2016 Rio
norm VIII
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NORM: A Public Health Perspective

E. van Deventer
Team Leader, Radiation Programme

Department of Public Health, Environmental and Social Determinants of Health
Geneva, Switzerland

World Health Organization

Outline

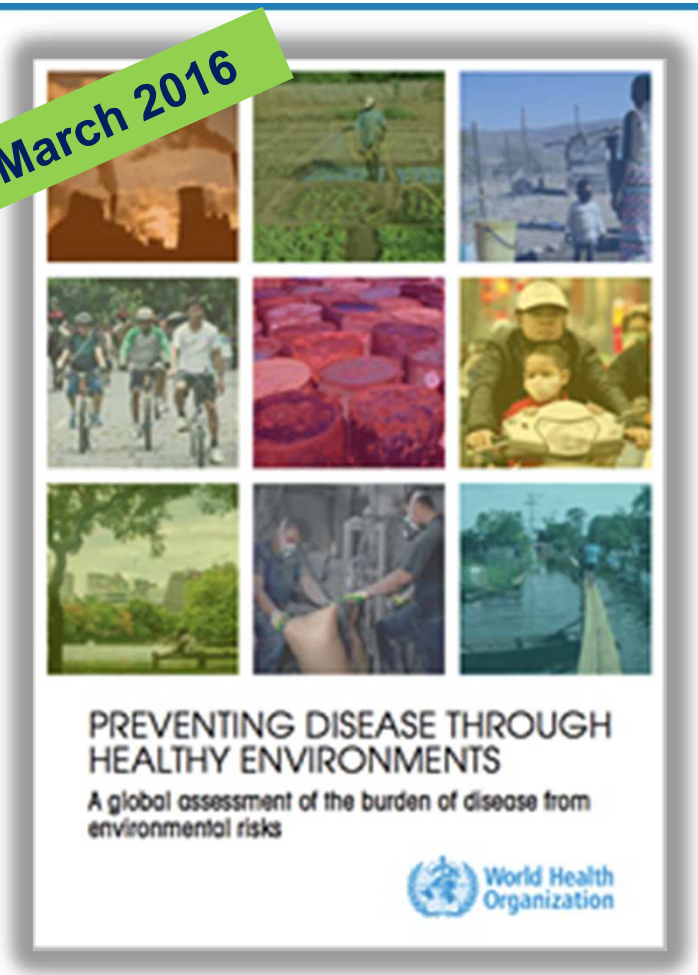
- Introduction
- Existing situations
- Radon
- Drinking/water and food
- Discussion

World Health Organization

- WHO is the UN specialized agency for health (established in 1948)
- Its objective is the attainment by all peoples of the highest possible level of **health**
- 194 Member States (Ministries of Health) collectively decide with the WHO Secretariat on global health priorities and actions to save lives and improve health

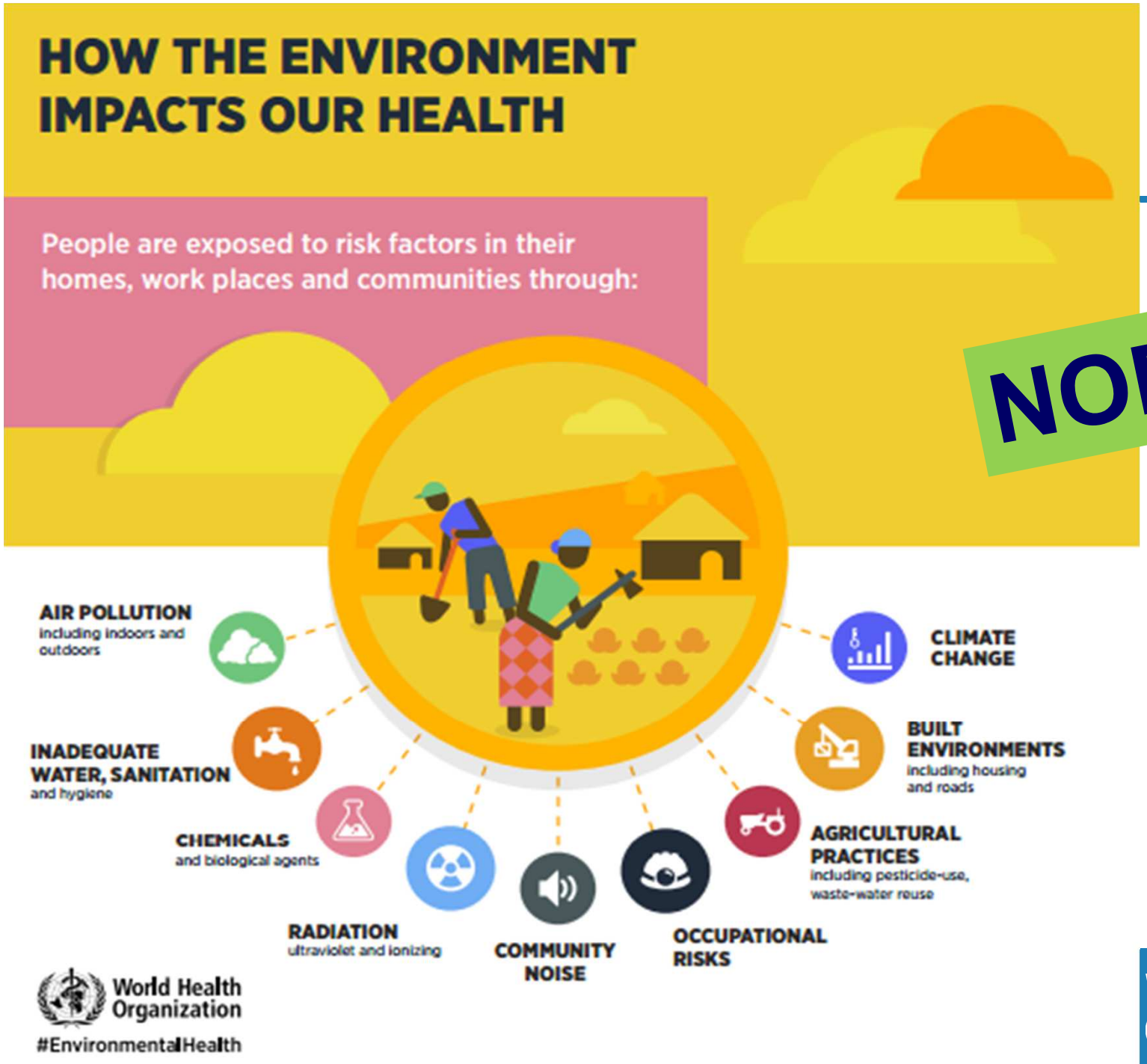
"HEALTH is a state of COMPLETE physical, mental and social well-being and not merely the ABSENCE of disease or infirmity" (WHO Constitution,1948)

Burden of disease from environmental risks



- 23% of global deaths (and “26% of deaths among children < 5y) linked to modifiable environmental factors
- 12.6 million people died in 2012 as a result of living or working in an unhealthy environment (nearly 1 in 4 of total global deaths).
- 2/3 of these deaths (8.2 million) due to noncommunicable diseases

http://www.who.int/quantifying_ehimpacts/publications/preventing-disease/en/



NORM?

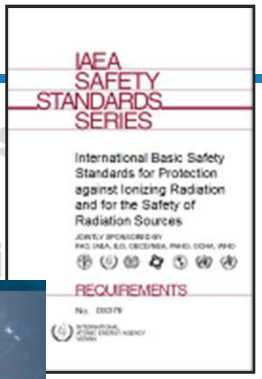
World Health Organization

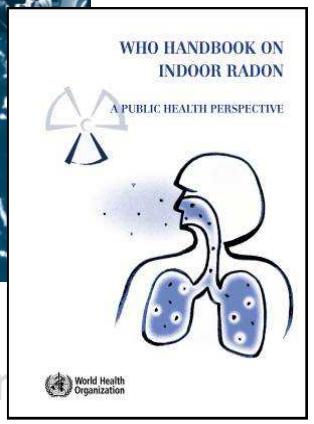
WHO's core functions

1. Articulate ethical and **evidence-based policy positions**
2. Setting **norms and standards**, and promoting and monitoring their implementation
3. Shaping the **research agenda**, and stimulating the generation, translation and dissemination of valuable knowledge
4. Providing **technical support**, catalysing change and developing sustainable institutional capacity
5. **Monitoring** the health situation and **assessing** health trends
6. Providing leadership on matters critical to health and engaging in **partnerships** where joint action is needed

These core functions encompass Radiation Protection

1. Articulate **ethical and evidence-based** policy positions
2. Setting **norms and standards**, and monitori implementation
3. Shaping the **research agenda**, a th translation and dissemination of v dg
4. Providing **technical support**, ca e sustainable institutional capacity
5. **Monitoring** the health situation and **assessing** health tren
6. Providing leadership on matte critical to health and engaging in **partnerships** where ac s ad





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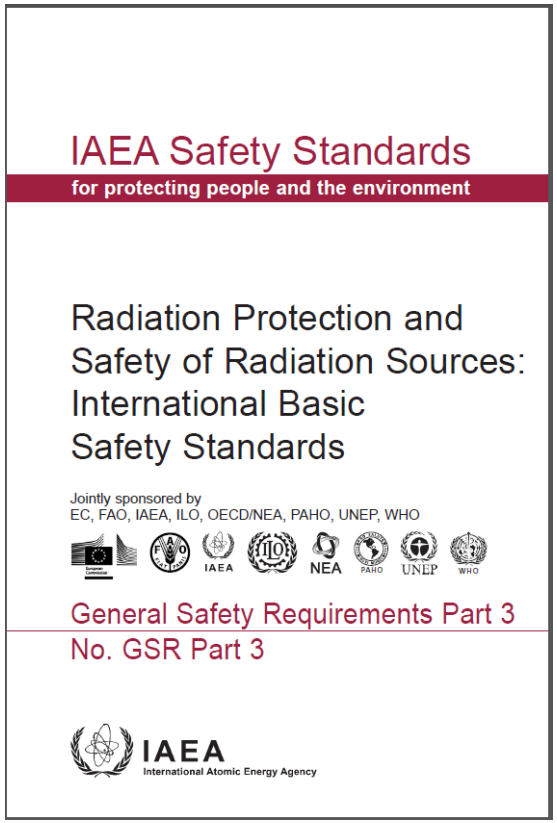
International Standards



Jointly sponsored by
EC, FAO, IAEA, ILO, OECD/NEA, PAHO, UNEP, WHO

WHO Ionizing Radiation Programme

Natural radiation, radon, cosmic

Existing

Planned

Emergency

Medical, occupational

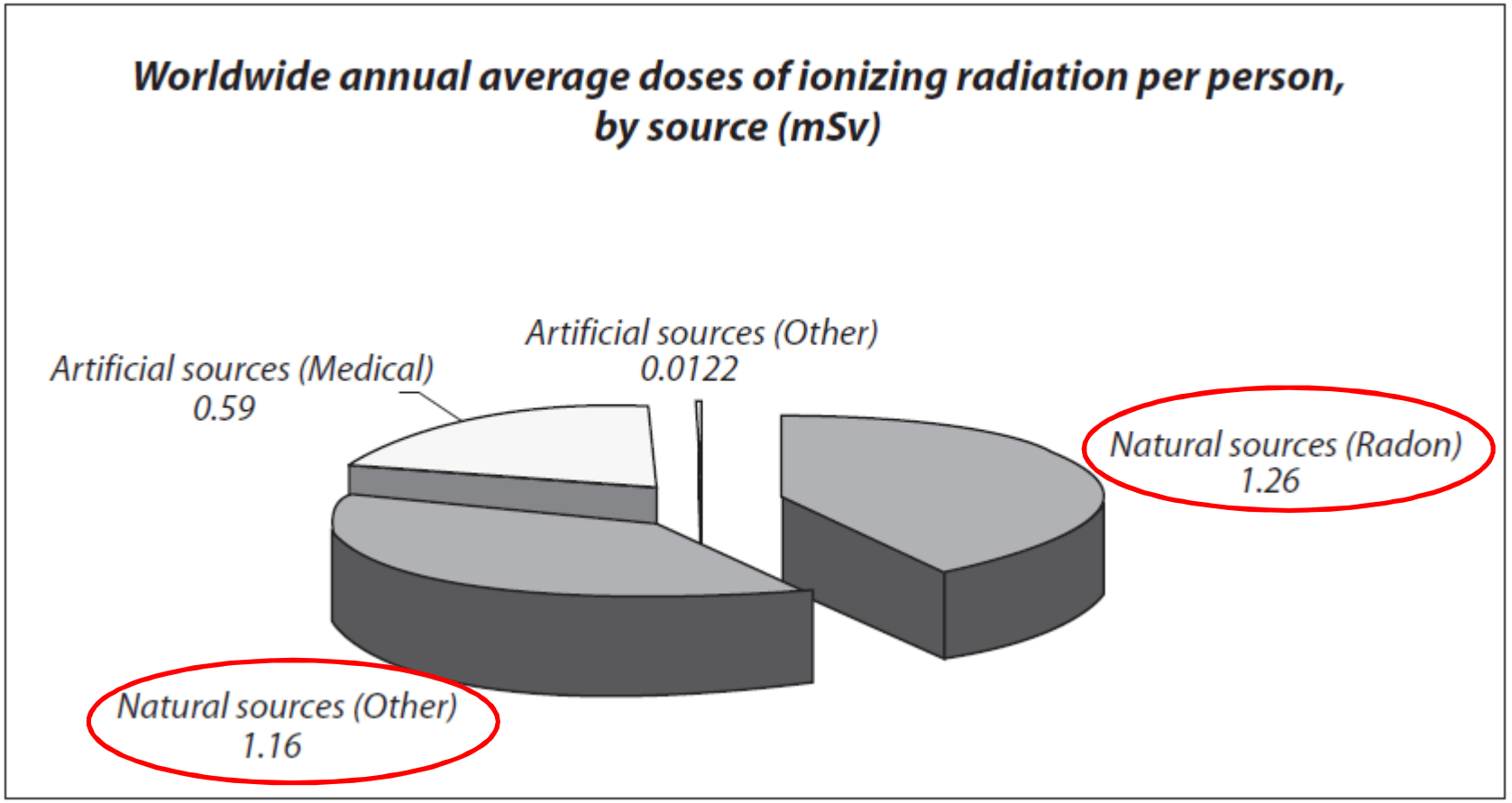
Accidents, incidents, deliberate events

World Health Organization

Outline

- Introduction
- Existing exposure situations

Radiation in our environment



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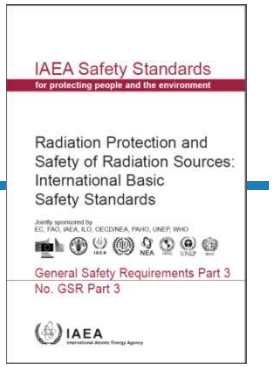
Radiation in our environment (cont'd)

Table 9.1 Average radiation dose from naturally occurring sources

Source	Worldwide average annual effective dose (mSv)	Typical annual effective dose range (mSv)
External exposure		
Cosmic rays	0.39	0.3–1[a]
Terrestrial radiation (outdoors and indoors)	0.48	0.3–1[b]
Internal exposure		
Inhalation (mainly radon)	1.26	0.2–10[c]
Ingestion (food and drinking-water)	0.29	0.2–1[d]
Total	**2.4**	**1–13**

[a] Range from sea level to high ground elevation.
[b] Depending on radionuclide composition of soil and building material.
[c] Depending on indoor accumulation of radon gas.
[d] Depending on radionuclide composition of foods and drinking-water.
Source: Adapted from UNSCEAR (2008)

International BSS (2014)



5. EXISTING EXPOSURE SITUATIONS

SCOPE

5.1. The requirements for existing exposure situations in Section 5 apply to:

....

(c) Exposure due to natural sources, including:

(i) ^{222}Rn and its progeny and ^{220}Rn and its progeny, in workplaces other than those workplaces for which exposure due to other radionuclides in the uranium decay chain or the thorium decay chain is controlled as a planned exposure situation, in dwellings and in other buildings with high occupancy factors for members of the public;

(ii) Radionuclides of natural origin, regardless of activity concentration, in commodities, including food, feed, drinking water, agricultural fertilizer and soil amendments, and construction materials, and residual radioactive material in the environment;

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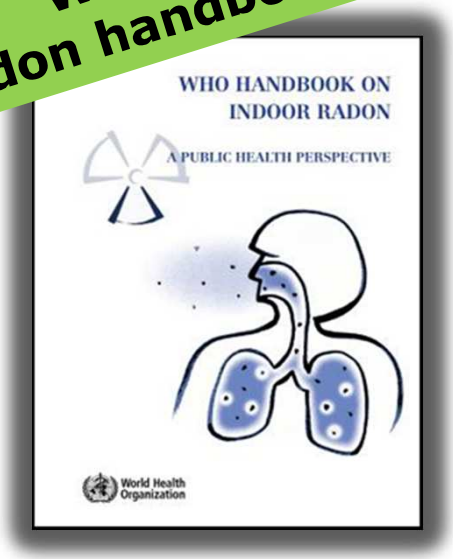
Existing exposure situations

WHO
Radon handbook

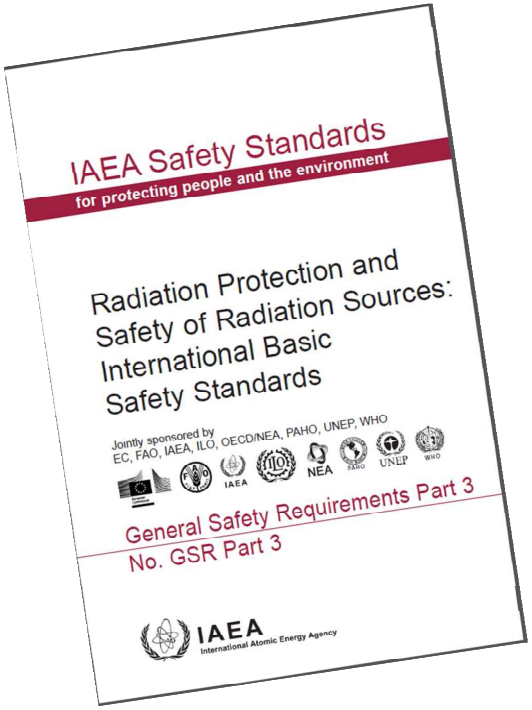


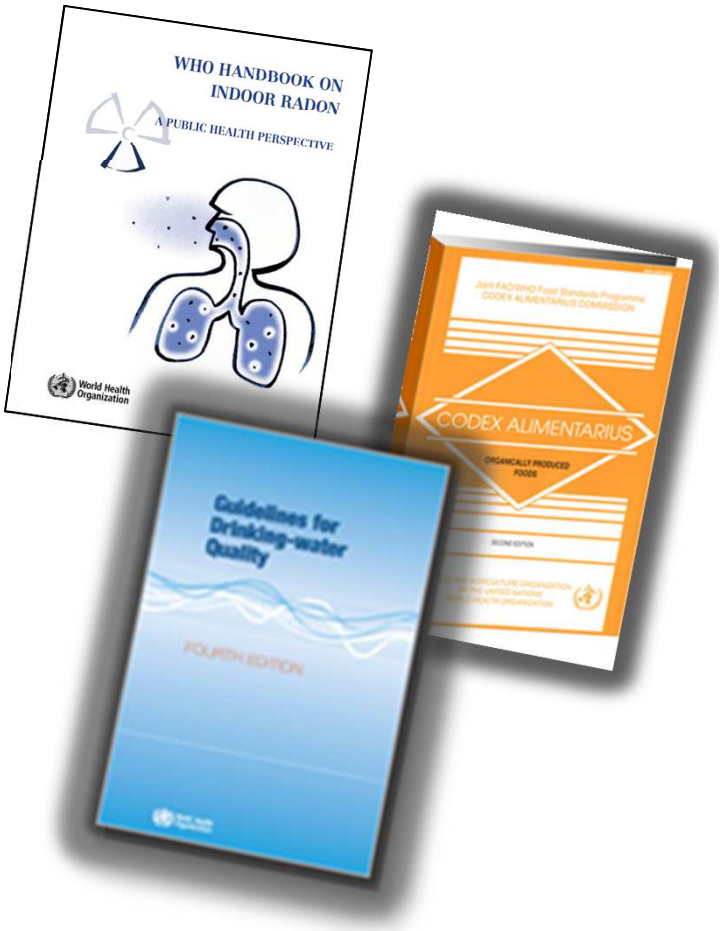
WHO
Drinking-water guidelines

FAO/WHO
CODEX Alimentarius

World Health Organization

International Standards





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Reference level

- "…*a **reference level (RL)** that generally does not exceed a value of approximately **1 mSv**"*

- **RL** is a level of dose above which it is not appropriate to plan to allow exposures to occur and below which optimization of protection and safety would continue to be implemented.

World Health Organization

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- Introduction
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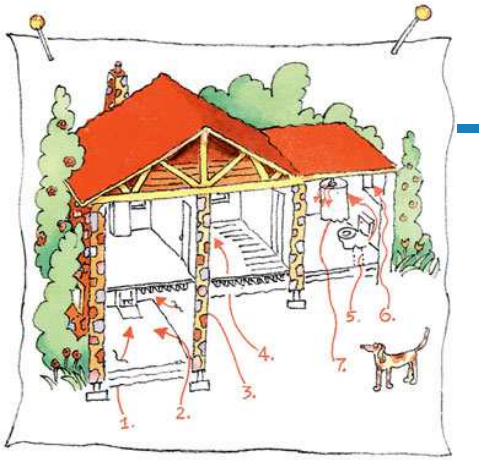
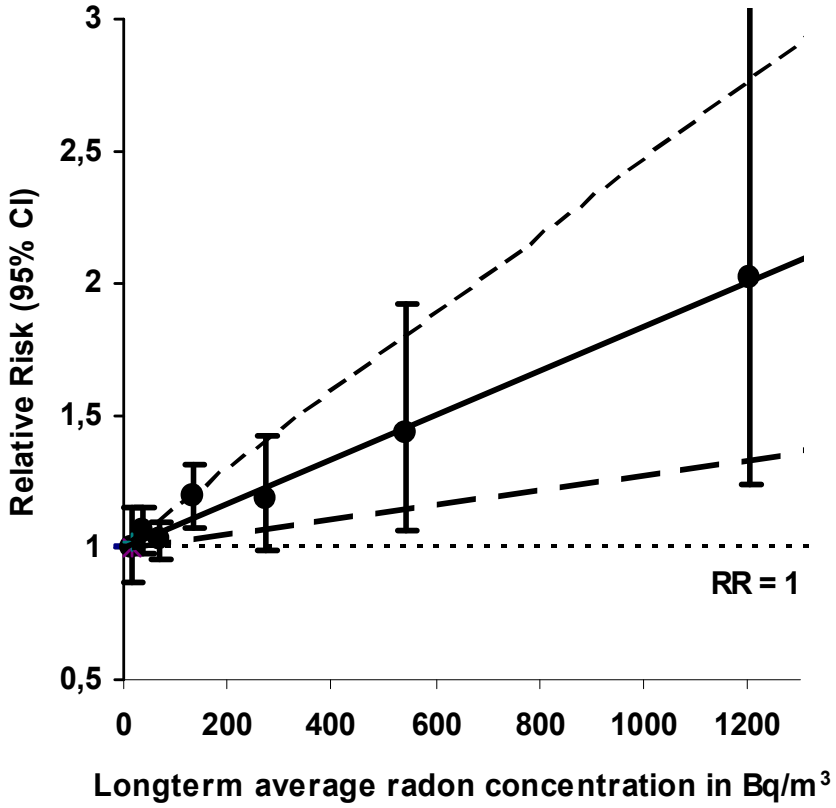
WHO Handbook on Residential Radon Exposure

http://apps.who.int/iris/bitstream/10665/161913/1/9789243547671_spa.pdf?ua=1

Lung cancer risk due to radon

Residential studies





Excess Relative Risk
ERR per 100 Bq/m³ = 8.4 %

95% CI = 3% - 16%

Relationship approximately linear without evidence for threshold

[Darby et al. 2005]

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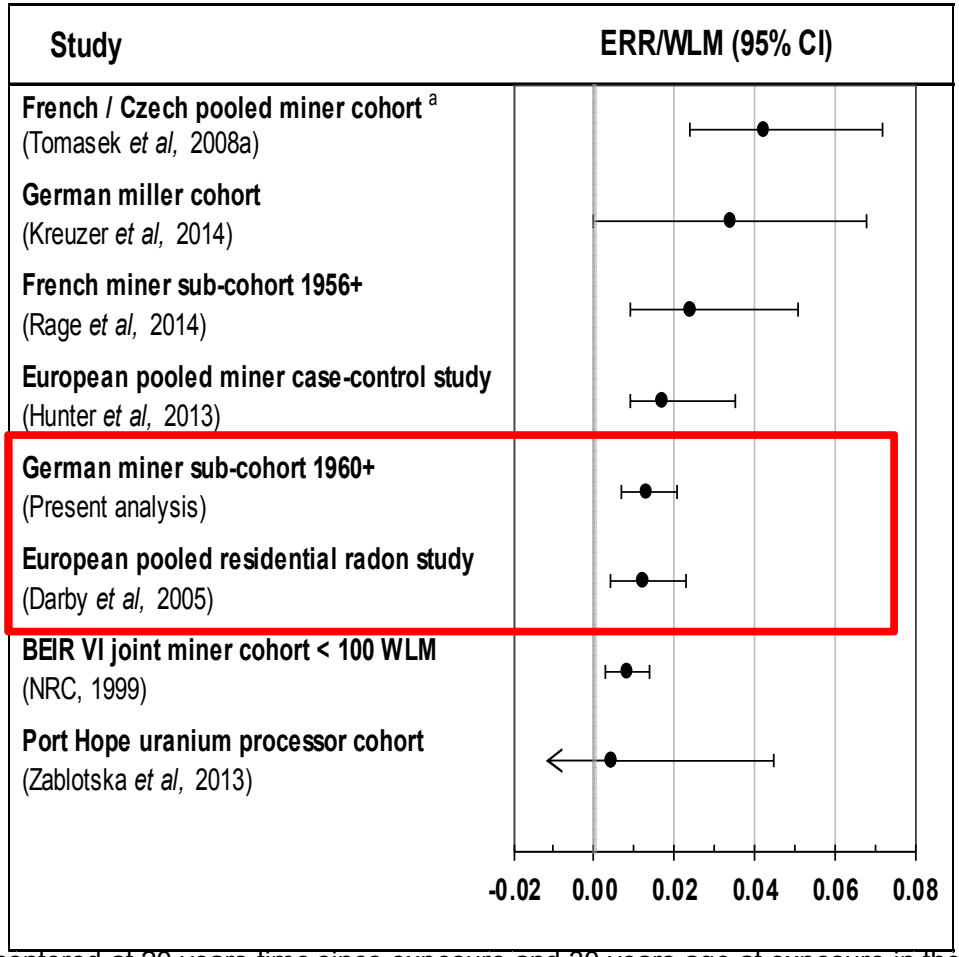
Lung cancer risk due to radon
(Uranium miner studies)



- Studies with low radon exposure rates comparable to current occupational settings
- There is a statistically significant risk of lung cancer after low radon exposures in miners, which is compatible with radon in homes

Kreuzer et al.
Br J Cancer 2015

[a] centered at 20 years time since exposure and 30 years age at exposure in the Czech/French study

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Health burden from radon
Residential studies

- Scientific evidence suggests 3-14% of lung cancers are due to exposure to indoor radon (2nd cause after smoking)
- Annually **around 100,000 deaths** from lung cancer are due to indoor radon exposure worldwide (Lim et al., 2012)
- Most lung cancer deaths related to radon are associated with **low / moderate concentrations** in normal dwellings
- Epidemiological studies do not support the evidence of a "safe" threshold level
- WHO recommends a reference level as low as reasonably achievable

WHO Reference Levels

- A RL of **100 Bq/m^3** is justified from a public health perspective because an effective reduction of radon-associated health hazards for a population is expected
- However, if this level cannot be implemented because of country-specific conditions, the reference level should not exceed **300 Bq/m^3** (approx. 10mSv / year according to ICRP)
- The decision to set a national RLs needs to account for prevailing economic and societal circumstances and other national factors such as:
  - Distribution of radon in the country
  - Number of existing homes with high radon concentrations
  - Prevalence of smoking

Reference levels for radon

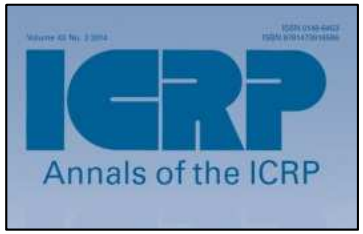
An evolving approach…

Publication	Year	Public	Workers
WHO handbook	2009	100-300 Bq/m^3	N/A
International BSS	2011 (2014)	300 Bq/m^3	1000 Bq/m^3
EC Council Directive	2013	300 Bq/m^3	300 Bq/m^3
ICRP 126	2014	300 Bq/m^3	300 Bq/m^3

From concentrations to doses…..

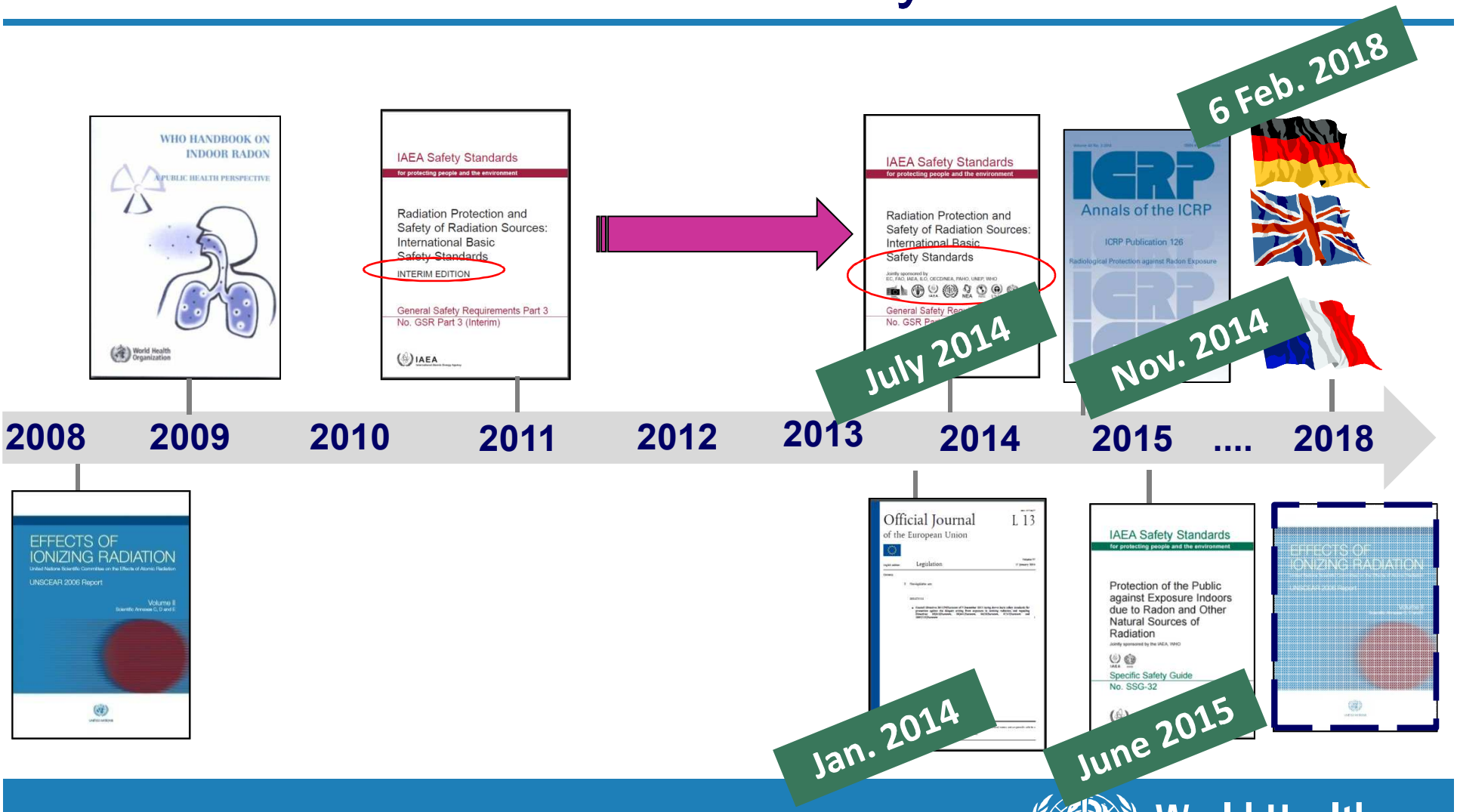
Bq/m^3 → mSv/y

??



Since then...

internationally



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"European BSS" (2014)


Official Journal of the European Union L 13

Legislation

October 2014

Radon national action plan workshop

asn AUTORITÉ DE SÛRETÉ NUCLÉAIRE

Statens strålevern
Norwegian Radiation Protection Authority

Following the publication of the new European Basic Safety Standards Directive (the Council Directive 2013/59/EURATOM), published in January 2014, Member States of the European Union have 4 years to incorporate it and to prepare or update their strategy for reducing radon concentration and the associated national radon action plan.

Under a joint initiative from ASN and NRPA, 20 European countries, represented by authorities in charge of Radiation Protection, Health, Labour and Housing and Landscaping were brought together during a workshop on national radon action plans.

The objective of the workshop, held in ASN's premises, from September 30th to October 2nd 2014, was to share the views and experiences concerning national strategies for reducing radon exposure of the population and associated lung cancer risk.

The radon workshop was supported by the World Health Organisation (WHO), the International Atomic

Après la publication en janvier 2014 de la nouvelle directive européenne 2013/59/Euratom définissant les normes de base en radioprotection, les États Membres de l'Union Européenne disposent d'un délai de 4 ans pour sa transposition en droit national et ainsi préparer ou mettre à jour leur stratégie pour réduire les concentration moyennes en radon et les plans nationaux d'action qui y sont associés.

A l'initiative de l'ASN et du NRPA, Autorité norvégienne de contrôle de la radioprotection, vingt pays européens, représentés par leurs Autorités en charge de la radioprotection, de la santé, du travail, du logement et de l'urbanisme, se sont réunis pour examiner les questions relatives à ces plans nationaux d'action dédiés à la gestion des risques liés au radon.

L'objectif du séminaire, qui s'est tenu au siège de l'ASN, était de partager les expériences et les projets concernant les stratégies nationales de réduction des expositions au radon pour la population et des risques de cancer du poumon associés.

http://www.herca.org/highlight_item.asp?itemID=7

October 2015

HERCA

Sv/Bq

222Rn

Geneva October 2015

HERCA Workshop

Radon in Workplaces

GENEVA / 12-14 October 2015
ILO Headquarters Geneva – 4, route des Morillons
CH 1211 Genève - Switzerland

REPORT on the HERCA Workshop

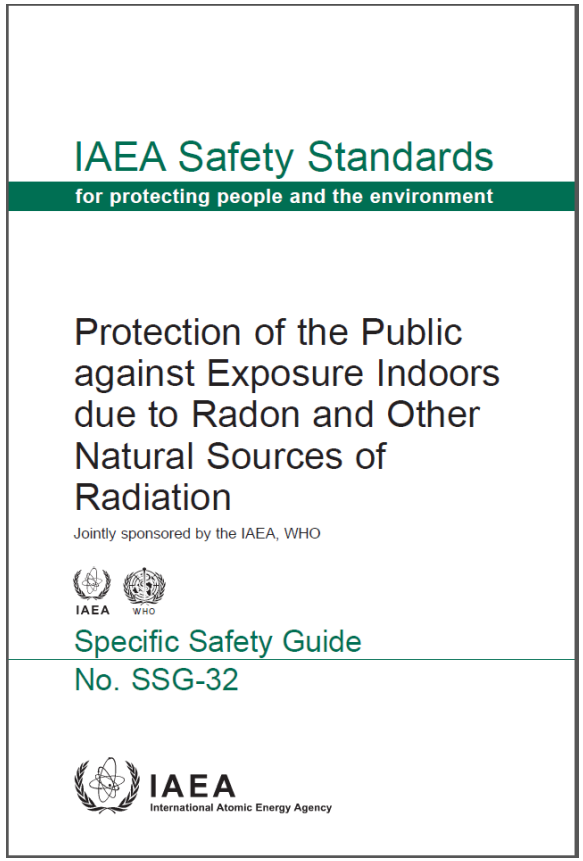
Organised by ASN, FOPH and NRPA
in the framework of the HERCA Action Plan in relation to the transposition and implementation of Directive 2013/59/Euratom (Euratom-BSS)

asn

Swiss Confederation
Federal Department of Home Affairs FDHA
Federal Office of Public Health FOPH

Statens strålevern

Building materials



http://oxpeckers.org/2015/10/2002/

www-pub.**iaea**.org/MTCD/.../PDF/Pub1651Web-62473672.pdf

Outline

- Introduction
- Existing exposure situations
- Radon
- Drinking-water and food

BSS requirements (5.22 and 5.23)
Exposure due to radioactivity in food and water

- The regulatory body or other relevant authority shall establish specific **reference levels** for exposure due to radioactivity in **food**, **drinking water**, and other commodities, each of which shall typically be expressed as, or be based on, an annual effective dose that does not exceed a value of about 1 mSv

- They have to consider the guideline levels for:
  - Radionuclides contained in drinking water published by WHO (i.e. **GDWQ**)
  - Radionuclides in food traded internationally published by the Joint FAO/WHO Codex Alimentarius Commission (i.e. **Codex Alimentarius**)

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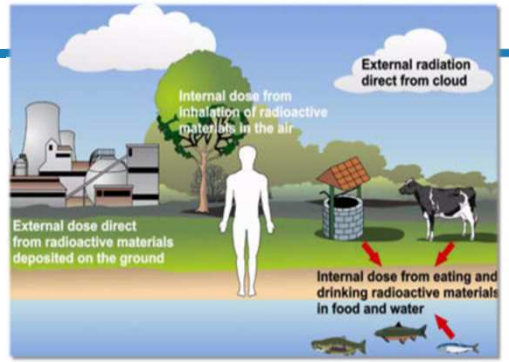

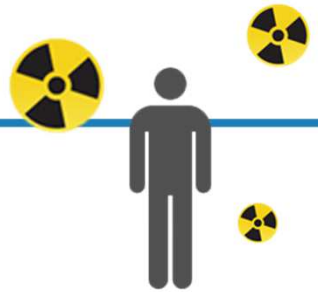

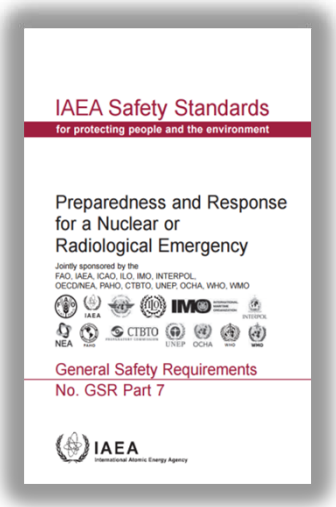

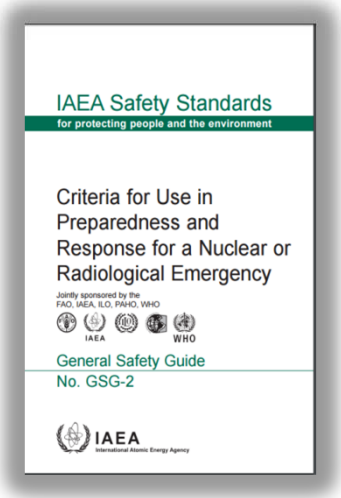

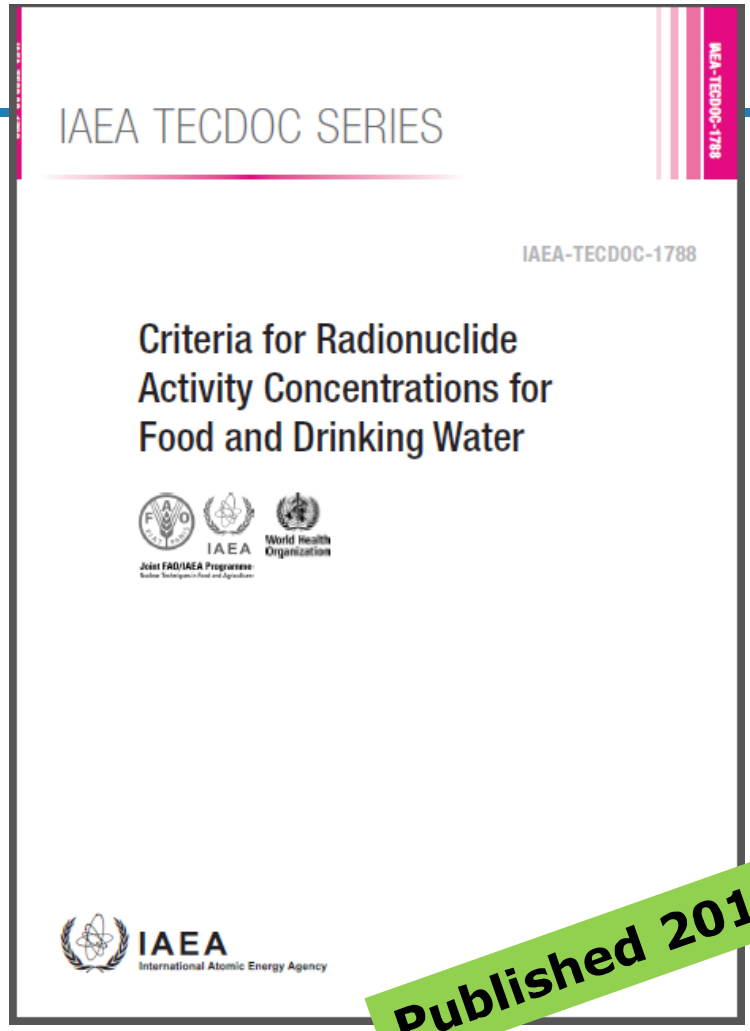

Published 2016

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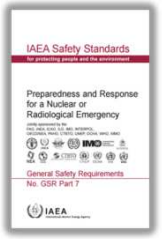
Reference levels for water

TABLE 7. TERMINOLOGY USED IN INTERNATIONAL STANDARDS FOR DRINKING WATER

Drinking water	Individual dose in a Year	Activity concentrations (Bq/L)	Responsible international organization
Reference level	1 mSv	NO	IAEA [1]
Indicative dose	0.1 mSv	YES — guidance levels	WHO [4]
Guidance level	—	Developed primarily for radionuclides of natural origin	WHO [4]



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WHO Guidelines for DWQ

- For use for an existing exposure situation, not for an emergency exposure situation
- Applies to radionuclides of both natural and artificial origin
- Individual dose criterion of 0.1 mSv/y from ingestion of drinking water (BSS dose criterion of 1 mSv/y quoted as a guidance on assessing the need for remedial measures when consistently above 0.1 mSv/y)
- Approach based on screening levels (measurements of gross α and β activity)

Table 9.2 Guidance levels for common[a] natural and artificial radionuclides for members of the public

Category	lide	Dose coefficient (Sv/Bq)	Guidance level[b] (Bq/l)
Naturally occurring radioactive isot… uranium decay series[c]	8	4.5×10^{-8}	10
Naturally … the uraniu…	…	4.9×10^{-8}	1
	Thorium-230	2.1×10^{-7}	1
	Radium-226	2.8×10^{-7}	1
	Lead-210	6.9×10^{-7}	0.1
	Polonium-210	1.2×10^{-6}	0.1
Naturally occurring radioactive isotope that starts the thorium decay series	Thorium-232	2.3×10^{-7}	1
Naturally occurring radioactive isotopes belonging to the thorium decay series	Radium-228	6.9×10^{-7}	0.1
	Thorium-228	7.2×10^{-8}	1

WHO Guidelines for drinking-water quality provide guidance levels for a number of radionuclides

Artificial radionuclides that can be released to the environment as part of the fission products found in reactor emissions or nuclear weapons tests	Caesium-134[d]	1.9×10^{-8}	10
	Caesium-137[d]	1.3×10^{-8}	10
	Strontium-90[d]	2.8×10^{-8}	10
Artificial radionuclide that can be released to the environment as a fission product (see above). It is used in nuclear medicine procedures and released into water bodies through		2.2×10^{-8}	10
Radioactive isotope as a fission nuclear w environme water sourc	[illegible]	1.8×10^{-11}	10 000
Naturally occ ng radioactive isotope widely distributed in nature and present in organic compounds and in the human body	Carbon-14	5.8×10^{-10}	100
Artificial isotope formed in nuclear reactors that also exists in trace quantities in *natural* uranium ores	Plutonium-239[d]	2.5×10^{-7}	1
Artificial isotope by-product formed in nuclear reactors	Americium-241[d]	2.0×10^{-7}	1

WHO Guidelines for drinking-water quality do not provide a guidance level for radon

Managing radon in drinking water

- Radon dissolved in water can be released and contribute to increase radon concentration in indoor air (Rule of thumb: 1000 Bq/l in water can give rise to 100 Bq/m3 in indoor air)

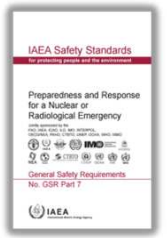
- Although ingested radon may deliver a radiation dose to the lining of stomach, the main route of entry into the body is via inhalation (> 90% radon dose from inhalation rather than ingestion [UNSCEAR, 2000])

- Hence it is more appropriate to measure/manage the radon concentration in indoor air rather than in drinking-water

Reference levels for food

TABLE 6. TERMINOLOGY USED IN INTERNATIONAL STANDARDS FOR FOOD

Food	Individual dose in a year	Activity concentrations (Bq/kg)	Responsible international organization
Reference level	1 mSv	NO	IAEA [1]
Intervention exemption level	1 mSv	YES — guideline levels	Joint FAO/WHO Codex Alimentarius Commission [5]
Guideline levels	—	Developed separately for infants and non-infants	Joint FAO/WHO Codex Alimentarius Commission [5]



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CODEX guidelines for radionuclides in food in international trade

- Applies only to food with contamination following a nuclear or radiation emergency
- Applies only to international trade
- CODEX guideline levels defined in terms of 4 radionuclide groups for 2 categories of foods (infant and non-infant foods)
  - Activity concentrations derived by assuming 10% of the diet is imported contaminated food (equivalent to 1mSv ingestion dose over a year)
  - Adult consumption rate of 550 kg/y and infant 200 kg/y

Outline

- Introduction
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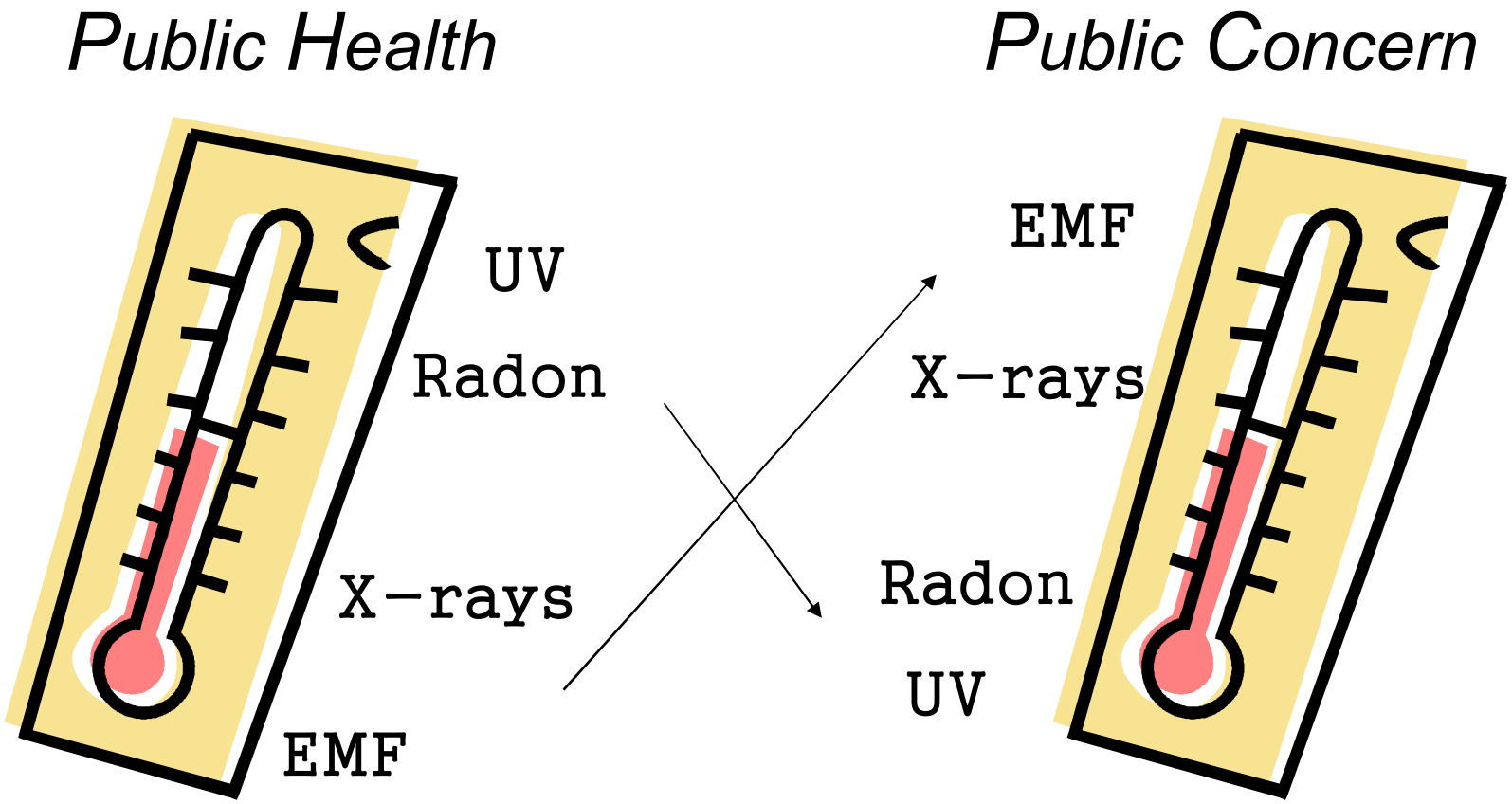
- Radon
- Drinking/water and food
- Discussion

Discussion

- The WHO public health perspective
  - Includes a worker's health perspective
  - Aims to reduce the overall population risk and the individual risk for people exposed to high radioactivity concentrations
  - Follows a conservative approach
  - Is inclusive of informal industries
  - Promotes clear risk communication strategies
  - Promotes health research

Radiation



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Thank You! ….. Obrigada!

SUNDAY TIMES NEWS BY KEVIN CROWLEY, 2016-03-16

WHO tests hair to probe uranium from Joburg gold mine

Children swim in a toxic water pool on a mine dump in Soweto.
Image: JAMES OATWAY

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