

Author(s) : Jorgen Claes
Lionel Sombré

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Title:	TECHNICAL GUIDE FOR WATER SUPPLIERS AND LABORATORIES: SAMPLING METHODS AND PROCEDURES FOR WATER INTENDED FOR HUMAN CONSUMPTION

Summary:	<p>This guide describes the approach to be followed for the collection of samples of water intended for human consumption (methodology of sampling).</p> <p>It covers the concepts of compliance points and the auto-control program. It refers to specific guides that provide explanation and comment in choosing these compliance points and the development of the auto-control program.</p>
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Document approval

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1	Jorgen Claes	Lionel Sombré	Michel Sonck

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1. Objective

The purpose of this guide is to present and explain the various procedures to be observed by water suppliers (and laboratories) taking samples with a view to analysing the radioactivity of drinking water as defined in the Royal Decree of 31 May 2016 on Protection of Water for Human Consumption from Contamination by Radioactive Substances.

Article 9.1 of the Royal Decree describes the specifications that FANC may impose with regard to services provided by a supplier of water to a laboratory to comply with the conditions stipulated by FANC pursuant to Article 10.

The FANC Decree of 24.11.2016 specifies the rules and methods for monitoring radioactive substances in water intended for human consumption.

This guide seeks to set out FANC's expectations and requirements regarding taking water samples.

2. Scope

Implementation of the Royal Decree of 31 May 2016 regarding the protection of public health from radioactive substances in water intended for human consumption of 31 May 2016.

3. Auto-control programme: selecting points of compliance

This(these) point(s) is(are) selected as being representative of the water supply area or of the water used in (incorporation) or comes into contact with foodstuffs intended for human consumption during the manufacturing process.

The sampling point, associated with the point of compliance, is selected in accordance with the provisions of Article 2 §11 of the Royal Decree. It may be:

- after the water treatment facility
- after mixing water except if the added water has previously been controlled by a supplier;
- at a water supply tap;
- after being incorporated or coming into contact with food company production lines unless the water used is distributed by a supplier and is already monitored.

The water sampling point/s must be representative of the supply area (in the case of water suppliers) and/or exposure/contamination pathways of the public (ingestion of foodstuffs).

For the submitting the requested auto-control programme, please consult FANC's data-exchange web platform (<https://dyp.fanc.be>) and the technical guide covering the information required to establish this programme (available for download on the web platform).

4. Water sampling and treatment protocols

Water suppliers and laboratories (ISO 17025 accredited) required to take water samples for the purpose of radioactivity analyses must follow the specifications set out in the instruction sheets enclosed as Annex 1 to this guide. These specifications must be adopted in the supplier's quality system.

Three methods are proposed for processing samples intended to determine the radon content (Rn-222) in water: sampling using a plastic tube and a container (jerry can), using a syringe or the method using a glass flask.

Precautions must be taken when carrying out the sampling procedure and the instructions must be followed to the letter since radon is a very volatile gas. Any losses must be avoided to not compromise the quality of the laboratory measurements.

A sample comprising 15 litres of water is required to determine the other radionuclides.

An example form for the registration of the water sample is defined and must be used in order to identify the sample (Annex 1). The supplier may use their own sampling form or layout but all relevant fields must be present. The unique identification code of each PDC point (automatically generated by the web platform for each PDC point that is encoded) must always be specified on the sampling form (and on the reporting template for radioactive measurements).

If the sampling point (Article 2, § 11 of the Royal Decree of May 31, 2016) is identical to the PDC point (Article 2 § 4 of the Decree of May 31, 2016) as defined in the submission of the auto-control program, it is not necessary to give the latitude and longitude coordinates. However, if different, the actual coordinates of the sampling point must be reported on the sampling form. In this latter case, the coordinates of the sampling point must be written in the "Comment column" on the mandatory reporting template of the radioactive measurements. The latitude / longitude coordinates are separated by a semicolon.

5. Registration and reporting of radioactive measurements

FANC recommends that the reporting of the radioactivity measurements is performed by using the reporting protocol it provides (Excel spreadsheet). This protocol identifies the required information and provides additional explanatory notes of the data.

The template can be downloaded from the web platform or from the informative website of the FANC for radioactivity in water intended for human consumption. More clarification regarding this spreadsheet for measurements (Annex 2) is also reflected in the technical guides:

- Technical guide for laboratories performing radioactivity analysis of water intended for human consumption;
- Technical guide for the suppliers of drinking water: modalities for the choice of compliance points and the creation of an auto-control programme.

The supplier can - at the registration of the auto-control programme and more specific at the identification of the laboratories which will carry out the analysis of radioactivity in water - authorize the laboratories to upload their measurement data directly into the data exchange web platform. In this case, both the supplier and the Agency receive a notification that new results are available which can be accessed after login.

6. Questions and Support

For questions or support regarding the required sampling procedures, please contact surveillance.dw@fanc.fgov.be.

7. Appendixes or forms to be used |

**TECHNICAL DATASHEET FOR TAKING & PROCESSING RADIOACTIVITY ANALYSIS
SAMPLES FOR WATER INTENDED FOR HUMAN CONSUMPTION****Containers and bottles for sampling****A. Taking samples to measure Rn-222**

Three different jerry cans/bottles can be used to take water samples to measure Rn-222. Each container is intended for a specific method:

Method 1: plastic tube and jerry can

A 5 l polyethylene jerry can/bottle is used in this method. The container must be filled completely at the sampling point using the instructions described in the "sampling using a plastic tube" method.

**Method 2: syringe**

This method uses a 10 ml syringe and a 20 ml Teflon-coated polyethylene vial.

**Method 3: glass vial**

This method uses a glass vial sealed with a septum stopper.

B. Taking samples to measure other radionuclides

The total sample volume taken must be at least 15 litres. A plastic jerry can is often the most appropriate for transport purposes. There must be no leakage during transport or handling of the jerry cans.

Sampling method

A. Taking samples to measure Rn-222

The sampling method is based on the method described in ISO/WD 13164-4 *Water quality - Radon-222 - Part 4: Test method using liquid scintillation counting*. Three different methods may be used.

1. Method using a plastic tube and a jerry can:

- Connect a plastic tube to a tap with an adjustment system adapted to the diameter.
- Insert the other end of the tube in the bottle as described below.
- Adjust the flow of water so that it flows uniformly (no turbulence).

Allow the bottle/jerry can to overflow for approximately 2 minutes. Adjust the flow to prevent turbulence, bubbles or voids in either the tube or the bottle.

- Gently remove the tube and screw the stopper in tightly, trying not to trap any air beneath the stopper.



- Label the sample and complete the sampling form (see the form in the Annex) to accompany the sample. This form must clearly identify the sample to which it relates.

2. Syringe method:

- Adjust the water flow from the tap so as to achieve a laminar flow (if at all possible).
- Insert the end of a 10 ml syringe in the centre of the flow of water without its needle.
- Rinse the syringe by gently pumping through 10 ml of water, then expel. Repeat twice more.
- Gently pump just over 10 ml of water and attach the needle to the end of the syringe.
- Adjust the volume of sampled water to 10 ml by gently pushing down the syringe plunger, with the syringe more or less vertical and the needle pointing upwards to remove any air bubbles. Start the sampling procedure again if any air bubbles remain.



- Transfer the sample directly into the bottom of a 20 ml Teflon-coated polyethylene liquid scintillation counting vial, having first filled the vial with 10 ml of UltimaGold F scintillation cocktail and 200 µl of 1 M nitric acid.
- Seal the scintillation vial and shake by hand for 10 seconds.
- Label the sample and complete the sampling form (see the form in the Annex) to accompany the sample. This form must clearly identify the sample to which it relates.
- Transport the vial to the laboratory where the radioactivity measurement will be performed in the vertical position.

3. Glass vial method:

- Incline the glass vial and allow water to flow gently into this vial.
- Fill the vial and allow water to overflow over the sides for 2 minutes.
- Seal the vial with the screw-type septum stopper.
- If there are any bubbles, start the sampling process again from the beginning.
- The laboratory will prepare the scintillation counting vial.



- Label the sample and complete the sampling form (see the form in the Annex) to accompany the sample. This form must clearly identify the sample to which it relates.

B. Taking samples to measure other radionuclides

- Allow the water to run for approximately 2 minutes.
- Fill the jerry can directly from the tap and screw in the stopper to provide a hermetic seal.
- The total sample volume taken must be at least 15 litres.
- Label the sample and complete the sampling form (see the form in the Annex) to accompany the sample. This form must clearly identify the sample to which it relates.

Transport and processing of the samples

The samples must be transported such that the temperature does not exceed the temperature at the time of sampling (although they must not be over chilled: they should not freeze). The time between taking the sample and the sample's arrival at the laboratory should be minimised: the maximum time between sampling and arrival at the laboratory may not exceed two days.

Annex: Registration form for the sample of water for human consumption



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agence fédérale de contrôle nucléaire

Identification label

Registration form for the sample of water for human consumption

General sample information					
<i>Information Client / Society / Company</i>	1. Company name: name/ legal entity / Company No.		2. Address (House number, street)		
	3. Town, postcode		4. Telephone	5. E-mail	
<i>Identification</i>	6. Sample identification (ID) (includes the identification code for the point of compliance)				
<i>Sample</i>	7. Date	8. Time	9. Name sampling officer	10. Method used for radon	
	11. Volume (l)			<input type="checkbox"/> 1. Plastic tube <input type="checkbox"/> 2. Syringe <input type="checkbox"/> 3. Glass vial	
<i>Quantity</i>	12. Sample temperature (°C)				
<i>Parameters</i>	13. Latitude WGS84 (__, __° N) – optional ¹				
<i>Location</i>	14. Longitude WGS84 (__, __° E) – optional ¹				
15. Additional comment(s)					

¹ if the sampling point (article 2, §11 of the RD of May 31, 2016) is identical to the specified point of compliance (article 2, §4 of the RD of May 31, 2016) it is not necessary to give the latitude and longitude coordinates. However, if different, the actual coordinates of the sampling point must be reported.

16. Sampling officer's signature	17. <input type="checkbox"/> Recorded in the database	19. Date recorded	20. Signature of the laboratory officer receiving the sample
	18. Registration ID No.		

ANNEX 2

The template for registration and reporting of the radioactivity measurements can be downloaded from the data exchange web platform of the Agency (<https://dxp.fanc.be>) or from the informative website of the FANC.

The spreadsheet for the measurements contains following information:

- PDC Sample ID = unique ID (identification) of the Point of Compliance
- LIMS ID = supplier column where measurements can be linked to the laboratory information management system ID for the laboratory/laboratories carrying out the measurement
- Locality Name = place/town and region where the PDC-point is located (drop-down list)
- NUTS Code = Geographical code (provinces) where the PDC-point is located (drop-down list)
- Catchment = description of the catchment area and water source (drop-down list)
- Latitude / Longitude = geographical coordinates of the PDC-point in decimal degrees (DD.DDDD)
- Accuracy Type = precise sampling point (drop-down list)
- Sample Type = type of sample / sample description (drop-down list)
- Sample treatment = method used to treat / prepare the sample (drop-down list)
- Nuclides = nuclide or calculated ID (drop-down list)
- Apparatus Type = type of measuring equipment used to determine the radioactivity (drop-down list)
- Begin Date = date on which sampling commenced (YYYY/MM/DD)
- Begin Time = time sampling commenced (HH:MM)
- End Date = date on which sampling ended (YYYY/MM/DD)
- End Time = time sampling ended (HH:MM)
- Less Than = if the measurement is less than the DL (detection limit), the "<" symbol is inserted and the DL is mentioned in the Uncertainty Value column. The Activity Value column stays in this case empty
- Activity Value = measured value
- Value Type = mathematical description of the measured value (drop-down list)
- Measuring Unit = measured value unit (drop-down list)
- Uncertainty Value = error associated with the measured value
- Uncertainty Type = mathematical method used to determine the measurement error (drop-down list)
- Uncertainty Unit = measurement error unit (drop-down list)
- Laboratory = abbreviation of the laboratory carrying out the measurement
- Supplier = abbreviation of the supplier from where the sample was taken
- Comment = empty field for adding comments or specifications such as the geographical coordinates of the sampling point if this location is not identical to the corresponding PDC-point location

Further details on the data to be entered:

- Locality Name, NUTS Code, Catchment: these cells may not be left empty and may only contain one value from the drop-down list.
REMARK: The cells may be empty if the measurements are uploaded to the EDWD web platform of the Agency. In that case, the cells are automatically filled in by the system with the information that is linked to the corresponding PDC-point of the proposed auto-control programme.
- Latitude, Longitude: degrees expressed as decimal figures – cells may not be left empty.
REMARK: The cells may be empty if the measurements are uploaded to the EDWD web platform of the Agency. In that case, the cells are automatically filled in by the system with the information that is linked to the corresponding PDC-point of the proposed auto-control programme.
- Accuracy Type, Sample type, Sample treatment, Nuclides, Apparatus Type: these cells may not be left empty and must contain a value from the drop-down list
- Begin Date and End Date: may not be left empty, format: YYYY/MM/DD. The end date is always later than or the same as the begin date (in case of a grab sample both dates are equal).
- Begin Time and End Time: may not be left empty, format: HH:MM. The end time is always later than or the same as the begin time if the begin and end dates are identical.
- Less Than: if < appears in this column, the Activity Value column must remain empty and the Uncertainty value column must contain the detection limit (DL).
- Value Type and Uncertainty Type: these cells may not be left empty and must contain a value from the drop-down list
- Measuring Unit and Uncertainty Unit: this cell may not be left empty and must contain a value from the drop-down list
- Activity Value and Uncertainty Value: decimal numbers
- Laboratory, Supplier: these cells may not be left empty and must contain their respective abbreviation or name
- Comment: when this cell should contain different or multiple items, values or text parts are separated by a semicolon.

Additional tabs on the spreadsheet itself clarify the various fields and how they should be completed.

The supplier can - at the registration of the auto-control programme and more specific at the identification of the laboratories which will carry out the analysis of radioactivity in water - authorize the laboratories to upload their measurement data directly into the data exchange web platform. In this case, both the supplier and the Agency receive a notification that new results are available which can be accessed after login.