Session 10

# Occupational Radiation Protection in Nuclear / Fuel Cycle Facilities
# Summary of the Contributed Papers

**H. Burçin OKYAR**
OECD Nuclear Energy Agency
Radiological Protection and
Radioactive Waste Management Division

International Conference on Occupational Radiation Protection, IAEA
1 – 5 December 2014, Vienna /Austria

# ORP in nuclear field

**Occupational Radiation Protection (ORP)** Programmes

- During the past decades, successful in reducing the radiation doses received by workers during the operation, maintenance, and refuelling phases of nuclear power plants
- Effectively applied across the whole range of nuclear facilities/ sites (with lessons)

- Need to continue to investigate means of reasonably achieving still lower radiation doses to workers,
  - without resulting in unplanned or excessive increases in other contributing factors to risk to workers,
  - to unacceptable consequences to safe and reliable facility operation.

# Session 10 – Contributing papers

## Main focus

- Future challenges for and strategic areas of ORP in the nuclear power sector in order to bring clear benefit with different country perspectives
- Provide input for the implementation of new nuclear energy programs

## Papers

- Four papers on ALARA and dose reduction programs, its implementation and monitoring experiences,
- Two papers on occupational radiation exposure and source-term management, characterization with necessary technology, and
- One paper on radiological impact of routine discharges.

# Contributing papers

[1] KANG, K. et al, "Introduction of KHNP's Dose Reduction Programs"

[2] INGHAM, G. A., "Demonstrating ALARA across the UK Nuclear Industry - Implementation of the Control of Occupational Radiation Exposure (CORE) Regulatory Inspection Project"

[3] LIU, L. et al, "Occupational Radiation Exposure and Radioactive Source Terms Control of PWRs in China"

[4] PADMA SAVITRI, P., "Occupational Radiological monitoring experience in Uranium Fuel Fabrication Facility of India"

[5] MILLER, D.W. et al, "Nuclear Power Plant Source Term Characterization with CZT Technology"

[6] WAHL, C.G. et al, "Polaris-H Imaging Spectrometer Source-Term Measurements"

[7] NASSAR, N. et al, "Assessing the Possible Radiological Impact of Routine Discharge from Proposed Nuclear Power Station"

# Dose Reduction through Effective ORP programmes

## Occupational exposures since 1980s/90s (NPPs)

- Strongly decreased
- Outlining efforts achieved by nuclear operators worldwide in order to reach and maintain occupational exposure ALARA in terms of collective exposures and average individual exposures
- In accordance with international recommendations and national regulations

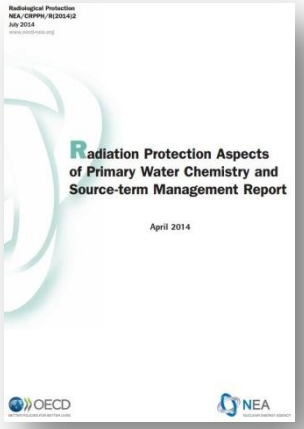
- Technical & operational aspects (reference docs, standards, guides)
  - implementation of key lessons learnt,
  - effective communication during the life-cycle for optimization,
  - balance of risk and allocation of resources
  - publicly recognisable effective ORP

# Collective opinion

- Collective radiation exposure should not been seen as the only indicator of the efficiency of ORP programmes at NPPs and new radiation protection indicators should be developed.
- Multi-disciplinary work environment (design engineers, operation, chemistry, maintenance, job planners, R&D, etc.) is enlarging, and needs further innovative approaches for sustainability.
- Source term management is still a topic of increasing interest, and requires international feedback from past year experiences to guide the new regimes.
- ISOE Expert Group Report

  RP Aspects of Primary Water Chemistry & Source-term Management

  isoe-network.net



# ORP programmes

- South Korea paper provides important clues for a successful dose reduction plan with effective methods for steam generator replacement, removal of resistance temperature detectors (RTD) bypass lines, installation of tritium removal facilities, and zinc injection.
- The UK paper reports on a novel and consistent approach (CORE- Control of Occupational Radiation Exposure, regulatory inspection project) which has been developed for the full range of nuclear facilities.
- In particular to PWRs, the paper form China indicates activated corrosion products, deposited on the surface of reactor coolant system and other equipment are the main causes of doses, and summarize the findings of a project to improve knowledge of occupational exposure and its related radiological source term in NPPs.

# ORP monitoring, state-of-art techniques

- Monitoring is integral part of the ALARA programme as indicated in number of papers.
- Management of the primary system water chemistry has been, and still is, a major contributor to collective dose reduction programs of the NPPs.

- It must be taken into account at all stage of the facility life:
  - Design and commissioning (choice of material, design of clean up system),
  - During its operation (operation chemistry, shutdown procedures, zinc injection, full system chemical decontamination, flushing)
  - Decommissioning (full system decontamination)

**An optimized strategy requires**

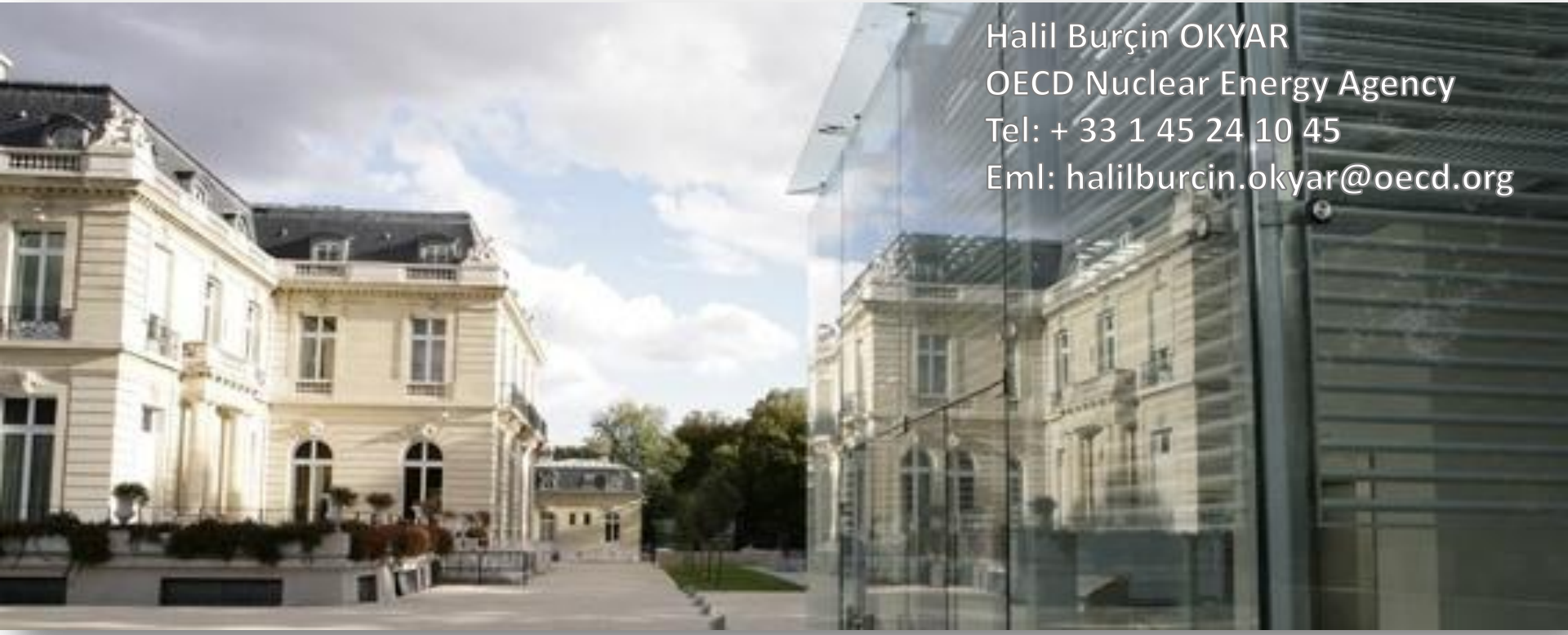
- involvement and collaboration among all stakeholders (operation, RP and chemistry staff,
- strong support from the management in order to cope with all operational priorities

# Conclusions

- The last two decades have been characterized by the substantial progress made in ORP, as shown by the reductions of individual and collective exposures.
- Networking is an important element to enable information collection and exchange on ORP over full life-cycle.
- The development and execution of effective ORP programmes cannot be accomplished without considering the other programmes that simultaneously are developed and implemented at nuclear/ fuel cycle facilities.
- Many factors have contributed to the success of ORP programme
  - Practical implementation of the ALARA principle requires the adoption by the facilities of appropriate technical and organizational measures,
  - Spreading of ORP philosophy among the various actors of the nuclear sector.

# Nuclear Energy Agency





Halil Burçin OKYAR
OECD Nuclear Energy Agency
Tel: + 33 1 45 24 10 45
Eml: halilburcin.okyar@oecd.org