The UNSCEAR 2021 report on occupational exposure: approach, trends and challenges

Borislava Batandjieva-Metcalf
Secretary of UNSCEAR

borislava.batandjievametcalf@un.org
• Established by UN General Assembly resolution in 1955
• Scientists from 27 UN Member States
• Assess levels, effects and risks of ionizing radiation
  – identify emerging issues
  – improve knowledge
  – identify areas for future research
• Disseminate findings to UN General Assembly, scientific community and public
Scientists from 27 UN States Member + 4 Observers*

- Algeria*
- Argentina
- Australia
- Belarus
- Belgium
- Brazil
- Canada
- China
- Egypt
- Finland
- France
- Germany
- India
- Indonesia
- Iran (IR)*
- Japan
- Mexico
- Norway*
- Pakistan
- Peru
- Poland
- Rep. of Korea
- Russia
- Slovakia
- Spain
- Sudan
- Sweden
- Ukraine
- UAE*
- UK
- USA

Input: Other Member States and international organizations provide relevant data and technical input


Latest Report to 75th General Assembly
Technical Meeting on Assessment and Evaluation of the Occupational Radiation Protection Appraisal Service (ORPAS), 17 Sept. 2021

ICRP
Protection philosophy, principles and units

ILO convention 115: occupational radiation protection

FAO/WHO
Codex Alimentarius Commission (food contamination guides)

UN transport regulations for radioactive material

implemented by UN Member States

issues
effects
risks

issues
levels
trends

UNSCEAR
Scientific basis

UNSCEAR
United Nations Scientific Committee on the Effects of Atomic Radiation
Key areas

- Weapons Tests
- Nuclear Accidents
- Medical Exposure
- Occupational Exposure
- Public Exposure
- Electricity Generation
- Natural Radiation Sources
- Radon (Sources and Effects)
- Non-Human Biota and Environment
- Health Effects, Risk Estimates and Uncertainties
- Effects of Children
- Biological Effects and Mechanisms
- Epidemiological Studies
- Hereditary Effects
- Radiation Sources
- Radon (Sources and Effects)
Occupational Exposure

- UNSCEAR evaluated levels of occupational exposure since 1975
- UNSCEAR approved the latest report in June 2021
  - Data from UNSCEAR Global Survey of Occupational Exposure
  - Review and analysis of peer reviewed literature
  - Data from international organizations
“Evaluation of Occupational Exposure to Ionizing Radiation”
2016 – 2021

**Aim:** To evaluate the contribution made by each of the major occupational sectors using ionizing radiation and to estimate the worldwide levels of exposure for each sector.

**Contributing Countries**

[Flag images of contributing countries]
Occupational Exposure

- Committee decision in 2014
- United Nations General Assembly invited all Member States
- UNSCEAR secretariat established a network of national contact persons to collect information from Member States through an online platform / questionnaires
- Carried out survey in 2016 (57 countries responses) and IAEA survey in 2020
- Data from the literature after a review process
  - Reviewed 692 articles
  - About 50% met the UNSCEAR criteria
- Supporting data directly from other sources such as IAEA, ICAO, ISOE and WNA very valuable
• uranium mining and milling
• nuclear power reactors in operation
• medical sector
• cosmic ray exposure of aircrew

Trends:
• UNSCEAR 2000 (1990-1994)
• UNSCEAR 2021 (2003-2014)

• **Progress**
  - Broad range of sectors (49)
  - Evaluation has improved substantially for some sectors (medical, civil aviation, NFC, etc)
  - First time uncertainties estimated (precision and accuracy)
  - Strong cooperation and information from international organizations (e.g. IAEA, ISOE, ICAO, WNA)

• **Challenges**
  - Underestimation of exposures (average and collective) in some sectors
  - Limited submission of data (e.g. industrial, military, sectors in Rn area, some subsectors in NFC area)
  - Limited data on lens of the eye and hands (skin dose)
  - Improving consistency and representativeness of reported data
Summary results (2010-2014)

• \( \sim 24 \text{ million} \) annual number of workers exposed to natural and human-made sources of ionizing radiation compared to 23 million (1995-1999)

Source: Report to UN GA A/76/46
Natural Sources

- 94% in extraction and processing of coal and minerals other than coal and Uranium

- About **12 million** - mining operations (70% in coal mining and 30% in other mining operations, excluding uranium mining)

- **0.7 million** - civilian aviation
Human-made Sources

- 11.4 million estimated worldwide monitored workers
- 80% working in the medical sector

### Estimates of worldwide occupational exposure associated from human-made sources for the period 2010–2014

<table>
<thead>
<tr>
<th>Sectors</th>
<th>Number of monitored workers ($10^3$)</th>
<th>Annual collective effective dose (man Sv)</th>
<th>Weighted average annual effective dose (mSv)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nuclear fuel cycle</td>
<td>760</td>
<td>485</td>
<td>0.6</td>
</tr>
<tr>
<td>Medical use</td>
<td>9,000</td>
<td>4,500</td>
<td>0.5</td>
</tr>
<tr>
<td>Industrial use</td>
<td>1,100</td>
<td>437</td>
<td>0.4</td>
</tr>
<tr>
<td>Miscellaneous use</td>
<td>540</td>
<td>38</td>
<td>0.1</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>11,400</strong></td>
<td><strong>5,460</strong></td>
<td><strong>0.5</strong></td>
</tr>
</tbody>
</table>

*Values are rounded.*
• The worldwide average annual effective dose for all workers during the period 2010–2014 was estimated to be around **1.2 mSv** resulting from **2.0 mSv** for workers exposed to natural sources and **0.5 mSv** for workers exposed to human-made sources.

![Estimated average annual effective dose of workers by radiation source (mSv)](image)

- Human made from 1.7 mSv (1970s) to 0.5 mSv
- Natural from 2.7 mSv (1995-1999) to 2.0 mSv (excluding Rn in other places than mines)
Conclusions

• Overall improvement of estimates
• Estimation due to limited data and future submission of essential data from larger Member States is needed for extrapolation (e.g., gas and oil industry, exposure to Rn other that mines)
• Likely underestimation of the number of workers and estimated collective effective doses, owing to the incomplete data submission for some occupational sectors for the reporting period.
• The Committee recommended the use of its occupational questionnaire to collect such information on a more regular basis (discussion at 69th session in 2022)
• The Committee noted that reported data on the equivalent doses for the lens of the eye and for the hands (skin dose) were limited.
• The Committee did not identify worker groups with high annual effective dose due to new techniques
• The Committee highlighted the importance and the need for reporting from more Member States in the future. Their participation will (a) maintain and extend the Committee’s network of national contact persons, and (b) enhance the quality, representativeness and reliability of the Committee’s evaluations of sources and levels of exposure to ionizing radiation.
• The collaboration with Member States and international organizations has been essential.
• While ORPAS reports have not been used, they could be a useful source of information for the next UNSCEAR evaluation (2025)
Thank you!

Scheduled publication and webinar
- 1Q 2022 –

Next UNSCEAR evaluation considered
- 2025-

www.unscear.org