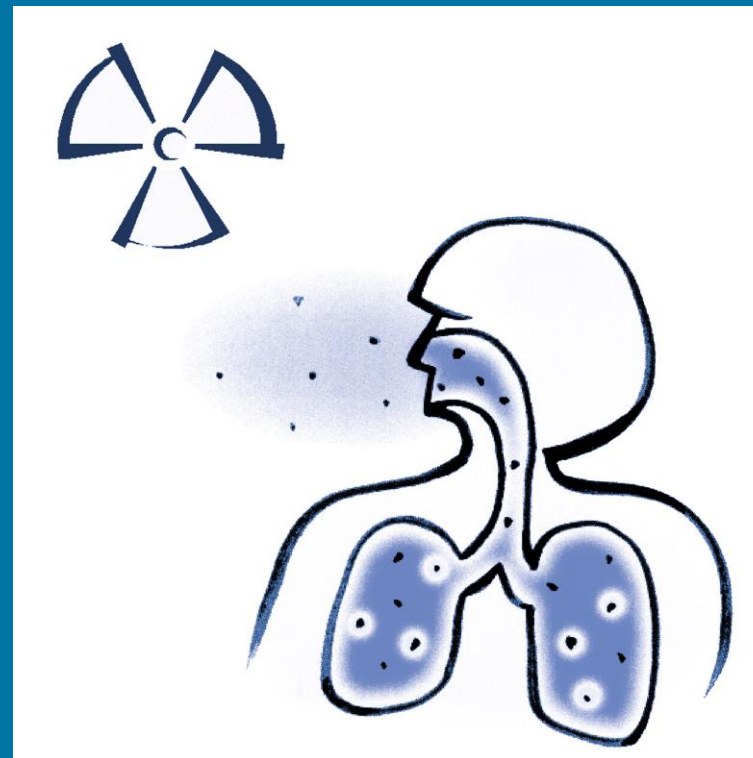


Radon et qualité de l'air intérieur

Une perspective de santé publique

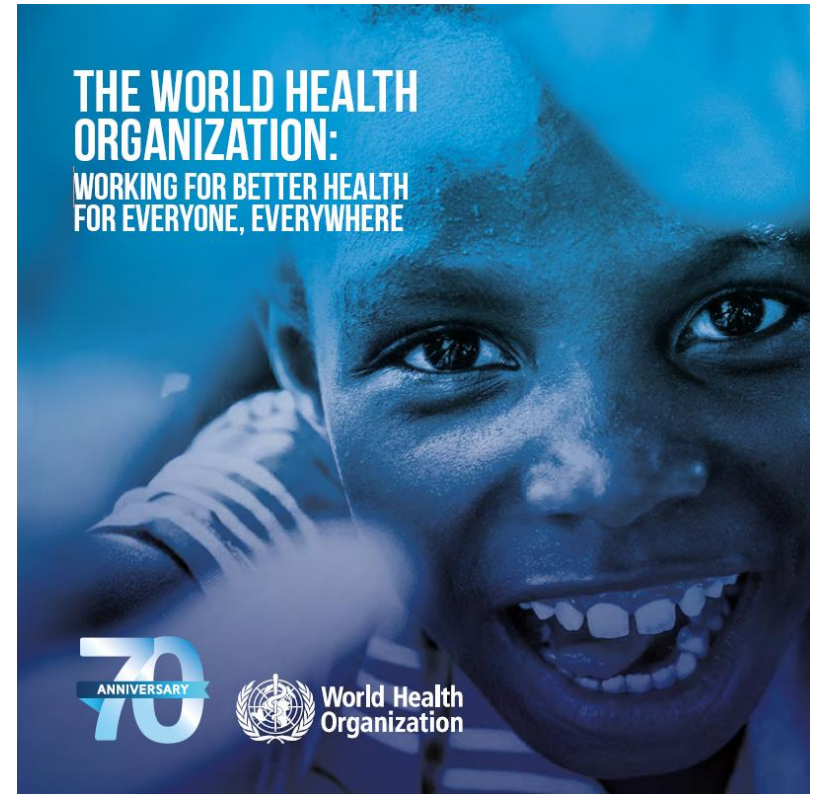
Dr Emilie van Deventer
Radiation Programme
Dept of Public Health, Environmental and
Social Determinants of Health



The World Health Organization



- Established on **7 April 1948**
- **Function:** act as the UN directing and coordinating authority on international health work
- **Objective:** attainment by all peoples of the highest possible level of health



HEALTH

a state of COMPLETE
physical, mental and
social well-being and
not merely the
ABSENCE of disease or
infirmity"

(Constitution, 1948)

The WHO 3-level structure

7000 people work for WHO in

- 150 WHO offices in countries, territories and areas,
- 6 regional offices,
- at IARC, and
- at the headquarters (Geneva)





SUSTAINABLE DEVELOPMENT GOALS

17 GOALS TO TRANSFORM OUR WORLD



World Health Organization



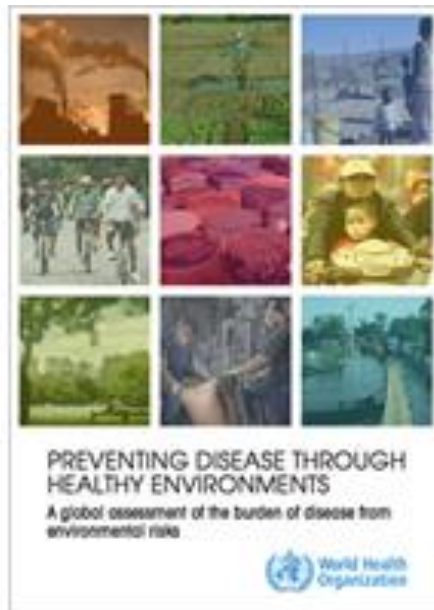
HEALTH IN THE SDG ERA

Health in all policies



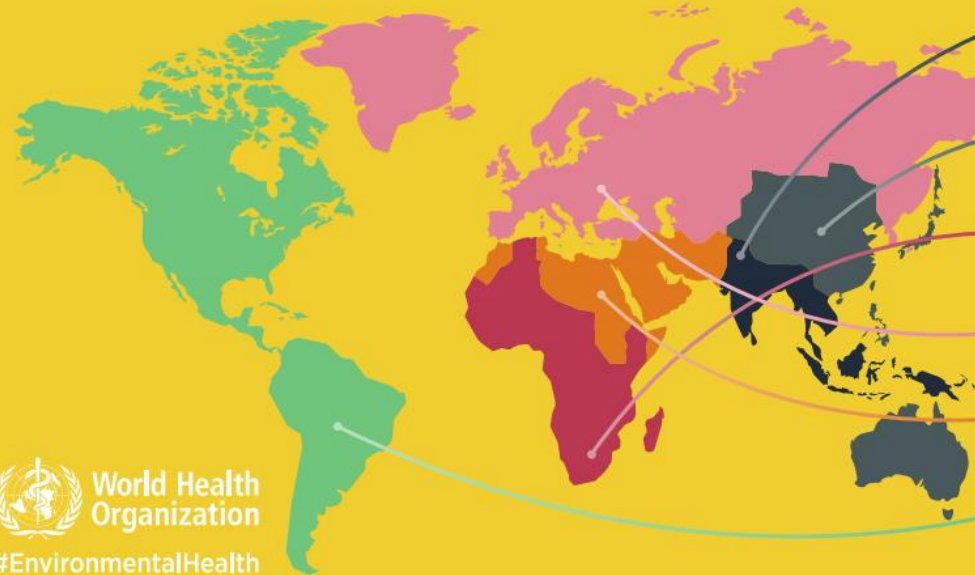
Public Health and Environment

WHO global assessment of the burden of disease from environmental risks



23%
of all global deaths are linked
to the environment.
That's roughly **12.6 million deaths** a year.

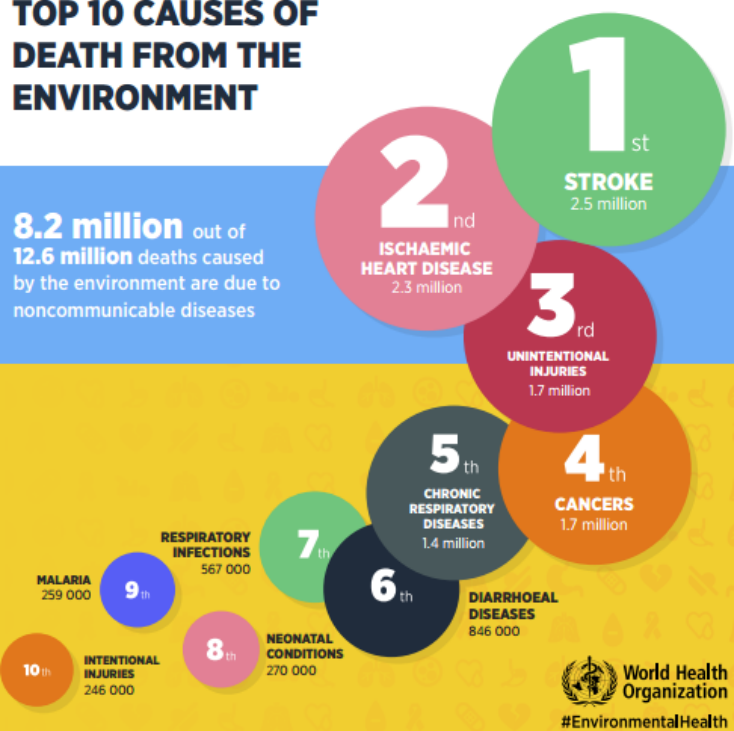
WHERE IS IT HAPPENING?



- 3.8 million**
in South-East Asia Region
- 3.5 million**
in Western Pacific Region
- 2.2 million**
in Africa Region
- 1.4 million**
in European Region
- 854 000**
in Eastern Mediterranean Region
- 847 000**
in the Region of the Americas

TOP 10 CAUSES OF DEATH FROM THE ENVIRONMENT

8.2 million out of
12.6 million deaths caused
by the environment are due to
noncommunicable diseases



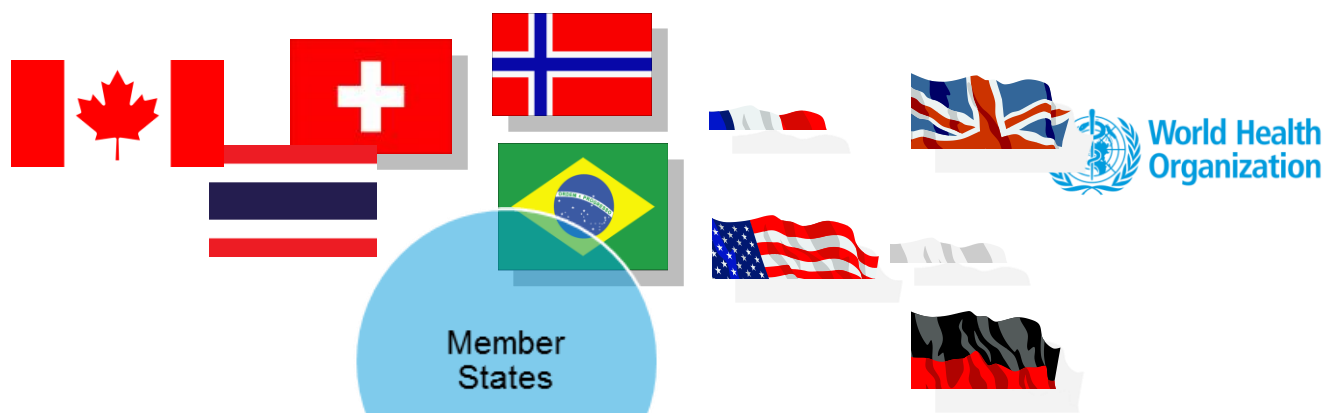
WHO IS MOST IMPACTED BY THE ENVIRONMENT

Children under five and
adults between 50 and 75
years old are most affected
by the environment.



Non-ionizing radiation

Ionizing radiation



Member States

World Health Organization

International organizations

Non-governmental organizations



Collaborating Centres



Australian Government

Australian Radiation Protection and Nuclear Safety Agency



Public Health England



Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Federal Office of Public Health FOPH



IAEA
International Atomic Energy Agency

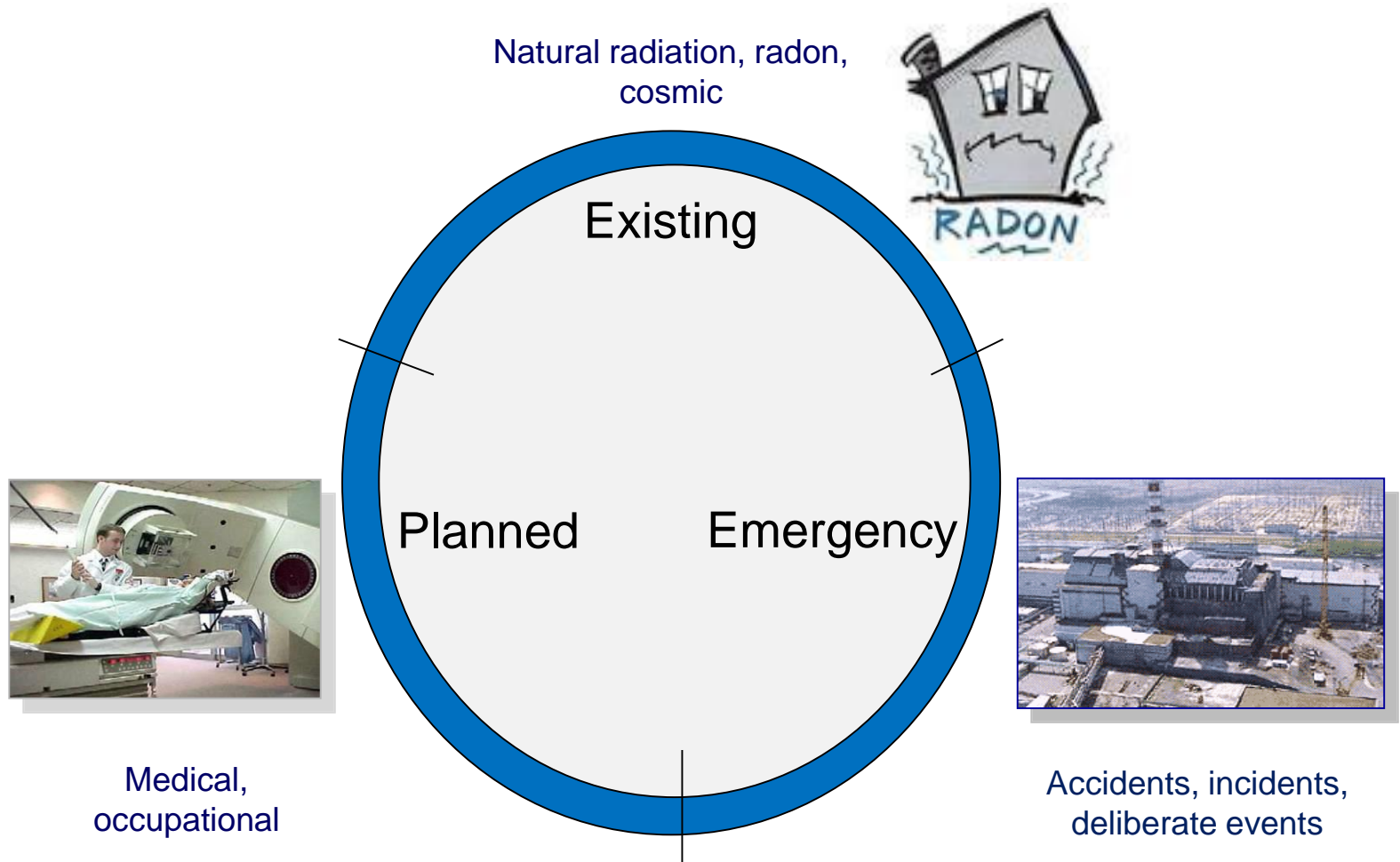
IRSN
INSTITUT
DE RADIOPROTECTION
ET DE SÛRETÉ NUCLÉAIRE



Bundesamt für Strahlenschutz

Radon

in the context of radioprotection



Association Romande de Radioprotection



Journée thématique ARRAD du 30.11.18

<http://www.arrad.ch>

«Radon : **un ancien problème** avec de nouvelles dimensions»

History of health effects

Middle ages (15th century)

1960: First epidemiological studies of miners

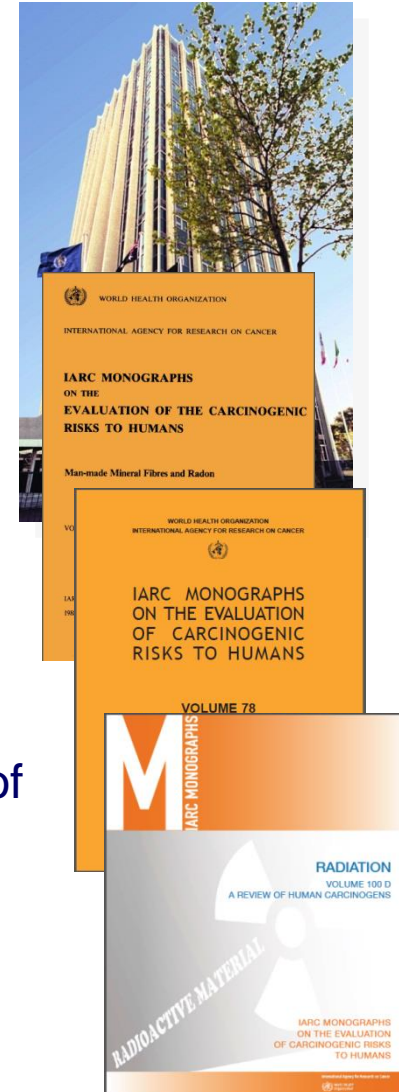
1990s: Epidemiological studies of public exposures (landmark publications in 2005)



German uranium miners, 1950s

WHO actions on radon

- **1979:** A WHO/EURO working group on indoor air quality first drew attention to the health effects from residential radon exposures
- **1988:** First IARC classification of radon as a human carcinogen
- **1993:** An international WHO workshop on indoor radon considered for the first time a unified approach to control radon exposures and advised on communication of associated health risks
- **2001:** IARC re-evaluation of the carcinogenicity of indoor radon
- **2005:** WHO established the *International Radon Project*
 - to identify effective strategies for reducing the health impact of radon
 - to raise awareness about the consequences of long-term radon exposures
- **2009:** WHO published the Handbook on residential radon
- **2012:** IARC re-evaluation of the carcinogenicity of indoor radon



WHO Handbook on Residential Radon Exposure



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

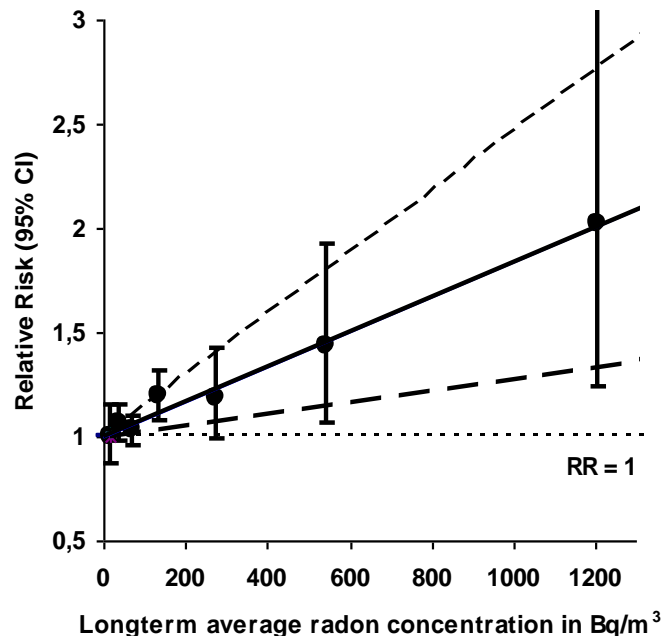
Residential Radon Exposure

The good news



✓ Scientific evidence in support of causation

- Strong association between radon concentration and lung cancer



Relationship approximately linear without evidence for threshold

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

95% CI = 3% - 16%

Source: Darby et al. 2005

Residential Radon Exposure

The good news

- ✓ **Scientific evidence in support of causation**
- ✓ **Radon measurements**
 - Easy to perform
 - Affordable
 - Need to be based on standardized protocols



Residential Radon Exposure

The good news



- ✓ **Scientific evidence in support of causation**
 - Strong association between radon concentration and lung cancer
- ✓ **Radon measurements**
 - Easy to perform and affordable
- ✓ **Prevention and mitigation**
 - Preventions strategies (new buildings) and mitigation strategies (existing buildings) exist
- ✓ **Existence of policies and recommendations**
 - From governments or NGOs at national or international level

Association Romande de Radioprotection

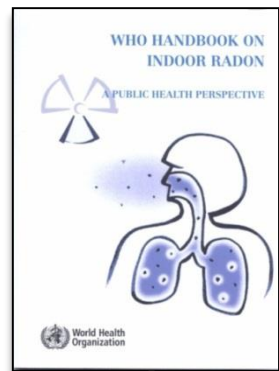


Journée thématique ARRAD du 30.11.18

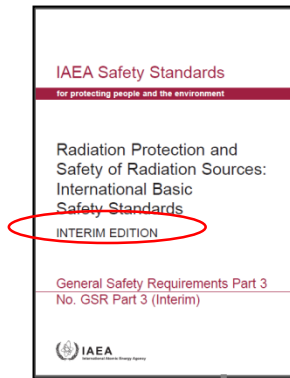
<http://www.arrad.ch>

«Radon : un ancien problème avec de nouvelles dimensions»

Since 2009... internationally



2009

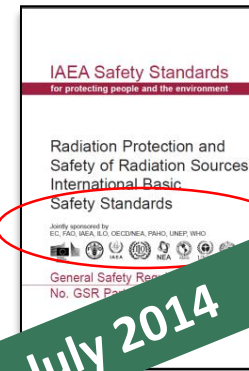


2010

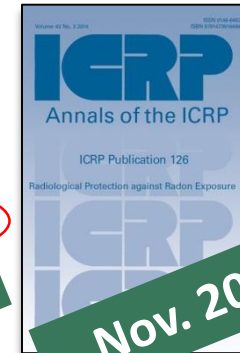
2011

2012

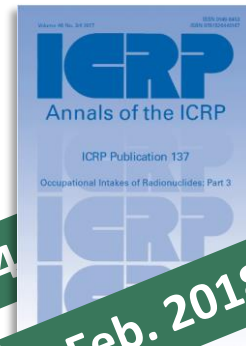
2013



July 2014



Nov. 2014

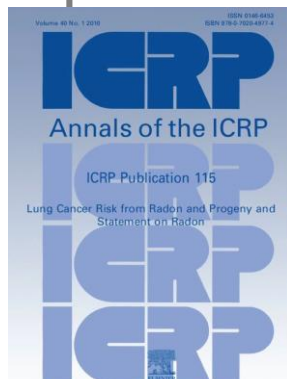
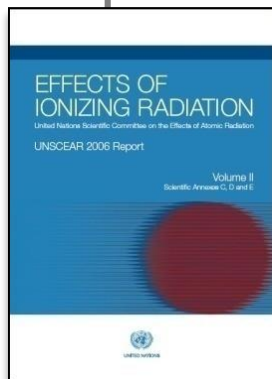


Feb. 2018

2015

...

2018



Residential Radon Exposure

Areas to be strengthened



- ❑ **Existence of legislation**
 - **at international level**
 - **at national level**

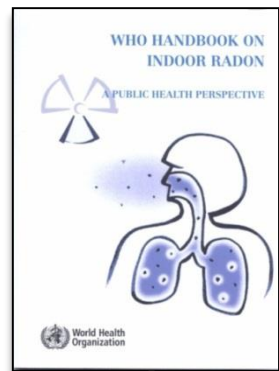
Ionizing Radiation Basic Safety Standards

- The **International Radiation Basic Safety Standards (BSS)** are the global benchmark on radiation safety requirements
- BSS cosponsoring organizations are cooperating to foster its **implementation** worldwide
- EU countries are transposing/ implementing the **COUNCIL DIRECTIVE 2013/59/EURATOM**: this provides an opportunity for collaboration
- European countries may become “champions” for other parts of the world through their experience in implementing radiation safety standards

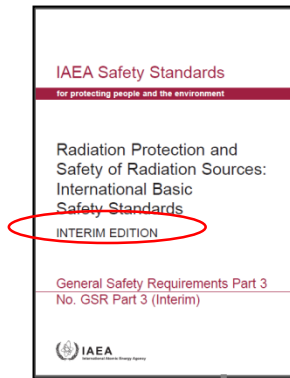
Jointly sponsored by
EC, FAO, IAEA, ILO, OECD/NEA, PAHO, UNEP, WHO



Since then... internationally



2009



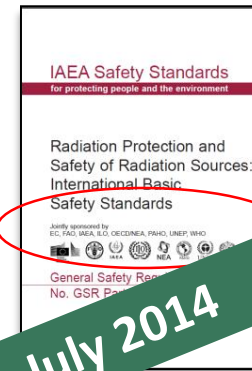
2010

2011



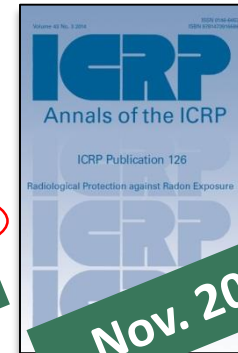
2012

2013



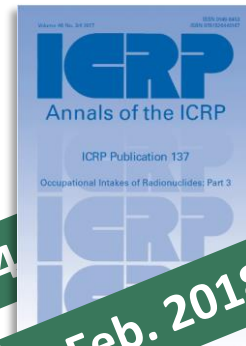
2014

July 2014



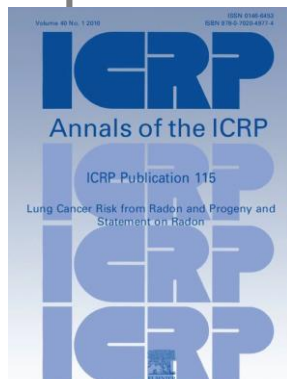
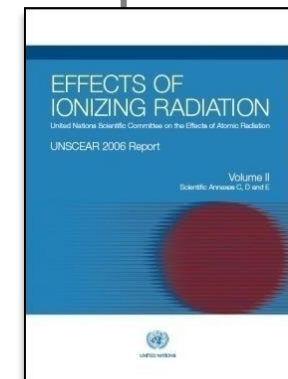
2015

Nov. 2014



.... 2018

Feb. 2018



Jan. 2014



6 Feb. 2018



Reference levels

An evolving approach...



Publication	Year	Public	Workers
WHO handbook	2009	100-300 Bq/m ³	N/A
International BSS	2011-14	300 Bq/m ³	1000 Bq/m ³
ICRP 126	2014	300 Bq/m ³	300 Bq/m ³

Bq/m³ → mSv/y ??

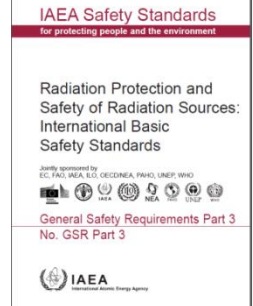
Residential Radon Exposure

Areas to be strengthened



- ❑ **Existence of legislation**
 - at international level
 - at national level
- ❑ **Awareness raising measures**
- ❑ **Level of advocacy for primary prevention**
 - National lung cancer reporting/screening strategy ?
 - National tobacco control strategy ?
 - National indoor air quality strategy ?
 - National energy conservation strategy ?
- ❑ **Public perception of risk**

International BSS (2014)



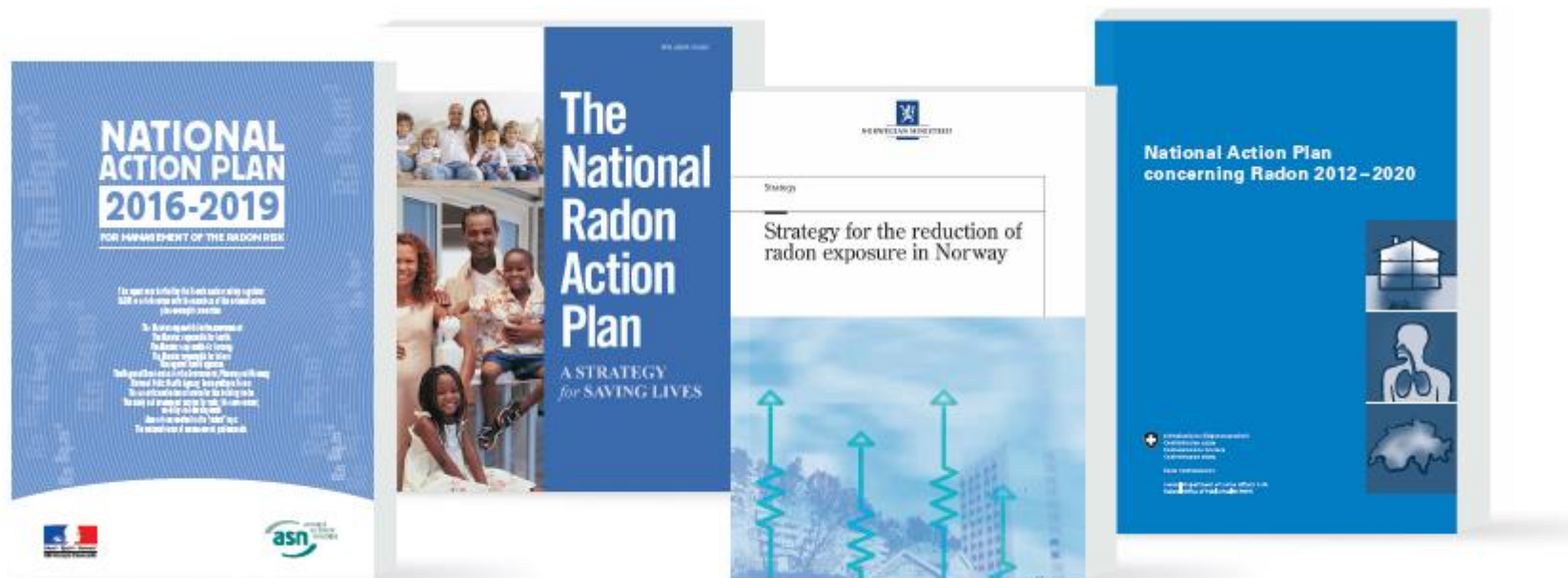
Requirement 50: Public exposure due to radon indoors

The government shall provide information on levels of radon indoors and the associated health risks and, if appropriate, shall establish and implement an action plan for controlling public exposure due to radon indoors.

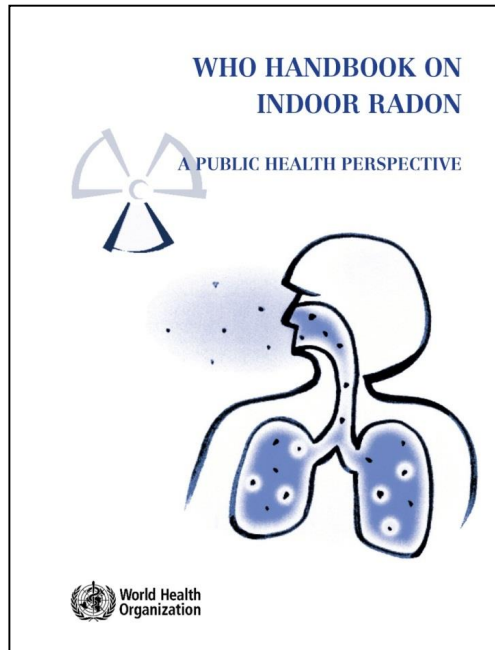
Requirement 52: Exposure in workplaces

The regulatory body shall establish and enforce requirements for the protection of workers in existing exposure situations.

National radon action plans



Radon

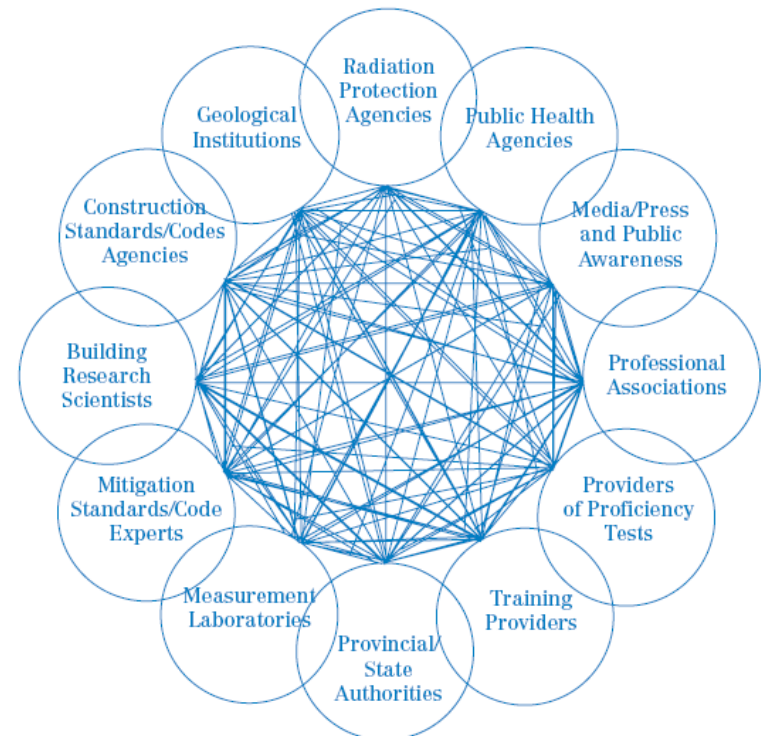


“Radon causes lung cancer”

“Radon is a radioactive gas present in homes”

“Radon is easy to measure”

“You can easily protect your family from radon”





Radon is a naturally occurring radioactive gas that causes lung cancer.

It is colourless and odourless.

It is found in buildings such as homes, schools, and offices.

Radon can be found all over Ontario.

WHAT CAN YOU DO ABOUT RADON?

Testing and remediation for radon are easy. Test kits are available at your local hardware store.

This is equivalent to over 2 people in Ontario dying each day from lung cancer caused by radon.

WHAT CAN WE ALL DO ABOUT RADON?

Building codes can help control radon levels indoors.

That is equal to about **850** lung cancer deaths each year in Ontario.

REFERENCES

Lung Cancer Risk from Radon in Ontario, Canada: How many lung cancers can we prevent?
<http://link.springer.com/article/10.1007/s10552-013-0278-x>

For more information on radon visit:
 Health Canada's website:
<http://www.healthcanada.gc.ca/radon>
 World Health Organization:
http://whqlibdoc.who.int/publications/2009/9789241547673_eng.pdf

www.publichealthontario.ca

Public Health Ontario

Santé publique Ontario

Ontario

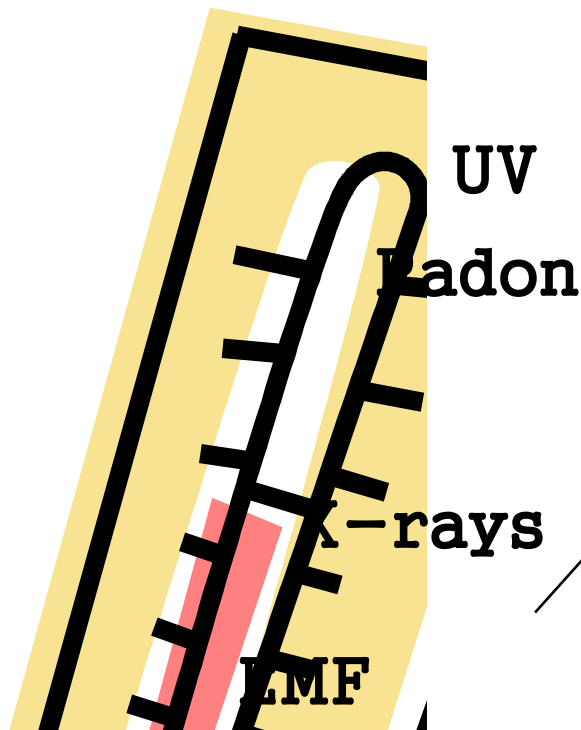


<http://www.bfs.de/media/radon/Radon.swf>

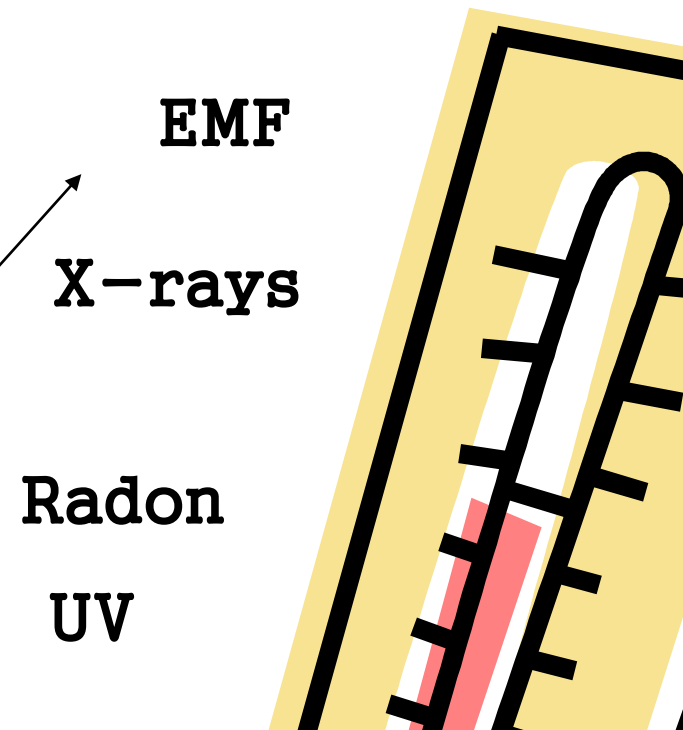
Radiation

Risk Communication

Public Health

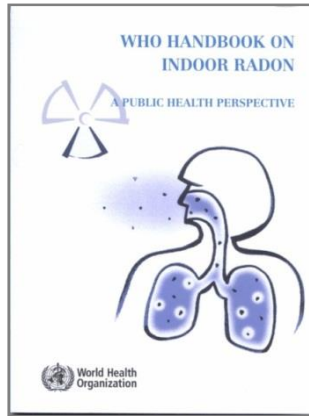


Public Concern

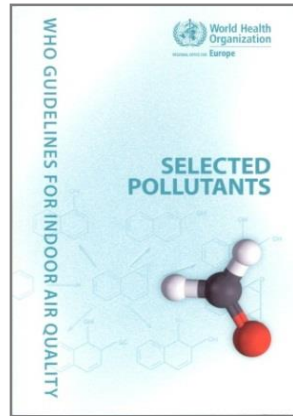


Since 2009...

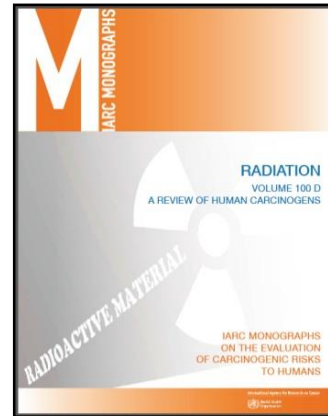
Radon in other WHO documents



2009



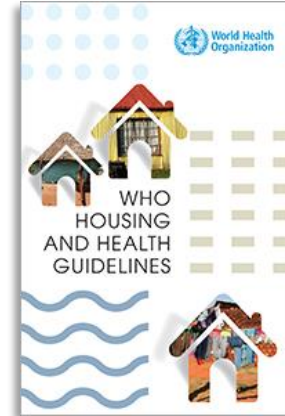
2010



2011



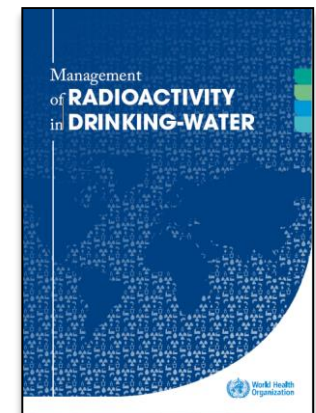
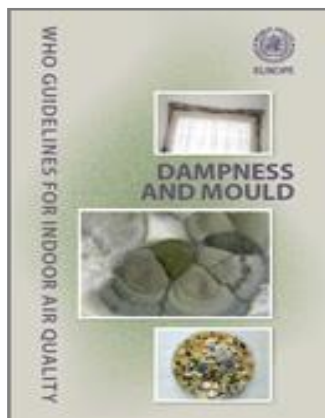
2012



...

2017

2018

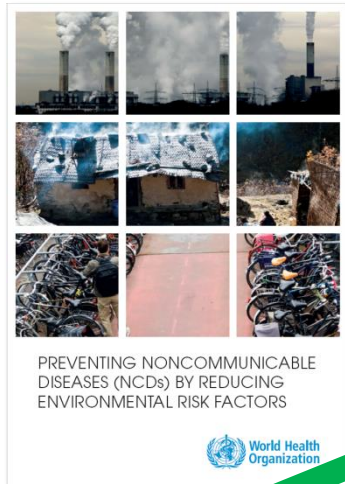


Radon

A contributor to indoor air pollution

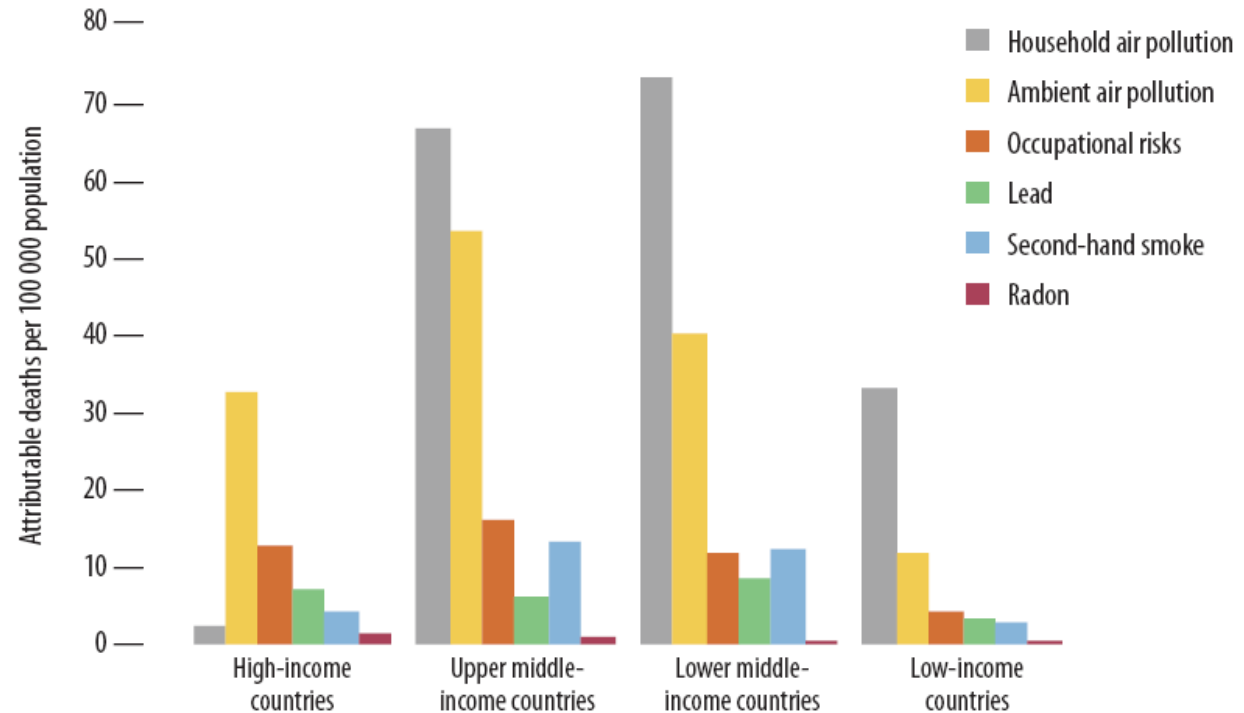
Radon

A contributor to indoor air pollution



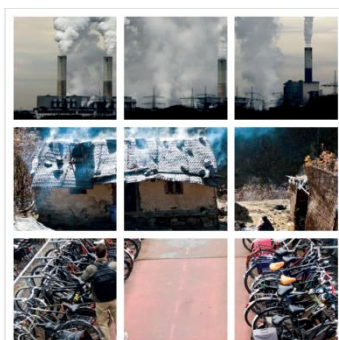
2017

Figure 3. NCD deaths attributable to environmental risks by income level



Sources: Air pollution: (4) for 2012; other risks: (3) for 2015.

Public Health and Environment (cont'd)



PREVENTING NONCOMMUNICABLE
DISEASES (NCDs) BY REDUCING
ENVIRONMENTAL RISK FACTORS



2017

“Regarding lung cancer deaths, 26% of deaths are attributed to exposure to occupational carcinogens, and 2% to second-hand tobacco smoke. Around 4% of lung cancer deaths are attributed to exposure to radon.”

Disease and their risk factors	Africa	Americas	Eastern Mediterranean	Europe	South-East Asia	Western Pacific	World
Lung cancer							
Household air pollution	4000	6000	3000	10 000	53 000	195 000	271 000
Ambient air pollution	4000	20 000	10 000	69 000	47 000	251 000	402 000
Second-hand tobacco smoke	1000	1000	1000	2000	3000	21 000	28 000
Occupational risks	11 000	62 000	15 000	85 000	42 000	230 000	445 000
Residential radon	3000	8000	3000	26 000	9000	15 000	64 000

Environmental and Occupational Interventions for Primary Prevention of Cancer: A Cross-Sectorial Policy Framework

Carolina Espina,^{1,2} Miquel Porta,^{3,4,5} Joachim Schüz,² Ildefonso Hernández Aguado,^{4,6} Robert V. Percival,⁷ Carlos Dora,¹ Terry Slevin,⁸ Julietta Rodriguez Guzman,^{9,10} Tim Meredith,¹ Philip J. Landrigan,¹¹ and Maria Neira¹

Table 1. Summary of nine environmental and occupational risk factors for cancer: areas to be strengthened.

Risk	Scientific evidence in support of causation ^a	Awareness-raising measures ^b	Existence of policies/recommendations ^c	Existence of legislation ^d	Level of advocacy for primary prevention ^e	Implementation of policies and legislation ^f	Public perception of risk ^g
Asbestos	High	High	High	High	High	Intermediate	Intermediate
POPs	Intermediate	Low	High	Intermediate	Intermediate	High	Low
Indoor radon	High	Intermediate	High	Intermediate	Intermediate	Intermediate	Low
Outdoor air pollution/diesel exhaust	High	High	High	Intermediate	Intermediate	Intermediate	Intermediate
Indoor emissions from household combustion	Intermediate	High	High	Intermediate	Low	Intermediate	Low
Secondhand smoke	High	High	High	Intermediate	Intermediate	Intermediate	Intermediate
Ionizing radiation (medical exposure)	High	Low	Intermediate	Low	Low	Intermediate	Low
UV and tanning beds	High	High	High	Intermediate	Intermediate	Intermediate	Intermediate
Electromagnetic fields	Low	Intermediate	Low	Low	Low	Low	High

POPs, persistent organic pollutants. The methodology followed to classify the risk factors combined a review of relevant literature, consultation with scientists and public health experts, and consensus reached among participants in the WHO International Conference on "Environmental and Occupational Determinants of Cancer. Interventions for Primary Prevention" (17–18 March 2011, Asturias, Spain) (WHO 2011a).

^aAmount of scientific evidence in support of causation. ^bNumber of awareness-raising measures (e.g., campaigns) at national and/or international level. ^cExtent of governmental or nongovernmental policies, understood as principles or rules, and/or recommendations at the national and/or international level. ^dExistence of legislation at national and/or international level. ^eLevel of advocacy (governmental and nongovernmental) for primary prevention of cancer at national and/or international level. ^fLevel of implementation of policies and/or legislation at national and/or international level. ^gLevel of the perception of risk held by the general population versus the actual amount of scientific evidence in support of causation.

Radon

A contributor to indoor air pollution



FIRST WHO GLOBAL CONFERENCE ON AIR POLLUTION AND HEALTH

IMPROVING AIR QUALITY, COMBATTING CLIMATE CHANGE – SAVING LIVES

30 October – 1 November 2018

WHO Headquarters, Geneva, Switzerland

save the date



World Health
Organization

LET'S ACT TOGETHER

BECAUSE THE COST IS FAR TOO HIGH

Air pollution claims 5.5 million lives a year

Air pollution is a major driver of the non-communicable disease epidemic

Air pollution accelerates climate change

AND WE HAVE SOLUTIONS

Affordable and clean urban, transport, waste & household energy strategies

Health, environment & development sectors can lead the way to change

Organised in collaboration with:



Clear Air. Healthy Future. Healthy Climate

30 October - 1 November 2018

<http://www.who.int/airpollution/events/conference/presentations/en/>

First WHO global conference on air pollution and health



- Almost 900 participants registered for the conference
- Pre-conference workshops (around 15)
- Several side events (including a talk on radon)
- Discussed about (outdoor and indoor) air pollution, its health effects, how to tackle this global crisis and related health, climate and economic benefits.
- Received and/or heard more than 70 commitments from countries, cities, UN organizations, intergovernmental organizations and civil society to tackle air pollution, or to contribute to the global battle, providing a positive message of hope and encouraging further engagement of the global community to keep moving on a path towards cleaner air.



Where art meets science – Pollution Pods



Clean Air for Health Geneva Action Agenda



First WHO Global Conference on Air Pollution and Health – Conference summary report: **CLEAN AIR FOR HEALTH: Geneva Action Agenda**

Geneva, 1 November 2018 – At the conclusion of the first WHO Global Conference on Air Pollution and Health, participants agreed an aspirational goal of reducing the number of deaths from air pollution by two-thirds by 2030. Leaders from national and city governments, intergovernmental organizations, civil society, philanthropy, research and academia considered the scientific evidence on air pollution and health and emphasized the urgent need for bold and prompt action to address this health crisis.

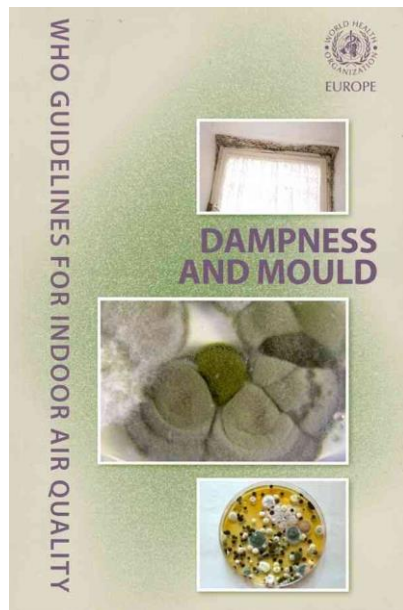


- Aspirational goal of reducing by 2/3 by 2030
- Urgent need for bold and prompt action

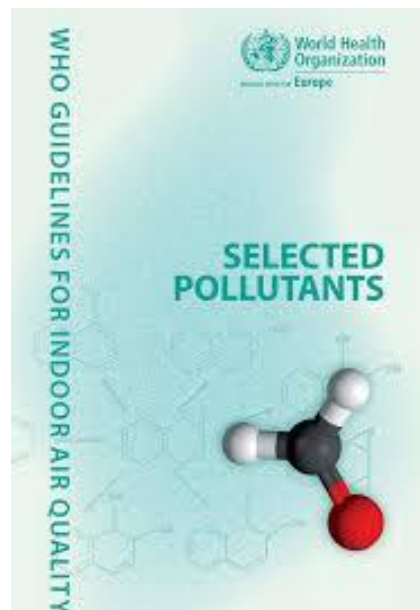
Indoor Air Pollution

WHO guidance on indoor air pollution and health risks

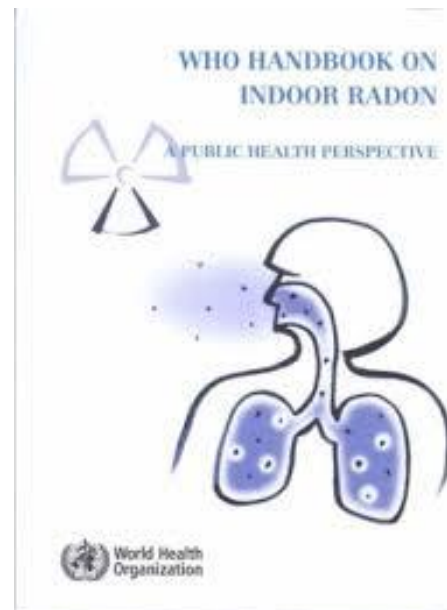
Dampness & Mould



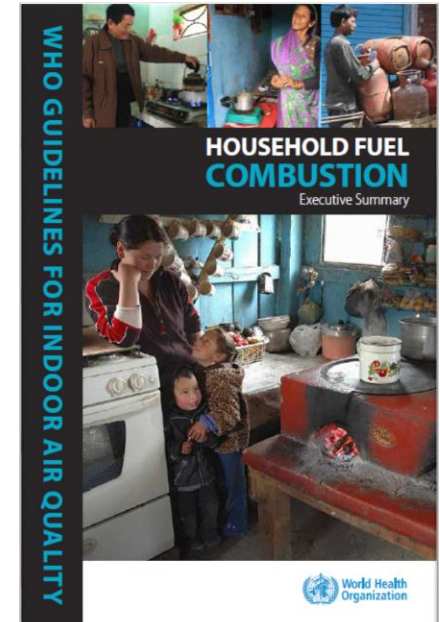
Selected Pollutants



Radon



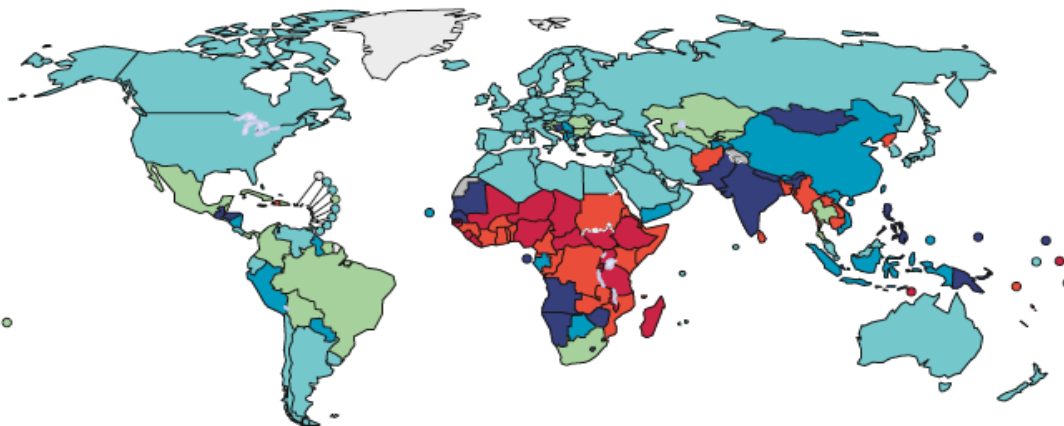
Household fuel combustion



More than 3 billion people rely on polluting energy sources for cooking



% Exposed to Household Air Pollution from Cooking (2016)



Population (%)

■ <5 ■ 5-25 ■ 26-50 ■ 51-75 ■ 76-95 ■ >95
■ Data not available ■ Not applicable



TIME LOST

Girls in households that cook with polluting fuels spent up to 35 hours a week collecting wood and water



WOMEN AND CHILDREN

accounted for over 60% of all premature deaths from HAP in 2012.



BLACK CARBON

The rapid transition of three billion people from using polluting to clean fuels and technologies could be one of the most effective black carbon mitigation opportunities of all

HOUSEHOLD AIR POLLUTION

3.8 million

die prematurely every year from household air pollution from cooking (2016). Household air pollution is mostly created by using kerosene and solid fuels such as wood with polluting stoves, open fires and lamps.

Women and children are the most at risk.



18%
from stroke



27%
from ischaemic heart disease



20%
from chronic obstructive pulmonary disease (COPD)

8%
from lung cancer

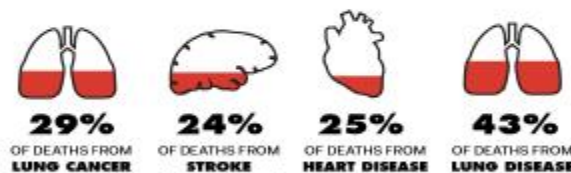
27%
are due to pneumonia

Air pollution is the second leading cause of non-communicable diseases (NCDs)



THE **INVISIBLE KILLER**

Air pollution may not always be visible, but it can be deadly.



BREATHE LIFE.
Clean Air. Healthy Future.



World Health Organization

UN



CLIMATE & CLEAN AIR

Ambient air pollution (AAP)

4.2 million deaths/yr

Household air pollution (HAP)

3.8 million deaths/yr

Joint effects of HAP and AAP

7 million deaths/yr

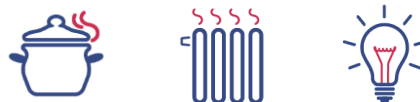
In some areas, a significant fraction of ambient air pollution (AAP) is caused by household fuel combustion

Defining “Clean” Energy for Health

WHO Guidelines for indoor air quality: household fuel combustion

Summary of Guideline Recommendations

- Address **ALL** household energy end-uses



- Provides **performance** PM & CO **targets** for fuels & stove/lamp combinations



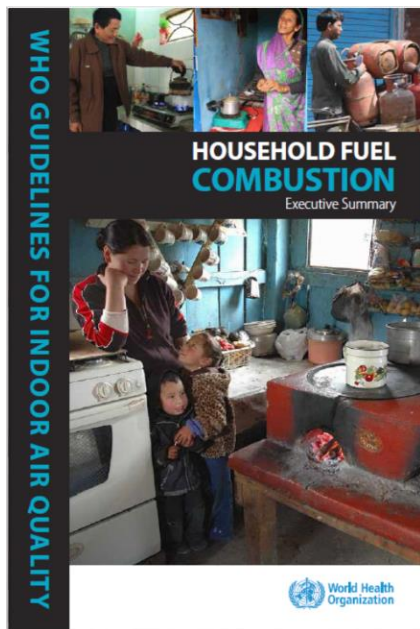
- No unprocessed **coal** use, avoid **kerosene**



- Prioritize the healthiest or ‘cleanest’ options in the **transition** to clean household energy



- Synergies with **climate change** mitigation



Clean Household Energy Solutions Toolkit (CHEST)



Information & tools to transition to clean energy in the home



Stakeholder Mapping



Needs Assessment and Situation Analysis



Identification of Technological and Policy Interventions



Guidance on Standards and Testing



Monitoring and Evaluation

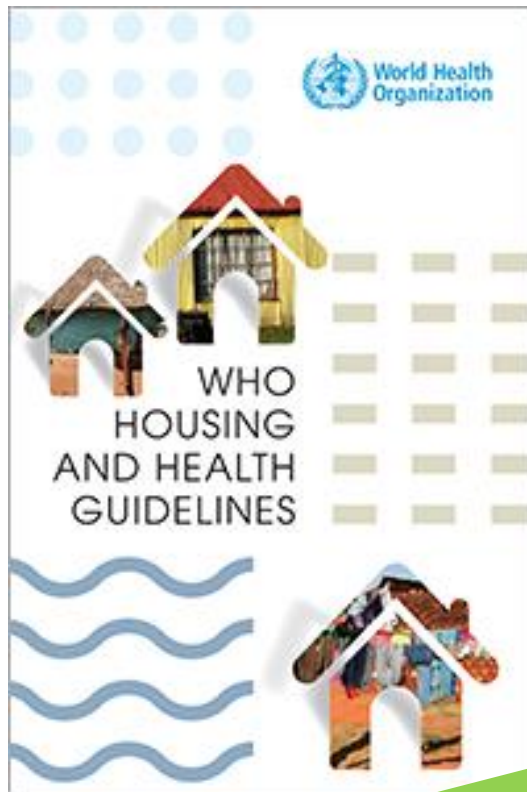


Engaging the Health Community



Communication and Raising Awareness

WHO Housing and Health Guidelines

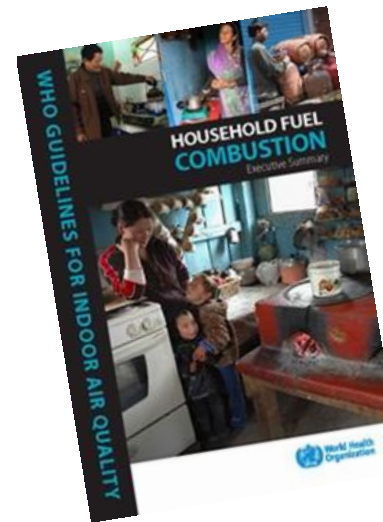


Just published!
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- Improved housing conditions can save lives, reduce disease, increase quality of life, reduce poverty, help mitigate climate change and contribute to the achievement of a number of SDGs, in particular those addressing Health (SDG 3) and Sustainable Cities (SDG 11)
- Recommendations on how to reduce major health risks associated with poor housing conditions

Challenges and Opportunities

- Energy conservation vs. radon control
- Public and political awareness on radon exposures
- Training and education of professionals
- Radon in the context of indoor air quality
- Implementation of the Basic Safety Standards



Looking ahead

Comparing radon to other indoor air pollutants



- The scientific evidence linking increased risk of lung cancer to radon exposure is strong.
- However, further research is needed to
 - understand better the global burden of disease from radon compared to other risk factors
 - indicate which interventions to reduce this risk are likely to be most effective over time
- Countries considering new radon policies should invest in studies to document the effectiveness and cost of the interventions

Merci Christophe !!



The Word Health Organization



The
Global
Guardian
of Public
Health



"Health is a complete state of physical, mental and social well-being, and not merely the absence of disease or infirmity"

WHO's Constitution (1948)