TRANSAT

Research and Innovation Action (RIA)

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Detailed Work Plan

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Summary

This document defines the activities of each Partner within each task with precision and identifies the involved persons. It contains contributions from all Work Package leaders (WPLs) and provides a bird's eye view of objectives, planned activities, timing, synergies and responsibilities.

Approval

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Abbreviations

ASME	American Society of Mechanical Engineers
ASTRID	Advanced Sodium Technological Reactor for Industrial Demonstration
CONCERT	European Joint Programme for the Integration of Radiation Protection Research
DEMO	DEMOnstration Power Plant
DEMO BB	DEMO Breeding Blanket
DNA	DeoxyriboNucleic Acid
DWP	Detailed Work Plan
EC DG RI	European Commission – Directorate General for Research and Innovation
ECCP	Electronic Collaborative Content Platform
EDX	Energy Dispersive X-ray spectrometry
ExCom	Executive Committee
GB	Governing Board
HCLL	Helium Cooled Lithium Lead
HCPB	Helium Cooled Pebble Bed
IBA	Ion Beam Analysis
ICP-MS	Inductively Coupled Plasma Mass Spectrometry
ITER	International Thermonuclear Experimental Reactor
LFR	Lead-cooled Fast Reactor
LIBS	Laser-Induced breakdown spectroscopy
NRA	Nuclear Reaction Analysis
OBT	Organically Bounded Tritium
PMO	Project Management Office
PQP	Project Quality Plan
SAC	Scientific Advisory Committee
SEM	Scanning Electron Microscopy
SG	Stakeholders Group
TEM	Transmission Electron Microscopy
TLK	Tritium Laboratory Karlsruhe
QA	Quality Assurance
RO	Responsible Officer
TBM	Test Blanket Module
WP	Work Package
WPL	Work Package Leader

TRANSAT Partners

No	Short name	Full name	Country
1	CEA	Commissariat à l'Energie Atomique et aux Energies Alternatives	France
2	AMU	Aix Marseille University	France
3	CIEMAT	Centro de Investigaciones Energeticas Medioambientales y Tecnologicas	Spain
4	URN (CORIA)	Université ed Rouen (COmplexe de Recherche Interprofessionnel en Aérothermochimie)	France
5	DH PHE	Public Health England	United Kingdom
6	ENEA	Italian National Agency of New Technologies, Energy and Sustainable Economic Development	Italy
7	IFIN HH	Horia Hulubei National Institute for Physics and Nuclear Engineering	Romania
8	IIT	Fondazione Istituto Italiano di Tecnologia	Italy
9	INFLPR	Institutul National De Cercetare Dezvoltare Pentru Fizica Laserilor Plasmei Si Radiatiei	Romania
10	IRSN	Institut de Radioprotection et de Sûreté Nucléaire	France
11	JSI	Josef Stefan Institute	Slovenia
12	KIT	Karlsruhe Institute of Technology	Germany
13	LGI	LGI consulting	France
14	RATEN	Regia Autonoma Tehnologii Pentru Energia Nucleara	Romania
15	SCK-CEN	Studiecentrum voor Kernenergie/Centre d'Etude de l'Energie Nucléaire	Belgium
16	UKAEA	UK Atomic Energy Authority, Culham Center for Fusion Energy	United Kingdom
17	UNIPV	University of Pavia	Italy
18	UOP	University of Plymouth	United Kingdom

Summary

This document defines the activities of each Partner within each task with precision and identifies the involved persons. It contains contributions from all Work Package leaders (WPLs) and provides a bird's eye view of objectives, planned activities, timing, synergies and responsibilities.

1 Introduction

1.1 Purpose of this document

This Detailed Work Plan (DWP) is written by the Project coordinator in order to define the activities of each Partner within each task with precision and to identify the involved persons. It contains contributions from all WPLs and provides a general overview of objectives, planned activities, timing, synergies and responsibilities. A general view of the project in terms of deliverables, milestones and schedule is given in appendices 1, 2 and 3.

1.2 Administration and Dissemination

CEA is responsible for the administration of the DWP. Proposals for modifications or additions must be submitted to CEA, which updates and issues the revisions of the DWP. All revisions need an approval by the Executive Committee (ExCom). In case a revision requires a change to the Grant Agreement, or has a considerable impact on the work, it must be brought before the Governing Board. Each new issue will be indicated in the revised document by means of a revision number. Revisions of the contents of the DWP become valid from the date of issue.

The DWP and its annexes are confidential to the beneficiaries and may be circulated outside the beneficiaries only with the approval of the ExCom. Copies of this plan are distributed to each participant of the project at the issue date via email. It will also be available on the project collaborative web platform, TRANSAT ECCP, https://app.lgi-consulting.org/ecm/transat .

1.3 Intended use of this document

The DWP is intended to be read and agreed on by the Project Team Members, WP leaders and the Executive Committee. It is foreseen that the DWP will be updated as necessary by the coordinator.

2 Work Package 1: Assessment and proposal for developments of barriers against tritium permeation and the treatment of the operational tritiated gases

Start date	End date	Led by	Contributors
09/2017	07/2020	Ion Cristescu (KIT)	Silvano Tosti (ENEA-Frascati), Marco Utili (ENEA-Brasimone), Mariea Deaconu (RATEN), Raluca Fako (RATEN), Christian Postolache (IFIN)

2.1 Objectives

The review of the experimental activities concerning the development of the barriers against tritium permeation will be followed by the validation of the barrier(s) based on coatings that have potential for industrialization. Complementary, the partners will assess how an active barrier system could be implemented to prevent tritium migrating through surfaces, thereby minimizing clean side equipment contamination. The detailed examination of the manufacturing challenges associated with incorporating the active barrier into an ASME compliant component such as heat exchanger will be carried out.

The treatment of the operational tritiated gases generated in the fission plants such as plenum gas purification, He purification in gas coolant reactor and the He purification system in the TBM from the fusion applications will be assessed and further developed. Also a viable route for the separation of lithium isotopes will be proposed based on thoroughly assessment of the developments on this field.

The WP will focus on:

- Assessment of term sources relevant for fusion and fission Reactors
- Assessment of different types of barrier against tritium permeation
- Experimental validation of permeation barriers based on coatings
- Development of an active barrier that may complement the coating technics.

- Review of gas treatment technologies in both fission and fusion, comparison of processes and their validation
- Experimental activities aimed at demonstrating transfer of technology under operating conditions of fusion/fission
- Assessment of a viable route for the separation of lithium isotopes

2.2 Activities

This work package deals with the following tasks:

2.2.1 *Task 1.1: Studies on tritium migration in view of refinement of knowledge on diffusion, retention and release mechanisms and validation of barriers against tritium permeation*

Start date: September 2017; End date: July 2020

Lead: Ion Cristescu (KIT)

Contributors: Silvano Tosti (ENEA-Frascati), Marco Utili (ENEA-Brasimone), Mariea Deaconu (RATEN), Raluca Fako (RATEN), Cristian Postolache (IFIN)

This task regroups the activity in terms of assessment of tritium term source and development of barriers against tritium permeation, including the following actions:

Actions	Start Date	Due Date	Responsible
▪ Action 1: Assessment of term sources relevant for fusion and fission Reactors	09 2017	09 2018	Ion Cristescu KIT
▪ Action 2: Assessment of different types of barrier against tritium permeation	02 2018	09 2018	Marco Utili ENEA
▪ Action 3: Experimental validation of permeation barriers based on coatings	08 2018	07 2020	Marco Utili ENEA
▪ Action 4: Development of an active barrier that may complement the coating technics	03 2018	07 2020	Ion Cristescu KIT

2.2.2 *Task 1.2: Treatment of the operational tritiated gases generated in the fission (plenum gas purification, He purification in gas coolant reactor) and fusion (He purification system in TBM) activities and assessment of a viable route for the separation of lithium isotopes*

Start date: September 2017; End date: July 2020

Lead: Silvano Tosti (ENEA)

Contributors: Marco Utili (ENEA-Brasimone), Ion Cristescu (KIT), Thomas Giegerich (KIT)

The Coolant Purification System, for both the European TBM concepts (HCLL and HCPB) of ITER Reactor and DEMO BB concepts has the role to extract the permeated tritium from the primary circuit and impurities from He that allows keeping controlled chemistry. The technologies developed for the fusion reactor can be applied to the Fission reactor in order to purify the cover gas of ASTRID and LFR and to perform the chemistry control of Gas Fast and Very High Temperature reactor.

This task mainly regroups the activity in terms of review of the assessment of the technologies for the treatment of the operational tritiated gases and also activities related to the separation of lithium isotopes, including the following actions:

Actions	Start Date	Due Date	Responsible
▪ Action 1: Review of gas treatment technologies in both	09 2017	12 2018	Silvano Tosti

fission and fusion, comparison of processes and their validation			ENEA
▪ Action 2: Experimental activities aimed at demonstrating transfer of technology under operating conditions of fusion/fission	02 2018	07 2020	Silvano Tosti ENEA
▪ Action 3: Assessment of lithium isotopes separation	02 2018	09 2018	Thomas Giegerich KIT

2.3 Deliverables

Number	Title	Due Date	Responsible
D1.1.1	Task 1 1 Report on the assessment of tritium term sources relevant for fusion and fission reactors	09 2018	Ion Cristescu (KIT)
D1.1.2	Task 1 1 Report on the assessment of different types of barrier against tritium permeation	09 2018	Marco Utili (ENEA)
D1.2	Task 1 2 Report on the assessment of a viable route for the separation of lithium isotopes	09 2018	Thomas Giegerich (KIT)
D1.3	Task 1 2 Report on review of gas treatment technologies	09 2018	Silvano Tosti (ENEA)
D1.4	Task 1 1 Report on active barrier that complement the coating technics	07 2020	Ion Cristescu (KIT)
D1.5	Task 1 2 Report on experimental activities demonstrating transfer of technology under operating conditions of fusion/fission	07 2020	Silvano Tosti (ENEA)
D1.6	Task 1 1 Report on experimental validation of permeation barriers based on coatings	07 2020	Marco Utili (ENEA)

2.4 Milestones

Number	Title	Verification mean	Due Date	Responsible
M1	Task 1 1 Design of the experimental rig and development of the integration of experiments in the Tritium Laboratory Karlsruhe (TLK) infrastructure	Report of the activities concerning the status of the design	12 2018	Ion Cristescu (KIT))
M2	Task 1 1 Development of the experimental rig in view of validation of the permeation barrier based on coatings	Report on status of the development of the experimental rig	06 2019	Marco Utili (ENEA)
M3	Task 1 2 Preparation of the experimental setup in view of demonstrating the gas treatment technologies	Report on the status of setup developments	06 2019	Silvano Tosti (ENEA)

2.5 Interactions

WP	Interaction description	Due Date	Responsible

WP2	Correlation with the modelling activities as far as identification of the tritium source term will be considered	05 2018	Ion Cristescu (KIT)

2.6 Risks

Number	Risk description	Risk mitigation	Proba-bility	Impact
R1	Delay in the manufacturing and the installation of the experimental rigs/facilities at KIT and ENEA	The design of the experimental rigs/facilities will start in the early phase of the project and the work at manufacturer/suplier site will be carefully checked	2	3

2.7 Synergies

Specific task	Interaction description	Due Date	Responsible
Task 1.1	Developments concerning tritium barriers based on coating are supported also under EUROfusion program in particular in the frame of the Breeding Blanket activities	07 2020	Marco Utili (ENEA)

2.8 Action list

Action	Start Date	Due Date	Responsible
▪ Action 1: The developments on various programs shall be complementary	08 2018	07 2020	Marco Utili (ENEA))

3 Work Package 2: Tritium inventory management and modelling

Start date	End date	Led by	Contributors
09/2017	10/2020	Carlos Moreno (CIEMAT)	Pascal Fichet (CEA), Arnaud Bultel (URN), Maria Dinescu (INFLPR), Sabina Markelj (JSI) and Thierry Gilardi (CEA)

3.1 Objectives

The aims of the WP2 are:

- The development of innovative methods for tritium contamination detection and tritium inventory measurement.
- The assessment and comparison of the prediction capabilities of tritium transfer models developed for fusion and fission. Both models will be tested in both nuclear technologies.

3.2 Activities

3.2.1 Task 2.1: Online and in material tritium inventory measurement development

Start date: September 2017; End date: October 2020
Lead: Pascal Fichet (CEA)
Contributors: Pascal Fichet (CEA), Arnaud Bultel (URN), Maria Dinescu (INFLPR), Sabina Markelj (JSI)

The main goal of this part is to develop in situ technique to investigate tritium on wastes coming from fusion or fission facilities. It is planned to test innovative methods for tritium contamination detection and tritium inventory measurement. The idea is not only to test technique sensitive to tritium on surface but also to investigate technique that can provide the contamination of tritium in depth. The proposed techniques are:

- Autoradiography
- Laser-induced breakdown spectroscopy (LIBS)
- Nuclear Reaction Analysis (NRA)

Autoradiography

The digital Autoradiography technique is considered as very promising technique for in situ tritium analysis. Commercial systems of digital autoradiography exist but dedicated to biological researches. The ambition with this project is to study some different kinds of autoradiography systems for tritium analysis for fusion and fission applications and compare the results with Liquid Scintillation Counting results after material pyrolysis.

Only to be used for rapid evaluation of tritium surface contamination. Extrapolation of surface contamination to all tritium inventory can turn to be rather inaccurate especially with complex materials

Laser based techniques as LIBS that is able to determine the tritium profile in materials. Due to the difficult excitation of D and T, double pulse experiments will be performed.

Laser-induced breakdown spectroscopy (LIBS)

The difference from LIBS activities already supported by EUROfusion is on the level of tritium concentration to be measured (high level for activities already supported by EUROfusion that are related to tritium inventory in Plasma Facing Components of the ITER tokamak; low level for the present proposal).

In TRANSAT, it is proposed to develop a LIBS measurement able to measure the concentration of T at the level below 1ppm in order to be able to measure tritium activity close to 1MBq/g in steel. In that sense, this LIBS development is innovative and that is why double pulse excitation will be mandatory.

Nuclear Reaction Analysis (NRA)

NRA aims at study the in depth and lateral distribution of tritium in materials and to compare results to deuterium. This tritium NRA will be here to test/develop the feasibility of tritium depth profiling and detection of tritium in mapping mode by micro-NRA with low tritium content (1GBq) up to a 10 µm depth in massive steel samples.

The NRA method is applied with either broad beam for depth profiling or focused ^{3}He beam. In this case, usually single energy of ^{3}He ions (3.3 MeV-4.5 MeV) is used in order to determine the absolute amount of deuterium/tritium in the material.

Action list

Action	Start Date	Due Date	Responsible
▪ Action 1: Review of the different techniques to analyse tritium	09 2017	03 2018	Pascal Fichet (CEA)
▪ Action 2: Realisation of deuterated samples for LIBS and IBA development	09 2017	03 2018	Maria Dinescu (INFLPR)
▪ Action 3: Realisation of tritiated samples for Ion Beam Analysis (IBA) measurements	03 2018	09 2018	Pascal Fichet (CEA)

▪ Action 4: Workshop on online tritium detection techniques	09 2019	09 2019	Pascal Fichet (CEA)
▪ Action 5: Synthesis on the results obtained by the LIBS technique, autoradiography and IBA to analyse tritiated samples	03 2018	10 2020	Arnaud Bultel (URN)

3.2.2 Task 2.2: Database development and modelling of tritium migration in fission & fusion processes

Start date: September 2017; End date: October 2020
Lead: Carlos Moreno (CIEMAT)
Contributors: Thierry Gilardi (CEA), Carlos Moreno (CIEMAT)

The main objective of this task is to improve knowledge of tritium inventories in the circuits of processes, machines or reactors. Specific inventory and migration assessment codes were developed either for the fission reactors (KUTIM code) or for the fusion machines (EcosimPro code). These tools rely on mass balances equations of hydrogen isotopes in the different circuits of nuclear facilities. The approach used in both fission and fusion codes are similar even though applied to different kind of systems. The objective here is to proceed to a code benchmarking activity which will lead to the improvement of the level of confidence in the tritium inventory estimated by such codes. The benchmarking activity will be conducted on the ASTRID Sodium fast reactor concept.

Action list

Action	**Start Date**	**Due Date**	**Responsible**
▪ Action 1: Identification of design and operational parameters of ASTRID.	09 2017	03 2018	Thierry Gilardi (CEA)
▪ Action 2: Input data and parameters description.	09 2017	03 2018	Thierry Gilardi (CEA)
▪ Action 3: Cross-checking of material databases used by both codes	03 2018	June 2018	Carlos Moreno (CIEMAT)
▪ Action 4: Update of material databases when needed	03 2018	June 2018	Carlos Moreno (CIEMAT)
▪ Action 5: Cross-checking of physical phenomena description	June 2018	09 2018	Thierry Gilardi (CEA)
▪ Action 6: Update of physical phenomena description when needed	June 2018	09 2018	Carlos Moreno (CIEMAT)
▪ Action 7: Modelling activities to adapt the description of the circuits in the codes	09 2018	09 2019	Carlos Moreno (CIEMAT)
▪ Action 8: Simulation of tritium migration in ASTRID sodium fast reactor	09 2019	03 2020	Carlos Moreno (CIEMAT)
▪ Action 9: Comparison of results and identification of the discrepancies.	03 2020	09 2020	Thierry Gilardi (CEA)
▪ Action 10: Identification of possible improvements	09 2020	10 2020	Carlos

	Moreno (CIEMAT)

3.3 Deliverables

Number	Title	Due Date	Responsible
D2.1	Task 2.1 Review of the different techniques to analyse tritium	03 2018	Pascal Fichet (CEA)
D2.2	Task 2.2 Technical document: data set about ASTRID design and operating conditions to be simulated	09 2018	Thierry Gilardi (CEA)
D2.3	Task 2.1 Synthesis on the results obtained by the LIBS technique, autoradiography and IBA to analyse tritiated samples	10 2020	Arnaud Bultel (URN)
D2.4	Task 2.2 Report on comparative analysis of simulation results obtained with KUTIM and ECOSIM PRO codes	10 2020	Carlos Moreno (CIEMAT)

3.4 Milestones

Number	Title	Verification mean	Due Date	Responsible
M3	Task 2.1 Realisation of deuterated samples for LIBS and IBA development	Data on samples characteristics available	03 2018	Maria Dinescu (INFLPR)
M5	Task 2.1 Realisation of tritiated samples for IBA measurements	Data on samples characteristics available	09 2018	Pascal Fichet (CEA)
M9	Task 2.1 Workshop on online tritium detection techniques	Minutes of the workshop	09 2019	Pascal Fichet (CEA)
M10	Task 2.2 Modelling tools meeting	Minutes of the meeting	09 2019	Carlos Moreno (CIEMAT)

3.5 Risks

Number	Risk description	Risk mitigation	Proba-bility	Impact
R2	Low detection efficiency of tritium by the NRA method	Use of only broad beam – lateral distribution by mm beam	1	3
R3	Samples with too small concentration of dopants	Preparation of samples based on those already prepared for former projects Preparation of additional samples with corrected traces concentrations	2	4
R4	Possible delay for recovery of updated data about ASTRID design	Possibility to consider assumptions on ASTRID design	2	1

		data (if not available) for benchmarking simulation		
R5	Possible simulation problem due to adaptation of the library of ECOSIM PRO	Possibility to consider assumptions on ASTRID design data (if not available) for benchmarking simulation	2	1
R6	Possible lack of published value for a nuclear interest material related with tritium technology	It will be classified as "no measured value" or a theoretical value will proposed	2	1
R7	Possible scatter in properties complicating to choose a reference value	A value will be proposed to the WP leaders in order to go on with the work	2	1
R8	Simulation problems with convergence	Increase Relative error – up to 0.1 (%) as limit	3	2

4 Work Package 3: Impact of tritiated products on environment and human health

Start date	End date	Led by	Contributors
09/2017	07/2021	Véronique Malard (CEA)	Christian Grisolia, Gregory Pieters, Laurence Lebaron-Jacobs (CEA), Thierry Orsière, Jérôme Rose, Mélanie Auffan (AMU), Rachel Smith (DP PHE), Séverine Le Dizès-Maurel, François Gendarmes, Eric Blanchardon (IRSN), Andrea Ottolenghi, Giorgio Baiocco (UNIPV), Awadhesh Jha, Andrew Turner, Vikram Sharma (UOP)

4.1 Objectives

In the framework of WP3, investigations are proposed to improve knowledge in the field of radiobiology, dosimetry, radiotoxicology, genotoxicology and ecotoxicology and environmental fate in case of contamination by tritiated products. During the decommissioning of nuclear facilities, operations are intended to remove or eliminate any tritiated material. These operations generate fine airborne dust, namely aerosols. It is proposed here to study the consequence of an accidental release of such tritiated particles in terms of radiotoxicology and ecotoxicology. The cross-cutting materials will be stainless steel and cement. The outcomes foreseen in this project will help radiation protection authorities, IAEA and other nuclear safety advisory organisms to assess more precisely the radiobiology, dosimetry, genotoxicology and ecotoxicology of tritiated particles. Accordingly, new safety rules and radiation protection approaches should emerge for safe handling tritium especially during dismantling activities.

4.2 Activities

This work package deals with

1. **Identification of the relevant steel and cement particles generated during decommissioning process in both fusion and fission.**
    a. Production of such particles in sufficient amount for eco and toxicology studies.
    b. Characterization of these particles in term of their physical and chemical stability.
    c. Tritiation of these particles.
2. **Ecotoxicological studies:**
    a. Assessment of the deposition velocity and metabolism of tritiated aerosols in the environment, development and validation of an associated model of deposition of tritium in particulate aerosol form on grass.
    b. Environmental transformation of the released particle by-products using mesocosm scale studies
    c. Toxicity and genotoxicity studies of tritiated steel and cement particles on a marine bivalve model
3. **Radiotoxicology / radiobiology studies:**

a. Acute and long-term toxicity and genotoxicity studies of these dusts on *in vitro* human lung models (cells and epithelium)
b. Evaluation of the behaviour of the tritiated dusts in lung (release of tritium from particles in lung fluids)
c. Investigation of the inhalation biokinetics of tritiated particles on rodent models

4. **Dosimetry studies:**
   a. Evaluation of the dosimetry of inhaled tritiated aerosols followed by the development of biokinetics models and dose coefficients.

4.2.1 Task 3.1: Production and characterization of tritiated products

Start date: September 2017; End date: August 2019

Lead: Christian Grisolia (CEA)

Contributors: Christian Grisolia (CEA), Gregory Pieters (CEA), Jérôme Rose (AMU), François Gendarmes (IRSN).

The aim of this task is to identify, produce and characterize tritiated steel and cement particles.

Action list

Action	**Start Date**	**Due Date**	**Responsible**
Action 1 : Selection of relevant dusts (CEA) Analysis of the technical documentation to identify the size of the tritiated particles of steel and cement generated during decommissioning operations.	09 2017	11 2017	C.Grisolia (CEA)
Action 2 : Particles production (IRSN, AMU) Production of steel and cement relevant particles (steel particles by cutting grinder, cement particles by polishing) and sorting of particles by size following 3 health-based fractions (i.e. Alveolar, Thoracic, Inhalable).	11 2017	08 2018	François Gendarmes (IRSN)
Action 3 : Particles characterization (AMU) - Characterization of the particles by different techniques (Transmission Electron Microscopy (TEM), Scanning Electron Microscopy coupled with Energy Dispersive X-ray spectrometry (SEM-EDX), laser diffraction and X-ray diffraction) - Study of the particles dispersion in various biologic media. A specific investigation of the dissolution and physico-chemical parameters evolution will be addressed by coupling separation techniques (dialysis, filtration…) and analytic techniques (Inductively Coupled Plasma Mass Spectrometry (ICP-MS), electrochemical and spectroscopic characterization…).	11 2017	02 2019	Jérôme Rose (AMU)
Action 4 : Particles tritiation (CEA) - Tritium charging of cement and steel particles in a glove box using a volumetric gas absorption method in sealed glass vessels at different temperatures and pressures. - Characterization of tritiated particles (Thermo-desorption, full dissolution followed by liquid Scintillation Counting, TEM, SEM and Dynamic light scattering measurements).	02 2018	08 2019	Gregory Pieters (CEA)

4.2.2 Task 3.2: Radioecology of tritiated products

Start date: August 2018 ; End date: July 2021

Lead: Awadesh Jha (UOP)

Contributors: Mélanie Auffan (AMU), Séverine Le Dizès-Maurel (IRSN), Awadhesh Jha, Andrew Turner, Vikram Sharma (UOP)

The aim of this task is the study of deposition and metabolism processes of tritium in particulate aerosol form in grass, the study of the environmental transformation of the released particle by-products using mesocosm scale studies (tritiated and untritiated particles) and the study of potential ecotoxicological and genotoxicological impact of tritiated and untritiated compounds on marine bivalve species.

Action list

Action	Start Date	Due Date	Responsible
Action 1 : Study of deposition and metabolism processes of tritium in particulate aerosol form in grass (IRSN) - Critical review of the literature to design and configure a deposition rate model for tritiated particles. - Development of a simple model of integration/assimilation of particles in plant biomass and achievement of a comparative study with existing generic models based on other forms than aerosols. Results obtained will be used to identify processes and parameters that will be refined.	02 2019	07 2021	S. Le Dizès (IRSN)
Action 2 : Study of the environmental transformation of the released particle by-products using mesocosm scale studies (AMU) - Investigation of the environmental transformation of the released particle by-products using mesocosm scale studies (Aquatic Mesocosm Platform) (AMU). - Assessment of the biodegradation of by-products in presence of several organisms part of a trophic link, of the distribution and bioavailability of the released by-products within different compartments (e.g. water, sediments, biota) and of the biotransformation of the by-products in the compartments where the concentrations are the largest. - Characterization of particles byproducts using X-ray based spectroscopic, 2D and 3D microscopic techniques. - Same experiments will be undertaken with tritiated particles at the Saclay Tritium Lab.	02 2019	07 2021	M.Auffan (AMU)
Action 3 : Study of potential ecotoxicological and genotoxicological impact of tritiated and untritiated compounds on marine bivalve species (UOP) - Determination of the rates of release of tritium from the dust in water under controlled conditions of salinity, temperature, pH, … - Bioaccumulation of metals and tritium through different routes of exposures (i.e. aqueous or through algal feed) will be determined using analytical (i.e. ICP-MS) and liquid scintillation counting for acute (~ 3 days) and chronic exposures (~10 days). - Genotoxicity / oxidative Deoxyribonucleic Acid (DNA)	02 2019	07 2021	A.Jha (UOP)

damage and epigenetic studies (DNA methylation pattern both at HpaII restriction sites and across the genome) will be determined in selected exposure conditions. Assessment of potential histopathological and physiological (e.g. 'clearance rate') effects as well as germ cell effects using comet assay in sperm cells collected from adults exposed to the particles. - Achievement of 'Label Free Quantitative Proteomics' experiments using samples corresponding to selected data points (times/exposures)..	

4.2.3 Task 3.3: Radiotoxicology / radiobiology of tritiated products (task leader: AMU, M18-M47)

Start date: February 2019; End date: July 2021

Lead: Thierry Orsière (AMU)

Contributors: Véronique Malard (CEA), Rachel Smith (DP PHE)

The aim of this task is genotoxicity study of tritiated particles in human in vitro lung models, toxicity and behaviour of tritiated particles in human in vitro lung models, and Investigation of the inhalation biokinetics of tritiated particles.

Action list

Action	Start Date	Due Date	Responsible
Action 1 : Toxicity, genotoxicity and behaviour of tritiated particles in human lung models (AMU, CEA) - Use of two in vitro models: the immortalized BEAS-2B cell line and the 3D in vitro cell model of the human airway epithelium MucilAir® to study the contribution of the chemical and the radiological stress by the use of tritiated and non tritiated particles - Assessment of short and long terms effects (2 hours - 28 days) and reversibility of the toxic effects after an acute exposure - Evaluation of the behaviour of the tritiated particles in lung model (i.e. release of tritium from particles in lung mucus and tritium transfer through the lung epithelial barrier in a kinetic mode) - Definition of the mode of cytotoxic effects using a combination of assays including cytotoxic (metabolism, epithelial integrity, pro-inflammatory response), clonogenic (cloning efficiency) and oxidative stress related assays. - Assessment of genotoxic hazards by standard genetic toxicology methods (comet and micronucleus assays using centromeric probes/ anti-kinetochore staining), measurements for epigenetic modifications (DNA methylation, chromatin profiling, microRNA content) to address DNA regulation, primary DNA lesions and chromosome damage	02 2019	07 2021	T.Orsière (AMU)
Action 2 : Investigation of the inhalation biokinetics of tritiated particles (DP PHE) - Exposition of laboratory rodents by nose-only inhalation to (a) tritiated nanoparticles, (b) tritiated micron-sized particles, and (c) control, HTO. Determination at various times to 6 months post-exposure (e.g. days 1 to 7, 14d, 1, 3,	02 2019	07 2021	R.Smith (DP PHE)

6 months) of the levels of tritium and the associated metal particle constituents in various body tissues (e.g. lung, lung associated lymph nodes, blood, muscle, liver and kidney) and excreta (faeces and urine) and analyse of the influence of particle size on deposition pattern within the lung. - Investigation of the release rate of tritium from the particles will be investigated through in vitro dissolution tests using biological relevant solutions (e.g. lung fluid simulants).	

4.2.4 Task 3.4 Dosimetry (task leader: UNIPV, M18-M47)

Start date: February 2019; End date: July 2021
Lead: Giorgio Baiocco (UNIPV)
Contributors: Eric Blanchardon (IRSN), Giorgio Baiocco (UNIPV),

The aim of this task is modelling of radionuclide concentration/dose deposition at the cellular/tissue/organ level and development of specific biokinetic models/organ dose calculations.

Action list

Action	Start Date	Due Date	Responsible
Action 1: Modelling of radionuclide concentration/dose deposition at the cellular/tissue/organ level in experimental setups adopted for irradiations. Crosscheck of the model predictions against experimental data and evaluation of the biological effectiveness of tritiated products according to their distribution in cellular compartments.	02 2019	07 2021	G. Baiocco (UNIPV)
Action 2: Development of compound specific biokinetic models on the basis of the experimental data collected during the project: magnitude and rate of absorption through the alimentary tract, the respiratory tract and the skin; time-dependent distribution of tritium activity between the organs and tissues of the body; localization of tritium within organs and tissues; clearance of tritium in urine and feces.	02 2019	07 2021	E.Blanchardon (IRSN)

4.3 Deliverables

Number	Title	Due Date	Responsible
D3.1	Task 3.1 Report on production of steel particles	08 2018	F.Gendarmes (IRSN)
D3.2	Task 3.1 Report on production of cement particles and characterization of steel and cement suspensions	02 2019	J.Rose (AMU)
D3.3	Task 3.1 Report on tritiation of cement and steel particles	08 2019	G.Pieters (CEA)
D3.4	Task 3.2 Report on model equations and comparison with generic models	07 2021	S. Le Dizès (IRSN)
D3.5	Task 3.2 Report on development of tools to study the environment fate of particles by-products	07 2021	M.Auffan (AMU)

D3.6	Task 3.2 Report on ecotoxicological and genotoxicological impact on tritiated and untritiated particles on marine bivalves	07 2021	A.Jha (UOP)
D3.7	Task 3.3 Report on acute and long-term toxicities, epi/genotoxic studies and transepithelial transfer of untritiated and tritiated particles on in vitro human models.	07 2021	T.Orsière (AMU)
D3.8	Task 3.3 Report on dissolution studies and in vivo inhalation studies	07 2021	R.Smith (DP PHE)
D3.9	Task 3.4 Report on predicted effectiveness of tritiated products	07 2021	G.Baiocco (UNIPV)
D3.10	Task 3.4 Report on biokinetic parameters and organ dose calculation	07 2021	E.Blanchardon (IRSN)

4.4 Milestones

Number	Title	Verification mean	Due Date	Responsible
M2	Task 3.1 Selection of relevant dusts	Short note on particles characteristics	11 2017	C.Grisolia (CEA)
M4	Task 3.1 Particles production	Amount of available material (~100g)	04 2018	J.Rose (AMU)
M7	Task 3.1 Particles tritiation	Amount of available material (~10g)	12 2018	G.Pieters (CEA)
M11	All Tasks Intermediate results presented at progress meeting	Minutes and presentation	10 2019	V.Malard (CEA)

4.5 Interactions

WP	Interaction description	Due Date	Responsible
WP2	Detection of tritium	12/2018	C.Grisolia (CEA)

4.6 Risks

Number	Risk description	Risk mitigation	Proba-bility	Impact
R8	Project partners fail to supply required tritiated particles on time	Good communication between involved partners. Dedicated milestones.	1	4
R9	Innovative and novel methods fail or do not produce data	Good communications among the partners with the WP leader, making use of expertise that developed these techniques. Regular review of progress. Operational exchange of staff to safeguard technological	1	5

understanding.

5 Work Package 4: Tritium issues in waste processing and decommissioning

Start date	End date	Led by	Contributors
09/2017	09/2021	Dave Coombs (UKAEA)	Robert Vale (UKAEA), Rob Smith (UKAEA), Xavier Lefebvre (UKAEA) Kris Dylst (SCK-CEN), Wouter Broeckx (SCK-CEN), Kurt Van den Dungen (SCK-CEN)

5.1 Objectives

The objectives of WP4 are:

- Development of tritium waste techniques (for soft waste and characterisation of tritiated getters).
- Definition of new tritiated waste container packages by means of measurement of permeability of material for Geological Disposal Facility and tritium migration in waste container modelling
- Production of a decommissioning plan-example for a tritiated fission industrial facility with fusion relevant component

5.2 Activities

5.2.1 Task 4.:1 Characterisation comparison of lower tritium activity soft waste

Start date: September 2017; End date: September 2020

Lead: Rob Vale (UKAEA)

Contributors: Dave Coombs (UKAEA), Rob Smith (UKAEA), Xavier Lefebvre (UKAEA)

The aim of this task is to analyse the levels of organically bounded tritium (OBT) and other types of tritium (HT, HTO) in different soft waste materials and use this information to help build a comparison of the effectiveness of the headspace, pyrolysis and water leeching tritium measurement methods on tritiated soft waste. If the levels of OBT, HT and HTO show a pattern for different materials as a ratio of the drum gas tritium levels for example this can be used to arrange soft waste into material type before it's put in a drum. Other elements of comparison of different methods will include cost, accuracy and length of time required.

Action list

Action	Start Date	Due Date	Responsible
▪ Action 1: Build of experimental setup to measure different forms of tritium in soft waste (UKAEA)	10 2018	01 2019	Rob Vale (UKAEA)
▪ Action 2: Use of National Physical Laboratory equipment to measure selected drum gas for tritium levels (UKAEA)	11 2018	02 2019	Rob Vale (UKAEA)
▪ Action 3: Measure specific items within drum of different materials to determine different forms of tritium (UKAEA).	01 2019	01 2020	Rob Vale (UKAEA)

5.2.2 Task 4.2: Tritium containment in disposal containers

Start date: October 2018; End date: September 2021

Lead: Rob Vale (UKAEA)

Contributors: Dave Coombs (UKAEA), Rob Smith (UKAEA), Xavier Lefebvre (UKAEA)

The aim of this task is to test material types that have been proposed for containers in a geological disposal facility to tritium permeability. These tests will explore a lower temperature range (close to ambient) than is usually looked at.

Action list

Action	Start Date	Due Date	Responsible
▪ Action 1: Installation and adaption of permeation rig in test building (UKAEA)	June 2019	01 2020	Rob Vale (UKAEA)
▪ Action 2: Test different materials for tritium permeability (UKAEA, National Physical Laboratory)	01 2020	10 2020	Rob Vale (UKAEA)

5.2.3 Task 4.3 Characterisation and investigating various disposal routes for obsolete tritiated Ti and NaK getters

Start date: September 2017; End date: March 2019
Lead: Kris Dylst (SCK-CEN)
Contributors: Yves D'Joos (SCK-CEN), Kurt Van den Dungen (SCK-CEN), Wouter Broeckx (SCK-CEN)

The aim of this task is to characterize the tritium content in the SCK-CEN Ti and Nak getters. The best detritiation technique will be selected for the most contaminated components. The consequences of different techniques on waste packages will be a consideration of the analysis.

Action list

Action	Start Date	Due Date	Responsible
▪ Action 1: Characterise the tritium content in the Ti and NaK getters (SCK.CEN)	09 2017	12 2018	Kris Dylst (SCK-CEN)
▪ Action 2: Select the best detritiation technique for the most contaminated components (SCK.CEN)	09 2018	03 2018	Kris Dylst (SCK-CEN)
▪ Action 3: Develop a decommissioning plan (SCK.CEN)	12 2018	06 2019	Kris Dylst (SCK-CEN)

5.3 Deliverables

Number	Title	Due Date	Responsible
D4.1	Task 4.1 Interim report on the state of the art. Completion of design of experimental study	09 2018	Rob Vale (UKAEA)
D4.2	Task 4.1 Final report	09 2020	Rob Vale (UKAEA)
D4.3	Task 4.2 Interim report concerning the state of the art. Completion of design of experimental study	09 2019	Rob Vale (UKAEA)
D4.4	Task 4.2 Final report 2	08 2021	Rob Vale (UKAEA)
D4.5	Task 4.3 Interim report containing research for disposal, reuse, neutralisation and partners, tritium inventory measurement	09 2018	Kris Dylst (SCK-CEN)
D4.6	Task 4.3 Disposal or recycling plan for tritium ready	03 2019	Kris Dylst (SCK-CEN)

5.4 Milestones

Number	Title	Verification mean	Due Date	Responsible
M12	Task 4.1 End of experimental tests 1	Data from tests is available	03 2020	Rob Vale (UKAEA)
M13	Task 4.2 End of experimental tests 2	Data from tests is available	01 2021	Rob Vale (UKAEA)

5.5 Interactions

There are no known interactions necessary with other WPs for the successful completion of this task.

5.6 Risks

Number	Risk description	Risk mitigation	Proba-bility	Impact
R10	Availability of UKAEA that are owned by other interests for soft waste measurements	This has been resolved now.	1	4
R11	Permeabilities cannot be assessed given the timeframe allotted	The temperature can be increased in order to get the permeabilities sooner.	3	3

6 Work Package 5: Dissemination, Communication & Stakeholders Engagement

Start date	End date	Led by	Contributors
09/2017	09/2021	Sabina Markelj (JSI)	ALL

6.1 Objectives

The general objectives of WP5 are to engage with stakeholders, to raise awareness on TRANSAT project and its achievements through specific communication actions. The activities in this WP will be to organize the dialogue with the Stakeholders group and other relevant actors. The dissemination of knowledge acquired towards the scientific community and beyond includes publications in selected scientific journals and participation to conferences and other events. Two summer schools will be organised in order to bring closer the R&D on Tritium to the young generation. The work package leader JSI will be supported by LGI for specific communication and networking tasks and all project partners will contribute to the wide scientific dissemination actions, led by CEA.

The WP will focus on dissemination, communication & stakeholders engagement.

6.2 Activities

This work package deals with dissemination, communication and stakeholders engagement. It is separated into four tasks where first one (5.1) deals with interaction with stakeholders. The second task (5.2) covers the dissemination of the TRANSAT project results to the scientific community and stakeholders. The third task (5.3) aims to develop and implement the education and training activities in the project. The last task (5.4) aims to make a communication plan and production of a communication toolkit.

6.2.1 Task 5.1 Interaction with stakeholders

Start date: September 2017; End date: August 2021
Lead: CEA
Contributors: CEA, LGI, JSI

The aim of this task is structure interactions with relevant stakeholders around the project.

- Identification of actors to establish dialogues with external entities considered as potential users of the project outcomes: established stakeholder networks (EUROfusion, ITER, IAEA, JHR Consortium, NUGENIA, MELODI, EPRI…); industrial actors (AREVA …); Technical Safety Organisations; and other stakeholders (ENEN, IGD-TP, OECD/ NEA, CEN/CENELEC…)
- Animation of cross exchanges with the two European Joint Programs (EUROfusion and CONCERT) and other major consortia in the field
- Creation and interaction with the Stakeholders Group (SG): covers regular invitation of pre-selected experts to the project meetings and structured discussion & their feedback on the project progress and outcomes
- Synthesis and final report on recommendations to stakeholders.

The task will organize and support the interactions, including information sharing (dedicated web pages), organizing meetings (dealing also with travel arrangement for SG members), providing secretariat and supporting Chair of each group in delivering their recommendations reports. This task will have strong interactions with all other Work Packages, via the project's Management body.

Action list

Action	Start Date	Due Date	Responsible
▪ Action 1: Project representative at the SG meeting (CEA.)	09 2017	08 2021	C. Grisolia (CEA)
▪ Action 2: Technical support to the SG; organization of meetings; support to group Chairs and production of the recommendation report (LGI)	09 2017	08 2021	G. Szendro (LGI)
▪ Action 3: Contribution to establish dialogues with external entities (JSI)	09 2018	08 2021	S. Markelj (JSI)
▪ Action 4: Review of the output and final report (CEA.)			C. Grisolia (CEA)

6.2.2 Task 5.2 Dissemination and exploitation plan

Start date: September 2017; End date: August 2021
Lead: JSI
Contributors: ALL

The aim of this task is dissemination of the TRANSAT project results to the scientific community and stakeholders and the delivery of a dissemination and exploitation plan.

- Delivery of a dissemination and exploitation plan
- Coordinating the participation of partners in conferences to disseminate knowledge and results. Possible conferences are e.g. International conference on Tritium Science & Technology, International conference on Radiation Research, Symposium on Fusion Technology, etc.
- Coordinating scientific publications, including open access journals, free (online) journals, and online repositories. Relevant journals are e.g. Particle and Fibre Toxicology, Journal of Nuclear Materials, Nuclear Fusion, Environmental Science and Technology, etc. The online project repository will also be used to archive and make accessible relevant publication.
- Preparation of the Data management plan
- Increase of the visibility of infrastructures available for Tritium R&D via the publication in AIR2 Bulletin and the incrementation of AIR2D2 database.

This task will interact with all knowledge-producing tasks in the project.

Action list

Action	Start Date	Due Date	Responsible
▪ Action 1: Coordinate scientific dissemination (JSI, CEA)	09 2017	08 2021	S. Markelj (JSI)
▪ Action 2: Exploitation and dissemination plan (CEA)	09 2017	02 2018	C. Grisolia (CEA)
▪ Action 3: Contribute to dissemination actions (all))	09 2017	08 2021	S. Markelj (JSI)

6.2.3 Task 5.3 Education & Training

Start date: September 2017; End date: August 2021
Lead: JSI
Contributors: JSI, CEA, LGI

The aim of this task is develop and implement the education and training activities in the project with particular focus of tritium and the fission and fusion cross-cutting issues. It includes:

- Developing a strategic plan for Education & Training and pilot actions with strategic vision of the future needs
- Development of appropriate educational tools and learning methodologies
- Organization of two Summer Schools (in Slovenia and other European country to be selected at later stage)
- Organisation of students exchanges by providing short term support for students and young post-doctoral positions within TRANSAT partners labs and relevant infrastructures

This task will interact with the entire project.

Action list

Action	Start Date	Due Date	Responsible
▪ Action 1: Organise and coordinate Education and Training activities (JSI)	09 2017	08 2021	S. Markelj (JSI)
▪ Action 2: Organize 1st Summer school (JSI, CEA)	09 2017	08 2019	S. Markelj (JSI)
▪ Action 3: Organize 2nd Summer school (CEA,JSI)	09 2019	02 2021	C. Grisolia (CEA)
▪ Action 4: School organization logistics (website, registration page budget follow-up)	09 2017	02 2021	G. Szendro (LGI)

6.2.4 Task 5.4 Public Communication

Start date: September 2017; End date: August 2021
Lead: LGI
Contributors: LGI, CEA, JSI

The aim of this task is to make communication action plan and to produce the communication toolkit.

A communication action plan will be drafted and implemented, with the following:

- Communication strategy; definition of audiences and key messages
- A detailed planning of all communication actions over the project duration according to the defined target audiences
- An event and publications management plan
- Indicators of success
- Production of a communication toolkit:
- Project logo & visual identity, including presentation and document templates
- Public website - developed and regularly updated
- Print communication – project brochure & poster & roll-up
- An electronic newsletter will be issued at the end of each year of the project. It will include for instance: a word from the coordinator, a video interview of one of the consortium partners, one highlight per work package, relevant news, relevant workshops and conferences

A Final Meeting will be organised at the end of the project to disseminate the knowledge acquired during the project. All relevant stakeholders will be invited to attend.

Action list

Action	Start Date	Due Date	Responsible
▪ Action 1: Communication strategy & toolkit (LGI);	09 2017	08 2021	C. Chavardes (LGI)
▪ Action 2: Providing input and validation of the final content of communication (CEA)	09 2017	08 2021	C. Grisolia (CEA)
▪ Action 3: Providing content (JSI, CEA)	09 2017	08 2021	S. Markelj (JSI)
▪ Action 4: Organization of final meeting		08 2012	G. Szendro (LGI)

6.3 Deliverables

Number	Title	Due Date	Responsible
D5.1	Task 5.1 Recommendations final report to stakeholders	08 2021	C. Grisolia (CEA)
D5.2	Task 5.2 Dissemination and exploitation plan	02 2018	C. Grisolia (CEA)
D5.3	Task 5.2 Data Management Plan	05 2018	S. Markelj (JSI)
D5.4	Task 5.3 1st Summer School Proceedings	09 2019	S. Markelj

			(JSI)
D5.5	Task 5.3 2nd Summer School Proceedings	Jul 2021	S. Markelj (JSI)
D5.6	Task 5.4 Communication Action Plan	02 2018	C. Chavardes (LGI)
D5.7	Task 5.4 Project Website	11 2017	C. Chavardes (LGI)
D5.8	Task 5.4 Proceedings of Final meeting	08 2021	G. Szendro (LGI)

6.4 Interactions

WP	Interaction description	Due Date	Responsible
WP1-4	Dissemination actions by publishing papers and attendance at conferences	08 2021	S. Markelj (JSI)

6.5 Risks

Number	Risk description	Risk mitigation	Proba	Impact
R13	Failure in Stakeholders involvement	Continuous direct and indirect contact	2	4
R14	The quality of the project results are lower than expected	The internal reviewing process for all project deliverables and reports, plus the contribution of the Advisory Board, will ensure high quality project results	1	5

6.6 Synergies

Specific task	Interaction description	Due Date	Responsible
Task 5.2	Establish synergies and boosting new collaboration with external parties (public authorities and international organizations)	08 2021	S. Markelj (JSI)
Task 5.1	Linking to the EC's coordination activities on radioprotection, waste disposal management and other fission & fusion R&D initiatives	08 2021	C. Grisolia (CEA)

Action list

Action	Start Date	Due Date	Responsible
▪ Action 1: Identifying the external parties and establish collaboration (JSI, CEA)	09 2017	08 2021	S. Markelj (JSI)

▪ Action 2: Linking the TRANSAT project to other EC's coordination activities (CEA)	09 2017	08 2021	C. Grisolia (CEA)

7 Work Package 6: Management

Start date	End date	Led by	Contributors
09/2017	09/2021	Christian Grisolia (CEA)	Christian Grisolia (CEA), Karine Liger (CEA), Gabor Szendro (LGI)

7.1 Objectives

This WP ensures the achievement of the project's objectives, in terms of scientific quality, timely delivery, and contribution to the expected impact of the project. WP6 aims at achieving: efficient progress monitoring; timely and detailed reporting to the EC; constitution and organisation of the WP management teams; proper scientific quality of the deliverables.

In terms of consortium management, WP6 objectives are to guarantee sound management of contractual and financial issues, setting-up and maintaining project management tools, good communication in the consortium, proper quality assurance in the delivered reports, financial and contractual management, reporting to the EC. Consortium management and scientific coordination are placed under the responsibility of the coordinator.

In terms of organisational matter, CEA will focus on strategic coordination while being supported by LGI for the operational and administrative project management.

7.2 Activities

This work package is separated into five tasks.

- Tasks 6.1 and 6.2 deal with project coordination and quality management.
- Task 6.3 covers project secretariat and meetings organisation.
- Task 6.4 will focus on contractual and financial management.
- Task 6.5 concerns the scientific advisory committee.

7.2.1 Task 6.1 Project coordination

Start date: September 2017; End date: August 2021
Lead: CEA
Contributors: CEA, LGI

This task groups the coordinator's activity of organization and monitoring of the work progress.

Action list

Action	Start Date	Due Date	Responsible
▪ Action 1: Elaboration of the detailed work plan (CEA, LGI and all WP leaders)	09 2017	12 2017	K. Liger (CEA)
▪ Action 2:Supervision of project deliverables, progress milestones, and planning (LGI)	09 2017	08 2021	G. Szendro (LGI)
▪ Action 3: Risk analysis and management plan throughout the project (CEA, LGI)	09 2017	08 2021	C. Grisolia

			(CEA)
▪ Action 4: Performance indicators identification and follow up (LGI, CEA)	09 2017	08 2021	G. Szendro (LGI)
▪ Action 5: Continuous monitoring of Partners' scientific achievements (LGI, CEA)	09 2018	08 2021	G. Szendro (LGI)
▪ Action 6: Scientific review of the work and deliverables performed by the Partners (CEA)	09 2018	08 2021	C. Grisolia, K. Liger (CEA)

7.2.2 Task 6.2 Quality management

Start date: September 2017; End date: August 2021
Lead: LGI
Contributors: CEA

This includes the following:

- Elaboration and application of a Project Quality Plan, internal guideline detailing project procedures (quality assurance, document management, document templates, etc.), in accordance with the project management and organisation defined in the Contract
- Set-up and maintenance of a web-based document management tool for publishing and exchanging documents within the consortium
- Monitoring of workflow and information management, ensuring good communication within the consortium
- Maintenance of Partners' contact information, including emailing lists

Action list

Action	Start Date	Due Date	Responsible
▪ Action 1: Elaboration and application of a Project Quality Plan (LGI, CEA)	09 2017	08 2021	G. Szendro (LGI)
▪ Action 2: Exploitation of web-based document management tool (LGI)	09 2017	08 2021	G. Szendro (LGI)
▪ Action 3: Workflow and information management (LGI.)	09 2017	08 2021	G. Szendro (LGI)
▪ Action 4: Maintenance of Partners' contact information (LGI)	09 2017	08 2021	G. Szendro (LGI)

7.2.3 Task 6.3 Project secretariat and meetings organization

Start date: September 2017; End date: August 2021
Lead: LGI
Contributors: LGI, CEA

This includes the following:

- Preparation, organization and minutes of the kick-off meeting with all Partners at the beginning of the project;
- Preparation, organization and minutes of project meetings every year
- Preparation, organization and minutes of ExCom meetings; physical meetings jointly with each project meetings and possible additional phone meetings

- Preparation, organization and minutes of the Scientific Advisory Committee (SAC) meeting (organised jointly with other project meetings/relevant events)
- Preparation, organization and minutes of the yearly GB meetings (jointly with the yearly project meetings);
- Handling of the project correspondence
- Acting as entry point for the project for external bodies
- Support to project Partners upon request
- More generally, ensuring that all Partners share the same level of information on general issues concerning the project, i.e. contract and project management, work progress, dissemination.

Action list

Action	Start Date	Due Date	Responsible
Action 1: Preparation, organization and minutes of project meetings (LGI, CEA)	09 2017	08 2021	G. Szendro (LGI)
Action 2: Handling of the project correspondence (LGI, CEA)	09 2017	08 2021	G. Szendro (LGI)
Action 3: Acting as entry point for the project for external bodies (CEA)	09 2017	08 2021	C. Grisolia (CEA)
Action 4: Support to project Partners upon request (LGI, CEA)	09 2017	08 2021	G. Szendro (LGI)

7.2.4 Task 6.4 Contractual & Financial Management

Start date: September 2017; End date: August 2021
Lead: LGI
Contributors: LGI, CEA

This task comprises the management of the administrative and financial issues:

- Maintenance of the Grant and Consortium Agreements;
- Management of funds and maintenance of budget files;
- Coordination of the periodic and final reports to the EC;
- Advice on contractual / financial matters to project Partners upon request.

Action list

Action	Start Date	Due Date	Responsible
Action 1: Maintenance of the Grant and Consortium Agreements (LGI, CEA)	09 2017	08 2021	G. Szendro (LGI)
Action 2: Management of funds (CEA)	09 2017	08 2021	C. Grisolia (CEA)
Action 3: Maintenance of budget files (LGI)	09 2017	08 2021	G. Szendro (LGI)
Action 4: Coordination of the periodic and final reports to the EC (LGI, CEA)	09 2017	08 2021	G. Szendro (LGI)
Action 5: Advice on contractual / financial matters to project Partners upon request (LGI)	09 2017	08 2021	G. Szendro (LGI)

7.2.5 Task 6.5 Scientific Advisory Committee

Start date: September 2017; End date: August 2021
Lead: CEA
Contributors: CEA, LGI

The scientific Advisory Committee (SAC) will be constituted by high-ranking scientists from organisations in and/or outside Europe. It will advise on specific questions raised by the project and provide its assessment of the scientific activities based on international trends and scientific developments in the fields of the project. The detailed terms of reference will be established at the beginning of the project.

Action list

Action	Start Date	Due Date	Responsible
▪ Action 1: Constitution and solicitation of the SAC, preparation, chairing the meetings (CEA)	09 2017	08 2021	C. Grisolia (CEA)
▪ Action 2: Pre- and post-processing of the meetings (LGI, CEA)	09 2017	08 2021	G. Szendro (LGI)

7.3 Deliverables

Number	Title	Due Date	Responsible
D6.1	Task 6.2 Project quality plan	11 2017	G. Szendro (LGI)
D6.2	Task 6.1 Detailed work plan	11 2017	K. Liger (CEA)
D6.3	Task 6.5 Summary report on Scientific Advisory Committee activities	08 2021	C. Grisolia (CEA)

7.4 Milestones

Number	Title	Verification mean	Due Date	Responsible
M1	Task 6.3 Kick-off meeting	Minutes of the meeting	09 2017	C. Grisolia (CEA)
M6	Task 6.5 Constitution and first meeting of the Scientific Advisory Committee	Minutes of the meeting	08 2018	C. Grisolia (CEA)

7.5 Interactions

WP	Interaction description	Due Date	Responsible
WP1-5	Management/coordination	08 2021	C. Grisolia (CEA)

7.6 Risks

Number	Risk description	Risk mitigation	Proba	Impact
R15	Partner underperforms or leaves the consortium	Such situations will be foreseen by the Consortium Agreement, which will describe measures to be taken to prevent non-compliance to project activities	3	4
R16	Insufficient appropriately skilled staff are available	Identify personnel that have the ability to take on new skills. Continually review what skills are required for staff for future potential projects	1	4

7.7 Synergies

Specific task	Interaction description	Due Date	Responsible
Task 6.5	Establish links to high level scientists from organisation in and/or outside Europe.	08 2021	C. Grisolia (CEA)

Action list

Action	Start Date	Due Date	Responsible
▪ Action 1: Identifying high level scientists to take part to the scientific advisory group and establish collaboration (CEA)	09 2017	08 2018	C. Grisolia (CEA)

8 Appendix 1: List of deliverables

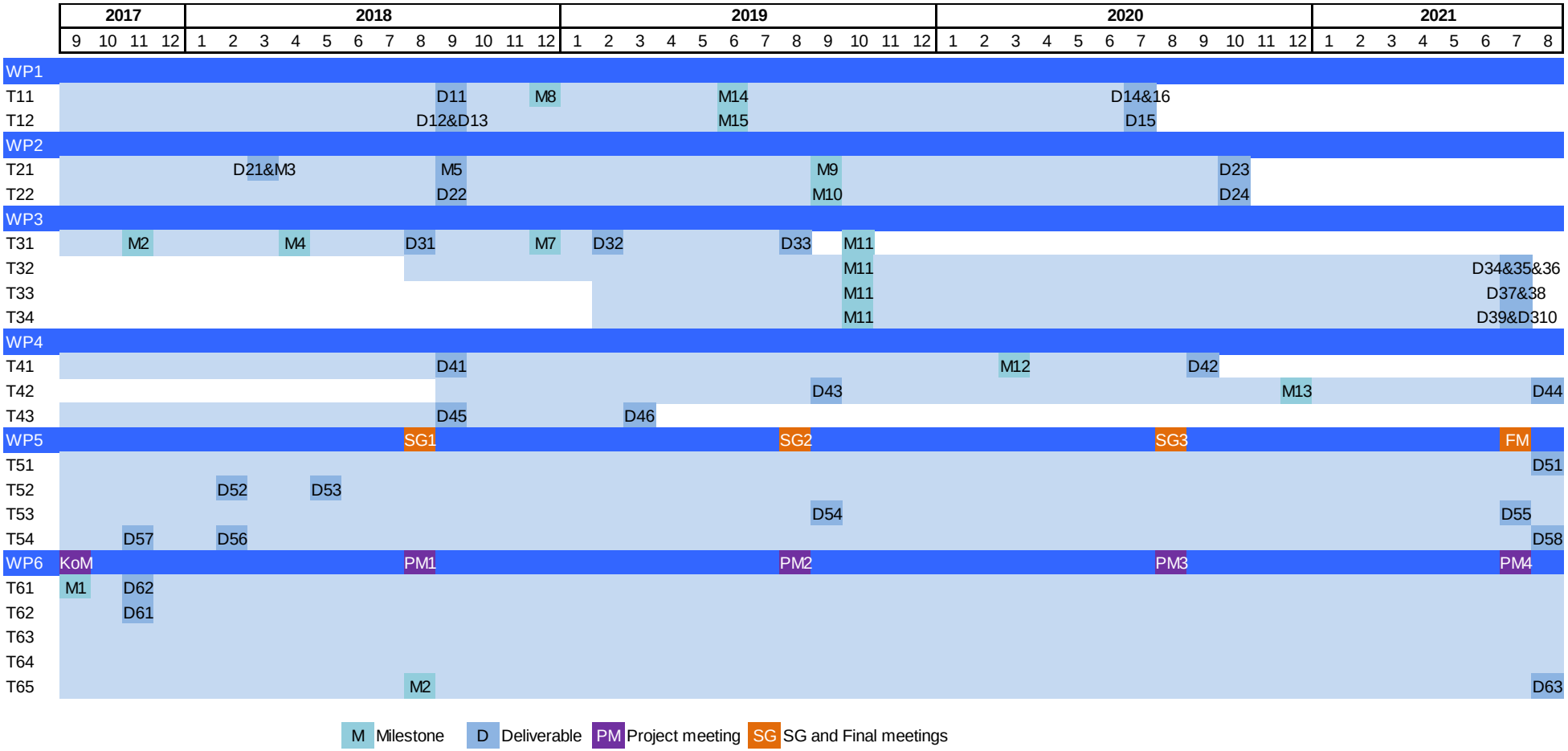
Number	Title	Due Date	Responsible
WP1			
D1.1.1	Task 1.1 Report on the assessment of tritium term sources relevant for fusion and fission reactors	09 2018	Ion Cristescu (KIT)
D1.1.2	Task 1.1 Report on the assessment of different types of barrier against tritium permeation	09 2018	Marco Utili (ENEA)
D1.2	Task 1.2 Report on the assessment of a viable route for the separation of lithium isotopes	09 2018	Thomas Giegerich (KIT)
D1.3	Task 1.2 Report on review of gas treatment technologies	09 2018	Silvano Tosti (ENEA)
D1.4	Task 1.1 Report on active barrier that complement the coating technics	07 2020	Ion Cristescu (KIT)
D1.5	Task 1.2 Report on experimental activities demonstrating transfer of technology under operating conditions of fusion/fission	07 2020	Silvano Tosti (ENEA)
D1.6	Task 1.1 Report on experimental validation of permeation barriers based on coatings	07 2020	Marco Utili (ENEA)
WP2			
D2.1	Task 2.1 Review of the different techniques to analyse tritium	03 2018	Pascal Fichet (CEA)
D2.2	Task 2.2 Technical document: data set about ASTRID design and operating conditions to be simulated	09 2018	Thierry Gilardi (CEA)
D2.3	Task 2.1 Synthesis on the results obtained by the LIBS technique, autoradiography and IBA to analyse tritiated samples	10 2020	Arnaud Bultel (URN)
D2.4	Task 2.2 Report on comparative analysis of simulation results obtained with KUTIM and ECOSIM PRO codes	10 2020	Carlos Moreno (CIEMAT)
WP3			
D3.1	Task 3.1 Report on production of steel particles	08 2018	F.Gendarmes (IRSN)
D3.2	Task 3.1 Report on production of cement particles and characterization of steel and cement suspensions	02 2019	J.Rose (AMU)
D3.3	Task 3.1 Report on tritiation of cement and steel particles	08 2019	G.Pieters (CEA)
D3.4	Task 3.2 Report on model equations and comparison with generic models	07 2021	S. Le Dizès (IRSN)
D3.5	Task 3.2 Report on development of tools to study the environment fate of particles by-products	07 2021	M.Auffan (AMU)
D3.6	Task 3.2 Report on ecotoxicological and genotoxicological impact on tritiated and untritiated particles on marine bivalves	07 20217	A.Jha (UOP)
D3.7	Task 3.3 Report on acute and long-term toxicities, epi/genotoxic studies and transepithelial transfer of untritiated and tritiated particles on in vitro human models.	07 2021	T.Orsière (AMU)

D3.8	Task 3.3 Report on dissolution studies and in vivo inhalation studies	07 2021	R.Smith (DP PHE)
D3.9	Task 3.4 Report on predicted effectiveness of tritiated products	07 2021	G.Baiocco (UNIPV)
D3.10	Task 3.4 Report on biokinetic parameters and organ dose calculation	07 2021	E.Blanchardon (IRSN)
WP4			
D4.1	Task 4.1 Interim report on the state of the art. Completion of design of experimental study	09 2018	Rob Vale (UKAEA)
D4.2	Task 4.1 Final report	09 2020	Rob Vale (UKAEA)
D4.3	Task 4.2 Interim report concerning the state of the art. Completion of design of experimental study	09 2019	Rob Vale (UKAEA)
D4.4	Task 4.2 Final report 2	08 2021	Rob Vale (UKAEA)
D4.5	Task 4.3 Interim report containing research for disposal, reuse, neutralisation and partners, tritium inventory measurement	09 2018	Kris Dylst (SCK-CEN)
D4.6	Task 4.3 Disposal or recycling plan for tritium ready	03 2019	Kris Dylst (SCK-CEN)
WP5			
D5.1	Task 5.1 Recommendations final report to stakeholders	08 2021	C. Grisolia (CEA)
D5.2	Task 5.2 Dissemination and exploitation plan	02 2018	K. Liger (CEA)
D5.3	Task 5.2 Data Management Plan	05 2018	S. Markelj (JSI)
D5.4	Task 5.3 1st Summer School Proceedings	09 2019	S. Markelj (JSI)
D5.5	Task 5.3 2nd Summer School Proceedings	07 2021	S. Markelj (JSI)
D5.6	Task 5.4 Communication Action Plan	02 2018	C. Chavardes (LGI)
D5.7	Task 5.4 Project Website	11 2017	C. Chavardes (LGI)
D5.8	Task 5.4 Proceedings of Final meeting	08 2021	G. Szendro (LGI)
WP6			
D6.1	Project quality plan	11 2017	G. Szendro (LGI)
D6.2	Detailed work plan	11 2017	K. Liger (CEA)
D6.3	Summary report on Scientific Advisory Committee activities	08 2021	C. Grisolia (CEA)

9 Appendix 2: List of milestones

Number	Title	Verification	Due Date	Responsible
WP1				
M8	Task 1.1 Design of the experimental rig and development of the integration of experiments in the TLK infrastructure	Report of the activities concerning the status of the design	12 2018	Ion Cristescu (KIT))
M14	Task 1.1 Development of the experimental rig in view of validation of the permeation barrier based on coatings	Report on status of the development of the experimental rig	06 2019	Marco Utili (ENEA)
M15	Task 1.2 Preparation of the experimental setup in view of demonstrating the gas treatment technologies	Report on the status of setup developments	06 2019	Silvano Tosti (ENEA)
WP2				
M3	Task 2.1 Realisation of deuterated samples for LIBS and IBA development	Data on samples characteristics available	03 2018	Maria Dinescu (INFLPR)
M5	Task 2.1 Realisation of tritiated samples for IBA measurements	Data on samples characteristics available	09 2018	Pascal Fichet (CEA)
M9	Task 2.1 Workshop on online tritium detection techniques	Minutes of the workshop	09 2019	Pascal Fichet (CEA)
M10	Task 2.2 Modelling tools meeting	Minutes of the meeting	09 2019	Carlos Moreno (CIEMAT)
WP3				
M2	Task 3.1 Selection of relevant dusts	Short note on particles characteristics	11 2017	C.Grisolia (CEA)
M4	Task 3.1 Particles production	Amount of available material (~100g)	04 2018	J.Rose (AMU)
M7	Task 3.1 Particles tritiation	Amount of available material (~10g)	12 2018	G.Pieters (CEA)
M11	All tasks: Intermediate results presented at progress meeting	Minutes and presentation	10 2019	V.Malard (CEA)
WP4				
M12	Task 4.1 End of experimental tests 1	Data from tests is available	03 2020	Rob Vale (UKAEA)
M13	Task 4.2 End of experimental tests 2	Data from tests is available	01 2021	Rob Vale (UKAEA)
WP5				
WP6				
M1	Task 6.3 Kick-off meeting	Minutes of the meeting	09 2017	C. Grisolia (CEA)
M6	Task 6.5 Constitution and first meeting of the Scientific Advisory Committee	Minutes of the meeting	08 2018	C. Grisolia (CEA)

10 Appendix 3: Gantt chart



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