



Radiological Protection Institute of Ireland
An Institiúid Éireannach um Chosaint Raideolaíoch

A Peer Review of the RPII Environmental Monitoring Programme

RADIATION UNITS

Radioactivity is measured in units called becquerels (Bq). One becquerel corresponds to one radioactive disintegration per second.

When measuring radioactive discharges to the environment or referring to the content of radioactive sources used in medicine, industry and education, it is more usual to talk in terms of kilobecquerels (kBq), megabecquerels (MBq), gigabecquerels (GBq) or terabecquerels (TBq)

1 kBq = 1000 Bq

1 MBq = 1,000,000 Bq

1 GBq = 1,000,000,000 Bq

1 TBq = 1,000,000,000,000 Bq

Much lower concentrations of radioactivity are normally found in the environment and so the measurement is often reported in units of millibecquerels (mBq). There are one thousand millibecquerels in a becquerel.

1 Bq = 1000 mBq

Radiation Dose When radiation interacts with body tissues and organs, the radiation dose received is a function of factors such as the type of radiation, the part of the body affected, the exposure pathway, etc. This means that one becquerel of radioactivity will not always deliver the same radiation dose. A unit called 'effective dose' has been developed to take account of the differences between different types of radiation so that their biological impact can be compared directly. Effective dose is measured in units called sieverts (Sv).

The sievert is a large unit, and in practice it is more usual to measure radiation doses received by individuals in terms of fractions of a sievert.

1 sievert = 1000 millisievert (mSv)

= 1,000,000 microsievert (μ Sv)

= 1,000,000,000 nanosievert (nSv)

In RPII reports the term 'effective dose' is often referred to as 'radiation dose' or simply 'dose'.

Collective dose is the sum of the radiation doses received by each individual in the population. This allows comparison of the total radiation dose received from different sources. Collective dose is reported in units of man sieverts (man Sv) or man millisieverts (man mSv).

Per caput dose is the collective dose divided by the total population. Per caput dose is reported in units of sieverts, or fractions of a sievert.



A Peer Review of the RPII Environmental Monitoring Programme

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1 Introduction

The RPII has since the early 1980s carried out an environmental monitoring programme covering radioactivity in air, food and water. The primary focus of this programme has been the assessment of human exposure and the protection of human health. The programme aims to meet Irish and European Union (EU) legal requirements, other national and international commitments and to support the RPII's advisory and information provision functions. In 2009 the RPII had the scope and effectiveness of its monitoring programme reviewed by an international peer group. This report provides the background to the review; an overview of the documents provided to the peer group for conduction of the review; and the comments and recommendations formulated by the peer group.

2 Statutory Requirements

The main legal instruments relevant to the RPII's monitoring programme are outlined below.

2.1 Radiological Protection Act, 1991

The Radiological Protection Act, 1991, hereafter referred to as the Act, establishes the legal basis for radiological protection in Ireland. The Act provided for the establishment of the RPII and defines its functions. Furthermore, the Act provides for the control of radioactive substances in Ireland and addresses, inter alia, licensing and control of radioactive substances, regulations and orders concerning permitted levels of radioactivity and implementation of EU legal instruments relating to radiation protection. The Act also gives effect in Ireland to a number of international conventions relevant to radiological protection.

The Act defines a number of general functions relevant to the RPII's environmental monitoring programme, including:

- the monitoring of radioactivity in food, drinking water and the environment;
- the monitoring of the exposure of individuals to radioactivity;
- advice to Government in relation to radiological safety, sources of ionising radiation, nuclear technology and related international standards;
- public information;
- emergency preparedness;
- the monitoring of scientific, technical and other developments in relation to radiological safety, sources of ionising radiation and nuclear technology;

- the undertaking of relevant research; and
- certification of exports.

2.2 Radiological Protection Act, 1991 (Ionising Radiation) Order, S.I. No. 125 of 2000

The Ionising Radiation Order transposes the EU Basic Safety Standards (Council Directive 96/29/EURATOM) into Irish law. The order provides that the RPII shall make estimates at intervals of the doses received by the population from licensed practices.

The Basic Safety Standards place further requirements on Member States to assess the contribution to the exposure of the population as a whole from all practices and to ensure that these are as realistic as possible.

2.3 Euratom Treaty

The Euratom Treaty requires Member States to carry out monitoring to ensure compliance with the basic standards for the protection of the population. Article 35 requires each Member State to establish the facilities necessary to carry out continuous monitoring of the level of radioactivity in the air, water and soil. Article 36 requires reporting of the results of this monitoring to the European Commission (EC).

Commission Recommendation 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 (2000/437/Euratom) sets out detailed practical guidance for Member States on how to discharge their obligations under this Article. This recommendation constitutes an important input into the design of the RPII's monitoring programme.

3 National and International Commitments

There are a number of other national and international commitments which are of relevance to the RPII's monitoring programme. These are described briefly in the following paragraphs.

3.1 OSPAR

Under Ireland's current National Plan for achieving the objectives of the OSPAR Radioactive Substance Strategy, the RPII has commitments regarding routine sampling of and testing for radioactivity in fish, shellfish, seaweed, sediments and seawater. Ireland's National Plan is currently undergoing revision, scheduled for completion in early 2010.

3.2 Drinking Water

Council Directive 98/83/EC – the Drinking Water Directive (DWD) – sets limit values for a range of parameters including radioactivity (tritium and Total Indicative Dose) in drinking water. This Directive has been transposed into Irish law by S.I. No. 278 of 2007, European Communities (Drinking Water) (No. 2) Regulations 2007.

In addition, the Commission is required under the DWD to adopt rules and procedures covering monitoring frequencies, methods and locations in accordance with procedures laid down in Article 12 of the Directive. This has not yet occurred, however, for the radioactivity parameters. In 2008, a Council Directive drafted under Article 31 of the Euratom Treaty laying down requirements for the protection of the health of the general public with regard to radioactive substances in water intended for human consumption was published. This draft directive is consistent with the DWD's approach to microbiological and physico-chemical parameters and includes the same radiological parameters. In addition, a Commission Recommendation on the application of Article 36 (2000/473/Euratom) specifies that 'monitoring of levels of radioactivity in drinking water should be such as to ensure compliance with the DWD'.

A Commission Recommendation on the protection of the public against exposure to radon in drinking water supplies (2001/928/Euratom) is also of relevance. This recommends that Member States should carry out representative surveys to determine the scale and nature of exposures caused by radon and long-lived radon decay products in domestic drinking water supplies.

3.3 Emergencies

The RPII has responsibilities for environmental monitoring in the event of an emergency under the National Emergency Plan for Nuclear Accidents (NEPNA) and the Major Emergency Framework (MEF) protocol for multi-agency response to radiological/ nuclear emergencies.

Exchange of emergency radiological monitoring data between EU Member States is required by ECURIE (European Community Urgent Radiological Information Exchange), based on Council Decision 87/600/Euratom of 14 December 1987 on Community arrangements for the early exchange of information in the event of a radiological emergency. EURDEP (EUROPEAN Radiological Data Exchange Platform) is a system for the exchange of environmental monitoring data which operates continuously to ensure availability in the event of an emergency. The RPII has recently signed a Memorandum of Understanding covering EURDEP with the EC.

4 Aims and Objectives of the RPII Monitoring Programme

The current stated aims and objectives of the RPII monitoring programme are:

1. To assess doses to individuals and the population from radionuclides in the environment.
2. To assess the temporal and geographical distributions of concentrations of artificial and natural radionuclides in the environment.
3. To maintain the systems, procedures and expertise necessary to facilitate a rapid assessment of environmental contamination in the event of a nuclear or radiological incident so that effective countermeasures to protect the Irish public can be implemented. Given the importance of agriculture to the Irish economy, there is also an imperative to maintain such a capability so that, in the event of an actual or perceived incident, levels of radioactivity in Irish foodstuffs can be assessed and compared to EU or international trading limits. For these reasons maintenance of a national laboratory capable of measuring a range of artificial radionuclides in food and environmental samples is of national strategic importance.
4. To provide up to date and accurate information on radiation levels in the environment to Government and the public. This takes into account the need to provide public reassurance in relation to the operation of nuclear facilities abroad and other potential radiological hazards. It is noted that there remains a significant level of public and political concern in relation to the operation of such facilities, particularly those at Sellafield on the north-west coast of England.
5. To support the RPII's role to provide high quality scientifically-based advice as an input to Government policy, in particular to assist in identifying measures necessary for the protection of individuals.
6. To support the Irish food and agriculture industry through the rigorous assessment of the radioactivity status of Irish foodstuffs. This assessment provides the basis for certification of radioactivity in produce for export.

5 Current Monitoring Programme

The RPII monitors environmental radioactivity in the Republic of Ireland and surrounding waters. The programme comprises both continuous monitoring¹ and an ongoing series of discrete projects of fixed duration with specific aims. It is noted that there are no nuclear fuel cycle facilities in Ireland.

5.1 Continuous Monitoring

The key elements of the monitoring programme implemented on a continuous basis include:

- assessment of ambient radioactivity based on measurements of radioactivity in air and of external gamma dose rate at permanent monitoring stations located throughout the country;
- assessment of levels of radioactivity in foodstuffs based on measurements of total diet, milk and miscellaneous ingredients;
- assessment of the levels of radioactivity in drinking water sourced from major supplies; and
- assessment of levels of radioactivity in the Irish marine environment based on sampling and measurement of seawater, sediment, seaweed, fish and shellfish.

Around 2,000 samples from fixed locations are analysed annually.

The continuous monitoring programme is reviewed annually, taking account of temporal and spatial trends in the activities measured as well as cost and available resources. Additional comprehensive internal RPII reviews of the marine monitoring programme were undertaken in 2002 and 2005. Also, the operation and efficiency of facilities were reviewed by a team of experts from the EC by way of an Article 35 verification visit in 2007.

¹ Note that the definition of 'continuous monitoring' from Commission Recommendation 2000/473/Euratom is assumed. That is, 'depending on the medium monitored: (i) continuous sampling and assessment; (ii) continuous sampling and periodic assessment; (iii) periodic sampling and periodic assessment; (iv) direct continuous measurement'.

5.2 Monitoring Projects

The continuous monitoring programme is complemented by specific projects which investigate particular aspects of terrestrial and marine radioactivity. Recent examples include:

5.2.1 Terrestrial Radioactivity

- 2008 – 2010: a national survey of groundwater drinking water supplies (in collaboration with the Environmental Protection Agency).
- 2003 – 2004: a Total Diet Study to investigate levels of radioactivity in a range of food ingredients (in collaboration with the Food Safety Authority of Ireland).
- 2003: a study of radon in drinking water extracted from private wells in County Wicklow.
- 2007 – 2009: a national survey of thoron gas in indoor air (in collaboration with University College Dublin (UCD) and the National Institute of Radiation Science in Japan).

5.2.2 Marine Radioactivity

- 2008: a marine habits survey along the north east coast of Ireland (conducted by CEFAS, UK).
- 2007 – 2008: development of a model to simulate the transport and distribution of technetium-99 along the east coast of Ireland (jointly undertaken with the National University of Ireland (NUI), Galway)
- 2007: an assessment of the doses to Irish seafood consumers from technetium-99 over the period 1991 – 2006.
- 2003 – 2004: a radiological impact assessment of the impact of discharges of therapeutic iodine-131 from hospitals into Dublin Bay.
- 2001 – 2004: an assessment of the inventory of caesium-137 and plutonium-239/240 in the western Irish Sea mud patch as well as the effect of remobilisation of radionuclides from sediments on uptake by biota (part of an EC Framework Project).
- 1998: a detailed assessment of the doses to the Irish public from the consumption of polonium-210 in seafood.
- 2009: measurement of technetium-99 and caesium-137 from sediment cores taken from the Irish Sea (in progress)

- A number of collaborative projects with UCD and the Environment and Heritage Service of the Department of the Environment for Northern Ireland (now the Northern Ireland Environment Agency). These included joint sampling of seawater around the Island of Ireland in recent years and assessments of artificial radioactivity levels in Lough Foyle (1996) and Carlingford Lough (1992).

The results of the RPII monitoring programme are published in an annual RPII monitoring report (Radioactivity Monitoring of the Irish Environment) and on the RPII website.

6 Aims of the Review

The key objective of the review was to consider whether the RPII environmental monitoring programme is meeting the stated aims and objectives and to provide recommendations for improvement if required. This exercise is part of a continual process of review and improvement of the RPII's monitoring programme. The review addressed both continuous monitoring and project-based elements of the programme. It was designed to be conducted at a strategic rather than an operational level.

7 Terms of Reference

The terms of reference accepted by the group and under which the review of the monitoring programme was conducted, were as follows:

1. Aims and Objectives of the Programme

To evaluate the scope of the current programme to ensure that it is optimal. This evaluation should consider specifically whether the aims and objectives of the programme are sufficiently broad to cover statutory requirements, other national and international commitments and international best practice.

2. Capacity of the Current Programme to Meet the Stated Aims and Objectives

To evaluate the effectiveness of the RPII environmental monitoring programme as currently implemented. This evaluation should consider specifically whether the RPII is meeting the stated aims and objectives of the programme. Both continuous monitoring and project-based elements of the programme should be considered.

The adequacy of the programme with respect to the following specific aims should be considered explicitly:

- the accuracy of public dose assessment and demonstration of compliance with basic standards;
- the need to provide public information and reassurance; and
- the need to provide accurate, up to date and scientifically based advice as input to Government policy.

In addition, the effectiveness of previous project-based monitoring should be considered explicitly.

3. Emergency Response Capability

To consider the strategic value of the programme with respect to the capability to respond effectively in the event of a nuclear or radiological emergency.

Due to the passage of time since the Chernobyl accident and the decreasing levels of radioactivity in the Irish marine environment, the RPII, along with organisations with similar responsibilities internationally, faces challenges in the future regarding the maintenance and retention of expertise and analytical capability. Specific consideration should be given to the maintenance of the capability to respond effectively not only to emergencies but to any radiological issues of potential concern to the public.

4. Value for Money

To comment on the effectiveness of the programme in achieving the stated aims and objectives efficiently. Identification of opportunities to streamline or improve the efficiency of the continuous monitoring programme while maintaining integrity is sought explicitly. Trends from monitoring results should be taken into account. Identification of the benefits of the current programme would also be welcome.

5. Future Needs and Scope for Innovation

To comment on the potential of the programme to meet future needs and the scope for innovation.

The following items should be considered specifically, along with any other issues raised by the group:

- General recommendations for environmental monitoring by the RPII in the future. These recommendations should address areas of weakness identified in the programme; gaps; redundancy; opportunities to improve quality or efficiency and any other issues which the group believe would improve the overall quality and effectiveness of the programme.
- Recommendations regarding the continuous monitoring aspect of the programme. Comment on sampling frequencies and densities with reference to trends in monitoring results is sought explicitly.
- Suggestions for potential future project-based monitoring. Comment on research needs to underpin and support the programme is sought explicitly. These recommendations should identify areas where insufficient data is currently available to adequately support the RPII's advisory, public information or other functions and which should be addressed through targeted research or monitoring projects. The recommendations should also address areas where research and development could lead to improved efficiency and better value for money in the execution of the programme.

- Consideration of areas of emerging interest where it may be appropriate to direct resources in the future. In this regard, comment on recent developments in relation to protection of the environment and exposure from natural sources is sought explicitly.
- Consideration of the skills mix of RPII staff involved in the programme and recommendations for future training and development if required.

Other comments or recommendations on any aspect of the monitoring programme are invited.

8 Review Methodology and Framework

A panel of five independent experts were appointed by the RPII to conduct the peer review of the RPII environmental monitoring programme. The membership of the peer review group was as follows:

1. Professor Peter Mitchell, Science Secretary, Royal Irish Academy (Chair)
2. Dr John Hunt, Former Head of Environmental Radioactivity, Centre for Environment, Fisheries and Aquaculture Science (CEFAS), UK
3. Mr Ken Ledgerwood, Former Chief Inspector, Industrial Pollution and Radiochemical Inspectorate, Northern Ireland Environment Agency (NIEA)
4. Dr Sven Nielsen, Head of Radioecology Programme, Radiation Research Division, Risø DTU, Denmark
5. Dr Ciaran O'Donnell, Programme Manager, Office of Environmental Assessment, Environmental Protection Agency

Each group member has expertise and knowledge in different aspects of radiation protection and environmental monitoring. Group members were asked to participate on the basis that they would apply all relevant experience to complete the objectives of the review and that they would be prepared to contribute independent conclusions and recommendations.

The main deliverable of the peer review is this report containing the group's conclusions and recommendations. This report will be used as a valued input in future RPII business planning. A copy of the report will be presented to the board of the RPII and its parent Government department, the Department of Environment, Heritage and Local Government.

The content of the report has been agreed by all group members.

The peer review group met twice in Dublin. In advance of the first meeting the group was provided with a number of documents for the purposes of conducting the review.

These included an Overview of the Peer Review which outlined the aims and objectives of the RPII monitoring programme; statutory requirements and national and international commitments of the RPII regarding monitoring; a summary of the current monitoring programme; and the aims and terms of reference of the peer review. In addition, a number of foundation documents describing the current RPII monitoring programme in detail were circulated to the review group in advance of the first meeting. These documents covered the following topics:

- A. Introduction to the RPII and the Environmental Monitoring Programme
- B. Overview of Continuous Monitoring Undertaken in the Current Programme
- C. Overview of Monitoring Projects
- D. Gap Analysis of Commission Recommendation 2000/437/Euratom
- E. Monitoring Performed to Satisfy OSPAR Commitments
- F. Exposure from Natural Sources in Ireland
- G. Emergency Preparedness and Response
- H. Monitoring of Radioactivity in Drinking Water

There were two supplements to the foundations documents:

- S1. Overview of Relevant National and International Legislation
- S2. List of Relevant RPII Reports, Journal Articles, Conference Papers and General Articles

A number of other related documents were supplied to the group for information. These included copies of publications referenced in the foundation documents, RPII reports of relevance and national and European legislation.

The key points from the *Overview of the Peer Review* and the foundation documents were presented to the peer review group at the commencement of the first meeting. After each presentation there was an opportunity for the group to pose questions to all RPII Monitoring Section staff members.

9 Comments and Recommendations of the Peer Review Group

The peer review group commended the RPII on the quality of the documentation and presentations provided to it for the purposes of conducting the review.

9.1 Overview of the Peer Review and Foundation Document A. Introduction to the RPII and the Environmental Monitoring Programme

The group recommended that the following additional item should be added to the stated aims and objectives of the RPII monitoring programme:

“To comply with statutory and international obligations concerning environmental monitoring and individual and population dose assessment.”

The group noted that the average individual dose in 2007 from all sources of radiation received by the Irish population was 3,950 μSv . The group also noted that this constitutes an increase of approximately 9% on the value of 3,620 μSv previously published. This difference is due to the fact that previous estimates of the doses from medical procedures and from thoron were based on international average values. In addition, the contribution from cosmic radiation has increased as a result of the recent growth in air travel.

The group appreciated that it would be unrealistic to expect any laboratory to maintain the capability to perform all possible analyses which might be envisaged. It emphasised that it is virtually impossible to maintain the full spectrum of analytical capability within a relatively small organisation. The group recommended that the RPII should identify clear priorities in relation to the range of analytical capabilities which should be maintained. This approach ensures that the RPII (and other agencies) have a realistic appreciation of its capabilities and is important in informing discussion on the prioritisation of budget allocation.

The group recommended that, where feasible, consideration should be given to identifying analyses which could usefully be subcontracted to other laboratories. These types of contract could be set up either on a commercial basis or by a mutually beneficial reciprocal arrangement.

The likely shortage of suitably qualified and experienced personnel available for future recruitment to work in the environmental laboratory was an area of concern to the group. Internationally there are few new graduates in the fields of environmental radioactivity and cognate areas. In Ireland graduates are particularly scarce. Radiochemistry is an area of particular concern requiring special attention in view of the type of skills and training required to measure trace levels of particular radionuclides.

The group agreed that the RPII must continue to foster a challenging and professionally rewarding work environment in order to recruit and retain the best young, highly-qualified scientists. In this context the group made the following suggestions:

- Maintain a research component in the monitoring programme and encourage publication of scientific papers in peer reviewed journals and at international meetings. The group agreed that this point is equally applicable in motivating, training and maintaining the morale of RPII staff already contributing to the monitoring programme.
- Put in place a system to actively keep under review new and emerging analytical techniques (radiometric and non-radiometric) and to make use of such techniques where appropriate.

The group also recommended the creation of a rolling bursary to sponsor a postgraduate studentship in this area. The provision of placements and work experience opportunities at undergraduate level by the RPII, both currently and in the past, was noted and commended by the group.

The group reflected on various possibilities for enhancing collaboration with universities and third level institutions including the following:

- Summer projects which are attractive to students for a variety of reasons (e.g. for gaining experience, financial support), preferably undertaken between the third and fourth years of a degree programme.
- Projects for fourth year students during term which would contribute towards the awarding of a degree and which would be part-supervised by university staff.

The group suggested that the RPII should be proactive in this regard, perhaps by maintaining an occasionally updated list of suitable projects. The group felt that this would go some way towards addressing the scarcity of suitable personnel over time, but noted that an appropriate return on the investment of the considerable time and resources involved would be required by the RPII.

A related area of concern to the group was ongoing maintenance of the expertise and motivation of RPII staff currently working on the monitoring programme. The group felt that it was important to identify the key analytical skills necessary to support the programme and ensure that staff had appropriate training and practice to maintain these skills. Furthermore, it was felt that at least two staff, supervised at an appropriate level and trained in each key analytical method should be considered the minimum. International collaboration, in particular, offers access to state of the art research and a breadth of expertise not available in a small country, as well as mutual support in the event of an incident.

The group agreed that project-based work should continue to be used to train staff, maintain expertise, encourage national and international collaboration and make best use of available resources. The group felt that the importance of this work in terms of maximising return from resources, underpinning advice and targeting work on the most pressing needs is self-evident. Project-based work also helps to engender the skills and expertise required to identify and develop analytical methods and so to facilitate the capacity to analyse atypical sample media and radionuclides.

The group considered that the programme of intercomparisons in which the RPII has participated recently was extensive and admirable. The group encouraged the additional employment of blind intercomparisons (i.e. those in which staff members involved in analysis are not aware of the radionuclide content of the samples).

The practice of RPII to rotate staff between its different work areas was commended. However, the group recommended that the past experience of personnel should be considered and that skills should be refreshed at intervals.

The group recommended that laboratory manuals, particularly those for radiochemical procedures, should continue to be regularly revised and updated to ensure adequate detail, particularly in the areas prioritised.

9.2 Foundation Document B. Overview of Continuous Monitoring Undertaken in the Current Programme

The current programme was considered adequate with respect to the requirement to provide reassurance to the public. In this regard the group agreed that it is vital to publish the annual RPII monitoring report in the year following monitoring activity. It was noted by the group that this has been the practice for the past several years.

The group also considered that the programme was adequate with respect to the need to provide accurate and scientifically-based advice to Government. In short, appropriate measurements are being performed, a quality system is in place to ensure integrity and expertise is being maintained.

The group observed that no specific environmental monitoring is routinely carried out by the RPII in relation to licensed discharges. It recommended that the RPII actively keep this under review were circumstances to change, bearing in mind the need for public reassurance and the obligation to provide advice to Government and other agencies.

The group agreed on a number of specific comments and recommendations for continuous monitoring. These are presented in the following paragraphs.

A general observation, however, was that if it became necessary to trim the monitoring programme, it is preferable to reduce the frequency of specific activities rather than discontinuing them altogether. The aim of this is to maintain requisite expertise. This observation is qualified by the requirements of accreditation whereby if a particular analysis has not been performed by an analyst in the previous 12 months, an integrity test is required before so doing.

9.2.1 Terrestrial Programme

High and Low Volume Aerosol Sampling and Gamma Dose Rate

The group considered that the existing networks are modern, comprehensive and cover an extensive area. The densities of the existing networks were considered generous and the group agreed that neither needed to be further expanded. In fact, when the time

comes to upgrade the existing infrastructure the group considered that the number of stations in both networks could be reduced on the basis that the safety of reactor systems abroad has improved and that there is extensive network coverage elsewhere throughout the EU. The group noted that there are two high volume aerosol samplers in Ireland (a second one, in addition to the RPII instrument located in Dublin, is operated in North Down) and others in Britain. The group also noted that charcoal filters could be inserted remotely at online aerosol sampling stations to provide a rapid response in an emergency.

The group recommended that consideration be given to the measurement and display of rainfall levels to assist interpretation of radon washout events in relation to the presentation of gamma dose rate data on the RPII website.

The group noted the RPII's decision in 2007 to cease air monitoring for krypton-85 on the basis that levels in recent years have proven to be generally very low, to vary in a predictable way and to be of no radiological significance. The group agreed with the decision and concurred with RPII's intention to review the issue periodically.

Rainwater

The group agreed that the current practice in relation to collection and analysis of rainwater is appropriate on the basis that the levels in rainwater are so low and have been for an extended period. Rainwater samples are collected continuously at 13 stations but, apart from the Clonskeagh sample which is screened for gamma emitting radionuclides, are not routinely analysed, though they are stored for an appropriate period.

Terrestrial Foodstuffs

The group noted that the main focus of the foodstuffs monitoring programme is currently on Irish produce consumed nationally, while certain exports are also monitored through the product certification programme. Initially the group was concerned that only minimal monitoring of food imports was being performed. However, the group was informed that in 2009 the RPII addressed the issue of radioactivity in foodstuffs imported from third countries as defined in Council Regulation (EEC) No 737/90 and Commission Regulation (EC) No 1635/2006. With help from Irish customs the RPII established that in 2008 only small quantities of foodstuffs were imported from such countries, though it is aware that some of these foodstuffs are not always imported through conventional channels. The group was pleased to learn that it is planned to sample and analyse such imports in the future.

The group recommended the investigation of approaches taken in other jurisdictions. In the UK, for instance, the onus for monitoring of imported foods is on the importer; however, it is also carried out at the request of port health authorities on particular consignments, especially in those (few) cases where portal gamma monitoring by the UK Borders Agency has triggered an alarm.

Regarding monitoring of 'wild foods'², the group considered that too few samples were currently collected for this monitoring to be useful for any particular type of food. It suggested increasing the number of samples collected and batching them to maintain the number of analyses at the same level. The group also suggested collecting samples over the season or on different dates from year to year, as appropriate to the foodstuff of interest.

Milk

The group stressed the importance of maintaining the capability to measure Sr-90 in milk.

The group recommended that iodine-131 levels, even minimum detectable activities, determined by gamma analysis should be reported in the annual RPII monitoring report. In the event of an emergency, analysis of iodine-131 in fresh (unpasteurised) milk constitutes both a backup and a complement to analysis of charcoal filters from aerosol samplers.

The group was satisfied that the testing in place was adequate for the intended purpose. However, the group recommended that the 'wide geographic area' from which milk is collected should be quantified.

Drinking water

The group considered that the current programme for monitoring of drinking water is adequate. This is discussed in more detail below.

9.2.2 Marine Programme

The group noted that the marine programme comprised the largest single body of work in the RPII monitoring programme. The group considered the current programme fit for purpose, though not excessive.

The group observed that on first glance the significant reductions in discharges of caesium-137 and technetium-99 from Sellafield in recent years would suggest that a reduction in sampling could be justified³. However, the group recognised that the scale of

² Commission Recommendation on the protection and information of the public with regard to exposure resulting from the continued radioactive caesium contamination of certain wild food products as a consequence of the accident at the Chernobyl nuclear power station (2003/120/EC) recommends that for the purpose of protecting the health of the consumer, Member States should take appropriate steps to ensure that the maximum permitted levels in terms of caesium-134 and 137 referred to in Article 3 of Council Regulation (EEC) No 737/90 (600Bq/kg) are respected in the Community for the placing on the market of wild game, wild berries, wild mushrooms and carnivorous lake fish.

³ See Figure 1. Marine discharges of Cs-137 from Sellafield, 1953-2007 and Figure 2. Marine discharges of Tc-99 from Sellafield, 1986-2007 in the RPII report *Radioactivity Monitoring of the Irish Environment 2007*.

the monitoring programme has evolved over the years to reflect changing discharges and considered that, with some rebalancing discussed below, it should be maintained at its current level in order to preserve scientific integrity.

The group considered that too few samples are currently analysed for transuranic isotopes and agreed that, in particular, more samples should be analysed for plutonium-239/240 and americium-241 to maintain analytical capability.

The group considered that the recently completed habits survey along the north east coast of Ireland was timely and agreed with the recommendations for changes in monitoring. In particular, the recommendations to monitor winkles and lobsters, on the basis of the bioaccumulation of radionuclides by these species and human consumption levels, were supported by the group. In addition, the group suggested sampling lobsters over the season rather than at just a single time.

The group agreed on a number of specific recommendations and comments for monitoring of the marine environment. These are presented in the following paragraphs. A general recommendation, however, was that more emphasis could be placed on the representativeness of sampling. Suggestions included:

- collection of fewer sample types and greater use of bio-indicators as an alternative; and
- batching of samples to maintain or even reduce the time and resources required for analysis.

The group noted that all suggestions for changes to the current monitoring strategy were conditional on continued compliance with OSPAR commitments.

The group agreed with the current approach not to monitor seawater for transuranic radionuclides on the basis that the levels are so low. However, it suggested the calculation of activity concentrations using bio-indicators and the well-established concentration factors for the Irish Sea as an alternative. The group recommended the *Fucus* species of seaweed as the preferred medium as its location is fixed, though winkles or mussels could also be used.

Bearing in mind the recent habits survey, the group considered that monitoring of seafood was broadly adequate. The group particularly supported the monitoring of shellfish, being generally more sensitive bio-indicators of a range of radionuclides as compared with fish.

Future monitoring in the Irish Sea at sites N1-N6 was discussed by the group. It was felt that the level of resources currently directed at this component of the monitoring programme could be reviewed. The group would recommend continuing to sample at all points but to batch samples in order to reduce the number of analyses. This recommendation was made on the basis that sediment types can vary significantly over small distances on the bed of the Irish Sea. Accumulation can also be influenced by biological activity. The group suggested a 'grand average' analysis rather than individual analysis of each sample. However, individual samples should be retained in an

appropriate sample bank. A similar strategy was suggested for water samples. It was appreciated by the group that once sampling was arranged for one Irish Sea location, the extra time involved in sampling at others is not excessive.

Finally, in relation to monitoring at sea, it was suggested that the possibility of contracting another organisation to perform the sampling should be investigated. In Denmark for instance the navy perform offshore marine sampling.

The group also discussed possible changes to indicator shoreline monitoring along the north east coast. The group recommended considering only the most northerly location in the Republic of Ireland closest to the Irish Sea's 'nodal' point (located on the coast of the Ards Peninsula in Northern Ireland) on the basis that this is where activity concentrations would be expected to be highest and where the earliest indication of an increase in levels would be first detected. The group recommended in general more frequent monitoring at this location rather than at multiple locations. The measurements performed could be used to infer values at other locations.

More radically, *Fucus* alone could be measured on the basis of its value as a general purpose bio-indicator which can be used for caesium-137, technetium-99 and the transuranics. In addition, *Fucus* can be used for the detection of americium-241 by gamma spectroscopy which is not usually possible for sediment samples.

The influence of the gyre in the western Irish Sea on this aspect of the monitoring programme was noted. The development of the technetium-99 marine transport model in collaboration with NUI Galway was commended. The results of the model can be used to estimate transit times and residence times with regard to seasonal effects such as the western Irish Sea gyre.

The group considered that monitoring of carbon-14 could cease on the basis that levels are very low and a baseline has been established.

Even at the time of highest discharges from Sellafield it was difficult to detect traces of radioactivity in samples from the west coast of Ireland as a result of the seafronts at the north and south of Ireland which act as barriers to flows from the Irish Sea. Consequently, the group considered that monitoring here is almost redundant and agreed with the strategy of the current programme to target significantly fewer resources to this coastline. Limited sampling at just one or possibly two locations (north and south of the western midpoint) is advised.

The group recommended the undertaking of a small project to investigate levels of radioactivity in edible seaweed such as carrageen moss.

9.2.3 Certification

The group noted that approximately one quarter of all samples analysed in the RPII laboratory in 2008 were for the purposes of the certification programme. However, the group also noted that the number of analyses requested by customers has been falling in recent years.

The group suggested that the potential for the certification programme to complement the continuous monitoring programme be examined. It may be possible, for example, to use some of the results of the former to establish baselines for use in case of emergency.

9.3 Foundation Document C. Overview of Monitoring Projects

The group considered the projects described in section 5.2 above to be useful and valid, and was impressed by the breadth of projects completed by a relatively small team.

It noted that desktop assessments of the impact on non human species in the marine environment have recently been conducted by the RPII using ERICA. Specifically, two case studies were selected; one based on the western Irish Sea mud patch and one on Carlingford Lough. For each case study four indicator organisms were considered: benthic fish, benthic molluscs, crustaceans and pelagic fish. Concentration data were used from published data covering the years 1988 to 1997. In all cases the probability of exceeding the screening dose of 10 $\mu\text{Gy}/\text{h}$ was found to be low. During the course of this work some questions arose in relation to the choice of concentration factors in ERICA. These have been addressed to the ERICA development team and a response is awaited. The group welcomed this ongoing work and suggested that, once completed, a paragraph should be included in the annual RPII monitoring report.

As commented earlier, the group considered that these projects are useful for encouraging good practice, staff training, enhancing staff morale, encouraging collaboration and identifying future recruitment opportunities. An additional benefit is that they encourage universities to maintain expertise in areas of relevance to the RPII. Projects are also beneficial to the image of the RPII. The group encouraged the continued publication of the results of such projects in peer reviewed journals.

The group made a number of suggestions for useful future research:

- *Monitoring of leachate from older or currently disused landfills.* Analysis for H-3 was suggested in order to investigate levels arising from luminous dials and other potential sources. Analysis of integrated samples to provide a better representation of typical levels was suggested. This project was considered highest priority by the group.
- *Representative monitoring of discharges from waste water treatment plants* to assess typical levels of radionuclides in such effluents. Gamma analysis of integrated samples was suggested.
- *Representative monitoring of discharges from major sewage pipes in the vicinity of cancer treatment and diagnosis departments.* Although the scope of this project would be wider, it would in part complement the previous radiological impact assessment of discharges of therapeutic iodine-131 from hospitals into

Dublin Bay (and doses to workers potentially exposed to them) which was carried out by the RPII between 2003 and 2004.

- *Analysis of sediment beds from surface drinking water sources.* This project is related to the requirement under Commission Recommendation 2000/437/Euratom to monitor surface water. As most drinking water in Ireland is sourced from surface water supplies, the results of drinking water monitoring are assumed sufficient to cover this requirement. However, there is a small but finite possibility that radionuclides could be present in the untreated water but are removed by processing at water treatment plants. This project would aim to address this possibility.
- *A repeat, 20 years on, of the project to investigate artificial radioactivity in Carlingford Lough.* The results of the original project were published in 1992. This would provide an opportunity to collaborate with colleagues in the NIEA. The group noted that a project plan for a follow-up study was drafted by the RPII in early 2009.
- *A study of strontium and plutonium in Irish human beings.* The ideal samples for this study would be biopsy samples but these are hard to obtain. Adult teeth removed for orthodontic purposes (i.e. healthy teeth) are considered a realistic alternative. Children's teeth are also a possibility.
- *Extend the current project investigating caesium-137 and technetium-99 in sediment cores from the Irish Sea* to additionally encompass plutonium and other transuranic radionuclides.
- *A project involving high resolution mass spectrometry, e.g. AMS or ICPMS, which would be applicable to the current programme.* Potential topics to investigate could include uranium in drinking water or technetium-99 and plutonium in Irish Sea samples. The aim of the project would be to acquire experience in the use of mass spectrometry. The actual measurement could be contracted to another laboratory, while the RPII investigated and developed expertise in the chemistry required for sample preparation.
- *Investigation of radium isotopes in Irish drinking water.* The aim of this project would be to enable a more refined assessment of the radionuclide content of drinking water, specifically the radionuclides contributing to the Total Indicative Dose once the contribution of uranium has been established. It would, therefore, be conducted on those samples that exceeded the screening level for gross alpha. The project would also address the maintenance of expertise in the laboratory. The group noted that some development work in this area has recently been undertaken by the RPII.

9.4 Foundation Document D. Gap Analysis of 2000/437/Euratom

The group considered that the RPII's monitoring programme was broadly adequate with regard to the requirements of Article 35 and 36 of the Euratom Treaty. However, the group felt that there was some latitude for further optimisation.

Apart from coastal waters, no specific monitoring of terrestrial surface waters is performed by the RPII, although technically required according to Commission Recommendation 2000/437/Euratom. The group noted that the bulk of Irish drinking water is derived from surface sources and that the results of the drinking water monitoring programme effectively cover this requirement (see also the suggestion for useful future research regarding monitoring of sediment beds from surface drinking water sources in section 9.3 above).

The group recommended changes to the current approach for monitoring of mixed diet. It suggested that, on the basis that modern food distribution networks are extensive and that regional variations regarding consumption in Ireland are not significant, sampling could be performed at one location only (Dublin) rather than the current four. Meals should be sampled more frequently, however, in order to develop a time series.

The group suggested that the monitoring of individual ingredients should be reviewed as this is recommended by Commission Recommendation 2000/437/Euratom "where appropriate" but currently is not routinely carried out by the RPII.

9.5 Foundation Document E. Monitoring Performed to Satisfy OSPAR Commitments

The group acknowledged that before implementing any recommended changes to the current marine monitoring programme, commitments made in Ireland's OSPAR National Plan in 2002 first have to be taken into account.

The group agreed that if it could be quantitatively demonstrated that the proposed changes would not reduce information available from monitoring of the marine environment, then OSPAR commitments should not present an obstacle to their implementation. In the view of the group the changes proposed for monitoring of the Irish marine environment could actually increase the available information and may present an improved representation of the radiological situation. The group noted that Ireland's National Plan is currently being reviewed and recommended that the views of the peer review group should be taken into account in this process. The group noted that in the 2002 National Plan Ireland also committed to the provision of measurements of H-3 in seawater. A method to analyse samples for this radionuclide is currently under development by the RPII.

9.6 Foundation Document F. Exposure from Natural Sources in Ireland

The group considered that the work performed to date in this area, as described in the foundation document, was both comprehensive and useful.

The group considered that the projects (already undertaken) concerning Naturally Occurring Radioactive Materials (NORM) industries in Ireland and radioactivity in building

materials in use in Ireland covered both of these areas in adequate detail. The group agreed that unless circumstances changed, no further work was required in either of these areas. Changes which were considered highly unlikely to occur but which could justify the need for renewed investigation in the future, included:

- commencement of uranium mining;
- changes to the nature or volume of certain imported materials including coal, phosphoric acid and gypsum.

The group concluded that the highest priorities for resources concerning exposure from natural sources are radon and thoron in buildings as Ireland has a significant problem in these areas. Radon and thoron are covered by separate RPII programmes.

9.7 Foundation Document G. Emergency Preparedness and Response

The group agreed that it is vital to maintain the systems, procedures and expertise necessary to facilitate a rapid assessment of environmental contamination in the event of a nuclear or radiological incident.

The group also agreed that the resources of the RPII (or indeed any single organisation) would be insufficient to meet demands in the event of a major incident of this type. The group had a number of suggestions to address this issue:

- Creation and maintenance of an inventory of analytical resources in the State which could be utilised in case of emergency. The inventory should include third level educational institutes, hospitals and other relevant establishments. Details of available expertise should also be recorded. The group recommended that current liaison between the RPII and chief physicists and radiation protection advisers could be extended to cover this issue. Arrangements for maintaining calibration of instruments and for regular intercomparisons would need to be defined. Links to the PET-CT research sector could be investigated. Individuals working in this sector may have suitable expertise which could be utilised in case of emergency. The creation of links to this sector may also present opportunities for the possible future recruitment of radiochemists.
- The group recognised that responsibility for live monitoring of sheep lies elsewhere, but recommended that the status of this capability should be clarified and reinstated and maintained as necessary. The group considered it important that the RPII be kept informed regarding the status of this monitoring capability.
- The operational status of the whole-body counting system located at St Vincent's University Hospital in Dublin should be clarified. Again, the group considered it essential that the RPII be kept informed of the status of this instrument.

- The group was advised that the operational status of the hand-held gamma dose rate monitors operated by the Reserve Defence Forces is checked biannually and that the RPII are kept informed. The group supported this arrangement.
- The group agreed with the recommendation of the Article 35 verification visit regarding investment in a mobile monitoring system. The group noted that the term 'mobile monitoring' can refer to anything from hand-held monitors to a fully functional mobile laboratory installed in a dedicated vehicle. The group recommended conducting a detailed analysis to refine requirements as a priority.

The group considered that the expertise required for gamma analysis is covered adequately. However, it was concerned that in the event of an emergency there might not be a sufficient number of trained analysts available for analysis of transuranics and strontium-90. Technetium-99 was also identified as an important radionuclide, though in this case doses would be received via the marine pathway and there would likely be more time to make adequate arrangements for sampling and analysis.

The group agreed that while the series of table-top exercises in which the RPII has participated recently was useful, a full scale, national emergency exercise is overdue and should be repeated at regular intervals.

The group stressed the need for detailed procedures to be drawn up covering assessment of environmental monitoring in the event of an emergency. Specifically, the group suggested that the current laboratory procedures be reviewed to ensure that these include, *inter alia*:

- the location and requirements of a sample reception centre;
- procedures for screening of samples before they are brought into the laboratory;
- a clear prioritisation policy for sampling and analysis, informed by previous incidents; and
- the influence of stress and long working hours on performance, specifically concerning the potential for cross-contamination of samples.

The group suggested that a quantitative analysis of the logistics surrounding environmental monitoring and assessment in the event of one or two specific hypothetical emergency scenarios would be a useful exercise. This project should consider the available analytical resources and sample prioritisation and throughput. A number of assumptions would have to be made and clearly stated regarding, for example, staffing levels and deposited activity thresholds. The group suggested that this desktop exercise might be added to the list of suggestions for useful future research which was presented earlier in this report.

9.8 Foundation Document H. Monitoring of Radioactivity in Drinking Water

The group considered that the current drinking water monitoring programme is adequate in broad terms. It noted that there is a possibility that the levels of natural radionuclides in drinking water might vary over time, being influenced by major projects such as road building or reforestation programmes. The group appreciated that at some point in the future it may be appropriate to reduce the frequency of monitoring of certain sources.

The group was mindful that the most likely target for malicious interference, unlikely though it may be, is a source supplying Dublin as it is the major population centre. On this basis the group suggested that it may be appropriate to perform monitoring at the three main water works serving Dublin more frequently than is currently the case. It also recommended that supplies serving Dublin should be monitored individually.

Regarding H-3 monitoring of drinking water, though the levels of previous monitoring have proved to be extremely low, the group noted that technically the requirement to monitor still stands (see Commission Recommendation 2000/437/Euratom).

The group noted that screening for gross alpha activity is undertaken on a regular basis by the RPII. When the gross alpha activity exceeds the World Health Organisation screening level, samples are assessed for uranium content. Generally uranium accounts for 20 - 70% of the alpha concentration. It was noted that it is seldom necessary to implement the procedure for determining the content of the remaining activity in order to calculate the Total Indicative Dose. (See also the suggestion for useful future research made in section 9.3 above regarding radium isotopes in drinking water.)

The group noted that liquid scintillation counting is used in Denmark in preference to the RPII's method of evaporation and gas flow proportional counting. While there is sometimes difficulty achieving the screening level of 0.1 Bq/l for gross alpha, it is nevertheless considered satisfactory both by the Danish authorities and the EC.

9.9 Supplementary Document S1. Relevant National and International Legislation

In arriving at these recommendations the group was satisfied that it had been supplied with all relevant national and international legislation.

9.10 Supplementary Document S2. Relevant RPII Reports, Journal Articles, Conference Papers and General Articles

The group was impressed by the rate of publication of RPII staff and by the quality and breadth of these publications, which lend further to the reputation of the RPII nationally and internationally, and confirm that RPII staff members continued to work to a high standard. This was also reflected in the quality of the documentation provided for the peer review and evinces the quality and relevance of advice offered to Government.

10 Traceability of the Group's Response to the Terms of Reference

The recommendations of the group in section 9 were presented in response to, and in the order of, the documentation provided by the RPII. In this section the group sets out how the Terms of Reference of the review (reproduced below) have been met, and cross-references the relevant recommendations of the group.

1. Aims and Objectives of the Programme

To evaluate the scope of the current programme to ensure that it is optimal. This evaluation should consider specifically whether the aims and objectives of the programme are sufficiently broad to cover statutory requirements, other national and international commitments and international best practice.

The group considered the scope of the aims and objectives of the programme. To provide optimal scope, the group recommended that one additional item should be inserted to ensure statutory and international obligations are met (see section 9.1). Assessment against these obligations produced some comments related to international requirements for Euratom and OSPAR, and these are given in sections 9.4 and 9.5.

2. Capacity of the Current Programme to Meet the Stated Aims and Objectives

To evaluate the effectiveness of the RPII environmental monitoring programme as currently implemented. This evaluation should consider specifically whether the RPII is meeting the stated aims and objectives of the programme. Both continuous monitoring and project-based elements of the programme should be considered.

The group's evaluation of the effectiveness of the programme against its stated aims and objectives is considered in section 9.2. The group agreed on a number of recommendations for continuous monitoring, as presented in that section. The effectiveness of project-based elements is considered in section 9.3, and the group made a number of suggestions for useful future research.

The adequacy of the programme with respect to the following specific aims should be considered explicitly:

- *the accuracy of public dose assessment and demonstration of compliance with basic standards;*
- *the need to provide public information and reassurance; and*
- *the need to provide accurate, up to date and scientifically based advice as input to Government policy.*

The group considered that the programme was adequate with respect to the requirements to provide reassurance to the public, given the continued publication of the annual RPII monitoring report in the year following the monitoring (section 9.2). The group

also considered that the programme was adequate with respect to the need to provide accurate and scientifically-based advice to government (section 9.2).

In addition, the effectiveness of previous project-based monitoring should be considered explicitly.

Previous projects were considered to be useful and valid, and the group was impressed by the breadth of projects completed by a small team. This and further remarks are made in section 9.3.

3. Emergency Response Capability

To consider the strategic value of the programme with respect to the capability to respond effectively in the event of a nuclear or radiological emergency.

The group considered that it is vital to maintain the systems, procedures and expertise necessary to facilitate a rapid assessment of environmental contamination in the event of a nuclear or radiological incident (section 9.7).

Due to the passage of time since the Chernobyl accident and the decreasing levels of radioactivity in the Irish marine environment, the RPII, along with organisations with similar responsibilities internationally, faces challenges in the future regarding the maintenance and retention of expertise and analytical capability. Specific consideration should be given to the maintenance of the capability to respond effectively not only to emergencies but to any radiological issues of potential concern to the public.

The group had a number of suggestions to address the issue of maintaining a response capability, and these are set out in section 9.7.

4. Value for Money

To comment on the effectiveness of the programme in achieving the stated aims and objectives efficiently. Identification of opportunities to streamline or improve the efficiency of the continuous monitoring programme while maintaining integrity is sought explicitly. Trends from monitoring results should be taken into account. Identification of the benefits of the current programme would also be welcome.

Broadly, the group felt that the RPII monitoring programme was efficient in achieving its aims and objectives, in that there appeared little scope for savings without prejudicing overall effectiveness. The group did, however, identify some opportunities (given the trends of decreasing concentrations of artificial radioactivity in the Irish Sea) for consideration within the marine and coastal monitoring programme, and these are given in section 9.2. Also, some suggestions were made for potential contracting out (sections 9.1 and 9.2).

The group considered that the benefits of the current programme are in meeting the aims and objectives and, particularly by maintaining a research component, keeping expertise vital so as to motivate specialist staff. Comments on this are made in section 9.1.

Additionally, a possible additional benefit of the research element is in the encouragement of universities to maintain relevant areas of expertise, and hence to provide a recruitment pool (section 9.3).

5. Future Needs and Scope for Innovation

To comment on the potential of the programme to meet future needs and the scope for innovation.

During the review the group maintained a weather eye towards future needs and a number of relevant recommendations are made particularly in section 9.1. Maintaining a research component to the programme contributes significantly to the ability to enable innovation and meet future needs. In section 9.3 a number of suggestions are made for useful future research.

The following items should be considered specifically, along with any other issues raised by the group:

- *General recommendations for environmental monitoring by the RPII in the future. These recommendations should address areas of weakness identified in the programme; gaps; redundancy; opportunities to improve quality or efficiency and any other issues which the group believe would improve the overall quality and effectiveness of the programme.*

Related recommendations were made mainly in section 9.2; optimisation of the Euratom programme was considered in section 9.4.

- *Recommendations regarding the continuous monitoring aspect of the programme. Comment on sampling frequencies and densities with reference to trends in monitoring results is sought explicitly.*

Relevant recommendations were also made in section 9.2. Sampling frequencies and densities of the marine and coastal programme are particularly referred to.

- *Suggestions for potential future project-based monitoring. Comment on research needs to underpin and support the programme is sought explicitly. These recommendations should identify areas where insufficient data is currently available to adequately support the RPII's advisory, public information or other functions and which should be addressed through targeted research or monitoring projects. The recommendations should also address areas where research and development could lead to improved efficiency and better value for money in the execution of the programme.*

Research suggestions were set out in section 9.3. Although many of these suggestions were directed at filling gaps in knowledge, there is an underlying need to aim for improved efficiency, such as by analysing integrated samples.

- *Consideration of areas of emerging interest where it may be appropriate to direct resources in the future. In this regard, comment on recent developments in relation to protection of the environment and exposure from natural sources is sought explicitly.*

These areas were addressed in section 9.3. This section contains a specific recommendation on protection of non-human species. Some desktop assessments have already been carried out, and can be taken further following a response from the ERICA development team.

- *Consideration of the skills mix of RPII staff involved in the programme and recommendations for future training and development if required.*

This topic was considered in section 9.1, in terms of maintaining a challenging and professionally rewarding environment. The R&D programme, and collaboration with, and support of, universities was seen as the best way to stimulate necessary development and opportunity for future recruitment.

Other comments or recommendations on any aspect of the monitoring programme are invited.

These are dealt with under the different headings of section 9. A summary of the recommendations is provided in section 11.

11 Conclusions and Summary of Recommendations

In this section the group's conclusions and recommendations are summarised, beginning with a compilation of more general recommendations arising from the review. Where appropriate, the section referred to is cross-referenced.

11.1 General

- a. The group recommended identifying priorities for maintenance of analytical capabilities.
- b. The group noted the importance of national and international collaboration, peer review publications and sharing resources with other laboratories.
- c. The group recommended that measures be taken to strengthen in so far as feasible the pipeline of expertise available to the RPII in the future. Certain suggestions were made in this regard.
- d. The group recognised the importance of maintaining and enhancing staff morale and commended the RPII for the project-based work undertaken and the obvious benefits which have accrued. Such work is also useful for professional development and for maintaining and developing expertise.
- e. The group fully supported the RPII policy of staff rotation and the consequent beneficial spin off in terms of staff backup, on both the technical and administrative side.
- f. The group was highly impressed with the scale of intercomparison work undertaken and the RPII's quality system as a whole.
- g. The group recommended that the status of all technical manuals be reviewed and, where appropriate, updated at regular intervals.
- h. The group was impressed by the quality and depth of the documentation provided.

11.2 Continuous Monitoring including Drinking Water

11.2.1 Terrestrial Programme

- a. The group was of the view that the programme of continuous monitoring undertaken by the RPII at the present time is adequate both from the perspective of public reassurance and from the need to provide accurate and scientifically-sound advice to

Government. Specifically, the group was satisfied that the existing high and low volume aerosol and gamma dose rate networks were fully sufficient and fit for purpose. The same observation applied to the collection and analysis of rainwater.

- b. The group had some concerns regarding the level of monitoring of food imports and recommended that an examination be carried out of the approaches to this issue in place in other jurisdictions.
- c. The group recommended that there be increased monitoring of 'wild foods' as recommended by Commission Recommendation 2003/120/EC.
- d. The group concurred with the RPII's high prioritisation for maintaining the capability to measure Sr-90 in milk.
- e. The group was satisfied that the monitoring of radioactivity in drinking water was more than adequate in normal circumstances. However, it expressed some concern in relation to the threat posed by the potential for malicious attack on the water supplies of the major cities. In the event of an incident of this type occurring internationally, the need for more regular monitoring may arise.

11.2.2 Marine Programme

- f. The group considered the scale of the current marine monitoring programme to be adequate and fully justified. However, the group felt that it should continue to be kept under review and that specific consideration should be given to the increased use of bio-indicators such as shellfish and seaweed; sampling close to nodal points where maximum concentration levels may be expected; a review of the need for and extent of off-shore sampling; effective design of sampling in terms of numbers of samples and bulking arrangements; and sampling of edible seaweed. In addition, it felt that there should be more monitoring of samples for plutonium and americium, not least in order to maintain analytical proficiency.
- g. The group commended the recently completed habits survey along the north east coast and agreed with the recommendations to monitor winkles and mussels.
- h. The group recommended that the monitoring for carbon-14 in marine material should cease.

11.2.3 Certification Programme

- i. The group noted the impressive scale of the food certification programme and suggested that its potential for complementing the continuous monitoring programme might be considered, for example, its utility in the provision of baseline data.

11.3 Monitoring Projects

- a. The group was very impressed with the quality and breadth of the monitoring projects undertaken by the RPII and recommended that this programme be maintained. The group made a number of specific suggestions for future work (see Section 9.3 above).

11.4 Articles 35 and 36 of the Euratom Treaty

- a. The group was satisfied that the RPII's monitoring programme fulfils the requirements of Articles 35 and 36 of the Euratom Treaty.
- b. The group recommended some changes to the mixed diet programme and a review of the need to monitor individual ingredients (see section 9.4 above).
- c. The group noted that as the bulk of Irish drinking waters are drawn from surface sources, monitoring of drinking water adequately covers the requirement to monitor surface water.

11.5 OSPAR

- a. The group concluded that the current monitoring programme fulfils Ireland's obligations under the OSPAR convention.

11.6 Natural Sources and NORM

- a. The group was satisfied that the monitoring and project work undertaken in relation to exposures arising from natural sources, including NORM industries, was comprehensive and required no expansion at the present time. However, there is a need to keep the situation under review in case of certain changes such as, for instance, in imports of coal, phosphoric acid and gypsum, etc.

11.7 Emergency Preparedness

- a. The group fully supported the RPII's position in relation to emergency preparedness and agreed that it is vital to maintain the systems, procedures and expertise

necessary to facilitate a rapid assessment of contamination in the event of a nuclear or radiological incident. The group had a small number of constructive suggestions in relation to this issue (see section 9.7 above).

11.8 Relevant RPII Reports, Journal Articles, Conference Papers and General Articles

- a. The group was impressed by the publication record in peer reviewed journals and other media of the staff of the RPII and commended all concerned for their dedication to this important task.

The RPII Radiation Monitoring Team 2009

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Notes



Radiological Protection Institute of Ireland

An Institiúid Éireannach um Chosaint Raideolaíoch

Mission Statement

In the three year period from 2008 to 2010 the RPII will grow the level of awareness and implementation of the measures needed to protect people in Ireland from the harmful effects of ionising (and non-ionising radiation) through scientifically based regulation, monitoring and advice.

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