



✦ Kirkjufellsfoss, Iceland, lit by the aurora borealis.  
Source: alexander milo on Unsplash.

# Foreword

Under the Euratom Treaty, the European Commission (EC) is mandated to collect, verify and report information on radioactivity levels in the environment (European Union, 2016). In this context the Joint Research Centre (JRC) of the European Commission, as a part of its institutional support programme to DG Energy, operates and maintains the Radioactivity Environmental Monitoring database (REMdb), which contains the environmental radioactivity monitoring data provided by the European Union Member States on an annual basis. The REM database also serves as a historical data pool of radioactivity information related to the Chernobyl accident (26 April 1986). In 1998, the JRC published the Atlas on Caesium-137 Deposition on Europe after the Chernobyl Accident (European Union, 1998), which is still available on-line.

All this information aims at monitoring artificial radioactivity, i.e. radioactivity introduced by man into the environment. However, natural ionising radiation is an important contributor to the exposure of members of the public. The human population is continuously exposed to ionising radiation from several natural sources that can be classified into two broad categories: high-energy cosmic rays incident on the Earth's atmosphere and releasing secondary radiation (cosmic contribution); and radioactive nuclides generated during the formation of the Earth and still present in the Earth's crust (terrestrial contribution). The terrestrial contribution is mainly composed of the radionuclides of the uranium and thorium decay chains together with radioactive potassium. In most circumstances, radon, a noble gas produced in the radioactive decay of uranium, is the most important contributor to radiation exposure. To gain a clearer overview of the radioactive nature of the environment, the JRC embarked on the European Atlas of Natural Radiation. This Atlas aims to provide reference values and generate harmonised data for the scientific community and national competent authorities. At the same time, it should help the public to become familiar with the naturally radioactive environment.

In this Atlas, the editors aim to present the current state of knowledge of natural radioactivity, by giving general background information, and describing its various sources. It is a compilation of contributions and reviews received from more than 100 experts in their field: they come from universities, research centres, national and European authorities, and international organisations.

The Atlas also contains a chapter on the legal basis and requirements on protection from exposure to natural radiation sources. It presents the latest Basic Safety Standards Directive (European Union, 2013), which, for the first time, introduces legally binding requirements on the protection from exposure to natural radiation sources and, more specifically, to radon. It stipulates, *inter alia*, that all EU Member States must establish national radon action plans, define reference levels for indoor radon concentrations in dwellings and in workplaces, and identify and delineate radon-priority areas.

The Atlas is complemented by a collection of European maps displaying the levels of natural radioactivity caused by different sources. As a first step, the JRC started to prepare a European map of indoor radon: it shows 'means over 10km × 10km grid cells of long-term indoor radon concentration in ground-floor rooms of dwellings.' At present (December 2019), 35 European countries participate to this map.

Maps of uranium, thorium and potassium concentration in soil, covering most European countries, have been created, while maps of uranium, thorium and potassium concentration in bedrock are available for some countries. A methodology has been developed (based on ambient dose equivalent rate measurements), while European maps have been created using uranium, thorium and potassium concentration in soil. Moreover, a European annual cosmic-ray dose map has been completed.

This publication is the result of collaboration between scientists and policy-makers in EU Member States and beyond. To this end, the JRC has organised and hosted several international workshops and meetings to promote and disseminate the results of this Atlas, as well as to discuss topics linked to natural radioactivity.

This Atlas provides reference values and makes harmonised datasets available to the scientific community and national competent authorities.

In parallel, it may serve as a guide to the public:

- to familiarise itself with natural radioactivity; and
- to be informed about levels of natural radioactivity caused by different sources.

The publication of this work would not have been possible without the invaluable help and support of all European authorities who provided us with the most current data and information, as well as the national and international experts and scientists who assisted in writing the text parts, and colleagues who provided graphic and photographic material.

This Atlas is addressed to all who are concerned with radioactivity in the European environment.

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