPAS active folders in addition to the responsible organisations own publishing procedures
The Deliverables are usually plans, minutes, memos or reports presenting the ongoing work, which will be later summarised into the WP or Experiment summary reports. They are not necessarily reviewed externally or the work results are preliminary in their nature and therefore the access to this document should be restricted. The restricted reports are not necessarily published in the report series of responsible organisation, but they are published within DOPAS consortium. In this category belongs also meeting minutes or travel reports or EE working material, which are not public in their nature and includes internal Consortium information. Also some plans etc. material is better to keep restricted, while the content might be detailed and is only internally reviewed. Restricted Deliverables needs to be approved in responsible organisation according to their practices and rules. If Restricted Deliverables contains input or information from other Beneficiaries, there need to be a possibility for review before approval in responsible organisation. Restricted Deliverables can be published in DOPAS website, but Consortium needs to be informed about that already during the review phase.

PP Restricted deliverable
Published in SESAM database; in IGD-TP Projectplace DOPAS active folders and in DOPAS website in addition to the responsible organisations own publishing procedures
The deliverables are usually memorandums or reports, which are public in nature, but represents only work in progress and are thus at high organisational level quality assured). The reports might include a disclaimer, which means that the report content represent authors view (i.e. do not present the official view of the publishing organisation)

PU Public deliverable
Published in SESAM database; in IGD-TP Projectplace DOPAS active folders and in DOPAS website in addition to the responsible organisations own publishing procedures
The deliverables are mostly reports which summarise the work done within DOPAS and has undergone the EE review (WP2-WP5 summary reports) and/or other type of external review by responsible organisation, and present the final results of the work. The preliminary table of content for reports to be reviewed by EE is in Appendix 3. The whole project is summarised in WP6 Summary report (See tentative Table of Content in Appendix 4) and it requires also an external review, which will be planned in later stage.
Main part of the Dissemination activities are public in nature, even though/if they are approved only by Consortium and published via SESAM Database, IGD-TP Projectpalce and DOPAS website. Dissemination activities may undergo also a review in the author organisation after consortium

approval, if this is required in responsible organisation. The process for Dissemination activities is described in Dissemination plan. All public deliverables can be published also in the website and in other publications of each member in DOPAS Consortium.

8 SUBCONTRACTING

The consortium beneficiaries are partly management and expert organizations with well-established procedures and with long-term framework or partnership agreements for subcontracting a range of products and services, and the selection procedure is efficiently organized and described in the Consortium Agreement to allocate the most suitable and efficient subcontractor, if long-term agreements do not exist. The subcontractors will have no rights or obligations vis-à-vis the Commission or the other beneficiaries. The beneficiaries will ensure that the subcontracts can be presented to European Commission or audited by the Commission at the benefiary's offices. Any bilateral agreement between a subcontractor and a beneficiary will include the obligations mentioned in the EC-GA (Grant Agreement), which concern, among others, obligations related to information and communication of data, and financial audits and controls. Allowing access rights to subcontractors can be agreed upon in respect to work directly related to the individual contracts (in general, and in some cases wider to selected subcontractors) to a degree that does not violate or hinder the waste management organisations from using the information they require for licensing their repository programmes. In subcontract agreements are included an obligation for presenting the results of their work in the consortium General Assembly or Management Team meetings or at the international conference or training workshop when it is appropriate.
The financial investments of the waste management organisations into the background and to the current DOPAS project need to be respected and cannot be opened up freely to subcontractors not contributing to the creation of new knowledge. The intellectual property rights for direct exploitation thus remain with the owners of the experiments (i.e. the implementing organisations who are the actual end-users of the results). Potential rights to license foreground, if such foreground is created in the project will be handled according to the project's exploitation plan, EC-GA and the Consortium Agreement. Subcontracting related to e.g. producing a report for a work package or to a part of it does not constitute a contribution to the creation of new knowledge, but is more technical secretarial and editing work and does not necessary justify a subcontractor to have wide access rights even though it can add to the work can add to the general competence of such a subcontractor and make them more competitive in their future activities. The procedure for the award of subcontracts has been based on existing framework agreements or procurement rules prior the start of the DOPAS project. During the project, the procurement rules will be based on the status of the beneficiary, i.e. if the beneficiary is a public or a private entity: Public entities follow the procurement principles established by their national legal framework adopted from the EC directives. For subcontracts that have a value equal or exceeding the national threshold values for contracts based on the directive on public procurement of goods/services will be applied and the publication of a call for tenders is mandatory. The sub-contracts will comply also with the terms of the EC-GA. Private legal entities follow their internal procurement rules that they apply for the selection of procurement contracts, respecting in any case the terms of the EC-GA on subcontracting. The publication of a call for tenders is not a requirement for private legal entities, but they have or will at least require submission of several quotes (usually a minimum of three), unless they have an established framework contract for the provision of those goods or services. However, public procurement is applied to new subcontracts exceeding the national threshold

values. There is a proportional relationship between the size in work and cost of the tasks to be subcontracted on the one hand and the degree of publicity and formality of the selection process on the other. The procedure ensures conditions of transparency and equal treatment. At the request of the Commission and especially in the event of an audit, beneficiaries will be able to demonstrate that they have respected the conditions of transparency and equal treatment. Beneficiaries will be able to prove that:
• The criteria and conditions of submission and selection have been clear and identical for any legal entity offering a bid;
• There was no conflict of interest in the selection of the offers;
• The selection has been based on the best value quality of the service proposed at the best quality/price ratio. The criteria defining "quality" have been clear in the specification of the work generally demanding special expertise outside the core activities of the beneficiary and coherent according to the purpose of the task to subcontract, in order to provide a good analysis of the ratio quality/price. Beneficiaries have also contracts based on framework agreements between the beneficiary and a third party for carrying out routine or repetitive tasks. They have been established before the beginning of the project, and are the standard practice of the beneficiaries for a given type of task. These frameworks contracts may be used to carry out tasks necessary for implementing the DOPAS project. When used they have been established on the basis of the principles of best value for money and transparency mentioned above.

9 INTERFACES TO OTHER PROJECTS

The DOPAS project has interfaces to the other projects working at nuclear waste management area like
- EBS Task Force - the tools developed by EBS Task Force can be used within DOPAS
- Modern - to use the developed knowledge for monitoring activities
- Lucoex project has large tests underground and coordination of timing for the Experiment activities needs to be take into account.
- Prototype Repository project has been given background information on constructing a full scale experiment
- ESDRED to use the developed knowledge on bentonite based and cementitious materials

10 TIME SCHEDULE

The DOPAS project schedule has been updated after DOPAS project was initiated and it shows interactions between work packages and has some additional internal milestones for project. The DOPAS project schedule will be updated yearly at Management Team meetings and in addition in WP meetings and possible changes are confirmed by General Assembly. In practice the changes will be done 3-4 times /year. The DOPAS project schedule is in Appendix 5.The updates to the DOPAS project schedule is done by Coordinator. Each Experiment has separate detailed time schedule as part of Experiments organised into the projects. Also some work scheduled within different tasks has detailed schedules. These time schedules will be available within Consortium at Projectplace under each Experiment folder. The follow up and updates in the Experiment time

schedules are managed by Experiment leaders. Significant delays (see alarm limits in Chapter 14), with consequences to the DOPAS schedule needs to be handled separately.

11 RISK MANAGEMENT

The risk management plan and actions for mitigation of risks are presented in separate Appendix 6. The risk management plan summarise project management risks and includes the general project risks, DOPAS work package related risks and main Experiment related risks. A separate detailed list of Experiment related risks for each experiment has been created and it is available within Consortium at Projectplace. The risks are followed in Management Team meetings and the risk status is updated yearly. The Coordinator takes care of the risk management plan summary updates. Experiment leaders are responsible to maintain the Experiment risks and update the plan when needed.

12 QUALITY, ENVIRONMENTAL AND HEALTH & SAFETY (QEHS) MANAGEMENT

Quality, Environmental and Health & Safety (QEHS) Management for DOPAS Project is important and the work planned, implemented and followed needs to follow the separate guidance related to quality, environment and health. The main principle is that organisation responsible for the work done in field or in laboratory or in the desk is also responsible to follow the guidance by organisation. In case there are persons from other organisations doing the work for Experiments they are subjected to follow the guidance from organisation responsible for Experiment. The underground construction work for implementation of experiments requires a separate guidance and training, which needs to be adapted for organisations doing full scale testing. The used guidance and procedures within POPLU project in ONKALO is presented in Projectplace as an example of QEHS management guidance. It is expected that all Experiment organisations have similar type of guidelines and each participant in DOPAS project should be active in asking the guidance and participating to the training related to the QEHS management.

12.1 Quality

All work done by participating organisations follows the guidance and procedures for each organisation Quality Management System or other relevant documentation. This guidance is applied also to the purchasing, subcontracting according to the practices at organisations. The third parties are responsible for their work, but the ultimate responsible for quality and results stays within the Partner Organisation who has purchased the work. To improve the quality of DOPAS project results the WP6 Task 6.3 main purpose is to give an external documented and traceable review on all public WP2-5 summary reports.

12.2 Environment

All work done by participating organisations follows the guidance and procedures for each organisation Environment Management System or other relevant documentation including all the national regulations and specific regulation for the experiment sites. This guidance is applied also to the purchasing and subcontracting according to the practices at organisations. The use of foreign

materials are a special issue for nuclear waste management field and a special attention needs to paid for material selection and avoidance of materials which might be harmful for EBS components.

12.3 Health and safety

All work done by participating organisations follows the guidance and procedures for each organisation Health and Safety Management System. Key items for health and safety are training of employees, a high safety culture, an active risk management, a continuous risk management improvement strategy and having procedures in place to document safety observations and related suggestions for improvement.

13 COMMUNICATION MANAGEMENT

DOPAS project has a separate dissemination and exploitation plan (D7.1 available on DOPAS website). The Dissemination activities table is updated yearly in General Assembly meetings.

14 CHANGE MANAGEMENT

Changes related to the DOPAS Consortium plan (including this Project Plan) are handled in different way related to the significance of the change. Minor changes related to the each organisations experimental work will go through the change management procedures at organisation doing the work. Changes which might influence to the DOPAS project schedule or cost need to be handled by General Assembly. If there are changes expected to have influence to the time schedule it should be informed to the Coordinator immediately, but all changes when there is a significant delay in a Milestone (the alarm limit is three months delay), its consequences needs to be handled in General Assembly. In case the planned change has influences to the DOPAS budget the organisation responsible for changes shall present the proposal for further actions to the General Assembly. The DOPAS project schedule will be revised in General Assembly meeting and in Management team meetings and updated version of DOPAS project schedule is available at Projectplace.

15 REFERENCES

SecIGD/IGD-TP 2011. Management Guidelines v.1 available at www.igdtep.eu.

16 APPENDICES

Appendix 1. The list of DOPAS Deliverables

Appendix 2. The list of DOPAS Milestones

Appendix 3. The tentative list of content for WP summary reports

Appendix 4. The tentative TOC of WP6 summary report

Appendix 5. DOPAS project schedule

Appendix 6. The DOPAS risk management plan summary

Delive-rable Number	Deliverable Title	WP num ber	Lead benefi-ciary number	Nature[1]	Dissemi-nation level[2]	Delivery date
D1.1	D1.1 General Assembly meetings and minutes (dates indicative)	1	1	O	RE	M3, M15, M26, M37, M44
D1.2	D1.2 Project Plan including risk management plan	1	1	O	PU	M7 (M3)
D1.3	D1.3 DOPAS website (public) and Extranet (for IGD-TP)	1	1	O	PU	M3-M48
D2.1	D2.1 Design Basis and Criteria Report	2	8	R	PP	M20 (M18)
D2.2	D2.2 Reference Designs Report	2	8	R	PP	M26 (M24)
D2.3	D2.3 Strategies of demonstrating conformity of reference design to design basis	2	8	R	PP	M38 (M36)
D2.4	D2.4 WP2 Final Report	2	8	R	PU	M43 (M41)
D3.1	D3.1 FSS Experiment	3	2	D	PU	M42
D3.2	D3.2 FSS tunnel model design report	3	2	R	RE	M8 (M6)
D3.3	D3.3 Report on clayish material definition for FSS	3	2	R	RE	M8 (M6)
D3.4	D3.4 Report on low-pH concrete formulas for FSS	3	2	R	RE	M8 (M6)
D3.5	D3.5 Lab test report on the performance of the clayish material for FSS	3	2	R	PP	M8 (M6)
D3.6	D3.6 Lab report on the performance of low-pH concrete for FSS	3	2	R	PU	M8 (M6)
D3.7	D3.7 Test report on FSS metric core emplacement	3	2	R	RE	M11 (M9)
D3.8	D3.8 Test report on FSS cast in-box concrete	3	2	R	RE	M11 (M9)
D3.9	D3.9 Test report on FSS test panel for shotcrete	3	2	R	RE	M11 (M9)
D3.10	D3.10 Drift model FSS construction report	3	2	R	PP	M18 (M16)
D3.11	D3.11 Report on FSS cast concrete plug construction	3	2	R	PP	M18 (M16)

[1] **R** = Report, **P** = Prototype, **D** = Demonstrator, **O** = Other

[2] **PU** = Public
PP = Restricted to other programme participants (including the Commission Services)
RE = Restricted to a group specified by the consortium (including the Commission Services)
CO = Confidential, only for members of the consortium (including the Commission Services)

D3.12	D3.12 Report on construction of FSS swelling clay core	3	2	R	PP	M18 (M16)
D3.13	D3.13 Report on shotcrete plug construction	3	2	R	PP	M18 (M16)
D3.14	D3.14 EPSP experiment	3	7	D	PP	M42
D3.15	D3.15 Detail design of EPSP plug	3	7	R	PP	M19
D3.16	D3.16 Testing plan for EPSP laboratory experiment	3	7,	R	PU	M8
D3.17	D3.17 Interim results of EPSP laboratory testing	3	7	R	PP	M11
D3.18	D3.18 Testing plan for EPSP instrumentation and monitoring	3	7	R	PP	M19
D3.19	D3.19 EPSP Functionalities demonstration	3	9	R	PP	M25 (M22)
D3.20	D3.20 EPSP Plug test installation report	3	7	R	PU	M27 (M28)
D3.21	D3.21 Final laboratory test report of EPSP	3	7	R	PU	M40
D3.22	D3.22 DOMPLU experiment	3	8	D	PU	M42
D3.23	D3.23 POPLU experiment	3	1	D	PU	M42
D3.24	D3.24 Detailed design of POPLU deposition tunnel end plug	3	1	O	RE	M12
D3.25	D3.25 Test plan for the full-scale test including the instrumentation plan for POPLU plug	3	1	O	RE	(M15) M12
D3.26	D3.26 URCF RSC work memorandum (POPLU)	3	1	O	PP	M14
D3.27	D3.27 POPLU concrete test memorandum	3	1	O	RE	M14
D3.28	D3.28 Status report on ELSA laboratory tests	3	4	R	PP	M24 (M18)
D3.29	D3.29 Final Technical Report ELSA related testing	3	4	R	PU	M42
D3.30	D3.30 WP3 Final summary report	3	2	O	PU	M44
D3.31	D3.31 Final Technical Report on ELSA related testing of mechanical - hydraulic behaviour of the shaft seal (LASA)	3	4	R	PU	M42

D3.32	D3.32 Final technical report on sealing behaviour of clay rock (THM-TON)	3	4	R	PU	M42
D4.1	D4.1 Report on qualification of commissioning methods	4	2, 5	R	PP	M18
D4.2	D4.2 Report on bentonite saturation test	4	2, 5	R	PP	M32 (M30)
D4.3	D4.3 DOMPLU experiment summary report	4	8	R	PU	M36
D4.4	D4.4 WP4 Integrated Report	4	6	R	PU	M40
D4.5	D4.5 POPLU experiment summary report	4	1	R	PU	M40
D4.6	D4.6 Monitoring data from EPSP plug test summary report	4	7	R	PU	M26
D4.7	D4.7 EPSP experiment summary report	4	9	R	PU	M44
D4.8	D4.8 FSS experiment summary report	4	2	R	PU	M44
D5.1	D5.1 Modelling plan for EPSP PA	5	7	O	PU	M20
D5.2	D5.2 Report on Andra's PA methodology for sealing systems	5	2	R	PP	M18
D5.3	D5.3 Report on Andra's understanding of processes involved in time and space	5	2	R	PP	M18
D5.4	D5.4 Report on approach concerning uncertainties	5	2	R	PP	M24
D5.5	D5.5 Status report on process modelling activities	5	4	R	PP	M24
D5.6	D5.6 Status report on conceptual and integrated modelling activities	5	4	R	PP	M24
D5.7	D5.7 Models and modelling summary report for EPSP	5	7	R	PU	M40
D5.8	D5.8 Final report on process, conceptual and integrated modelling activities	5	4	R	PU	M42
D5.9	D5.9 Integration of results of demonstrators in total repository system's PA by special	5	10	R	PU	M42

	performance indicators.					
D5.10	D5.10 WP5 Final integrated report	5	4	R	PU	M45 (M44)
D6.1	D6.1 Plan for the integrating analysis by experts and selection of experts	6	1	O	PP	M26
D6.2	D6.2 Expert staff visit travel reports	6	1	O	RE	M36 (M30)
D6.3	D6.3 EE documentation (in Work Report format) from Expert Group EE meetings inputs and outcomes	6	1	R	PU	M46 (M43)
D6.4	D6.4 DOPAS Final Project Summary Report	6	1	R	PU	M48
D7.1	D7.1 Dissemination Plan (incl. exploitation)	7	1	R	PU	M4
D7.2	D7.2 Plug and Seal Training Workshop planning and implementation report	7	1	R	PU	M39
D7.3	D7.3 Organisation and publication of proceeding an international seminar in 2016	7	1	R	PU	M44
D7.4	D7.4 Publishing in total six newsletters in pdf-format at 9 months interval on the IGD-TP/DOPAS website	7	1	R	PU	M9. M18, M27, M36, M45, M48
D7.5	D7.5 Project description for the EC FP7 project compendium	7	1	R	PU	M8 (M4)
D7.6	D7.6 Two journalist edited 2-page summary documents of project's scientific and technical achievement	7	1	R	PU	M47
D7.7	D7.7 Experiment poster of DOMPLU with EC acknowledgements at the underground site in Äspö (Sweden)	7	8	O	PU	M7 (M3)
D7.8	D7.8 Experiment poster of POPLU with EC acknowledgements at the ONKALO site (Finland)	7	1	O	PU	M12
D7.9	D7.9 Experiment poster of FSS at the underground site with EC acknowledgements	7	2	O	PU	M7 (M3)

	in BURE (France)					
D7.10	D7.10 Experiment poster of EPSP at the underground site with EC acknowledgements in URC Josef Gallery (Czech Republic)	7	9	O	PU	M8

Milestone number	Milestone name	WP	Lead beneficiary number	Planned date (DoW date in Parenthesis)	Comments
MS1	MS1 Agenda of first General Assembly meeting	WP1	1	M1	DOPAS project kick-off meeting
MS2	MS2 Design basis and reference design task meeting	WP2	8	M6 (M8)	Early 2013
MS3	MS3 Location for FSS experiment ready	WP3	2	M8 (M6)	FSS; experiment 1
MS4	MS4 Location for EPSP experiment 2 ready	WP3	7	M5	EPSP, experiment 2
MS5	MS5 Location for experiment 4 POPLU, ready	WP3	1	M12	POPLU, experiment 4
MS6	MS6 Laboratory test plans on materials characterisation and components available	WP3	4	M9	ELSA, experiment 5
MS7	MS7 Detailed design for FSS experiment ready	WP3	2	M8 (M6)	FSS; experiment 1
MS8	MS8 Testing plan for POPLU ready	WP3	1	M12	POPLU, experiment 4
MS9	MS9 Installation of FSS experiment complete	WP3	2	M20 (M18)	FSS, experiment 1
MS10	MS10 Construction of POPLU full-scale plug	WP3	1	M21 (M18)	POPLU, experiment 4
MS11	MS11 EPSP Experiment construction and installation	WP3	9	M21	EPSP, experiment 2
MS12	MS12 Instrumentation and monitoring plans for experiment complete	WP3	4	M37 (M24)	ELSA, experiment 5
MS13	MS13 Inputs from FSS experiment for WP4	WP4	2	M32 (M24)	

	integration report				
MS14	MS14 Inputs from DOMPLU experiment for WP4 integration report	WP4	8	M23 (M18)	
MS15	MS15 Inputs from POPLU experiment for WP4 integration report	WP4	1	M36 (M30)	
MS16	MS16 Inputs from EPSP experiment for WP4 integration report	WP4	7	M30	
MS17	MS17 Draft WP4 report for EE process available	WP4	6	M36	
MS18	MS18 Input from Andra's PA methodology for sealing systems	WP5	2	M14	
MS19	MS19 Status report on process modelling activities	WP5	4	M24	
MS20	MS20 Status report on conceptual and integrated modelling activities	WP5	4	M24	
MS21	MS21 Input for WP5 Final integration report	WP5	2	M28	
MS22	MS22 Expert group assembled	WP6	1	M28	The final decision on the experts depends on the issues to be elicited, depending on the final reports, the experts may also be added to the group later.
MS23	MS23 Quality assurance - Inputs of EE review received for WP2 - WP5 final work package report.	WP6	1	M45 (M42)	The delivery date refers to the EE outcomes related to the last of the Work Package reports. Inputs expected for WP2-WP5 from month M38 to M45.
MS24	MS24 The partner inputs for the	WP6	1	M42	The final draft report input and the EE process inputs are

	preparation of the final project report received by the coordinator.				available at the coordinator for the start of the reporting of the DOPAS project's technical summary report.
MS25	MS25 Dissemination plan content drafted	WP7	1	M2	
MS26	MS26 First newsletter published	WP7	1	M10	
MS27	MS27 Learning and implementation plan for the training workshop produced	WP7	1	M27 (M24)	
MS28	MS28 First call for the papers and for the international seminar in 2016 announced	WP7	1	M30	

Tentative list of content for the WP summary reports

Within the DOPAS project the deliverables describe the plans, results, experiences and lessons learned from the technical work conducted in the various Work Packages and Tasks therein. Even though the scope of the whole project is clearly defined, the amount of material will be huge and collected in several countries around Europe and the content is varying in their nature and form. Therefore each RTD and Demonstration Work Package produces a coherent technical summary report on the main achievements within the DOPAS project.

The tentative Table of Content (TOC) of the final WP summary report is described for each RTD/demonstration Work Package, in order to keep in mind the goals, objectives, targets and scope of the work and to support the assessment and presentation of project results in WP2-WP5 summary reports. These tentative Table of Content will be frozen during the reporting phase and so far will be used only as a reporting template. The reports presented below will undergo an Expert Elicitation process before their publishment.

Table of Content WP2 Summary report

A-1. Appendix Summarising Questionnaire Response

Table of Content WP3 Summary report

Table of Content WP4 Summary report

Table of Content WP5 Summary report

WP6 Task 6.4 DOPAS Final Project Summary Report

Full-scale Demonstration of Plugs and Seals

The aim of the report is to compile the lessons learned related to:
- the fulfilment of the performance requirements on studied plugs and seals for the operational phase and post closure phase and
- on the feasibility of construction of plugs and seals according to chosen designs

Tentative Table of Contents[1] for adaptation to the DOPAS Final Project summary report

Executive summary

Preface

PART I. The Framework for development of plugs and seals within DOPAS

Chapter 1.1. Introduction

Chapter 1.2. Research, Development and Demonstration Questions, Scope and Objectives of DOPAS

- including analysis of the RD&D environment of DOPAS and
- short term forecasts of RD&D development in plugs and seals

Chapter 1.3. Description of the DOPAS project concept and strategy

- including identification of DOPAS main processes (related to the designing, testing, implementation and evaluation of plugs and seals experiments and their assessment against safety functions), inputs and outcomes and
- interactions with other processes within the activity and in the partner organisations

Chapter 1.4. Summary of the DOPAS Related Demonstration Experiments

Chapter 1.5. Summary of the main DOPAS project outcomes

-including long-term forecast of RD&D development and future needs and
- improvement and/or innovation activities (carried out or proposed)

PART II. Technical DOPAS project summary report

Chapter 2.1. Starting points of the DOPAS project and the background information and methods used

- including needs and expectations of the beneficiaries, IGD-TP and the EC from DOPAS

Chapter 2.2. WP1 Experiences from running the DOPAS project

- including management of technical risks, types of risks encountered and lessons learned and

[1] the content also reflects the content of the IGD-TP management guideline v.1 Table 5-1 (D18 of SecIGD project available at www.igdtp.eu)

- major corrective and preventive actions related to the risk mitigations for conducting full scale experiments (if applicable)

Chapter 2.3. WP2 Description of processes showing how requirements and reference designs were developed and used and applied for the new plugs and seals (closure of the disposal facility) design basis and design development

-including national statutory requirements

Chapter 2.4. WP3 Planning, siting and implementation of the full scale experiments

- laboratory work programme supporting the design and implementation of demonstrations
- including activities and methods definitions (in brief, more detail in respective experiment reports),
- types of records that were required and kept, and
- applicable parts of measurement, monitoring and analysis

Chapter 2.5. WP4 Integration of the experiment experiences and outcomes from plugs and seals including lessons learned

- including applicable parts of measurement, monitoring and analysis

Chapter 2.6. WP5 Safety and performance assessment advances, outcomes, models and tools for plugs and seals assessment within DOPAS including lessons learned

- including applicable parts of measurement, monitoring and analysis

Chapter 2.7. WP6 Quality assurance and review using the EE process on the work package reports

- major corrective and preventive actions (if applicable) and
- improvement and/or innovation activities

Chapter 2.8. WP7 Analysis on achievements and conclusions for dissemination activities and impact of the DOPAS project

- including the workshop
- including the training activities

Chapter 2.9. Summary of lessons learned and future guidelines for testing the plugging and sealing based on DOPAS

Chapter 2.10. Conclusions and Recommendations

Chapter 2.11. Summary

References

Appendices

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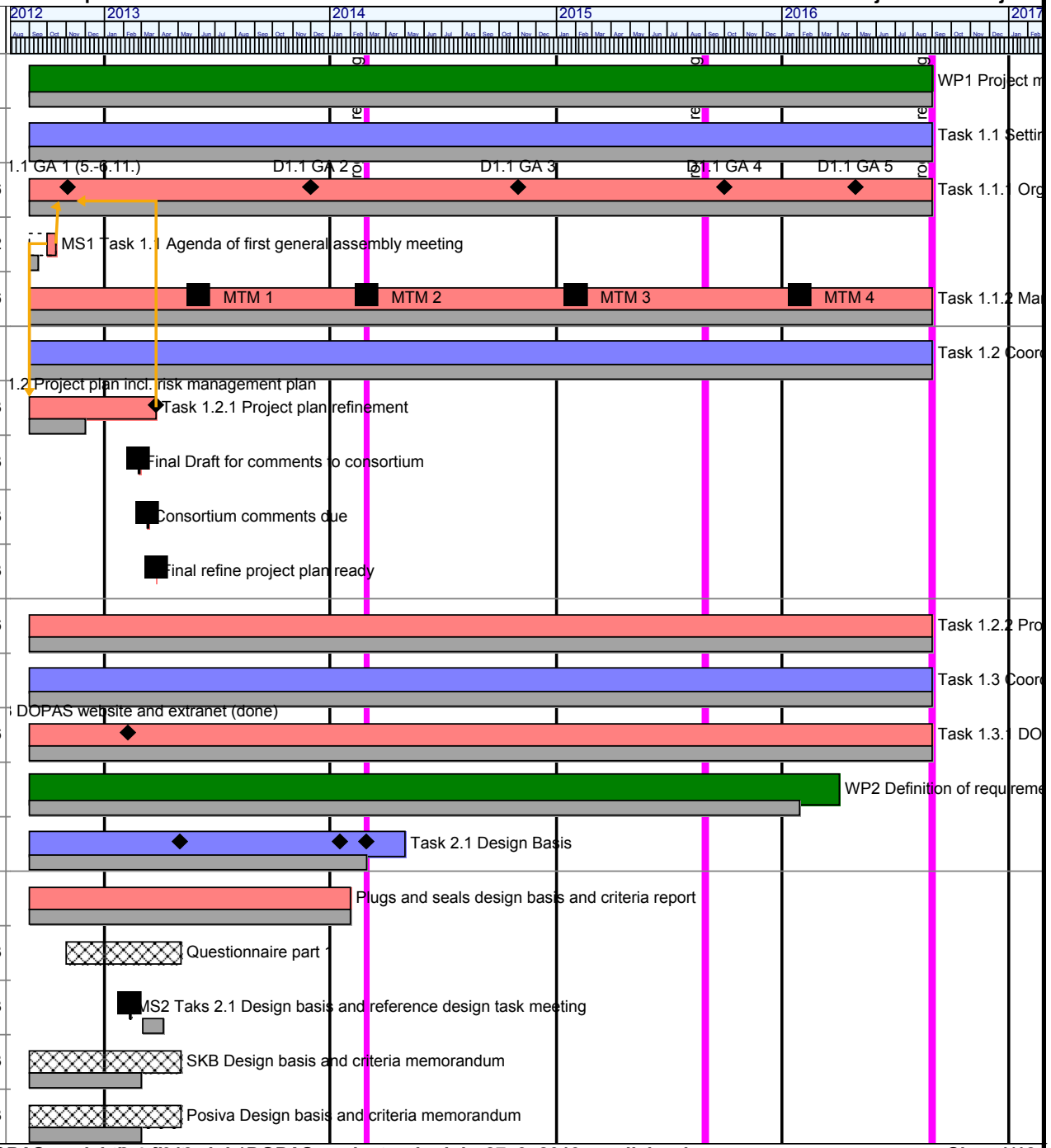
DOPAS project schedule

Päällikkö: Hansen Johanna — **updated 22.3.2013** — **Suunnittelija: Palmu Marjatta**

Activity	Start	End
WP1 Project management and coordination		
Task 1.1 Setting up and coordinating the DOPAS project structure and	3.9.2012	
Task 1.1.1 Organization of project management meetings	3.9.2012	31.8.2016
MS1 Task 1.1 Agenda of first general assembly meeting	1.10.2012	12.10.2012
Task 1.1.2 Management team meetings (approx. every nine months)	3.9.2012	31.8.2016
Task 1.2 Coordination of project management with project plan		
Task 1.2.1 Project plan refinement	3.9.2012	26.3.2013
Final Draft for comments to consortium	26.2.2013	26.2.2013
Consortium comments due	12.3.2013	12.3.2013
Final refine project plan ready	26.3.2013	26.3.2013
Task 1.2.2 Project management and coordination	3.9.2012	31.8.2016
Task 1.3 Coordination of project reporting and publications		
Task 1.3.1 DOPAS website and extranet	3.9.2012	31.8.2016
WP2 Definition of requirements and design basis		
Task 2.1 Design Basis		
Plugs and seals design basis and criteria report		
Questionnaire part 1	1.11.2012	3.5.2013
MS2 Taks 2.1 Design basis and reference design task meeting	11.2.2013	12.2.2013
SKB Design basis and criteria memorandum	3.9.2012	3.5.2013
Posiva Design basis and criteria memorandum	3.9.2012	3.5.2013



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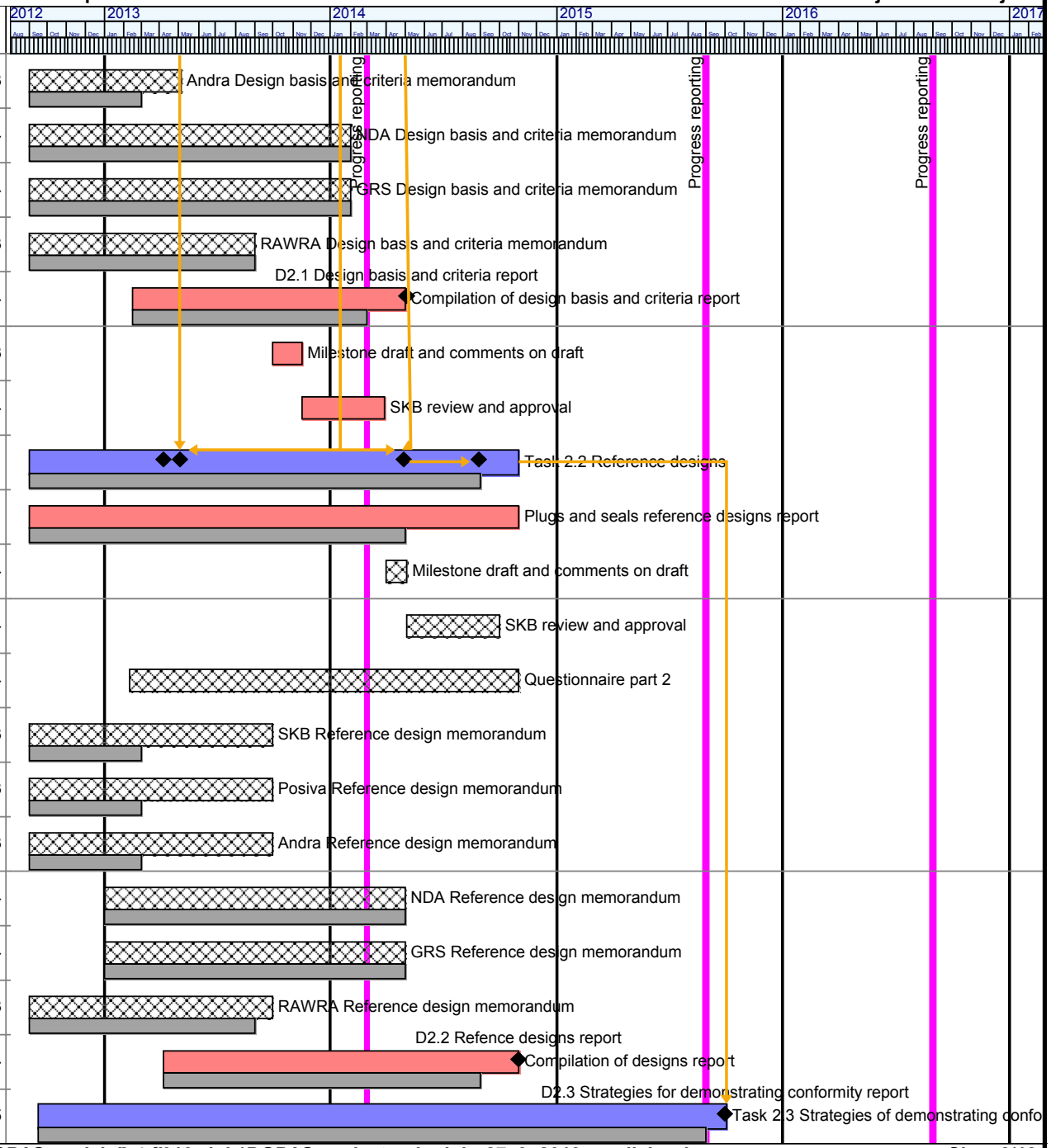
DOPAS project schedule

Päällikkö: Hansen Johanna — **updated 22.3.2013** — **Suunnittelija: Palmu Marjatta**

Activity	Start	End
Andra Design basis and criteria memorandum	3.9.2012	3.5.2013
NDA Design basis and criteria memorandum	3.9.2012	31.1.2014
GRS Design basis and criteria memorandum	3.9.2012	31.1.2014
RAWRA Design basis and criteria memorandum	3.9.2012	30.8.2013
Compilation of design basis and criteria report	15.2.2013	30.4.2014
Milestone draft and comments on draft	1.10.2013	15.11.2013
SKB review and approval	18.11.2013	28.3.2014
Task 2.2 Reference designs	3.9.2012	
Plugs and seals reference designs report		
Milestone draft and comments on draft	1.4.2014	5.5.2014
SKB review and approval	6.5.2014	1.10.2014
Questionnaire part 2	12.2.2013	31.10.2014
SKB Reference design memorandum	3.9.2012	30.9.2013
Posiva Reference design memorandum	3.9.2012	30.9.2013
Andra Reference design memorandum	3.9.2012	30.9.2013
NDA Reference design memorandum	2.1.2013	30.4.2014
GRS Reference design memorandum	2.1.2013	30.4.2014
RAWRA Reference design memorandum	3.9.2012	30.9.2013
Compilation of designs report	8.4.2013	31.10.2014
Task 2.3 Strategies of demonstrating conformity of reference design to	17.9.2012	1.10.2015



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DOPAS project schedule

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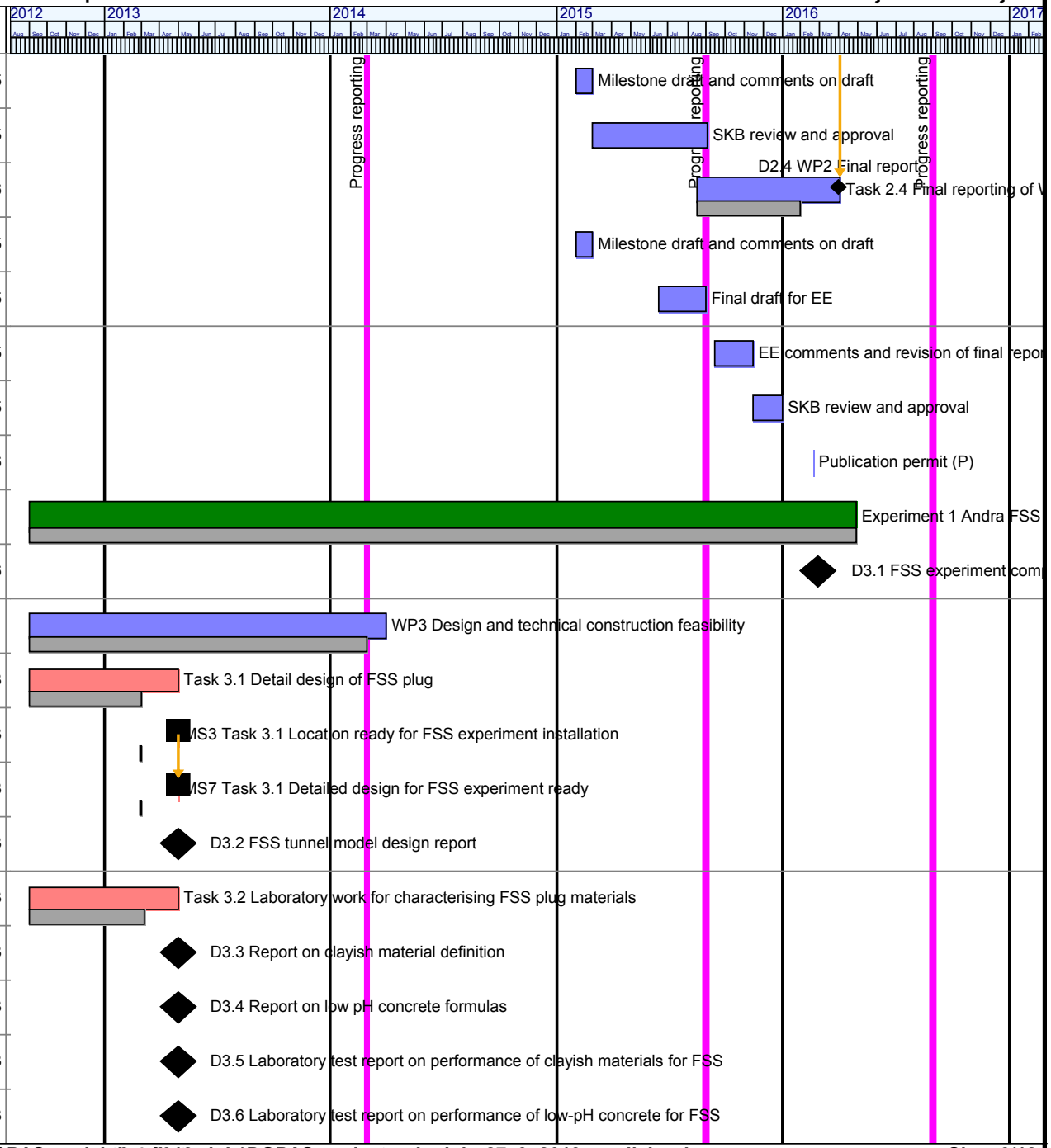
Suunnittelija: Palmu Marjatta

Activity	Start	End
Milestone draft and comments on draft	2.2.2015	27.2.2015
SKB review and approval	27.2.2015	1.9.2015
Task 2.4 Final reporting of WP2	17.8.2015	1.4.2016
Milestone draft and comments on draft	2.2.2015	27.2.2015
Final draft for EE	16.6.2015	31.8.2015
EE comments and revision of final report	14.9.2015	13.11.2015
SKB review and approval	16.11.2015	30.12.2015
Publication permit (P)	19.2.2016	19.2.2016
Experiment 1 Andra FSS	**3.9.2012**	
D3.1 FSS experiment complete	29.2.2016	29.2.2016
WP3 Design and technical construction feasibility		
Task 3.1 Detail design of FSS plug	3.9.2012	30.4.2013
MS3 Task 3.1 Location ready for FSS experiment installation	30.4.2013	30.4.2013
MS7 Task 3.1 Detailed design for FSS experiment ready	30.4.2013	30.4.2013
D3.2 FSS tunnel model design report		30.4.2013
Task 3.2 Laboratory work for characterising FSS plug materials	3.9.2012	30.4.2013
D3.3 Report on clayish material definition		30.4.2013
D3.4 Report on low pH concrete formulas		30.4.2013
D3.5 Laboratory test report on performance of clayish materials for F		30.4.2013
D3.6 Laboratory test report on performance of low-pH concrete for F		30.4.2013



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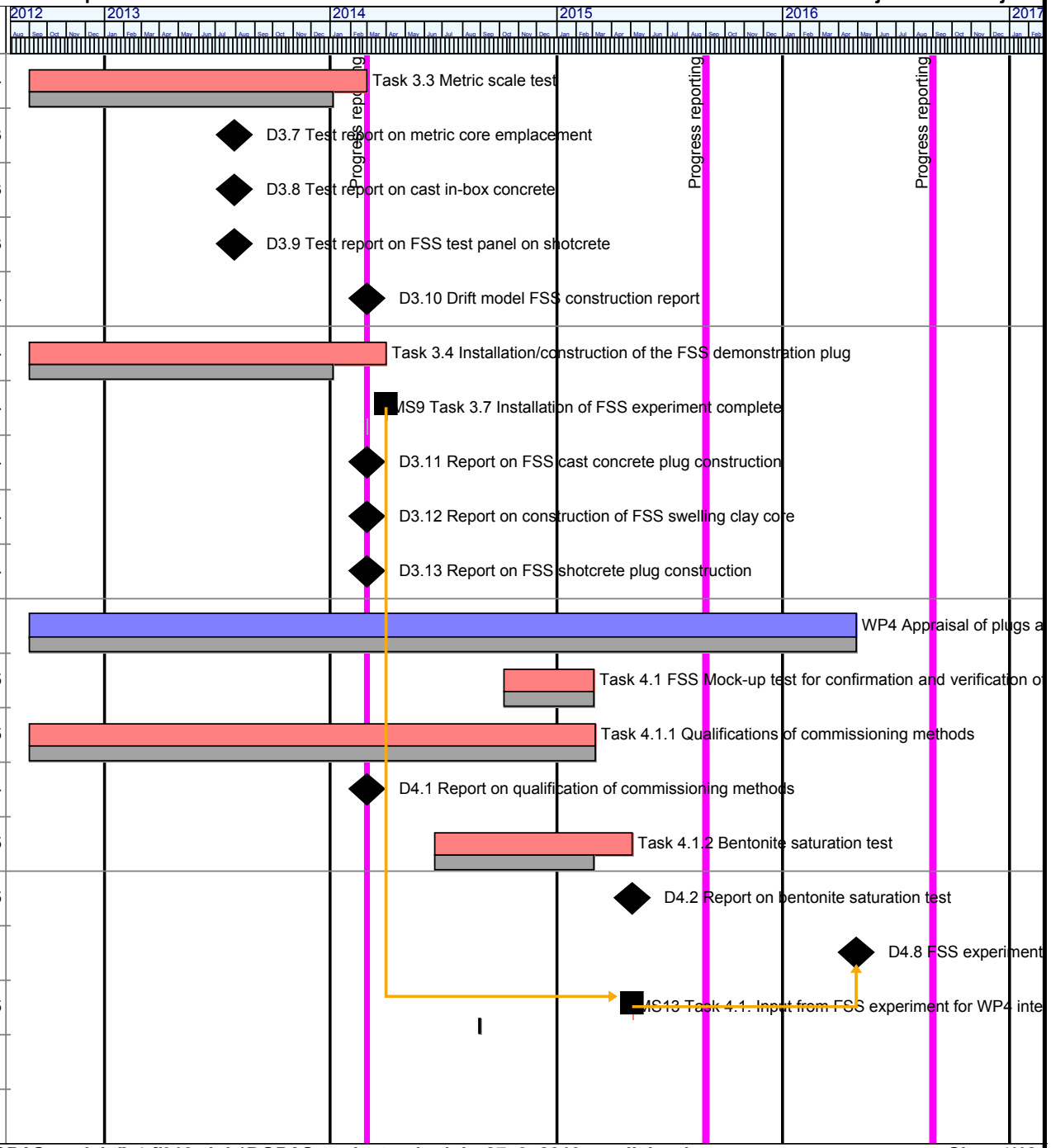
DOPAS project schedule

Päällikkö: Hansen Johanna — **updated 22.3.2013** — **Suunnittelija: Palmu Marjatta**

Activity	Start	End
Task 3.3 Metric scale test	3.9.2012	28.2.2014
D3.7 Test report on metric core emplacement		31.7.2013
D3.8 Test report on cast in-box concrete		31.7.2013
D3.9 Test report on FSS test panel on shotcrete		31.7.2013
D3.10 Drift model FSS construction report		28.2.2014
Task 3.4 Installation/construction of the FSS demonstration plug	3.9.2012	1.4.2014
MS9 Task 3.7 Installation of FSS experiment complete	1.4.2014	1.4.2014
D3.11 Report on FSS cast concrete plug construction		28.2.2014
D3.12 Report on construction of FSS swelling clay core		28.2.2014
D3.13 Report on FSS shotcrete plug construction		28.2.2014
WP4 Appraisal of plugs and seals system's function		
Task 4.1 FSS Mock-up test for confirmation and verification of swelli	8.10.2014	2.3.2015
Task 4.1.1 Qualifications of commissioning methods	3.9.2012	4.3.2015
D4.1 Report on qualification of commissioning methods	28.2.2014	28.2.2014
Task 4.1.2 Bentonite saturation test	18.6.2014	4.5.2015
D4.2 Report on bentonite saturation test	4.5.2015	4.5.2015
D4.8 FSS experiment summary report	29.4.2016	
MS13 Task 4.1. Input from FSS experiment for WP4 integration repo	4.5.2015	4.5.2015



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DOPAS project schedule

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Suunnittelija: Palmu Marjatta

Activity	Start	End
Experiment 2 RAWRA EPSP		
D3.14 Experiment 2 EPSP	29.2.2016	29.2.2016
WP3 Design and technical construction feasibility		
Task 3.1 Detail design of EPSP plug	3.9.2012	31.3.2014
MS4 Task 3.2 Location ready for RAWRA experiment installation	31.1.2013	31.1.2013
D3.15 Detail design EPSP plug	31.3.2014	31.3.2014
Task 3.2 Laboratory work for geotechnical testing of EPSP plug mate	3.9.2012	31.12.2015
D3.16 Testing plan for EPSP laboratory experiments	30.4.2013	30.4.2013
D3.17 Interim results of EPSP laboratory testing	31.7.2013	31.7.2013
Task 3.4 Installation/construction of the EPSP demonstration plug	1.2.2013	30.9.2014
MS11 Task 3.9 EPSP Experiment construction and installation	30.5.2014	30.5.2014
MS11 Task 3.9 EPSP Experiment construction and installation	30.5.2014	30.5.2014
D3.18 Testing plan for EPSP instrumentation and monitoring	31.3.2014	31.3.2014
D3.19 EPSP functionalities demonstration (combined with D3.20?)	30.9.2014	30.9.2014
D3.20 EPSP plug test installation report	28.11.2014	28.11.2014
D3.21Final laboratory test report of EPSP	31.12.2015	31.12.2015
WP4 Appraisal of plugs and seals system's function		
Task 4.2.1 Loading and monitoring test of EPSP	3.9.2012	28.6.2013
Task 4.2.2 Monitoring of data from EPSP plug's loading sequences	31.5.2013	29.2.2016
D4.6 Monitoring data report for EPSP experiment	31.10.2014	31.10.2014

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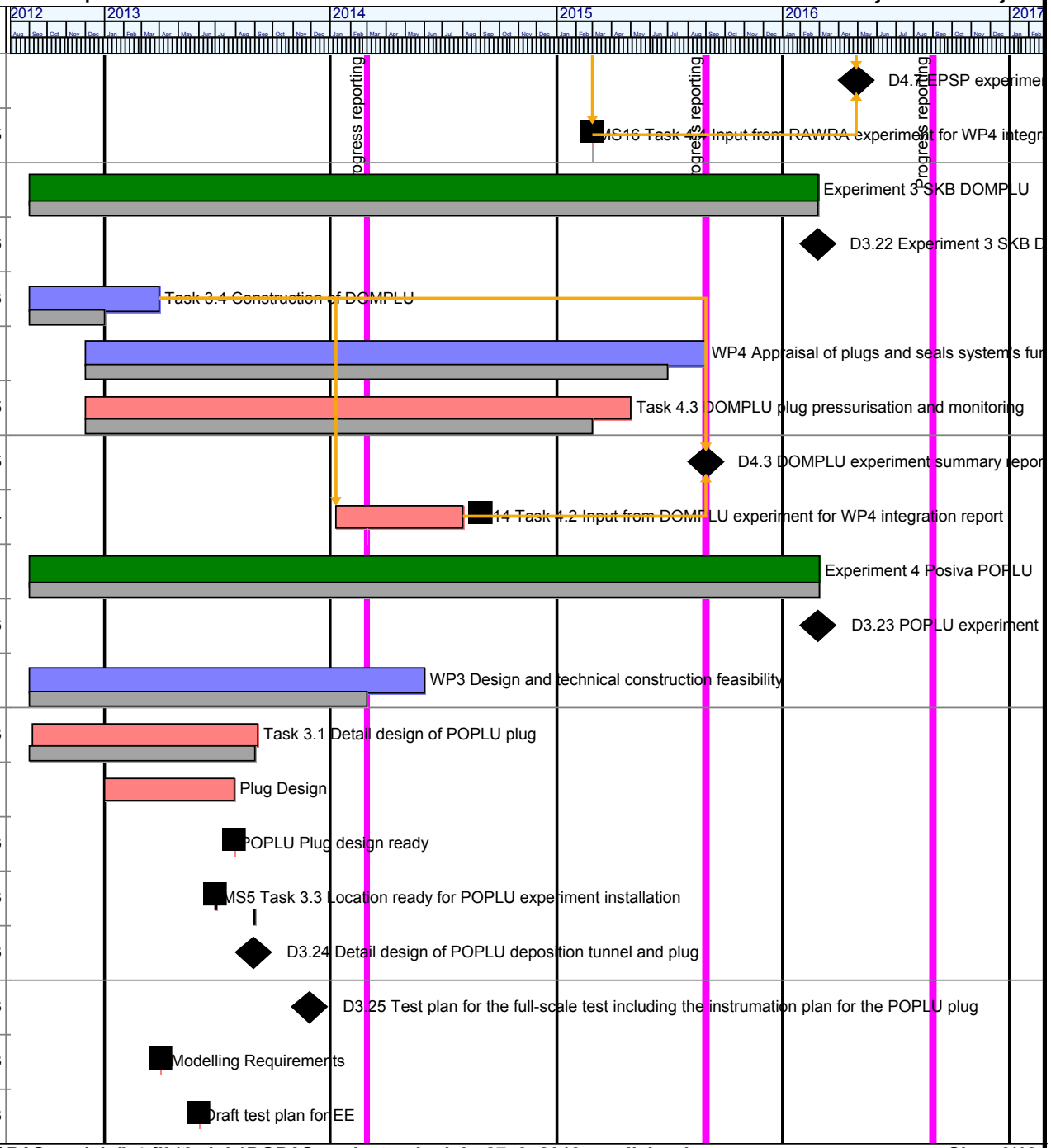
Activity	Start	End
D4.7 EPSP experiment summary report	29.4.2016	
MS16 Task 4.4 Input from RAWRA experiment for WP4 integration r	27.2.2015	27.2.2015
Experiment 3 SKB DOMPLU		
D3.22 Experiment 3 SKB DOMPLU	29.2.2016	29.2.2016
Task 3.4 Construction of DOMPLU	3.9.2012	28.3.2013
WP4 Appraisal of plugs and seals system's function		
Task 4.3 DOMPLU plug pressurisation and monitoring	3.12.2012	30.4.2015
D4.3 DOMPLU experiment summary report	31.8.2015	31.8.2015
MS14 Task 4.2 Input from DOMPLU experiment for WP4 integration	9.1.2014	31.7.2014
Experiment 4 Posiva POPLU		
D3.23 POPLU experiment	29.2.2016	29.2.2016
WP3 Design and technical construction feasibility		
Task 3.1 Detail design of POPLU plug	7.9.2012	5.9.2013
Plug Design		
POPLU Plug design ready	30.7.2013	30.7.2013
MS5 Task 3.3 Location ready for POPLU experiment installation	1.7.2013	1.7.2013
D3.24 Detail design of POPLU deposition tunnel and plug	30.8.2013	30.8.2013
D3.25 Test plan for the full-scale test including the instrumation plan	28.11.2013	28.11.2013
Modelling Requirements	2.4.2013	2.4.2013
Draft test plan for EE	3.6.2013	3.6.2013



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DOPAS project schedule

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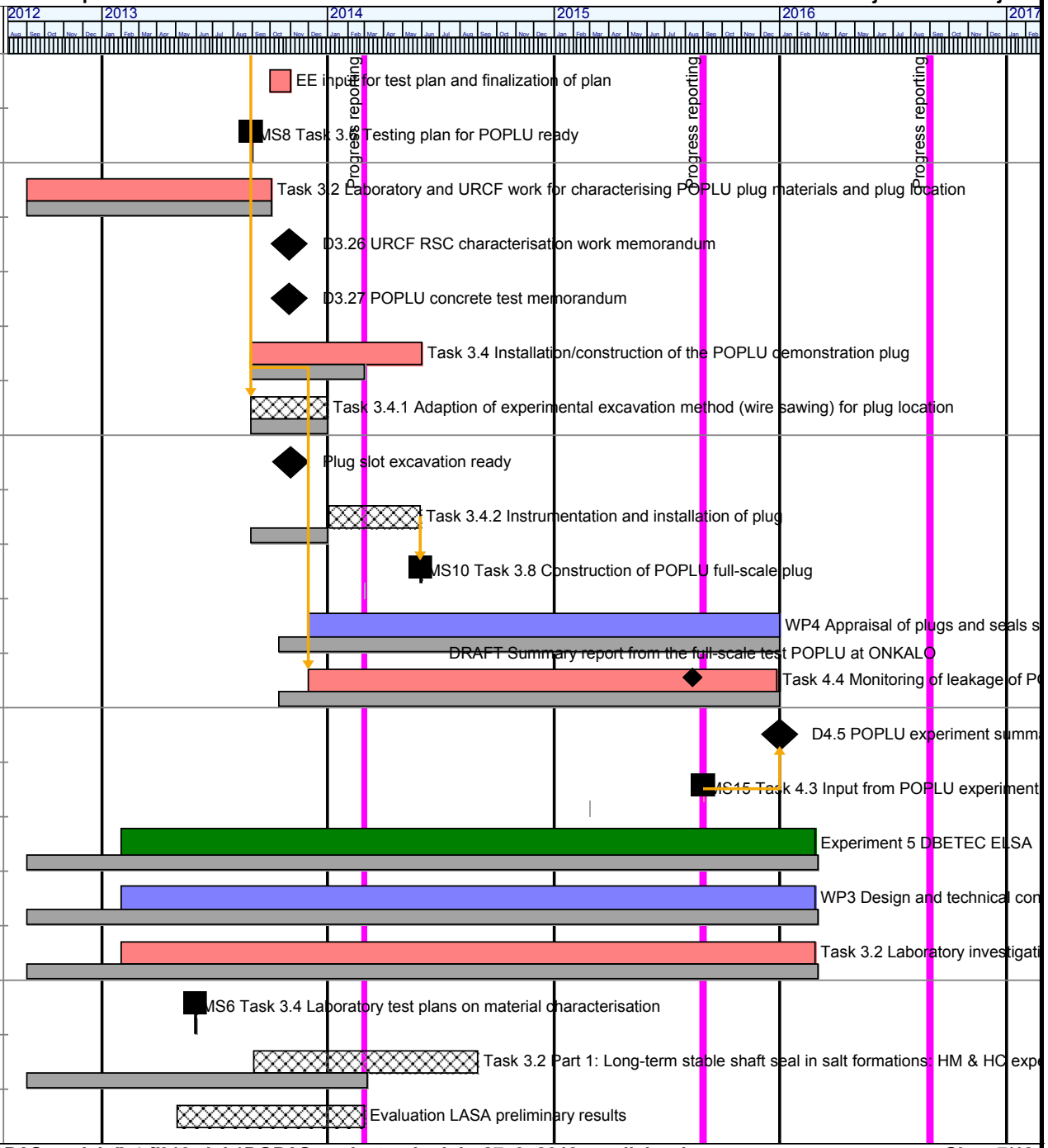
Suunnittelija: Palmu Marjatta

Activity	Start	End
EE input for test plan and finalization of plan	30.9.2013	31.10.2013
MS8 Task 3.6 Testing plan for POPLU ready	30.8.2013	30.8.2013
Task 3.2 Laboratory and URCF work for characterising POPLU plug	3.9.2012	1.10.2013
D3.26 URCF RSC characterisation work memorandum	31.10.2013	31.10.2013
D3.27 POPLU concrete test memorandum	31.10.2013	31.10.2013
Task 3.4 Installation/construction of the POPLU demonstration plug		
Task 3.4.1 Adaption of experimental excavation method (wire sawi	30.8.2013	31.12.2013
Plug slot excavation ready	4.11.2013	4.11.2013
Task 3.4.2 Instrumentation and installation of plug	2.1.2014	29.5.2014
MS10 Task 3.8 Construction of POPLU full-scale plug	30.5.2014	30.5.2014
WP4 Appraisal of plugs and seals system's function		
Task 4.4 Monitoring of leakage of POPLU plug	2.12.2013	29.12.2015
D4.5 POPLU experiment summary report	31.12.2015	31.12.2015
MS15 Task 4.3 Input from POPLU experiment for WP4 integration re	31.8.2015	31.8.2015
Experiment 5 DBETEC ELSA	**3.9.2012**	
WP3 Design and technical construction feasibility	3.9.2012	
Task 3.2 Laboratory investigations for ELSA shaft seal		
MS6 Task 3.4 Laboratory test plans on material characterisation	31.5.2013	31.5.2013
Task 3.2 Part 1: Long-term stable shaft seal in salt formations: HM	3.9.2013	29.8.2014
Evaluation LASA preliminary results	2.5.2013	28.2.2014



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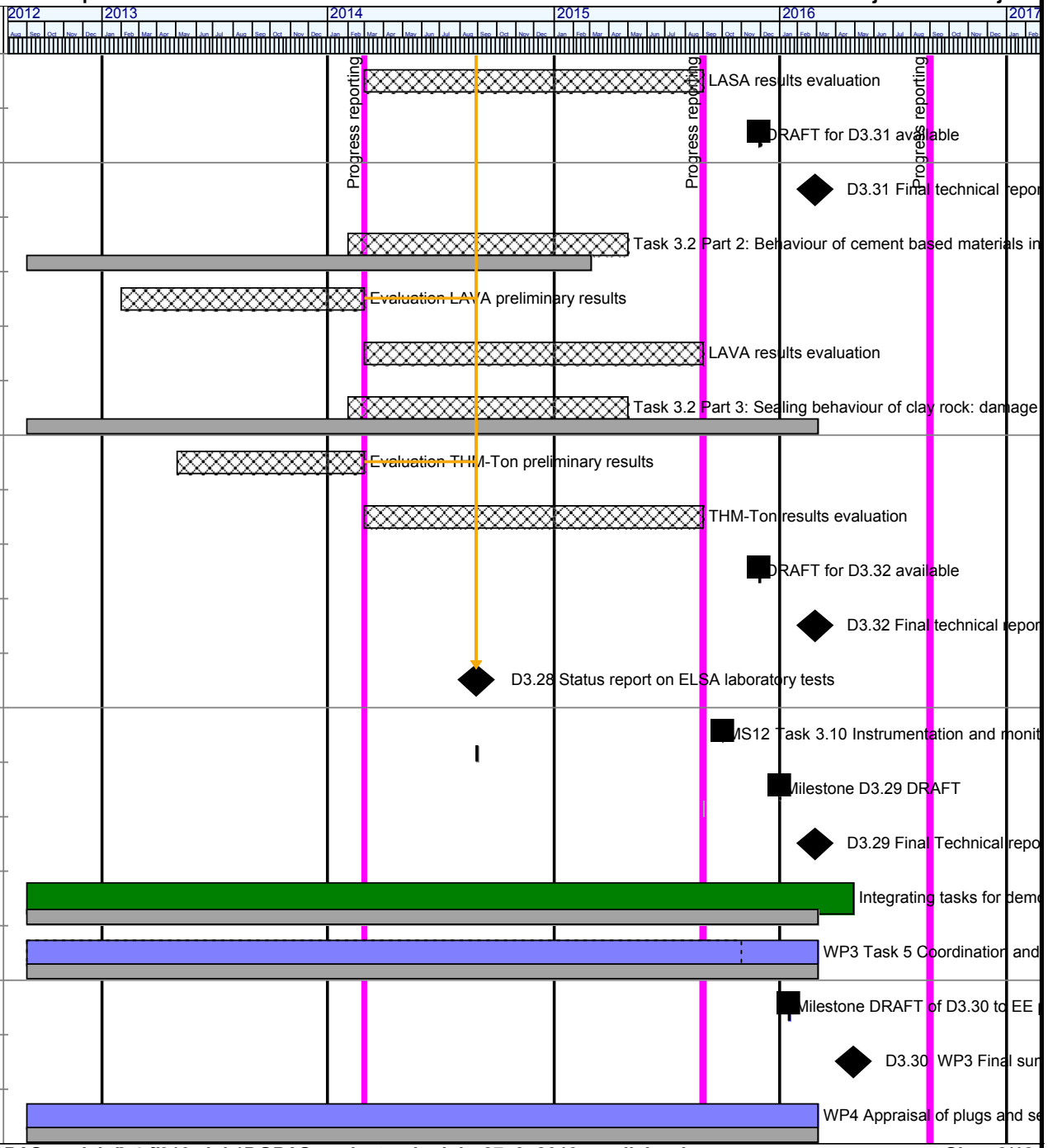
DOPAS project schedule

Päällikkö: Hansen Johanna — **updated 22.3.2013** — **Suunnittelija: Palmu Marjatta**

Activity	Start	End
LASA results evaluation	28.2.2014	31.8.2015
DRAFT for D3.31 available	30.11.2015	30.11.2015
D3.31 Final technical report on ELSA related testing - of mechanica	29.2.2016	29.2.2016
Task 3.2 Part 2: Behaviour of cement based materials in shaft and	3.2.2014	30.4.2015
Evaluation LAVA preliminary results	1.2.2013	28.2.2014
LAVA results evaluation	28.2.2014	31.8.2015
Task 3.2 Part 3: Sealing behaviour of clay rock: damage /recompac	3.2.2014	30.4.2015
Evaluation THM-Ton preliminary results	2.5.2013	28.2.2014
THM-Ton results evaluation	28.2.2014	31.8.2015
DRAFT for D3.32 available	30.11.2015	30.11.2015
D3.32 Final technical report on sealing behaviour of clay rock (THM	29.2.2016	29.2.2016
D3.28 Status report on ELSA laboratory tests	29.8.2014	2.9.2014
MS12 Task 3.10 Instrumentation and monitoring plans for experime	30.9.2015	30.9.2015
Milestone D3.29 DRAFT	31.12.2015	31.12.2015
D3.29 Final Technical report ELSA related testing	29.2.2016	29.2.2016
Integrating tasks for demonstration experiments 1-5		
WP3 Task 5 Coordination and integration of results/ final reporting of V	3.9.2012	
Milestone DRAFT of D3.30 to EE process	15.1.2016	15.1.2016
D3.30 WP3 Final summary report	29.4.2016	29.4.2016
WP4 Appraisal of plugs and seals system's function		



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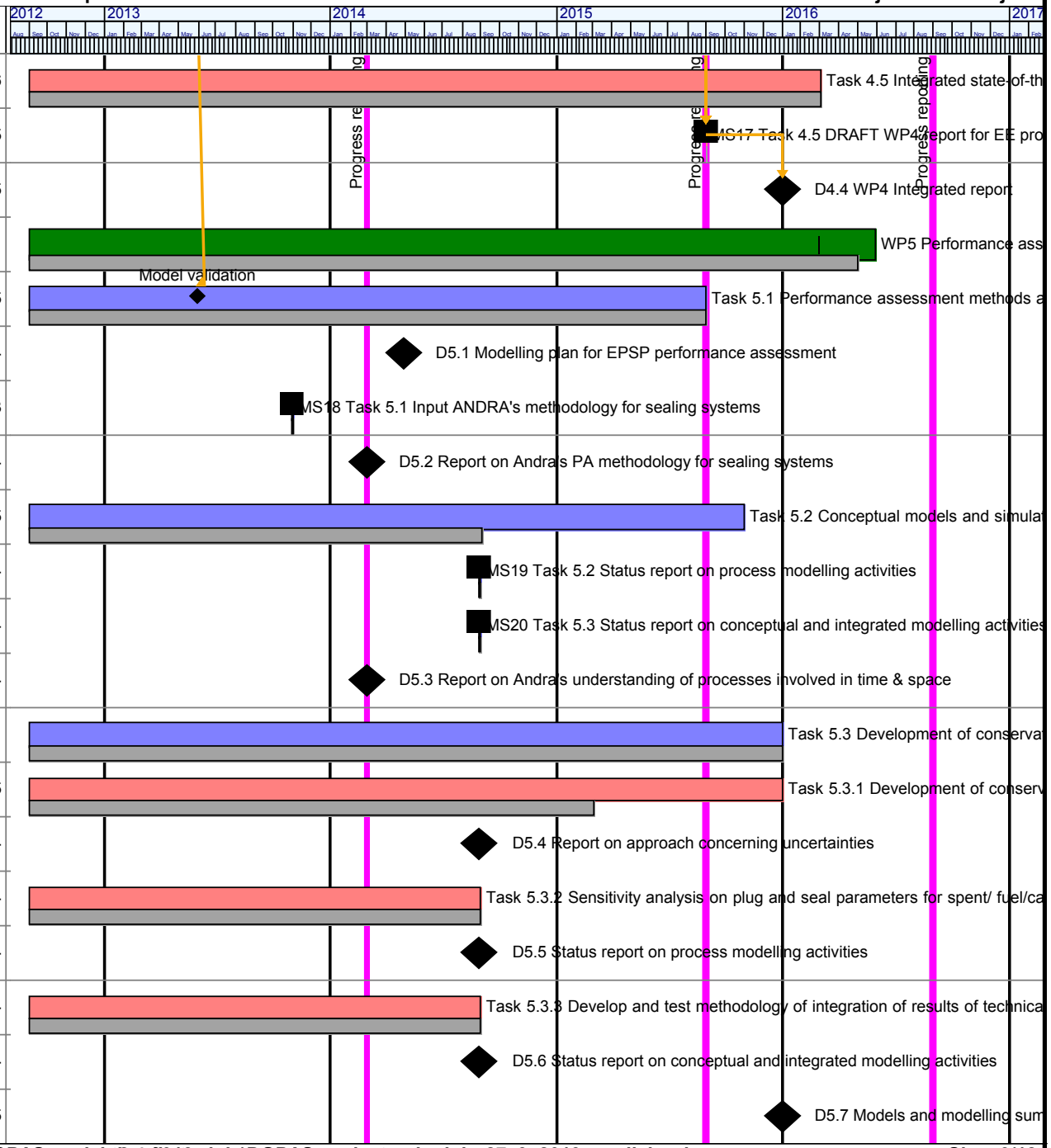
Päällikkö: Hansen Johanna

DOPAS project schedule

updated 22.3.2013

Suunnittelija: Palmu Marjatta

Activity	Start	End
Task 4.5 Integrated state-of-the-art report of the results of WP4	3.9.2012	2.3.2016
MS17 Task 4.5 DRAFT WP4 report for EE process available	31.8.2015	31.8.2015
D4.4 WP4 Integrated report	31.12.2015	31.12.2015
WP5 Performance assessment of plugs and seals syster		
Task 5.1 Performance assessment methods and tools for predicting th	3.9.2012	31.8.2015
D5.1 Modelling plan for EPSP performance assessment	30.4.2014	30.4.2014
MS18 Task 5.1 Input ANDRA's methodology for sealing systems	31.10.2013	31.10.2013
D5.2 Report on Andra's PA methodology for sealing systems	28.2.2014	28.2.2014
Task 5.2 Conceptual models and simulation of processes and their ev	3.9.2012	30.10.2015
MS19 Task 5.2 Status report on process modelling activities	29.8.2014	29.8.2014
MS20 Task 5.3 Status report on conceptual and integrated modelling a	29.8.2014	29.8.2014
D5.3 Report on Andra's understanding of processes involved in time &	28.2.2014	28.2.2014
Task 5.3 Development of conservative PA models of methodology and	3.9.2012	
Task 5.3.1 Development of conservative PA models and modelling a	3.9.2012	31.12.2015
D5.4 Report on approach concerning uncertainties	29.8.2014	29.8.2014
Task 5.3.2 Sensitivity analysis on plug and seal parameters for spent	3.9.2012	29.8.2014
D5.5 Status report on process modelling activities	29.8.2014	29.8.2014
Task 5.3.3 Develop and test methodology of integration of results of	3.9.2012	29.8.2014
D5.6 Status report on conceptual and integrated modelling activities	29.8.2014	29.8.2014
D5.7 Models and modelling summary report for EPSP	31.12.2015	31.12.2015



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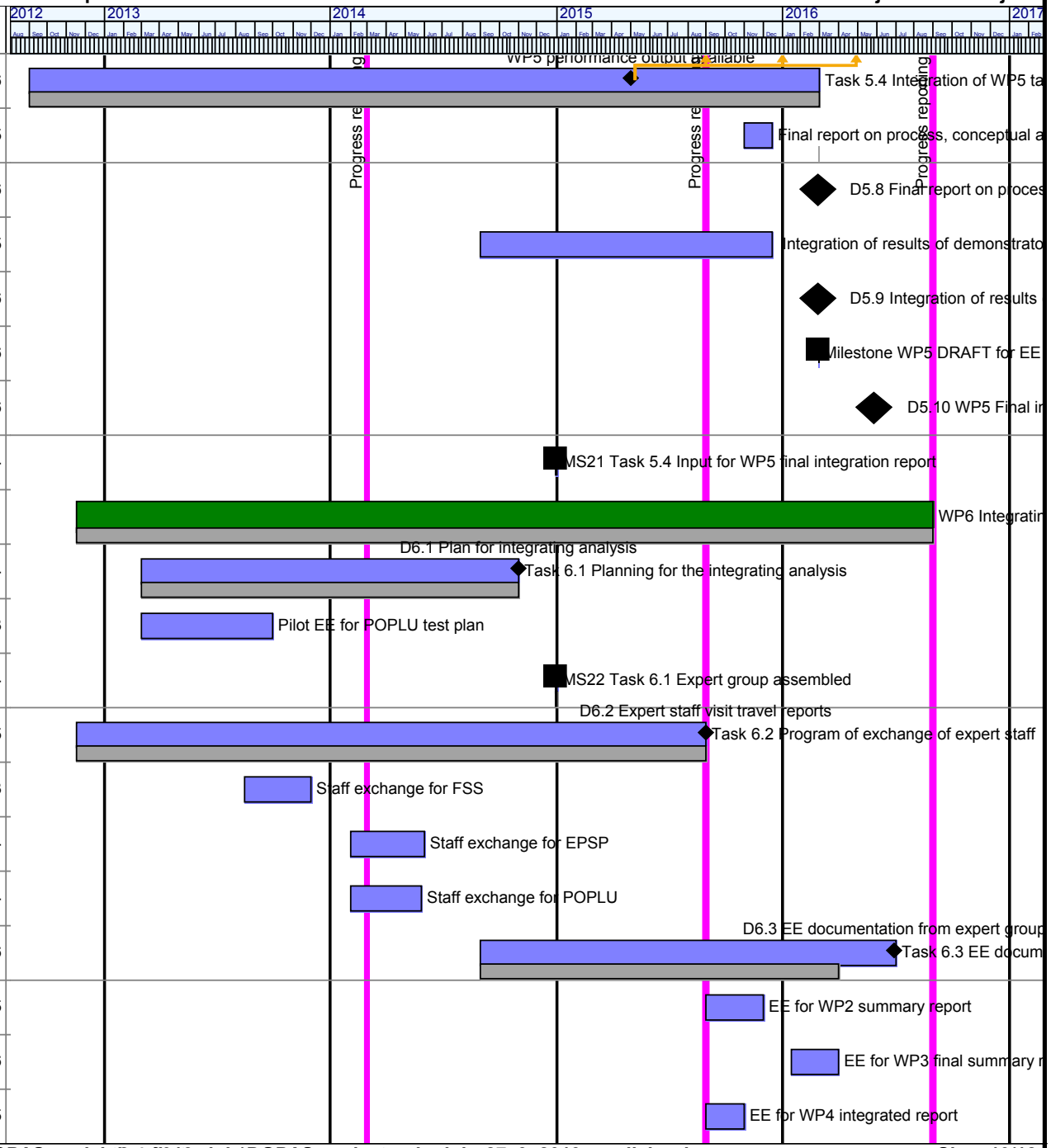
DOPAS project schedule

Päällikkö: Hansen Johanna — **updated 22.3.2013** — **Suunnittelija: Palmu Marjatta**

Activity	Start	End
Task 5.4 Integration of WP5 task reports	3.9.2012	29.2.2016
Final report on process, conceptual and integrated modelling activities	2.11.2015	15.12.2015
D5.8 Final report on process, conceptual and integrated modelling acti	29.2.2016	29.2.2016
Integration of results of demonstrators in total repository system's PA	1.9.2014	15.12.2015
D5.9 Integration of results of demonstrators in total repository system's	29.2.2016	29.2.2016
Milestone WP5 DRAFT for EE process	26.2.2016	26.2.2016
D5.10 WP5 Final integrated report	30.5.2016	30.5.2016
MS21 Task 5.4 Input for WP5 final integration report	31.12.2014	31.12.2014
WP6 Integrating analysis		
Task 6.1 Planning for the integrating analysis	1.3.2013	31.10.2014
Pilot EE for POPLU test plan	1.3.2013	30.9.2013
MS22 Task 6.1 Expert group assembled	31.12.2014	31.12.2014
Task 6.2 Program of exchange of expert staff	16.11.2012	31.8.2015
Staff exchange for FSS	15.8.2013	29.11.2013
Staff exchange for EPSP	3.2.2014	30.5.2014
Staff exchange for POPLU	3.2.2014	28.5.2014
Task 6.3 EE documentation from Expert Group	1.9.2014	30.6.2016
EE for WP2 summary report	1.9.2015	30.11.2015
EE for WP3 final summary report	15.1.2016	31.3.2016
EE for WP4 integrated report	31.8.2015	30.10.2015

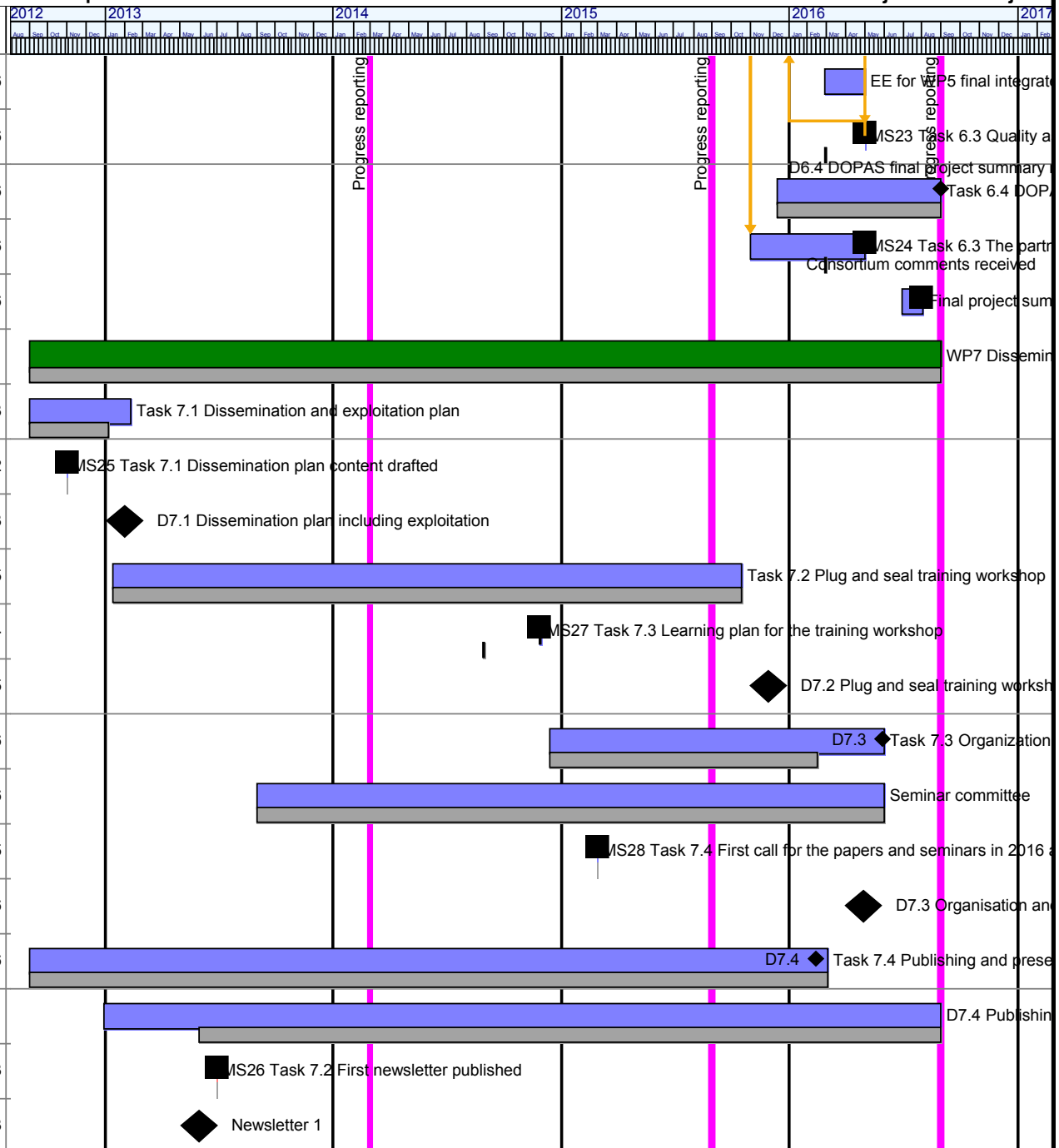


Posiva Oy

DOPAS project schedule

Päällikkö: Hansen Johanna — **updated 22.3.2013** — **Suunnittelija: Palmu Marjatta**

Activity	Start	End
EE for WP5 final integrated report	26.2.2016	29.4.2016
MS23 Task 6.3 Quality assurance-inputs of EE review received for WP	2.5.2016	2.5.2016
Task 6.4 DOPAS final project summary report	15.12.2015	31.8.2016
MS24 Task 6.3 The partner inputs for the preparation of final project re	2.11.2015	2.5.2016
Final project summary draft for comments	30.6.2016	1.8.2016
WP7 Dissemination		
Task 7.1 Dissemination and exploitation plan	3.9.2012	8.2.2013
MS25 Task 7.1 Dissemination plan content drafted	31.10.2012	31.10.2012
D7.1 Dissemination plan including exploitation	1.2.2013	1.2.2013
Task 7.2 Plug and seal training workshop	15.1.2013	15.10.2015
MS27 Task 7.3 Learning plan for the training workshop	28.11.2014	28.11.2014
D7.2 Plug and seal training workshop planning and implementation rep	30.11.2015	30.11.2015
Task 7.3 Organization in co-operation and input for the IGD-TP interna	15.12.2014	31.5.2016
Seminar committee	2.9.2013	31.5.2016
MS28 Task 7.4 First call for the papers and seminars in 2016 announc	27.2.2015	27.2.2015
D7.3 Organisation and publication of international seminar conference	29.4.2016	29.4.2016
Task 7.4 Publishing and presenting the DOPAS project's public results	3.9.2012	2.3.2016
D7.4 Publishing in total six newsletter in pdf-format at 9 months interva		
MS26 Task 7.2 First newsletter published	28.6.2013	28.6.2013
Newsletter 1	31.5.2013	31.5.2013

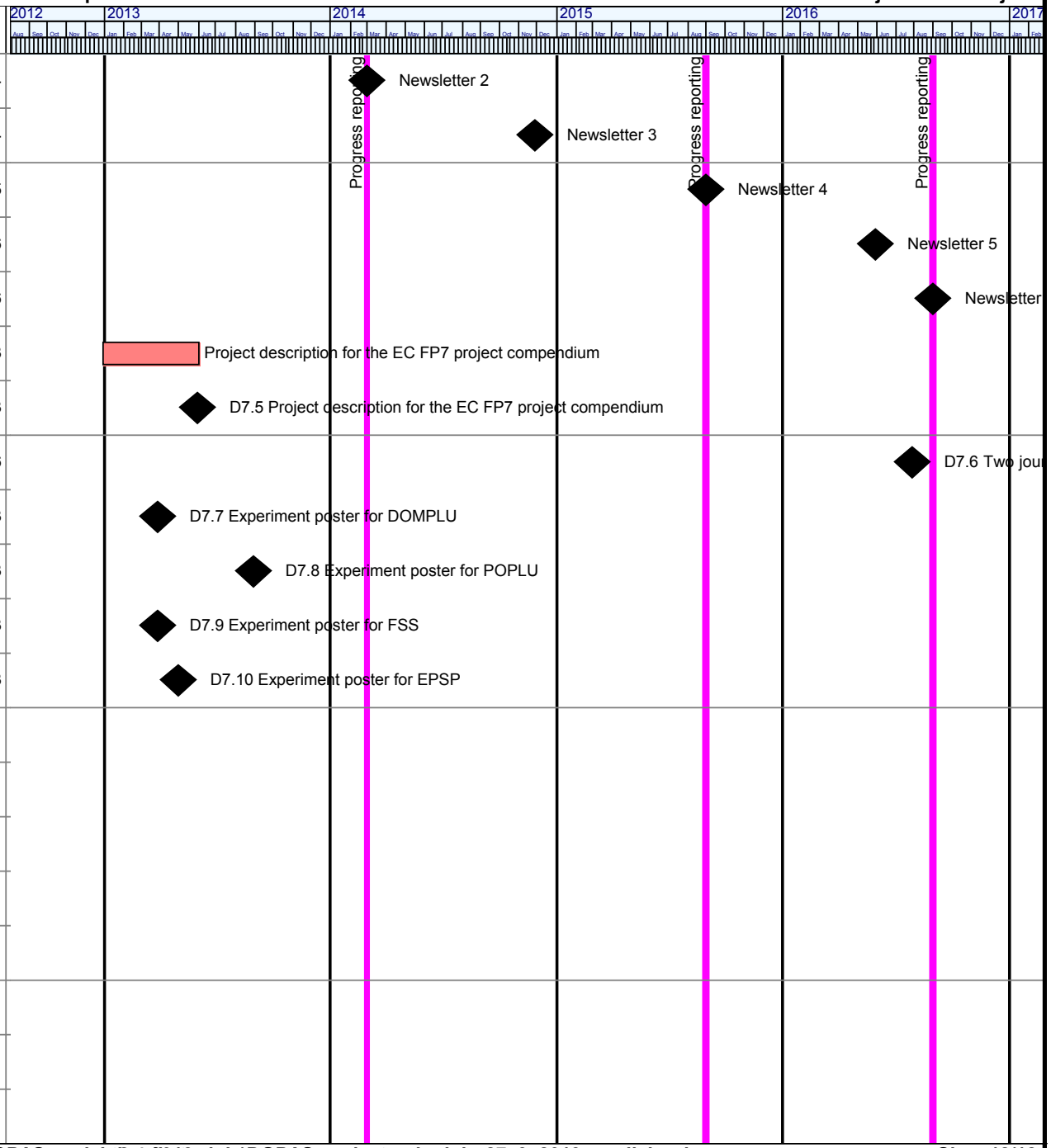


Posiva Oy

DOPAS project schedule

Päällikkö: Hansen Johanna — **updated 22.3.2013** — **Suunnittelija: Palmu Marjatta**

Activity	Start	End
Newsletter 2	28.2.2014	28.2.2014
Newsletter 3	28.11.2014	28.11.2014
Newsletter 4	31.8.2015	31.8.2015
Newsletter 5	31.5.2016	31.5.2016
Newsletter 6	31.8.2016	31.8.2016
Project description for the EC FP7 project compendium	31.12.2012	31.5.2013
D7.5 Project description for the EC FP7 project compendium	31.5.2013	31.5.2013
D7.6 Two journalist edited 2-page summary documents of project's sci	29.7.2016	29.7.2016
D7.7 Experiment poster for DOMPLU	28.3.2013	28.3.2013
D7.8 Experiment poster for POPLU	30.8.2013	30.8.2013
D7.9 Experiment poster for FSS	28.3.2013	28.3.2013
D7.10 Experiment poster for EPSP	30.4.2013	30.4.2013



DOPAS RISK MANAGEMENT PLAN SUMMARY

1 Definitions and purpose

Risk management plan defines how risks are managed in a project. The plan is generally based on the risk management system of the project management organisation and the risk management plan is integrated into the project plan.

The purpose of the DOPAS project's risk management plan is to identify the major adverse risks that could hinder or delay the DOPAS project from achieving its objectives within the planned time and budget. The risks in the plan are divided in the three categories: non technical project risks, general technical project risks and Work Package risks with main experiment related risks included. In addition the detailed Experiment risks are compiled into the separate documents which are followed by Experiment leaders. Since the DOPAS project is a joint activity of several different organisations carrying out independently in-situ experiments, the risk plan needs to take into account the project, risk and quality management procedures of each implementing organisations also in respect to their subcontracting. The risk plan also addresses the major means of managing the risks and preventing/mitigating their adverse consequences to the DOPAS project. Responsibilities for the management and prevention/mitigation of individual consortium members are defined in the plan in alignment to the EC Grant Agreement and the DOPAS consortium agreement.

2 Areas of major uncertainty of the DOPAS project and their likelihood (Risk matrix)

Table 1 Risk register of most significant DOPAS risks and organisations responsible for their management

Owner, and proje	Organisation and procedures	Construction plans and design solutions	Procurement and operations	Environment and conditions	Lifecycle, functionality and use
Uncertainty of funding	Experiment Owners and their organisations	Nuclear Regulatory requirements and other subsystem input data	Procurement packages and contract limits	Local conditions	Functionality and use
Scope and programme	Coordinator organisation	Experiment site conditions and locations	Offering, economic cycle and competition the market	Authorities (non-nuclear)	Care-taking
Actions and needs	Subcontracting organisations	Design input/basis	Deficiencies in contracts and deliverie	Political and cultural environment	Maintenance including preventive maintenance
Quality and qualifications	Users (design, operations, licensing regulators)	Architecture and generic design concepts		EU/ National / organisational specifi terminology	
Timetable	Procedures /QM Systems	Technical solutions	Work safety management	Third parties	Reporting of outcomes and their quality assurance
Budget	Decision making process	Compatibility of designs and subsystems	Quality assurance of materials, deliveries an operations	Adversaries	Housekeeping on site

Likelihood

Pink	very likely
Violet	not likely, but can happen
Light blue	unlikely, exceptional

3 Risk register of most significant DOPAS risks and organisations responsible for their management

Table 2 Related areas of uncertainty and the consequence of risks realised (draft adopted from RT 10-11081, Figure 3)

Owner, and project	Organisation and procedures	Construction plans and design solutions	Procurement and operations	Environment and conditions	Lifecycle, functionality and use
Uncertainty of funding	Experiment Owners and their organisations	Nuclear Regulatory requirements and other subsystem input data	Procurement packages an contract limits	Local conditions	Functionality and use
Scope and programme	Coordinator organisatio	Experiment site conditions and locations	Offering, economic cycle and competition in the market	Authorities (non-nuclear)	Care-taking
Actions and needs	Subcontracting organisations	Design input/basis		Political and cultural environment	
Quality and qualifications	Users (design, operation licensing, regulators)	Architecture and generic design concepts	Deficiencies in contracts and deliveries	EU/ National / organisational specific terminology	Maintenance including preventive maintenance
Timetable	Procedures /QM System	Technical solutions	Work safety management	Third parties	Reporting of outcomes and their quality assurance
Budget	Decision making proces	Compatibility of designs and subsystems	Quality assurance of materials, deliveries and operations	Adversaries	Housekeeping on site

Consequences

Red	high
Yellow:	medium
Green:	low

4 Risk management and mitigation of significant adverse project risks

The risk register is reviewed by the project consortium and each responsible organisation for an experiment and work package identifies for the risks related to their activities the risk management methods and potential mitigation actions (including insurance coverage) into the risk management plan. These individual tables are in Table 4 of this plan. The status of risks is followed and the prevention, realisation or mitigation are discussed yearly in DOPAS General Assembly meetings.

The levels of the risks are identified with respect to their probability and consequences to the project, in accordance with the following Table 3.

Table 3. Risk level grading, which is used for identifying the most significant risks at DOPAS project

Probability	**Consequence**		
	Minor	**Harmful**	**Serious**
Unlikely	***1 Insignificant risk***	***2. Minor risk***	***3. Moderate risk***
Not likely, but can happen	***2. Minor risk***	***3. Moderate risk***	***4. Remarkable risk***
Very likely	***3. Moderate risk***	***4. Remarkable risk***	***5. Intolerable risk***

No	Name of identified risk	Major consequences	Responsibility	Risk grading	Counter measures	Included into project plan	Risk handling
	General non technical risks		**Org; person**	**I-Internal / E- External; Level, Likelihood, Consequences**	**P- prevention M- mitigation**		
1	Partners leaving the consortium	More work load for others - schedule delay	GA	E, 3, unlikely, serious	P - Clear expectation in Project Plan and Grant Agreement. M - other partners cover work.		
2	Limited financial resources	Quality of the work might be insufficient	GA	E, 3, unlikely, serious	P- planning the work, sharing the resources, supervising the work and cost		
3	Limited visibility of network/ Underused website	All target groups are not reached	WP1 Coordinator	E, 3, not likely, harmful	P- Excellent and informative web site, which are updated requrlarly		
4	Not well structured documentation library / database	Learning from others insufficient, experiences not shared within consortium	WP1 Coordinator	I, 3, not likely, harmful	P- Active coordination, documentation practices agreed in Project Plan and in Consortium agreement	DOPAS projet plan	
5	Low contribution of partner	Poor work, experiments, reporting	Each partner	I, 3, not likely, harmful	P- Good planning of DOPAS project and clearly define work tasks for each partner	DoW and Experiment plans	
6	Weak links with other networks	Similar work done in several projects or experiences are not utilised	WP1 Coordinator	I, 3, not likely, harmful	P- Participation to the IGD-TP events and knowledge share within IGD-TP and other networks		

7	Travel risk of everyone traveling together as experts in specialized field	Knowledge availability (resources)	Each organisation	I, 3, unlikely, serious	P - Reduced travelling (e-meetings, use of local staff), to have the deputies for key areas		
8	No political support for ambitious tasks	Outside influences interupting or harming experiments. Cannot implement results in practice.	Each organisation	E, 3, not likely, harmful	P- proper dissemination, M- strong consortium and improved political support from other consortium and IGD-TP members		
No	**Name of identified risk**	**Major consequences**	**Responsibility**	**Risk grading**	**Counter measures**	**Included into project plan**	**Risk handling**
	General technical risks jointly for DOPAS		**Org; person**	**I-Internal /E-External; Level, Likelihood, Consequences**	**P- prevention M- mitigation**		
1	Time schedule is too tight	Errors in construction, Documentation (plans,design) missing or uncomplete, resources overloaded	Experiment leaders	I, 4, not likely, serious	P – efficiency in work and decision making. Enough resources allocated to complete work.		
2	Time delay caused by any reason	Cost increase	Experiment leaders and WP leaders	I or E, 3, very likely, harmful	P - Good planning		
3	Change of scope of work	Time delay	General Assembly	I, 3, not likely, harmful	P - Close communication between coordinator and WP Leaders in order to early find indications of possible changes.		

4	Late delivery of contributions	Time delay	WP leaders	I, 3, not likely, harmful	P - Active communication between WP2 Leader and the other WP Leaders/experimental Leaders of status in contributions		
5	Inhomogeneous contributions	Time delay and decreased quality of result	WP leaders	I, 3, not likely, harmful	P - Active communication between WP2 Leader and the other WP Leaders/experimental Leaders of status in contributions		
6	Experienced resources/people are not available. Or change positions within project (lose people).	Poor quality	Experiment leaders	I, 4, very likely, harmful	P – allocate enough resources to work on project so work and knowledge is distributed	POPLU project plan and its subdocuments	
7	Not enough time for planning project (project plan not detailed/accurate enough with poor defining extension and scope of the project)	Cost increase	Experiment leaders	I, 3, not likely, harmful	P - Time for planning, commitment of key persons and experienced project manager.	Experiment or WP project plan and its subdocuments	
8	Tender process takes more time than expected	Time delay	Experiment leaders	I, 3, not likely, harmful	P- time for planning, good parctices in companies	Experiments schedule	

9	Lack of information in contributions	Time delay	WP leaders	I, 3, not likely, harmful	P - Active communication between WP2 Leader and the other WP Leaders/experimental Leaders of status in contributions		
10	Late change of facts in contributions	Time delay and lower quality of result	WP leaders	I, 3, not likely, harmful	P - Active communication between WP2 Leader and the other WP Leaders/experimental Leaders of status in contributions		
No	**Name of identified risk**	**Major consequences**	**Responsibility**	**Risk grading**	**Counter measures**	**Included into project plan**	**Risk handling**
	General technical risks for WP2		**Org; person**	**I-Internal /E-External; Level, Likelihood, Consequences**	**P- prevention M- mitigation**		
1	Design basis and design requirements are not completely defined for the five experiments	Time delay	Experiment leaders	I, 2, not likely, minor	P - allocate enough resources to ensure that requirements are defined M. revise the WP2 reports in accordance to the design changes		
2	Design basis change during project and causes new requirements	The experiment does not fullfil its requirements	Experiment leaders	E, 3, not likely, harmful	P - Good communication and awareness of changes		

3	EE review does not fulfil the quality expected. Additional review is needed	Final report will be delayed. Affects the time table even for WP4	WP2 Experiment leader	E, 2, unlikely, harmful	P - allocate the experts needed. Define the quality level of the review. Allocate more time for review		
No	**Name of identified risk**	**Major consequences**	**Responsibility**	**Risk grading**	**Counter measures**	**Included into project plan**	**Risk handling**
	General technical risks for WP3		**Org; person**	**I-Internal /E-External; Level, Likelihood, Consequences**	**P- prevention M- mitigation**		
1	Coordination between other underground work and demonstrations under ground and aboveground	Time delay	Each experiment leader	E, 3, not likely, harmful	P – accurate scheduling and procurement of materials and subcontractors	Experiment (FSS, EPSP, DOMPLU, POPLU) project plan	
2	Lack of experience of plug design	The main project aims fail.	FSS, EPSP, POPLU Experiment leaders	I, 2, not likely, harmful	P- Comments and requirements from experts M - learning from DOMPLU	Experiment (FSS, EPSP, DOMPLU, POPLU) project plan	
3	Contractor cannot do things in expected schedule, quality, extent etc	Cost increase, time delay, results not quality assured,	FSS, EPSP,DOMPLU, POPLU, ELSA Experiment leaders	E, 3, not likely, harmful	P- clearly defined purchase orders and follow up the contractors work	Experiment (FSS, EPSP, DOMPLU, POPLU, ELSA) project plan	

4	New methods, materials and techniques are difficult to implement in large scale	Time delay, cost increase	FSS, EPSP,DOMPLU, POPLU, ELSA Experiment leaders	I, 3, not likely, harmful	P- reassessment of methods and testing before use in the experiment	Experiment (FSS, EPSP, DOMPLU, POPLU) project plan	
5	Cost of experiments underestimated	Cost increase, change of experimental plan (equipment, monitoring, etc)	Each experiment leader	I, 3, not likely, harmful	M- The extent of the work can be reconsiderd M- redivision of resources between experiments	General Assembly	
6	EE review does not fulfil the quality expected. Additional review is needed	Final report will be delayed. Affects the time table even for WP5	WP3 leader	E, 2, unlikely, harmful	P - allocate the experts needed. Define the quality level of the review. Allocate more time for review		
7	Availability of materials (bentonite, concrete)	Time delay or change of materials	Each experiment leader	E, 3, not likely, harmful	P- Planning and purchasing early enough. M - change material sources for experimental purpose only.	Experiment projet plans	
No	**Name of identified risk**	**Major consequences**	**Responsibility**	**Risk grading**	**Counter measures**	**Included into project plan**	**Risk handling**
	General technical risks for WP4		**Org; person**	**I-Internal /E-External; Level, Likelihood, Consequences**	**P- prevention M- mitigation**		
1	Malfunction of the pressurization system or higher water loss than expected to surrounding rock.	The pressurization program cannot be implemented as planned.	FSS, EPSP, DOMPLU, POPLU Experiment leader	I, 3, not likely, serious	P - Redundant (double) pump capacity and safety valves introduced. P - Detailed system inspections before start of the experiment.	Experiment (FSS, EPSP, DOMPLU, POPLU) project plan	

2	Water tightness of the plug is not possible to check	The main project goal fail.	FSS, DOMPLU, POPLU Experiment leader	I, 4, not likely, serious	P - In-house development of a suitable leakage measurement system with extensive testing before start of the experiment	Experiment (FSS, DOMPLU, POPLU) project plan	
3	Failure or malfunction of sensors	Less suitable data	FSS, EPSP, DOMPLU, POPLU Experiment leader	I, 4, very likely, harmful	P- use of proven sensors, redundency in design (using more than 1 type).	Experiment (FSS, EPSP, DOMPLU, POPLU) project plan	
4	Unexpected cracking of concrete parts from several reason	The Experiment does not fullfil its scope or plans. Testing the behaviour is difficult	FSS, EPSP, DOMPLU, POPLU Experiment leader	I, 3, not likely, harmful	M- or P - different prevention and mitigation aspects experiments, related to the reasons. Extra grouting, sealing, coating, repair, etc.	Experiment plans	
5	Saturation of the bentonite seal takes longer time than is available for the project.	Sealing function is reached later than wanted; the final report is delayed.	FSS, DOMPLU Experiment leader	I, 3, not likely, harmful	P - Artificial wetting of the seal is made possible via the filter M- Sensor monitoring during test. Prolong test schedule, beyond duration of project.		
6	The Design Basis and Design Requirement reports (Deliverables of WP 2) do not allow evaluation of predicted behaviour against the initial state performance	Objectives of WP4 cannot be fulfilled entirely	WP leaders	I, 2, not likely, minor	(P) Early communication of structure / needs / details required for the assessment report of WP 4		

7	Delayed construction of in-situ experiments and related reports	Re-scheduling WP 4 planning required. Consequences for providing timely input to WP5	WP3 leader and experiment leaders	E, 3, not likely harmful	(P) Follow WP 3 activities in detail. Adjust planning. Early communication within WP 4 and to WP 5. (M) Flexibility in the own resource planning		
8	As built reports delivered not in time and / or not according to QA standards, subsequently they do not allow assessment.	Poor quality assessment and evaluation report	WP3 leader and experiment leaders	I, 3, not likely, harmful	(P) Early engagement to define structure and content of deliverable reports. (M) Progress monitoring of experiments during project.		
9	(Quality) Data monitored do not allow the systematic evaluation of the initial state behaviour (sensor failures, sensor drifts, calibration)	Poor quality assessment and evaluation report	Experiment leaders	E, 3, not likely, serious	Early communication of structure / needs / details required for the integration report. (P) Build in redundancy in the number and type of sensors for the experiments.		
10	Delayed reporting of WP 3 Experiments (Initial State monitoring) as input of for the WP4 integration report	Final integration /summary report of WP4 delayed. Delay of WP 5	WP3 leader and experiment leaders	I, 3, not likely, harmful	Re-scheduling WP 4 planning required. Reallocation of resources		

11	Unexpected behaviour of plug and seal systems require longer monitoring phase – thus delaying the dismantling phase	Assessment / evaluation report cannot be delivered in time	WP3 leader and experiment leaders	E, 4, not likely, serious	(M) Reassess the overall objectives and time plan of DOPAS		
12	EE review does not fulfil the quality expected. Additional review is needed	WP4 and Final report delayed	WP4 leader	E, 2, unlikely, harmful	P - allocate the experts needed. Define the quality level of the review. Allocate more time for review		
No	**Name of identified risk**	**Major consequences**	**Responsibility**	**Risk grading**	**Counter measures**	**Included into project plan**	**Risk handling**
	General technical risks for WP5		**Org; person**	**I-Internal /E-External; Level, Likelihood, Consequences**	**P- prevention M- mitigation**		
1	EE review does not fulfil the quality expected. Additional review	WP5summary report and DOPAS final summary report will be delayed	WP5 leader	E, 2, unlikely, harmful	P - allocate the experts needed. Define the quality level of the review. Allocate more time for review		
2	Delay of process modelling in task 5.1	Delay of work on model abstraction and integrated modelling in tasks 5.2 and 5.3	WP5 leader	I, 2, not likely, minor	M - Work will be started on preliminary results		
3	Availability of results from laboratory investigations in WP3	Delay of process modelling work in task 5.1	WP5 leader	I, 2, not likely, minor	M - Scoping calculations in task 5.1 will be started on preliminary results		

4	Experimental work in WP3 fails or gives unexpected results that are not suitable for model abstraction and integrated modelling in WP5	Integration of results in long-term performance assessment not possible for affected experiments	Experiment leaders	I, 3, not likely, harmful	P- Coordination between WP3 and WP5		
	Name of identified risk	**Major consequences**	**Responsibility**	**Risk grading**	**Counter measures**	**Included into project plan**	**Risk handling**
No	**General technical risks for WP6**		**Org; person**	**I-Internal /E-External; Level, Likelihood, Consequences**	**P- prevention M- mitigation**		
1	Functionality and use/Quality and qualifications: Task 6.1 Inappropriate tools developed for the EE process of individual deliverables	The quality of the EE process does not meet the desired QA targets set for the deliverables, alternative QA procedures need to ensure the quality of publications (additional review resource need as a consequence)	WP6 leader	E, 3, not likely, but can happen, harmful	P – Early planning of documents for EE review and early identification of experts. Accurate guidelines for EE process and expectations. P - Pilot EE carried out to prevent this risk. (M) - A final company internal QA carried out prior publication	known by 30.10.2015	-

2	Functionality and use/ Timetable Task 6.1 The EE tools and the experts are not ready by the time the drafts are ready	Delay for the work packages final deliverables, possible other timing problems with overlapping draft EE processes simultaneously (WP6 leader and partners as bottleneck)	WP6 leader	I, 3, not likely, harmful	P- follow up of developments in the WP2-WP5 to have a sufficient understanding of the context in terms of L/T safety and technical solutions for the tools preparation M- acquiring additional resources with the required expertise either from VTT/Hukki or within the consortium (GSL)	known by 30.5.2013 for the pilot and for the EE by 31.8.2015	-
3	Organisation and produres/ decision making process: Task 6.1 Not coming to an agreement on the experts to be selected for the EE process (General assembly and EC)	Delays in finding new experts that can be approved with consensus and potential budget overruns	WP6 leader	I, E, 3, not likely, harmful	P- preliminary listing of candidates to be discussed in General assembly no 2 at the end of 2013, final proposal at General assembly no 3 end of 2014. M- proposing new individual candidates for approval	known by 31.12.2014	-

4	Functionality and use/Quality and qualifications: Task 6.3 Inappropriate tools developed for the EE process of individual deliverables resulting in unsuitable review results	The input for the deliverables is not appropriate for the Work Packages or cannot be included into the final reports within the preserved time (=> delays in timetable)	WP6 leader	E, 3, not likely, but can happen, harmful	P – Early planning of documents for EE review and early identification of experts. Accurate guidelines for EE process and expectations. Pilot EE carried out to prevent this risk	known in stages by 30.10.2015 30.11.2015 31.3.2016 29.4.2016	-
5	Construction plans and design solutions/Technical solutions' timetables: Task 6.3 The drafts of the deliverables subject to the EE are not ready on time	Delays for the EE process and consequently delays for a final report or several reports	WP2-WP5 leader	I, 3, not likely, harmful	P- follow up of development and especially timetable milestones in the WPs 2-5 for timely planning and for tracking potential delays or changes in draft delivery dates M - recruitment of additional resources for the EE group and for facilitation, and for the documentation of the process (=> budgetary consequences resulting from mitigation)	known in stages by 1.9.2015 31.8.2015 15.1.2016 28.2.2016	-

6	Lifecycle/Reporting of outcomes timetable/ Task 6.3 The draft deliverables are delayed and submitted during a season in the year when the experts cannot have a consensus meeting	Delays in the input resulting in resource bottlenecks within the WP6	WP2-WP5 leader	I, 4, very likely, harmful	P- follow up of development and especially timetable milestones in the WPs 2-5 for timely planning and for tracking potential delays or changes in draft delivery dates M- Impact assessment on the deliverable submission timetable and identification of new critical paths and other more specified mitigative actions agreed by the consortium	known in stages by 1.9.2015 31.8.2015 15.1.2016 28.2.2016	-
7	Construction plans and design solutions: Task 6.2 Timing of site visits	Timetable of site visits is dependent on the progress of the experiment activities	POPLU experiment leader	I & E, 2, very likely, minor	P - Planning for the site visits is not prevented by delays in the actual experiments. The actions can take place any time during the project	known by summer 2014	-

8	Construction plans and design solutions: Task 6.2 Work safety during site visits	Potential accidents on the demonstration sites (health concerns)	FSS, EPSP, POPLU Experiment leaders	I & E, 3 unlikely, harmful	P - Construction sites and underground work places are high risk working environments and site safety induction is required for entry into the facilities and the instructions of the site visit host organisations need to be complied to the point. Participants to the site visit need to have appropriate insurance coverage provided by their employer for the site visits. M - immediate mitigation actions are provided by the host organisation, but all visitors enter at their own risk unless due to gross negligence by the hosting organisation or third parties engaged in the visit.	known by end of 2014	-
9	Lifecycle/Reporting outcomes timetable. Task 6.4 Summary report does not receive the input timely	Delay of D6.4 DOPAS summary report	Posiva Oy, Coordinator	I, 3, not likely, harmful	P- Writing and draft available in good time before deadline M - Finding extra reporting resources for WP6 from the consortium	known by 15.1.2016	-

10	Pilot EE process time need can cause delay to POPLU instrumentation procurement and implementation	Delay in the implementation schedule of POPLU experiment	WP6 leader	I & E, 3, very likely, harmful	P - Early follow-up of the POPLU instrumentation planning and experiment timetable and interaction with the POPLU project manager, project group and instrumentation and modelling staff, inclusion of the process information and time needs into POPLU experiments plan and timetable M- Review of timetable and new critical path	known by 30.5.2013	some delay to the original DoW timetable
	Name of identified risk	**Major consequences**	**Responsibility**	**Risk grading**	**Counter measures**	**Included into project plan**	**Risk handling**
No	**General technical risks for WP7**		**Org; person**	**I-Internal /E-External; Level, Likelihood, Consequences**	**P- prevention M- mitigation**		
1	Task 7.1 All planned dissemination activities are not completed	Extent of dissemination remains poor	All , Scientific contact persons of each organisation.	I, 2, not likely, minor	P - commitment and follow up to the Dissemination plan M - new dissemination activities are proposed throughout the DOPAS	D7.1 Dissemination plan	

2	Task 7.2 Planning of the workshop programme and tutors	Unsuccessful learning process and desired learning outcomes due to weak content and delivery	Posiva Oy, Task leader and CTU	I, 2, not likely, minor	P- following learning process and the concept in the design of the programme; selection of tutors based on prior delivery records or pre-tutoring sessions with tutors prior delivery, use of ECVET experiences in the design of delivery to assess learning outcomes M -after workshop assessment requirement for participants	known by 1.9.2015	
3	Task 7.2 Less then foreseen participants or wrong target group of participants participating the workshop	Weaker than intended knowledge transfer to the academia, WMOs and other target groups then intended (less impact of the project)	Posiva Oy, Coordinator	E & I, 3, not likely, harmful	P- use of all dissemination channels and networks of the consortium and other bodies to reach a maximum number of participants from the desired target groups M - potential additional funding scheme considerations for participants with the correct profiles but limited means; additional marketing efforts to the potential target groups need to be undertaken	known by 1.9.2015	

4	Task 7.2 Keeping within Training Workshop budget	budget not enough or does not allow for flexibility in terms of delivery and assessment	Posiva Oy, Task leader	I & E, 2, unlikely, harmful	P- a more detail cost estimate and budget formulated on the basis of the learning and delivery process plan and follow up of the costs directly related to the workshop M - potential inclusion of in-kind contributions to the deliveries, transfer of Posiva and CTU budget from other WPs and sponsorship contributions from other IGD-TP EG members as a last resort	known by 1.6.2016	
5	Task 7.3 Capacity for seminar is wrongly estimated	All participants cannot participate due the capacity problems	Posiva, Coordinator	E, 2, unlikely, harmful	P - preannouncement and capacity reservation		
6	All cannot have access to the Experimental site visit due the limited or strict visiting practices in (ex. ONKALO only 7 persons allowed to visit at the same time)	Reaching all target groups are not complete	Experiment leaders at each experiment site	I, 2, very likely, minor	M - To take care that the information of project is shared with visitors above surface		