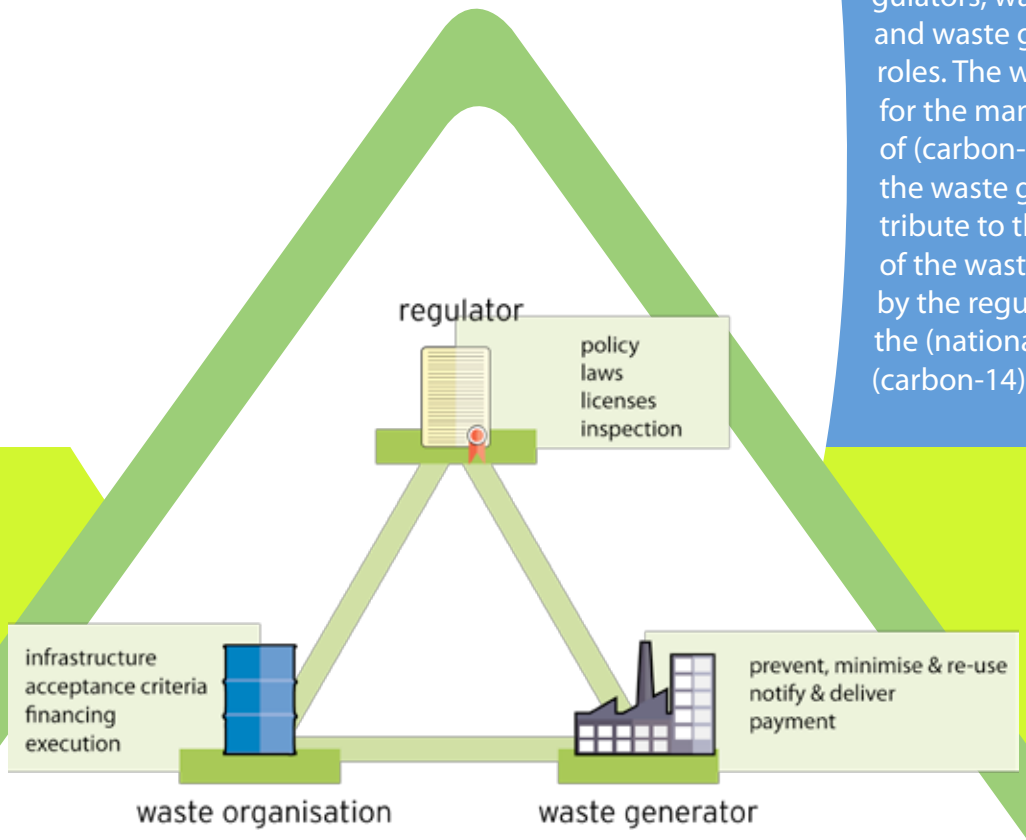
WORKSHOP 1

CAST (Carbon-14 Source Term) is an EU research project that aims to develop understanding of the potential release of carbon-14 from radioactive waste materials under conditions relevant to waste packaging and disposal to underground geological disposal facilities. The project focusses on the release of carbon-14 as dissolved and gaseous species from irradiated metals (steels, Zircaloys), irradiated graphite and spent ion-exchange resins.

Carbon-14 is a radionuclide that cannot be measured from the waste non-destructively. The substantiation for the carbon-14 content and distribution can therefore be best defined upon generation or processing e.g. in discussion with the waste generator or producer. This workshop can be used by countries advanced or executing the disposal of (one of) these 4 types of waste to optimize the disposal volume. This workshop can help countries less advanced into disposal of waste in drafting the carbon-14 inventory for the 4 types of waste investigated in CAST.

Two workshops are envisaged in CAST for participants with an interest in the research executed in CAST, but who can also contribute to the confidence in national safety assessments. The research is evaluated from different perspectives in order to specify this contribution. The scientific progress is already evaluated by the CAST Advisory Group and results obtained in CAST have been and will be presented at several scientific fora. For an implementation of the new understanding developed in CAST, stakeholders with a responsibility in the management of radioactive waste are envisaged. The objectives of the workshops are to contribute to an integrated view of the management of carbon-14 containign waste between the regulator, waste generator and waste management organisation and further identify synergies between countries for (future) cooperation. The institutional arrangement of these responsibilities can be viewed in a triangle in which regulators, waste (management) organisation and waste generators have clearly defined roles. The waste organisation is responsible for the management and eventual disposal of (carbon-14 containing) waste. For CAST, the waste generator (or producer) can contribute to the reliability of the charactization of the waste for disposal; the contribution by the regulator is expected to depend on the (national) progression in disposal of (carbon-14) containing waste.



Dissemination from CAST

A three-fold aim for the first workshop is:
1. to become acquainted with the research;
2. to disseminate the initial findings;
3. to allow sufficient opportunity for questions.

The first workshop takes place in the Netherlands at COVRA's premises because the waste investigated in CAST can be viewed at a single location and is therefore beneficial to become acquainted with the proposed research. The photo on the left is the HABOG facility; one of the storage facilities at COVRA's premises.

Contribution to CAST

Different waste types that generate carbon-14 are studied within CAST. The origin of the investigated wastes is schematisized for a Pressurised Water Reactor. In order to identify synergies between countries for (future) cooperation, each participating country presents - preferably by the waste management organisation - for each type of carbon-14 containg waste investigated in CAST:

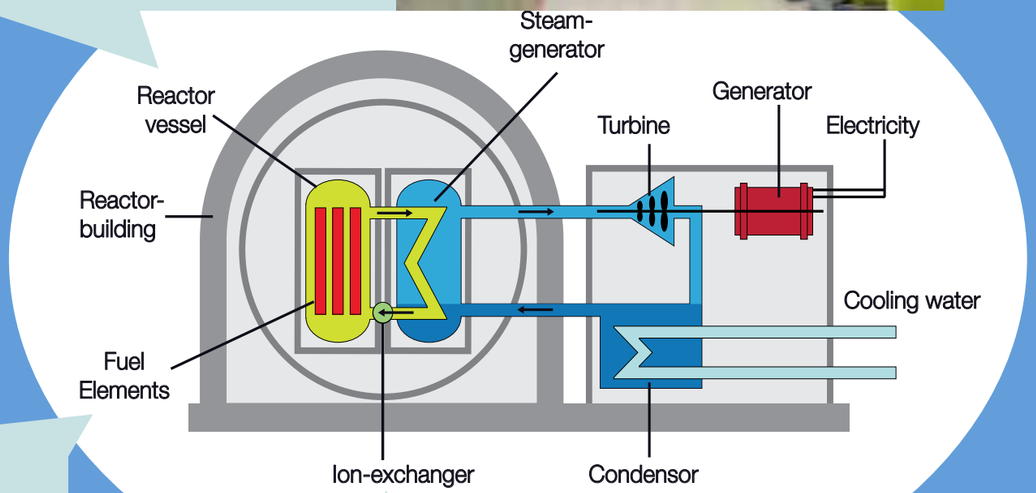
- What are the amounts you expect to have / will be generated?
- How is the carbon-14 content determined / specified?
- What is the carbon-14 activity per waste package / kilogram waste matrix?
- What is the designated end-point of each type of waste?

For the waste generators / producers, it should become clear in the first workshop what (traceable) information they can share for the waste characterisation to calculate disposal of the waste / processed waste. This contribution is evaluated in the second workshop (organized by the end of the CAST project in 2018).

For the regulators, an overview of achievements of technical results for workshop 1 is available at www.projectcast.eu in the section Training. In this first workshop, discussions can be initiated and questions can be raised. For the second workshop to be held in 2018, another overview will be made in which it is intended to incorporate the answers of the questions raised. This contribution from CAST to the regulators can be evaluated in the second workshop . Initiated discussions can be completed during the second workshop.

Graphite waste
Some types of reactors use graphite moderators and reflectors, instead of water. This produces irradiated graphite, which may release carbon-14 under geological disposal conditions.

Steels
Steel is frequently used in water moderated reactors, and the largest structural material is the reactor vessel. The carbon steel wall thickness can be several decimetres thick. The inside of this vessel consist of several millimetres of stainless steel to prevent corrosion of the vessel. Other structural materials include components to assemble fuel elements and ducts to transport heated water. Irradiated steel becomes (decommissioning) waste. At COVRA, irradiated steel is (expected to be) conditioned in steel. Storage for decay to facilitate the conditioning is one of the options and shown on the left in the yellow temporary containers.



Zircaloy
The cladding of fuel elements is normally made of Zircaloy. The thickness of these claddings is usually less than 1 mm. Fuel elements are replaced several times during the lifetime of a reactor. Spent fuel can be reprocessed: carbon-14 is released from irradiated metal-oxide fuel during the fuel dissolution process. The claddings are not dissolved during reprocessing and become waste. At COVRA, this waste is stored in the 'HABOG' facility.

Ion-Exchange Resins
Oxygen is a component of the moderator water. Neutron capture by oxygen and corrosion products are the two origins of carbon-14 in the primary circuit of the reactor. Carbon-14 is filtered from water with an ion exchanger. These exchangers are frequently replaced and become waste. In the Netherlands, spent-ion exchange resins are together with sludge mixed with cementituous mortar in a drum. Each drum is contained in a reinforced concrete vessel for permanent additional shielding.

5 October 2016	6 October 2016
Become acquainted with the proposed research	Examples national safety assessments
Bus to COVRA's premises leaves at 9:00 from Hotel The Roosevelt and Hotel Arneville, both in Middelburg 9:30 Coffee and tea	Bus to COVRA's premises leaves at 9:00 from Hotel The Roosevelt and Hotel Arneville, both in Middelburg 9:30 Coffee and tea
10:00-10:15 Introduction of the waste investigated in CAST	10:00-11:00 Spent ion exchange resins - Finland
10:15-12:15 Contribution each participating country Amount expected, specification carbon-14 Designated end-point	11:00-12:00 Irradiated Graphite - Lithuania
12:15 Lunch	12:00 Lunch
13:00-13:30 3D-Movie	13:00-14:00 Irradiated Steels - Switzerland
13:30-15:30 Visit storage facilities HABOG Irradiated Zircaloy & Irradiated Steel LOG Spent ion exchange resins (& Irradiated graphite)	14:00-15:00 Irradiated Zircaloy - The Netherlands
15:30 Coffee and tea	15:00 Coffee and tea
16:00-16:45 Roles and responsibilities of a country less advanced in disposal of waste - The Netherlands	15:30-16:30 Wrap-up and closure
16:45 Bus to Hotel The Roosevelt in Middelburg 19:00 Dinner at restaurant Kloveniersdoelen in Middelburg (paid by CAST)	16:30 Bus to Hotel The Roosevelt in Middelburg

A lot of public accessible reports are made in CAST. Detailed experimental set-ups are expected to be of interest for researchers performing experimental work e.g. at universities and institutes. Overviews are made to have a state-of-the art of knowledge and understanding in disposal of carbon-14 containing waste. This knowledge and understanding is integrated in a conceptual model and calculated in a safety assessment. For the first workshop of CAST, the dissemination of the inititial findings in these integrations are expected to be of interest to regulators, waste organisations and waste generators (and / or producers). For each type investigated in CAST, a national example of a safety assessment is presented.

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CAST
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