

Introduction to UNSCEAR and the UNSCEAR report of 2016

Hans Vanmarcke
SCK•CEN

BVS-ABR

Brussels, Friday 7 December 2018



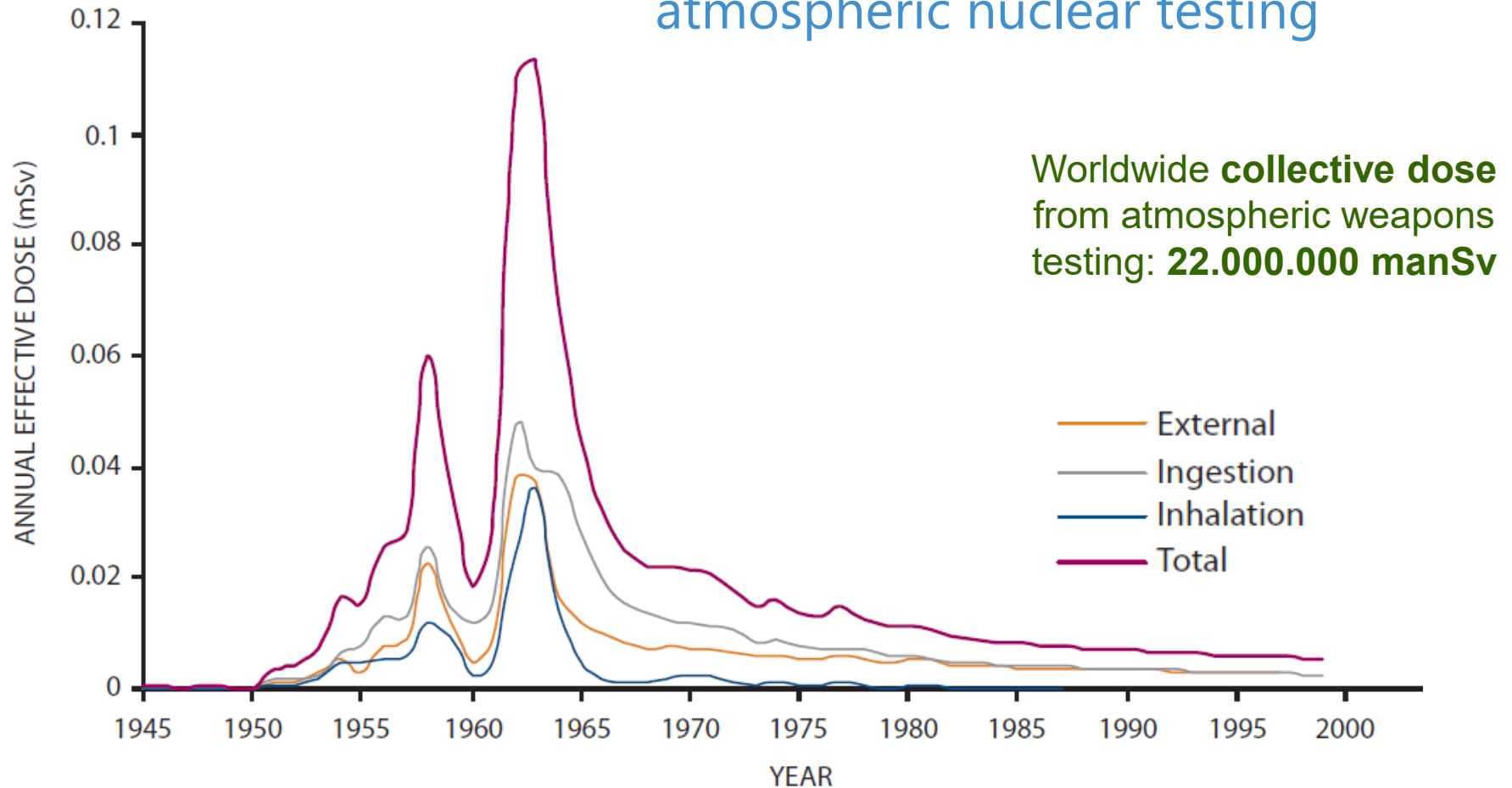
- **UN Scientific Committee reporting to the General Assembly**
- UNSCEAR's evaluations of sources and effects of ionizing radiation
- 65th session of UNSCEAR: Vienna 11 to 14 June 2018
- UNSCEAR 2016 report

United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR)

- UNSCEAR is a scientific committee established by the General Assembly of the United Nations in 1955 in response to concerns about the health effects of ionizing radiation
- At that time the main concern was the radioactive fallout from the many atmospheric nuclear weapons tests

The testing of nuclear weapons in the atmosphere, from 1945 until 1980, caused the largest collective dose from man-made sources of radiation (*medical exposures not included*)

Worldwide average **individual dose** from atmospheric nuclear testing



- **1963**: maximum worldwide average dose = 0.11 mSv/y
- **Present** worldwide average dose ~ 0.005 mSv/y

UNSCEAR's mandate

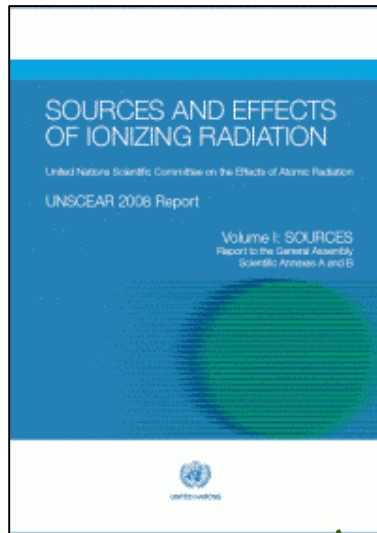
Main organization of the United Nations with respect to

- Worldwide levels and trends of radiation exposure of workers, patients, public and environment in normal and accidental situations
- Review of biological and health effects of ionizing radiation
 - At high exposures: radiation burns, acute radiation sickness or even death
 - At lower levels, principal risk is increase in radiation-induced cancer
 - But also hereditary disease, non-cancer effects and effects of radiation on plants and animals

UNSCEAR

- ➡ Reports to General Assembly of United Nations
- ➡ Provides scientific basis of radiation protection

UNSCEAR provides scientific basis of radiation protection



UNSCEAR
Scientific basis

Biological and health effects

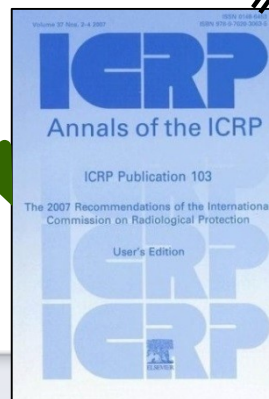
ICRP
Fundamental principles
of radiation protection

Levels and trends of exposure

IAEA
New Intern. BSS



Recommendations (ICRP 103)



National legislation



Member States had to comply with new EU BSS by 6 February 2018



European Union
New EU BSS

UNSCEAR

Method of working

Committee composed of 27 Member States:

Argentina, Australia, Belarus, **Belgium**, Brazil, Canada, China, Egypt, Finland, France, Germany, India, Indonesia, Japan, Mexico, Pakistan, Peru, Poland, Russia, Slovakia, South-Korea, Spain, Sudan, Sweden, Ukraine, the United Kingdom and the United States of America

4 candidate Member States: Algeria, Iran, Norway and the United Arab Emirates

Annual meetings: to evaluate the scientific reports prepared by the secretariat in Vienna

All UNSCEAR reports are available on the website:

<http://www.unscear.org/index.html>

2017 / 2016 / 2013 / 2012 / 2010, 2008 and 2006 / 2001 and 2000 / 1996 / 1994 / 1993 / 1988 / 1986 / 1982 / 1977 / 1972 / 1969 / 1966 / 1964 / 1962 / 1958

UNSCEAR officers for the 64th and 65th sessions (2017 and 2018)

- Chair: Hans Vanmarcke (Belgium)
- Vice-Chairs: Peter Jacob (Germany)
Michael Waligorski (Poland)
Patsy Thompson (Canada)
- Rapporteur: Gillian Hirth (Australia)

Challenging year for UNSCEAR

Understaffing Secretariat

- UNSCEAR Secretary, Malcolm Crick, left end of February 2018
- Scientific Officer, Ferid Shannoun, is also Acting Secretary
- ➔ Weighs heavily on the operation of the Committee
- ➔ Session postponed from April to a 4-day session in June 2018
- ➔ Hampers the future programme of work

Election new officers postponed because Vice-Chair Patsy Thompson could not attend the session

- ➔ Hans Vanmarcke remains Chair until next session

➔ Successful session despite the many problems

Belgian delegation (Benelux)

Representative: [Hans Vanmarcke](#) (SCK•CEN)

Alternate representatives: [Sarah Baatout](#) (SCK•CEN)
[Patrick Smeesters](#) (FANC/AFCN)

Advisors: [Hilde Bosmans](#) (KUL), [Hilde Engels](#) (RIZIV),
[Harry Slaper](#) (RIVM, NL), [Leon Mullenders](#) (Univ. Leiden, NL),
[Petra Willems](#) (FANC/AFCN), [François Jamar](#) (UCL)

Belgian delegation is very active

- [Sarah Baatout](#): Rapporteur document on biological mechanisms
- [Hans Vanmarcke](#): Chair document on lung cancer from radon
- [Hilde Bosmans](#): Member Expert Group on medical exposures
- [Leon Mullenders](#): Member Expert Group on biological mechanisms
- [Petra Willems and FANC colleagues](#): submitted data on medical and occupational exposure in Belgium

Belgium takes the lead in diplomatic issues related to UNSCEAR

- Excellent support by the [Belgian Missions in Vienna and New York](#)

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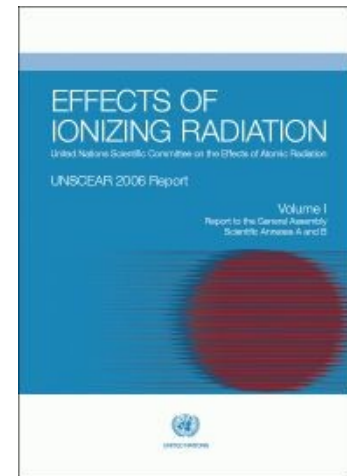
UNSCEAR 2006 report

First part of the previous cycle

Volume I: Epidemiological studies

Annex A. Epidemiological studies of **radiation and cancer**

Annex B. Epidemiological evaluation of **cardiovascular disease**
and other **non-cancer** diseases following radiation exposure

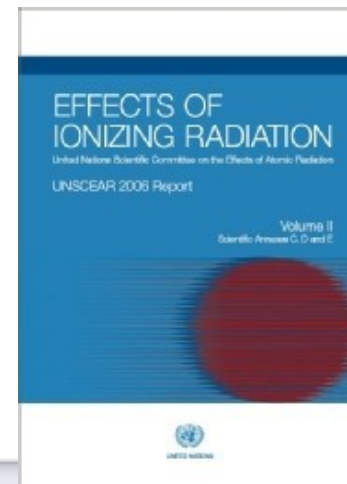


Volume II: Effects

Annex C. **Non-targeted** and delayed effects of exposure to ionizing radiation

Annex D. Effects of ionizing radiation on the **immune system**

Annex E. Sources-to-effects assessment for **radon** in workplaces and homes



UNSCEAR 2006 lifetime risk estimates averaged over five populations of all ages and both sexes

Risk of exposure-induced death for **solid cancer** following an acute exposure (% at specified dose)

- 1 Sv : 4.3 – 7.2 (lower than UNSCEAR 2000 estimate of 11%/Sv)
- 0.1 Sv : 0.36 – 0.77 (*) (in line with UNSCEAR 2000 assuming a DDREF of 2)

Risk of exposure-induced death for **leukemia** (% at specified dose)

- 1 Sv : 0.6 – 1.0 (in line with UNSCEAR 2000 estimate of 0.9%/Sv)
- 0.1 Sv : 0.03 – 0.05 (*) (in line with UNSCEAR 2000 assuming a DDREF of 2)

The UNSCEAR 2006 models implicitly account for extrapolation to low doses (no need for a DDREF correction)

(*) **Uncertainties at 0.1 Sv:** factor of 2-3 higher and include zero

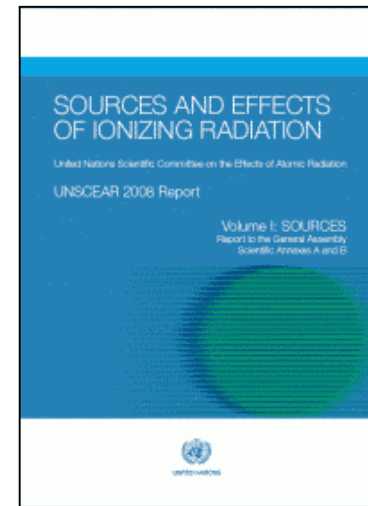
UNSCEAR 2008 report

Second part of the previous cycle

Volume I: Sources

Annex A. **Medical** radiation **exposures**

Annex B. **Exposures of the public and workers** from various sources of radiation

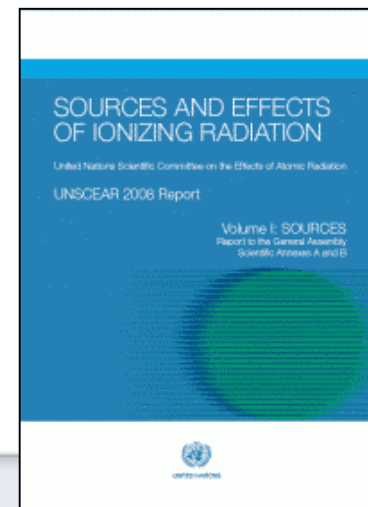


Volume II: Effects

Annex C. Radiation exposures in **accidents**

Annex D. Health effects due to radiation from the **Chernobyl** accident (3rd report on the Chernobyl accident)

Annex E. Effects of ionizing radiation on **non-human biota**

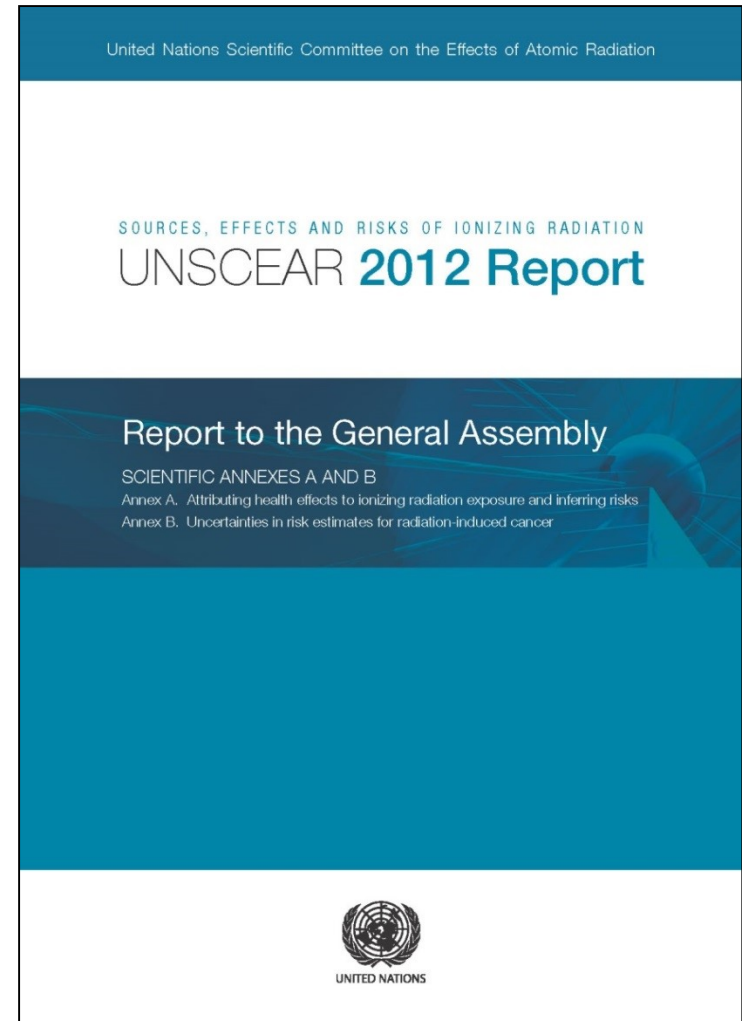


UNSCEAR 2012 report

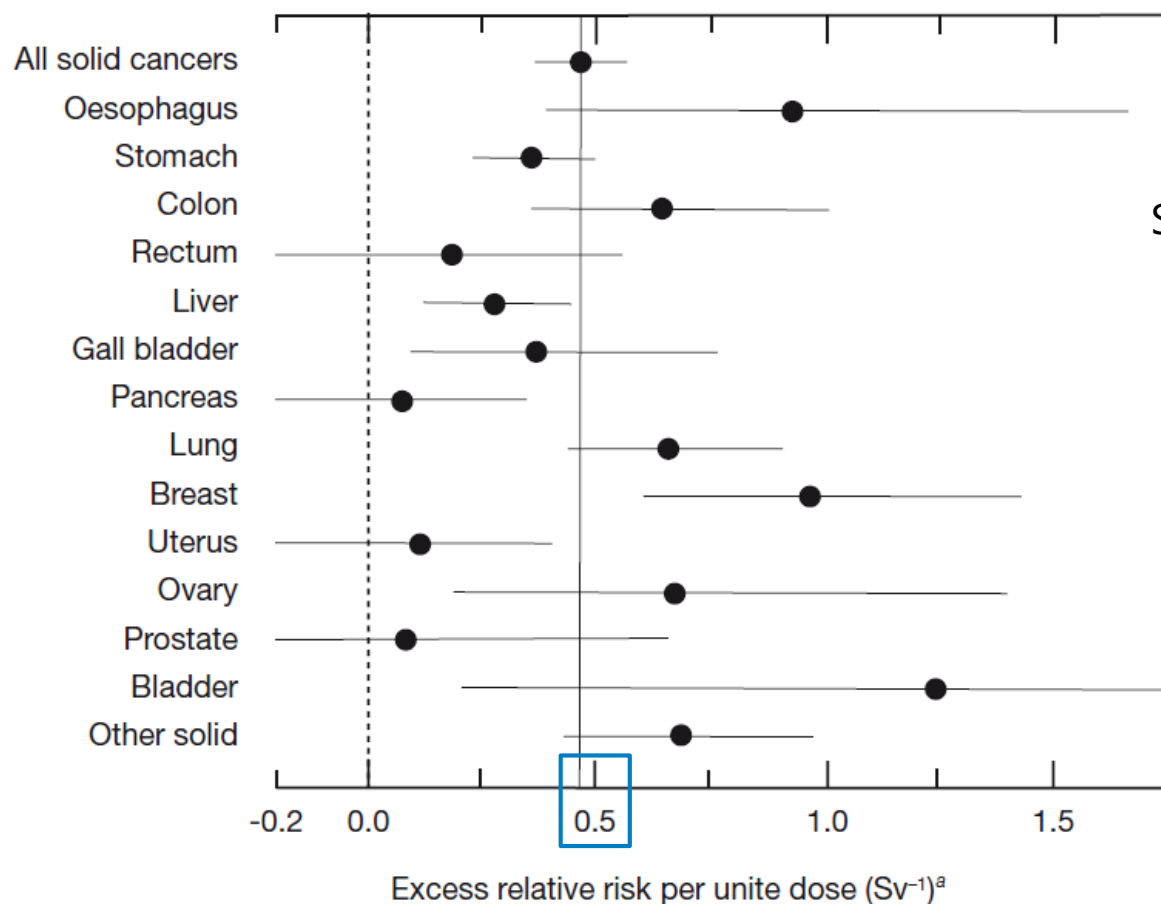
Annex A. **Attributing health effects** to ionizing radiation exposure and **inferring risks**

- It took UNSCEAR 3 years, after the approval by the General Assembly, to reach a consensus on the scientific annex

Annex B. **Uncertainties** in risk estimates for radiation-induced cancer



Organ-specific solid cancer mortality among the survivors of the atomic bombings in Japan

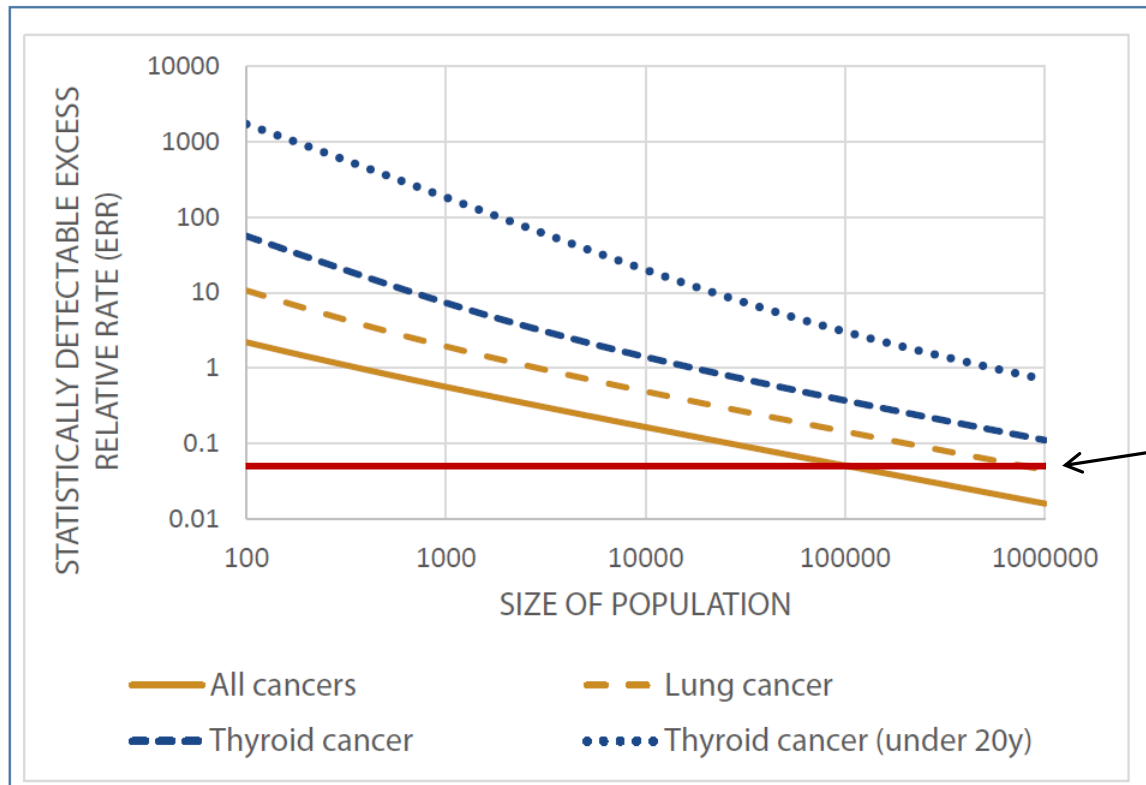


Substantial differences in cancer mortality for various organs

≈ 0.5 per Sv for solid cancers
or an **ERR of 5% per 100 mSv**
(assuming LNT)

UNSCEAR, 2006

What cohort size is needed to detect an excess relative rate of 5%?



UNSCEAR, 2012

ERR of 5%

(100 mSv in the Hiroshima-Nagasaki study)

- For **all cancers** and an ERR of 5%, **two perfectly matched populations of 100,000 people** are needed
 - For **specific cancers** **much larger cohorts** are needed
 - In practice, due to **bias and confounding factors** **larger cohorts** are needed
- ➔ **Sets an effective limit** on the power of low dose epidemiological studies

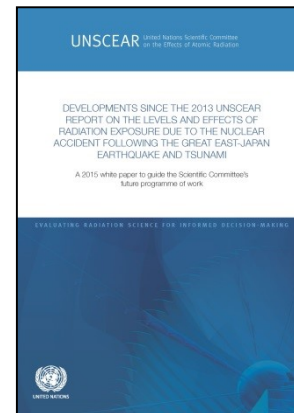
UNSCEAR 2013 report

Volume I: **Fukushima accident**

Levels and effects of radiation exposure due to the nuclear accident after the 2011 great east-Japan earthquake and tsunami

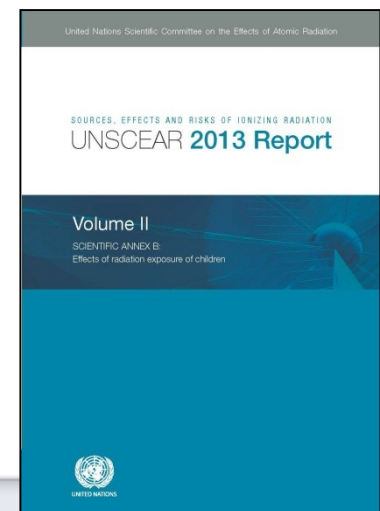
Fukushima 2015, 2016 and 2017 white papers

Yearly review of new publications on the Fukushima accident



Volume II: Effects of radiation exposure of **children**

- Substantial differences in radiosensitivity between children and adults (children are more sensitive for leukemia and for thyroid, brain, skin and breast cancer)



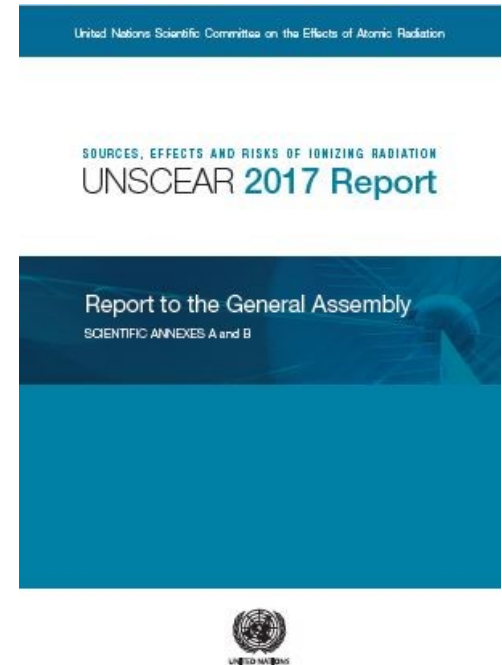
UNSCEAR 2017 report

Annex A. Principles and **criteria for ensuring the quality of the Committee's reviews of epidemiological studies** of radiation exposure

- **UNSCEAR procedure** to assess the strengths and limitations of epidemiological studies

Annex B. Epidemiological studies of **cancer risk** due to low dose-rate radiation **from environmental sources**

- One paragraph on **DDREF**
 - **DDREF cannot be expressed by a single value** because dose response relationships depend on a large number of factors
- ➡ **Radiation protection concept** (not for a scientific committee)



Update of thyroid cancer data from Chernobyl

Number of thyroid cancers in 1991-2015: \approx 20,000

in under-18 in 1986 in Belarus, Ukraine and the most contaminated regions in Russia

- **Three times higher than in 1991-2005**
- **Confounding factors**
 - Increased spontaneous incidence rate with adulthood
 - Improvements in diagnostic methods

Fraction attributable to radiation exposure: \approx 25%
(7%-50%)

UNSCEAR United Nations Scientific Committee
on the Effects of Atomic Radiation

EVALUATION OF DATA ON THYROID CANCER
IN REGIONS AFFECTED BY
THE CHERNOBYL ACCIDENT

A white paper to guide the Scientific Committee's
future programme of work



UNEP booklet

Radiation: Effects and Sources (60 pages)

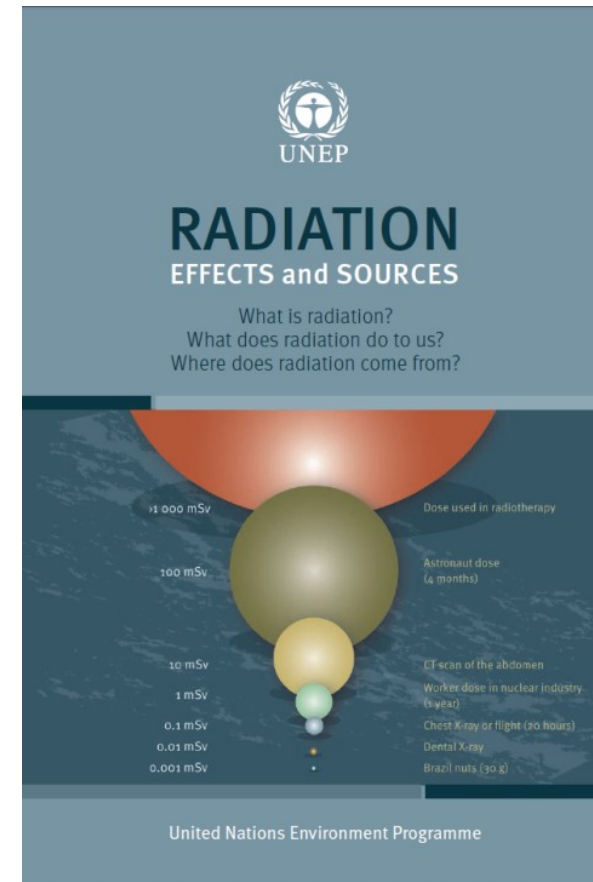
To inform the general public on

- What is radiation?
- What does radiation do to us?
- Where does radiation come from?

Booklet available at the UNSCEAR website:

<http://www.unscear.org/unscear/en/publications/booklet.html>

- Kristine Leysen (SCK•CEN) acknowledged for her contribution
- Translation in the 6 UN languages, including **French** by France, Canada, Switzerland and Belgium. SCK•CEN reviewed the translation
- Translation in 5 other languages, including **Dutch** by FANC/AFCN, SCK•CEN, ANVS and RIVM



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Documents discussed with a view

To publish next year (2019)

- **Selected evaluations** of health effects and of risk inference due to radiation exposure
- Lung cancer from exposure to **radon**
 - Will the factor two between the epidemiological and dosimetric approaches be confirmed? (*in contrast to ICRP 137*)

To publish in two years (2020)

- **Biological mechanisms** influencing health effects from low-dose radiation exposure
- **Medical, occupational and public exposure** to ionizing radiation

Future programme of work severely hampered by understaffing

Update 2013 UNSCEAR report on the **Fukushima accident**

- New report before 2021 (10th anniversary) (Japanese proposal)

Programme on **mechanisms and effects of radiation exposure (2020-2024)** developed by ad hoc working group

- New projects delayed awaiting new UNSCEAR secretary
 - **Second primary cancer** after radiotherapy (French proposal)
 - Epidemiological studies of **radiation and cancer** (US proposal)

Human exposure to natural radiation sources delayed (Chinese proposal)

- Awaiting decision on radon dose conversion factor

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UNSCEAR 2016 report

Annex A. **Methodology** for estimating public exposures due to radioactive discharges

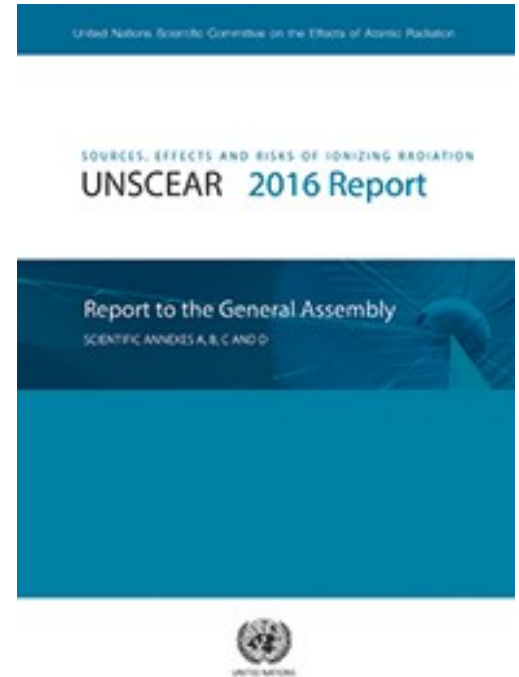
- **Used in annex B** to calculate radiation exposures from different electricity-generating technologies

Annex B. Radiation exposures from **electricity generation**

- Detailed evaluation of **nuclear fuel cycle** and **coal cycle**
- More **rudimentary evaluation** of other electricity-generating technologies: **gas, oil, geothermal, solar PV, wind and biomass**

Annex C. Biological effects of selected internal emitters: **tritium**

Annex D. Biological effects of selected internal emitters: **uranium**



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Centre d'Etude de l'Energie Nucléaire
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Registered Office: Avenue Herrmann-Debrouxlaan 40 – BE-1160 BRUSSELS
Operational Office: Boeretang 200 – BE-2400 MOL

