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AUTORITÉ DE SÛRETÉ NUCLÉAIRE

INSTITUT DE RADIOPROTECTION ET DE SÛRETÉ NUCLÉAIRE

FEEDBACK ON OBT EXERCISES ORGANIZED FOR ENVIRONMENTAL MONITORING LABS APPROVAL BY THE FRENCH NUCLEAR SAFETY AUTHORITY (ASN).

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- Regulatory framework of environmental monitoring in France
  - why, how, what's in
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  - Presentation
  - Results
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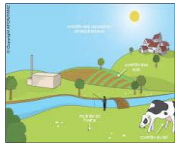


Regulatory framework of environmental monitoring in France (1)

Order of 7 February 2012 laying down the general rules governing basic nuclear facilities:

- ✓ The operator shall take all measures, from the design stage, to limit the discharge of effluents from the installation.
- ✓ The effluent discharge limit values for the installation shall be set on the basis of the best available techniques under technically and economically acceptable conditions, taking into account the characteristics of the installation, its geographical location and the local environmental conditions.

Regulatory framework of environmental monitoring in France (2)

ASN Decision No. 2013-DC-0360 of the French Nuclear Safety Authority of 16 July 2013 on the control of nuisances and the impact on health and the environment of basic nuclear facilities:

- ✓ Art. 3.2.13. (...) the operator shall ensure that the tritium activity in rainwater remains of the same order of magnitude as that present in atmospheric precipitation, unless it can be demonstrated that no tritium is released from the installation.
- ✓ Art. 3.3.2. - II. - Except when justified by an emergency, the radioactivity measurements mentioned in I **that are the subject of an approval issued by the Nuclear Safety Authority** are carried out by a laboratory that has such an approval and transmitted to the national network for environmental radioactivity measurements. The elements justifying the reduction or cessation of this monitoring shall be transmitted in advance to the Nuclear Safety Authority.
- ✓ Art. 3.3.4. - I. The sampling and measurement techniques used for environmental monitoring ensure that the decision thresholds do not exceed the following values:
  - ❖ for the measurement of atmospheric tritium: 0.5 Bq/m^3;
  - ❖ for the measurement of free tritium in water: 10 Bq/L;
  - ❖ for the measurement of tritium in biological matrices: 10 Bq/L (water obtained by combustion or freeze-drying).

Regulatory framework of environmental monitoring in France (3)

ASN Decision No. 2017-DC-0588 of 6 April 2017 on the terms and conditions of water withdrawal and consumption, effluent discharge and environmental monitoring of pressurised water reactors:

- ✓ Art. 1.1.1 - In application of Article L. 592-20 of the Environment Code, this decision supplements the terms of application of the forementioned Order of 7 February 2012. It also supplements the provisions of the aforementioned decision of 16 July 2013, with regard to the control ofand the impact on health and the environment of pressurised water nuclear reactors in operation. reactors in operation. It applies to all pressurised water nuclear reactors, from their commissioning andreactors, from the time they are commissioned until they are decommissioned, in normal operation or in a degraded mode of operation. It does not concern waste. It does not concern waste.

Individual decisions taken by the ASN governing releases from each nuclear facility (or each site):

- ✓ Decision setting discharge limits, approved by the minister responsible for nuclear safety
- ✓ Decision setting the terms and conditions for discharges and water withdrawals and also definition of the monitoring strategy (parameter, matrix, sampling frequency…)

Laboratory Approval System (1)

In France, all environmental monitoring results should be available to the public on the RMN (or French national network) website: www.mesure-radioactivite.fr

The **French national network** are defined in the Code of public health art.R.1333-11

I- Mission of the French National Network
- Contribution to the dose estimation due to ionising radiation
- Public information ⇒ WEB site **« www.mesure-radioactivite.fr »**
  - Results of environmental radioactivity measurements by the IRSN and by Authorised laboratories
  - Estimation of doses received by the population

II- French National Network centralize data from :
- 1° operators : regulatory surveillance measurements of the impact of nuclear activities on the environment
- 2° ASN, local communities, government departments or public services
- 3° any association or private organisation, subject to the communication of the res to the National Monitoring Network

III- National Network Objectives set by ASN and Network management by IRSN

⇒ **Decision ASN 2008-DC-0099 of the 29th of april 2008**

-Terms of the Network organisation
-Nature of informations to communicate
-Terms of data availability for the public

Laboratory Approval System (2)

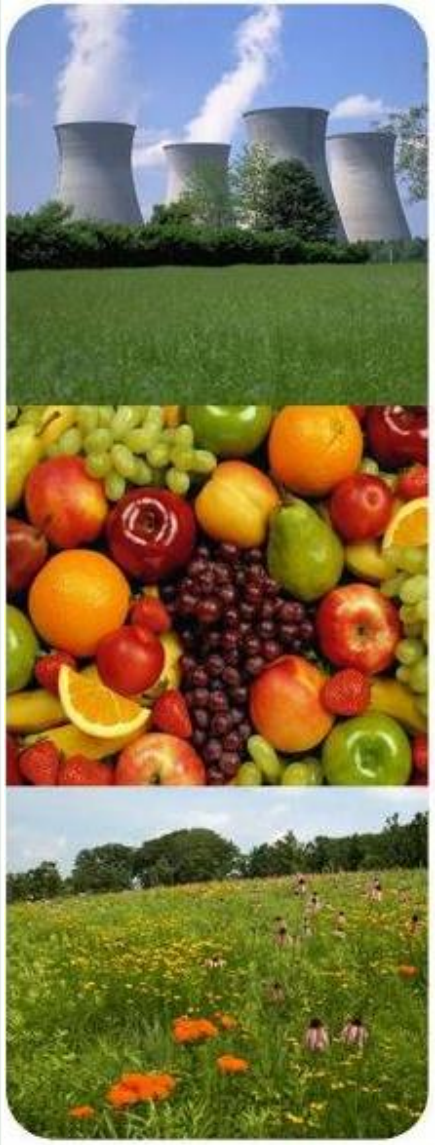
European Regulatory Framework

French National Network complies with the regulations set by:

The European directive 2003/4/CE : public information on the status of the environment (art. 1 et 2) and data quality (art. 8)

The Euratom directive 96/29 : estimation of doses due to the nuclear facilities

Laboratory Approval System (3)



The French national network addresses the main major following objectives

- ✓Contributes to the dose estimation of the population exposure to ionizing radiation
  - ❖ development of a data base
- ✓Ensure the transparency of information about environmental radioactivity in France
  - ❖ development of a web site
- ✓Pursues a quality policy for the measurements performed by laboratories
  - ❖ establishment of **an approval system** for the laboratories

Laboratory Approval System (4)

Different Environment Compartments

Water

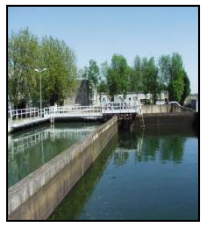
Soils

Biological

Aerosols

Gases

Air kerma dose rates



Different types of measurements

Global measurements alpha, beta

« Artificial » radionuclides by alpha and gamma spectrometry

« Natural » radionuclides by alpha and gamma spectrometry

Pure Beta emitters by liquid scintillation,

…

- About 40 types of approval
- Duration of validity 4 years

Laboratory Approval System (5)

Which terms and constraints for the applying laboratory for an Authorisation ?

To get an approval laboratories must:

Have a QA system which complies with the standard ISO/CEI 17025

Comply with standards and procedures

→ **Application**

Demonstrate their ability to perform adequate measurements through good results obtained at intercomparison campaigns organised by IRSN

→ Results of intercomparisons campaign and feedback

Laboratory Approval System (6)

What are the different Laboratory Authorisations ?
- Laboratory Authorisation Table -

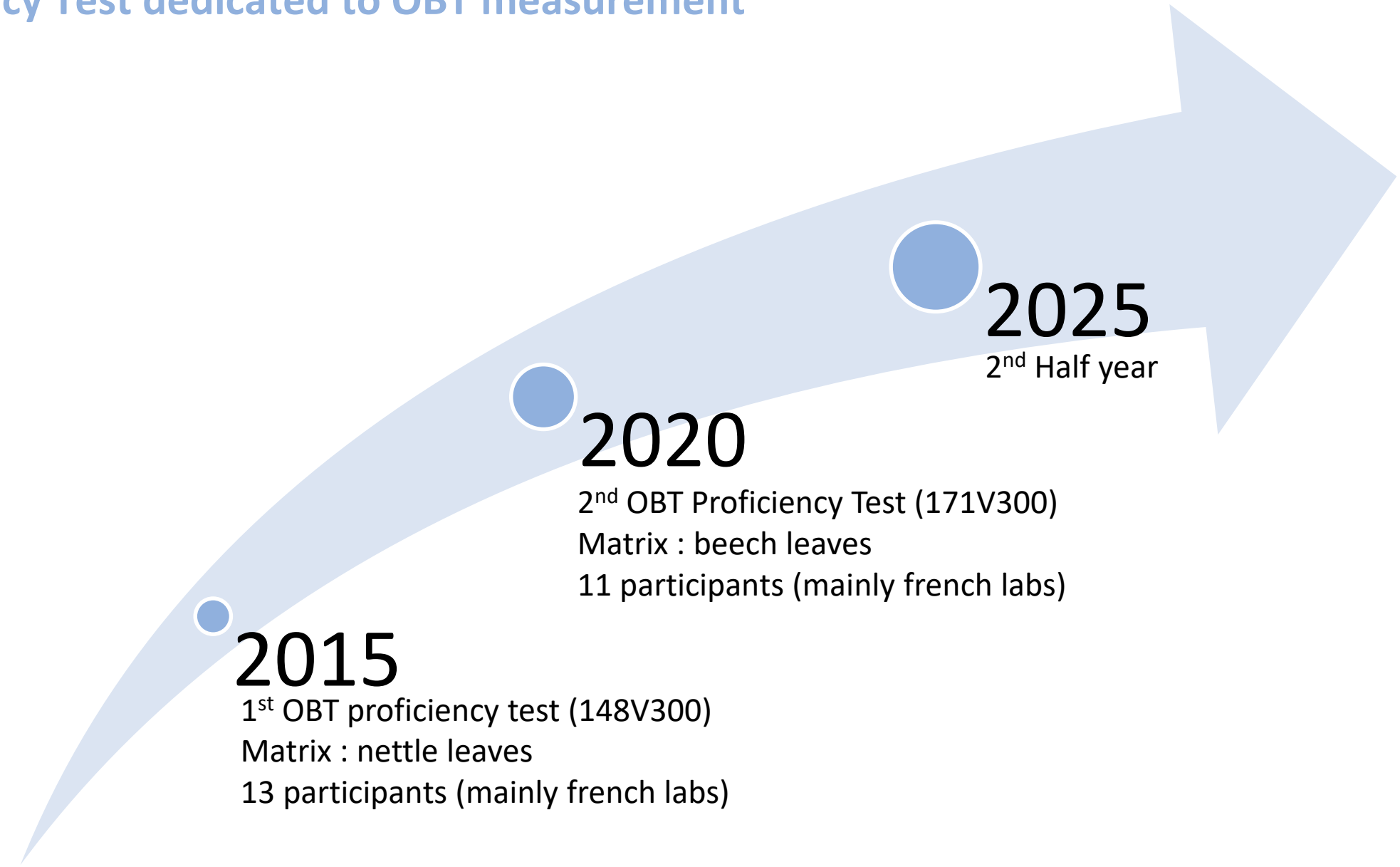
		Type 1		Type 2		Type 3		Type 4		Type 5		Type 6	
Code :	Catégorie de mesures radioactives	- Eaux -		- Matrices sols-		- Matrices biologiques -		- Aérosols sur filtre -		- Gaz air-		-Milieu ambiant (sol/air) -	
.. -01	Radionucléides émetteurs γ > 100 keV		1_01		2_01		3_01		4_01		5_01		-
.. -02	Radionucléides émetteurs γ < 100 keV		1_02		2_02		3_02		4_02		5_02		-
.. -03	Alpha global		1_03		-		-		4_03		-		-
.. -04	Bêta global		1_04		-		-		4_04		-		-
.. -05	H-3		1_05		2_05		3_05		-		Cf eau		-
.. -06	C-14		1_06		2_06		3_06		-		Cf eau/Na OH		-
.. -07	Sr-90/Y-90		1_07		2_07		3_07		4_07		-		-
.. -08	Autres émetteurs bêta purs (Ni-63, …)		1_08		2_08		3_08		-		-		-
.. -09	isotopes U + desc.		1_09		2_09		3_09		4_09		-		-
.. -10	isotopes Th + desc.		1_10		2_10	?	3_10		4_10		-		-
.. -11	Ra-226 + desc.		1_11		2_11		3_11		-		Rn 222 : 5_11		-
.. -12	Ra-228 + desc.		1_12		2_12	?	3_12		-		Rn 220 : 5_12		-
.. –13	Isotopes Pu, Am, (Cm, Np)		1_13		2_13		3_13		4_13				-
.. –14	Gaz halogénés		-		-		-		-		5_14		-
.. –15	Gaz rares		-		-		-		-		5_15		-
.. –16	Dosimétrie gamma		-		-		-		-		-		6_16
.. –17	uranium pondéral		1_17		2_17		3_17		4_17		-		-

Proficiency tests (PT) organized by IRSN

- Mainly designed for French laboratories in the frame of the French approval system but **open to any laboratory** worldwide.
- **Up to 7 proficiency test organized each year** for nearly all radionuclide/matrix combinations relevant in environmental monitoring. The schedule is availlable for the next 5 years availlable in our website.
- IRSN has been **accredited by COFRAC** since 2006 according to ISO/IEC 17043 standard for organizing proficiency tests.
- IRSN is in charge of the conception of PT program, the reference value, the statistical analysis of all results and the final report.

IRSN newsletter on our website **cilei.irsn.fr**

Proficiency Test dedicated to OBT measurement



2015

1st OBT proficiency test (148V300)
Matrix : nettle leaves
13 participants (mainly french labs)

2020

2nd OBT Proficiency Test (171V300)
Matrix : beech leaves
11 participants (mainly french labs)

2025

2nd Half year

Feedback of the last PT organized in 2020 (171V300)

- Sample collection
- Drying
- Grinding and homogenization
- Dispatching and packing of the samples
- Tests of characterization
- Results and performance of laboratories

PT 171V300 : Sample collection (july 2020)

- Select an appropriate place with significant OBT activity (objective 100 Bq/kg dry)
- Collect the right quantity of sample (beech leaves), taking into account the fresh /dry mass product ratio
- Take only the leaves for the homogenity of the matrix

PT 171V300 : Drying (July / August 2020)

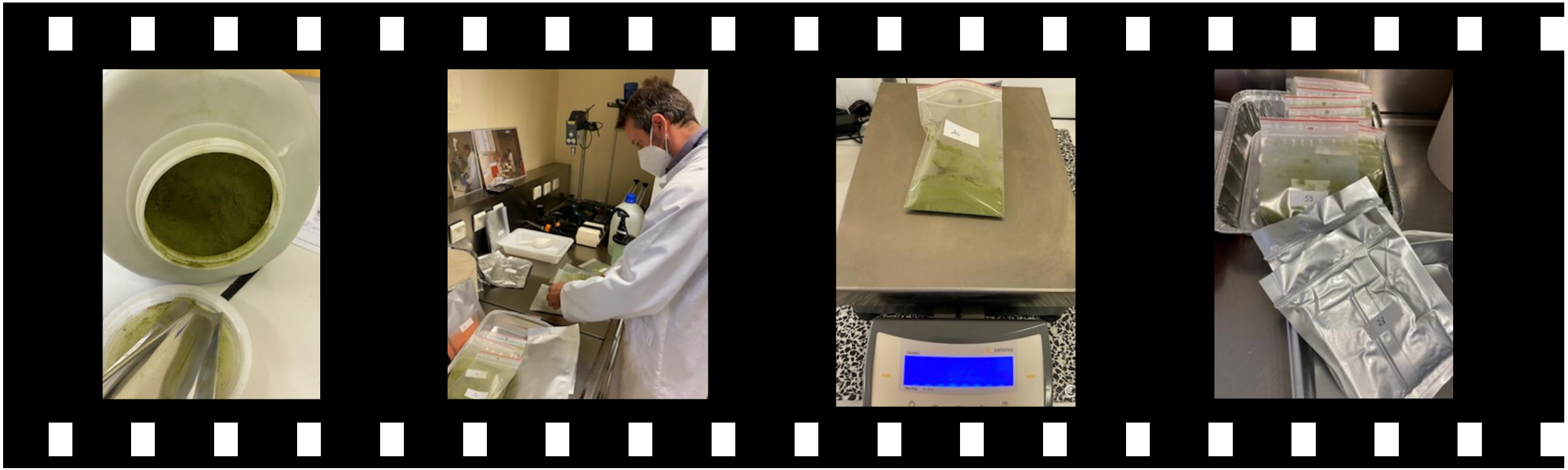
- Free drying in atmospheric area during 1week
- Leaves are chopped into 1 cm pieces and dispatched in trays
- steamroom at 60°C during 1 month
- freeze dryer

17 kg of fresh matrix — Fresh /dry mass product ratio = 7 — **2.4 kg of dry matrix**

PT 171V300 : Grinding and homogenization (september 2020)

- Specific vegetal grinder to obtain a 200 µm powder
- Shaking for 1 hour

PT 171V300 : dispatching packing (October 2020)



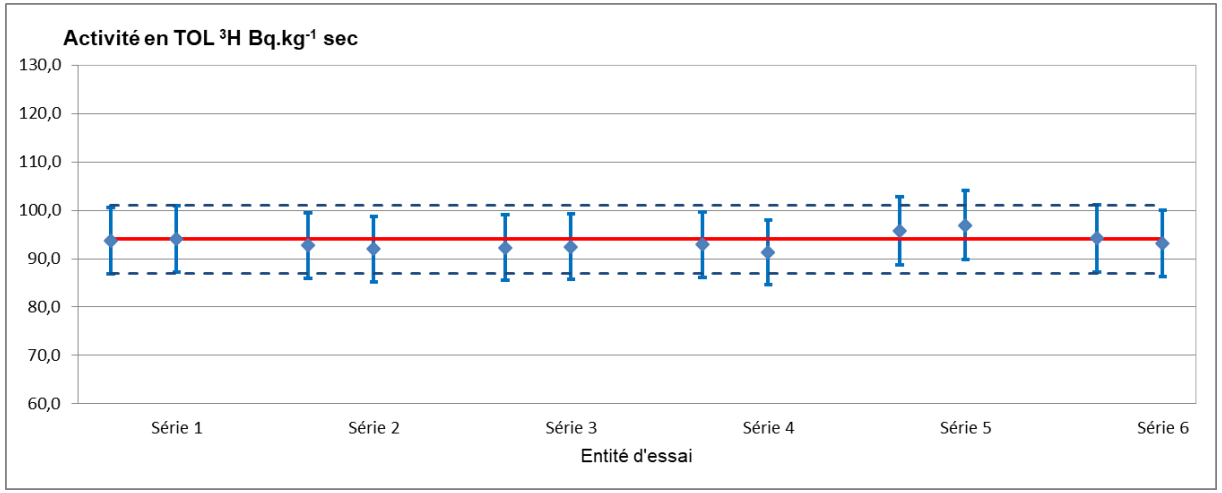
- Dispatch in 75 samples of 30 g each
- Double packaging in a plastic bag and in a vacuum-sealed aluminum pouch for tightness
- A random selection of 18 samples dedicated for characterization tests (reference value determination, homogeneity, stability).

PT 171V300 : Characterization of the matrix (October / December 2020)

- The analytical method is based on the measurement of the collected water after burning the sample in a tubular furnace (ERALY model)
- 30 g of sample is burnt up to 850°C
- Collected water : 15 mL
- LSC measurement : Quantulus 1220, 1000 min, mix of 10/10 Ultimagold LLT

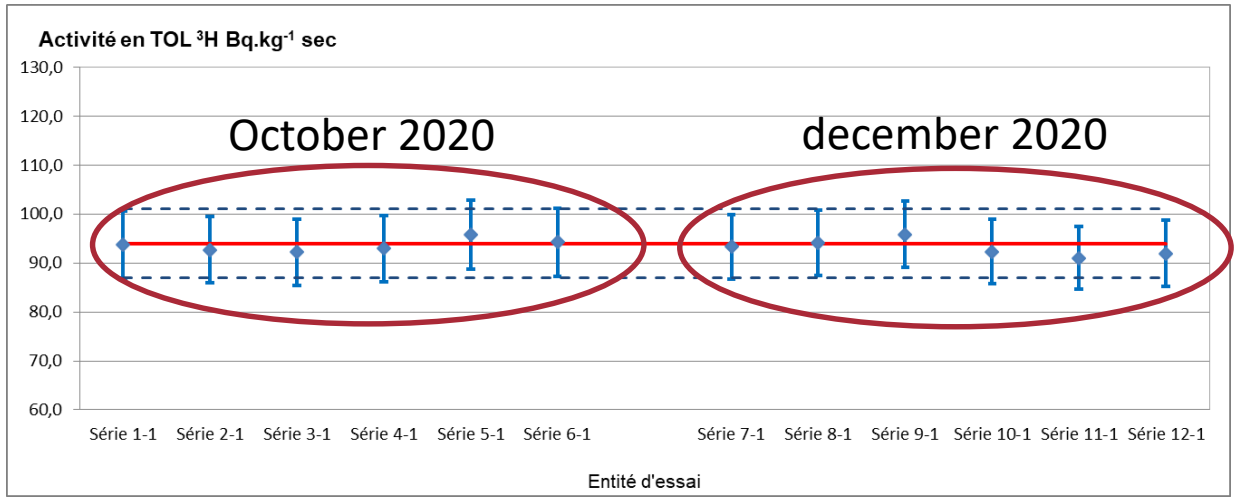
PT 171V300 – Characterization tests

HOMOGENEITY (OCTOBER 2020)



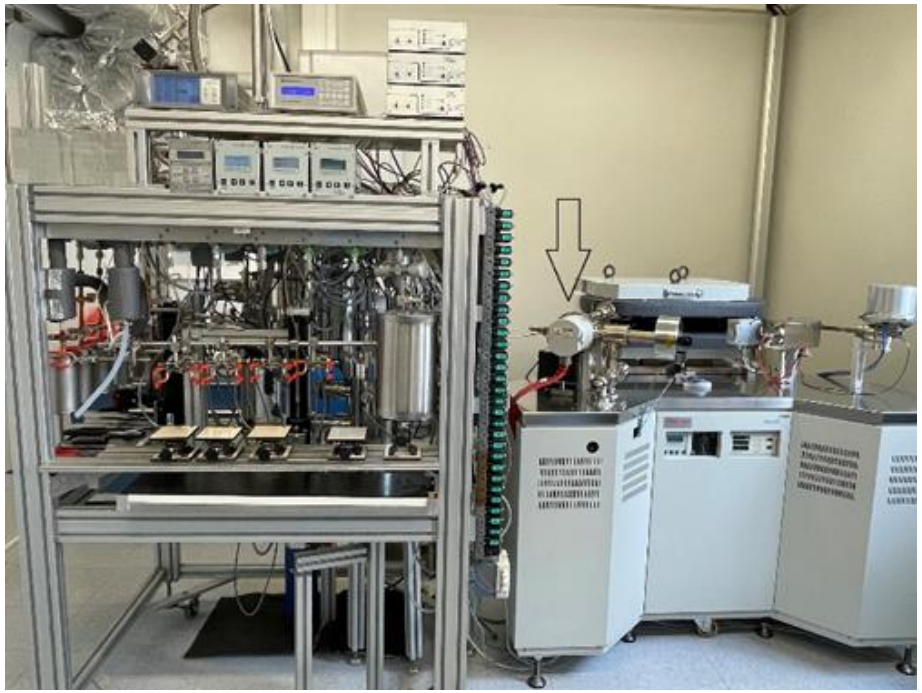
- Number of samples = 12
- Mean value of measurement = (169±9) Bq.L^{-1}
- Total hydrogen contents : (6,16±0,31) %
- Reference value = (94±7) $Bq.kg^{-1}$ dry
- σ= 1,7 $Bq.kg^{-1}$ dry (1,8%)

STABILITY (DECEMBER 2020)



- Number of samples = 6
- Stability has been checked by comparing 6 results measured at the beginning and 6 measured at the end of the exercise (test of student).

PT 171V300 – Characterization test : comparison with a different method

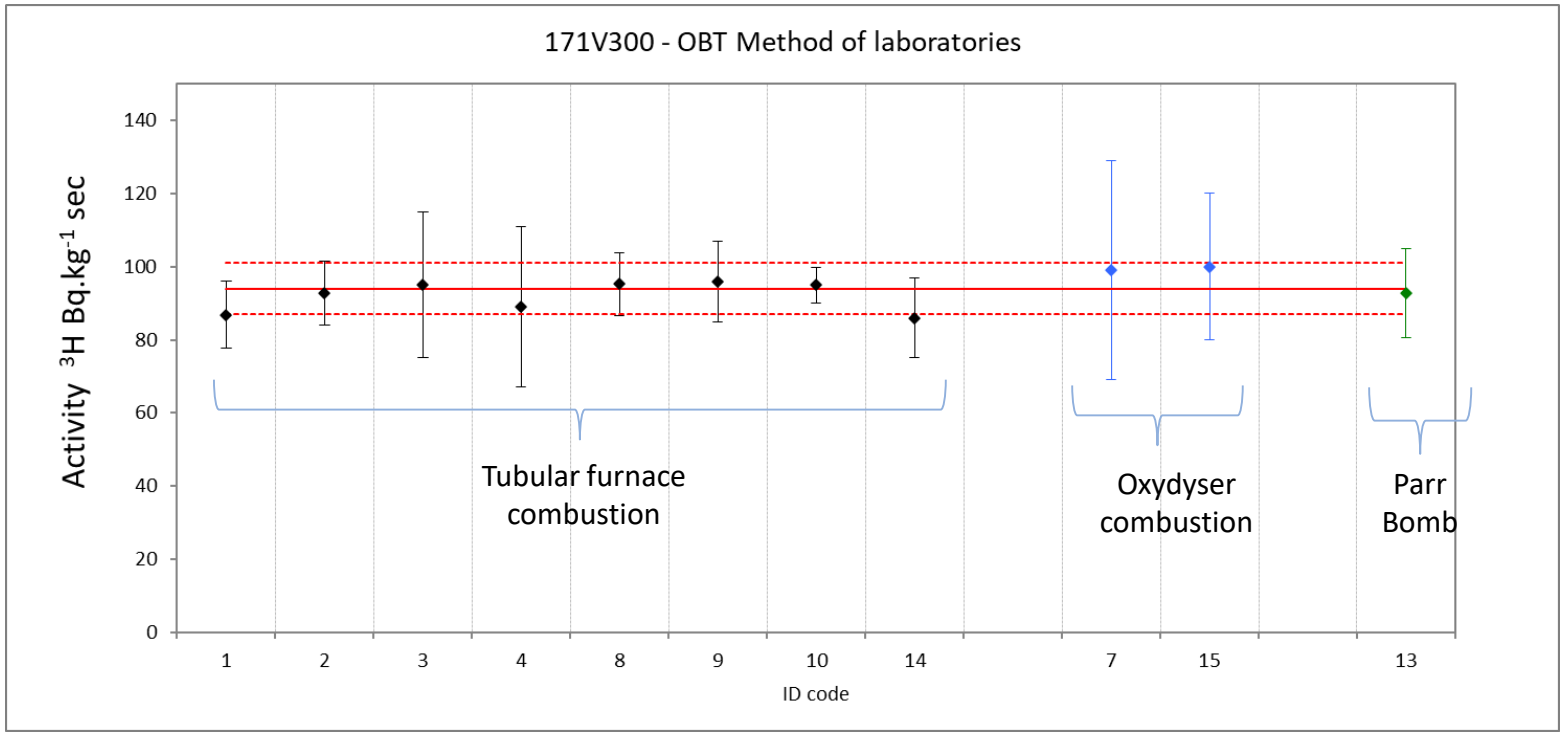


MS system Helix (Thermo)
IRSN – LMRE in Orsay

Comparative methode (MS He-3 ingrowth) (Bq.kg^{-1} dry)		Reference value (Combustion system + LSC measurement) (Bq.kg^{-1} dry)		Tests of compatibility	
Activity	**Uncertainty (k=2)**	**Activity**	**Uncertainty (k=2)**	**Relative bias**	**Normalized error**
93,5	**6,5**	**94**	**7**	-0,5%	-0,05

PT 171V300 - Results of laboratories

Laboratories were ask to provide results in **Bq/kg dry**



Mean value = 93 Bq/kg dry

Sigma PT = 9 Bq/kg dry

Reference value = (94±7) $Bq.kg^{-1}$ dry

PT 171V300 - Performance evaluation

- **RELATIVE BIAS (<15%)**
- **Z SCORE (BETWEEN -2 AND 2)**
- **NORMALIZED ERROR (BETWEEN -1 AND 1)**

All results complies with the regulatory requirement

Code	OBT activity ($Bq.kg^{-1}$ dry)	RB	Z-SCORE	Normalized error	Status
1	86,8	-7,66%	-1,44	-0,62	Conform
2	92,8	-1,28%	-0,24	-0,11	Conform
3	95	1,06%	0,20	0,08	Conform
4	89	-5,32%	-1,00	-0,41	Conform
7	99	5,32%	1,00	0,41	Conform
8	95,2	1,28%	0,24	0,11	Conform
9	96	2,13%	0,40	0,16	Conform
10	95	1,06%	0,20	0,12	Conform
13	92,8	-1,28%	-0,24	-0,10	Conform
14	86	-8,51%	-1,60	-0,66	Conform
15	100	6,38%	1,20	0,49	Conform

Conclusion

- The PT organized in 2020 was a success :
  - the matrix and the packaging have shown good homogeneity and stability
  - The level of OBT activity in the samples was consistent with all kind of system of measurement
  - All laboratories satisfied the French approval system requirements

Next step

- Check the long-time stability of the samples (12 samples from last PT are available)
- Define the need in term of quantity of matrix for the next PT of 2025 :
  - How many labs will participate ?
  - How many samples are needed for a reference material ?