

Peer Review of the RPII's Environmental Monitoring Programme 2009

Foundation Document

D. Gap Analysis of Commission Recommendation 2000/437/Euratom

1. Introduction

Under Article 35 of the Euratom Treaty, each Member State of the European Union is required to establish the facilities necessary to carry out continuous monitoring of the levels of radioactivity in the environment.

In addition, Article 36 of the Euratom Treaty requires that data arising from this programme be communicated periodically to the European Commission. In fulfilment of this requirement, the RPII transmits the results of its monitoring programme to the Commission on an annual basis. The database of Member States' environmental radioactivity measurements is maintained on behalf of the Commission by the Joint Research Centre at Ispra in Italy and compilations of the data submitted are published periodically in the EU Environmental Radioactivity Series (European Commission, 2005).

Commission Recommendation 2000/473/Euratom (European Commission, 2000) on the application of Article 36 of the Euratom treaty gives specific guidance on the monitoring of the levels of radioactivity in the environment for the purpose of assessing the exposure of the population as a whole. This Recommendation gives specific guidance as to the structure of monitoring networks; the media that should be sampled; the types of measurement; the radionuclides to be monitored; and the sampling frequencies.

This foundation document comprises a comparison of the current RPII continuous monitoring programme with the guidance published in Commission Recommendation 2000/473/Euratom, specifically that presented in section 4.

It should be noted that an independent assessment of Member States' facilities is carried out periodically by the European Commission to verify their operation and efficiency. A verification mission was carried out by a team of experts from the Commission during 2007 when a number of environmental radioactivity monitoring sites and two hospitals were visited. The team concluded that the requirements of Article 35 are fully met by the facilities, staff and monitoring programmes carried out, although there were minor recommendations (European Commission, 2007). These findings are an independent validation of the RPII's environmental monitoring programme.

2. Gap Analysis

Terms defined in section 2 of Recommendation 2000/473/Euratom are reproduced in Annex 1 of this document.

2000/473/Euratom	Comment
4. The following requirements should be met:	
(a) <i>Monitoring networks</i>	
(i) Each Member State should define representative geographical regions for its own territory.	<i>Single representative geographical region for Ireland</i>
(ii) Each Member State should define for each type of medium a sparse monitoring network and a dense monitoring network.	<i>For airborne particulates a dense network (12 low volume aerosol samplers) and a sparse network (single high volume aerosol sampler in Dublin). For all other media only a sparse network exists.</i>
(iii) The sites comprising a network should be representative of the regional situation taking into account, where appropriate, the population distribution within the region.	
(b) <i>Sampling media, types of measurement and periodicity</i>	
(i) The sampling media and types of measurements are listed in Annex I. Except where otherwise specified in this Recommendation, measurements should preferably be carried out for the sparse network on a monthly basis and for the dense network quarterly.	
(ii) For the sparse monitoring network, the detection limits and sensitivities of the measurement instruments should allow the actual levels to be quantified.	
(iii) For the dense monitoring network, the detection limits of the measurement devices should be lower than the reporting levels defined in Annex III.	

2000/473/Euratom	Comment
(iv) The Member States should inform the Commission of the detection limits and of the uncertainties taken into account.	
(v) The Member States should retain measurement techniques that have proven reliable and ensure quality control of the results.	<i>Quality system maintained (operating procedures, quality manual and accreditation to ISO 17025)¹.</i>
(vi) Member State laboratories supplying data under the terms of this Recommendation should periodically participate in intercomparison exercises, in particular those organised by the Commission, so as to ensure the intercomparability of the data reported.	<i>RPII regularly participates – see Foundation Document A for details.</i>
(c) <i>Sampling strategies and measurements in relation to each of the required sampling media</i>	
<p>(i) Airborne particulates</p> <p>Measurements of gamma emitting radionuclides should be performed on a routine basis to detect and measure man-made radioisotopes as well as naturally occurring radionuclides. Beryllium-7 should be reported as a qualitative check of the methods used. Where gross beta activity measurements are recorded these should also be reported.</p> <p>Sampling locations should be in the vicinity of densely populated areas; adequate geographical coverage should be ensured by the choice of at least one sampling location per geographical region.</p> <p>Sampling should be performed by systems operating continuously.</p>	<p><i>12 low volume samplers run continuously. 5 online samplers measure gross alpha and gross beta; filters returned weekly from 7 offline stations. One filter from each analysed for gamma emitting radionuclides (not reported, in recent years below detection limit) and gross beta activity per month.</i></p> <p><i>1 high volume sampler runs continuously. Filter returned monthly and analysed for Cs-137 and Be-7 by gamma spectroscopy.</i></p> <p><i>High volume sampler located in Dublin. Low volume samplers cover main population centres except Galway.</i></p>

¹ Regarding measurements outlined in Table 1 of this document, the Scope of Accreditation certified by the Irish National Accreditation Board covers all gamma spectroscopy measurements and determination of Sr-90 in milk (Y-90 cerenkov counting).

2000/473/Euratom	Comment
<p>(ii) External ambient gamma dose rates should be measured continuously. No reporting level is defined.</p>	<p><i>Measured continuously at 15 locations with 1 minute intervals. 10 minute and 1 hour aggregated values transferred automatically to RPII. Monthly values reported.</i></p>
<p>(iii) Surface water Samples should be taken from major inland waters of the Member States' territory and, if relevant, from coastal waters. In the case of river water, sampling should be carried out, where practicable, at locations for which flow rate measurements are available. In such cases, the average flow rate during the sampling period should be reported to improve the representativeness of the mean values calculated by the Commission. Gamma emitting radionuclides should be monitored. Where residual beta activity measurements are recorded these shall also be reported.</p>	<p><i>Inland water measurements not performed. Coastal sampling is undertaken most frequently along the north east coastline (monthly to quarterly) and least frequently along the south and west coasts (annually until 2004 and currently biennially). Seawater samples are analysed and reported for Cs-137, Tc-99. Analysis technique for H-3 in seawater in development.</i></p>
<p>(iv) Water intended for human consumption Monitoring of levels of radioactivity in drinking water should be such as to ensure compliance with the requirements of Directive 98/83/EC. For the purposes of compliance with Article 36 of the Euratom Treaty, values shall be reported for major ground or surface water supplies and for water distribution networks such as to ensure a representative coverage of the Member State. The corresponding volumes of water distributed or produced in a year should be reported to improve the representativeness of the mean values calculated by the Commission.</p>	<p><i>All public water supplies serving populations in excess of 10,000 are sampled at least once every four years. Gross alpha and gross beta screening performed using WHO technique (WHO, 1993). Most measurements performed on surface waters as majority of drinking water (83.7%) in Ireland originates from surface water (i.e. rivers and lakes) (Environmental Protection Agency, 2009). See Foundation Document G for more details.</i></p>

2000/473/Euratom	Comment
<p>(v) Milk</p> <p>Milk samples should be taken from dairies. The necessary statistical information on production rates should be reported to improve the representativeness of the mean values calculated by the Commission. The spread of dairies should be sufficient to ensure representative coverage of the Member State.</p> <p>Gamma emitters and strontium-90 should be monitored; potassium-40 should be reported as a qualitative check of the methods used.</p>	<p><i>Milk samples collected monthly from four milk processing plants that source milk from a wide geographic area.</i></p> <p><i>Samples are bulked and analysed quarterly for Sr-90 and gamma emitting radionuclides (Cs-137 and K-40).</i></p>

2000/473/Euratom	Comment
<p>(v) Mixed diet</p> <p>Due to the trade in foodstuffs, the mixed diet is not necessarily representative of the regional or national environmental contamination but is an indicator of the public exposure.</p> <p>Where appropriate, foodstuffs are measured as separate ingredients; in this case the Member State should report to the Commission the results of measurements of the individual ingredients and the composition of the diet. The sampling programme should take into consideration regional variations in dietary patterns. Individual ingredients should be from market places or local distribution centres providing food products to large population groups. Appropriate account should be taken of products from natural or semi-natural ecosystems, to the extent that the fallout from the Chernobyl accident may still affect such systems.</p> <p>In addition, Member States should sample complete meals to give a representative figure for the average level of radioactivity in mixed diet. Actual meal samples should be taken from large consumption centres such as canteens or restaurants.</p> <p>Gamma emitters and strontium-90 should be monitored; the measurements should be not less frequent than quarterly. Where carbon-14 measurements are performed, these should also be reported.</p>	<p><i>Samples of complete meals collected from restaurant facilities in Dublin and Drogheda annually and Cork and Galway biennially. Samples are analysed for gamma emitting radionuclides.</i></p> <p><i>S-90 measurements not currently performed but have been previously.</i></p> <p><i>C-14 measurements not not currently performed but have been previously.</i></p>

Table 1: Sampling types and measurements (Adapted from Annex I, Commission Recommendation 2000/473/Euratom)

Media	Measurement category	
	Dense network	Sparse network
Airborne particulates	<p>Cs-137, gross beta</p> <p><i>12 low volume aerosol sampling station – 5 online and 7 offline. Cs-137 screened by gamma spectroscopy. Gross beta activity measured by proportional counter.</i></p>	<p>Cs-137, Be-7</p> <p><i>1 high volume aerosol sampling station in Dublin. Cs-137 and Be-7 measured by gamma spectroscopy.</i></p>
Air	<p>Ambient gamma dose rate</p> <p><i>No network</i></p>	<p>Ambient gamma dose rate</p> <p><i>15 automatic gamma dose rate monitoring stations</i></p>
Surface water	<p>Cs-137, residual beta</p> <p><i>No network</i></p>	<p>Cs-137</p> <p><i>Coastal waters along the north east coastline sampled monthly to quarterly and biennially along the south and west coasts. Samples are analysed and reported for Cs-137 and Tc-99. Technique for H-3 in development.</i></p>
Drinking water	<p>Tritium, Sr-90, Cs-137</p> <p><i>No network</i></p> <p>Natural radionuclides as monitored in compliance with Council Directive 98/83/EC</p> <p><i>No network</i></p>	<p>Tritium, Sr-90, Cs-137</p> <p><i>Tritium monitoring performed between 2001 and 2007. This monitoring no longer justified on the basis that results showed no detectable levels of this radionuclide and that there are no sources in Ireland. Sr-90, Cs-137 is not justified on basis that there are no nuclear facilities on the island of Ireland.</i></p> <p>Natural radionuclides as monitored in compliance with Council Directive 98/83/EC</p> <p><i>All public water supplies serving populations in excess of 10,000 are sampled at least once every four years. In counties where there isn't a source serving this size of population the largest source is sampled. Samples are screened for gross alpha and gross beta using WHO technique (WHO, 1993).</i></p>
Milk	Cs-137, Sr-90	Cs-137, Sr-90, K-40

	<i>No network</i>	<i>Monthly samples from 4 milk processing plants bulked and analysed quarterly for Sr-90 and gamma emitting radionuclides.</i>
Mixed diet	Cs-137, Sr-90 <i>No network</i>	Cs-137, Sr-90, C-14 <i>2 samples of complete meals analysed annually, 2 further locations biennially. Samples analysed for gamma emitting radionuclides. Sr-90 and C-14 analysis not performed.</i>

Table 2: Reporting levels (Adapted from Annex III, Commission Recommendation 2000/473/Euratom) and typical minimum detectable activities (Source: Fegan et al, 2008)

Sample type	Radionuclide category	Reporting level	Typical MDAs
Air	Gross beta (based on Sr-90)	5×10^{-3} Bq/m ³	5×10^{-5} Bq/m ³ (2 hour count)
	Cs-137	5×10^{-3} Bq/m ³	1×10^{-7} Bq/m ³ (7 day count, high volume sampler, sparse network)
Surface water	Residual beta (based on Sr-90)	6×10^{-1} Bq/l	n/a
	Cs-137	1 Bq/l	0.8×10^{-3} Bq/l
Drinking water	H-3	1×10^2 Bq/l	1.2×10^1 Bq/l (30 minute count)
	Sr-90	6×10^{-2} Bq/l	n/a
	Cs-137	1×10^{-1} Bq/l	n/a
	Gross alpha	n/a	5×10^{-3} Bq/l (24 hour count)
	Gross beta	n/a	5×10^{-3} Bq/l (24 hour count)
Milk	Sr-90	2×10^{-1} Bq/l	2×10^{-2} Bq/l (2 hour count)
	Cs-137	5×10^{-1} Bq/l	3×10^{-1} Bq/l (24 hour count)
Mixed diet	Sr-90	1×10^{-1} Bq/d.p. ¹	n/a
	Cs-137	2×10^{-1} Bq/d.p	5×10^{-1} Bq/kg (5 hour count)

¹ Becquerel per person per day.

3. Issues for Consideration by the Peer Review Group

The Terms of Reference (TOR) are laid out in the Overview of the Peer Review. Of particular relevance is:

- The *capacity of the Current Programme to Meet the Stated Aims and Objectives (TOR 1)*, and *Value for Money (TOR 4)*, specifically whether the monitoring described is fulfilling the requirements of Articles 35 and 36 (in accordance with the Commission Recommendation) in the most effective and efficient way.
- Recommendations for any changes to the scope of the programme or the way in which the Commission Recommendations are addressed and implemented.
- To identify research needs to underpin and support the application of the Commission Recommendations.

References

Environmental Protection Agency, 2009. The Provision and Quality of Drinking Water in Ireland, A Report for the Years 2007-2008. Wexford: Environmental Protection Agency.

European Commission, 2000. Commission Recommendation 2000/437/Euratom of 8 June 2000 on the application of Article 36 of the Euratom Treaty concerning the monitoring of the levels of radioactivity in the environment for the purpose of assessing the exposure to the population as a whole. Official Journal of the European Communities, L191, 27.7.2000, p 37-51.

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European Commission, 2007. Verifications under the Terms of Article 35 of the Euratom Treaty: Irish National Monitoring Network for Environmental Radioactivity; Nuclear Medical Installations Technical Report – IE-07/03. Luxembourg: European Commission, Directorate-General for Energy and Transport.

Fegan, M., Dowdall, A., Hanley, O., Hayden, E., Kelleher, K., Long, S., Smith, V., Somerville, S., Wong, J., Pollard, D., 2007. Radioactivity Monitoring of the Irish Environment. RPII-08/02. Dublin: Radiological Protection Institute of Ireland.

WHO, 1993. Guidelines for drinking water quality. Geneva: World Health Organisation.

Annex 1: Definitions Reproduced from Recommendation 2000/437/Euratom

(a) 'continuous monitoring' means the existence and implementation of a continuing monitoring programme. Depending on the medium monitored, this is achieved as appropriate through:

- (i) continuous sampling and assessment;
- (ii) continuous sampling and periodic assessment;
- (iii) periodic sampling and periodic assessment;
- (iv) direct continuous measurement;

(b) 'facilities' means the monitoring programme, the direct measurement and sampling and analysis equipment and procedures (including quality control and the reporting and archiving of all relevant data), and the laboratories necessary to implement continuous monitoring of the levels of radioactivity;

(c) 'monitoring network' means the combination of each medium of the sampling and direct measurement locations, as appropriate, used for the monitoring of that specific medium;

(d) 'dense monitoring network' means a monitoring network comprising sampling locations distributed throughout the Member State's territory such as to allow the Commission to compute regional averages for radioactivity levels in the Community;

(e) 'sparse monitoring network' means a monitoring network comprising for every region and for every sampling medium at least one location representative of that region. At such locations high sensitivity measurements should be performed thus giving a transparent representation of actual levels and trends of radioactivity levels;

(f) 'region' means each representative area of a Member State for the assessment of the radiological exposure of the population as a whole under consideration of the radiological impact by emissions and ambient dose and the population distribution. The regions currently defined in the Commission monitoring reports are given in Annex II².

² Ireland is defined as a single region.