



*Institute of Nuclear Power Operations*

# **INPO / WANO Collective Radiation Exposure Observations & Recommendations**

## **2013 ISOE ALARA Symposium**

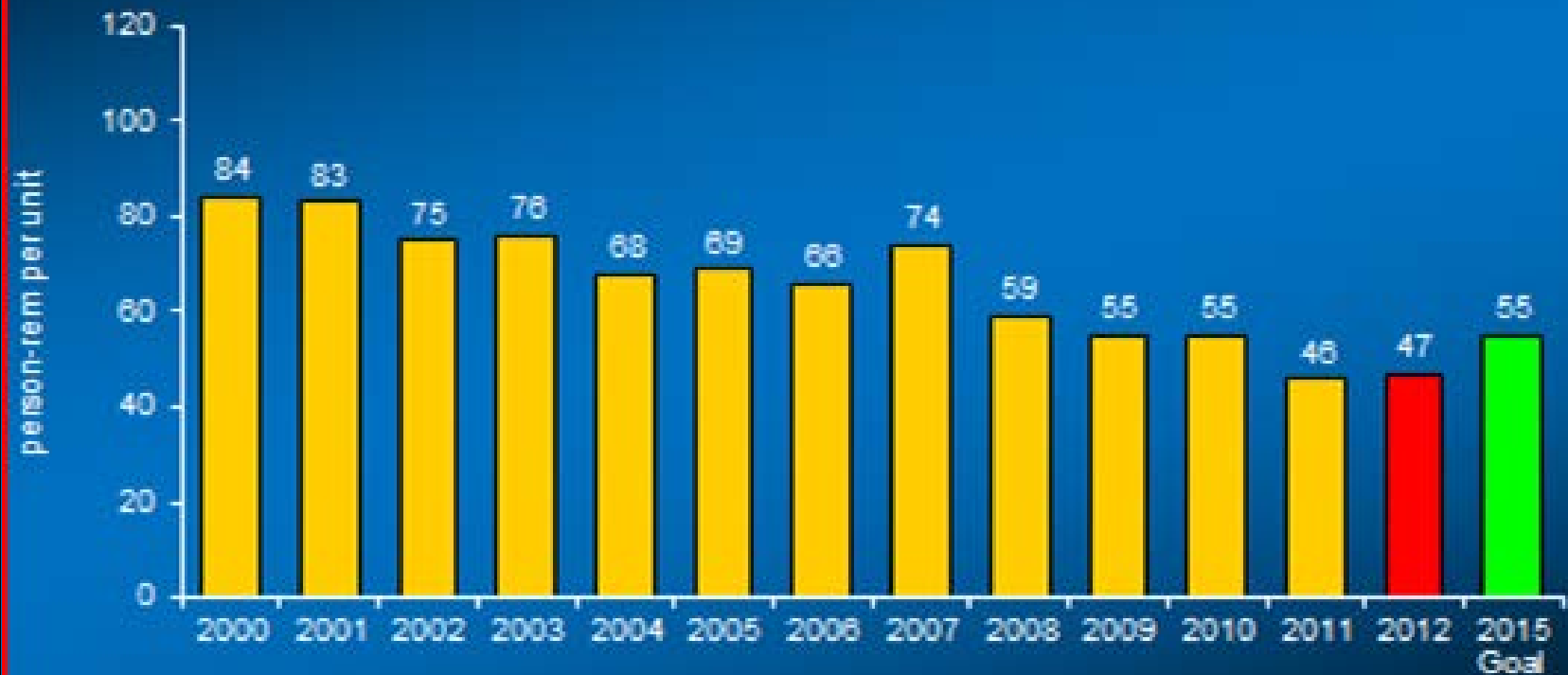
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# Key Topics

- Summary: Industry Collective Radiation Exposure (CRE) Performance
- Review: Recent Areas for Improvement (AFIs) and Performance Deficiencies
- Principal Contributors to the Problems
- Recommendations to Close Performance Gaps

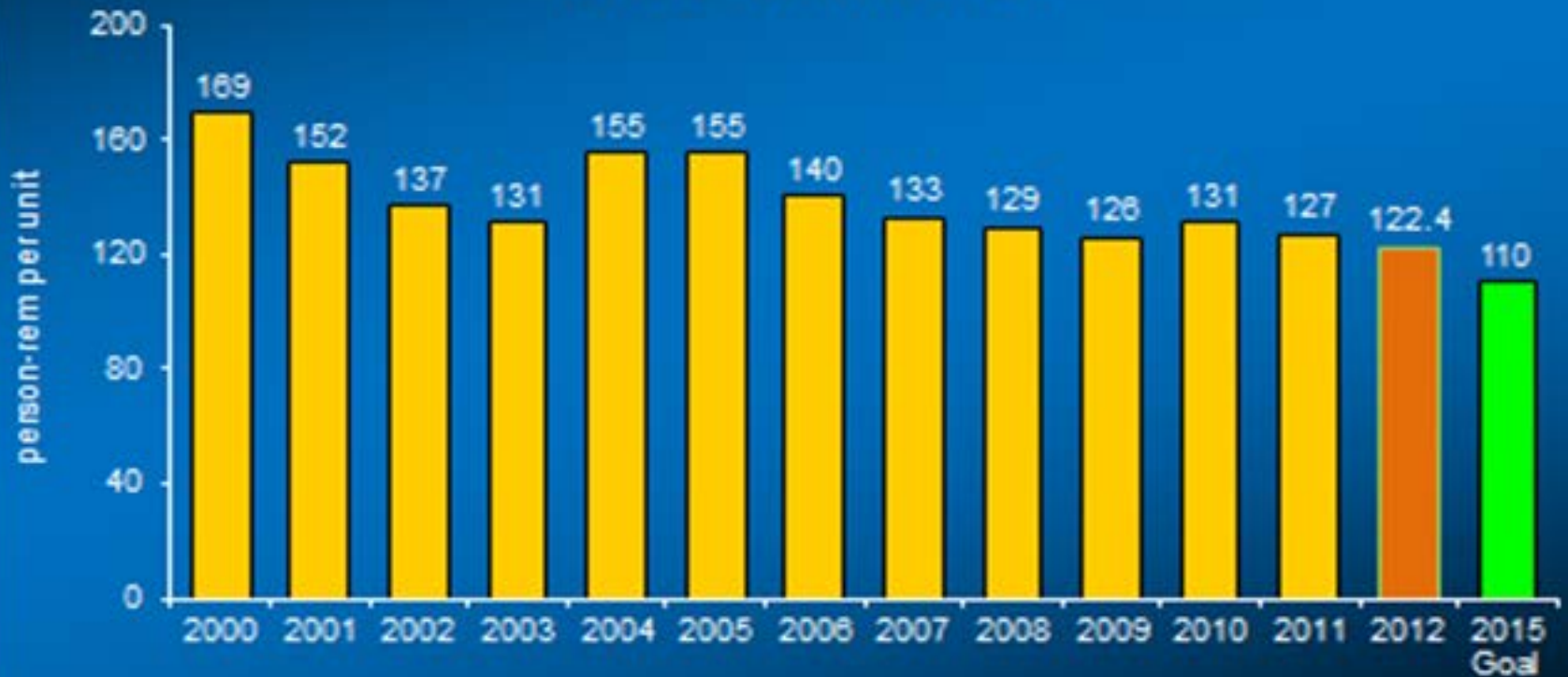
## U.S. Collective Radiation Exposure (PWR) Median Values Third Quarter 2012



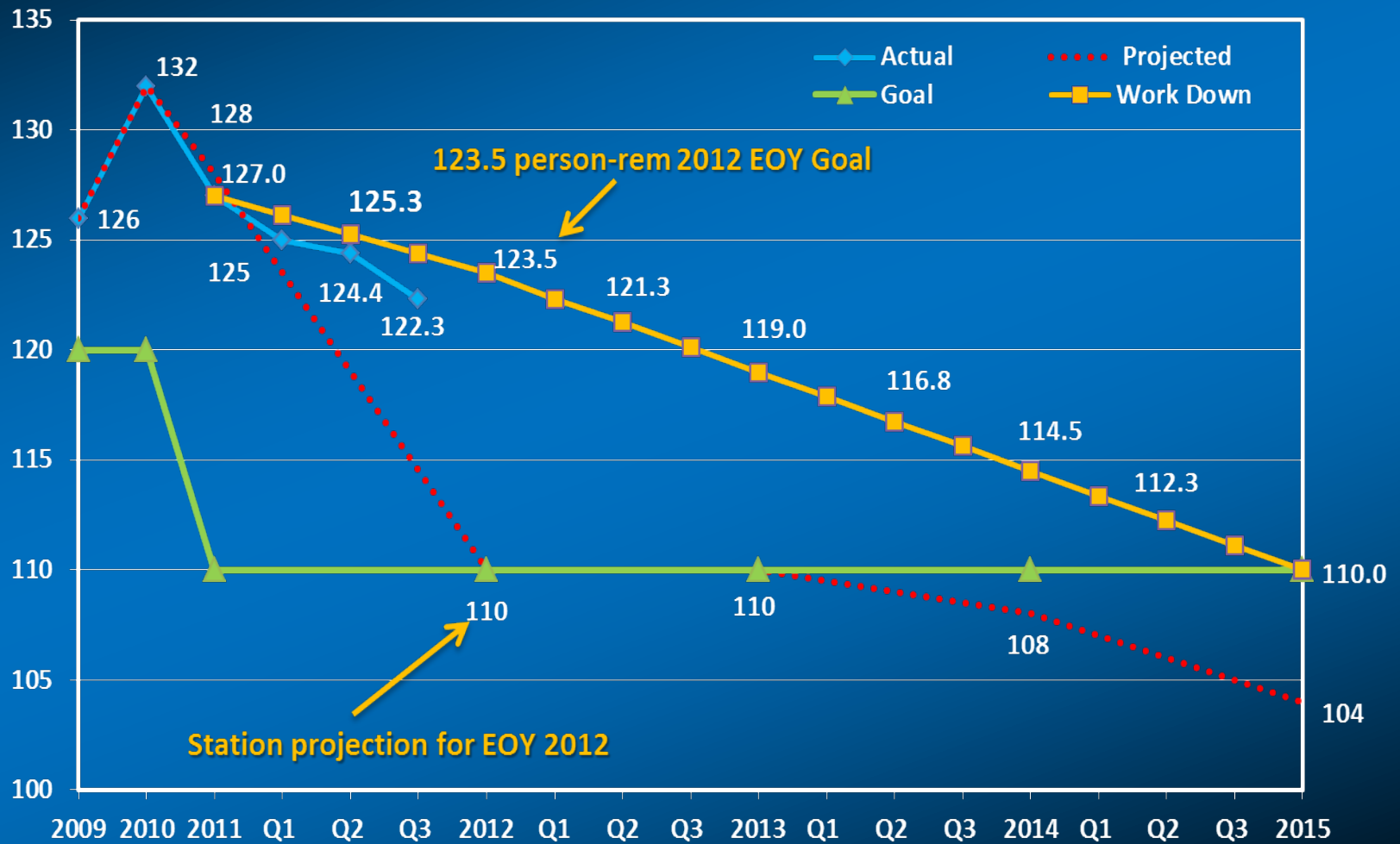
# U.S. Collective Radiation Exposure (BWR)

Median Values

Third Quarter 2012

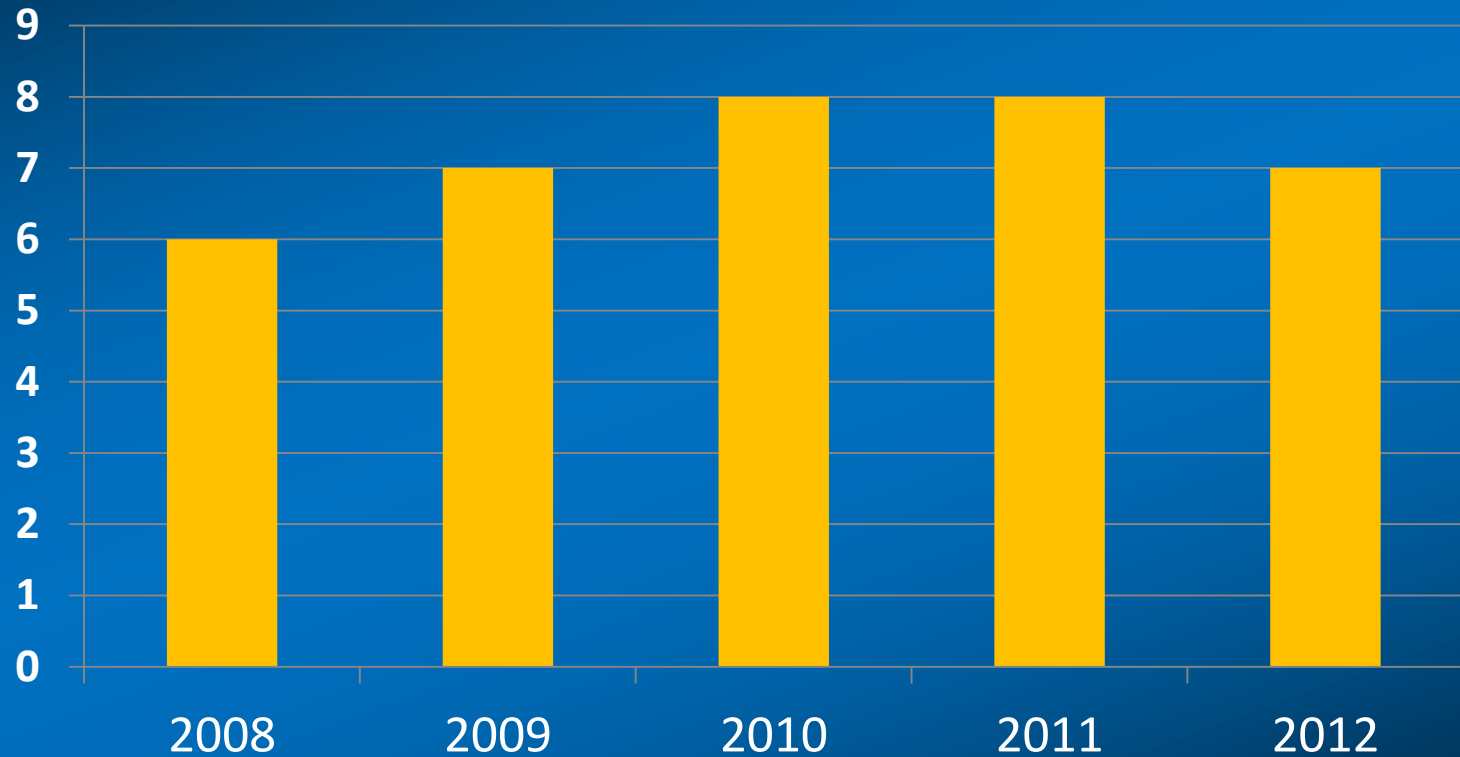


# BWR CRE Progress 3<sup>rd</sup> Qtr 2012



# INPO / WANO

## Areas for Improvement / Year



CRE AFIs Identified during INPO Evals and WANO – AC Peer Reviews



**1. Shortfalls in executing ALARA plans, and projecting and tracking dose during the most recent refueling outage resulted in exceeding the outage dose goal by nearly 60 person-rem.**

Examples of the Problem:

- RWCU not maintained in service during critical shutdown periods contributed to an additional 6.5 person-rem
- Untimely installation of temp shielding to support recirc pipe weld inspections. *Misperceptions that shielding would interfere with scaffolding installation and insulation removal*
- ALARA in-progress reviews for several high dose jobs lacked detail on causes of dose overruns / did not identify actions to correct the problems



# **1. Shortfalls in executing the ALARA plan, and projecting and tracking dose during the most recent refueling outage resulted in exceeding the outage dose goal by nearly 60 person-rem.**

## Causes:

- ❑ Insufficient management oversight of ALARA planning activities
  - Outage schedule activities for RWCU operation and installation of temp shielding not adequately reviewed by management
  - During RFO, missed opportunities to adjust outage schedule to address / recover from dose overruns
  - Insufficient resources assigned to ALARA staff
  - ALARA supervisor assigned to manage multiple radiation protection groups during the outage



**2. Improvements in collective radiation exposure have not been achieved over the review period. As a result, dose performance for three of the four units is in the industry bottom quartile.**

Examples of the Problem:

- ❑ Initiatives to prevent elemental cobalt from entering the reactor system were not implemented; e.g. a cobalt cleanliness program / x-ray fluorescence analyses
- ❑ Several proposed source term initiatives were not implemented:
  - Alternative material for cobalt in refueling machine ram balls
  - Use of nano-fiber filters to optimize coolant purification
- ❑ Limited departmental focus and ownership of dose reduction
- ❑ ALARA plans for outage boiler (steam generator) work lacked specific recommendations for reducing contamination and radiation levels

**2. Improvements in collective radiation exposure have not been achieved over the review period. As a result, dose performance for three of the four units is in the industry bottom quartile.**

Causes:

- ❑ Comprehensive long-range plans not established to address high source-term:
  - ALARA initiatives fall outside the prioritization process for plant improvements and receive low scores within the plant health committee
- ❑ Management has not reinforced site wide dose awareness:
  - ALARA is not ingrained in workforce culture
- ❑ Management not aware of what good dose performance looks like; challenging dose estimates not established for work activities:
  - Deficiencies in benchmarking



**3. Efforts to reduce high source term and CRE have not been aggressive and many initiatives have not been implemented per approved plans. As a result, CRE has been consistently among the highest in the industry.**

*This area for improvement identifies a weakness in the implementation of IER L2-11-1, Inadequate Collective Radiation Exposure Improvements*

Examples of the Problem:

- ❑ Many (25 of 54 ) long-range dose reduction plan initiatives were not implemented during the recent RFO. Examples include:
  - Installation of shielding on the portion of core support barrel that is not submerged
  - Relocation of upper guide structure lift rig, or installation of shield wall between the lift rig and the laydown area to reduce general area dose rates
  - Installation of tungsten blankets on Rx head

3. **Efforts to reduce high source term and CRE have not been aggressive and many initiatives have not been implemented per approved plans. As a result, CRE has been consistently among the highest in the industry.**

Causes:

- ❑ Management has not placed sufficient focus on developing and maintaining an effective long-range strategy for reducing CRE:
  - Long-range ALARA plan initiatives are not sufficient for meeting the 2015 industry CRE goal. (*If all initiatives were implemented as scheduled, EOY 2015 CRE would be 130 person-rem*)
  - Several ALARA plan initiative due dates and funding not updated to reflect actual implementation readiness
  - Fleet and site management not aligned to address high CRE challenges (lack of funding and dedication of engineering resources)



## Summary of Common GAPS in CRE AFI

- ❑ Long-Range CRE Reduction Plans:
  - Dose savings projections not realistic for some actions
  - Plans do not identify dose savings projections for each action
  - Actions are not approved by SLCs or sufficiently funded
  - Actions are not identified in online / outage work schedules
  - Sufficient resources (e.g. Engineering) are not assigned to support actions requiring modifications
- ❑ Removal of Cobalt Sources not aggressively pursued
  - OEM control rod blades (BWRs)
- ❑ Reactor cleanup / let down systems not maintained in-service for sufficient durations during plant shutdown periods
- ❑ RP management not participating in RFO schedule reviews

- ❑ FW Hydrogen Injection instability (BWRs)
  - Perturbations contribute to crud bursts
- ❑ Depleted Zinc Injection not optimized
- ❑ Noble Metals Chemical Addition has not been performed (BWRs):
  - Increased dose from N-16 (moderate H2 Injection plants)
  - Sustained elevated recirculation pipe dose rates
- ❑ RFO ALARA plans and work in-progress reviews do not identify sufficient actions to lower CRE and correct adverse CRE performance respectively
- ❑ Maintenance performance deficiencies resulting in rework:
  - valve maintenance, welding activities, refuel floor work



## Recommendations to Close Gaps

- ✓ Develop long-range dose reduction plans that illustrate a path for meeting 2015 CRE goals:
  - Tools for planning on INPO RP Member's Website:
    - Exelon Bingo chart:  
<http://www.inpo.org/rp/ExeloDoseReduction.pdf>
    - Crud Burst Control:  
<http://www.inpo.org/rp/HowTo/CrudBurstHowTo.pdf>
- ✓ Ensure long-range plan initiatives have owners, due dates, and are funded:
  - Fully supported by senior leadership
  - Periodically reviewed / discussed at SAC meetings



- ✓ Effective RP staff engagement in work management and scheduling meetings
  - Work schedule logistics support ALARA
  - Dose reduction initiatives incorporated into the schedules
- ✓ Job specific ALARA plans contain *actionable* initiatives to reduce dose
  - Actions thoroughly communicated to RP technicians, workers, and organizations responsible for implementation
- ✓ ALARA work in-progress reviews identify and correct problems
  - Included observations of field work (*not limited to dose analyses of RWP data*)
  - Performance gaps entered into CAP and resolved promptly

- ✓ Improve Supplemental Worker Performance (*Reduce Rework*):
  - ☐ Increase oversight of less experienced supplemental workers:
    - In training environments:
      - reinforce expectations / standards
    - In the plant:
      - assign experienced and knowledgeable workers to less experienced work crews
  - ☐ Develop work instructions that are sufficiently descriptive / easy to follow:
    - INPO AP-928, *Supplemental Personnel Process Description*

# **INPO**

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## **Questions & Comments**