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CArbon-14 Source Term

CAST

General Assembly Meeting 2 Minutes (D1.4)

21st – 22nd October 2014

Brussels, Belgium

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CAST – Project Overview

The CAST project (CArbon-14 Source Term) aims to develop understanding of the potential release mechanisms of carbon-14 from radioactive waste materials under conditions relevant to waste packaging and disposal to underground geological disposal facilities. The project focuses on the release of carbon-14 as dissolved and gaseous species from irradiated metals (steels, Zircaloys), irradiated graphite and from ion-exchange materials as dissolved and gaseous species.

The CAST consortium brings together 33 partners with a range of skills and competencies in the management of radioactive wastes containing carbon-14, geological disposal research, safety case development and experimental work on gas generation. The consortium consists of national waste management organisations, research institutes, universities and commercial organisations.

The objectives of the CAST project are to gain new scientific understanding of the rate of release of carbon-14 from the corrosion of irradiated steels and Zircaloys and from the leaching of ion-exchange resins and irradiated graphites under geological disposal conditions, its speciation and how these relate to carbon-14 inventory and aqueous conditions. These results will be evaluated in the context of national safety assessments and disseminated to interested stakeholders. The new understanding should be of relevance to national safety assessment stakeholders and will also provide an opportunity for training for early career researchers.

For more information, please visit the CAST website at:
http://www.projectcast.eu

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General Assembly Meeting 2 Minutes (21st – 22nd October 2014)

Executive Summary

The second General Assembly Meeting for the CAST Project was held on 21st – 22nd October 2014 in Brussels, Belgium. These minutes record the main points discussed at the meeting and serve to meet the objective of Deliverable 1.4 for the CAST Project.

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1 Introduction

1.1 *Welcome*

The 2nd CAST General Assembly Meeting was opened by Steve Williams from RWM, UK. He welcomed the participants to Brussels, thanked Ondraf/Niras for organising the meeting venue, and thanked the participants for the productive Work Package meetings the day before. Participants of the meeting gave a short introduction to themselves and their organisation's involvement in CAST.

1.2 *Attendees*

The attendees for the 2nd CAST General Assembly Meeting were:

Table 1: Participants at the 2nd CAST General Assembly Meeting

Name	Organisation
Steve Williams	RWM
Simon Norris	RWM
Helen Kendell	RWM
Jens Mibus	Nagra
Sophia Necib	Andra
Stéphan Schumacher	Andra
Pascal Reiller	CEA
Manuel Capouet	Ondraf/Niras
Erika Neeft	Covra
Manuela Fulger	INR
Daniela Diaconu	INR
André Rübel	GRS
Erich Wieland	PSI
Frank Druyts	SCK.CEN
Volker Metz	KIT
Antonietta Rizzo	ENEA
Hitoshi Owada	RWMC
Corrado Rizzato	Jülich
Werner von Lensa	Jülich
David Bottomley	JRC-ITU
Petr Vecernik	UJV Rez
Miguel Cuňado	Enresa
Kaija Ollila	VTT

Olli Nummi	Fortum
Ernestas Narkunas	LEI
Tomo Suzuki	Subatech
Hans Meeussen	NRG
Viorel Fugaru	IFIN-HH
Antonin Vokal	Surao
Klas Kallstrom	SKB
Steve Swanton	Amec
Marina Rodriguez	Ciemat
Laurent Petit	EdF
Ellie Scourse	MCM International
Irka Hajdas	Independent Expert
Fraser King	Independent Expert

2 WP2 Steels Update

Jens Mibus gave an overview of Work Package 2 Steels for the first year of the Project, including:

- An overview of the objectives and tasks for WP2: Task 1 – the Literature Survey, has been completed; Task 2 – the analytical development, is in progress; and Task 3 – the corrosion experiments and measurements, is about to start. Task 4 – the synthesis of results will be completed towards the end of CAST.

- An overview of the progress in the 1st year of WP2 was given: a productive joint meeting with WP3 was held in Paris in July 2014. The literature survey is complete, analytical techniques and experimental set up have made good progress. In comparison to the original programme the experiments are slightly delayed but are due to start in 2015.

- The statuses for the due deliverables and milestones for WP2 are: D2.1 (State of the art review of steel corrosion and ^{14}C release) has been submitted for final approval, which is expected to be completed in November; D2.2 (Annual progress report Year 1) contributions have been received and the report will be finalised in November 2014. MS6 (publication of D2.1) publication of the status review of steel corrosion on the CAST website is expected late November/ early

December once the report has received final approval from the Work Package manager and the CAST coordinator.

- Two sets of Round Robin comparisons are planned for WP2: one for activation calculations of ^{14}C in steels (Nagra, KIT, SCK and possibly Amec) and one for ^{14}C speciation measurements (PSI, Armines).

- At the joint WP2/WP3 technical meeting in July the approaches to the corrosion experiments were agreed including:

  - sample preparation (mild cleaning and characterisation, representative of real waste);

  - measurement of corrosion rate during leaching tests recommended where possible;

  - recommended duration for tests of 1 year;

  - porewater composition under discussion – $Ca(OH)_2$ solution at pH 12.5 or NaOH solution at pH 13 (or pH 12.5) depending on saturation of calcite;

  - sampling of liquid and gas phase;

  - ^{14}C measurement using liquid scintillation counting (LSC) or accelerator mass spectrometry (AMS) – preconcentration may be needed, AMS may be commercially available in Spain.

- An overview of the samples, experimental conditions and planned analyses for each participant in WP2 was given. At the CAST Kick Off meeting it was discussed that KIT would do a short term acidic experiment, but also a longer term neutral/alkaline experiment. KIT confirmed that they would do the short term acidic experiment first, to see if it is possible to determine between organic/inorganic carbon (as stated in the DoW for CAST). Depending on the results and progress of the experiments with acidic solution, KIT will consider

performing additional experiments under near-neutral conditions. It was also noted that the spring sample for the experiments had been found to be manufactured from X7-CrNiAl-17-7 stainless steel, rather than Inconel (i.e. Ni-Cr-Mn stainless steel).

- Another joint WP2 and WP3 technical progress meeting is planned for April 2015 in Switzerland, hosted by Nagra and held in combination with an analytical techniques knowledge exchange workshop hosted by Nagra/PSI.

- In summary:

  - WP2 has started successfully with the State-of-the-art Report on the corrosion of steels and ^{14}C release;
  - analytical development is making good progress, even presenting first speciation results;
  - experiments are planned and represent a good selection of relevant conditions;
  - reporting is slightly delayed.

Some of the key results from WP2 this year were then presented by two participants in the WP.

2.1 D2.1 Literature Review

Steve Swanton from Amec gave an overview of the literature review on corrosion of steels and ^{14}C release. A draft of the report is available to CAST participants; this should shortly be available on the public website as D2.1 (once approved after final review). A lot of work has been undertaken on the corrosion of steels relevant to disposal conditions although most of this relates to unirradiated steels relevant to waste containers. Irradiation of stainless steels may lead to sensitization to localised corrosion through radiation-induced segregation. There is little, and somewhat contradictory, published information on carbon release from

unirradiated steels. There is almost no information on ^{14}C release from irradiated steels (one test only), which highlights the expected contribution of WP2 to developing understanding. Some implications for the experimental programme from the literature review include: very low corrosion rates are expected, so sufficient inventories of ^{14}C in experimental samples are required, a sufficient sample surface area is needed and the ability to detect small quantities of ^{14}C. Annual release rates of ^{14}C could be a few Bq per year.

There was discussion about the assumption that ^{14}C release is assumed to be congruent. Limited data suggest that this is appropriate for carbon steels.

In the UK programme, it is currently assumed that all ^{14}C is released as methane at a rate congruent with, and controlled by, the corrosion of the steel. It may be expected that a range of species are produced, rather than just methane, but a better understanding would be needed to change the current assumption.

2.2 Experimental Set-Up

Erich Wieland gave an overview of the experimental set-up work undertaken this year in WP2 by PSI, including:

- The concept of planned corrosion experiments with activated steel, analysing both liquid and gas samples.
- Samples – irradiated steel nuts from a reactor core, exposed for 2 years and transferred to the hot lab, sliced and prepared for analysis.
- Challenges of the experiments - high dose rate and small samples, which require shielding as the experiments cannot be accommodated in the available hot cell, very low ^{14}C content and very low corrosion rates under alkaline conditions.
- The analytical approach for ^{14}C that has been developed for the liquid phase (Fahrni et al. 2010) but needs adapting for corrosion studies with irradiated steel. For the gas phase, the analytical approach needs developing.

- The preparation of liquid samples by ion chromatography for ^{14}C AMS including ^{14}C-free ^{12}C carriers (need 10 µg ^{14}C-free ^{12}C-carrier for analysis procedure).

- The installation and testing of the gas GC-MS system is ongoing and development of a fraction collector for compound-specific ^{14}C-AMS is planned for 2015.

- Work planned for CAST Year 2 – analytics for liquid and gas phase experiments; and installation and testing of the reactor for the corrosion experiment.

During discussions it was confirmed that in the liquid chromatography, the pH of the eluents was neutral. There was some discussion about whether the stable organic species released in the PSI experiments with unirradiated steels would be important as an 'instant release fraction'. It was felt that this was a transient release associated with a very limited inventory of oxidised species on the surface (treated steels give a higher concentration of oxidised organic carbons than untreated metal). Their concentrations would not be expected to increase with time and eventually they could degrade.

3 WP3 Zircaloy Update

Sophia Necib of Andra gave an overview of the first year progress for WP3 Zircaloy, including:

- The objectives and tasks for WP3.

- The deliverables for WP3: Five deliverables were due in the first year: D3.1 to D3.4 are all complete and available on the CAST website. D3.5 – the WP3 Annual Report is intended to be submitted by the end of October, all draft contributions have been received.

- Status of the tasks for WP3:

- Task 3.1 Current status review of Zircaloy corrosion and ^{14}C release – deliverable D3.1 (State of the art of ^{14}C in Zircaloy and Zirconium alloy) was led by Andra. This is completed and available on the CAST website. A significant part of the ^{14}C inventory is present in the external oxide (contribution from ^{17}O in coolant). Hulls of new zirconium alloys will be less oxidised than older Zircaloy-4 claddings and hydrogen pick-up will be lower. Uniform corrosion expected to be the main, if not only, mode of corrosion under 'normal' repository conditions. Japanese studies show release of ^{14}C from both the metal hull and the oxide layer, ^{14}C was only found in solution for Zircaloy-4 but was also seen in the gas phase for Zircaloy-2. Uncertainties identified include the inventory of ^{14}C in irradiated Zircaloy, corrosion rates are very low (assumed rates of 10 to 20 nm y^{-1} may be excessively conservative), but there are uncertainties in the rate of corrosion of Zr at low temperatures (corrosion rates cannot be reliably extrapolated from high temperature experiments and hydrogen is taken up by the metal), the dissolution rate of ZrO_2 and the release of ^{14}C from the oxide layer.

- Task 3.2 Development of analytical methods for measuring ^{14}C speciation – this is being done in conjunction with WP2. D3.3 (Description of the analytical procedure for gaseous and dissolved ^{14}C species quantification), is completed and available on CAST website and was led by KIT. Five WP3 participants are working in this area. Experimental methodologies have been agreed for Task 3.3, including: characterisation of samples, oxide thickness, cleaning of samples, no polishing. The analytical techniques proposed by each participant in Task 3.3 was summarised including sampling (liquid/gas) and ^{14}C speciation details and sample type and experimental conditions.

- Tasks 3.3 Characterisation of ^{14}C released from irradiated zirconium fuel clad wastes – D3.2 (Definition of operating conditions and presentation of the leaching experiments) led by CEA, has been completed and is available on the CAST website. D3.4 (Progress report on corrosion tests in the hot cell

– experiment set –up) led by SCK.CEN has been completed and is also available on the CAST website. The scope of the leaching and corrosion tests proposed by the WP3 partners was summarised. Achievement of Milestone 5 (Experimental set-up for Zircaloy corrosion tests in hot cell completed) has been delayed with the first experiment in a hot cell now expected to commence early in 2015.

- The first annual report from WP3 (D3.5) has been slightly delayed but is drafted and expected to be sent to the coordinator by the end of October 2014.

- CEA's leaching tests cannot be undertaken at LECI laboratory at CEA Saclay as planned, but CEA are finding an alternative laboratory to undertake these experiments. This may introduce a delay to their work.

- Looking forward to Year 2: Joint meeting with WP2 planned for April in Switzerland. Six deliverables are due in Year 2 - D3.6 to D3.11. D3.7 (Definition of the analytical strategy for ^{14}C measurements) will depend on progress with setting up the experiments in the alternative CEA laboratory. This will also impact on D3.9 (Quantification of ^{14}C in liquid and gas phase) from Subatech.

During the discussion on WP3 the following points were noted:

- In the planned experiments it may not be possible to distinguish between the oxide and metal contributions to the total ^{14}C inventory. The intention is first to determine the total ^{14}C inventory and then try to distinguish the two contributions.

- It would be interesting (if possible) to characterise the metals before and after the experiments to compare if there is visible corrosion/alteration during the experiment.

- Cleaning metal samples should be considered carefully as it has the potential to remove features from the sample.

- Characterisation of Zr material prior to starting leaching experiments is important –the initial state of the material must be known. It is important to control the experimental conditions: similar leaching solutions, similar cleaning process, similar temperature, and for irradiated samples, should try and have similar thicknesses of samples. It is possible to control the experimental conditions, but the oxide state and ^{14}C inventory may vary so characterisation and recording the sample history is important.

4 WP4 Ion-Exchange Resins

Pascal Reiller from CEA gave an overview of the progress made so far in WP4 Ion-Exchange Resins, including:

- The state of current knowledge on ^{14}C in spent ion exchange resins is different to WP2, 3 and 5 with much less information available –essentially the existing knowledge and state of the art information comes from a single PhD thesis.

- The main contribution to ^{14}C in PWR resins comes from the coolant circuits and the spent fuel ponds. In BWR resins it comes from condensate treatment.

- Task 4.1 Current status review of ^{14}C and its release from SIERs:

    - The state of the art review (D4.1) on sample choice, analytical techniques and current knowledge of release from SIERs has been drafted and is undergoing internal approval at CEA before being sent to the CAST coordinator. ENEA and FZJ provided key input. It should be ready for publication by the end of October 2014.

- Summary of sample availability for the experiments for each participants: For PWRs: 5 samples being provided to CEA from EdF (1 received to date); samples from the Cernavoda NPP will be provided to INR in 2015; samples from the Trino NPP will be obtained by ENEA by end of 2014; SKB have numerous samples from 2009 – 2014 from all Swedish reactors that are currently in operation; UJV will use samples from Temelín NPP and a Rez LWR. For BWRs: FZJ have potential access to up to 5 samples of BWR resins (3 received to date).

- Possible analytical techniques include: LSC, where all partners have high expertise; AMS (no partners have direct access to AMS currently but collaborations are on-going between ENEA, FZJ and Salento); and cavity ring down spectroscopy (ENEA/Florence). For speciation there are several strategies: distinguish between inorganic/organic, then the analysis of organic molecules by chemical functionalities (FTIR), low molecular mass species (ion and gas chromatography), high molecular mass species (ElectroSpray Ionisation-MS, pre-treatment needed as other ions, e.g. sodium, can interfere).

- Task 4.2 ^{14}C inventory and speciation in SIERS:

  - Some partners will investigate the degradation of structure using SEM, AFM, FTIR and XRF. Speciation of ^{14}C in fractions will be undertaken looking at total ^{14}C, inorganic/organic, and fractionation. There is a large amount of data and samples from the SKB programme. The amount of ^{14}C and the ratio between inorganic/organic depends on where the sample is taken from, and how it is pre-treated. Very low amount of ^{14}C in resins remain after heating to 150°C during waste conditioning. Inorganic ^{14}C (the majority of the ^{14}C) is driven off in preference to organic ^{14}C. Trials by CEA/LARC have developed reliable techniques for total ^{14}C and inorganic ^{14}C determinations; further work is needed on the methodology for organic ^{14}C determination. ENEA are developing a double combustion technique for ^{14}C determination.

- Task 4.3 ^{14}C release from SIERs and its speciation:
    - Leaching (once samples received) will be undertaken on virgin and spent IERs in argillaceous, crystalline rock or cementitious waters. FZJ will also examine the effect of gamma irradiation. Analytical techniques developed under Task 4.2 will be applied.
- Task 4.4 – synthesis of all experimental data and interpretation in a final report.
- Two deliverables have been produced so far: D4.2 (WP4 annual report) has been published on the CAST website, D4.1 is under internal review with CEA and should be finalised by the end of October 2014. The next due deliverable is D4.3 (Year 2 annual report) in September 2015.
- An interim meeting of WP4 is being planned in France in late winter/ spring 2015.

During discussions the effects of gamma radiation on resins was considered. The effect of radiolysis on speciation or release will be investigated; it may produce more oxidised, or different, species.

5 WP5 Graphite

Simon Norris from RWM gave an overview on WP5 Graphite:

- There is a lot of preceding information from projects like CARBOWASTE, so as much information as possible should be integrated into WP5 from these relevant projects.
- There is a range of national approaches to i-graphite management – this affects research requirements and prioritisation of i-graphite studies within national programmes.

- The status of the WP5 deliverables for Year 1 is: D5.1 (Review on ^{14}C leaching in French i-graphite) was completed on time; D5.2 (WP5 Annual progress report year 1) is almost complete; D5.3 (Report on graphite categories in the RBMK reactor) –is awaited from IGNS; D5.4 (Definition of the scientific scope of leaching experiments and definition of harmonised leaching parameters) is in progress. D5.5 (Review of current understanding of inventory and release of ^{14}C from irradiated graphites) is due early in Year 2 and Simon requested that information be sent to him as soon as possible, so that the deliverable can be finalised on time. WP5 has generally made good progress in Year 1.

A series of progress presentations were then given.

5.1 *ENEA*

Antonietta Rizzo from ENEA presented work completed on Task 5.4 and gave an overview of ultrasound-assisted organic solvent treatment to exfoliate irradiated graphite and extract ^{14}C. Samples from the Magnox Latina NNP were used. The efficiency of ^{14}C extraction depends on the organic solvent used and the duration of the ultrasonic treatment. Laser Raman micro-spectroscopy and SEM has been used to characterise the chemical and structural properties of the treated graphite.

5.2 *IFIN-HH*

Viorel Fugaru from IFIN-HH presented work under Task 5.1. Two graphite samples have been taken from one of the graphite rods present in the former cooling channels within the thermal column of the VVR-S research reactor. The ^{3}H, ^{14}C, ^{60}Co and ^{154}Eu specific activities have been measured/calculated. In Task 5.2 IFIN-HH will explore the use of AMS to measure ^{14}C distribution within the irradiated graphite. Initial studies are using virgin graphite of the same type as that within the thermal column; the results from this should be available soon. The apparatus and methodology to be used in Task 5.3 to measure the $^{14}C/^{3}H$ activity in irradiated graphite was also described.

5.3 EdF

Laurent Der Petit from EdF gave an overview of the joint Edf and Andra review for deliverable D5.1 (review on ^{14}C leaching in French i-graphite). This is available to CAST participants only but will be incorporated into the public deliverable D5.8 (Synthesis report on ^{14}C speciation in solution and gas from French graphite waste) due in December 2015. An overview of D5.1 was given, including the main chapters on the origin of graphite, experimental methodologies and ^{14}C leaching results. An outline on experimental methodologies was given. The experimental leaching methodology was initially developed for determining ^{36}Cl and had to be adapted to measure the very low ^{14}C releases. The results show that the ^{14}C release rates are always very low, many below quantification limits, but a near steady-state release rate is reached after about 100 days. There is no clear impact of the pH of the leaching liquid but up until recently there have been no experiments using high pH disposal conditions (pH 13). The studies are on powdered samples which increases release rates to solution but does not represent realistic conditions for disposal whereby graphite will be in blocks. Operational wastes – sleeve graphites –seem to show higher cumulative release fractions than stack graphite; however there are uncertainties on the radiochemical measurements and the sample history – more experiments would be needed to confirm this. It was cautioned not to extend the results from French i-graphite to other nuclear i-graphites, ^{14}C releases might depend on operational history and the background of the irradiated graphite.

5.4 FZJ

Werner von Lensa from FZJ gave an overview of contributions to tasks in WP5:

- Task 5.1 –contributions of information from CARBOWASTE and CarboDISP, and from other sources – safety reports from decommissioning of AVR and DIDO have been reviewed. Waste acceptance criteria for the KONRAD repository have limits on ^{14}C activity and disposal of ^{14}C wastes in KONRAD is only possible if it can be shown that <1% of the ^{14}C would be released as volatile species during the operational period.

- Task 5.2 - characterisation of the ^{14}C inventories in MTR and HTR graphites. FZJ have graphite samples from MERLIN, RFR, DIDO and AVR but larger quantities are only available for RFR (Rossendorf Research Reactor) and so Block 4 sample has been selected for leach and treatment tests. Beta hot spots are also seen on the surface and at different depths and EDX and SEM analyses are underway. Releases are so low, only some of the samples (RFR samples) can be used.

- Task 5.3 – establish harmonized rules for leach tests; investigate impact of treatment on leaching. The literature review for harmonized procedures for leach tests is complete but inputs from other contributing partners are needed urgently. Not enough graphite is available from previous FZJ decontamination studies to be used in leach tests so further material is being treated. Higher ^{14}C gaseous releases under humid conditions have been confirmed. Leaching experiments are underway using samples from AVR, MERLIN and RFR and these will include gaseous release measurements.

5.5 *RWM*

Steve Williams from RWM gave an overview of previous RWM funded research. This has shown that small amounts of gaseous ^{14}C were released from irradiated WAGR and BEP0 graphites in contact with a high pH solution. Recent studies by Amec funded by RWM have investigated the effect of experimental conditions on gaseous ^{14}C release from irradiated Oldbury Magnox graphite. Release to solution was also measured. A summary of the experimental conditions were given, including the pH, atmosphere, temperature, graphite form and duration of the experiments. Some typical results were shown, highlighting that the ratio of volatile organic compound (methane, or hydrocarbon, but treated as methane in Performance Assessments) to CO is about 2:1 under reducing conditions but 1:1 under oxic conditions, and that there seems to be a fast initial instant release fraction, which slows to a steady-state release over time. The results from this work are published and will be made available to CAST participants. Comparison of the total ^{14}C releases as gas under different conditions for the Oldbury graphite, and with the limited data available for the WAGR and BEP0 graphites, showed that both experimental conditions and the source of the graphite

affected the release, in agreement with the observation by Laurent der Petit (EdF) that not all graphite samples are the same and that the history of the sample plays a part in the ^{14}C release. A conceptual model for ^{14}C release under high pH disposal conditions was outlined. Some of the experiments with Oldbury graphite are continuing for a further year.

Some points that arose during discussion of this presentation were:

- The ratio of dissolved/gaseous ^{14}C under high pH conditions is about 2 orders of magnitude. Much appears to be released as carbonate, which is retained in alkaline solution in the reaction vessel but is released as gaseous CO_2 if the graphite is leached under near-neutral conditions.
- CO and volatile hydrocarbons are discriminated by a selective oxidation sequence. CO is first oxidised at 'low' temperature catalyst and the resulting CO_2 trapped. Hydrocarbons are then oxidised at a higher temperature on palladium and this resulting CO_2 trapped separately.
- Although there is no understanding at present of the 2:1 and 1:1 hydrocarbon:CO ratios seen in the reducing vs oxic experiments the results show that that controlling the redox environment in experiments is important for gaseous speciation and that reducing conditions seem to favour methane.
- Any CO_2 released from the experiments is trapped on a soda lime column prior to the first sample oxidiser.

6 WP7 Dissemination

Erika Neeft from Covra gave an outline for WP7, including:

- An overview of the CAST presentation template and use of logos, outlining that the template needs to have CAST logo, Euratom and EC flag, but that participants can also add their own logo if required.

- An outline of the website use and monitoring, where IP addresses can be stored and the number of visitors to the website can be recorded. For the CAST public website this was 842 in September and 1010 in October. The EC requires us to keep the website up to date – so this is shown on the website. Participant logos don't show up in colour unless your cursor hovers over it – you can click and go to company websites.

- The publication route for deliverables seems to work well – publication approval forms are uploaded to the private WP1 area, and public deliverables are uploaded onto the public website. The deliverables are filed into categories on the public website i.e. reports, general assembly, newsletter etc.

- Erika would like more pictures and photos for website, please send images to Erika. There are plenty of good images in the publications, but we can't extract images from pdfs as high quality – so could images be put as jpegs on the private website, or emailed to Erika. Everyone is responsible for trying to take images that could be suitable for dissemination purposes and use on the website, for example taking good images of apparatus set up prior to putting it in the hot cell. Good images for the Newsletter would be really useful.

- If your organisation is disseminating CAST information please let Erika know (by email) as this is a research indicator and impact indicator used by the EC.

- Erika will shortly be producing the CAST Newsletter (D7.4), which will be available to the general public, will be about 4 pages long, and will include general CAST info and a progress update including publications, achievements, and information on events/training courses/meetings.

The main discussion points are recorded below:

- A contact list for interested parties could be useful for future GAM observers, potential attendees of workshops/training courses etc.

- The notifications for publications are for the upload of the publication approval forms to the private website, not of the upload of published report to the public website. We try to minimise the number of emails sent to participants, so we do not also send notifications for uploads to public website.

7 WP6 Safety Case

Manuel Capouet from Ondraf/Niras gave an overview of WP6 for the first year:

- The status of D6.1 (^{14}C in safety assessments) including agreed table of contents, progress so far, possible improvements and the proposal for peer review within the WP6 group was outlined. The peer review would be structured so that each organisation would review three reports from other WP6 participants. The programme for delivery of D6.1 including the peer review would be: self-review of input by the end of January 2015; peer review by end of February 2014; WP6 progress meeting in April 2015; finalise D6.1 by June 2015 (the initial draft will be available to CAST participants in December 2014). The outcomes of the peer review will be presented at the 2rd GAM in 2015. It will be necessary to inform the EC of this delay to the public deliverable, especially as it spans the EC 18 month reporting period, however the additional peer review process will improve the report and ensure consistency so that it is a quality product that forms the basis for the rest of the work undertaken in WP6.

- It is important to capture within the D6.1 report whether ^{14}C gas transport and/or solute transport is more important for individual concepts and safety cases and explain why. For some concepts gaseous transport is not an important priority. Priority information requirements should also be outlined in D6.1 and built upon in D6.2.

- There is a short time for calculations with actual results at the end of the CAST project. WP6 would like to have some iteration and input with the technical WPs

earlier than this. It will be important to clarify data inputs at the 2016 GAM, and obtain intermediate results/preliminary outcomes from the WPs in April 2017, so that WP6 have enough time to interpret the results and re-calculate the safety assessment models.

- WP6 plan to share information on transport parameters for sorption in clay and cementitious environments during 2016 and are also interested in microbial effects on ^{14}C speciation and migration based on expert opinions.

8 WP1 Coordination

Steve Williams from RWM gave an overview of WP1 Coordination for the first year. This included discussions on:

- CAST deliverables produced during 2014. Eleven have been completed this year with nine still to complete. Steve thanked everyone for getting deliverables produced and published. The publication approval route via the Coordinator for signature, and to Erika for upload to the website seems to be working well. Steve requested that outstanding Year 1 deliverables should be completed as soon as possible, with WP leaders responsible for chasing any outstanding deliverables from their WPs. This is especially important as we have to submit financial and progress reports to the EC for the first reporting period in March 2015. Looking forward there are lots of deliverables for Year 2 and we need to ensure that these are completed on time.

- Four of six CAST milestones for Year 1, MS1, 2, 3 and 4, are complete; MS5 (Experimental set-up for Zircaloy corrosion test in hot cell completed) and 6 (Publication of status review of steel corrosion and ^{14}C release) are still to be completed. There are no CAST milestones in Year 2, but there is the EC 18 month reporting period – which will require all participants to submit financial and progress reports to the EC directly via the website portal. We will send

around some guidance on this and an example of what the online form looks like –the financial reports need to be accurate.

- The CAST Advisory Group has been set up and is made up of two independent experts and WMO/end-user representatives from Work Package 6. Two independent experts have been contracted via RWM to give technical overview and to steer the direction of the project (via the review of annual reports). The independent experts will also undertake a technical review of the final technical deliverables from each Work Package. The rest of the Advisory Group is made up from WMO/end-user representatives. We currently have eight organisations (Ondraf/Niras, RWM, Nagra, GRS, LEI, Surao Andra and SKB) interested in being part of the group. Any other CAST WMOs/WP6 participants interested in being part of the Advisory Group were requested to contact Steve or Ellie within one month. The WMO/end-users are not expected to undertake detailed reviews of the annual reports or the final deliverables, rather they will be asked to ensure through an overview of CAST that the project outputs will be suitable for use in safety assessment models.

- Consortium Agreement – thank you for your inputs to this – it has been a long process but we now have a final version that we are all happy with. There are 2 outstanding signature forms from Armines and FNAG, which we would like to obtain as soon as possible. The final version will then be uploaded to the private website.

- Templates: the second version of the word document is available online and seems to be working well. The EC flag will be inserted into the Powerpoint template and new version uploaded to the private website. Please remember to use the acknowledgement back page if you are presenting using your own organisation's template. An endnote template is available for referencing in Word documents.

- A Risk Register for the CAST project is available on the WP1 area of the private website. This captures high-level risks, for example sample availability. As new risks are identified through WP leaders these will be added to the Risk Register. The Risk Register is on the agenda for the annual management team meetings.

- The possibility of sharing analytical methodology experience across WPs has been discussed at this meeting, and a forum will be organised to ensure knowledge transfer between WPs. This will also be discussed at the management meeting.

- INR, with IFIN-HH, has kindly offered to host the next GAM in Bucharest in October 2015. Nagra have kindly offered to host the 2016 GAM in Switzerland.

The main discussion points are captured below:

- It was confirmed that the minutes from General Assembly Meetings will be published on the CAST website and are a publicly available deliverable (the General Assembly Meetings are open meetings advertised on the CAST website, where observers could come and attend if they wished). Participants will have an opportunity to review the minutes in draft format prior to their publication.

- A non–disclosure form will be drafted for the independent experts on the Advisory Group as they are not covered by the consortium agreement.

- If part of work is done as a PhD then contributions to the publically available annual reports should not include any specific information that could jeopardise the successful submission of the PhD thesis, but could include, for example, general descriptions at a high-level. For final deliverables, which would need to include detailed information from a PhD, we would deal with this on a case by case basis. All the final deliverables are public documents. However, it may be possible to upload a draft final deliverable to the private website and then make it a publicly available deliverable once the PhD student has submitted their thesis.

- How the EC monitor deliverables was discussed - the EC has their own archiving system, so deliverables should be uploaded to the ECAS website and not just to the CAST website. The Coordinators will check and be responsible for this.

- Annual reports can be at a high-level because they summarise the overall work within a Work Package that year. However, the technical deliverables and the final deliverables for the project should be at the same level of detail as would be expected for a journal paper/publication.

- The Coordinators will produce a very high-level annual report for the IGD-TP, which will essentially be a combination of the Executive Summaries from the WP annual reports, with an added introduction, summary and list of deliverables.

- We will monitor technical progress of the WPs via WP leaders on a six monthly basis using a simple form but, other than the requirements from the EC on the financial reporting, we do not currently expect any additional progress information from each participant.

Steve Williams closed the General Assembly Meeting, and thanked Ondraf/Niras for organising the meeting venue. He thanked the participants for the work done this year and for participating in successful WP meetings. We look forward to a productive second year of CAST and to seeing you in Romania in 2015.

Figure 1: Members of the CAST consortium at the 2nd CAST General Assembly Meeting in Brussels, October 2014.