ROUND TABLE 1: Health risk management

Health examinations in different workplaces

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Health is a human right
WHO's definition of "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)
The global workforce represent half of the world’s population.

Workers are the major contributors to economic and social development.

Workers' health is determined not only by workplace hazards but also by social and individual factors including access to health services.
Health promotion

- Health promotion is the process of enabling people to increase control over, and to improve, their health.

- It includes improvement of individual behavior, as well as a wide range of environmental and social interventions to promote and sustain health (education, housing, energy, food, employment, air quality, water quality, sanitation, chemical safety, radiation safety, ... )
Health Care Quality Dimensions

- Safety
- Effectiveness
- Patient-centeredness
- Timeliness
- Efficiency
- Equality
Health expenditure: large inequalities

*(between and within countries)*

- Availability
- Accessibility
- Affordability

*(map: health expenditure)*
Universal Health Coverage (UHC)

- **UHC** means that all people have access to health services without suffering financial hardship paying for them (*sufficient quality and effectiveness*).

- Population coverage, service coverage and cost coverage

*Occupational health services within UHC*
Environmental burden of disease (BoD)

- Nearly **one quarter of the global disease burden** is attributable to the modifiable environment:
  - 24% of the number of years of healthy life lost due to disease;
  - 23% of the mortality associated with the diseases.

- Although this is a significant contribution to the overall BoD, it is a conservative estimate because there is as yet no evidence for many diseases.
Occupational Health Hazards and Global Burden of Disease (GBoD)

- Approximately **2 million annual deaths** worldwide are due to work-related diseases. This represents an average of **5,500 deaths per day**.

- Workers suffer **270 million occupational accidents** and **160 million occupational diseases** each year.

- Overall BoD is measured by the **Disability-Adjusted Life Year (DALY)**, expressed as number of years lost due to illness, disability or early death.

- Further research is still needed to precise the magnitude of this GBoD attributable to **occupational radiation exposure**.

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WHO's global plan of action on workers' health

The 60th World Health Assembly endorsed the **WHO global plan of action on workers' health** 2008-2017 (resolution WHA60.26/2007) and urged WHO to:

- Promote the implementation of the **global plan of action on workers' health** at national and international level.

- Strengthen **collaboration with ILO and other related international organizations** and to stimulate joint regional and country efforts on workers' health.

- Maintain and strengthen the **network** of WHO collaborating centres for **occupational health**.
The Global Occupational Health Network (GOHNET) includes ~70 WHO Collaborating Centres that support the implementation of the Global Plan of Action on Workers' Health.
WHO Global Plan of Action on Workers’ Health 2008-2017

This Global Plan of Action includes:

- Primary prevention of occupational hazards;
- Protection and promotion of health at work;
- Employment conditions; and
- Better response from health systems to workers’ health.
Global Plan of Action on Workers’ Health: common principles

1. All workers should be able to enjoy the highest attainable standard of physical and mental health and favorable working conditions.
2. The workplace should not be detrimental to health and wellbeing.
3. Primary prevention of occupational health hazards is a priority.
4. All components of health systems should be involved in an integrated response to the specific health needs of working populations.
5. The workplace can also serve as a setting for delivery of other essential public-health interventions, and for health promotion.
6. Activities should be planned, implemented and evaluated with a view to reducing inequalities in workers’ health within and between countries.
7. Workers, employers and their representatives should participate.
WHO's global plan of action on workers' health: objectives

1. to devise and implement policy instruments on workers' health;

2. to protect and promote health at the workplace;

3. to improve the performance of and access to occupational health services;

4. to provide and communicate evidence for actions and practice;

5. to incorporate workers' health into other policies.
Objective 1: to devise and implement policy instruments on workers’ health

- National health policies and national action plans on workers' health
- National approaches to prevention of occupational diseases and injuries
- Measures to minimize the gaps in terms of levels of risks and health status between different groups of workers (e.g. young workers, gender issues, migrant workers, …)
- Support to Ministries of Health to provide leadership for activities related to workers' health
Objective 2: to protect and promote health at the workplace

- Assessment and management of health risks at the workplace.

- Endorsement, adoption and enforcement basic occupational health standards, building collaboration between the competent regulatory agencies.

- Capacity building for primary prevention of occupational health hazards (healthy practices, health promotion culture).

- Prevention of non-communicable diseases (e.g. cancer, cardiovascular are relevant for radiation exposure).

- Provision of guidance and tools
Objective 3: to improve the performance of and access to occupational health services

- Coverage and quality of occupational health services.
- Building institutional capacities for planning, delivering and monitoring OH services, dissemination of information and provision de specialized expertise.
- Development of human resources for workers' health (post-graduate and basic training, target primary health care physicians).
- Provision of tools, information products, training packages, good OH practices.
Objective 4: to provide and communicate evidence for action and practice

- Design systems for surveillance of workers' health to identify and control occupational hazards.
- Establish national information systems and building capability to estimate occupational burden of disease.
- Create registries of occupational exposure, occupational accidents and occupational diseases.
- Improving early detection, reporting and learning.
- Framing a research agenda and fostering research.
- Increase awareness and knowledge about work & health links.
Objective 5: to incorporate workers’ health into other policies

- Promoting inclusion of workers' health in other sectors' policies.
- Workers' health considered in the context of trade policies.
- Assessment of the impact of employment policies.
- Considering environmental protection aspects and plans for emergency preparedness and response.
- Workers' health incorporated in primary, secondary and higher level education and vocational training.
Implementation of the Global Plan of Action on Workers' Health

- WHO to engage in partnerships and joint action with ILO and other organizations of the UN systems, employers' organizations, trade unions and other stakeholders from the civil society (NGOs) and private sector.

- From the radiation protection perspective this Plan of Action provides a robust framework to integrate occupational radiation protection into the broader concept of workers' health.

- Health surveillance in different workplaces is part of it.
Workers health surveillance vs, occupational health surveillance

**Workers’ health surveillance**: assessment of workers’ health by means of detection and identification of diseases/ abnormalities. It may include clinical examination, biological monitoring, surveys, imaging procedures, reviews of workers’ radiation dose records and workers' health records.

**Occupational health surveillance**: collection of information about conditions in the workers' health as well as in the working environment (hazards, risks).
Integrating radiation protection in the global occupational health agenda
Occupational radiation protection

Purpose

- To provide an **appropriate level of protection** to workers by preventing tissue reaction (deterministic effects) and reducing the probability of stochastic effects to an acceptable level (ALARA)

![Diagram](attachment:image.png)

- Radiation source
- Exposure pathways
- Exposed individual
- Radiation dose
- Radiation risk

- External exposure
- Internal exposure

[World Health Organization]
Tissue reactions


- Particular relevant for ORP concerning risk of circulatory disease and cataracts:
  - New evidence of higher incidences of injury than expected after lower doses; hence, threshold doses appear to be lower than previously considered.
  - A threshold dose of 500 mGy is proposed for practical purposes, irrespective of the dose rate.
Radiation-induced cataract & occupational health

- Early diagnosis possible (opacity at the posterior subcapsular region) but there is no established medical treatment to mitigate the radiation injury.

- Lens replacement is a well-established and effective surgical procedure for treating cataract. However, it requires access to specialized surgical services and has associated costs with implications on the healthcare system.

- **Radiation-induced cataract is preventable.**
Cataract: workers at risk

- Relatively uniform whole-body radiation exposures;
- Highly non-uniform radiation exposures in which the head may be particularly exposed;
- Weakly penetrating radiation exposures (beta particles, photons of low energies)
Cancer risk at low-dose: the LNT approach

- For the purposes of radiation protection it is assumed that the risk at low doses is proportional to the dose (i.e. radiation exposure always poses some risk, albeit very small at low doses)
- Categories at risks: all occupationally exposed workers
Common scenarios of workers’ exposure to IR

- **Medical applications** of radiation (about 75% of exposed workers)

- Mines, mineral processing plants, oil, gas and other extractive industries (NORM)

- Radiation sources used for **industrial purposes** (e.g. construction, manufacturing and food industries)

- **Nuclear industry** (NPPs, nuclear fuel cycle)

- Radiation or radioactive materials used for **academic, research and/or development** purposes

- **Radiation emergencies**
ORP of health workers

The principles of RP:

• Justification of practices
• Optimization of protection
• Limitation of dose

The golden rules:

• Time
• Distance
• Shielding

Early 20th century
ORP of health workers

1895

Early 20th century

TODAY

Same RP principles and "golden rules". The conditions for their implementation have changed. ORP in medical settings has to address the new challenges of modern technology and adapt to evolving conditions.
Health workers occupationally exposed to radiation

Annually worldwide, about **7 million health workers** incur radiation doses attributable to their occupation. Differences in the exposure conditions as well as in the level of radiation protection knowledge and skills are substantial.

- **Physicians specialized in the use of IR:** diagnostic radiologists, interventional radiologists, nuclear medicine physicians, radiation oncologists;
- **Medical physicists, radiographers, radiation technologists, radiopharmacists, nurses**;
- **Physicians who use IR modalities in their practice** (e.g. cardiologists, vascular surgeons, orthopedists, urologists, gastroenterologists).
Health workers' risks

- In general the doses and associated risks are higher in staff involved in interventional procedures. In particular regarding cataract, the lens doses and risks are higher for staff involved in:
  - fluoroscopy guided interventional procedures;
  - CT-guided interventional procedures;
  - nuclear medicine procedures (e.g. preparation of radiopharmaceuticals, PET/CT, cyclotrons);
  - manual brachytherapy.
Occupational exposure to radon

- Radon concentration may be very high in enclosed workplaces such as underground mines, caves, tunnels, thermal baths, spas, etc.

- Concentrations in the range between 5000 and 28000 Bq/m$^3$ have been reported in underground mines.

- Health surveillance programmes should consider co-morbidities (e.g. dust inhalation resulting in pneumoconiosis)
Radon exposure and workers' health risks

- Radon is a radioactive inert gas produced from the radioactive decay of uranium in rocks and soil, that escapes into the air and tends to concentrate in enclosed spaces (e.g. underground mines, houses, other buildings).

- It is the second cause of lung cancer after smoking (3-14% of cases would be attributable to radon). Most of the radon-induced lung cancer cases occur among smokers.

- The risk increases proportionally with the exposure (significant association observed at radon concentrations >100 Bq/m3)
Occupational exposure in NORM industries

Natural Occurring Radioactive Materials (NORM) that are present in earth crust can be brought to the surface due to human activities (e.g. extractive industries).

**Exposure scenarios**: mineral mining, processing and milling (e.g. gold, copper, nickel, iron, coal, phosphate, others), mineral sands, oil and gas production, electricity generation with coal & peat, ceramics and building materials, ground water purification, sewage treat, phosphogypsum landfill, …, others.

NORM industries produce **80%** of the worldwide annual collective dose from occupational exposures, excluding U mining (UNSCEAR 2000). Individual doses can be substantially high..
NORM exposure and workers' health risks

- Most NORM contains radionuclides from the chains resulting from the decay of uranium-238 (238U), uranium-235 (235U) and thorium-232 (232Th). Workers may be exposed either:
  - internally through inhalation of radon gas or inhalation of radioactive aerosols in dusty working conditions,
  - Internally through ingestion, and/or
  - externally from gamma emitters.

- **Radon** is an inert gas alpha emitter- risk: **lung cancer**.

- **Radium** (alpha, beta and gamma), affinity for chloride ions, "bone seeker"- risk: **bone cancer, lymphoma, leukemia and aplastic anemia, other cancers**.
Nuclear emergency workers' health risks

- Occurrence of acute radiation effects will depend on the dose e.g.: while observed in Chernobyl liquidators, (ARS), no deterministic effects were observed in Fukushima emergency workers.

- Increased risk of cataract and circulatory disease may be considered if the doses exceed the threshold level (around 500 mGy).

- Thyroid cancer risk is the most common stochastic risk after intake of radioactive iodine (higher for young workers, function of dose). Other radiation-related cancer risks will depend on the dose level, as well as on the exposure pathways, and radionuclides involved.

- Mental health disorders & psychosocial impact are health consequences most affecting radiation emergency workers.
Particular considerations applicable to all occupational exposure scenarios

- Particular considerations for female workers
  - Pregnant female workers
  - Female workers of reproductive capacity
  - Female workers while they are breastfeeding in case there is a risk of internal exposure to radionuclide in the workplace (e.g. health workers in a nuclear medicine service)