

# IAEA project on occupational radiation protection and risk management during decommissioning activities at NPPs

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**IAEA**

International Atomic Energy Agency

# Outline of presentation

## *Project on ORP and decommissioning*

Background, Scope, Objective  
Implementation

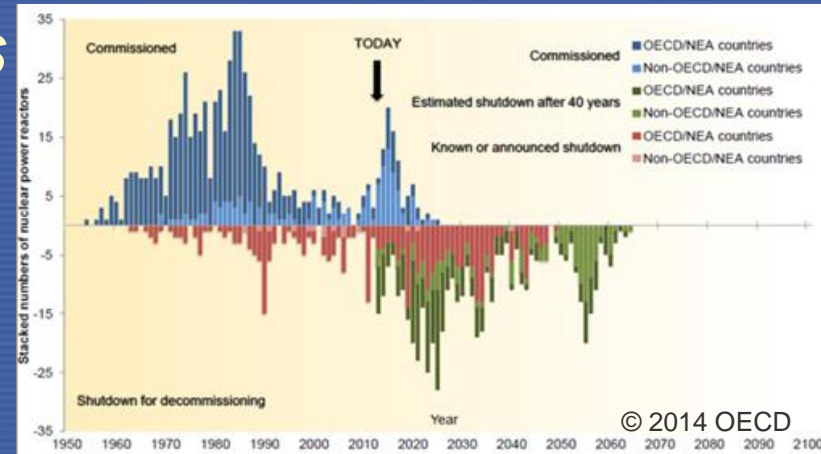
## *Output*

General overview of content  
Specific examples

# Background

*Decommissioning of NPPs is a growing activity*

*Need for further practical guidance in managing radiation protection of workers, taking into account non-radiological hazards*



# Scope and objective

## ***Management of worker protection during decommissioning of nuclear installations***

- focus on NPP and research reactors
- not including decommissioning after severe accidents

## ***Planned output***

- Practical guidance on ORP in decommissioning of nuclear installations, including aspects on management, planning and conduct. To be published in IAEA Tecdoc series
- Aimed at managers, regulators, contractors

## ***Project is conducted during 2014-2016***

# Implementation

## *2014: meetings with*

- operators, service providers and RP experts involved in decommissioning
- regulators from member states
- information exchange with ISOE and ILO

## *2015: meetings with*

- consultants to develop and prepare the guidance material

## *2016: publication*

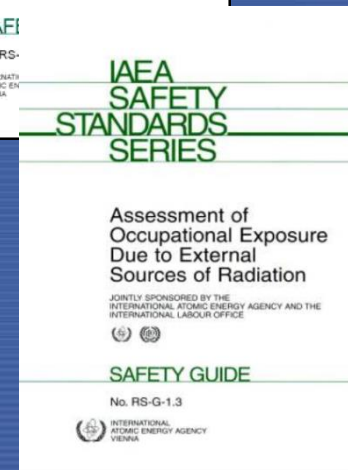
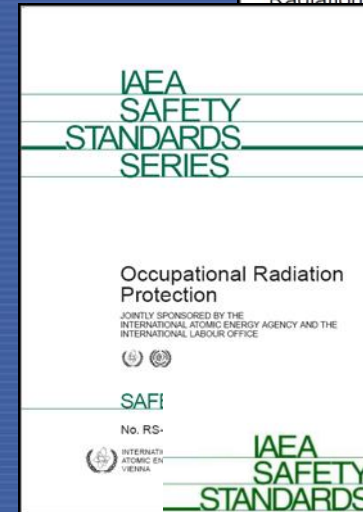
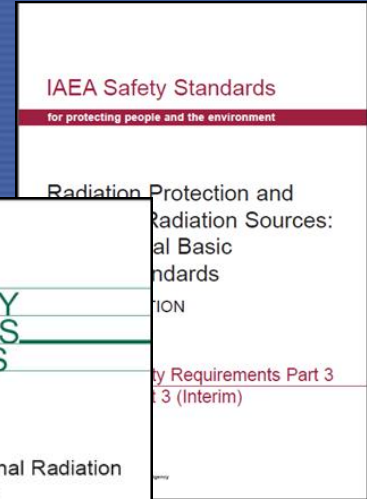


# Content of the planned guidance

*Impact of decommissioning on protection of workers*

*Setup of ORP for decommissioning*

*ORP during the conduct of decommissioning*



# Impact of decommissioning on protection of workers

## *Hazards for workers*

- different to operation, changing environment, history of operation and industrial hazards

## *Safety culture*

- change in perception, uncertainty in future, use of contractors

## *RP aspects of decommissioning strategy*

- early RP involvement, radiological situation, availability of waste facilities

# Set-up of ORP for decommissioning

## *Adaption of Radiation Protection Program*

- Sufficient flexibility to handle unforeseen tasks

## *Establishment of RP organization*

## *Radiological characterization*

- Nature, location and concentration of radionuclides
- Care in deciding level of detail initially
- Nuclide vectors need careful derivation



# Site preparation

## *Radiation protection areas*

- Access, control measures

## *Monitoring programme*

- workplace, dosimetry, clearance monitoring



Bradwell (UK): example of a typical temporary structure used for a contamination area work

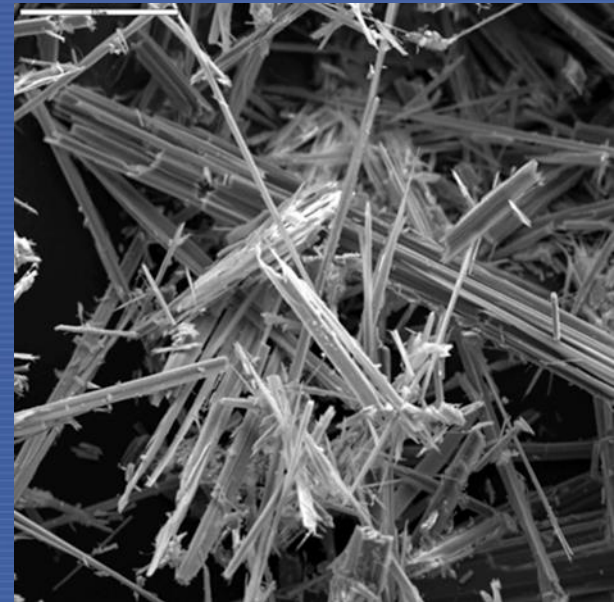
## *Facilities and systems, PPE and contamination control measures*

- procedures, action/investigation levels, zones, equipment including airborne activity

# Non-radiological hazards

## *Examples of hazards to consider*

- Asbestos
- Chemical
- Oxygen deficient atmosphere
- Electric shock
- Heat stress
- Fire
- Falling debris



*Magnitude of risk is difficult to quantify*

# ORP in decommissioning activities (1)

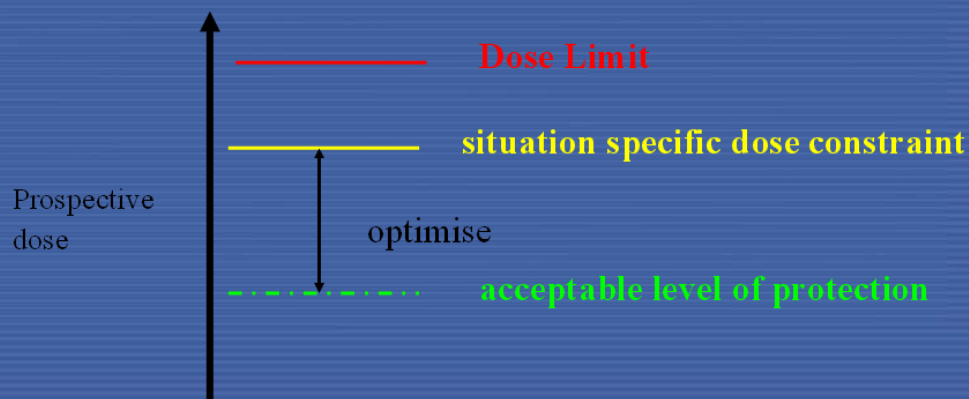
## *RP Optimization*

- graded approach
- consider what can be done to reduce doses

## *Useful tools*

- action levels
- investigation levels
- dose budgets
- dose constraints

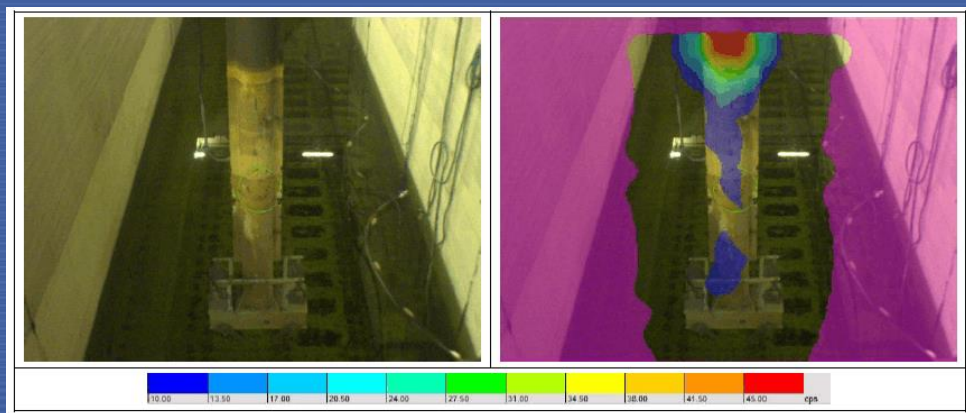
Optimisation – use of dose constraint



# ORP in decommissioning activities (1)

## *Selection of technique*

- Experience/dose criteria
- Gamma cameras
- Chemical decontamination
- Remote cutting techniques



Gamma-ray imaging at Hinkley Point A Site by  
Cavendish Nuclear in Feb 2015



Chooz A decontamination (2014)  
Left - decommissioning of the fuel building  
Right - pipework before and after cleaning

# ORP in decommissioning activities (2)

## *Operating experience and knowledge transfer*

- Records and knowledge of long term workers

## *Detailed planning*

- Information on ALARA measures, layouts, work sequence relevant for exposure, list of monitors, samplers, other RP equipment, etc

## *Detailed radiological characterization*

- Lists of dose rate and contamination measurements, nuclide composition and vectors

# ORP in decommissioning activities (3)

*Work permits*

*RP interaction*

- with management, workers and contractors

*Cleanliness*

- helps promote a positive culture

*Classification of areas*

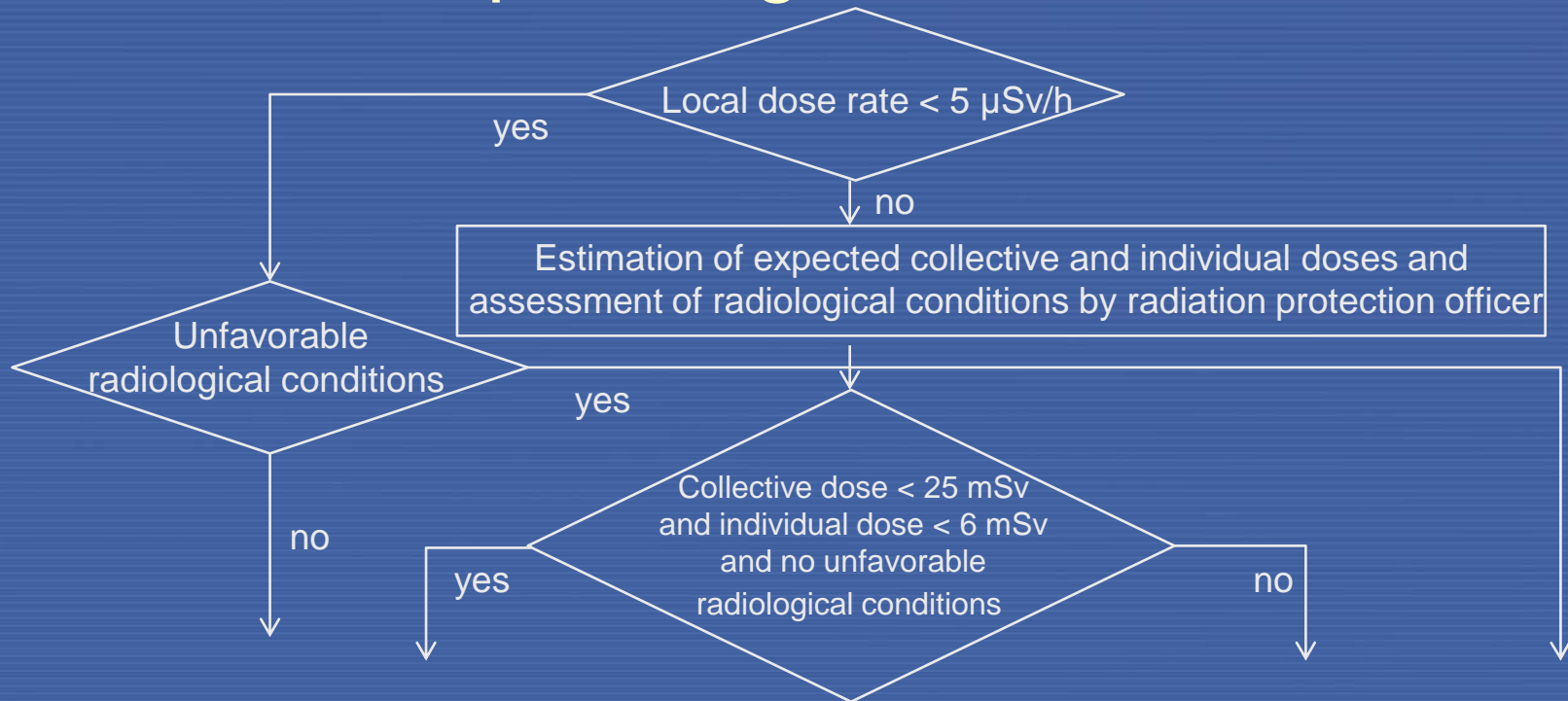
*Training in RP*

*Waste management*



# Example: Staged approach

- ORP selection criteria for necessary level of detail of the planning



**routine** radiation protection procedure

**special** radiation protection procedure

# Example: ORP budgets and threshold levels

- Work planning:

Daily planning value: 200  $\mu\text{Sv}$

Max. dose per day: 1 mSv

## Control:

Warning thresholds EPD

Pre-alarm 100 $\mu\text{Sv}$

Main alarm 200 $\mu\text{Sv}$

dose rate 50 $\mu\text{Sv/h}$

## RP measures:

Contamination: access areas to controlled 0.7 Bq/cm<sup>2</sup>

Permanent accessible rooms in RCA 7 Bq/cm<sup>2</sup>

Dismantling areas “yellow” over shoes 7...70 Bq/cm<sup>2</sup>



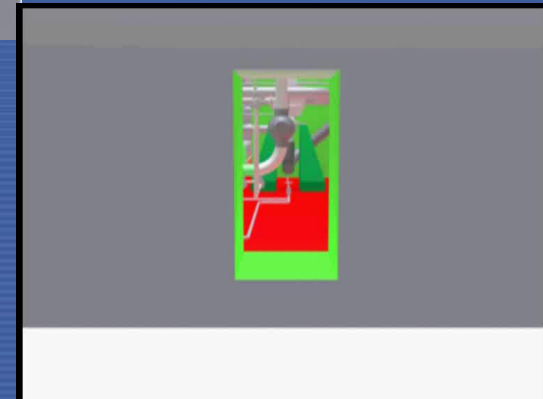
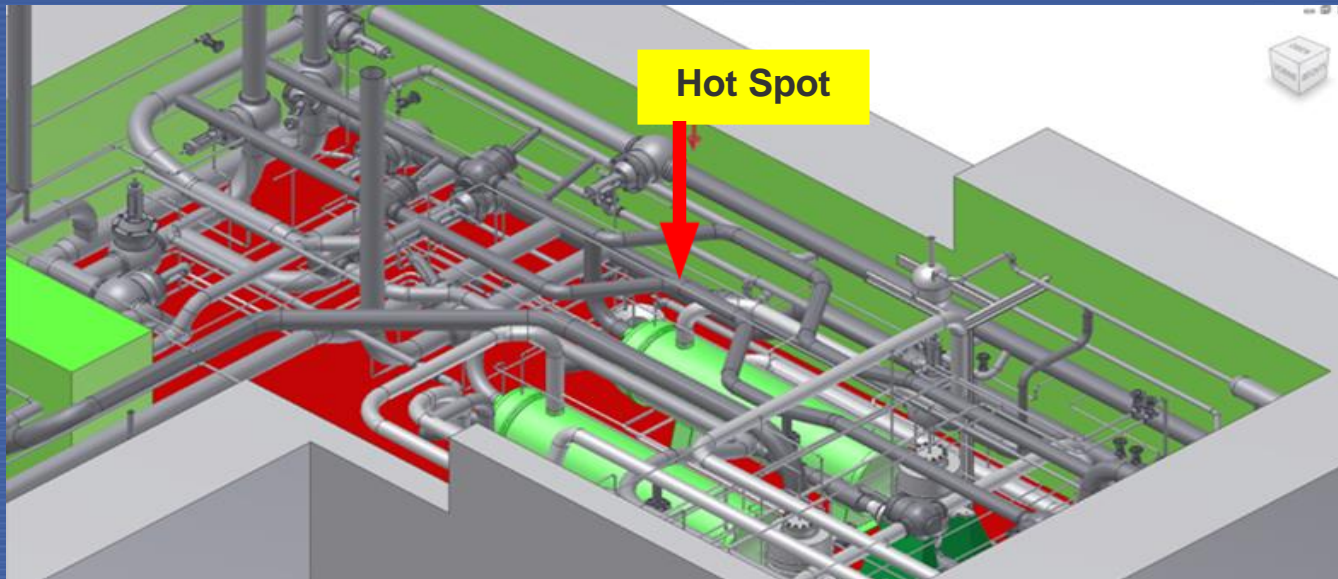
# Example: Detailed work planning 1

- Complicated local conditions and unfavourable radiological conditions....



# Example: Detailed work planning 2

- ...requiring 3D simulation, mock-up and detailed planning of each work step



# Example: Detailed work planning 3



	<u>Planned</u>	<u>Real</u>
<b>Total time</b>	597 h	210 h
<b>Man hours</b>	1800 man h	630 man h
<b>Collective dose</b>	28,3 mSv	6,3 mSv
<b>max. individual dose</b>	6,9 mSv	1,5 mSv

# Acknowledgement

*This presentation was prepared in  
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TUV Rheinland Industrie Service GmbH*

# *Thank you for your attention...*



**IAEA**



The FAFA Partnership  
Managing Projects with  
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