

## Environmental radioactivity analyses in Italy following the Fukushima Dai-ichi nuclear accident

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### ABSTRACT

Following the Fukushima power plants accident on the 11th March 2011, the radioactivity monitoring programme at the Italian ENEA research centres was activated in order to detect the possible new input of radionuclides through atmospheric transport and precipitation. Measurements of <sup>131</sup>I and <sup>134,137</sup>Cs were carried out on atmospheric particulate, atmospheric deposition, seawater and mussels and sheep milk. In the daily samples of air particulate, <sup>131</sup>I was detectable between March 28 and April 12, with extremely low concentrations (<1 mBq m<sup>-3</sup>; the detection limit for <sup>131</sup>I was ~0.2 mBq m<sup>-3</sup>) while Cs isotopes were always below the detection limit (<0.2 mBq m<sup>-3</sup>). The two main episodes of <sup>131</sup>I atmospheric deposition were registered in La Spezia research centre, around March 28 and April 15, reaching values of 17.8 ± 1.1 and 8.0 ± 2.5 Bq m<sup>-2</sup> respectively; maximum values of <sup>134</sup>Cs and <sup>137</sup>Cs were 0.11 ± 0.03 and 0.17 ± 0.02 Bq m<sup>-2</sup>, respectively, detected in Brasimone research centre in April (reference date April 15). Mussels and seawater were collected in the Gulf of La Spezia: only mussels after the main <sup>131</sup>I deposition, on March 28, contained a measurable, although very small, amount of <sup>131</sup>I (0.18 ± 0.05 Bq kg<sup>-1</sup>, detection limit <sup>131</sup>I = 0.03 Bq kg<sup>-1</sup> wet weight – soft parts). The <sup>131</sup>I was also detected in sheep milk in Rome (Casaccia research centre) until May 5, showing a maximum concentration of 4.9 ± 0.4 Bq L<sup>-1</sup>. As for other European Countries for which data are available, activity levels remain of no concern for public health.

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### 1. Introduction

The main source of anthropogenic radioactivity in Italy is fallout from nuclear weapons testing in the early 1960s (UNSCEAR, 1982, 2000a) and from the Chernobyl accident in April–May 1986 (UNSCEAR, 1988, 2000b). The only gamma-emitting anthropogenic radionuclide still present in the environment from these two sources is <sup>137</sup>Cs (half life: 30.1 y). Its cumulative deposition from global fallout is 2.8 kBq m<sup>-2</sup> (UNSCEAR, 2000a; Delfanti and Papucci, 2010). Chernobyl fallout was maximum in northern Italy (on average 15 kBq m<sup>-2</sup>), medium in Central Italy (3.7 kBq m<sup>-2</sup>) and lowest in Southern Italy (0.7 kBq m<sup>-2</sup>) (ref. date: ENEA, 1986),

reaching maximum values of more than 100 kBq m<sup>-2</sup> in the Alps (De Cort and Tstatorov, 1996). Since 1986 no new input of <sup>137</sup>Cs were recorded in Italy up to 2011.

Following the Fukushima (Japan) power plants accident on the 11th March 2011, radioactivity monitoring was carried out by the System of Environmental Agencies, covering the whole Italian territory, under the supervision of the Institute of Environmental Protection and Research (ISPRA) and monitoring results were published daily through ISPRA's web site ([www.isprambiente.gov.it/site/it-IT/Documenti\\_emergenza\\_nucleare\\_Giappone/](http://www.isprambiente.gov.it/site/it-IT/Documenti_emergenza_nucleare_Giappone/)).

In the period 23 March –7 April, in atmospheric particulate ISPRA detected <sup>131</sup>I activity ranging from 0.0021 to 3.10 mBq m<sup>-3</sup>; the ratio <sup>134</sup>Cs/<sup>137</sup>Cs was around 0.8. In the same period, ISPRA fallout data show a maximum activity of 25.4 and 0.076 Bq m<sup>-2</sup> for <sup>131</sup>I and <sup>137</sup>Cs respectively. Very low activities were detected in milk, with 5.24 and 0.22 Bq L<sup>-1</sup> for <sup>131</sup>I and <sup>137</sup>Cs.

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Herein we report and discuss the results of the analyses carried out at ENEA (Italian National agency for new technologies, Energy and sustainable economic development) centres between March 14 and the beginning of May 2011 and give an overview of the input and uptake of radionuclides in different terrestrial and marine foodstuff.

## 2. Materials and methods

Starting on March 14, 2011 the radioactivity monitoring programme at the ENEA Centres was implemented and adapted to detect the possible new input of radionuclides from Fukushima through atmospheric transport and rainfall. The radioactivity monitoring was carried out at five ENEA Research Centres, located in Northern Italy (Saluggia, La Spezia and Brasimone), in Central Italy (Casaccia, near Rome) and in Southern Italy (Trisaia). The sampling stations (Fig. 1) are representative of different geographic and meteorological conditions. The ENEA Centres are equipped for measurements of radionuclides in atmospheric particulate (Saluggia, Casaccia and Trisaia) and atmospheric deposition (Saluggia, La Spezia, Brasimone and Trisaia). The marine environment research

centre in La Spezia also carried out measurements on marine samples (seawater and mussels) while the Casaccia Centre followed accumulation of the Fukushima radionuclides in sheep milk.

### 2.1. Atmospheric particulate

In the Saluggia Centre, the air sampler was located on a station with aspiration point at 2 m height, no building nearby, without recirculation of air. Subsequent laboratory analyses provided data on airborne radioactivity. Daily air samples were collected by air pump at a flow rate of about 10 m<sup>3</sup>/h on two filters in cascade: the atmospheric particulate was collected on Glass Microfiber Binder Free GF/F filters (110 mm diameter) retaining particles down to 0.7 µm, while active carbon filters were used for gaseous iodine.

The filters were measured in one filter geometry by gamma spectrometry with low background HPGe detectors (efficiency of 30–60% and a nominal resolution from 1.9 to 2.5 keV at the 1.33 MeV) after 2 h from daily collection.

In the Casaccia Centre there are three sampling stations and all air filters daily collected were also assembled in a monthly

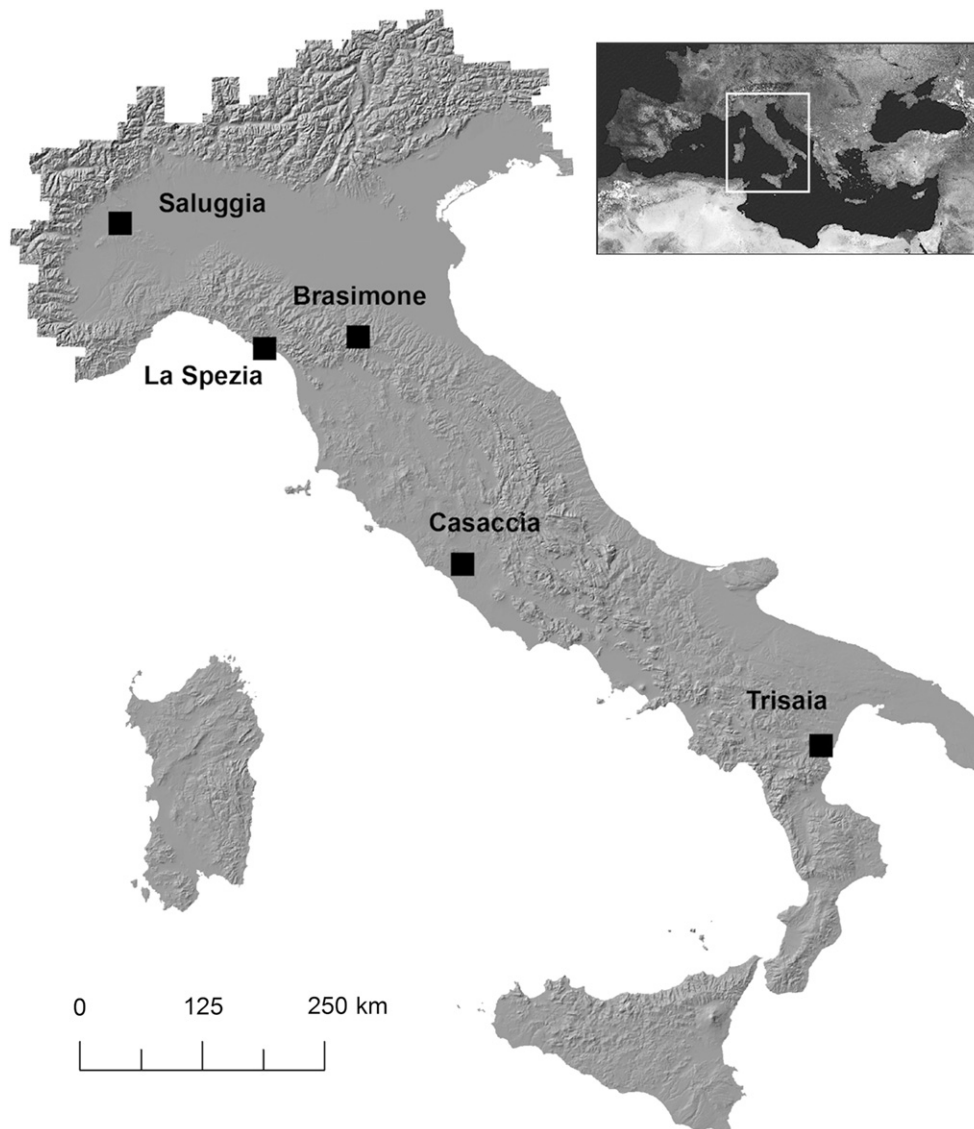


Fig. 1. ENEA sampling sites in Northern (Saluggia, La Spezia, Brasimone), Central (Casaccia) and Southern Italy (Trisaia).

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