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TECHNICAL REPORT

VERIFICATIONS UNDER THE TERMS OF ARTICLE 35 OF THE EURATOM TREATY

Sardinia and Tuscany

17 to 21 June 2013

Reference: IT-13/01

VERIFICATIONS UNDER THE TERMS OF ARTICLE 35 OF THE EURATOM TREATY

FACILITIES:	Installations for monitoring and surveillance of environmental radioactivity in central Italy (Sardinia and Tuscany) as well as the environmental radiological monitoring around military bases in Sardinia.
DATE:	17 to 21 June 2013
REFERENCE:	IT-13/01
VERIFICATION TEAM:	Mr C. Gitzinger (Head of team) Mr E. Henrich Mr A. Ryan Ms C. Hanot
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ABBREVIATIONS AND ACRONYMS

ANPA	Agenzia Nazionale della Protezione dell'Ambiente (National Environmental Protection Agency)
APAT	(former) Agenzia per la Protezione dell'Ambiente e per i Servizi Tecnici (Agency for Environmental Protection and Technical Services)
APPA	Agenzia Provinciale per la Protezione dell'Ambiente (Autonomous Province Agency for Environmental Protection)
ARPA	Agenzia Regionale di Protezione Ambientale (Regional Agency for Environmental Protection)
ARPAS	Agenzia Regionale Protezione Ambientale Sardegna (Regional Agency for Environmental Protection of Sardinia)
ARPAT	Agenzia Regionale Protezione Ambientale Toscana (Regional Agency for Environmental Protection of Tuscany)
ASL	Azienda Sanitaria Locale (Local Public Health Service)
a.s.l.	above sea level
AUSL	Azienda Unità Sanitaria Locale (Local Public Health Service)
CNSA	National Committee of Food Security
CRNR	Centro di Referenza Nazionale per la Ricerca della Radioattività nel Settore Zootecnico Veterinario (Centre for the Research of Radioactivity in the livestock sector) of IZS Foggia
CRR	Centro Regionale Radioattivitá (Regional Reference Centre for Radioactivity)
cps	counts per second
DBRad	Database on environmental radioactivity
DG ENER	Directorate-General for Energy
DU	Depleted Uranium
EC	European Commission
ENEA	Ente per le Nuove tecnologie, l'Energia e l'Ambiente (National Agency for New Technology, Energy and Environment)
EU	European Union
EURDEP	EUropean Radiological Data Exchange Platform
GAMMA	The national on-line gamma dose rate monitoring network (part of the national early warning system)
GM	Geiger-Müller (radiation measurement)
GPRS	General Packet Radio Service (telecommunication)
GPS	Global Positioning System
HPGe	High Purity Germanium (gamma detector)
IAEA	International Atomic Energy Agency
ICRAM	(former) Istituto Centrale per la Ricerca scientifica e tecnologica Applicata al Mare (Central Institute for Scientific and Technological Research applied to the Sea)
INFS	(former) *Istituto Nazionale per la Fauna Selvatica* (National Institute for Wildlife)
IIZZS	Istituti Zooprofilattici Sperimentali (Experimental Zooprophylactic Institutes)
INMRI	Istituto Nazionale di Metrologia delle Radiazioni Ionizzanti (National Institute of Ionizing Radiation Metrology of ENEA)
IRMM	Institute for Reference Materials and Measurements (of JRC, Geel, Belgium)
ISO	International Organization for Standardization
ISPRA	Istituto Superiore per la Protezione e la Ricerca Ambientale (Institute for Environmental Protection and Research)
ISS	Istituto Superiore di Sanità (National Health Institute)
IZS	Istituto Zooprofilattico Sperimentale
JRC	Joint Research Centre (European Commission DG)
LIMS	Laboratory Information Management System

LR	Legge Regionale (Regional Law)
LSC	Liquid Scintillation Counting/Counter
MATTM	Ministero dell'Ambiente e della Tutela del Territorio e del Mare (Ministry of the Environmental and Protection of the Territory and the Sea)
MDA	Minimum Detectable Activity
MH	Ministry of Health (Ministero della Salute)
NIM	Nuclear Instrumentation Module
NOE	Ecological Operational Unit of the Carabinieri
NORM	Naturally Occurring Radioactive Material
OJ	Official Journal
PISQ	Poligono sperimentale e di addestramento Interforze del Salto di Quirra (Salto di Quirra inter-forces experimental test site and training ground)
PM10	Particulate Matters of (less or equal) 10 micrometers
POD	Piano Operativo di Dettaglio (Operative Details Plan)
RADIA	Italian system of transfer and storage of environmental radioactivity data (managed by ISPRA)
REM DB	Radioactivity Environmental Monitoring Data Base
REMRAD	REte nazionale di Monitoraggio della RADioattivitá nel particolato atmosferico (Automated national network for the on-line monitoring of airborne radioactivity; part of the national early warning system)
RESORAD	REte nazionale di SOrveglianza della RADioattività ambientale (National Environmental Radioactivity Surveillance Network)
RRC	Regional Reference Centre for the monitoring of environmental radioactivity
SMOD	Sedimentable Mineral Organic Detritus
UPS	Uninterruptible Power Supply
ZnS	Zinc sulphide (radiation detector)

1 INTRODUCTION

Article 35 of the Euratom Treaty requires that each Member State shall establish 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 Standards[1].

Article 35 also gives the European Commission (EC) the right of access to such facilities in order that it may verify their operation and efficiency.

For the EC, the Directorate-General for Energy (DG ENER) and in particular its Radiation Protection Unit (DG ENER D.3) is responsible for undertaking 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 for:

- Liquid and airborne discharges of radioactivity into the environment by a site.
- Levels of environmental radioactivity at the site perimeter and in the marine, terrestrial and aquatic environment around the site, for all relevant pathways.
- Levels of environmental radioactivity on the territory of the Member State.

Taking into account previous bilateral protocols, a Commission Communication has been published in the EU Official Journal on 4 July 2006 with a view to define some practical arrangements for the conduct of Article 35 verification visits in Member States.

From 17 to 21 June 2013 two verification teams from DG ENER.D.3 visited Sardinia and Tuscany in order to verify the monitoring of environmental radioactivity in these regions as well as the environmental radiological monitoring around the former military bases in Sardinia in which depleted uranium ammunition were suspected to have been tested. Representatives of the regions of Sardinia and Tuscany provided full information of the environmental radiological monitoring in their regions on paper and during the opening meeting.

The visit also included meetings with representatives of the national and regional authorities having competence in the field of radiation protection.

The present report is based on information collected from documents received and from discussions with various persons during the visit and contains the results of the verification team's review of relevant aspects of the radiological environmental surveillance in all above named regions and sites in Italy.

2 PREPARATION AND CONDUCT OF THE VERIFICATION

2.1 PREAMBLE

The Commission's notification to conduct a verification under the terms of Article 35 of the Euratom Treaty was forwarded to the Italian competent authorities by letter ENER/D4/CG/mp/Ares (2012) 1365258 of 20 November 2012 to the Italian Permanent Representation to the European Union. Subsequently, practical arrangements for the implementation of both verifications were made with the Italian competent authority *Istituto Superiore per la Protezione e la Ricerca Ambientale* (ISPRA).

2.2 PROGRAMME OF THE VISIT

On 17 June an opening meeting was held in Cagliari (Sardinia) and another one in Florence (Tuscany) in the premises of ARPA-Sardinia and ARPA-Tuscany respectively. The Italian competent authority (ISPRA) and representatives of both regions of Italy participated in these meetings. Both the political and the operational levels (ARPAs) of each region were represented. The regions (Sardinia and

[1] Council Directive 96/29/Euratom of 13 May 1996 laying down basic safety standards for the protection of the health of workers and the general public against the dangers arising from ionizing radiation (OJ L-159 of 29/06/1996) which will be superseded by Council Directive 2013/59/Euratom of 5 December 2013 laying down basic safety standards for protection against the dangers arising from exposure to ionising radiation, and repealing Directives 89/618/Euratom, 90/641/Euratom, 96/29/Euratom, 97/43/Euratom and 2003/122/Euratom (OJ L 13 of 17.1.2014, p. 1)

Tuscany) presented the radiological monitoring programmes already implemented in their regions and the activities that are to be realised in the near future. For Sardinia, team 1 received also full information concerning the environmental radiological monitoring in place around former and present military bases on the island in relation to the potential military testing of depleted uranium (DU) ammunition. The programme of verification activities was discussed and finalised, based on a Communication by the EC[2], setting out the framework and modalities within which Article 35 verifications may be conducted.

The verifications were carried out in accordance with the agreed verification programmes in Appendix 1. The verification was focused on the environmental radiological monitoring programmes and activities as implemented by both visited regions of central Italy including sampling and monitoring systems, analytical methods, quality assurance and control aspects, reporting, etc. Verification activities were performed at the different regional ARPA laboratories, addressing infrastructure, analytical methods, quality assurance and control aspects, and reporting. At the same time the monitoring and sampling provisions located on the laboratory premises were also subject to verification. Verification covered different stations of the national surveillance networks GAMMA and REMRAD and the radiological monitoring in place around former and present military bases in Sardinia.

2.3 DOCUMENTATION

In order to facilitate the work of the verification team, a package of information concerning each region was supplied in advance by the Italian authorities. Additional documentation was provided during and after the visit. All documentation received is listed in Appendix 2. The verification team notes the comprehensiveness of all presentations made and documentation provided. The information thus provided has been extensively used for drawing up the descriptive sections of this report.

2.4 REPRESENTATIVES OF THE COMPETENT AUTHORITIES

During the verification visit, the following representatives of national authorities, regional authorities, regional ARPAs, Italian Army and other bodies were met.

Ministry of Environment and Protection of the Territory and of the Sea (MATTM)

Dr Paola Schiavi	Jurist, managing the III Division of the Department for Environmental Evaluation at Ministry of Environment (MATTM)

Institute for Environmental Protection and Research (ISPRA)

Dr Giancarlo Torri	Chemist, responsible for the Service of radiometric measurements – Department of nuclear, technological and industrial risk
Dr Sonia Fontani	Biologist, Service of radiometric measurements, responsible for the Monitoring network Sector
Dr Giuseppe Menna	Physicist, Service of radiometric measurements, responsible for the Natural radioactivity sources Sector
Dr Stefano Zennaro	Physicist, Department of nuclear, technological and industrial risk, Control nuclear activities Service, Emergency coordination Sector charged for GAMMA network management activity

Region of Sardinia

Eng. Salvatore Careddu	Engineer responsible for Prevention and Safety of the Working and Life Environments Sector

[2] 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 (OJ 2006/C 155/02).

Region of Tuscany	
Eng. Luigi Giardina	Department of environment, energy, and pollution
ARPA –Sardegna	
Dr Massimo Cappai	Physicist responsible for the regional network for monitoring environmental radioactivity
Dr Riccardo Lai	Director Cagliari department
Dr Maria Patrizia Ubai	Director Cagliari lab
Ms Angela Ligas	Cagliari lab
Dr Pietro Caria	Director Sassari lab
Dr Franco Pinna	Physicist, Sassari lab
Mr Giovanni Chessa	Technician, Sassari lab
ARPA Toscana	
Dr Andrea Poggi	Technical Director
Dr Antonio Limberti	Director of the Florence laboratory
Dr Silvia Bucci	Director of the regional Radioactivity and asbestos laboratory
Dr Nicoletta Vincenzi	Support to Dr Bucci
Dr Simona Caselli	Quality system manager
Dr Ilaria Peroni	Physicist
Dr Marta Pantani	Physicist
Dr Gabriele Pratesi	Physicist
Ms Sandra Gambi	Expert
Prosecutors office, Lanusei	
Dr Domenico Fiordalisi	Prosecutor
Dr Daniele Rosa	Associate Prosecutor
PISQ Headquarters, Perdasdefogu	
Mr Sanzio Bonotto	Commander
Mr Antonio Massaiu	Lt. Col

3 COMPETENT AUTHORITIES AND RELEVANT LEGISLATION

3.1 LEGAL BASIS

The main legislative act, establishing the responsibilities of the various actors in environmental radioactivity monitoring, in the radiological surveillance of foodstuffs and in emergency preparedness is the Legislative Government Decree Nr. 230 of 17 March 1995 (amended by Legislative Decrees 187/2000, 241/2000, 257/2001 and 151/2001; the latter implementing European Directives 89/618/Euratom, 90/641/Euratom, 92/3/Euratom and 96/29/Euratom).

Decree Nr. 230, Article 54 specifies that:

- Operators of authorised nuclear installations shall supply and operate the equipment necessary for permanent surveillance of the level of radioactivity of the atmosphere, waters, soil and foodstuffs, both within the site perimeter and within the surveillance area around the site.

Decree Nr. 230, in Article 104 specifies that:

- The responsibility for monitoring environmental radioactivity in Italy is with the Ministry of Environment and Protection of the Territory and the Sea (MATTM).
- The responsibility for the radiological surveillance of foodstuffs and feedstuffs is with the Ministry of Health (MH).
- Both Ministries shall exchange radiological information gathered during the exercise of their respective responsibilities.

- Radiological surveillance shall be established through national and regional monitoring networks.
- The implementation and operation of regional networks is under the full responsibility of the regional governments; the latter shall abide by directives issued at national level by both the MATTM and the MH. National directives shall aim at harmonising methods and techniques for sampling and sample analysis across the regions to ensure standardisation and comparability thereof.
- The national monitoring networks shall be operated by bodies, entities or organisations having the necessary competence in the field of radiological protection. The monitoring system is based on regional/provincial and national networks. All Regions and the two Autonomous Provinces (Trento and Bolzano) have the responsibility to implement regional/provincial networks. The Regional/Provincial agencies for the environmental protection (ARPA/APPA) have been delegated to implement the regional/provincial monitoring programme.
- An independent national radiological emergency network is under the responsibility of the Ministry of Home Affairs. ISPRA is the Italian nuclear safety authority and has, at national level, the responsibility for the European Community Urgent Radiological Information Exchange (ECURIE) system.

3.2 COMPETENT MINISTRIES

3.2.1 Ministry of the Environment and the Protection of the Territory and the Sea

The Ministry of the Environment and the Protection of the Territory and of the Sea (MATTM) was established under law 349 of 8/07/1986 and its further modifications and integrations. MATTM is organized in six general directorates. Two of them have responsibilities for radiological surveillance of the environment:

- The directorate for the protection of the territory and waters is responsible for the management and the final treatment of radioactive waste and specific storages.
- The directorate for environmental evaluation is responsible for the protection of the environment from ionizing radiation, and for granting the legal authorisations required to import, export, use or transport any sources of radiation.

Considering the special nature of this subject and the technical aspects, the MATTM makes use of ISPRA, established with a dedicated MATTM's Decree (n. 112 – 25 June 2008). ISPRA is the Italian nuclear safety authority under the control of MATTM.

3.2.2 Ministry of Health

The Ministry of Health (MH) is responsible for the radiological surveillance of foodstuffs (art. 104 – Legislative Decree 230/95). It is the top level body of the national health system which also comprises bodies at regional level and involves also the *Istituto Superiore di Sanitá* (ISS), the leading scientific and technical institution in Italy in this field. MH, in accordance with Law n. 317 of 2001, was created by separation from the Ministry of Welfare. It has been attributed the functions of human and veterinary health protection, the coordination of the national sanitary system, as well as the hygiene and surveillance of foodstuffs. In order to fulfil its responsibilities and the requirements for protection and promotion of the health of citizens and of veterinary health, MH is organised in Directorates-General and Departments. The Directorate-General of Sanitary Prevention is – among other tasks – responsible for the radiological surveillance of foodstuffs.

3.2.3 Ministry of the Interior

Guaranteeing citizens' security is the main institutional mission carried out by the Italian Ministry of Interior through prevention and repression activities in a range of fields, including counterterrorism, transport security, fight against drug trafficking and sports event security.

The Ministry of Interior is responsible for providing the public rescue service in the event of firefighting and prevention operations, natural disasters and major catastrophes for the national territory. This is done through the National Fire Brigade, a State organised body governed by civil

law, working within the Department for Fire Service, Public Rescue and Civil Defence. It carries out civil defence functions through the setting up of a National Plan for Civil Defence which defines risks, explores possible scenarios and identifies measures to be adopted. The National Plan represents the general directive for developing both plans worked out by public/private agencies supplying essential services and 103 Provincial Plans drawn up by the Prefects.

3.2.4 Ministry of Defence

The Ministry of Defence is responsible for the military and civil defence. In the Ministry there is a technical-administrative area and a technical-operational area.

The technical-administrative area is organised into 4 General Directorates under the supervision of the General Defence Secretary, who is also the National Armaments Director. The Secretariat General of Defence's main responsibilities include the implementation of high-level administrative directives issued by the Minister, the operation of the defence technical-administrative area, the fostering and coordination of technological research relating to armament materiel, the procurement of material, equipment and weapons systems for the Armed Forces and the support to the Italian defence industry.

The technical-operational area consists of the Italian Armed Forces: Army, Navy, Air Force and Arma of Carabinieri. The Defence General Staff is responsible for planning, coordinating and supervising the various sectors of activities in the technical-operational area of defence. The Chief of Staff of the Army, Navy, Air Force and the Arma of the Carabinieri is hierarchically dependent from the Chief of the Defence General Staff, who is directly dependent from the Minister of Defence.

3.3 INSTITUTE FOR ENVIRONMENTAL PROTECTION AND RESEARCH

3.3.1 Introduction

The Institute for Environmental Protection and Research (*Istituto superiore per la protezione e la ricerca ambientale* - ISPRA), was established by Decree no. 112 of 25 June 2008, converted into Law no. 133 (with amendments) on 21 August 2008. ISPRA performs, with the inherent financial resources, equipment and personnel, the duties of:

- ex-APAT, Italian Environment Protection and Technical Services Agency (article 38 of Legislative Decree no. 300, 30 July 1999, and subsequently amended)[3];
- ex-INFS, *Istituto Nationale per la Fauna Selvatica* - National Institute for Wildlife (Law no. 157 of 11 February 1992, and subsequently amended);
- ex-ICRAM, *Istituto Centrale per la Ricerca scientifica e tecnologica applicata al Mare* - Central Institute for Scientific and Technological Research applied to the Sea (Decree no. 496, article 1-bis, 4 December 1993, converted into Law no. 61, Article 1, 21 January 1994, with amendments).

ISPRA is the Italian nuclear safety authority. It is technically, scientifically and financially autonomous and reports directly to the Ministry of the Environment and the Protection of the Territory and of the Sea (MATTM). ISPRA operates in three-year programmes which are annually updated. These programmes aim at the implementation of directives issued by MATTM, by setting objectives, defining priorities and allocating resources.

3.3.2 Main statutory responsibilities

The main duties and statutory responsibilities of ISPRA as the Italian nuclear safety authority, so as to fulfil the obligations laid down in Decree Nr. 230 are:

- Controls and inspections on existing nuclear installations;

[3] APAT (*Agenzia per la Protezione dell'Ambiente e per i Servizi Tecnici* - Agency for Environmental Protection and Technical Services), one of the predecessors of ISPRA, was created in 2002 by merging ANPA with the Department for National Technical Services of the Presidency of the Council of Ministers (provision of Presidential Decree Nr. 207 of 8 August 2002). the former National Environmental Protection Agency, ANPA (*Agenzia Nazionale della Protezione dell'Ambiente*), was established by Art. 38 of Legislative Decree Nr. 300 of 30 July 1999.

- Licensing of new nuclear installations;
- Controls and inspections on the possession, commerce, transport, use and release of radioactive materials;
- Controls and inspections on radioactive waste management;
- Radiation protection of workers, the public and the environment;
- Nuclear emergency preparedness;
- Fulfilment of international agreements on control and surveillance of nuclear materials;
- Promotion of international co-operation in the field of nuclear safety and radiation protection;
- Promotion of actions aimed at maintaining and improving the national know-how and the national safety culture in the field of nuclear safety and radiation protection.

In addition to these duties, ISPRA also has to:

- Support the national administrations (environment, health, home affairs and industry) to issue decrees that implement primary nuclear legislation;
- Issue specific technical guidance;
- Realise a national database on all nuclear applications;
- Assess the safety analysis carried out by the operating organisation;
- Inspect equipment and materials during the design, construction and operational phases (systematic operational safety verification);
- Enforce actions to remedy any failure to meet the licensing conditions and/or operational safety criteria.

In order to guarantee homogeneity of survey criteria, and following the directives of MATTM, ISPRA

- co-ordinates measurements carried out by the agencies and institutions belonging to the national network in order to assure uniform techniques and methodologies of sampling and analysis;
- promotes the installation of sampling and measurement stations whenever this is necessary for the achievement of an appropriate survey network on a national scale;
- transmits the collected data to the European Commission;
- co-ordinates and supervises the implementation of the environmental radioactivity monitoring in the Italian regions by ARPAs and APPAs.

4 ENVIRONMENTAL RADIOACTIVITY MONITORING IN ITALY

4.1 INTRODUCTION

In Italy, the Ministry for the Environment and the Protection of the Territory and of the Sea is responsible to control environmental radioactivity in accordance with article 104 of Legislative Decree no. 230/1995 and its subsequent amendments and integrations. The national system of environmental radioactivity monitoring is based on a set of networks for surveillance, measurements and controls carried out by different structures distributed throughout the territory. The above mentioned Legislative Decree entrusts ISPRA with the technical coordination functions of national surveillance networks. Italy has been divided in three "macro-regional areas" and 21 autonomous regions/provinces. In compliance with the Italian legislation the surveillance of the environmental radioactivity in Italy is organized at three different levels:

At national level there are three networks. The first one is the RESORAD network that includes all regional/provincial agencies for environmental protection (ARPA/APPA) and other qualified bodies (such as the Italian Red Cross – CRI and the *Istituti Zooprofilattici Sperimentali* – IIZZS). The IIZZSs, which are participating to the RESORAD network since October 2012, are public bodies operating in the framework of the National Health Service, coordinated by the Ministry of Health, with duties related to food safety and welfare and animal health. There are 10 institutes covering all the Italian regions which perform specific activities for the entire national health system and for the international organizations with which they collaborate and they have national monitoring programmes for radioactivity in feed and foodstuffs. Data collected from the network are sent to EC according to Art. 36 of the Euratom Treaty. The Institute for Environmental Protection and Research (ISPRA) ensures the technical coordination of this network.

The other two networks are part of the national telemetric alarm system, developed as a support system to the National Plan of Protective Measures against Nuclear and Radiological Emergencies, with an early warning and fallout detection function after a nuclear emergency potentially affecting large parts of the national territory. They are under the direct responsibility of ISPRA. These networks consist of about 60 automatic stations for the monitoring of gamma dose rate in the air (GAMMA network) and 7 automatic stations for the air particulate measurements (REMRAD network). The two networks also contribute to the routine monitoring of environmental radioactivity required by Art. 35 of the Euratom Treaty.

At regional level, there are 21 regional/provincial environmental radioactivity surveillance networks, each of which is under the responsibility of the concerned region or autonomous province. Currently the related programmes are implemented by the laboratories of the regional/provincial environmental protection agencies (ARPA/APPA).

In the case of a nuclear installation the radioactivity monitoring network has to be operated even if the site is under decommissioning. These networks are under the responsibility of the plant operator. Monitoring on and around military bases is generally performed through collaboration between the armed forces and civilian bodies (e.g. ARPAs).

Additionally there is a national network for the surveillance of gamma radiation under the responsibility of the Ministry of the Interior. Data collected from this network are considered confidential and are not publicly available. This network was not part of the verification.

4.2 NATIONAL NETWORKS FOR ENVIRONMENTAL RADIOACTIVITY MONITORING

The national monitoring programmes for monitoring environmental radioactivity (Art. 104 Legislative Decree 230/95) and for alarming in the event of an emergency are established and co-ordinated by ISPRA.

The laboratory-based national environmental radioactivity monitoring programme RESORAD is developed as a subset of the regional laboratory-based environmental radioactivity monitoring programmes, adapted to the EU Recommendation 2000/473/Euratom. The parameters covered by the programme are selected by ISPRA, which also influences and controls the regional implementation and the further development of the system. The RESORAD programme is implemented by the laboratories of the regional/provincial agencies (ARPA, APPA) and other qualified institutions. The automatic systems GAMMA and REMRAD are managed directly by ISPRA. The GAMMA network is connected to the European Radiological Data Exchange Platform (EURDEP).

The aim of the monitoring networks is surveillance of environmental and dietary contamination and identification of anomalous variations of radioactivity as a result of a nuclear accident. They serve to assess the radiation doses which the Italian population may receive and to produce data to support the management of emergencies.

4.2.1 RESORAD network

The sampling network RESORAD has been set up to give information on the average extent of environmental and dietary contamination. The 'ideal' sampling programme should provide representative samples able to reveal the average situation both in time and space. RESORAD is generally a subset of the regional/provincial sampling network with a selection of parameters to allow a picture at national level.

In order to guarantee that the laboratories participating in the RESORAD network perform measurements with a certain degree of accuracy and quality, ISPRA carries out a quality assurance programme through organisation of inter-comparison and inter-laboratory exercises. The programme is performed with the collaboration of the National Institute of Ionising Radiation Metrology (INMRI) of the Italian National Agency for New Technologies, Energy and the Environment (ENEA).

The sampling programme has been defined in accordance with the EU Recommendation 2000/473/Euratom[4] and in agreement with the organisations participating in the National

[4] Commission Recommendation 2000/473/Euratom of 8 June 2000 on the application of Article 36 of the Euratom Treaty concerning the monitoring of the levels of radioactivity in the environment for the purpose of assessing the exposure of the population as a whole (OJ L 191, 27 July 2000, page 37 – 46).

Environmental Radioactivity Network. A general overview of the programme is shown in table 1. Data of this network are routinely transmitted to the European REM database, located at the JRC.

Table 1: Sampling programme of the RESORAD network

Matrix	Sampling frequency	Measurement frequency
Air particulates	Daily	Monthly
Fallout	Monthly	Monthly
Aquatic Environment	Six-Monthly	Six-Monthly
Drinking water	Six-Monthly	Six-Monthly
Milk	Weekly	Monthly
Meat	Monthly	Three-Monthly
Cereal and by-product	Seasonal	Seasonal
Complete meal = mixed diet	Three-Monthly	Three-Monthly
Vegetable	Seasonal	Seasonal
Fruit	Seasonal	Seasonal

4.2.2 Automatic dose rate monitoring networks

The REMRAD and GAMMA automatic monitoring networks have been installed in compliance with the Council Decision 87/600/Euratom on the basis of the experience acquired after the Chernobyl accident.

The main tasks of these networks are to confirm the information produced by the international notification systems, in particular when the national territory is involved in a possible contamination situation, and to generate an early warning where data exchange information would not be available. They are also meant to inform about the actual radiation levels following radioactivity fallout due to contamination crossing the national territory. Data from these networks are routinely transferred to the ISPRA data centre in Rome.

To fulfil its institutional duties in the emergency preparedness at national level, ISPRA has an integrated support system for decision making in the case of a nuclear emergency, which provides early notification and information exchange, early warning, prognosis of the possible evolution of the radioactivity released to the atmosphere and measurement results of the actual contamination level on the national territory.

GAMMA network

In Italy external gamma dose rate monitoring is mainly performed by the national telemetric network GAMMA, which consists of some 60 ambient gamma dose rate probes, mostly placed at sites of the National Forestry Corps.

Each measuring station is composed of:

- A gamma dose rate probe (IGS421B; manufacturer: TechniData AG, formerly Hörmann, now Envinet, Markdorf, Germany) composed of three GM counting tubes: two redundant large volume tubes for low dose rate levels, allowing the detection of minor changes in the radiation level (down to about 10 nGy/h) and the third counting tube for higher radiation levels (up to about 10 Gy/h); the probe integrated control unit automatically switches between the detectors.
- A data-logger unit (DLM 1450, model ROSA, software version 15.01, LOGEM LGM 28.8D1; manufacturer: TechniData AG, formerly Hörmann, now Envinet, Markdorf, Germany) for the automatic collecting, storing and transmission of measured data and system status messages to the network control centre at the Nuclear Emergency Centre at the headquarters of ISPRA. Local data transfer to e.g. a notebook computer is possible via an RS232 interface.
- A rain sensor (model *RD202*, on/off type) is connected to the system in order to allow taking into account the increase of the dose rate due to precipitation (washout effect of radon decay products).

The detection range of the gamma dose rate devices is 10 nSv/h to 10 Sv/h for photon energies of 40 keV–1.25 MeV; the operating temperature range is from -40°C to +60°C. Data are presented as equivalent ambient dose rate. The measuring time of the devices is 1 minute. Data are collected every

10 minutes and every hour. Data transmission to the ISPRA centre is by ISDN and analogue lines (six stations). Data are automatically checked by software and if necessary an alert by email is given. According to the EURDEP criteria, and following the analysis of the measurement trends, the alert threshold level is set at twice the background value.

Technicians from ISPRA perform the routine service for all stations of the GAMMA system in Italy; check sources are available at the ISPRA headquarters. ISPRA still has a technical assistance contract with *TechniData*; all instrument documentation from *TechniData* is available. For protection the stations are located in fenced areas. Local batteries provide a 72 hours power back-up.

Data collected by this network provides input to the European EURDEP platform, with a daily transmission in routine operation and 10 minute transmission intervals under emergency conditions. In the event of a malfunction, the network sends an alarm signal to the GAMMA network control centre at the ISPRA Emergency Centre enabling the operator to effectively supervise operation of the remote stations.

The GAMMA network is integrated also with the regional automatic networks of Arpa Valle d'Aosta (5 stations), Arpa Piemonte (29 stations) and Arpa Emilia Romagna (7 stations) involving a total of 41 gamma dose rate stations. The technical and operational responsibility of the regional network lies with the regions and regional environmental agencies (not serviced by ISPRA). The Nuclear Emergency Centre of ISPRA ensures the transmission to the EURDEP platform also for the monitoring data collected from regional networks, after their conversion into the EURDEP data format.

In central regions of Sardinia and Tuscany there are eight stations of the GAMMA network, as shown in table 2.

Table 2: Location of GAMMA network stations in the central Italy regions of Sardinia and Tuscany

Region	District	Locality Name
Sardinia	Cagliari	Cagliari - Poetto
Sardinia	La Maddalena	La Maddalena
Sardinia	Oristano	Abbasanta
Tuscany	Arezzo	Montevarchi
Tuscany	Grosseto	Ansedonia
Tuscany	Grosseto	Massa Marittima
Tuscany	Livorno	Cecina Marina
Tuscany	Lucca	Bagni di Lucca

REMRAD network

The REMRAD network is a network of seven automatic monitoring stations located mainly at Air Force sites though used for civilian purposes, performing measurements of airborne radioactive particulates and acting as an early warning system. The stations are located in places of meteorological relevance chosen with a view of covering the most probable access routes of radioactivity in case of an accident in a plant outside Italy.

The dose rate detectors installed in this system are not connected to the general national dose rate monitoring system (GAMMA) and thus also not to the EURDEP system. Data transmission to the centre at ISPRA in Rome is by ADSL. The REMRAD automatic stations are able to perform the following functions:

- air particulate sampling on a continuous fibreglass filter tape;
- on-line measurement of the alpha/beta total and artificial component;

- delayed (5 days after the sampling) measurement of artificial alpha/beta;
- on-line high resolution gamma spectrometry analysis by an electrically cooled HPGe detector;
- ambient gamma dose rate measurement;
- measurement of local meteorological parameters.

The monitoring equipment is manufactured by *Perkin Elmer Berthold*. The nominal air flow rate is 25 m^3/h; the filter tape is advanced by means of a capstan which is provided with slits allowing the sampled air to pass through them to the collection area at close distance (4 mm) from the detector.

The alpha/beta detectors (prompt and delayed measuring units) are ZnS/plastic sandwich scintillators coupled to 2" NaI photomultiplier tubes. Integration time for alpha/beta measurement is 60 min in routine conditions and 10 min in the emergency mode. The detection limit for on-line artificial beta measurements is about 0.5 Bq/m^3.

For the high resolution gamma spectrometry devices, the spectrum analysis is performed every 2 hours on a sampling window of 24 hours. In addition, a daily sum spectrum is produced and analysed. Detection limit of Cs-137 is less than 1 mBq/m^3 for the sum spectrum and a few mBq/m^3 on the 2 hours spectrum.

There is one REMRAD automatic station in Sardinia. It is located in Capo Caccia (Alghero) and hosted by an Italian Air Force base. There is no REMRAD station in Tuscany.

4.3 NATIONAL RADIOACTIVITY MONITORING OF THE ENVIRONMENT AND FOODSTUFFS

In December 2006 the Ministry for the Environment and the Protection of the Territory and of the Sea (MATTM) started a programme to support the environmental monitoring, part of which was devoted to implement and reorganise the radioactivity monitoring in the environment and in foodstuffs including radon and NORM.

The programme is carried out through an agreement between MATTM and ISPRA called "Technical support to the Ministry of Environment and Protection of the Territory and of the Sea for the elaboration of guidelines and methodological approaches in the framework of environmental safeguards".

The Operative Details Plan (*Piano Operativo di Dettaglio*, POD) of the Agreement was approved in 2009 and the activities started in September 2009. The main objective is harmonisation between the national network RESORAD and the 21 regional/provincial networks. The foreseen activities are the revision of the regional monitoring plans in terms of sampling media, sampling locations, radionuclides, sampling frequencies and measurements and MDA's, in accordance with the Recommendation 2000/473/Euratom and the EU Basic Safety Standards. Moreover, some guidelines will be developed and national intercomparison exercises will be carried out in cooperation with the National Primary Institute of Metrology for Ionizing Radiations (ENEA–INMRI). The end of this agreement has been scheduled for January 2014.

In 2011, following indications of the Ministry of Environment and Protection of the Territory and of the Sea, ISPRA and the ARPA/APPA Agency System, with the participation of the Health Ministry, the National Health Institute and the IIZZSs, started an activity to define guidelines for the radioactivity monitoring at national and regional level that have been published in December 2012[5].

At the opening meeting of the verification the verification team was informed that on the level of the federal ministries responsible for environment and health a decree is being drafted with regard to a re-organisation of regional monitoring. Taking into account the recommendations of past EC verification visits the collaboration between the regions should be strengthened, e.g. by forming 'macro-regions' whose members would split part of the monitoring tasks. This could be in the form of taking over some specific laboratory methods, for sample analysis, for the whole 'macro-region', while another partner would take up other specific tasks for the group.

[5] http://www.isprambiente.gov.it/it/pubblicazioni/pubblicazioni-del-sistema-agenziale/linee-guida-per-il-monitoraggio-della-radioattivita

4.4 REGIONAL ENVIRONMENTAL RADIOACTIVITY MONITORING

4.4.1 Introduction

The regional/provincial programmes for environmental radioactivity monitoring are under the responsibility of the regional/provincial governments. Following the directives of the Ministry of Health and of the Ministry for the Environment and the Protection of the Territory and of the Sea, under the coordination of ISPRA, the regional/provincial agencies for environmental protection (ARPA/APPA) propose and implement these programmes. These should include the sampling and subsequent laboratory analysis of air (particulates), precipitation (fallout), various waters, soil and food (milk, pasta, mixed diet, meat, cereals, vegetables, and fruits).

In Italy there are nineteen administrative regions and two autonomous provinces. Each of them has its own environmental protection agency (ARPA/APPA), established by special regional laws and responsible to the local government. The ARPA/APPAs are environmental control and technical support bodies for the regional/provincial, district and local authorities. Generally, the competences of the regional agencies are almost the same as those of ISPRA. Although sponsored by their regions/provinces the ARPA/APPAs are administratively and technically independent. A list of all agencies can be found in Appendix 3.

The regional programmes used to be very different – there were remarkable differences of implementation of the monitoring programmes for environmental radioactivity proposed by ISPRA between north and south Italy. In 2006 some regions in central and southern Italy had very little environmental radioactivity monitoring. The purpose of several verifications (this one and the ones in 2010 and 2011) was to verify progress achieved in this area by the central and southern regions since the Article 35 verification in 2006.

4.4.2 Regional radioactivity monitoring of the environment and foodstuffs in central Italy

Since 2006 measurements have been carried out in central and southern regions of Italy. Data include monthly aggregated results of the daily measurements of ambient gamma dose rate and airborne particulates. Data from IIZZSs are still not available for all regions, since the participation of IIZZSs in the RESORAD network only started in October 2012. In table 3 the number of analysed samples by regional laboratories in 2005, 2009, 2010, 2011 and 2012 are shown.

Table 3: Number of samples analysed by regional laboratories in 2005 and 2009 - 2012

Region / ARPA	Samples 2005	Samples 2009	Samples 2010	Samples 2011	Samples 2012
Abruzzo	120	31	90	100	120
Lazio	0	76	170	318	290
Marche	180	30	30	260	220
Molise	93	38	44	82	34
Sardinia	399	582	403	345	500
Tuscany	112	220	481	230	430
Puglia	75	88	135	172	330
Basilicata	-	195	200	283	210
Calabria	-	55	169	150	114
Sicily	81	18	89	102	103
Umbria	170	266	188	237	232
Campania	-	57 (*)	-	210	320

(*) Data produced, but not in format compatible with the RADIA-DBRad/REM data base.

In the following chapters, detailed information on the currently performed activities and on the planned monitoring programmes of the Sardinia and Tuscany Regions is reported. The monitoring activities of radon and NORM are excluded unless explicitly mentioned.

5 AUTOMATIC ENVIRONMENTAL RADIOACTIVITY MONITORING NETWORKS IN SARDINIA AND TUSCANY – VERIFICATION

5.1 GENERAL

The verification team was informed that currently 56 of the 60 GAMMA stations in Italy were in operation, the others were being relocated. The devices show the measured values locally in Gy/h, reflecting the ambient (gamma) dose equivalent rates (Sv/h). In a few locations the detector probes are installed in such a way that the active measuring volume is situated much higher than 1 m above ground (the 'ideal' position).

The verification team encourages all efforts to find solutions for placing the equipment in locations that are technically well suited and easily manageable in the long-term. It is recommended to have all GAMMA detector probes at an effective height of 1 m above ground, without obstacles in the surroundings and to use the same unit for displaying the measurement values.

5.2 SARDINIA

In Sardinia, automatic gamma dose rate monitoring stations of the national GAMMA system are located at Cagliari-Poetto, La Maddalena, and Abbasanta. A REMRAD automatic station is located in Capo Caccia (Alghero). The team verified the stations at Cagliari-Poetto, La Maddalena and Capo Caccia.

5.2.1 Cagliari-Poetto

The station of the GAMMA network is located in the Carabinieri barracks at Piazza San Bartolomeo in Cagliari-Poetto. The detector installation site is fenced and locked. The team noticed that the equipment was of 'standard' Italian open-space setup with rain sensor. The location of the station is very good in a wide plain ten meters away from the nearest building. The active volume of the probe is ca. 1 m above ground.

The equipment is a DLM 1450 gamma dose rate device from *Hörmann/TechniDATA* (model *ROSA*, version 15.01, serial number 0072, with intelligent gamma probe *IGS421B*, serial nr. 141; installed on 5.5.1999). The key for the electronics cabinet was locally available with the responsible contact person. The status messages, including ISDN line availability and battery capacity were all 'ok'; the alarm threshold was set at 0.3 µGy/h. At the time of the verification, the ambient dose rate value was 0.100 µGy/h. A log-sheet was available locally showing the last large repair on 1.4.2009.

Data transmission is normally performed every day to the data centre in Rome. In intensive mode this will be performed each half hour. Data can be consulted manually from the data centre in Rome at any time.

Verification does not give rise to specific remarks.

5.2.2 La Maddalena

The station no. 61 of the GAMMA network is located in the harbour area of La Maddalena. The probe, equipped with a rain sensor, is located on top of a two meter high metal cabin, close to a pedestrian area. At the time of the visit the cabin containing the electronics was locked, as was also the gate in the wall.

The probe is well located, on the side of a road. The probe is mounted at ca. 2.5 m above ground, close to the street, 15 meters distance of a two storey building. The device is basically the same type as the one verified at Cagliari, however a 'building' mounted version. No log sheet was available at site.

The status messages were all 'ok'; the last data transfer had been 2 hours before. The ambient dose rate value was 0.146 µGy/h as median.

The verification team suggests having the log sheet locally available in order to facilitate control tasks. The team would also encourage considering a location where mounting of the detector probe at 1 m above ground would be possible.

5.2.3 Capo Caccia, Alghero

The station, despite being used for civilian purposes, is located at the meteorological station of the Aeronautica Militare base. The station is located on a hill, with only low growing bushes in the vicinity and no trees, 50 m away from the next building. The area is fenced and protected by a locked gate.

The team was shown a technical inspection of the station carried out by a technician from ISPRA. However, at the time of the visit, there were no data transmissions due to works on the data transmission system.

The system includes an automatic air monitor, containing an alpha/beta detector and a high resolution gamma spectrometry device (*EG&G Berthold BAI 9100-DG*, 2 *Micrologger BAI 9111*; electrically cooled HPGe with 30% relative efficiency and 1.85 keV resolution; cooler control with *Ortec CryoSecure*; *Ortec DSPEC LF* digital data handling; devices in locked container; step filter band method; flow rate 25 m^3/h). On the roof of the container some meteorological measurement devices and a gamma dose rate probe are mounted. The technical manual, calibration files (*Amersham, DKD* certificates) etc. were available at the place.

Normally there is a remote control from ISPRA Rome but due to works by *Telecom* this was not available. The verification team was informed that ISPRA performs basic maintenance (calibration checks, change of filter band) once every 6 months.

An important item for the location and for the situation in Italy in general is that there is air conditioning to guarantee stable temperature and thus stable operating conditions during winter and summer.

Verification does not give rise to specific remarks.

5.3 TUSCANY

In Tuscany, automatic gamma dose rate monitoring stations of the GAMMA system are located at Montevarchi, Ansedonia, Massa Marittima, Cecina Marina and Bagni di Lucca. The stations consist of a probe with 3 detectors, 2 for low and 1 for high dose rates. There is no REMRAD station in this region.

The verification team visited four of the five stations. In all cases the operation of the station could be verified and full service records were available within the securely locked instrumentation box.

5.3.1 Montevarchi

The station is located on the lawn within the boundary of the Corpo Forestale dello Stato offices, without any fencing. A nearby tree is likely to cause obstruction in the coming years. One rain detector is incorporated.

The verification team suggests looking closely at the risk of obstruction due to nearby trees.

5.3.2 Bagni di Lucca

The station is located in a fenced area within the boundary of the Corpo Forestale dello Stato offices on the outskirts of the town. There are no obstructions nearby which could disturb the operation of the station at the current time or in the foreseeable future.

Verification does not give rise to specific remarks.

5.3.3 Cecina Marina

The station is sited on the edge of a grass field belonging to the Corpo Forestale dello Stato at a place used for growing trees for future plantation. Some nearby shrubs (±1.8 m tall) and higher trees (at ± 15 m) currently do not obstruct the device. The station is somewhat inland in a quiet residential area. No additional fencing was in place.

Verification does not give rise to specific remarks.

5.3.4 Massa Marittima

The gamma probe is placed in an unfenced area on ground belonging to the Corpo Forestale dello Stato. At the time of the visit a hedge containing a number of high trees (>7-8 m) was worryingly close to the probe. Whilst the branches do not as yet directly obstruct the probe this is likely to be an issue in the near future, notwithstanding the risk posed by falling branches.

The verification team suggests looking closely at the risk of obstruction due to nearby trees.

6 REGIONAL ENVIRONMENTAL RADIOACTIVITY MONITORING IN SARDINIA AND IN TUSCANY - VERIFICATION

6.1 SARDINIA

6.1.1 Regional legislative acts regulating environmental radioactivity monitoring

Following the Circular Letter of the Ministry of Health n. 2/1987 a Regional Reference Centre (RRC) for the monitoring of environmental radioactivity (*Centro Regionale Radioattivitá - CRR*) was established in Cagliari (*Delibera della Giunta Regionale n. 49 del 27/10/1987*).

Since 1990 the RRC and the Laboratory of La Maddalena (work performed by the Sassari Local Health Service department) have been carrying out environmental radioactivity monitoring, based on a general regional programme defined by the Regional Health Department.

The Regional Agency for Environmental Protection of Sardinia (ARPAS), established under the regional Decree of 30 September 2002, n. 323, confirmed in 2006 by the Regional Act of May 18 2006, n. 6, is the technical reference institution for environmental monitoring.

6.1.2 Radioactivity monitoring organisation

The analytical laboratories involved in the monitoring of environmental radioactivity are:

- Regional Reference Centre for the monitoring of environmental radioactivity (RRC-Sardinia). Via F. Ciusa 6 I-09100 Cagliari;
- Environmental radioactivity laboratory – Sassari Department. Via Rockfeller, 58-60 I–07100 Sassari.

The available measurement techniques are listed in table 4.

Table 4: Available measurement techniques in Sardinia's laboratories

Available measurement techniques	Cagliari	Sassari
Gamma Spectrometry	x	x
Gamma dose rate	x	x
Liquid scintillation	x	
Gross beta	x	x
Sr-90	x	
H-3	x	
Gross alpha	x	x
Alpha spectrometry	x	

Alpha spectrometry and determinations of Sr-90 were carried out in Cagliari until 2008. These methods should have re-started in 2011, but have been delayed due to lack of specialised personnel. The fixed term contract of the staff member foreseen for performing this work expired. The specialist has not been adequately replaced, and the existing staff still has to follow specific training courses. The personnel currently involved in the radioactivity monitoring are reported in table 5.

Table 5: Personnel currently involved in the radioactivity monitoring in Sardinia

Personnel	Units	Man-Months/Year
Responsible	2	3
Graduate	1	4
Technician	3	24
Support		

The fixed sampling locations of the monitoring programme are listed in table 6.

Table 6: Fixed locations for environmental sampling in Sardinia

Location	Prov.	Sampling media	Radionuclide
Cagliari/Via F. Ciusa 6	CA	Airborne particulates	Cs-137, I-131, K-40, Be-7
Sassari/ Via Rockfeller, 58-60	SS	Airborne particulates	Cs-137, I-131, K-40, Be-7
Sassari/ Via Rockfeller, 58-60	SS	Fallout	Cs-137
Cagliari/Via F. Ciusa 6	CA	Fallout	Cs-137, Sr-90
Cagliari/Via F. Ciusa 6	CA	Gamma dose rate	
Sassari/ Via Rockfeller, 58-60	SS	Gamma dose rate	

6.1.3 Ambient dose rate monitoring

Ambient gamma dose rate monitors are installed on the premises of the two regional laboratories, in Cagliari and in Sassari. Both devices are from Genitron (now Saphymo). At the time of the verification they were out of operation, because the batteries were empty. Due to delays caused by the change from Genitron to Saphymo and also for financial reasons the batteries had not yet been replaced. Two spare probes that are also available cannot be used for the same reason.

The verification team recommends finding a viable solution for the replacement of the batteries and to re-install the devices as soon as possible.

6.1.4 Regional radiological monitoring

Table 7 gives an overview of the sampling media (environmental and foodstuff samples) and the analysed radionuclides by ARPA Sardegna in 2011 - 2012. Foodstuffs samples are picked up by the Local Health Services mainly from large scale distributers in non-fixed sampling points. Some samples of feed and foodstuffs from the Sardinia region are analysed by the IZSs of Puglia and Basilicata within the framework of the national programme.

Table 7: Overview of environmental and foodstuffs samples (2011 and 2012)

Sampling media	Radionuclide	N. of samples 2011	N. of samples 2012
Fallout	Gamma spectrometry	14	9
Airborne particulates	Gamma spectrometry	166	77
Waste water	Gamma spectrometry	64	97
Sea water	Gamma spectrometry	20	
Mussel (environmental sample)	Gamma spectrometry	12	20
Sewage treatment plant	Gamma spectrometry	9	39
River sediment	Gamma spectrometry	-	-
Sea sediment	Gamma spectrometry	-	-
Milk	Gamma spectrometry	51	64
Drinking water	Gamma spectrometry	-	-
Lettuce	Gamma spectrometry	39	32
Meat	Gamma spectrometry	50	62
Cereals (pasta, flour)	Gamma spectrometry	18	46
Fish	Gamma spectrometry	19	34

Fruit	Gamma spectrometry	16	34
Cheese	Gamma spectrometry	23	48

With regard to the situation in 2013 (and onward) the following describes the plans and programmes foreseen at regional level.

General programme

The environmental radioactivity monitoring and the collaboration with the RESORAD network is established in ARPAS's general programme of activity (2012-2014). The general programme of the Agency has been defined and approved by "ARPASs Coordination Committee" that includes the regional departments of Health and of Environmental Protection. Details of the planned programme for radioactivity monitoring are listed in table 8.

Table 8: Detailed planned regional programme for radioactivity monitoring in Sardinia (Cagliari (CA); Sassari (SS))

Sampling media	Measurement	Frequency of measurement	Measurements/year
Airborne particulates	Cs-137, I-131, K-40, Be-7	Weekly (CA) Monthly (SS)	52 12
Fallout	Cs-137, I-131, Be-7 Sr-90	Monthly	24 12
Air	Ambient gamma dose rate	Monthly	24
Drinking water	Cs-137, Sr-90, H-3 gross alpha, gross beta	Half-yearly	10
Sea water	Cs-137, Sr-90	Half-yearly	
Waste water	I-131, In-111, Tc-99m, Cs-137	Half-monthly	90
Mussel (environmental sample)	Cs-137	Half-yearly	12
Sewage treatment plant	I-131, In-111, Tc-99m, Cs-137	Half-monthly	48
Cereals	Cs-137, I-131	Monthly	24
Milk	Cs-137, I-131, Sr-90	Monthly	48
Dairy products	Cs-137, I-131	Monthly	
Fruit	Cs-137, I-131	Monthly	24
Vegetables	Cs-137, I-131, Sr-90	Monthly	36
Meat (bovine, pork, ovine)	Cs-137, I-131	Monthly	50
Fish	Cs-137, I-131	Monthly	24

Foodstuffs

The regional official foodstuffs control plan 2011-2012-2013 and the regional official foodstuffs control plan 2012-2013-2014 have been adopted in order to ensure a system of control and surveillance of foodstuffs, which must comply with food legislation at all stages of foodstuff production, processing and distribution.

In this plan, among other activities, controls of different food matrices including drinking water are planned. Gross α and gross β radioactivity determinations are planned exclusively for drinking water analyses. The sampling plan is defined by the Public Health Services (ASL) based on particular risk analysis.

Animal feed

The official animal feed Regional Control Plan, approved by the Director of the Regional Department of Health, determines sampling activities for radionuclide determinations.

The central Competent Authority for the nationwide control of animal feed (Ministry of Health) defines the national planning regarding sampling media, analysed radionuclides, and the number of

samples for each region. The Regional Department of Health redistributes, based on risk analysis, the total number of samples to be made between the different local ASL.

The ASL carries out the sampling plan and sends the samples to the IZS for subsequent laboratory analysis. Test reports are sent to the ASL, which reports half-yearly to the Region that in turn reports to the Ministry of Health.

At national level the matrices (animal feed) to be sampled for analysis of radionuclides are defined for the following species: pigs, cattle, rabbits, poultry, aquaculture, and other species significant for regional production or regional consumption. Product categories prevailing in the region shall also be considered, as well as raw materials which may be considered as main animal feed components (soybeans, legumes, etc.).

At regional level annually five samples of animal feed are to be taken; one at ASL 4, one at ASL 8 (small ruminants feed), one at ASL 8 (pork feed), one at ASL 6 and one at ASL 7 (bovine feed and meat production). The ASL numbers correspond to different regional districts (ASL n. 8 is the area around Cagliari, ASL n. 4 is the area around Lanusei, ASL n. 6 is the area around Senorbì and ASL n. 7 is the area around Iglesias.). For each official sample four sub-samples have to be taken.

The plan foresees a progressive increase in the radionuclides to be measured during the three years of the plans validity as follows:

- Year 2012: K-40, Cs-137, Cs-134, I-131

- Year 2013: K-40, Cs-137, Cs-134, I-131 / Sr-90

- Year 2014: K-40, Cs-137, Cs-134, I-131 / Sr-90 / U-Pu isotopes

6.1.5 ARPAS laboratory Cagliari - Verification

The team verified the radiological unit of the ARPA Sardegna laboratory in Cagliari, located at Viale Ciusa 6.

At the time of the verification there was only one person trained for the handling of samples with elevated levels of radioactivity and the corresponding measurements (including gamma spectrometry). Another person could also perform sample preparation and measurement handling (i.e. sample change) but was not trained for result validation and interpretation.

> *The verification team points out that it is important to maintain sufficient staffing at the laboratory, in particular with regard to trained personnel for specific tasks (e.g. radiochemical analyses).*

Sample registration

According to the task distribution between the laboratories in Cagliari and Sassari samples for radiological analyses come from the provinces Cagliari, Olbia and Oristano. All samples are registered in a LIMS (*'Prelab'*, modified software, installed in 2011) which is used for the whole laboratory, and in a paper log book. The sample codes are composed by the year of sampling plus the sample location (e.g. 'CA' for Cagliari) and a running number. Other data complete the unique identification of every sample (e.g. sampling date, sample substance, sampling person). Information on which analysis has to be performed is only available in the LIMS, not in the log book. Every sample is accompanied by a sample sheet, which records the registration number, the date and time of arrival and an indication to which unit/department the sample is addressed (e.g. 'FI' – physics).

As a demonstration of the LIMS, the team was shown that 12 aerosol samples were treated in 2013. The results were not put into the LIMS, because the radiological unit personnel was not yet familiar with this part of the system. In future it is planned to enter these data also into the LIMS.

The LIMS has a barcode possibility, but this is not yet used for radiological samples, because for the moment the radiological laboratory has no interfaces between measuring devices and the LIMS network/data base.

The same structure is also used in the ARPAS laboratory in Sassari. Thus, ARPAS-Cagliari can read Sassari data (but not change them).

The verification team encourages entering measurement results in the LIMS. It recommends using appropriate semi-automatic interfaces for this task, in order to avoid manual data input which can be a source of errors.

Sample preparation

Cooled sample storage is available for milk, meat, fish, etc... At the time of the verification the sample treatment staff was on holiday. The chemistry laboratory is quite large and well equipped. The team witnessed muffle furnaces (not used for radiological samples) and a dryer (*Memmert ENCO*) for foodstuff (drying at 80 – 100°C). Water samples are evaporated in a 20 l glass beaker on a heater with a magnetic stirrer (*FALC*). For measurements with LSC 100 ml samples are evaporated to 10 ml.

The team was informed that for large fallout samples there were problems in drying, which means that staff is not confident about the measurements performed. Therefore in Cagliari these analyses had been stopped for the moment. Currently the Cagliari laboratory has collaboration with the Sassari laboratory with the intention to adapt the methodology developed in Sassari for such samples to the Cagliari laboratory.

The verification team encourages finding an appropriate sample preparation method and re-starting fallout measurements.

Measuring devices

Gamma spectrometry

The laboratory runs two gamma spectrometry systems, one with equipment from *Canberra* (HPGe detector with ca 50% efficiency, resolution 1.8 keV, *Canberra* NIM devices; calculations are performed using *Genie 2000*), and an 'old' *Ortec* system (35% HPGe detector, *Ortec* NIMs, with *GammaVision 42* Version 6.1 software for calculations).

For gamma spectrometry there is an internal registry in a log book. It contains information on the measuring device used, the sample weight defining the measurement geometry, etc...

Spectrum energy calibration is performed using the K-40 peak of the samples. The team was told that an energy drift is noticed rather often, approximately every 2 months, which means that staff has to re-tune the amplifier settings. There is no fixed schedule for energy and efficiency calibrations. Background measurement is done once per year using ultra-pure water blank samples.

The geometries used are: 150 ml, ½ l, 1 l and 2 litre Marinelli beaker and a '30 filter packet' geometry which is also used for large filters put into an appropriate form. No density or summing corrections are applied.

Calibration sources are provided by the Czech Metrological Institute. The laboratory also uses old calibration sources from Amersham. The laboratory has encountered problems with Cs-137 analysis when taking part in the wild berry intercomparison exercise organised by the JRC-IRMM. The team was told that the staff had done a new calibration just for this test, but obtained deviating results; it was thought these were due to wrong data in the calibration source description. Using another calibration, the laboratory obtained good results. Currently a 10 kVA UPS is available for all devices of the radiological unit. There is an intention to switch to a 25 kVA device in combination with a diesel generator that would serve all laboratories.

Other measurement devices

The team witnessed also the presence of an LSC device from *Perkin Elmer* (model *Quantulus*) which is used for alpha and beta activity measurements. A *Berthold LB770 10 channel low level counter* with *LB530PC low radioactivity data system* is planned to be used in future for Sr-90 determinations (the last Sr-90 analysis took place in 2011).

An *Ortec Octète* plus alpha spectrometer with an *Edwards* vacuum pump was available but also not in operation.

For radon determinations *CR-39* polycarbonate film is used for the track etch method and a *Genitron Alphaguard* device for direct measurements.

A contamination monitor that could be used for checks of incoming samples of higher activity was broken; a foot contamination monitor was available.

The verification team suggests finding a firm explanation of the deviating wild berry inter-comparison results, in order to be able to use the available calibration sources with reasonable certainty.

The verification team suggests repair of the contamination monitor and use it e.g. for screening incoming samples for their radioactivity level in order to avoid lab contamination.

Quality management

The laboratory does not have accreditation, but it is hoped that preparation for accreditation can soon be started. The procedures in place in the radiological unit are simple and practical; at the time of the visit they were not available at the working places in writing. The laboratory participates in inter-comparison exercises organised on both national and international level.

The verification team recommends putting an effort in gaining accreditation for the whole laboratory. As a first step written procedures could be developed, e.g. in collaboration with other regional laboratories.

Tracing

The team consulted online the ISPRA RADIA database and selected an aerosol sample from January 2012 (sample 12CA00114) for tracing purposes. The value for Be-7 in the database (unreasonable MDA value of <.0005 Bq/m^3) did not compare with the (much more reasonable) value of (3.351E-3 ± 7.517E-5) Bq/m^3 in the laboratory's spectrum analysis and *Excel* data system, where an MDA of 4.54E-5 Bq/m^3 was shown. The explanation given was that by error (while testing an experimental semi-automatic interface for selected values of the gamma spectrometry system to the LIMS) the calculated MDA (minimum detectable activity) was taken as the measured activity concentration value.

Archiving

Every three to four months all data are archived on a 'mainframe' computer using a USB device for data transfer.

Reporting

Usually there is no direct reporting of measurement data. Data are transferred to the annual general report. All data are transferred also to the ISPRA RADIA database.

Roof area

The *Genitron* probe for ambient gamma dose rate measurements mounted on the roof of the building was out of order. After several years of operation the batteries were changed, but the problems persisted and in February 2013 the laboratory sent the device to *Saphymo*, Germany for service but did not yet get it back. The location on the roof of the building is very good (flat roof with no significant obstacles). The high volume aerosol sampler (*HiVol Analitica strumenti*; flow rate 200 litres/min) of the laboratory was the first one in Italy to detect Cs-137 after the Fukushima accident in March 2011. Filter material is fibreglass. The flow measurement of the sampler was calibrated when installed; no checks or re-calibrations are possible because of the lack of equipment.

For fallout sampling four square plates covered with a protective net are installed on the roof (total sampling area ca. 1.5 m^2). Sampling used to be for one month, but was stopped due to a water quantity issue: the samples contained a lot of deposited material that during measurement sank down in the Marinelli beaker disturbing the measurement geometry.

A small meteorological station is also available on the roof.

The verification team recommends follow-up with Saphymo with regard to fixing the ambient gamma dose rate device in order to resume the gamma dose rate measurements.

6.1.6 ARPAS laboratory Sassari - Verification

The team verified the radiological unit of the ARPA Sardegna laboratory in Sassari, located at Via Rockfeller 35, in a building that at the time of the verification visit was under renovation.

Sample registration

Sample preparation and measuring areas are located in one large room. There is no entry control for the activity of the samples (so that higher activity samples could be handled differently, e.g. prepared in another area). The sample registration procedure is different from the one used in Cagliari, as it is not centralised: each unit does its own registrations. All samples are registered in a LIMS (same as in Cagliari) and in a log book. For the paper log there is a general register protocol number. The sample codes are composed of the year of sampling plus the sample location and the LIMS code. Other data complete the unique identification of every sample (e.g. sampling date, sample substance, sampling person). 'Official' samples, e.g. such from sewage purification plants, come in sealed form; in such cases there is also a respective remark, e.g. 'seal ok'.

> *The verification team suggests checking incoming samples for their radioactivity level by screening in order to avoid contamination of the measuring lab when preparing samples with higher activity.*

Sample treatment

Sewage water and sludge

Sewage water is poured directly into a Marinelli beaker. Measurement is as soon as possible, normally within one day after arrival. Sewage sludge arrives in cylindrical beakers; measurement is done over the following weekend.

> *The verification team suggests exploring the possibility of measuring sewage sludge very soon after sampling and using some fixation of the sludge with suitable means (for example with cellulose wallpaper paste – Metylan; attention: this influences the K-40 value). Such fixation would allow avoiding changes of geometry during measurement by sedimentation and would allow a reasonable detection of short lived radionuclides such as Tc-99m coming from medical uses. The verification team is aware that such detection is not a specific task of the laboratory (whose original programme is rather restricted to the determination of Cs-137).*

Fallout samples

Precipitation ('fallout') samples are prepared for measurement using an ion exchange methodology. First, filtering into a large container (60 l) is performed using a 63 µm lab test sieve (*Endecotts Ltd.*, UK). Then a peristaltic pump (*VELP scientifica SP311*) pumps the solution on top of a cation exchange resin column (*BIO-RAD AG®* 50WX8 resin, 100-200 mesh, hydrogen form). After loading of the column, the resin is eluted using HNO_3. The elute is collected in a 1 l Marinelli beaker which is used for the gamma spectrometric measurement. Control is by using the natural K-40 content as a 'tracer'. The laboratory only determines Cs-137, Be-7 and radioiodine (according to the programme of ISPRA). The team was told that the method used is seen as qualitative. The team noted that the column was rather dry and not very homogeneous.

> *The verification team is aware that the lab's programme only asks for qualitative determination of a few radionuclides. However, with a view to improving the method applied and increasing its range, the team suggests experimenting with a triple column – glass fibre, cation exchange resin and anion exchange resin. This could allow a more quantitative radionuclide determination. In any case, the team recommends taking care that the column doesn't dry out and that the filling is homogeneous.*

Measuring devices

Gamma spectrometry

The laboratory runs two *Canberra* gamma spectrometers (one HPGe detector having 30% relative efficiency and a resolution of 1.81 keV, the other one 50% rel. efficiency and 1.7-1.8 keV resolution; analogue NIM electronics is from *Canberra*). The laboratory uses *Canberra Genie 2000* software for calculations. The team noted check labels on the devices.

The shields consist of 10 cm Pb with Cu lining; no cling film for end cap protection is used. Quality control is performed weekly using QA plots with a Eu-152 sample (energy, resolution and efficiency checks). Background is determined every 2 months, after cleaning the shields inside.

No UPS is available for the moment though the lab has the intention to purchase one. A spectrum archive is available on PC with a backup on the server. Once per year a general backup is done on tape by the IT group of the ARPAS Sassari laboratory.

Alpha/beta

For (gross) alpha and beta activity measurements a *Berthold LB770 10 channel low level counter* is available but not used anymore. Sassari has no liquid scintillation counter, therefore the plan is to perform alpha/beta activity measurements in Cagliari. The procedures for transport and sample preparation have not yet been decided; this depends also on the local authority.

The verification team encourages the installation of a suitable UPS device.

The verification team encourages finding a quick solution to rebuild the routine capacity for alpha and beta measurements.

Other equipment

The verification team noted the presence of an air sampler in the lab of the same type as the sampler installed on the roof of the lab in Cagliari, however with a complete PM10 head which was used for taking air samples after the Fukushima accident. A muffle oven (*Nabertherm*) and a soil crusher (*Fritsch*) were also available.

The radiological unit also has a metal 1 l Marinelli beaker with tight insulation that can be used for Rn measurements.

Tracing

For tracing purposes the verification team chose the air filter of 31.8.2012 (beginning of sampling) from ISPRA's on-line RADIA database (sample identification 13SS00024). The choice was restricted due to the fact that in 2012 only 7 air filters were taken and analysed (the pump was broken for a while). The results for Be-7 in RADIA (5 ± 0.6 mBq/m^3) and in the lab's gamma spectrometry report file showed complete agreement.

Quality management

The laboratory has no accreditation for gamma spectrometry. Until 2-3 years ago it had accreditation for Cs-137 in food (milk etc.). The laboratory participates in inter-comparison exercises (eg. IAEA). The team was shown the good results in one such exercise.

The verification team recommends regaining accreditation at least for the most common analysis methods.

Roof area

Gamma dose rate

Similar to the situation for the ARPAS laboratory in Cagliari a gamma dose rate measurement probe was mounted on the roof of the building, but it was now out of order, probably due to a problem with the batteries. The device had been sent to Germany (*Genitron/Saphymo*) for service but had not yet come back. The original position on the roof of the building is very good.

As for the laboratory in Cagliari, the verification team recommends follow-up with Saphymo regarding repair of the device in order to resume the gamma dose rate measurements.

Fallout

Fallout sampling is performed using combinations of five, four and three large plastic pots (diameter ca. 60 cm each), giving different sampling surface areas. The pots are filled with about one to two cm of distilled water, which is refilled when the pots run dry due to evaporation.

Aerosol sampler

A high volume aerosol sampler (*HiVol Analitica strumenti*) is situated on the upper roof. Nominal flow rate is 200 litres/min. This device is not equipped with a PM10 head. Filter changes are performed daily, except on Saturday and Sunday. The team was informed that the Sassari and Cagliari laboratories will collaborate for air flow rate checks.

6.2 TUSCANY

6.2.1 Regional legislative acts regulating environmental radioactivity monitoring

The regional law (LR 32/2003 of 7 July 2003, n. 32 "*Disciplina dell'impiego di sorgenti di radiazioni ionizzanti*") assigns to the Reference Regional Centre for radioactivity of the Agency for Environmental Protection of Tuscany (ARPAT) the management of the regional network for monitoring environmental radioactivity. This attribution was confirmed with the regional law "*Nuova disciplina dell'Agenzia regionale per la protezione ambientale della Toscana*" (LR 30/2009) that includes environmental radioactivity control among the duties of ARPAT.

6.2.2 Regional programme for radioactivity monitoring

The Tuscany regional monitoring programme for 2013 is presented in table 9. Details for the fixed sampling locations of the monitoring programme are given in table 10. Table 11 provides details for the radiological monitoring in 2009 to 2011. In table 12 the sampling media and the methods of analysis by ARPAT in 2011-2013 are listed.

Table 9: Tuscany's regional programme for environmental samples and foodstuffs (2013)

Sampling media	Measurement	Frequency of measurement	Measurements /year
Airborne particulates	Cs-137	Daily	262
Air	Ambient gamma dose rate	Daily	2920
Fallout	Cs-137	Monthly	12
Surface water, SMOD	Cs-137	Quarterly	28
Drinking water	Cs-137, Rn-222 gross alpha, gross beta,	Variable	52
Sea water	Cs-137	Half-yearly	6
Sea sediment	Cs-137	Half-yearly	15
Sewage purification plant	I-131, In-111, Tc-99m, Cs-137	Half-yearly	24
Waste water	I-131, In-111, Tc-99m,	Half-yearly	24
Fume dust, bottom ash of municipal waste treatment plants and sanitary	I-131, In-111, Tc-99m, Cs-137, Ra-226	Yearly	8
Geothermal fluids	Rn-222	Three years	
Other environmental sampling media	Gamma spectrometry	Variable	6
Mushrooms	Cs-134, Cs-137, K-40	Variable	20
Foodstuffs	Cs-134, Cs-137, K-40	Variable	48

Table 10: Fixed sampling, locations, media, and radionuclides analysed in Tuscany

Fixed location	Prov.	Sampling media	Radionuclide
Firenze/Via Ponte alle Mosse 211	FI	Airborne particulate	Cs-137, Cs-134
Firenze/Via Ponte alle Mosse 211	FI	Fallout	Cs-137, Cs-134, Be-7, C-60
Grosseto/ via Unione Sovietica (43°31'08,20"N 10°19'14,90"E)	GR	Gamma dose rate	
Livorno/piazza L. Cappiello, (43°31'08,20"N 10°19'14,90"E)	LI	Gamma dose rate	
Massa/via Galvani, 10 (44°02'14,030"N 10°08'07,80"E)	MS	Gamma dose rate	
Prato/ via Roma, 101 (43°52'24,30"N 11°05'32,50"E)	PO	Gamma dose rate	

Firenzuola/ Passo del Giogo (FI) (44°02'50,30"N 11°23'20,60"E)	FI	Gamma dose rate	
Pisa/ piazza Del Rosso (42°46'40,00"N 11°07'05,60"E)	PI	Gamma dose rate	
Settignano (FI)/via Desiderio da Settignano (43°47'17,30"N 11°19'23,20"E)	FI	Gamma dose rate	
Stia (AR)/Papiano Alto (43°49'54,00"N 11°42'04,20"E)	AR	Gamma dose rate	
Firenze/Lungarno Ferrucci, Circolo Canottieri di Firenze	FI	SMOD	Cs-137, I-131
Calcinaia (PI)/Circolo Canottieri di Calcinaia (43°40'59"N 10°36'56"E)	PI	SMOD	Cs-137, I-131
Firenze/Lungarno Ferrucci, Circolo Canottieri di Firenze	FI	River water	Cs-137, I-131
Calcinaia (PI)/Circolo Canottieri di Calcinaia (43°40'59"N 10°36'56"E)	PI	River water	Cs-137, I-131
Istia d'Ombrone – Grosseto (GR) (42°46' 41"N 11°11'15"E)	GR	River water	Cs-137, I-131
Sansepolcro (AR) (43° 33' 55"N 12° 07' 15"E)	AR	River water	Cs-137, I-131
Costa Versilia - Marina Carrara	MS	Sea sediment	Cs-137, I-131
Costa Serchio - Nettuno	LU	Sea sediment	Cs-137, I-131
Costa Pisana - Fiume Morto	PI	Sea sediment	Cs-137, I-131
Costa Livornese - Antignano	LI	Sea sediment	Cs-137, I-131
Livorno Porto	LI	Sea sediment	Cs-137, I-131
Costa del Cecina - Rosignano Lillatro	LI	Sea sediment	Cs-137, I-131
Costa Piombino - Salivoli	LI	Sea sediment	Cs-137, I-131
Costa Follonica -Carbonifera	GR	Sea sediment	Cs-137, I-131
Costa Ombrone -Foce Ombrone	GR	Sea sediment	Cs-137, I-131
Costa Uccellina - Cala Forno	GR	Sea sediment	Cs-137, I-131
Costa Albegna - Foce Albegna	GR	Sea sediment	Cs-137, I-131
Costa Argentario - Porto S.Stefano	GR	Sea sediment	Cs-137, I-131
Costa Burano Ansedonia - Orbetello	GR	Sea sediment	Cs-137, I-131
Arcipelago Toscano Elba Nord - Portoferraio	LI	Sea sediment	Cs-137, I-131
Arcipelago Toscano – Isola di Montecristo	LI	Sea sediment	Cs-137, I-131
Costa Pisana - Fiume Morto	PI	Sea water	Cs-137, I-131
Livorno Porto	LI	Sea water	Cs-137, I-131
Costa Burano Ansedonia - Orbetello	GR	Sea water	Cs-137, I-131
Firenze/via Ponte alle Mosse, 211 - 50144 (43°46'38"N 11°14'55"E)	FI	Drinking water	Cs-137, I-131
Grosseto/ via Scansanese 150, Consorzio Produttori latte Maremma	GR	Milk	Cs-137
Firenze/ via dell'Olmatello 20, Centrale del latte di FI, PT e LI	FI	Milk	Cs-137
Capannori (LU)/ via Circonvallazione Colognora di Compito 1/3, C.A.P.L.A.C. Soc. Coop. Ar.l.	LU	Milk	Cs-137
Castel Del Piano / Via del Gallaccino N° 19 - Mattatoio Macellai Riuniti	GR	Meat, bovine	Cs-137

Table 11: Radiological monitoring in 2009 - 2011 by ARPAT (environment and foodstuffs)

Samples/media	Parameter	N. of samples 2009	N. of samples 2010	N. of samples 2011
Airborne particulate	Gamma spectrometry	12	12	5
Fallout	Gamma spectrometry	12	12	11 (7 Fukushima incident)
Air/deposition	Gamma dose rate	12	12	5
River water	Gamma spectrometry	8	4	3
Ground water	Gamma spectrometry,	4	3	-

	gross alpha, gross beta			
Spring water	Gamma spectrometry	3	-	-
SMOD	Gamma spectrometry	5	4	3
Sea sand	Gamma spectrometry	1	-	-
Sea water	Gamma spectrometry	1	-	-
Soil	Gamma spectrometry	13	5	-
Mud depuration plant	Gamma spectrometry	-	10	3
Waste water	Gamma spectrometry	-	19	7
Fume dust, bottom ash of municipal waste treatment plants and sanitary	Gamma spectrometry	-	18	-
Geothermal fluids	Rn-222	22	12	-
Milk	Gamma spectrometry	36	43	19
Drinking water	Gamma spectrometry, gross alpha, gross beta and Rn-222	42	29	10
Mushrooms	Gamma spectrometry	25	60	11
Other foodstuffs	Gamma spectrometry	24	21	24 (17 Fukushima incident)

Table 12: Environmental and foodstuffs samples by ARPA Toscana (2011-13)

Sampling media	Method of analysis	N. of samples 2011 (*)	N. of samples 2012	N. of samples 2013
Airborne particulate	Gamma spectrometry	253	270	262
Fallout	Gamma spectrometry	18	12	12
Gamma dose rate		96	96	96
River water	Gamma spectrometry	6	12	20
SMOD	Gamma spectrometry	8	5	8
Sea sediment	Gamma spectrometry	7	10	15
Sea water		2	6	6
Soil	Gamma spectrometry			
Mud depuration plant	Gamma spectrometry	25	20	24
Waste water	Gamma spectrometry	23	39	24
Fume dust, bottom ash of municipal waste treatment plants and sanitary	Gamma spectrometry	8	4	8
Milk	Gamma spectrometry	48	36	36
Drinking water	Gamma spectrometry, gross alpha, gross beta and Rn-222	36	70	52
Mushrooms	Gamma spectrometry	57	61	20
Other foodstuffs	Gamma spectrometry	28	68	48

(*) The number of samples in 2011 includes radioactivity monitoring during the release from the Fukushima Daiichi nuclear power plant; in particular, the following samples were added to the annual program: milk (9), vegetables (8) and fallout (6).

Some samples of feed and foodstuffs taken in the territory of the Tuscany region are analysed by the IZSs of Tuscany and Lazio in the framework of their national programme. In table 13 the sampling media, the number of samples and the method of analysis for the IZS samples are reported for 2011 and 2012.

Table 13: IZSs of Tuscany and Lazio, samples from Tuscany

Sampling media	Method of analysis	N. of samples 2011	N. of samples 2012
Fish	Gamma spectrometry	5	2
Molluscs (lamellibranches)	Gamma spectrometry	7	1
Molluscs (cephalopods)	Gamma spectrometry	9	2
Crustacean	Gamma spectrometry	1	
Feeds	Gamma spectrometry	1	5
Mushrooms	Gamma spectrometry		1
Other foodstuffs	Gamma spectrometry	1	10

6.2.3 Ambient dose rate monitoring

Description

A total of eight ambient dose rate monitoring stations are operated by the regional authorities, six of which are sited with air quality monitoring stations (ozone, particles etc.) whilst two mountain stations are at altitudes over 800 m (Stia and Passo del Giogo), both situated at meteorological monitoring stations.

The air quality monitoring stations are manufactured by *CAE* s.p.a. and are equipped with *FHZ 621* gamma dose rate detectors (from *Thermo Electron Corporation*). The gamma probes are attached to the upper corner of the container which houses the electronics, thus situated at 2.5-3 m above ground level. All containers are securely locked and have no windows. The technical characteristics of the detectors are:

- measurement range — 100 nSv/h – 100 mSv/h
- linearity — <10% for Cs-137
- gamma response — typically 9.5 cps per µSv/h
- energy range — for 30 keV to 1.3 MeV within ±30%
- operating temperature — -30°C to +60°C
- serial interface — RS-485

The monitoring system was calibrated when installed and after that during every planned system maintenance. The stations are energy independent thanks to a solar panel which can provide 30 W of power, sufficient to supply the monitoring stations and keep the 115 Ah battery charged for use during night and when the solar panel cannot provide enough power.

Data can either be read on a display within the container or by connecting a laptop computer, the latter offering a better display, particularly of peaks. Data are transferred by GPRS.

Access to the system is available at four points: at the station itself, in the regional headquarters, in the Florence laboratories and in Livorno. Daily the mean standard deviation is checked and the monthly mean is sent twice a year to ISPRA. It is necessary to connect to the system to verify the status of each station; no automatic alarm or alert system is in place.

Verifications

The verification team visited five of the eight stations which comprise the Tuscany region gamma dose rate network. The Stia station was not feasible for verification as it is located in the mountains and would have involved a long journey which would have adversely affected the verification programme. Nevertheless the team were shown photos which clearly showed that the probe was located at a similar height to all others in an open area of grass with some small trees in the vicinity, but not obstructed. The stations at Firenzuola and Massa had been excluded from the verification due to the distance involved.

Florence (Settignano)

The station is located on the edge of a suburb of the city. It has some trees growing nearby but these do not obstruct the probe. The station's operation was demonstrated to the team. This station also measures the rain fall.

Prato

This station is situated on the grounds of the local administration. Though the site is surrounded by houses and there are also trees within the boundary there is no obstruction. After opening the container the station was found to be working well.

Pisa

The station is located on a small square close to the city centre along the banks of the river Arno. Though there were a number of tall trees in the area they do not obstruct the probe. The verification team could check the good functioning of the system.

Livorno

Located on a small square in a suburban area close to the coast there was no obstruction from buildings or any vegetation. A small Cs-137 source was placed near the probe with a view to demonstrating the station's operation. Following two 15 minute cycles the peak could be very clearly seen.

Grosseto

The container of the station is sited in the middle of a large parking in a built up area of the town. Despite a number of large trees in the area there is no obstruction. Unfortunately due to a problem with the key it was not possible to gain access to the gamma display (though the container itself could be opened).

> *The verification team recommends verifying the availability of keys to access the containers and the gamma dose rate equipment.*

6.2.4 ARPAT laboratory Florence - Verification

The team verified the radiological unit of the ARPA Toscana laboratory in Florence, located at Via Ponte alle Mosse 211. The analytical laboratory involved in the monitoring is the Department of Radioactivity and Asbestos. The available measurement techniques are shown in table 14 and the personnel situation in table 15. The number of man months refers to radioactivity including radon measurements and extra laboratory activities (control). The personnel involved are 10 graduated staff and technicians, but some of them are partially devoted to the asbestos laboratory.

In addition to this particular laboratory, which specialises in radioactivity analyses, dioxins and asbestos there are two further ARPAT laboratories in Siena and Livorno, which were not part of the verification.

Table 14: Measurement techniques available at ARPAT

Available measurement technique	
Gamma Spectrometry	x
Gamma dose rate	x
Liquid scintillation	x
Sr-90	
H-3	
Gross alpha	x
Alpha spectrometry	

Table 15: Personnel involved in radioactivity monitoring at ARPAT

Personnel	Units	Man-Months/Year
Responsible	2	17
Graduated	5	52
Technician	3	32
Support	several	2

The verification team was given a comprehensive tour of the various laboratories and were provided with detailed explanations concerning the equipment used and the analyses performed, and additionally the quality control and quality assurance processes.

Shortly before the verification, staff and instruments had moved to a new 150 m^2 building (excluding office space). There are 8 persons devoted to radioactivity analyses (5 physicists, 3 technicians). Since 1998 the laboratory is accredited according to ISO 17025. In addition, ARPAT has a management system with general requirements for control activities according to ISO 9001.

The radioactivity laboratory has three accredited methods: gamma spectrometry in milk and in foodstuffs, radon by means of nuclear track detectors and since May 2013 liquid scintillation for drinking water. The other methods are kept under control according to the principles of the quality assurance programme, which includes:

- Validation of the methods;
- Estimation of uncertainty of measurement;
- Calibration of the instruments;
- Quality control of equipment and data, i.e. regular (when possible yearly) participation to intercomparison exercises and use of control charts.

Samples which arrive to an office outside the laboratory area are first checked to see if they belong to the regional radioactivity monitoring programme. It was noted that the analysis of samples for third parties, outside the official programme, is prohibited by law. All samples are stored at the appropriate temperature (room temperature, chilled or frozen). Details concerning all samples for analysis are introduced into the laboratory's computerised system which automatically generates a sequential number in the form of a bar code which accompanies the sample to the laboratory. Several labels are generated to cover samples which will be subdivided for various analyses.

Samples which may present a radioactivity hazard, together with those samples to be disposed of as "hazardous" waste, are stored in a separate room.

Samples are preserved at the appropriate temperature until the results have been issued, typically 30-60 days for official samples. If the sample is part of a legal process it is held until proceedings have been concluded.

A centralised computer system is in place for all quality control documents which can be accessed from any workstation. In addition all operating instructions and technical manuals are stored centrally and updated as necessary. The system also includes records of the methods for which each member of staff has been trained and authorised to carry out measurements. Details of all intercomparisons (IAEA, JRC etc.) in which the laboratory has participated are also archived online.

All calibration sources are securely stored in shielded safes in a locked room to which a limited number of people have access and only on the basis of it being necessary.

The laboratory is equipped with over 80 instruments both for general purpose and for measuring radioactivity, with new facilities for radiochemistry. The radioactivity analysis instruments of the laboratory are 3 gamma spectrometers (Ortec, the latest, recently installed features low background and low energy detection) and Quantulus 1220 ultra-low level LSC. Gamma detectors are located in a separate air conditioned room. In addition there are 2 scales (for small and large masses) and various machines for the preparation of samples (mixer, homogeniser etc.).

All measurement devices have calibration certificates. The gamma spectrometers are subject to stringent annual checks; efficiency controls are carried out monthly. Since 2008 the centralised informatics system contains information concerning the maintenance and availability of all instruments. An email is sent daily to the responsible person concerning the status of all instruments, thus allowing him to take action if a particular instrument is unavailable for whatever reason (repair, maintenance etc.).

The first check on surface water samples is their conductivity to determine the degree of evaporation required, the samples having previously been stabilised with HNO_3 to ensure a pH of 3. The conductivity meter is verified monthly using standard solutions. In addition pH standard solutions are available to be used to ensure that samples have the correct pH.

Following analysis of all samples the results are printed and subject to a two stage approval process; firstly by the supervisor and secondly by the laboratory manager. In addition to their physical signature they are required also to electronically sign in the LIMS. For security reasons a double backup is made regularly by the competent informatics department.

There is a chemical laboratory for the preparation of drinking water samples for liquid scintillation analysis. Due to the location of the laboratory in an urban area a radioisotope fume cupboard has been installed at the end of May 2013 with a view to ensuring the lowest possible emissions, but had not been used up to the date of the verification.

Laboratory staff was quickly and efficiently able to produce result protocols for a number of randomly selected samples analysed in 2012, including one sample which had been divided into three separate samples. All showed that the strict quality control and quality assurance procedures had been adhered to.

Within the grounds of the Florence laboratory the verification team were shown two high volume air samplers located on the rooftop of a small building, which have a throughput of ± 860 m^3 of air per day. At any given time only one of the samplers is in operation; normally they operate on alternate days. This ensures that in case of any problem there is a "reserve" sampler already in place ready to continue the air monitoring. Filters are changed daily. Annual calibration is by an accredited Italian authority.

A total of 4 fallout samplers, protected by a fine wire mesh, giving a total area of 2 m^2 were also seen.

An important activity is indoor radon measurements with over 20 000 samples having been analysed between 2006 and 2010 covering in excess of 2000 dwellings with 4000 monitored rooms, 1200 workplaces with 3500 monitored rooms and 1200 schools in all 287 municipalities in the region. Indeed Tuscany is the only Italian region which has radon prone areas. Two *Saphymo Alpha Guard* radon monitors which offer a measurement range of 2 – 2 000 000 Bq/m^3 are used mainly in schools.

Equipment available for field measurements in case of an emergency includes three *Exploranium* hand held radioisotope identification devices, two *GR-130 miniSPEC* portable gamma ray spectrometers (third one is available in Livorno) and an *Automess* GM counter. No designated vehicles are allocated for the transport of this equipment, but the laboratory has a small fleet of cars and vans at its disposal.

> *The verification does not give rise to any specific recommendations. It is evident that great progress has been made in the last few years on the management of the laboratories. In this respect the verification team fully endorses any improvements which may be implemented with a view to further improving the laboratory management. It is hoped that as a minimum sufficient resources will be made available to ensure that the current high standard is maintained.*
>
> *With regard to highly specific tasks involving radiochemical sample preparation such as alpha spectrometry and analysis of Sr-90 the team recommends co-operation between the ARPAs/APPAs. Such co-operation should achieve that not each laboratory has to perform each of these complex analyses. For some tasks (e.g. with regard to mass spectrometry) other units of the local ARPA/APPA could be involved. Necessary training for such tasks could be organised and given by ISPRA. The team points out that in particular radiochemical work should be performed as a routine task to guarantee continuity and to reach a reasonably high qualitative standard.*

7 RADIOACTIVITY MONITORING AROUND MILITARY AREAS IN SARDINIA

7.1 BACKGROUND

In 2004 the Italian government instituted a Parliamentary Commission of inquiry concerning "*cases of death and serious diseases that hit Italian military staff used in international missions of peace on conditions of storage and the possible use of depleted uranium in military exercises on the national territory*"[6].

The report of the inquiry included the military areas[7] in Sardinia. The Parliamentary Commission recommended a review of the regulations for the management of the activities of these areas.

In 2006 a new Parliamentary Commission of inquiry was established concerning again "*cases of death and serious diseases that hit Italian staff used in military missions abroad, in military polygons and in ammunition storage sites, as well as civilian populations in conflict and adjacent areas in military bases on the national territory, with particular attention to the effects of the use of depleted uranium bullets and the release of nanoparticles of heavy minerals produced by military exercises into the environment*"[8]. The Parliamentary Commission essentially dealt with sanitary consequences, also in military areas and reiterated the need for a careful control of activities conducted and materials used in Italian military areas with particular attention to the monitoring of health issues and of the environment, in the structures and in the adjacent areas.

In 2010 a further Parliamentary Commission of inquiry concerning the same issues has been instituted[9]. The Parliamentary Commission dealt with the Italian military issues with particular attention to installations in Sardinia. The activities of the Parliamentary Commission encouraged the Italian Ministry of Defence to start in 2008 an environmental characterisation, including radioactivity monitoring, in the Salto di Quirra inter-forces experimental test site and training ground (PISQ).

Information from different sources reveals data concerning a high number of malformations in livestock in the Salto di Quirra region and an abnormally high number of death cases by cancer of herdsmen in that region. Occasionally, this incidence of illnesses was referred to as "Quirra syndrome". Very often the effect was reported to be related to military testing of new weapons in that region, particularly highlighting thorium, depleted uranium and nanoparticles stemming from these tests. One source found in the open literature also mentions the possibility of an (additional) influence of the former Baccu Locci arsenic mine that is situated in the area[10]. Additionally it has been reported that the prosecutor of Lanusei has ordered the exhumation of a number of dead herdsmen in order to analyse radionuclides, especially thorium, in their bones, by specialised institutes.

In preparation for an Article 35 verification mission to Sardinia in June 2013, the Commission services informed the Italian authorities that they would appreciate receiving full information concerning these effects reported in the media and noticed in animals and humans living in the surroundings of the PISQ.

7.2 SITUATION IN SARDINIA

7.2.1 Introduction

There are several military sites in Sardinia, among them "Salto di Quirra" (PISQ) and the island of San Stefano (La Maddalena).

[6] http://www.senato.it/service/PDF/PDFServer?tipo=BGT&id=187639

[7] In the Italian documents, the word 'poligono' is typically used for these military testing areas. "Poligono" in Italian means a shooting range (for training or military purposes).

[8] http://www.senato.it/service/PDF/PDFServer/BGT/298458.pdf

[9] http://www.senato.it/service/PDF/PDFServer/DF/288867.pdf

[10] M. Zucchinetti "Environmental Pollution and Health Effects in the Quirra Area, Sardinia Island (Italy) and the Depleted Uranium Case", Journal of Environmental Protection and Ecology, Vol. 7, No. 1, pg. 82-92 (2006)

Salto di Quirra inter-forces experimental test site and training ground is an Italian Armed Forces site established in 1956. It is located in a large area (about 130 km^2) between the provinces of Cagliari and Ogliastra. It includes the base and the "ground" site of Perdasdefogu and the detachment of the Air Force at Capo San Lorenzo with the site named "at sea". Inside the main military area specific "high intensity military areas" are defined in which different activities such as testing of missiles, helicopter and tank firing, dropping of bombs, etc. were conducted.

From 2001 onwards, large scale environmental sampling and monitoring programmes have been undertaken inside and outside the "high intensity military areas"[11] by different local administrations (Ministry of Defence, Local Health Service (ASL), Regional Health Department, Regional Environmental Department, University etc.).

In 2003 a radiochemical analysis of U and U-235/U-238 was conducted by the CRR Cagliari in the context of an environmental investigation conducted by the NOE requested by the Military Prosecutor's Office. The sampling sites were identified by the Military Prosecutor's Office and the CRR of Cagliari carried out the analytical determinations.

From 2008 to 2011 a large environmental monitoring programme was conducted by the Italian Ministry of Defence. Within this programme more than 2000 samples of soil, plants, animals and foodstuffs have been analysed and two continuous radioactivity monitoring stations for the analysis of alpha, beta and gamma activity in air particulates and for continuous gamma dose rate measurement[12] have been set up. The two automatic monitoring stations are located inside the military areas in Perdasdefogu and Capo San Lorenzo. Environmental samples were taken by the Italian authorities within this programme both inside and outside the military areas; the concentrations of heavy metals, U, Th and the isotopic ratio for U have been determined in most of the samples.

ARPA Sardegna followed and supervised the final part of the sampling plan having had the mandate in the final stages of the survey. It also validated chemical analysis on heavy metals. ARPA Sardegna, on the basis of the results produced by laboratories charged with the monitoring plans, produced an independent report with the environmental considerations arising from the results of all investigations conducted in the area, including exposure to electromagnetic fields, chemical pollution etc.

Between May and November 2011 the Regional Departments of Health and of Environmental Protection promoted a monitoring programme of environmental radioactive contaminants in Salto di Quirra, with the aim of assessing the risk associated with any potential presence of artificial radionuclides (beta and gamma emitters) in foodstuffs, related to military activities.

The sampling programme, carried out by ASL Veterinary Services, included samples of food of animal origin (muscle, organs, cheese, milk) and samples of pasture, several tree species and water.

The samples were taken by ASL and were transferred by IZS-Sardinia to the National Reference Centre for the Research of Radioactivity in the livestock sector (CRNR) of IZS-Foggia, which performed all the analytical tests. This centre works using a quality management system according to ISO-17025; the test methods used are accredited by the national accreditation body Accredia.

At the time of the verification visit, the determination of gamma-emitting radioisotopes by gamma spectrometry of different food matrices was in progress and was expected to be completed by June 2014. 89 herds of animals and specifically all 48 farms in the area of PISQ and 41 in control areas were investigated. The numbers of tests carried out for each matrix and by area of origin are shown in table 16.

[11] http://www.difesa.it/smd_/approfondimenti/poligonoperdasdefogu/Pagine/default.aspx

[12] http://www.iss.it/binary/epam/cont/CTE_PISQ_rid.pdf

Table 16: Number of samples taken for each matrix and by area of origin

Matrix	PISQ	Control areas	Total
Water	21	34	55
Milk	30	40	70
Bodies + Muscle/Bone	16	8	24
Shrubs / woodland pasture	7	10	17
Total	74	92	166

In October 2011, the Autonomous Region of Sardinia requested the Ministry of Health to provide a scientific opinion concerning the risk related to the presence of thorium detected in products of animal origin collected in the provinces of Cagliari and Ogliastra. On the basis of the documentation submitted, the National Committee of Food Security (CNSA) has expressed its view arguing that, based on a conservative estimate of carcinogenic risk associated with the consumption of various foods produced on site, an appreciable increase in the risk of cancer due to prolonged high consumption of those foods is unlikely. In addition, for certain foods for which it was possible to carry out a comparative evaluation, data do not show a clear increase in contamination as compared to areas considered as not exposed.

In 2012 a new environmental monitoring programme has been established by the Ministry of Defence.

7.2.2 ARPA Sardegna

At the opening meeting of the Article 35 verification at ARPA Sardegna in Cagliari, staff from ARPA Sardegna confirmed the information that had been supplied in advance of the visit. It was confirmed that ARPAS had already taken up some tasks with regard to the depleted uranium issue in the past. First samples from PISQ were measured already in 2002 upon a request of the NOE on the mandate of the Military Prosecutor's Office, regarding chemical analysis of heavy metals and depleted uranium. An ARPAS staff member who witnessed the sampling exercise was present at the opening meeting. At that time ARPAS had nearly no information about the military activities at the site. Only about five years ago was ARPAS informed about the structure of the PISQ and its specialised military activities.

PISQ covers an area of about 130 km^2. Since the site is not totally fenced, it is difficult to see what is 'outside' or 'inside' the area. The village of Perdasdefogu is located just outside the military zone (north-west of the site) and it is the location where many military employees live. The fixed automatic monitoring system operated by the military is installed inside PISQ, near its entrance and very close to the village. Thus, this station can be considered to monitor the situation in the Perdasdefogu village.

Among other activities PISQ was a testing ground for Milan missiles. Apparently these missiles were equipped with thorium containing devices. The main testing of these missiles was in the central and south-eastern parts of the site. The large environmental monitoring programme conducted by the Italian Ministry of Defence from 2008 to 2011 evaluated the results of the analysis carried out by the laboratories contracted by the Ministry of Defence of all organic compounds (explosive residue) and inorganic (heavy metals including uranium and thorium) and compared them with natural reference values (background) of samples far from the military site.

The verification team received a data set from ARPA staff indicating uranium contamination in different areas of the PISQ. The data shown did not give information on the U-238/U-235 ratio. Maps were also shown identifying areas of higher thorium and uranium concentration within PISQ as well as outside PISQ. These data indicate, among all the sampling points, only those that show higher values compared to the background values characteristic of each lithology (>1σ of the mean background value), where the natural background values has been determined taking samples for each lithology, in areas away from areas where military activities have been carried out.

The map showed also the Air Force sea base at Capo San Lorenzo, where some weapons tests had been performed. Also for this region of the PISQ site elevated thorium levels were indicated in several spots on the map. In particular in the northern part of the Capo San Lorenzo, a few points showing elevated thorium levels were located inside but also outside the site boundary (northerly part) within the public domain.

A graph with time trends for gross beta aerosol activity measured by the fixed monitoring station at Perdasfogu and particulate measurements with a mobile station at some 8-10 km distance was shown.

The figures gave the impression that there could be a correlation; however, since no uncertainties were shown for the values this could also be a statistical effect.

ARPAS told that work was on-going and no convincing conclusions could yet be found. The authorities advised that a new characterisation plan has been ordered from the military forces. The region of Sardinia will be involved also in this study. Sampling and measurements are planned to start in about four months. Thousands of samples are said to be involved in the characterisation of all kinds of pollution in those areas and, in a further plan, the characterisation of the thorium contaminated areas will be carried out too.

The team was informed by the authorities that the Ministry of Defence states that no depleted uranium has been ever used by Italian forces, NATO or others in Sardinia.

7.2.3 Salto di Quirra

In order to get a complete picture of the situation in the surroundings of Salto di Quirra the verification team met Comandante Sanzio Bonotto, Lt Col. Antonio Massaiu and some five other officers at the operational centre for PISQ in Perdasdefogu. Lt Col. Massaiu gave a detailed presentation of the situation.

As a precaution, the commander had decided to fence some areas in PISQ and ordered characterisation activities concerning these areas.

The team was invited to visit the fixed monitoring station which continuously measures radioactivity (inside PISQ, near the fence, at some 600 m a.s.l.) located beside a meteorological station (measuring temperature, relative humidity etc.). The station (*RTS Instruments Srl*, Rome; air monitor *model RAM 31* with local processing unit *LPU02*; by *West Systems*) is housed in a locked container. The measurements continuously cover gross alpha and gross beta activity on filter, as well as gamma dose rate (at the time of the visit 57 nSv/h).

A mobile station is also available, equipped with the same type of devices and a GPS.

With regard to the former thorium target area the team was informed that fencing the area was on-going using a so called 'New Jersey wall', in order to exclude animals, although no clear evidence of negative effects on livestock from contamination was available.

The commander of the site reported that some soil profiles had been taken; data will also be looked at by ARPAS, with which collaboration was seen as important.

7.2.4 La Maddalena

The monitoring of environmental radioactivity in the archipelago of La Maddalena was carried out for about thirty years, as a result of the operations on the island of San Stefano supporting nuclear-powered submarines of the U.S. Navy.

Monitoring was conducted by the "*Area Fisico-Geologico Ambientale / Presidio Multizonale di Prevenzione AUSL No. 1 di Sassari*", as a part of the Local Health Service. It was divided in two independent stages:

- first level network for continuous monitoring of radioactivity in the water and in the air (3 continuous alpha, beta, gamma monitors in water and 1 continuous gamma dose rate monitoring station);
- basic level network (zero level) for the periodic sampling and analysis of the most relevant environmental samples (marine water, sediments, vegetables, mussels) and various foodstuff samples.

During the monitoring no abnormal effects were detected. The control activity was concluded, following the closure of the U.S. Base, in November 2007. The monitoring network has been dismantled and some of the laboratory instruments have been transferred to the ARPAS Sassari laboratory, where they are still in use.

7.2.5 Verification remarks

PISQ area

Verification team concludes that there is no obvious proof that DU ammunition has been tested in the PISQ area. In certain locations of the site thorium contamination has been measured.

The verification team encourages in-depth studies for characterisation of the situation in the vicinity of the PISQ area. In particular the team recommends a good overview of soil contamination with detailed soil profiles. Such soil profiles should include fine top millimetre-layer sampling, e.g. using vacuuming, 0-2 cm, 2-5 cm, 5-10 cm and lower layer sampling. This should be done in order to be able to distinguish the amount of radionuclides of deposited and of geologic origin.

Concerning measured radionuclide concentrations outside the military area of Capo Lorenzo the team recommends carrying out a study to determine the origin (natural or "manmade") and recommends in the latter case to take all measures to prevent such contamination of the public domain in future.

La Maddalena area

The team witnessed that the former US naval station at La Maddalena has been closed and that all US military activities have ceased.

With regard to the current situation in La Maddalena the verification does not give rise to remarks.

8 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 during and after the verification, was useful.

(1) The verification activities that were performed demonstrated that the national scale facilities necessary to carry out continuous monitoring of levels of radioactivity in the air, water and soil in central Italy (Sardinia and Tuscany) are adequate. The Commission services could verify the operation and efficiency of these facilities in these regions.

(2) The verification activities that were performed demonstrated that the regional scale facilities for monitoring environmental radioactivity on the territory of the regions of Sardinia and Tuscany are adequate and that each of these regions is currently implementing a specific programme for the monitoring of environmental radioactivity. The Commission services could verify the operation and efficiency of these facilities in these regions.

(3) With regard to the laboratories involved in environmental radioactivity monitoring in Sardinia and Tuscany the verification team notes that laboratory staffing should allow that each work task can be performed by at least two persons in order to allow operating a routine programme also during holiday times and in case of sickness of a staff member. The verification team recommends finding a stable solution to achieve this with trained personnel.

(4) With regard to highly specific laboratory tasks involving radiochemical sample preparation such as alpha spectrometry and analysis of Sr-90 the team recommends co-operation between the ARPAs/APPAs. Such co-operation should achieve that not each laboratory has to perform each of these complex analyses. Necessary training for such tasks could be organised and given by ISPRA.

(5) With regard to the depleted uranium issue in Sardinia the verification team encourages in-depth studies for characterisation of the situation in the vicinity of the PISQ area. In particular the team recommends a good overview of soil contamination with detailed soil profiles.

With regard to the measured radionuclide concentrations outside the military area of Capo Lorenzo the team recommends a study to determine the origin (natural or "manmade") and in the latter case to take all measures to prevent such contamination of the public domain in future.

The verification team requests to be kept informed about the outcome of the on-going and future studies, in particular with regard to the situation in areas easily accessible by the public.

(6) In addition, a number of technical recommendations are formulated. These recommendations aim at improving some aspects of the surveillance of environmental radioactivity in Sardinia and Tuscany.

(7) The present Technical Report is enclosed with the Main Conclusions document and is addressed to the Italian competent authorities through the Italian Permanent Representative to the European Union.

(8) The Commission services request a report on the implementation of the recommendations by the Italian authorities and about any significant changes in the set-up of the monitoring systems before the end of 2016. Based on this report the Commission will consider the need for a follow-up verification in Italy.

(9) Finally, the verification team acknowledges the excellent co-operation it received from all persons involved in the activities it performed.

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APPENDIX 1

Verification Programme

Team 1

Euratom Article 35 verification Italy – 17 to 21 June 2013
Sardinia

Sun, 16 June	Travel to Cagliari
Mon, 17 June	Opening Meeting in Cagliari (ARPA Sardegna)
	Verification of GAMMA station in Cagliari
	Verification of ARPA Sardegna radiological laboratory in Cagliari
	Travel to Quirra
Tue, 18 June	Meeting with prosecutor in Lanusei
	Verification in PISQ, Perdasdelfogo
	Travel to Palau
Wed, 19 June	Ferry from Palau to La Maddalena
	Verification at La Maddalena monitoring station
	Travel to Sassari
	Laboratory Sassari
	Travel Sassari to Capo Caccia
Thu, 20 June	Verification of monitoring station, Capo Caccia
	Travel Capo Caccia to Cagliari
Fri, 21 June	Closing Meeting (Cagliari, ARPA Sardegna)
	Return travel

Team: C. Gitzinger, E. Henrich

Team 2

Euratom Article 35 verification Italy – 17 to 21 June 2013
Tuscany

Mon, 17 June	Travel to Florence
	Opening Meeting in Florence (ARPAT)
Tue, 18 June	Verification of ARPAT radiological laboratory and sampling locations in Florence
	Verification of monitoring stations Florence, Montevarchi
Wed, 19 June	Travel to Prato
	Verification of monitoring station Prato
	Travel to Bagni di Lucca
	Verification of monitoring station Bagni di Lucca
	Travel to Pisa
	Verification of monitoring station Pisa
	Travel to Livorno
	Verification of monitoring station Livorno
	Travel to Cecina Mare
	Verification of monitoring station Cecina Mare (return to Livorno)
Thu, 20 June	Travel to Massa Marittima
	Verification of monitoring station Massa Marittima
	Travel to Grosseto
	Verification of monitoring station Grosseto
	Travel to Florence
Fri, 21 June	Closing Meeting
	Return flight to Luxembourg

Team: A. Ryan, C. Hanot

APPENDIX 2

Documentation received and consulted

1. Main Legislation

- Legislative Government Decree Nr 230 of 17 March 1995 transposing the European Directives 89/618/Euratom, 90/641/Euratom, 92/3/Euratom and 96/29/Euratom.
- Legislative Decree Nr 241 of 26 May 2000, amending Government Decree Nr 230.
- Legislative Decree Nr 257 of 9 May 2001, amending Government Decree Nr 230.
- Legislative Decree Nr 151 of 26 March 2001, amending Government Decree Nr 230.

2 Legislative acts regulating environmental radioactivity monitoring

- Circular n. 2 of 3 February 1987 of the Health Ministry "Directives to the Regions for the execution of the controls on the environmental radioactivity".
- Legislative Decree 230/1995 modified to: Legislative Decree187/2000, Legislative Decree241/2000, D.Lgs 257/2001, and Legislative Decree151/2001 "Implementation of EC Directives EURATOM 89/618, 90/641, 92/3/ and 96/29 on ionising radiation" Ordinary Supplement OJ, 13 June 1995, n.136.
- Commission Recommendation 2000/473/Euratom of 8 June 2000 on the application of Art. 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 (Official Journal L 191, 27 July 2000, p. 0037 – 0046).

3 Legislative acts regulating the radiological surveillance of foodstuffs

- Council Regulation EURATOM 3954/87 of 22 December 1987 laying down maximum permitted levels of radioactive contamination of foodstuffs and of feeding stuffs following a nuclear accident or any other case of radiological emergency (OJ L371, 30 December 1987, p. 11). Amended by: Council Regulation EURATOM 2218/89 of 18 July 1989 (OJ L211, 22 July 1989, p. 1).
- Council Regulation EEC 737/90 of 22 March 1990 on the conditions governing imports of agricultural products originating in third countries following the accident at the Chernobyl nuclear power station (OJ L82, 29 March 1990, p. 1ff). Amended by: Council Regulation EEC 616/2000 of 20 March 2000 (OJ L75, 24 March 2000, p. 1).
- Council Regulation EURATOM 944/89 of 12 April 1989 laying down maximum permitted levels of radioactive contamination in minor foodstuffs following a nuclear accident or any other case of radiological activity (OJ L101, 13 April 1998, p. 17).
- Commission Regulation (ECC) 2219/89 of 18 July 1989 on the special conditions for exporting foodstuffs and feeding stuffs following a nuclear accident or any other case of radiological activity (OJ L211, 22 July 1989, p. 4).
- Commission Regulation (EC) 1661/99 of 27 July 1999 laying down detailed rules for the application of Council Regulation 737/90/EEC on the conditions governing imports of agricultural products originating in third countries following the accident at the Chernobyl nuclear power-station (OJ L197, 29 July 1999, p. 17). Amended by: Commission Regulation (EC) n° 1621/2001 of 8 August 2001 (OJ L215, 9 August 2001, p. 18); Commission Regulation (EC) n° 1608/2002 of 10 September 2002 (OJ L243, 11 September 2002, p. 7).
- Commission Recommendation 2000/473/Euratom of 8 June 2000 on the application of Art. 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. Official Journal L 191, 27 July 2000, p. 0037 – 0046).
- Commission Regulation (EC)1609/2000 establishing a list of products excluded from the application of Council Regulation 737/90/EEC the conditions governing imports

of agricultural products originating in third countries following the accident at the Chernobyl power station (OJ L185, 25 July 2000, p. 27).

- Legislative Decree 31/2001, "Implementation of EC Directive 98/83 on the quality of water intended for human consumption" (Ordinary Supplement OJ, 3 March 2001, n. 52).
- Commission Recommendation 2003/274/EURATOM of 14 April 2003 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 (OJ L99, 17 April 2003, p. 55f and OJ L109, 1 May 2003, p. 27).

4 Main national guidance documents

- "Raccolta dei risultati dell'attività dei Gruppi di Lavoro delle Reti Nazionali", ANPA, May 1995.
- CTN_AGF (AGF-T-RAP-99-13) "Rassegna di Bioindicatori per la Radioattività Ambientale", 2000.
- CTN_AGF (AGF-T-RAP-00-13) "Criteri per l'adeguamento degli insiemi di dati sulla radioattività ambientale", 2000.
- CTN_AGF (AGF-T-RAP-01-12) "Assistenza all'ANPA per la revisione delle reti nazionali di controllo della radioattività ambientale", 2001.
- CTN_AGF (RTI CTN_AGF 2/2002) "Guida tecnica sulle misure di radioattività ambientale", 2002.
- CTN_AGF (AGF-T-SFW-01-05) "Sviluppo della banca dati delle reti nazionali di monitoraggio della radioattività ambientale", 2001.
- CTN_AGF (AGF-T-GTE-03-01) "Guida tecnica sulle misure di radioativită ambientale: H-3 α e β totale in acque potabili, α e β emettitori artificiali e naturali in matrici ambientali", 2004.
- CTN_AGF (AGF-T-RAP-03-15) "Adeguamento della rete nazionale della radioattività ambientale: completamento della proposta operativa e integrazione con la rete d'allarme", 2005.
- CTN_AGF (AGF-T-RAP-04-04) "Definizione di standard informativi per la gestione del flusso di dati sulla radioattività ambientale", 2005.

5 Main international guidance documents

- IAEA (1985), "Survey of currently available Reference Materials for use in Connection with the determination of Trace Elements in Biological and Environmental materials", IAEA/RL/128 REP-1, IAEA, Vienna.
- IAEA (1989) "Measurement of radionuclides in food and the environment. A guidebook" Technical Report Series N° STI/DOC/010/295 TRS 295. IAEA, Vienna
- IAEA (1998) "Analytical Quality Control Services, AQCS Programme 1998, Intercomparison Runs, Reference Materials", IAEA, Vienna.
- National Council on Radiation Protection and Measurements (1978), "A Handbook of Radioactivity Measurements Procedures", Report n° 58, Washington D.C.
- WHO, (2004) "Guidelines for Drinking-water Quality", 3rd edition

6. Documents received:

- ISPRA: Descriptive report with annexes, 2013
- Power Point presentations by all concerned regions

7 Web sites consulted

Environment Ministry (MATTM)	http://www.minambiente.it/home_it/index.html?lang=it
Health Ministry (MH)	http://www.salute.gov.it/
Ministry of Defence	http://www.difesa.it/EN/Pagine/home.aspx
ISPRA	http://www.isprambiente.it
ARPA Sardegna	http://www.sardegnaambiente.it/arpas/
ARPA Toscana	http://www.arpat.toscana.it/

APPENDIX 3

Provincial and regional environmental protection agencies – APPA/ARPA Network

1. Provincial Agency for Environmental Protection – Bolzano
2. Provincial Agency for Environmental Protection – Trento
3. Regional Agency for Environmental Protection of Emilia-Romagna
4. Regional Agency for Environmental Protection of Veneto
5. Regional Agency for Environmental Protection of Calabria
6. Regional Agency for Environmental Protection of Campania
7. Regional Agency for Environmental Protection of Lazio
8. Regional Agency for Environmental Protection of Marche
9. Regional Agency for Environmental Protection of Molise
10. Regional Agency for Environmental Protection of Piemonte
11. Regional Agency for Environmental Protection of Puglia
12. Regional Agency for Environmental Protection of Tuscany
13. Regional Agency for Environmental Protection of Umbria
14. Regional Agency for Environmental Protection of Basilicata
15. Regional Agency for Environmental Protection of Friuli Venezia Giulia
16. Regional Agency for Environmental Protection of Liguria
17. Regional Agency for Environmental Protection of Lombardia
18. Regional Agency for Environmental Protection of Sicilia
19. Regional Agency for Environmental Protection of Valle d'Aosta
20. Regional Agency for Environmental Protection of Abruzzo
21. Regional Agency for Environmental Protection of Sardegna