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Radiation Protection

TECHNICAL REPORT

VERIFICATIONS UNDER THE TERMS OF ARTICLE 35 OF THE EURATOM TREATY

MALTESE MONITORING NETWORK FOR ENVIRONMENTAL RADIOACTIVITY

2 to 4 September 2008

Reference: MT-08/07

**VERIFICATIONS UNDER THE TERMS OF ARTICLE 35
OF THE EURATOM TREATY**

FACILITIES: Monitoring network for environmental radioactivity in Malta

LOCATIONS: Malta Environment & Planning Authority, Corradino
Mater Dei Hospital, Sptar Mater Dei
Department for Environmental Health, Valletta Laboratory
Department for Environmental Health, Guardamangia
Laboratory

DATE: 2 to 4 September 2008

REFERENCE: MT-08/07

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V. Tanner

DATE OF REPORT: 15.5.2009

SIGNATURES:



F. MacLean



V. Tanner

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APPENDIX 1 **Verification programme**

APPENDIX 2 **Summary of the Maltese legal framework relating to radioactivity and nuclear materials**

ABBREVIATIONS

ADC	Analogue to Digital Converter
CEFAS	Centre for Environment Fisheries and Aquaculture Science
DEH	Department for Environmental Health
DG TREN	European Commission Directorate-General for Energy and Transport
EC	European Commission
EPD	Environmental Protection Directorate
EURDEP	EUropean Radiation Data Exchange Platform
FWHM	Full Width at Half Maximum
IAEA	International Atomic Energy Agency
ISO	International Organization for Standardization
MEPA	Malta Environment and Planning Authority
MNL	Malta National Laboratory
NIM	Nuclear Instrumentation Module
NORM	Naturally Occurring Radioactive Materials
OHSA	Occupational Health & Safety Authority
OPM	Office of the Prime Minister
PHL	Public Health Laboratory
QA	Quality Assurance
REM	Radioactivity Environmental Monitoring (European Commission database)
RPB	Radiation Protection Board

1. INTRODUCTION

Article 35 of the Euratom Treaty requires that each Member State establish the facilities necessary to carry out continuous monitoring of the levels of radioactivity in air, water and soil and to ensure compliance with the Basic Safety Standards¹.

Article 35 also gives the European Commission the right of access to such facilities in order that it may review and verify their operation and efficiency. Within the Commission, the Radiation Protection Unit (TREN H4) of the Directorate-General for Energy and Transport (DG TREN) is responsible for conducting these verifications.

The main purpose of verifications performed under Article 35 of the Euratom Treaty is to provide an independent assessment of the adequacy of monitoring facilities, as far as applicable, in the Member State concerned for:

- Levels of environmental radioactivity on the territory of the Member State;
- Liquid and airborne discharges of radioactivity into the environment from relevant sites, and control of these discharges;
- Levels of environmental radioactivity at relevant site perimeters and in the marine, terrestrial and aquatic environment around sites, for all relevant pathways.

A verification team from DG TREN visited Malta from 2 to 4 September 2008. The purpose of the visit was to verify progress made in implementing the monitoring requirements of Article 35 in Malta following the first verification visit by DG TREN in 2006².

The team visited facilities which are part of the Maltese national system for monitoring environmental radioactivity and included meetings with representatives of the Radiation Protection Board, the Office of the Prime Minister, the Malta Environment and Planning Authority, the Public Health Laboratory and the Mater Dei Hospital. Details of the programme can be found in section 2.2 below.

The present report contains the results of the verification team's review of relevant aspects of the surveillance of environmental radioactivity on the territory of Malta. The verification team acknowledges the excellent co-operation it received from all participants.

2. PREPARATION AND CONDUCT OF THE VERIFICATION

2.1 General

The Commission's decision to conduct verification under the terms of Article 35 of the Euratom Treaty was notified to the Permanent Representative of Malta to the European Union by a letter bearing the reference TREN/H4/CG/cd D(2007)326117. The Maltese authorities subsequently designated the Radiation Protection Board (RPB) as the lead Maltese agency for the preparation of the visit and co-ordination of the Maltese agencies involved.

2.2 Verification programme

Prior to the visit, the Commission and the RPB agreed the programme of verification activities, following the modalities for the conduct of Article 35 verifications as set out in the Commission Communication on Article 35 verifications³.

¹ Council Directive 96/29/Euratom of 13 May 1996 laying down basic safety standards for the health protection of the general public and workers against the dangers of ionizing radiation. (OJ L-159 of 29/06/1996).

² Verifications under the terms of Article 35 of the Euratom Treaty, Malta 25 to 27 April 2006, Technical report, DG TREN H4, Reference MT-06/02, 19.2.2007.

The opening meeting was held at the premises of the Occupational Health and Safety Authority (OHSA) in Pieta. Slight adjustments were made to the programme during the opening meeting in order to optimise the logistics of the visit. The final programme of the verification activities is attached as Appendix 1.

The programme included verification of the control of discharges from the Mater Dei Hospital as well as the verification of MEPA and DEH radiological monitoring programmes.

The closing meeting was held on 4 September, in the presence of the responsible Permanent Secretaries, Mr. Joseph Ebejer, responsible for Social Policy, and Mr. Peter Portelli, responsible for the MEPA, as well as representatives of the OHSA, the RPB, the DEH, and the OPM. During the meeting, the verification team presented its verification activities and preliminary conclusions, subject to full examination of all information received at headquarters.

2.3 Verification documentation

The verification team and the RPB regularly discussed information that was supplied in advance by the RPB, in the form of answers to a questionnaire prepared by the Commission services. Additional documentation and information was provided during and after the verification visit and has been drawn upon extensively in the drafting of the descriptive sections of this report.

2.4 Representatives of the Maltese authorities

Tuesday 2nd September 2008 8:30-10:30

Opening meeting, OHSA premises, Pieta

Paul Brejza	Chairperson Radiation Protection Board
Albert Tabone	Radiation Protection Board member from Civil Protection Department
Joseph Cremona	Radiation Protection Board member from OHSA
John Attard Kingswell	Radiation Protection Board member from Public Health
Louis Vella	Radiation Protection Board member from Environment
Edward Grupetta	Radiographer, Radiation Protection Unit, Mater Dei Hospital
Karen Borg Grima	Radiographer, Nuclear Medicine Department Mater Dei Hospital
Marie Louise Mangion	Head, Tourism and Sustainable Development Unit within OPM
Mark Musu	Director EU Affairs, Ministry of Social Policy
Kevin Mercieca	Unit Manager, Waste Air, Radiation and Noise Unit, MEPA
Matthew Yeomans	Environment Protection Officer, Radiation and Noise Unit, MEPA
Sandro Sammut	Principal Health Inspector
Graziella Borg	Principal Health Inspector
Doris Gambin	Senior Scientific Officer, Environmental Health Laboratories

Tuesday 2nd September 2008 11:00-13:00

Department for Environmental Health Laboratory, St Luke's Hospital

Albert Gambin	Chief Scientific Officer
Doris Gambin	Senior Scientific Officer
Raymond Camilleri	Senior Scientific Officer
Raymond Grech Marguerat	Principal Medical Laboratory Technologist

³ Commission Communication on the verification of environmental radioactivity monitoring facilities under the terms of Article 35 of the Euratom Treaty. Practical arrangements for the conduct of verification visits in Member States. (2006/C 155/02).

Wednesday 3rd September 2008 7:30-9:30**Department for Environmental Health Laboratory, Valletta**

Albert Gambin	Chief Scientific Officer
Doris Gambin	Senior Scientific Officer
Raymond Camilleri	Senior Scientific Officer
Raymond Grech Marguerat	Principal Medical Laboratory Technologist

Wednesday 3rd September 2008 10:00-14:00**Environmental Protection Directorate, Corridino**

Kevin Mercieca	Unit Manager, Waste Air, Radiation and Noise Unit, MEPA
Louis Vella	Radiation Protection Board member from Environment
Mathew Yeomans	Environment Protection Officer, Radiation and Noise Unit, MEPA

Thursday 4th September 2008 08:00-9:30**Nuclear Medicine Facility, Mater Dei Hospital**

Anthony Samuel	Consultant Nuclear Medicine Physician, Chair Medical Imaging
Edward Grupetta	Radiographer, Radiation Protection Unit, Mater Dei Hospital
Karin Borg Grima	Radiographer, Nuclear Medicine Department, Mater Dei Hospital
Joseph Cassar	Manager Medical Imaging Department Services, Mater Dei Hospital

Thursday 4th September 2008 10:45-11:45**Closing meeting, OHSA premises, Pieta**

Joseph Ebejer	Permanent Secretary Social Policy
Peter Portelli	Permanent Secretary responsible for MEPA
Mark Gauci	Chief Executive Officer, Occupational Health & Safety Authority
Marie Louise Mangion	Head, Tourism and Sustainable Development Unit within OPM
Paul Brejza	Chairperson Radiation Protection Board
Joseph Cremona	Radiation Protection Board member from OHSA
John Attard Kingswell	Radiation Protection Board member from Public Health
Louis Vella	Radiation Protection Board member from Environment
Sandro Sammut	Principal Health Inspector

3. PROVISIONS FOR ENVIRONMENTAL RADIOACTIVITY MONITORING IN MALTA**3.1 General**

As a result of its accession to the European Union in 2004, Malta has brought its legal framework and procedures addressing radioactivity and nuclear issues into line with the EURATOM Treaty, including provisions for monitoring environmental radioactivity, and has made efforts to establish and operate the necessary arrangements for environmental radioactivity monitoring. The main document outlining the arrangements is "The First National Environment Radioactivity Surveillance Plan for Malta", adopted by the RPB on 01/09/2006.

3.2 Legal framework

The national legal framework covering the control of radioactive materials, radiation protection and monitoring of environmental radioactivity in Malta consists of several acts and their derived legislation (listed in detail in Appendix 2). In addition, directly applicable, pertinent Euratom and European Community legislation applies.

A number of European and international guidance documents are also used in Malta for monitoring and control of radioactivity in the environment and in foodstuffs:

- Commission Recommendation on the application of Article 36 of the Euratom Treaty⁴;
- IAEA Tecdoc 1000, Clearance of materials resulting from the use of radionuclides in medicine, industry and research;
- IAEA WS/G/2.3 Regulatory control of radioactive discharges to the environment;
- IAEA Safety Report Series, Generic models for use in the control of radioactive discharges to the environment;
- Reports of IAEA Expert missions performed in 2005 and 2006.

3.3 Authorities involved in monitoring of environmental radioactivity

3.3.1 Radiation Protection Board

The Radiation Protection Board (RPB) acts as the national co-ordinator for all matters concerning environmental radioactivity and radiation protection, including co-ordination of implementation of the Euratom Treaty primary and secondary legislation. It is responsible for preparing reports for the EU and the international institutions in accordance with Malta's obligations. The RPB is appointed by the Prime Minister under the provisions of the Nuclear Safety and Radiation Protection Regulations (LN44/03). The RPB is composed of representatives from four agencies:

- The Occupational Health and Safety Authority (OHSA);
- The Environment Protection Directorate of the Malta Environment and Planning Authority (MEPA);
- The Superintendent of Public Health;
- The Civil Protection Department.

Each member agency nominates one member of the Board. OHSA nominates the Chairperson of the Board (with an executive capacity), thus making OHSA the lead authority on the Board. Figure 1 below summarises the bodies represented within the RPB, their parent ministries, and their respective responsibilities as regards the environmental monitoring programme.

In the field of radiation protection, OHSA is normally the lead Maltese agency for coordinating the contacts to the Commission and to the IAEA. OHSA does not have a laboratory for radiation measurements, but it possesses a number of portable and hand-held instruments for monitoring contamination, and alpha, beta and gamma radiation.

⁴ Commission Recommendation 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 of the population as a whole (2000/473/Euratom).

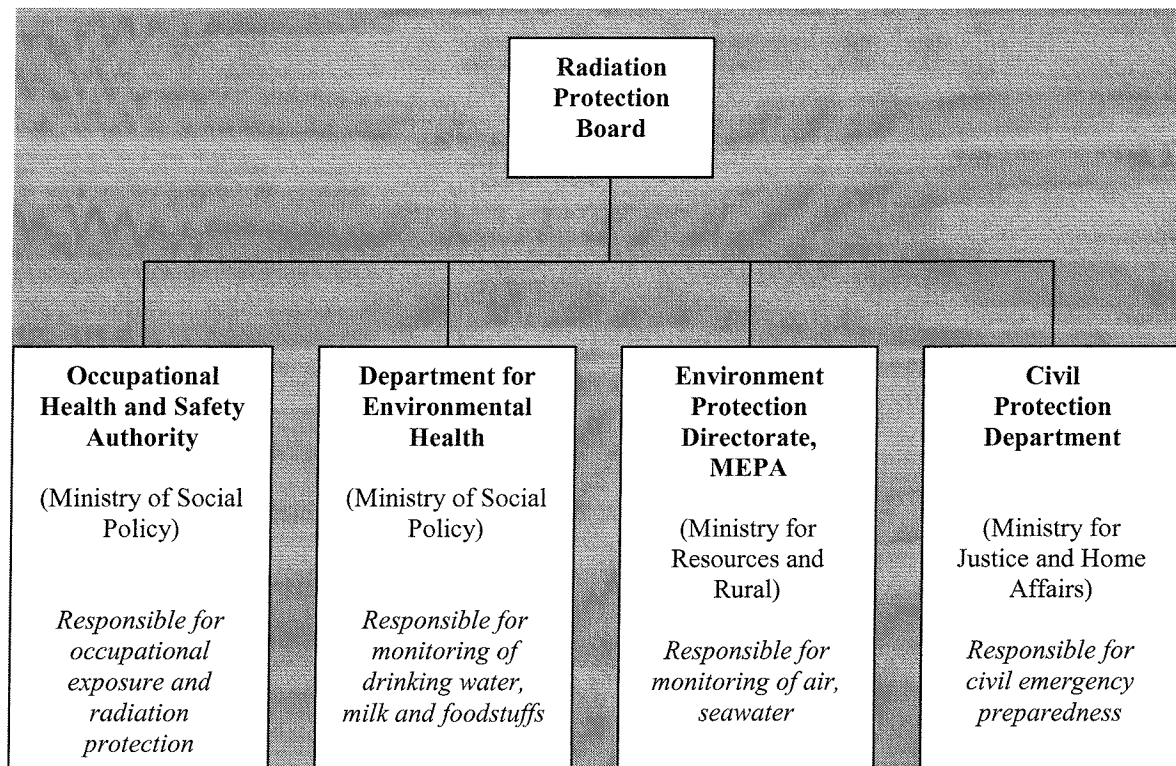


Figure 1. Organigram of the Radiation Protection Board with regard to Article 35 issues

3.3.2 Occupational Health and Safety Authority

The statutory responsibilities of the Occupational Health and Safety Authority (OHSA) relevant to the EU requirements are:

- Protection of workers from the risks arising from the use of ionising radiation;
- Management of the personal dosimetry data of radiation workers;
- Inspection of installations handling radioactive materials in the medical, industrial, research and educational sectors;
- Licensing of occupational applications of ionising radiation in the industrial, research and educational sectors;
- Implementation Euratom safeguards on nuclear materials;
- Licensing of import, export, transport, storage, use and disposal of nuclear materials, sealed sources and other radioactive materials;
- Licensing the use of radiation producing equipment;
- Reporting environmental monitoring data to the EC in accordance with the Euratom Treaty Article 36.

3.3.3 Department for Environmental Health

The Ministry of Social Policy is responsible for a number of areas including public health. Amongst its various responsibilities, the Department for Environmental Health (DEH) is responsible for verifying and controlling the levels of radioactivity in drinking water, foodstuffs and milk. The execution of these responsibilities is entrusted to the Public Health Laboratory and the Health Inspectorate.

3.3.4 Environment Protection Directorate

The main areas of activity of the Malta Environment and Planning Authority (MEPA) are environmental protection and development planning. The operation of Malta's environmental monitoring network, including monitoring of radioactivity in air, soil and seawater, falls within the remit of the Pollution Prevention and Control unit of MEPA's Environment Protection Directorate.

3.3.5 *Civil Protection Department*

The Civil Protection Department of the Ministry of Justice and Home Affairs is responsible for preparedness and response in the event of civil emergencies, including emergencies involving radioactivity.

4. ARRANGEMENTS FOR ENVIRONMENTAL RADIOACTIVITY MONITORING IN MALTA

4.1 General

Malta lies approximately 95 km to the south of Sicily and 300 km to the north of the African coastline and has a total surface area of 316 km². The Maltese archipelago comprises seven islands of which only the three largest, Malta, Gozo, and Comino, are inhabited. The main island (Malta) is 27 km long. There are no permanent rivers or lakes and natural water resources are scarce: roughly half of Malta's potable water is supplied from boreholes and half from desalination plants. Malta's proximity to North Africa means that Malta is often affected by dust-laden winds blowing from the Sahara.

The islands are for the most part composed of marine sedimentary rocks, principally limestone. Therefore elevated levels of natural radioactivity and radon would not be expected and indeed levels of natural background radiation are low; of the order of 100 nSv/h or less.

There are no nuclear power plants or other installations of the nuclear fuel cycle in Malta. The nearest large nuclear power plants and nuclear fuel cycle installations are situated more than 1200 km away, in the south of France. Malta was not significantly affected by the radioactive fall-out from the Chernobyl accident.

In Malta there are neither producers of radioisotopes nor significant NORM industries. The main applications of ionising radiation are unsealed sources used for medical purposes and sealed sources used for industrial non-destructive testing and industrial nuclear gauges. The only planned discharges of radioactivity to the environment in Malta are associated with medical activities using unsealed sources in three hospitals.

Because of its small size, the Maltese authorities consider Malta to constitute a single region for the purposes of assessing radiological exposure in line with the Recommendation 2000/473/Euratom. The first national surveillance plan was approved by the RPB in order to fulfil the requirements of the Euratom Treaty's Articles 35 and 36. The plan, which was drawn up with the assistance of an expert provided by the IAEA, was designed to be in-line with the practices set out in Recommendation 2000/473/Euratom on the application of Article 36 of the Euratom Treaty, although it has to be said that generally the plan seeks to observe the minimum level of these practices. It includes altogether some 55 environmental samples and 113 analyses per year. Generally, the implementation of the measurement systems and procedures is not yet mature, and some elements of the plan are still partially incomplete (see Section 5 for verification activities).

4.2 Monitoring of the environment

4.2.1 *Monitoring of external ambient gamma dose rate*

External ambient gamma dose rate is monitored using one monitoring system located at the MEPA facility in Corradino. Results are made available to the EURDEP system. The 2006-2008 national surveillance plan indicates that a second system for monitoring gamma dose rates is located on Gozo. However, the verification team was informed that its installation is planned for 2009, subject to availability of funding.

4.2.2 *Monitoring of airborne radioactivity*

Airborne radioactivity (particulates only) is monitored using one high-volume air sampler located at the MEPA facility in Corradino. Filters are sent to the ENEA laboratory in Italy for analysis. At the time of the verification, there were no plans for installing more high volume air samplers.

4.2.3 *Monitoring of surface water and precipitation*

The Environmental Protection Directorate is responsible for monitoring of non-potable waters. Malta has no permanent surface waters and therefore the surveillance plan makes no provision for sampling of surface waters.

The climate in Malta is dry and the annual rainfall is about 60 cm/year. Summer is normally rainless. Precipitation normally occurs as heavy showers during winter (November-April) and therefore there is no provision in the surveillance plan for routine sampling of rainwater, although the verification team was informed that precipitation would be sampled in the event of a radiological emergency.

4.2.4 *Monitoring of drinking water*

Drinking water samples are taken by the Health Inspectorate within the Department for Environmental Health and sent to the Public Health Laboratory, also within the Department for Environmental Health on a monthly basis from the normal pipe supply of drinking water at several locations on Malta and on a six-monthly basis from two locations on Gozo. It was stated that the samples cover both sources of piped drinking water: boreholes and desalination, which each supply around 50% of Malta's potable water.

Samples are measured for total α/β , Cs-137, Sr-90 and Tritium at the CEFAS laboratory in the UK. Measurement results are transmitted by DEH to OHSA and subsequently also to the EC for inclusion in the REM database.

4.2.5 *Marine monitoring*

Coastal sea water sampling is carried out by MEPA on quarterly basis from three locations. Twelve 60-litre samples of sea surface water are taken each year. Samples are pumped through an ion-exchange resin which is sent to the CEFAS laboratory in the UK for K-40 and Cs-137 analysis. Marine sediments, biota and fish are not included in the sampling programme.

4.2.6 *Monitoring of soil*

Soil surface samples are taken once a year by MEPA from a set of five undisturbed locations. Cs-137, Co-60 and K-40 analyses are performed by CEFAS.

4.2.7 *Monitoring of milk*

Malta's sole dairy supplies almost 100% of Maltese fresh milk consumption. Milk is sampled at the dairy on a quarterly basis. The samples are analysed for Cs-137, K-40 and Sr-90 at CEFAS.

4.2.8 *Monitoring of mixed diet*

Every month a mixed diet sample is taken from a different public canteen (hospitals, schools, hotels etc). The sample consists of a whole day's food and drink intake. Samples are sent to CEFAS for Cs-137, Sr-90 and C-14 analysis. The national surveillance plan justifies the non-inclusion of vegetation, or food components by the high frequency of mixed diet sampling and the high percentage of imported food consumed in Malta.

4.3 **Monitoring of imported foodstuffs**

Health Inspectors from Port Health Services, also within the Department for Environmental Health, carry out sampling of imported foodstuffs placed on the EU market for the first time. Consignments without certification of their radioactivity levels are systematically sampled, and random samples may also be taken. Samples are measured by gamma spectroscopy at the PHL radiation measurement facility in the St. Luke's Hospital. About 80% of the foodstuffs imported into Malta originate from within the EU. So far not a single case of elevated radioactivity levels has been detected.

The airport and two sea-ports and are equipped with radiation detector gates for detection of radioactive consignments.

4.4 Laboratories involved in the monitoring programme

4.4.1 Public health laboratory

The Department for Environmental Health (DEH) is responsible for the surveillance of the safety of food in Malta. The Public Health Laboratory (PHL) is one of the five sections of the Department for Environmental Health. The principal laboratory is located in Valletta and is equipped for sample preparation, and chemical and bacteriological analysis of food and water.

PHL also maintains a small laboratory at St. Luke's Hospital, Guardamangia, in which gamma spectrometry of foodstuffs and drinking water can be carried out. This laboratory was established following the Chernobyl accident. However, at the time of the visit no samples from the national surveillance programme were being analysed in this laboratory. DEH's policy is to ensure as far as possible that samples are analysed by ISO 17025 accredited methods. DEH is currently engaged in obtaining such accreditation for its analytical methods, but as the gamma spectrometry analyses were not a high priority for obtaining accreditation, the decision had been taken to outsource analysis instead to ISO 17025 accredited laboratories, such as CEFAS, until such time as accreditation could be obtained. However, the gamma spectrometry facility is used for the analysis of samples of foodstuffs and feeding stuffs submitted by DEH.

The DEH inspectors sample milk, drinking water and mixed food diet in accordance with the annual programme issued by DEH. The samples are taken to the PHL in Valletta where they are registered and given an identification number, which follows the sample throughout the measurement procedure. Samples which require mechanical treatment such as homogenisation are treated in the sample preparation area at the PHL in Valletta. Samples taken in the framework of the national radiological monitoring programme are sent to a laboratory outside Malta for analysis.

The results of the measurements are recorded on the sample request form and then entered into the foodstuffs database or the water database as appropriate. Both databases are housed on the government server and are backed up every night. After verification by the Chief Scientific Officer of the PHL, the results are transmitted to the OHSA for forwarding to the Commission's Joint Research Centre in Ispra.

4.4.2 CEFAS laboratory (UK)

CEFAS laboratory carries out the analysis of many of the environmental samples originating from the Maltese programme. The laboratory is located at Lowestoft, UK. CEFAS radioanalytical analysis of environmental samples is accredited to ISO/IEC 17025:2005.

4.4.3 ENEA laboratory (IT)

ENEA, the Italian National Agency for New Technologies, Energy and the Environment, analyses the filters from the MEPA high-volume air sampler. The laboratory is located in Rome, Italy. ENEA radioanalytical analysis of environmental samples is accredited to ISO/IEC 17025:2005.

5. VERIFICATION ACTIVITIES

5.1 General

Verification activities were carried out in accordance with the agreed verification programme. Some aspects of the programme could not be fully verified since the practical implementation had been outsourced to a foreign analysis provider (laboratory measurements).

5.2 Environmental radioactivity surveillance plan

The verification team discussed the Maltese environmental radioactivity surveillance plan with the Maltese Authorities. As already indicated in section 4, the Maltese monitoring programme fulfils the minimum requirements for environmental surveillance, but cannot be considered to be extensive or detailed. Unlike other EU States' programmes, the Maltese programme does not include monitoring of precipitation, marine sediments, biota or food components. In addition, the total number of samples in

the programme is fairly low. Most of the analytical services required by the programme have been outsourced to overseas laboratories with the result that there is very little radioanalytical expertise available in Malta.

The Maltese approach is understandable given the remoteness of major nuclear fuel cycle installations, and the fact that Malta was unaffected by the fall-out from the Chernobyl accident. Nonetheless, if one or more of Malta's neighbours should construct major fuel cycle facilities such as power reactors then the Maltese authorities would need to re-examine their approach to monitoring of radioactivity in the environment.

The Maltese programme was extended following Malta's accession to the EU. Malta does not benefit from a long experience in monitoring of environmental radioactivity. It is clear that the experience gained is likely to result in the need to make changes to the plan. Indeed, the verification team was informed that the monitoring programme would be reviewed at the end of 2008.

The verification team recommends that the RPB develop the programme towards a more detailed and comprehensive monitoring system and consider including monitoring of precipitation/dry deposition and biota.

5.3 Public health laboratory

The verification team visited the main PHL laboratory in Valletta and its radiation measurement facility at St. Luke's Hospital in Guardamangia.

5.3.1 PHL Valletta laboratory

The Valletta laboratory is well equipped and was recently extensively refurbished. However, it is not equipped for measurement of radioactivity and therefore its role in respect of the monitoring programme in the main laboratory is limited to preliminary sample preparation and sample management. At the time of the visit, CEFAS was performing gamma spectroscopy, total- α/β , Sr-90 and C-14 analyses for the part of the Maltese Environmental Monitoring Programme for which the Department for Environmental Health is responsible, i.e. mixed diet samples, milk, and drinking water.

Verification included examination of the sample management of imported foodstuffs and environment samples. After analysis and reporting the samples are discarded. The team verified the management of outsourced analyses from sample receipt through reporting. Upon receipt the samples are registered, weighed, homogenised and if necessary frozen before sending them to CEFAS for gamma spectroscopy, total- α/β , Sr-90 and C-14 analysis as per the monitoring programme. Evidently, the fact that samples must be shipped away for analysis equates to a longer wait for receipt of results. CEFAS measurement reports were made available to the team for examination.

The verification does not give rise to any recommendations. The verification team suggests that in the longer term it would be beneficial to develop national radio-analytical capabilities in order to increase the level of radiological expertise in Malta.

5.3.2 PHL gamma-spectrometry facility at St. Luke's Hospital, Guardamangia

As noted previously, at the time of the visit the PHL laboratory held ISO-17025 quality accreditations for certain analysis procedures, but not for the radiation measurements and therefore the measurement of PHL's samples taken under the national monitoring programme has been outsourced. Nonetheless, the facility is used on an *ad-hoc* basis for making gamma measurements of samples of imported food, milk and water samples on behalf of the Port Health Services.

The only instrument at the PHL St. Luke's facility for measurements of environmental radioactivity is a gamma spectrometry system composed of a Canberra model GC-2518 coaxial HPGe detector (relative efficiency 22%) mounted inside a lead/copper low background shielding, cooled by a Canberra model 7500SL low background cryostat and connected to a NIM rack containing the power

supply, amplifier and ADC. Spectrum analysis is carried out using the proprietary Genie 2000 package. The measurement room is clean and tidy and its temperature is maintained at 25°C.

Samples are weighed into 500 ml or 1000 ml Marinelli beakers for measurements. When samples are being measured, an air blank measurement is also performed as a check on the instrument's operation. There is a written procedure (dating from 2004) covering sample preparation and gamma spectrometric measurements. However, the procedure concentrates on how to run the software and makes no mention of quality related matters such as checks on the spectrum, e.g. FWHM of a peak, blanks, calibration.

Five members of the PHL staff have received training from the IAEA on the use of the instrument. The system is only used infrequently for measurements of samples. Nonetheless, it is kept in an operational state throughout the year by weekly filling of the instrument's Dewar flask and monthly checks on the instrument's energy calibration using a Co-60 source and every six months using a certified standard multi-energy source acquired in 2007. The manufacturer's source activity certificate was presented to the team.

The PHL will receive sample preparation equipment and training assistance from the IAEA in 2009 under an IAEA technical co-operation project. This may serve as a basis for seeking ISO 17025 accreditation for the gamma spectrometry measurements in the future.

The gamma spectrometry facility intends to participate in the current IAEA intercomparison exercise. Samples of air filters have been received from the IAEA in the framework of an international measurement inter-comparison exercise. The samples were analysed in the gamma spectrometry facility, but the results were not included in the associated IAEA report due to administrative problems.

The verification team suggests updating the operating procedure and addressing quality related matters such as control of peak location, peak width and detector efficiency.

The verification team encourages progress towards obtaining ISO 17025 accreditation for the gamma spectrometry facility, which would address the quality issues identified above.

5.4 MEPA facility

5.4.1 Ambient gamma dose rate monitor

The verification team verified the multi-function gamma monitor; model number MFM203, manufactured by AMES (Slovenia) which is installed at the roof of the MEPA's Corradino premises for continuous monitoring of the external ambient gamma dose rate. The instrument comprises two Geiger counters of different sensitivities, providing a very wide measuring range from 50 nSv/h to 10 Sv/h. Data is logged and displayed on a PC located at the MEPA office. There is an automatic routine for sending the hourly average ambient doserates to the EURDEP system twice daily. Data is not made directly available to the Maltese public, although it is available through the EURDEP website.

In practice, measured doserates show little variability and are normally close to 85 nSv/h. The first re-calibration of the gamma monitor is due at the end of 2008. At the time of the visit no procedure was in place for performing the re-calibration.

Currently the instrument at the MEPA facility roof is the only dose rate measurement instrument in Malta; there is no back-up system or built-in redundancy. There is no back-up electrical supply either. The verification team was informed that the MEPA's 2006-2008 Environmental Monitoring Programme includes acquisition of a second dose rate monitor instrument for installation on the island of Gozo.

The verification team recommends installation of a UPS system for electrical power back-up of the monitoring device.

As a matter of transparency, the verification team suggests providing the public direct access to the dose rate data.

The verification team suggests increasing the number of dose rate monitors in Malta and supports the intention to install a dose rate monitor on the island of Gozo.

5.4.2 High-volume air sampler

The verification team verified the high-volume air sampler installed on the roof of MEPA's Corradino premises for continuous sampling of air particulates. The sampler's nominal air flow rate is 1055 m³/h. It is equipped with a humidity controlled filter heater in order to avoid condensation. Airflow is measured using a pressure difference flowmeter. The Pitot-static tube (also called Prandtl tube) measures pressure difference, which is used to derive the air flow velocity. This is multiplied by the cross-section of the tube to obtain the flow rate. The pump frequency is increased to keep the flow rate steady when the filter is clogged. The system was calibrated by the Physikalisch Technische Bundesanstalt, the German National Metrology Institute.

The sampler is equipped for particulate sampling only, there is no provision for installation of activated charcoal cartridges for iodine measurements during an emergency situation.

The sampler is operated on a continuous basis and the filter is changed once per week. On occasions sand blown from the Sahara causes the filter to clog thereby necessitating more frequent filter changes.

Filters are Petranoff glassfibre type. There is no suitable analytical capability in Malta, so at the end of the sampling period the filters are pressed and sent to the ENEA laboratory in Italy for gamma spectroscopy measurements. ENEA returns the filters to MEPA after analysis.

Verification does not give rise to recommendations. The verification team suggests giving consideration to the installation of an activated charcoal filter for iodine activity measurements in the event of a reactor emergency.

The verification team supports all efforts to create analytical capabilities for filter analysis in Malta.

5.4.3 Sampling of coastal waters

In 2007 MEPA commenced sampling of coastal waters. According to the Maltese Environmental Monitoring Programme, sampling should be performed on a quarterly basis, whereas at the time of the visit (near the end of the third quarter of 2008) coastal water sampling had only been performed once.

The analysis of the samples is sub-contracted to CEFAS. MEPA performs sample preparation involving passing the collected water through an ion-exchange resin according to a procedure specified by CEFAS. The ion-exchange resins are also prepared by CEFAS.

The verification team recommends that MEPA bring its sampling activities for coastal waters into line with what is set out in the national monitoring programme.

5.5 Nuclear medicine facility of the Mater Dei hospital

Three hospitals are the only sources of radioactive discharge to the environment in Malta. The Mater Dei hospital is new and the Radiology and Nuclear Medicine Department was transferred there at the end of 2007. The department operates two dual-head gamma imaging cameras used for some 3200-3500 imaging operations annually. Around 200-300 imaging procedures per month are performed involving the administration of thallium, technetium, gallium or iodine radio-isotopes.

The verification team visited Mater Dei's nuclear medicine facility in order to verify the monitoring of discharges resulting from these imaging procedures. The Nuclear Medicine Department is equipped with two 1500 litre retention tanks located in the hospital's basement. The tanks collect all sewage

from the toilets and sinks in the nuclear medicine department, as well as all liquid effluents from the laboratory where radioactive substances are handled. The tanks are fitted with sensors that indicate 70% and 90% fill levels. In the event of a high level tank alarm (90%), the water supply to the unit is shut down.

The verification team found the tank room to be clean and tidy. The tanks are lined with 2 mm of Pb shielding and are equipped with sampling lines. Operating procedures require a minimum of 10 days decay time for the sewage before discharge into the public sewers. The radioisotope content of the tanks is not measured before discharge. Tank discharge and change-over is performed manually. The verification team checked the change-over schedule.

The RPB has issued the Mater Dei hospital with a discharge authorisation specifying annual discharge limits per isotope in respect of these discharges. The hospital is obliged to report its discharges at the end of January each year in respect of the preceding calendar year. The verification team notes that the annual return of discharges is based upon estimates of the fraction of administered radio-isotopes excreted by patients during their stay at the hospital. Samples from the filled tanks are not analysed before discharge of the tanks.

Furthermore, current practice is to calculate the estimates of discharges for a particular calendar year, only after the end of that calendar year. Although the verification team visited the hospital at the start of the ninth month of the calendar year, no estimate had yet been prepared of discharges in for that calendar year. There is thus a risk of discharge limits being exceeded unnoticed if changes occur which invalidate the basis of the estimates of discharges.

The verification team recommends that the discharge tanks be sampled and analysed prior to discharge.

The verification team recommends that a running total of discharges throughout each calendar year be maintained in order to ensure that discharge limits are not exceeded.

CONCLUSIONS

All verifications that had been planned by the verification team were completed successfully. In this regard, the information supplied in advance of the visit, as well as the additional documentation received before the start and during the verification, was useful. The information provided and the outcome of the verification activities led to the following observations:

- (1) The verification activities that were performed demonstrated that some of the monitoring devices necessary to carry out continuous monitoring of levels of radioactivity in the air and soil in Malta are newly installed or in an advanced phase of planning.
- (2) A number of recommendations have been formulated. These recommendations aim at improving the overall coverage and quality of environmental radiation surveillance in Malta. The recommendations do not detract from the fact that environmental monitoring in Malta is in conformity with the provisions laid down under Article 35 of the Euratom Treaty.
- (3) The verification findings and ensuing recommendations are compiled in the 'Main Findings' document that is addressed to the competent authority in Malta through the Permanent Representative of Malta to the European Union.
- (4) The present Technical Report is to be enclosed with the Main Findings.

APPENDIX 1

Verification programme

Date & Time	Activity	Location
Tuesday, 2.9.2008		
08:30 – 09:45	Opening Meeting - Presentation by DG TREN - Presentation by RPB - Technical questions - Finalisation of the verification programme	OHSA, Pieta
09:45 - 10:30	- Discussion of National Environment Radioactivity Surveillance Plan for Malta - Discussion of procedures for dealing with imported foodstuffs	OHSA, Pieta
11:00 – 14:00	Verifications at the PHL radiation monitoring facility	St. Luke's Hospital, Guardamangia
Wednesday, 3.9.2008		
07:30 – 09:30	Verifications at the PHL headquarters - Examination of sample preparation - Management of imported food samples	Environmental Health Laboratory, Valletta
10.00 – 15.00	Verifications at the Malta Environment & Planning Authority - Implementation of MEPA's contribution to the national surveillance plan	MEPA, Corradino
Thursday, 4.9.2008		
08:00 – 09:30	Verifications at the Mater Dei Hospital - Liquid discharge monitoring at the nuclear medicine facility	Sptar Mater Dei, B'Kara bypass
10:00 – 10:45	Verification team meeting	OHSA, Pieta
10:45 – 11:45	Closing meeting with the Maltese authorities	OHSA , Pieta

APPENDIX 2

Summary of the Maltese legal framework relating to radioactivity and nuclear materials

Legal Notice Number	Publication Date	Title Regulation	Act under which regulation falls
LN 338/2001	28-Dec-2001	Supervision and Control of Radioactive Waste Regulations, 2001 Repealed 13 Feb 2009	Environment Protection Act (Cap 435)
LN48/2009	13-Feb-2009	Waste Management (supervision and Control of shipments of radioactive waste and spent fuel) regulations, 2009	Environment Protection Act (Cap 435)
LN 245/2002	30-Aug-2002	Radiological Emergency (Information to the Public) Regulations, 2002	Civil Protection Act (Cap 411)
LN 44/2003	28-Jan-2003	Nuclear Safety and Radiation Protection Regulations, 2003	National Interest (Enabling Powers) Act (Cap 365)
LN 23/2004	20-Jan-2004	Quality of water intended for Human Consumption Regulations, 2004	Food Safety Act (Cap 449)
LN116/2004	9-Mar-2004	Quality of water intended for Human Consumption (Amendment) Regulations, 2004	Food Safety Act (Cap 449)
LN 173/2004	20-Apr-2004	Nuclear Safety and Radiation Protection (Amendment) Regulations, 2004	National Interest (Enabling Powers) Act (Cap 365)
LN 242/2004	30-Apr-2004	Importation Control Regulations, 2004	Supplies and Services Act (Cap 117)
LN 416/2004	20-Sep-2004	Dual-use Items (Export Control) Regulations, 2004	National Interest (Enabling Powers) Act (Cap 365)
LN 472/2004	19-Nov-2004	Ionising Radiation Medical Exposure Regulations, 2004	The Public Health Act, 2003 (Cap 465)
LN 378/2005	18-Nov-2005	Sewer Discharge Control (Amendment) Regulations, 2005	Malta Resources Authority Act (Cap 423)
LN 13/2006	13-Jan-2006	Control and Security of High-Activity Radioactive and Orphan Sources Regulations, 2006	National Interest (Enabling Powers) Act (Cap 365)
LN182/2007	10-Jul-2007	Treaty on the Non-Proliferation of Nuclear Weapons (Euratom Safeguards and Additional Protocol) Regulations, 2007	National Interest (Enabling Powers) Act (Cap 365)
LN 440/2007	28-Dec-2007	Convention on Nuclear Safety Regulations, 2008	National Interest (Enabling Powers) Act (Cap 365)