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United Nations Scientific Committee
on the Effects of Atomic Radiation

UNSCEAR Evaluation of Public Exposure to Ionizing Radiation from Natural and Man-made Sources

SG 2 - Natural Radiation Sources (Other than Radon)

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NCPs Webinar
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United Nations Scientific Committee
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UNITED NATIONS



NATIONS UNIES

UNSCLEAR Evaluation of Public Exposure to Ionizing Radiation from Natural
and Man-made Sources

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⁸ ISS

November 2020

Scope and methodology for Subgroup “Natural Radiation Sources (Other
than Radon)”.

1) Scope:

a) Radionuclides and type of radiations considered.

- i) Cosmic Rays.
 - o Primary cosmic rays – External exposure, high energy charged particles (up to TeV, and from electrons or protons to heavy nuclei).
 - o Secondary cosmic rays – External exposure (electrons, muons and neutrons mainly, up to 20 GeV)

SCOPE SG2

- Natural Background:
 - Cosmic Rays
 - Cosmogenic Radionuclides
 - Primordial Radionuclides
- HBRA
- NORM

METHODOLOGY

- UNSCEAR 1982
- UNSCEAR 2000
- UNSCEAR 2008
- UNSCEAR 2016

DATA COMPILATION

- LITERATURE REVIEW (SCIENTIFIC LITERATURE)
- **SURVEY FROM NCPS (NATIONAL DATA)**



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GENERAL GUIDANCE FOR COMPLETION OF 2021 UNSCEAR QUESTIONNAIRE (2007-2020)

1. Introduction

The General Assembly of the United Nations (A/RES/75/91) has invited its Member States to provide data for the new UNSCEAR Global Survey on Public Exposure and to report data according to their national information on public exposure since 2007. The UNSCEAR secretariat has prepared a survey that contains spreadsheet questionnaires, each consisting of several worksheets for each main topical area of public exposure to natural and other sources.

In this regard, the UNSCEAR secretariat invites all UN Member States to respond to the questionnaire with available data, relevant for their country. The information should be submitted by the National Contact Persons to the secretariat via the UNSCEAR online platform. The UNSCEAR secretariat will acknowledge all contributors by countries in the respective annual UNSCEAR reports to the United Nations General Assembly and the final report, scheduled for 2024.

2. Questionnaires

Please read carefully the instructions in the cell's "note field", which become visible when placing the mouse cursor on the title cell. Further explanations on the completion of the questionnaire are given on the UNSCEAR online platform.

Some technical instructions:

- Only cells in or are editable and required to be completed. All other cells are protected and should not be modified as the questionnaire will be processed automatically after submission.
- Please use "0" only when the numerical value is definitely nil. If the requested information, however, is not available leave the cell blank.
- The country identification code and the date of submission are provided automatically when uploading the questionnaire on the UNSCEAR online platform.
- The questionnaires can only be submitted by national contact persons. Thus, they are kindly asked to provide their contact details (including email/phone) to facilitate any follow up, if needed. Names of other persons who helped in completing the questionnaire are also required for the follow up and acknowledgement.
- Please provide any additional information (e.g. comments, references in English or national language with indicated sections) that support the responses and/or might be of interest for this evaluation in the specific fields in the questionnaire or via the UNSCEAR online platform, which allows uploads of additional documents and references. The literature preferred to include scientific articles published in peer reviewed journals. Governmental reports and reports of international organizations, where relevant can also be used as references.

The deadline for including information in the next UNSCEAR public exposure evaluation is **30 September 2021**. Member States are encouraged to respond even if the information is incomplete and if there are specific questions to contact the secretariat (unscear-survey@un.org).

Regular webinars with national contact persons will be organized by the secretariat starting March 2021.

Your assistance in contributing to this survey is very much appreciated.

UNSCLEAR secretariat

ACKNOWLEDGEMENT:

UNSCLEAR secretariat expresses its appreciation to the European Commission (EC), International Atomic Energy Agency (IAEA), Nuclear Energy Agency of the Organisation for Economic Co-operation and Development (OECD/NEA) and the World Health Organization (WHO) for the cooperation established to conduct this survey.

Not all the cells and spreadsheets are required to be completed.

All the data requested is divided into

- Essential data and
- Supplementary data

Essential data is the minimum information needed to perform the dose assessments.

Supplementary data would provide information which would be used to produce more realistic assessments.

Information on parameters, uncertainties, etc. are included



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Version 1.7 PE-SG2 2021-03-01	Please read the further instructions given as comments. They become visible when moving the mouse cursor on the cells. Do not modify the structure of this spreadsheet, as it will be processed automatically.
General information	
Country information	
Country code	
Date of submission	generated on upload
Years (period, from [year] to [year])*	
Population [inhabitants]* (local, national or regional)	
Population (survey base)*	
* required fields	
The data submitted should be signed off and submitted by the national contact person, registered online via the UNSCEAR survey platform, including name, institution and contact details (email/phone) to facilitate any feedback. Please, indicate contact details of any other person who might provide further information or feedback, if needed, and who should be acknowledged in the final report.	
Contact information of NCP	
Name*	
Institution*	
Function*	
Email*	
Phone*	
Supporting national experts	
Name	
Institution	
Function	
Email	
Phone	
Name	
Institution	
Function	
Email	
Phone	
Name	
Institution	
Function	
Email	
Phone	
Comments	

General information regarding the NCP sending the survey.



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United Nations Scientific Committee on the Effects of Atomic Radiation
 Survey 1.1: FS-503 2007-2020
 Please read the further instructions given as footnotes.

SURVEY OF SOURCES AND LEVELS OF PUBLIC EXPOSURE TO IONIZING RADIATION FROM NATURAL SOURCES OTHER THAN RADON (2007-2020)

Notes: Please provide information on averages (arithmetic means - AM) and their associated standard deviations (SD) and ranges (min and max), for one or more of the sections below:
 - Ambient dose equivalent rates;
 - Concentrations of natural radionuclides in water, food, soil, rocks and other raw materials;
 - Annual effective dose (and basis for estimates).
 For each section provide or cite references for the information. For the uncertainties provided, please, provide the methodology used for the calculations performed or a reference where it can be consulted. If an average (AM) and a standard deviation (SD) are not available, please, provide minimum and maximum values measured in the country. Please provide the essential data on levels of public exposure (Section 1 and 2). Supplementary data on sources of public exposure (Section 3) will be highly appreciated.

1. Essential data - all countries

1.1 Information about the country or at least large regions of the country

Please provide measurement data of background exposure or background activity concentrations available in your country for the period 2007-2020 or, if not previously reported to the UNSCEAR, provide the most recent data.

Period covered:

1.1.1 Absorbed dose rate (Gy/h) or Ambient dose equivalent rate (Sv/h) in the environment at ground level (including cosmic rays)

Dose type and unit	Location	Arithmetic mean	Standard deviation	Range (min-max)	Number of measurements
	Indoors				
	Outdoors				
	Underground				

References to reports and publications (Web links and files as attachments will be appreciated. File attachments can be uploaded as additional material on the platform.)

Comments

1.1.2 Natural radionuclides in soils (Bq/kg dry mass)

Activity concentrations in	Radionuclide	Arithmetic mean (Bq/kg dry mass)	Standard deviation (Bq/kg dry mass)	Range (min-max) (Bq/kg dry mass)	Number of measurements
Soil	²³⁸ U				
	²³⁵ U				
	²²⁶ Ra				
	²¹⁰ Pb				

Regions covered:

References to reports and publications (Web links and files as attachments will be appreciated. File attachments can be uploaded as additional material on the platform.)

1.1.3 Natural radionuclides in building materials (Bq/kg dry mass)

Notes: Please, complete the table below for each considered building material and enter additional materials into the indicated fields. Cements are used as an example of mixes of materials which can contain elevated activity concentrations of natural radionuclides. Pozzolana is used as an example of a natural material, not altered by human activities, which is used as a building material.

Building material	Radionuclide	Arithmetic mean (Bq/kg dry mass)	Standard deviation (Bq/kg dry mass)	Range (min-max) (Bq/kg dry mass)	Number of measurements
Concrete	²³⁸ U				
	²³⁵ U				
	²²⁶ Ra				
Brick	²³⁸ U				
	²³⁵ U				
	²²⁶ Ra				
Rocks (e.g. Pozzolane)	²³⁸ U				
	²³⁵ U				
	²²⁶ Ra				
Other material, please indicate:	²³⁸ U				
Other material, please indicate:	²³⁸ U				
Other material, please indicate:	²³⁸ U				
Other material, please indicate:	²³⁸ U				
Other material, please indicate:	²³⁸ U				
Other material, please indicate:	²³⁸ U				
Other material, please indicate:	²³⁸ U				

Footnote: Add the building material if measurement data is available:
 - Air: see UNSCEAR 2008 Annex A, (2008 Annex A);
 - Water: see UNSCEAR 2008 Annex A, (2008 Annex A);
 - Food: see UNSCEAR 2008 Annex A, (2008 Annex A);
 - Soil: see UNSCEAR 2008 Annex A, (2008 Annex A);
 - Rocks: see UNSCEAR 2008 Annex A, (2008 Annex A);
 - Cements: see UNSCEAR 2008 Annex A, (2008 Annex A);
 - Pozzolana: see UNSCEAR 2008 Annex A, (2008 Annex A);
 - Other material: see UNSCEAR 2008 Annex A, (2008 Annex A).

References to reports and publications (Web links and files as attachments will be appreciated. File attachments can be uploaded as additional material on the platform.)

Comments

1.2 Naturally Occurring Radioactive Material (NORM) Industries

If you have detailed information on any of the industries listed in the table below, such as dose evaluations or activity concentrations measured after 2007 or not previously reported to the UNSCEAR, please provide them in the table below. Supplementary, more detailed, information of the NORM industries in the country is requested in section 2.2.

General information of NORM industries in the country

Notes: Please, provide national references on assessments performed on each industry (which include dose assessments, activity concentrations measurements, ...).

Industry	Period covered	Number of facilities	Annual production (t/y)	Waste / Radioactive waste produced (t/y)
Iron and Steel				
Oil and Gas				
Phosphate				
Rare Earth and TiO ₂				
Coal				
Uranium				
Platinum				
Water extraction				

References to reports and publications (Web links and files as attachments will be appreciated. File attachments can be uploaded as additional material on the platform.)

Comments

NORM industries:
 At least number of facilities,
 Processed materials and
 Production of wastes.

Natural background and Building materials:
 Country level (or at least big regions), based in actual measurements.



Version 1.7 (20-03-2021-04-01) [Please read the further instructions given on the platform.](#)

SURVEY OF SOURCES AND LEVELS OF PUBLIC EXPOSURE TO IONIZING RADIATION FROM NATURAL SOURCES OTHER THAN RADON (2007-2020)

Notes: Please provide information on averages (arithmetic means - AM) and their associated standard deviations (SD) and ranges (min and max), for one or more of the sections below:

- Ambient dose equivalent rates;
- Concentrations of natural radionuclides in water, food, soil, rocks and other raw materials;
- Annual effective dose (and data for estimates);
- Essential data on levels of public exposure (Section 1 and 2).

For each section provide or cite references for the information. For the uncertainties provided, please, provide the methodology used for the calculations performed or a reference where it can be consulted. If an average (AM) and a standard deviation (SD) are not available, please, provide minimum and maximum values measured in the country. Please provide the most recent data. Supplementary data on sources of public exposure (Section 3) will be highly appreciated.

2. Essential data - High background radioactivity areas (HBRA) if any in the country

If in your country there are areas with exceptionally high doses or activity concentrations (HBRA), and only if you have made new measurements of background doses or background activity concentrations in your country after 2005, please fill in the tables of this section. If measurements were not previously (prior 2007) reported to the UNSCEAR, please provide that information.

Notes: HBRA (or enhanced natural radiation areas - ENRA) are areas of the world that are known to have levels of exposure due to natural sources of radiation that are in excess of those considered to be "normal background". Not every country has such areas. Fill this section only if, in your country, there exist areas with natural radiation significantly above average national values.

Characteristics of high background radioactivity areas	Area 1				Area 2				Area 3				Area 4			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Name of HBRA																
State/Region																
Nearest settlements																
Geographical coordinates or Plus Code, or Web link, e.g. https://www.google.com/maps/@51.3193888,36.1504832,8z																
HBRA area (km ²)																
Period covered																
Short description of HBRA (environment, materials with enhanced radionuclide content, its origin, etc.)																
References to reports and publications																
Comments																

2.1 Absorbed dose rate (Gy/h) or Ambient dose equivalent rate (Sv/h) in the environment at ground level (including cosmic rays) in HBRA

Dose type and unit	Location	Arithmetic mean				Standard deviation				Range (min-max)				Number of measurements				
		Area 1	Area 2	Area 3	Area 4	Area 1	Area 2	Area 3	Area 4	Area 1	Area 2	Area 3	Area 4	Area 1	Area 2	Area 3	Area 4	
	Indoors																	
	Outdoors																	
	Undefined																	

References to reports and publications (Web links and files as attachments will be appreciated. File attachments can be uploaded as additional material on the platform.)

Comments

2.2 Natural radionuclides in soils (Bq/kg dry mass) in HBRA

Activity concentration	Radionuclide	Arithmetic mean (Bq/kg dry mass)				Standard deviation (Bq/kg dry mass)				Range (min-max) (Bq/kg dry mass)				Number of measurements				
		Area 1	Area 2	Area 3	Area 4	Area 1	Area 2	Area 3	Area 4	Area 1	Area 2	Area 3	Area 4	Area 1	Area 2	Area 3	Area 4	
Soil	²³⁸ U																	
	²³² Th																	
	²³⁵ U																	
	⁴⁰ K																	

References to reports and publications (Web links and files as attachments will be appreciated. File attachments can be uploaded as additional material on the platform.)

Comments

2.3 Natural radionuclides in building materials (Bq/kg dry mass) in HBRA

Notes: Please, complete the table below for each considered building material and enter additional materials into the indicated fields. Defaults are used as an example of types of materials which can contain elevated activity concentrations of natural radionuclides. Radon is used as an example of a natural material, not related to human activities, which is used as a building material.

Building material	Radionuclide	Arithmetic mean (Bq/kg dry mass)				Standard deviation (Bq/kg dry mass)				Range (min-max) (Bq/kg dry mass)				Number of measurements				
		Area 1	Area 2	Area 3	Area 4	Area 1	Area 2	Area 3	Area 4	Area 1	Area 2	Area 3	Area 4	Area 1	Area 2	Area 3	Area 4	
Concrete	²³⁸ U																	
	²³² Th																	
	²³⁵ U																	
	⁴⁰ K																	
Bricks	²³⁸ U																	
	²³² Th																	
	²³⁵ U																	
	⁴⁰ K																	
Rocks (e.g. Pozzolans)	²³⁸ U																	
	²³² Th																	
	²³⁵ U																	
	⁴⁰ K																	
Other material (bricks)	²³⁸ U																	
	²³² Th																	
	²³⁵ U																	
	⁴⁰ K																	
Other material (bricks)	²³⁸ U																	
	²³² Th																	
	²³⁵ U																	
	⁴⁰ K																	
Other material (bricks)	²³⁸ U																	
	²³² Th																	
	²³⁵ U																	
	⁴⁰ K																	

Add other building materials if measurements data is available:

- Add other materials and name (UNSCLEAR 2007 Annex B);
- Photographic and material manufacturer data (UNSCLEAR 1992 Annex A, 1992 Annex A);
- Full and partial lists of radionuclides (UNSCLEAR 2007 Annex B);
- Full and partial lists of radionuclides (UNSCLEAR 2007 Annex B);
- Please use in range (UNSCLEAR 2007 Annex B).

References to reports and publications (Web links and files as attachments will be appreciated. File attachments can be uploaded as additional material on the platform.)

Comments

Identification of the HBRA and

Actual measurements on the HBRA (absorbed dose, activity concentrations,...),

- Provide a range and the uncertainties (SD).
- Provide references where possible.



Version 1.7 PE-902-2021-02-01. Please read the further instructions given as footnotes.

SURVEY OF SOURCES AND LEVELS OF PUBLIC EXPOSURE TO IONIZING RADIATION FROM NATURAL SOURCES OTHER THAN RADON (2007-2020)

Notes: Please provide information on averages (Arithmetic Means - AM) and their associated standard deviations (SD) and ranges (min and max), for one or more of the sections below:
 - Ambient dose equivalent rates;
 - Concentrations of natural radionuclides in water, food, soil, rocks and other raw materials;
 - Annual effective dose (and basis for estimates).
 For each section provide or cite references for the information. For the uncertainties, please, provide the methodology used for the calculations performed or a reference where it can be consulted. If an average (AM) and a standard deviation (SD) are not available, please, provide minimum and maximum values measured in the country. Please present the most recent data.

3. SUPPLEMENTARY DATA

3.1 Information about the entire country or at least large regions of the country

Period covered:

3.1.1 Cosmogenic radionuclides measured at ground levels (Bq/m³)

Concentration	Radionuclide	Arithmetic mean (Bq/m ³)	Standard deviation (Bq/m ³)	Range (min-max) (Bq/m ³)	Number of measurements
Air	⁷ Be				
	¹⁰ C				
	¹⁴ C				
	²¹⁰ Pb				

References to reports and publications (Web links and files as attachments will be appreciated. File attachments can be uploaded as additional material on the platform.)

Comments

Additional information on cosmogenic radionuclides measured at ground level (mean, SD and range) – if available at country level.

Additional information per NORM industry.

- Effective dose – assessed at country level – provide methodology and parameters.
- Activity concentrations – main radionuclides.
- References (not scientific articles, but national reports).

3.2 Naturally Occurring Radioactive Material (NORM) Industries

3.2.1 Oil & Gas industry (drilling, storage and transport)

Period covered:

Notes: If there is a national estimation of the annual effective doses received by members of the public due to the activity of this industry (from extraction to waste recycling or disposal, including processing), please, provide the following information:

Effective Dose	Average (mSv/y)	Minimum (mSv/y)	Maximum (mSv/y)	Number of exposed people
Provide the methodology used to estimate the effective doses or a reference where it can be found				

Activity concentration	Radionuclide	Arithmetic mean (Bq/kg)	Standard deviation (Bq/kg)	Range (min-max) (Bq/kg)	Number of measurements
Waste containing naturally occurring radioactive materials (and radioactive waste)	²²⁶ Ra				
	²¹⁰ Pb				
	²¹⁰ Po				
Other isotopes which can be of concern regarding public doses. Please specify					

References to reports and publications (Web links and files as attachments will be appreciated. File attachments can be uploaded as additional material on the platform.)

Comments



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QUESTIONS

SG2

What are the criteria/definition for high background radiation areas?

If you have an area in your country where the background exposure deviates 3,4 or 5 times from the standard values, or it is in some way unusual – please report it. The UNSCEAR has concluded that natural radiation sources indicate that the average annual effective dose to the world population is approximately 2.4 mSv, which is the same as the previous estimates.

The cosmic rays are not to be included separately in relation to this topic. Also, this type of survey usually indicates the number of miles covered, not number of measurements conducted.

We request absorbed dose rate in the air or ambient dose equivalent rate at ground level, which includes cosmic radiation. But we do request dose rates caused by cosmic rays separately. If a country has conducted measurements of dose rates from cosmic rays separately, please share that data as supplementary data.

Water treatment plants are only to include ground water.

At present we primarily focus on the topics of previous reports, which is the ground water and not the surface water. If you do not have some information or you have different information related, please state this in the comments and explain why.

Reports focus mainly on radioactive waste, but not explicitly from the NORM industries.

We will cover NORM waste from oil and gas, other NORM industries, and radioactive waste, as some countries do not categorise NORM waste as radioactive waste. Please specify in your response how waste from NORM industries is classified.

90% of the time the exposure is indoor exposure and NORM is used in building materials. What would be the place to provide this information?

In section 1.1.1 of the questionnaire we are requesting both, indoor and outdoor absorbed dose rate in the air or ambient dose equivalent rate at ground level. We included building materials separately in section 1.1.3.



SG2

For part 1 on exposure from natural radionuclides, we are wondering if some fields are missing. The 'note' on the top of the page states that data is requested for "Concentrations of natural radionuclides in water, food, soil, rocks, and other raw material", amongst other things. However, from what we can see, there are no fields for information on radionuclides in water or food. We can only see that dose rates, soil and building materials (1.1.1-1.1.3), as well as information on NORM industries (1.2). Are there any fields missing, or have we misinterpreted?

The initial version of the questionnaire had food and water, but it was decided to reduce the amount of data to be asked from NCPs and we now rely on review of scientific publications for this topic first. The questionnaire was updated, distributed to NCPs and published on the survey website. The revised questionnaires include a change log.

Corrigendum:

Essential data - all countries:

Notes: Please provide information on averages (arithmetic means - AM) and their associated standard deviations (SD) and ranges (min and max), for one or more of the sections below:

- Absorbed dose rates in air or ambient dose equivalent rates at ground level (including cosmic rays);
- Average activity concentrations of natural radionuclides in soils and building materials (including rocks and other raw materials);
- Number of NORM industries for each requested category and annual production of product and waste.

For each section provide or cite references for the information. For the uncertainties provided, please, provide the methodology used for the calculations performed or a reference where it can be consulted. If an average (AM) and a standard deviation (SD) are not available, please, provide minimum and maximum values measured in the country. Please provide the most recent data.



SG2

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Corrigendum:

Essential data - HBRA areas:

Notes: Please provide information on averages (arithmetic means - AM) and their associated standard deviations (SD) and ranges (min and max), for one or more of the sections below:

- Absorbed dose rates in air or ambient dose equivalent rates at ground level (including cosmic rays);
- Average activity concentrations of natural radionuclides in soils and building materials (including rocks and other raw materials);

For each section provide or cite references for the information. For the uncertainties provided, please, provide the methodology used for the calculations performed or a reference where it can be consulted. If an average (AM) and a standard deviation (SD) are not available, please, provide minimum and maximum values measured in the country. Please provide the most recent data."



SG2

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Corrigendum:

Supplementary data:

Notes: Please provide information on averages (Arithmetic Means - AM) and their associated standard deviations (SD) and ranges (min and max), for one or more of the sections below:

- Activity concentrations of cosmogenic radionuclides measured in air at ground level;
- Annual effective dose estimated for the public affected by each NORM industry in the country (please, provide references that support your estimation);
- Activity concentrations of natural radionuclides measured in wastes generated in the NORM industries in your country;

For each section provide or cite references for the information. For the uncertainties provided, please, provide the methodology used for the calculations performed or a reference where it can be consulted. If an average (AM) and a standard deviation (SD) are not available, please, provide minimum and maximum values measured in the country. Please provide the most recent data."



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The corrected file was sent and uploaded to the UNSCEAR Global Survey website:

<http://survey.unscear.org/doku.php>



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Thank you



Unscear@un.org