

**Ispettorato nazionale per la
sicurezza nucleare e la
radioprotezione**



Italian environmental radioactivity monitoring system

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Italian competent authority



Legislative Decree n. 45/2014 “Implementation of the Council Directive 2011/70/ Euratom, establishing a Community framework for responsible and safe management of spent fuel and radioactive waste”

Legislative Decree n. 137/2017 “Implementation of the Council Directive 2014/87/ Euratom amending the Directive 2009/71/ Euratom establishing a Community framework for the nuclear safety of nuclear installations”



National Inspectorate for Nuclear Safety and Radiation Protection - ISIN

has been established as **national competent authority**, the activities and the personnel involved in this matter of the Italian Institute for Environmental Protection and Research (ISPRA), since the 1st of August 2018, are under the responsibility of ISIN.

Radioactivity environmental monitoring



Italian radioactivity environmental monitoring is carried out on

three levels:

- **LOCAL** (NPP's, waste storage facilities)
- **REGIONAL** (administrative districts)
- **NATIONAL**

Italian Legislation



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Legislative Decree n. 230/1995

Implementation of Directives 89/618/Euratom, 90/641/Euratom, 92/3/Euratom and 96/29/Euratom on ionizing radiation

Legislative Decree n. 28/2016

Implementation of Directive 2013/51/Euratom laying down requirements for the protection of public health in relation to radioactive substances in water intended for human consumption

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

NOT YET IMPLEMENTED



LOCAL - D. Lgs. 230/1995 – Art.54



Local surveillance of environmental radioactivity

“1. The holder of the authorization and the operator are required to provide the equipment

Italian competent authority has to check the respect of the local surveillance

radioactivity of the atmosphere, water, soil and food in the monitored areas and in the neighboring areas and related determinations”.

LOCAL network



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- (A) NPP Garigliano
- (B) NPP Latina
- (C) NPP Trino
- (D) NPP Caorso
- (E) Research Reactor –University of Palermo
- (F) ITREC - C.R. Trisaia ENEA
- (G) Research Reactor ENEA Center Casaccia
- (H) Reactor RTS 1 – CISAM
- (I) Plant FN – Bosco Marengo
- (L) Plant EUREX - C.R. Saluggia ENEA
- (M) Research Reactor TRIGA L.E.N.A.- University of Pavia
- (N) Reactor ESSOR – JRC Ispra
- (O) Storage area Avogadro –FIAT AVIO



REGIONAL/NATIONAL - D. Lgs. 230/95 - Art. 104



Ministry of Environment
and Protection of Land and Sea

Ministry of Health

D. Lgs. 230/95 – Art. 104 Environmental radioactivity surveillance

21 Regional Agency for Environmental Protection
ARPA/APPA

Other institutes

NATIONAL Networks



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radioprotezione

National network for environmental
radioactivity surveillance **RESORAD**

National alarm networks
REM RAD and **GAMMA**

National alarm telemetric network for radioactive
fallout (Ministry of Interior)

National Alarm Network - REMRAD

6 automatic station (sampling and measurements)

- Gross α and gross β
- Gamma Spectrometry

Trieste (TS)

Bric della croce (TO)

Monte Cimone (MO)

Monte S. Angelo (FG)

Capo Caccia (SS)

Cozzo Spadaro (SR)



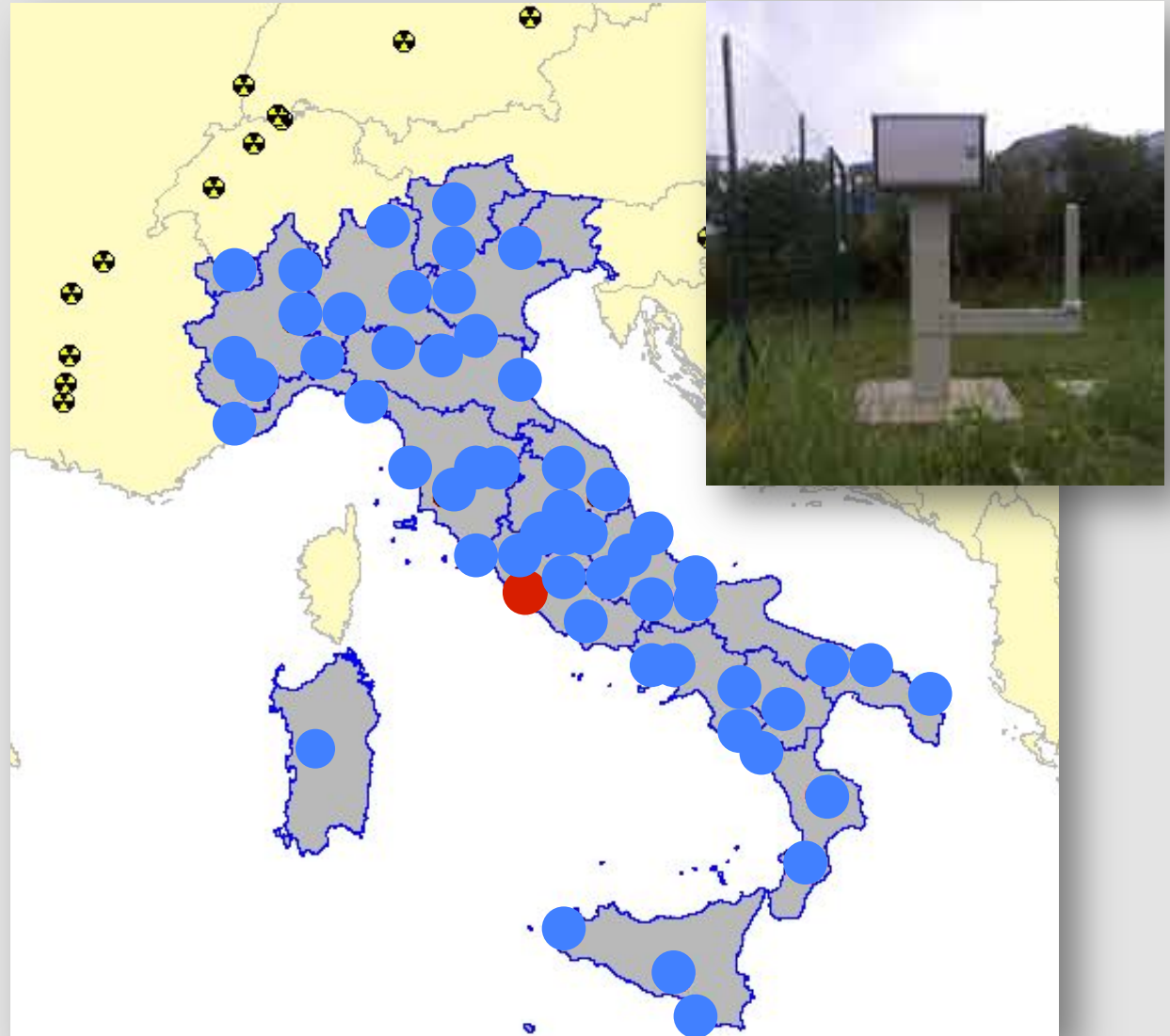
● Evaluation data Center
CeVaD



National Alarm Network - GAMMA

● 58+49 telemetric stations Ambient gamma dose rate

● Evaluation data Center
CeVaD

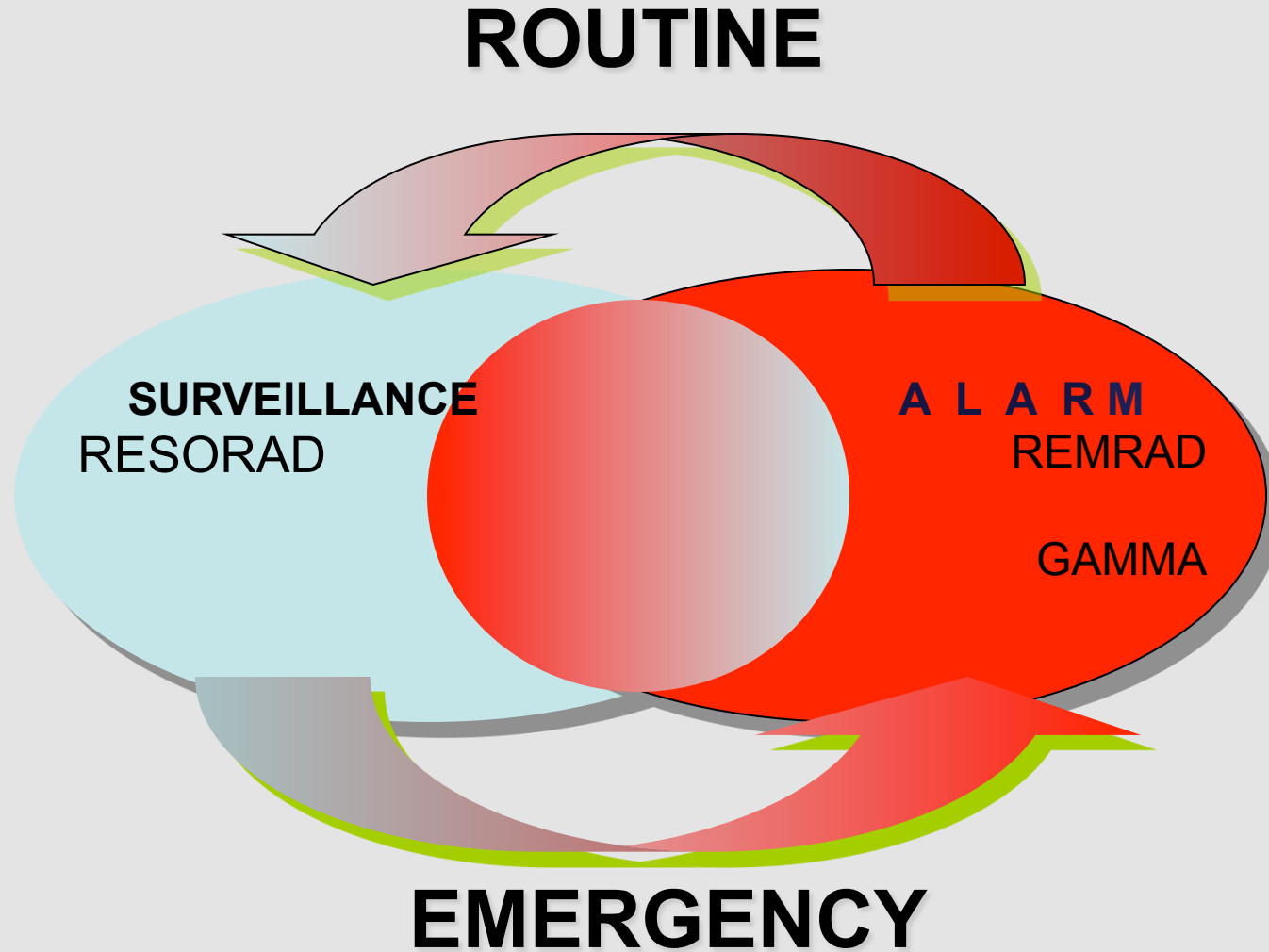


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Routine - emergency



Ispettorato nazionale per la
sicurezza nucleare e la
radioprotezione



RESORAD - Aim



To follow the spatio-temporal trend of radionuclide concentrations in environmental media and foodstuffs



- to obtain a solid representative database for dose assessment to the public

In compliance with the art.35 and art.36 of the Euratom Treaty

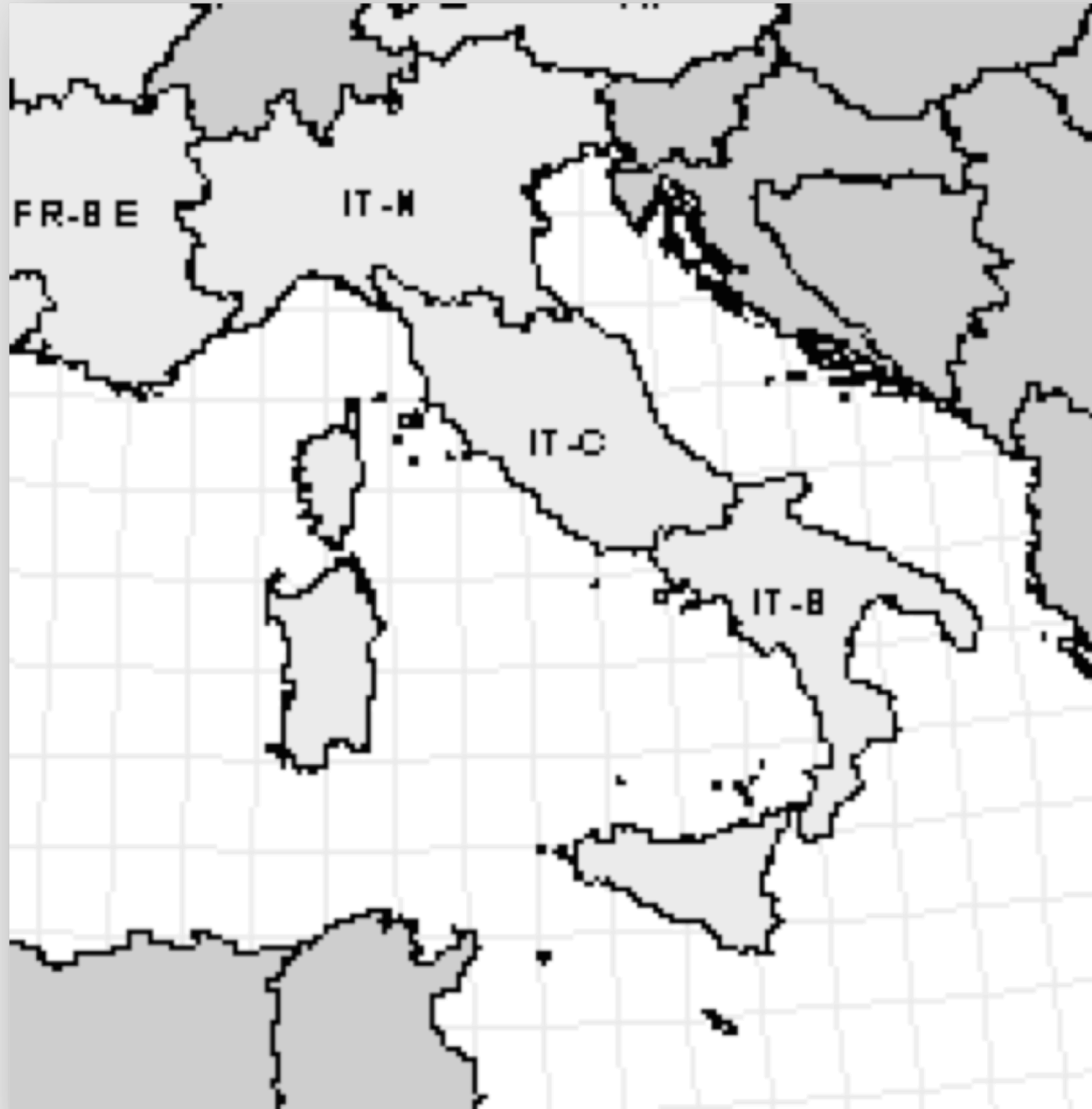
- to report promptly any anomalous situations
- to ensure a database for transparent information to the Institutions and the public
- to provide support in management and decisions in case of radiological emergencies

2000/473/Euratom



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Comitato Nazionale
per la Protezione
dell'ambiente



Main sample types -measurements



Sample type	Dense Network	Sparse Network
Airborne particulates	Cs-137, gross β	Cs-137
Air	Ambient gamma dose rate	Ambient gamma dose rate
Surface water	Cs-137, residual beta	Cs-137, residual beta
Drinking water	H-3, Cs-137, Sr-90, gross- α , gross- β	H-3, Cs-137, Sr-90, gross- α , gross- β
Milk	Cs-137, Sr-90	Cs-137, Sr-90, K-40
Mixed Diet	Cs-137, Sr-90	Cs-137, Sr-90
Total Deposition	Cs-137	

Main sample types -measurements



Sample type	Dense Network	Sparse Network
Airborne particulates	Cs-137, gross β	Cs-137
Air	Ambient gamma dose rate	Ambient gamma dose rate
Surface water	Cs-137, residual beta	Cs-137, residual beta
Drinking water	H-3, Cs-137, Sr-90, gross- α , gross- β	H-3, Cs-137, Sr-90, gross- α , gross- β
Milk	Cs-137, Sr-90	Cs-137, Sr-90, K-40
Mixed Diet	Cs-137, Sr-90	Cs-137, Sr-90
Total Deposition	Cs-137	

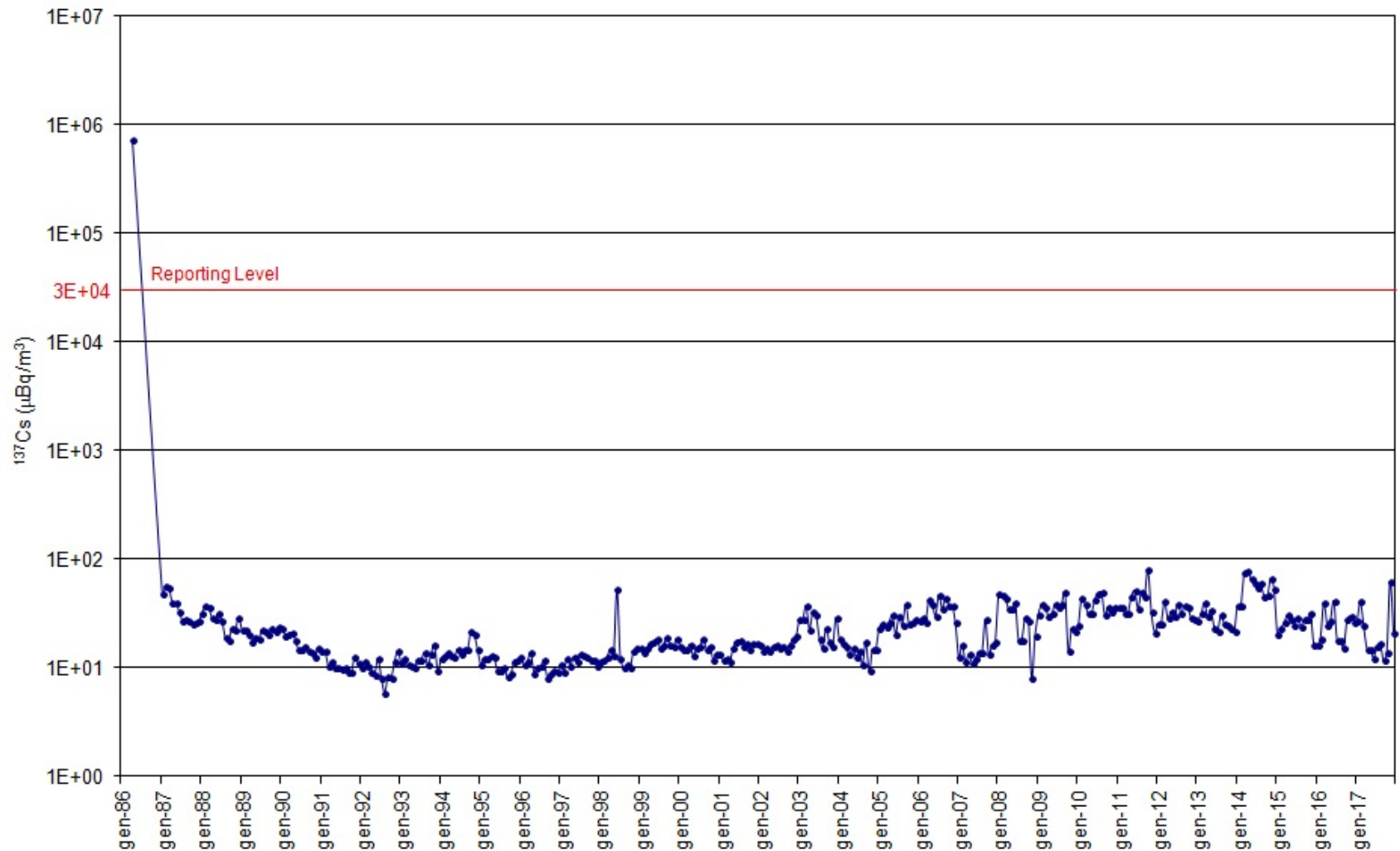
☺ = good

☹ = not complete coverage

^{137}Cs - airborne particulates



Ispettorato nazionale per la
sicurezza nucleare e la
radioprotezione

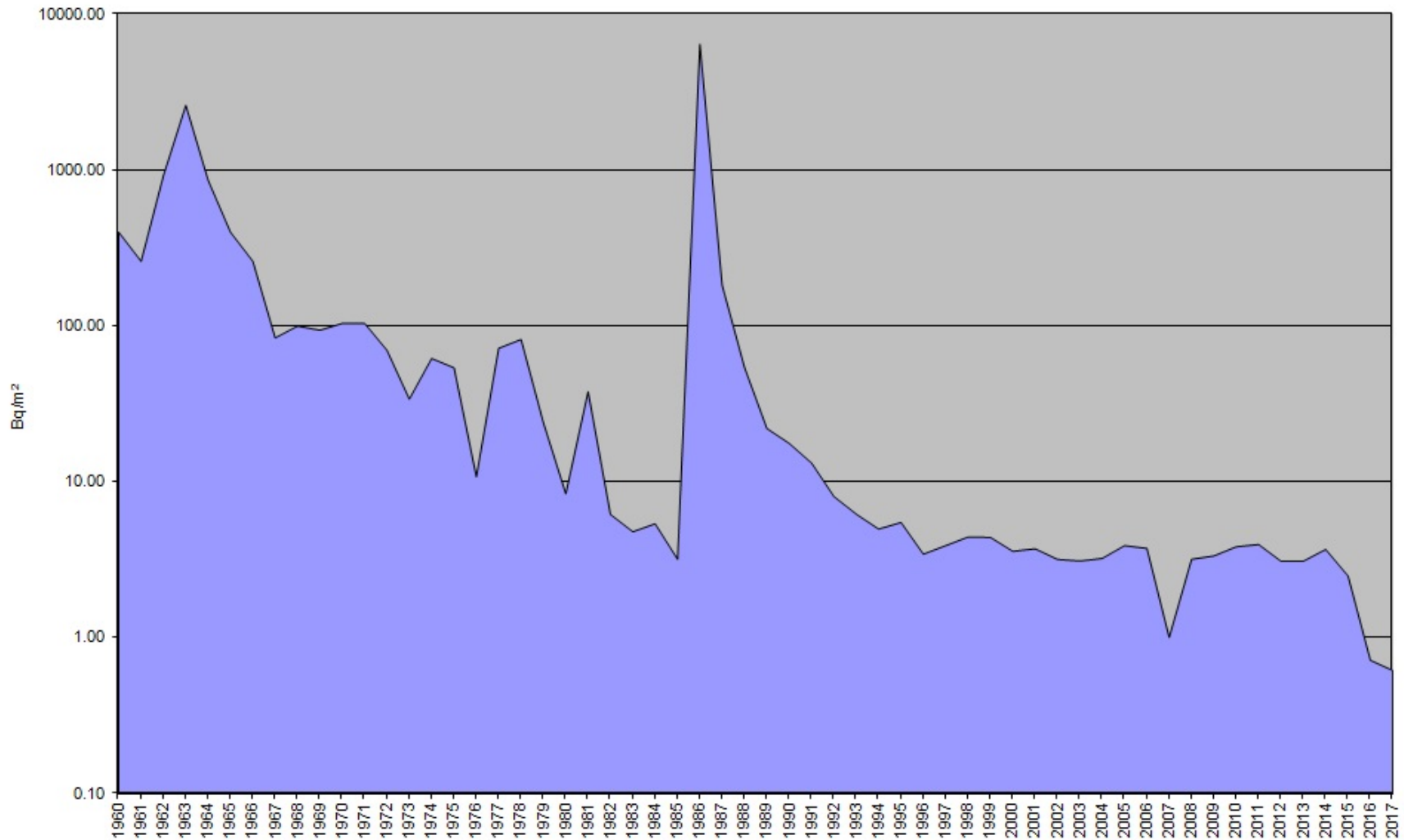


^{137}Cs – total deposition



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per la Protezione
dell'Ambiente



Other relevant sample types



Sample types	Measurements
Sediments	Cs-137, Sr-90, Pu-isotopes
DMOS	Cs-137, Sr-90, Pu-isotopes
Soil	Cs-137, Sr-90, Pu-isotopes
Honey	Cs-137
Molluscs	Cs-137
Mushrooms	Cs-137
Sludge from sewage treatment plants	Gamma emitters radionuclides
Waste water from sewage treatment plants	Gamma emitters radionuclides

Sample analysis increasing requests



NORM (Naturally Occurring Radioactive Materials) – determination of radionuclides concentration activity of natural series of Uranium and Thorium in the radiometric characterization of NORM sites

DRINKING WATER – H-3, Rn-222, gross- α , gross β , eventually natural radionuclides (U-238, U-234, Ra-226, Ra-228, Pb-210, Po-210), artificial radionuclides (C-14, Sr-90, Pu-239/240, Am-241, Co-60, Cs-134, Cs-137, I-131)

RESORAD - numbers

2017 Data

21 Regional Agency for Environmental Protection - ARPA/APPA + **3** IIZZSS



36 Laboratories

1513 Sampling sites

10279 Samples per year

(7561 environmental samples, 2718 foodstuffs)

25671 Measurements per year



RESORAD - requirements



Reliability of each sample site

Reliability of the measurements

Data comparison

Data collection and flow

**NATIONAL COMPETENT
AUTHORITY**

Technical Coordination

Guidelines



Linee guida per il monitoraggio della radioattività

MANUALI E LINEE GUIDA



Indice	
1	PREMESSA..... 1
2	CONTESTO NORMATIVO NAZIONALE E COMUNITARIO..... 2
3	RETE NAZIONALE DI MONITORAGGIO DELLA RADIOATTIVITÀ AMBIENTALE (RESORAD)..... 4
3.1	Obiettivi della rete nazionale..... 4
3.2	Struttura della rete nazionale..... 5
3.3	Matrici, punti di prelievo, tipologia di misura, frequenze di campionamento e di misura della Rete Nazionale..... 5
3.3.1	Particolato atmosferico totale in sospensione (PTS)..... 6
3.3.2	Deposizione totale (umida e secca)..... 6
3.3.3	Radiazione esterna (rateo di equivalente di dose ambientale/rateo di dose gamma in aria)..... 7
3.3.4	Acque superficiali..... 7
3.3.5	Acqua potabile..... 8
3.3.6	Latte..... 8
3.3.7	Dieta mista..... 9
3.3.8	Alimenti per consumo animale (foraggi e mangimi)..... 10
3.4	Altre matrici rilevanti..... 12
3.4.1	Detrito Minerale Organico Sedimentabile (DMOS)..... 12
3.4.2	Sedimenti (marini, fluviali e lacustri)..... 12
3.4.3	Suolo..... 12
3.4.4	Miele..... 13
3.4.5	Molluschi..... 13
3.4.6	Funghi, bacche, selvaggina e pesci carnivori di lago..... 13
3.4.1	Muschi..... 13
3.5	Attività straordinarie..... 14
3.6	Banche dati della radioattività ambientale e flusso dei dati..... 14
4	RETI REGIONALI DI MONITORAGGIO DELLA RADIOATTIVITÀ AMBIENTALE..... 15
4.1	Obiettivi della Rete Regionale..... 15
4.2	Struttura della Rete Regionale..... 16
4.3	Matrici, punti di prelievo, tipologia di misura, frequenze di campionamento e di misura della Rete Regionale..... 16
4.3.1	Fanghi e acque reflue da impianti di depurazione civile..... 16
4.4	Banche dati regionali della radioattività ambientale e flusso dei dati..... 16
5	RISORSE NECESSARIE PER LA GESTIONE DELLA RETE DI CONTROLLO DELLA RADIOATTIVITÀ AMBIENTALE (LABORATORI, STRUMENTAZIONE E PERSONALE)..... 18
5.1	Attrezzature e materiali per i campionamenti..... 18
5.2	Laboratorio di spettrometria gamma, misure alfa-beta..... 18
5.2.1	Locali..... 19
5.2.2	Strumentazione fissa di laboratorio..... 19
5.2.3	Strumentazione portatile..... 19
5.2.4	Risorse umane..... 20
5.3	Laboratorio radiochimico..... 20
5.3.1	Locali..... 20
5.3.2	Strumentazione di laboratorio..... 20
5.3.3	Risorse umane..... 21
5.4	Laboratorio spettrometria di massa..... 21
5.4.1	Locali..... 21
5.4.2	Strumentazione di laboratorio..... 21
5.4.3	Risorse umane..... 21
6	ESPOSIZIONE DELLA POPOLAZIONE E DEI LAVORATORI AL RADON..... 22
6.1	Laboratorio radon..... 22
6.1.1	Locali..... 22
6.1.2	Strumentazione di laboratorio..... 22
6.1.3	Risorse umane..... 22
7	AFFIDABILITÀ DELLE RETI DI SORVEGLIANZA DELLA RADIOATTIVITÀ AMBIENTALE..... 24

<http://www.isprambiente.gov.it/it/publicazioni/publicazioni-del-sistema-agenziale/linee-guida-per-il-monitoraggio-della-radioattivita>

RESORAD manual



1. Laboratories and instruments

2. Sampling plan

3. Sampling methods

4. Measurements methods

5. Collection and flow data

6. Dose assessment

3 Years of work

25 Institution

41 Measurements methods

60 Experts

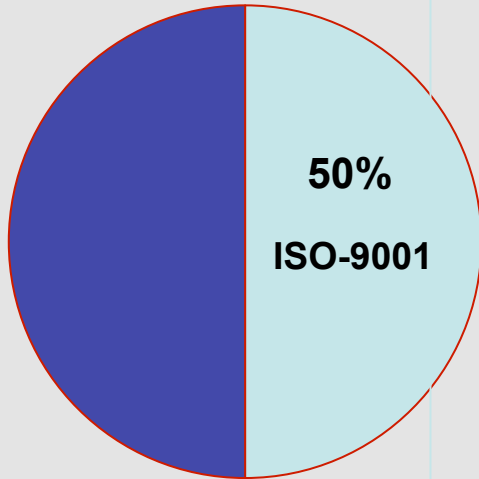
515 Pages

http://www.isprambiente.gov.it/files/sicurezza-nucleare-radioattivita/ManualeReteRESORAD_rev2.pdf

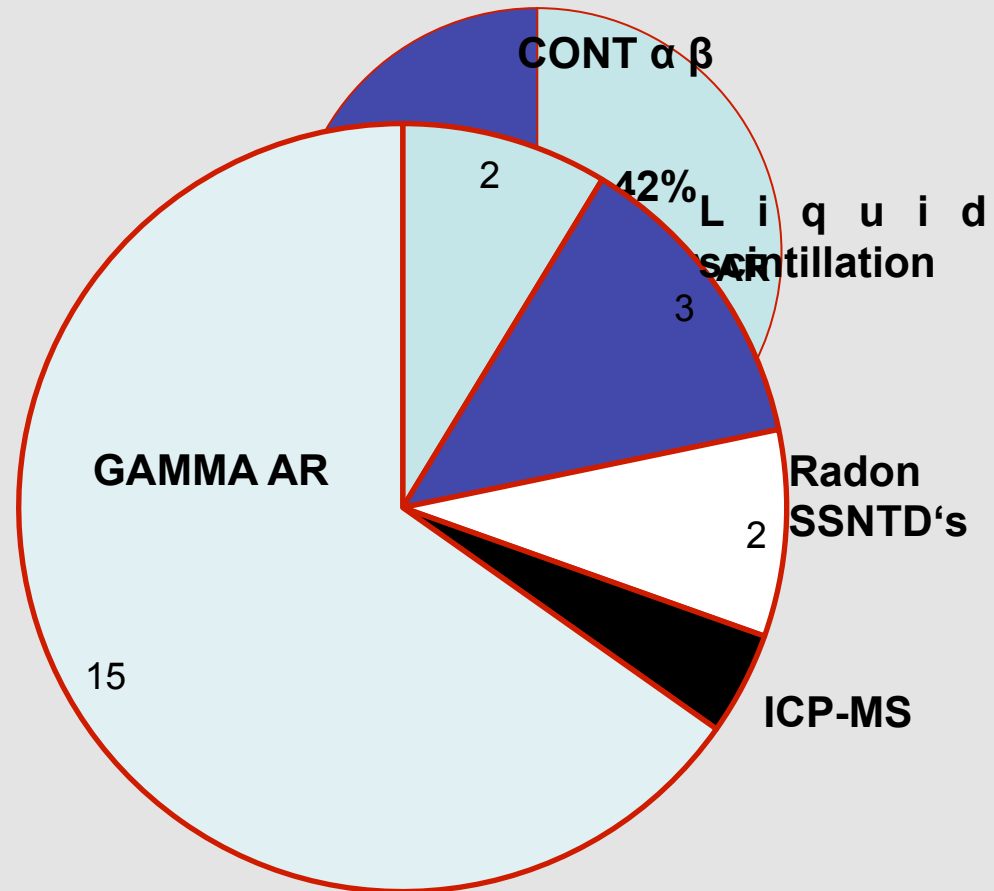
Quality System Management



Certification ISO-9001



Accreditation ISO/IEC 17025



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Inter-comparison exercises



ISPRA

Istituto Superiore per la Protezione
e la Ricerca Ambientale



Agenzia nazionale per le tecnologie, l'energia
e lo sviluppo economico sostenibile

Istituto Nazionale di Metrologia delle Radiazioni Ionizzanti

2014 Alpha/ beta/ gamma measurements in liquid media

Determination of gamma emitters, alpha-total, beta-total and Sr-90 in a mixture of radionuclides in aqueous liquid solution with higher density than water

Participants: 57 laboratories

42 RESORAD, ISS e INAIL laboratories

15 "host" laboratories

EC Proficiency Testing



International Comparison Scheme for Radioactivity Environmental Monitoring programme – ICS-REM JRC– Geel



Year	Matrix	Radionuclide(s)
2003	Air filter	^{137}Cs
2005	Milk powder	$^{134}/^{137}\text{Cs}$, ^{40}K , ^{90}Sr
2008	Water	$^{238}/^{234}\text{U}$, $^{226}/^{228}\text{Ra}$
2010	Soil	^{40}K , ^{137}Cs , $^{212}/^{214}\text{Bi}$, $^{212}/^{214}\text{Pb}$, ^{226}Ra , $^{230}/^{232}\text{Th}$, $^{234}/^{235}/^{238}\text{U}$, $^{238}/^{239}/^{240}\text{Pu}$, ^{90}Sr
2011	Bilberry	^{90}Sr , ^{137}Cs , ^{40}K
2012	Water	Gross alpha/beta activity
2014	Air filter	^{137}Cs



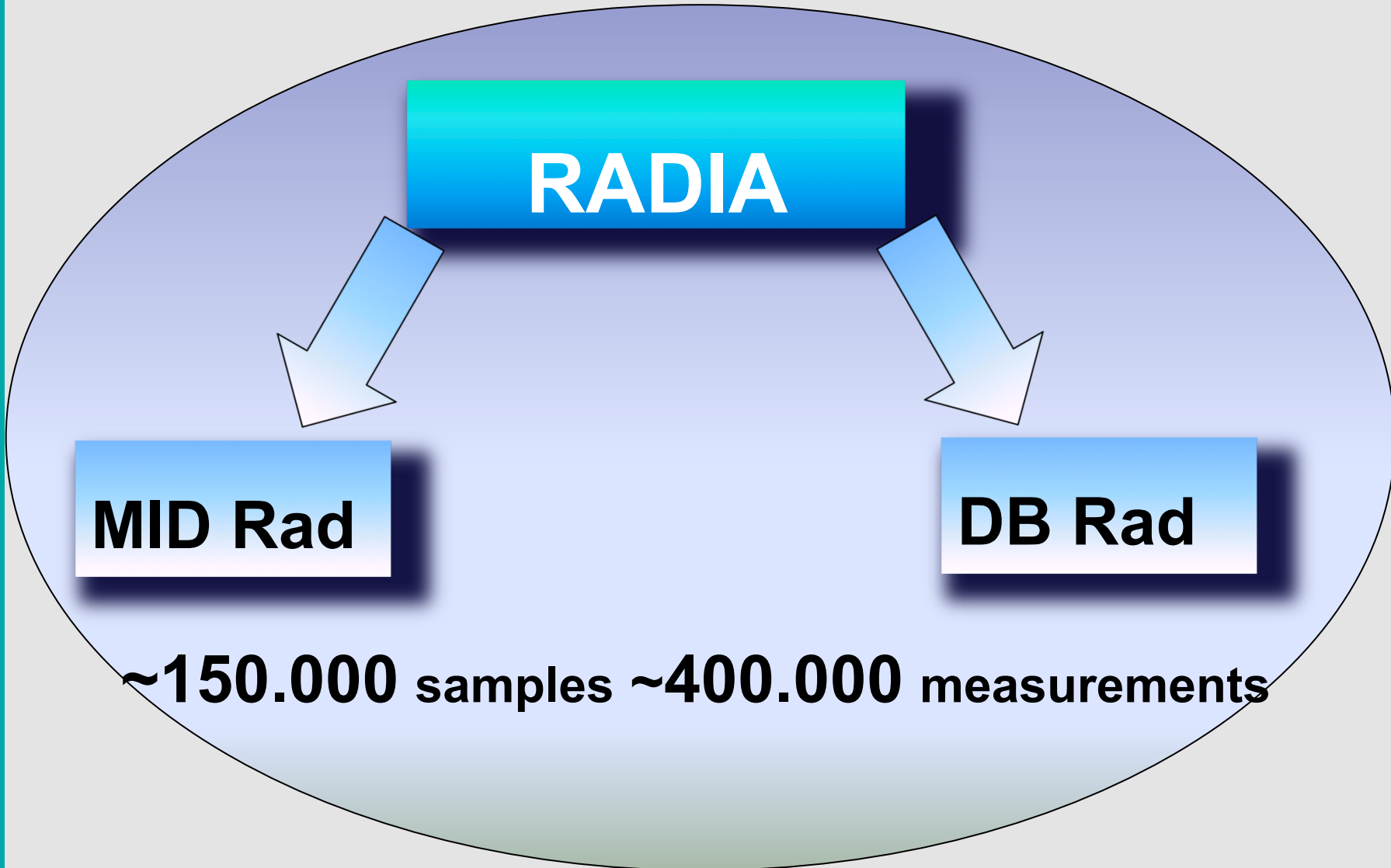
2017 Maize (spiked) Cs-137, Cs-134, I-131

2018 Water Rn-222 (in progress)

RESORAD database



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dell'Ambiente

RESORAD database



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SINA.net

Rete del Sistema Informativo Nazionale Ambientale

RADIA



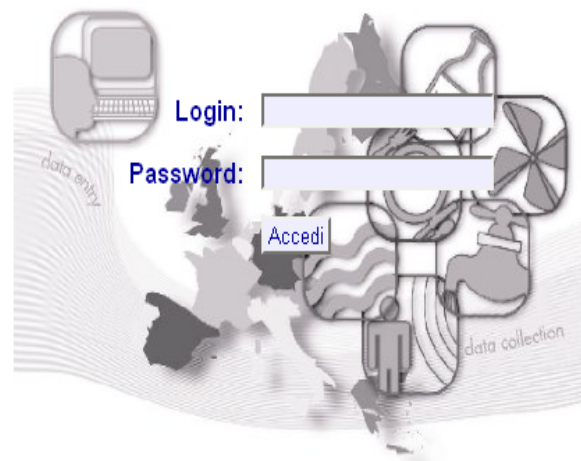
Dati di radioattività ambientale della rete RESORAD

Home

- Dati
- Normativa
- Area Riservata

Accesso al Sistema RADIA

Modulo di interscambio dati di radioattività ambientale della rete RESORAD



RESORAD database



Rete del Sistema Informativo Nazionale Ambientale

RADIA

Dati di radioattività ambientale della rete
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[Home](#)

[Guida](#)

[Logout](#)

Database

- Invio file dati per caricamento massivo
- Interrogazione database misure
- Inserimento nuova misura

— Sistema RADIA

— Utente connesso: LATINA

RESORAD database



SINAnet

RADIA



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Dati di radioattività ambientale della rete RESORAD

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RADIA - Definizione formato file misurazioni

Selezionare per ognuna delle colonne del file il campo corrispondente

NOME LABORATORIO	CRR FI	CRR MI	CRR MI	CRR MI	CRR MI
REGIONE	Toscana	Lombardia	Lombardia	Lombardia	Lombardia
TIPO CAMPIONE	AL	AL	AL	AL	AL
IDENTIFICATIVO ANALISI CAMPIONE	AP1108	2011.0267.01	2011.0267.01	2011.0267.01	2011.0267.01
DATA INIZIO	01/08/2011	07/04/2011	07/04/2011	07/04/2011	07/04/2011
DATA FINE	31/08/2011	07/04/2011	07/04/2011	07/04/2011	07/04/2011
COMUNE DI PRELIEVO	FIRENZE	COMO	COMO	COMO	COMO
CATCHMENT	--	--	--	--	--
LATITUDINE	43.46.38	45.48.34	45.48.34	45.48.34	45.48.34
LONGITUDINE	11.14.55	09.05.03	09.05.03	09.05.03	09.05.03
FRAZIONE, ECC. INDICATIVO LOCALITÀ PRELIEVO	FIRENZE	--	--	--	--
PROVINCIA PRELIEVO	FI	CO	CO	CO	CO
CODICE MATRICE	181	181	181	181	181
RADIONUCLIDE	CS-137	AC-228	AG-110M	AM-241	BA-140
INDICATORE MAR	<	<	<	<	<
ATTIVITÀ SPECIFICA	0.0008	0.55	0.13	1.3	0.46
UNITÀ MISURA	Bq/L	Bq/Kg	Bq/Kg	Bq/Kg	Bq/Kg
INCERTEZZA	--	--	--	--	--
UNITÀ MISURA INCERTEZZA	--	--	--	--	--
NOTE	--	Acque potabili - Acqua potabile di acquedotto	Acque potabili - Acqua potabile di acquedotto	Acque potabili - Acqua potabile di acquedotto	Acque potabili - Acqua potabile di acquedotto
CONTESTO DEL CAMPIONAMENTO	RN+RR	--	--	--	--
CODICE NAZIONE PROVENIENZA	380	380	380	380	380
LABORATORIO CHE ESEGUE LA MISURAZIONE	--	--	--	--	--
METODO TRATTAMENTO CAMPIONE	A	A	A	A	A
TIPI DI CAMPIONAMENTO	--	--	--	--	--
METODO DI MISURAZIONE	--	A	A	A	A

[Imposta default per la definizione campi](#)

[Awia elaborazione dati](#)

Per default si intende la definizione dell'ordine dei campi nel file come appare nella guida.

RESORAD database



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RADIA

Dati di radioattività ambientale della rete
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[Home](#)

[Guida](#)

[Logout](#)

Database

- [Invio file dati per caricamento massivo](#)
- [Interrogazione database misure](#)
- [Inserimento nuova misura](#)

Sistema RADIA

Utente connesso: LATINA

RESORAD database



SINA.net

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RADIA - Database delle misure

Immettere il criterio della ricerca

Contesto del campionamento:

Laboratorio:

Matrice (primo livello):

Matrice (secondo livello):

Radionuclide:

Tipo campione:

Regione:

Provincia:

Comune di rilevazione:

Identificativo Analisi Campione:

Escludere valori MAR:

Data inizio rilevazione: *Selezione (gg-mm-aaaa)* Data fine rilevazione: *Selezione (gg-mm-aaaa)*

[Esegui ricerca](#)

- [Pagina iniziale](#)

Sistema RADIA
Utente connesso: ADMIN

RESORAD database

**SINA**net**RADIA**

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Dati di radioattività ambientale della rete RESORAD

[Home](#)[Guida](#)[Logout](#)

RADIA - Risultato della Ricerca Campioni / Misurazioni

Identificativo campione	Laboratorio	Matrice	Tipo Campione
2010/4695	ARPA UMBRIA	ACQUA DI CORSO D'ACQUA SUPERFICIALE	Ambientale
2010/9096	ARPA UMBRIA	ACQUA DI CORSO D'ACQUA SUPERFICIALE	Ambientale
2010/2046	ARPA UMBRIA	ACQUA DI CORSO D'ACQUA SUPERFICIALE	Ambientale
2011/8776	ARPA UMBRIA	ACQUA DI CORSO D'ACQUA SUPERFICIALE	Ambientale
2011/3968	ARPA UMBRIA	ACQUA DI CORSO D'ACQUA SUPERFICIALE	Ambientale
2011/5141	ARPA UMBRIA	ACQUA DI CORSO D'ACQUA SUPERFICIALE	Ambientale
2011/1884	ARPA UMBRIA	ACQUA DI CORSO D'ACQUA SUPERFICIALE	Ambientale
2012/4131	ARPA UMBRIA	ACQUA DI CORSO D'ACQUA SUPERFICIALE	Ambientale
2012/1980	ARPA UMBRIA	ACQUA DI LAGO	Ambientale

Campioni mostrati: da 1 a 9 su 9

[1]

[Nuova Ricerca](#)[Nuovo Campione](#)[Export Excel](#)[Export Zip](#)

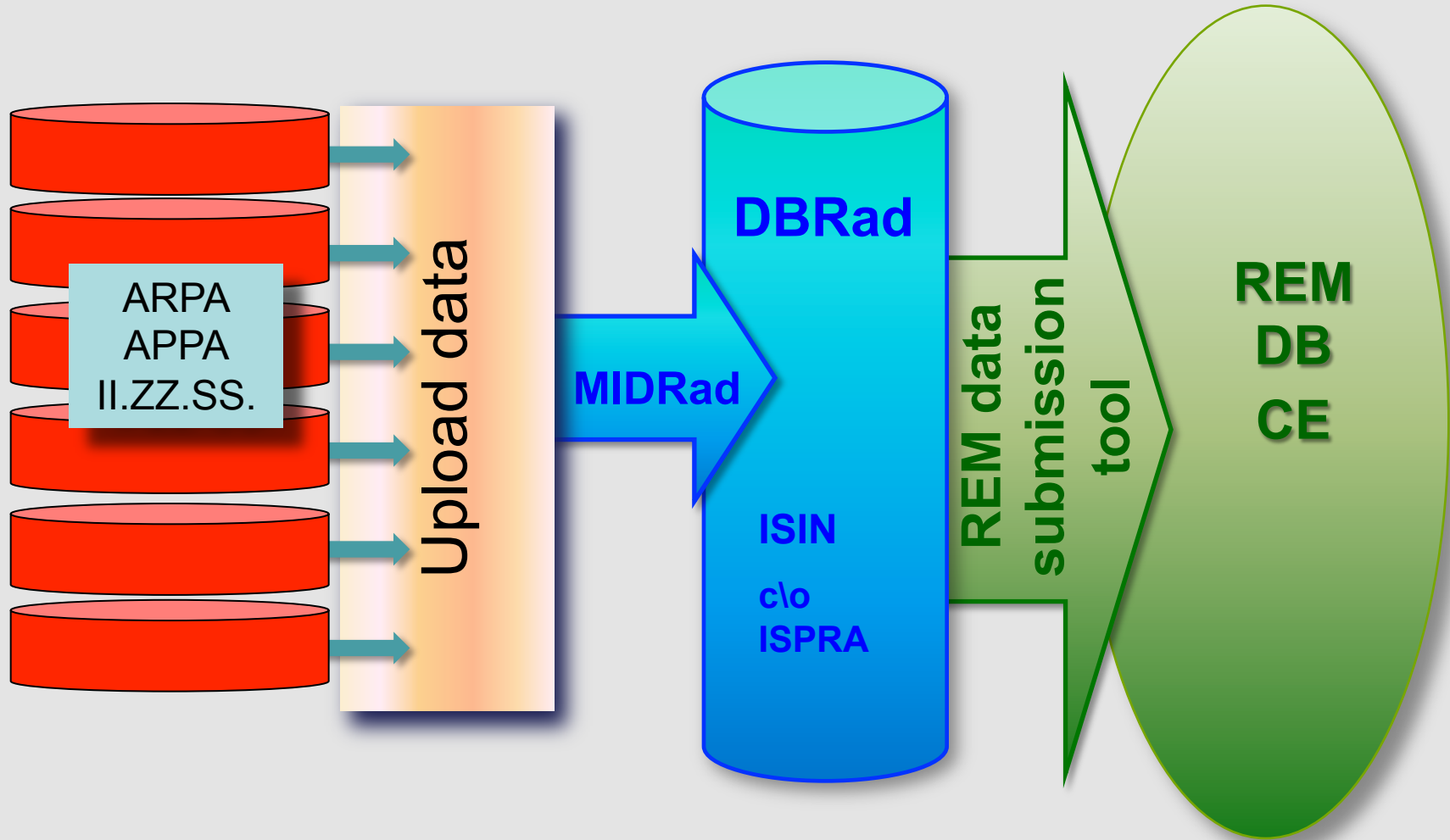
Sistema RADIA

Utente connesso: ADMIN

RESORAD data flow



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radioprotezione



Art.35 Euratom – EC verification visit



15 to 19 May 2006 – Commission's Article 35 verification to Caorso and Latina Nuclear Power Plants and to the national environmental monitoring network.

02 to 07 May 2010 – Commission's Article 35 verification in Southern Italy to regional environmental monitoring network of Sicily, Calabria, Basilicata, Campania and Puglia

12 to 17 September 2011 – Commission's Article 35 verification in Central and Southern Italy to regional environmental monitoring network of Campania, Molise, Abruzzo, Marche, Umbria and Lazio.

17 to 21 June 2013 – Commission's Article 35 verification in Central Italy to regional environmental monitoring network of Sardinia and Tuscany.

15 to 16 December 2015 – Commission's Article 35 verification to ITREC Nuclear Power Plant

Art.35 Euratom – EC verification visit



Art.35 Technical Report – IT-11/06

The verification team recommends ISPRA setting up an independent control programme for the monitoring by the operator, as a minimum to select a few samples every year which were measured by SoGIN and to do re-measurement of these samples in ISPRA's own lab and to compare results. The region of Campania as regulator should be involved in this task.

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 facilities necessary to carry out continuous monitoring of levels of radioactivity in the air, water and soil in Central and Southern Italy (Campania, Molise, Abruzzo, Marche, Umbria and Lazio) are adequate. The Commission services could verify the operation and efficiency of these facilities in these six regions and was informed of the situation in Sardegna and Toscana.
- (2) Under the co-ordination of ISPRA a detailed monitoring programme for environmental

The verification activities that were performed demonstrated that the facilities necessary to carry out continuous monitoring of levels of radioactivity in the air, water and soil in Central and Southern Italy (Campania, Molise, Abruzzo, Marche, Umbria and Lazio) are adequate.

Art.35 Euratom – EC verification visit



(5) With regard to the laboratories involved in environmental radioactivity monitoring in central Italy the verification team recommends the following:

a. Staffing of the laboratories 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 sick leave. **“staffing of the laboratoriesat least two person”**

b. 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 regional environment agencies (ARPAs and 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. The team points out that radiochemical work should be performed as a routine task to guarantee continuity and to reach a reasonably high quality.

“radiochemical sample preparation such as alpha spectrometry and analysis of Sr-90 the team recommended cooperation between ARPA/APPA”

Fukushima Dai-ichi

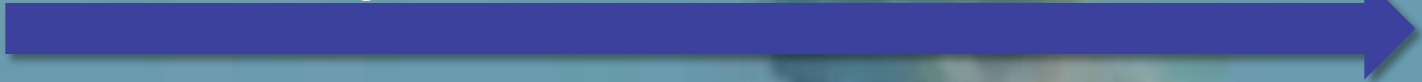


11/03/2011

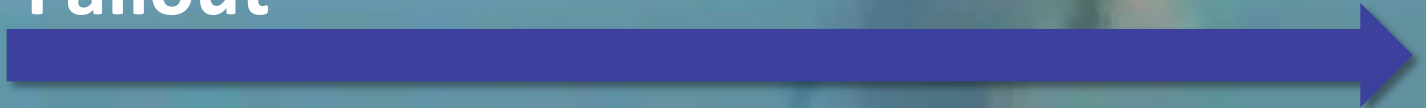
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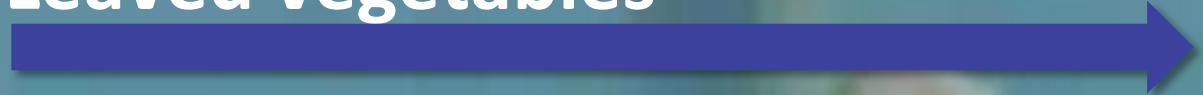
Airborne particulates



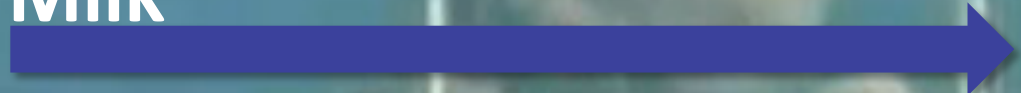
Fallout



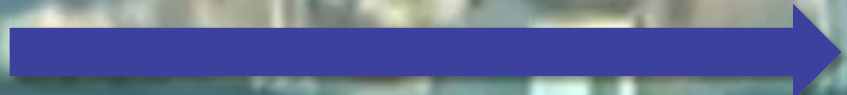
Leaved vegetables



Milk



Foodstuffs etc.



Fukushima Dai-ichi - airborne particulates sample sites



Ispettorato nazionale per la
sicurezza nucleare e la
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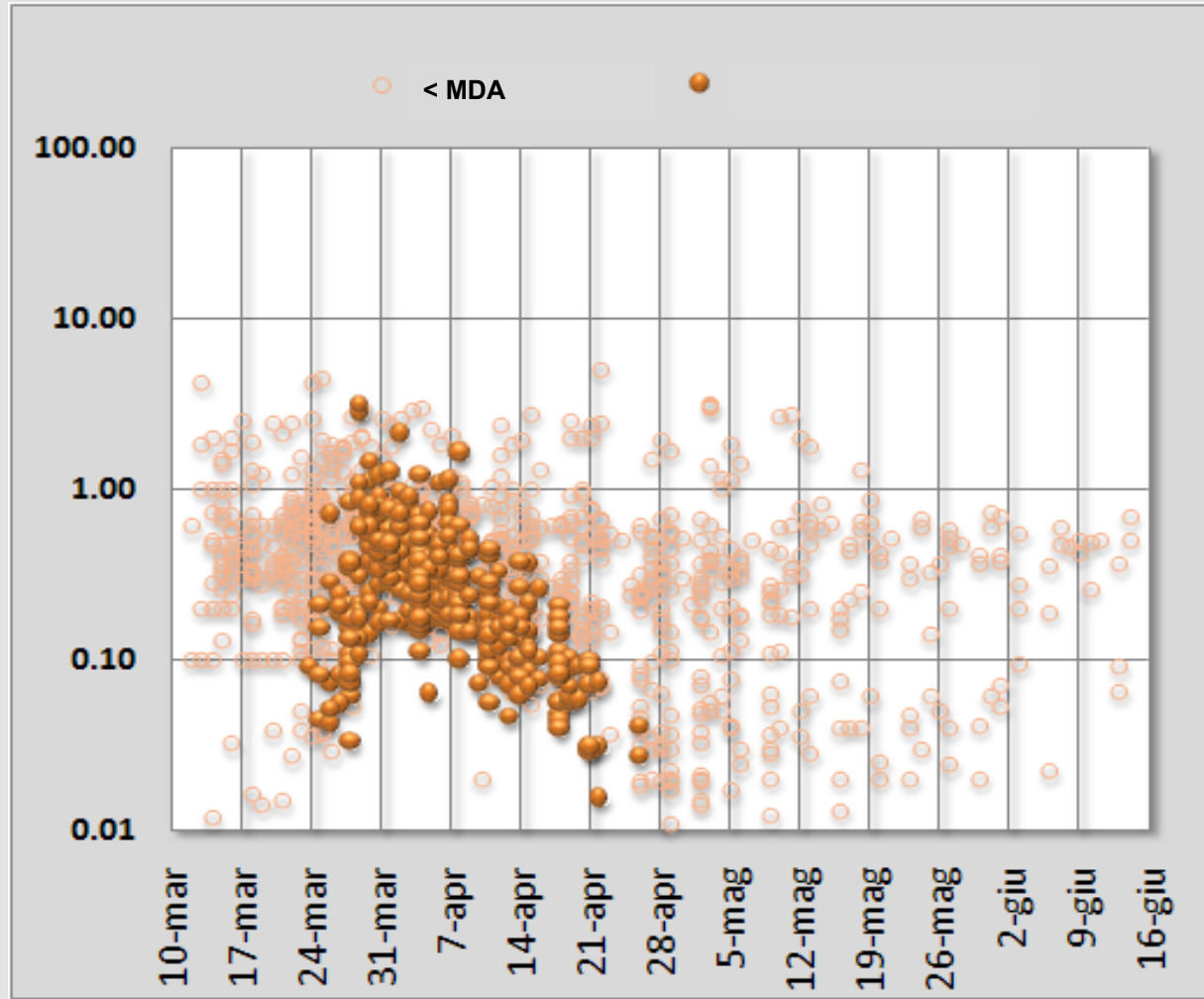


Istituto Nazionale
per la Protezione
dell'Ambiente

Airborne particulates : I-131



Ispettorato Nazionale per la
sicurezza nucleare e la
radioprotezione



Fukushima Dai-ichi



Sample Types	Nuclides	N° measurement	N° measurement > MDA
Airborne Particulates	Cs-137	1196	76
	I-131	946	299
Fallout	Cs-137	183	26

This event represented a **“test”** for **RESORAD network**

- Technical and organisational capability to intensify environmental monitoring programme.
- Ability to answer to the requests from the institutions and the population.

health and the environment.

Fodder	Cs-137	55	11
	I-131	55	41

Detections of Ru-106 in environmental samples



02/10/2017 3.6 mBq/m³ in airborne particulate

214 measurements at 26 sample sites

Sample Types	N° measurement	N° measurement > MDA	Ru-106 Max conc. activity
Airborne Particulates	154	57	54.3 mBq/m ³
PM10	45	9	15.8 mBq/m ³
Fallout	15	8	6.7 Bq/m ²

the event had no radiological relevance, but represented a **“test”** for **RESORAD network** for measurement sensitivity, the lab were able to detect small traces of Ru-106

RESORAD - Strengths and critical issues



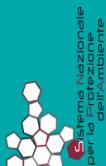
1. Network suitable for radioactivity environmental surveillance (measurement reliability and EC Art.35 verifications)
2. Consolidated experience (> 50 years)
3. Good responsiveness in case of accidental events



1. Not complete territorial coverage
2. Scarcity of human resources dedicated to this field



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... Thanks for your attention