

INPO

Institute of Nuclear Power Operations

INPO / WANO Collective Radiation Exposure Observations & Recommendations

2013 ISOE ALARA Symposium

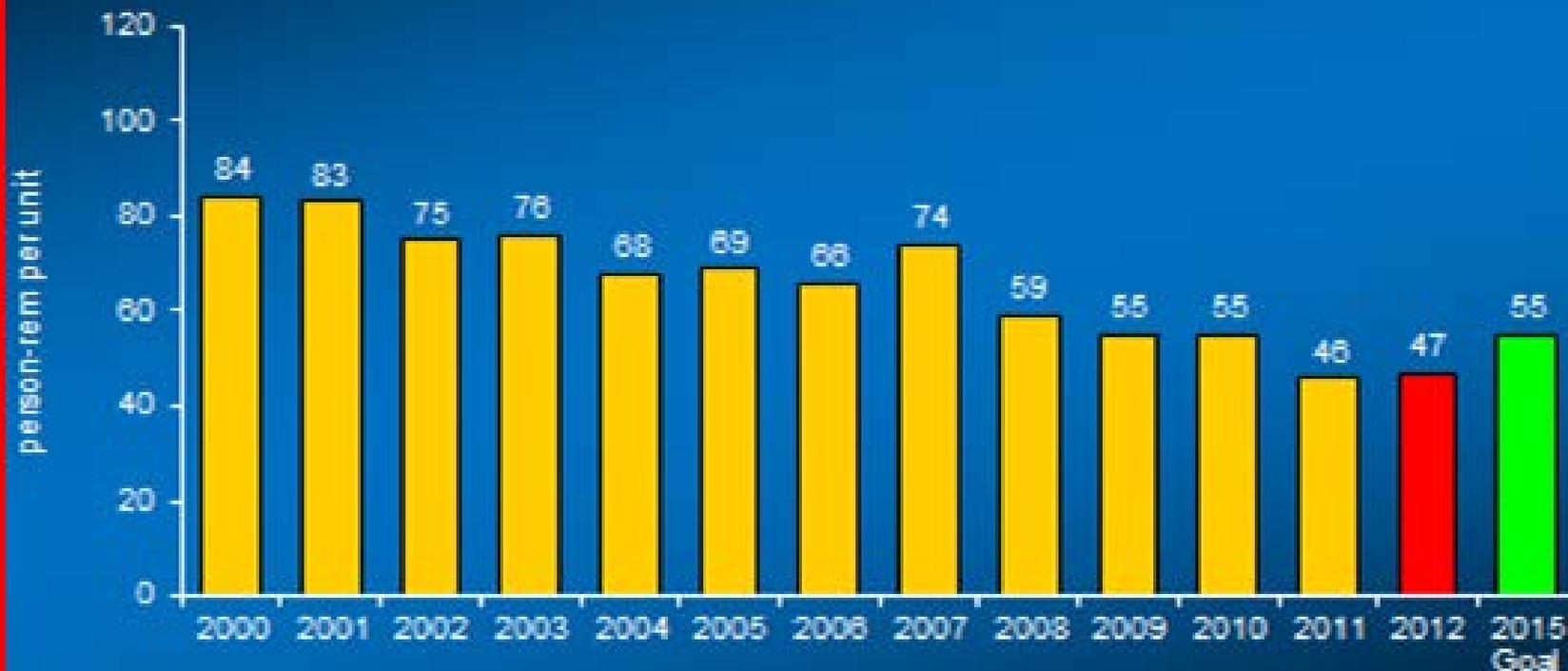
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Key Topics

- 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



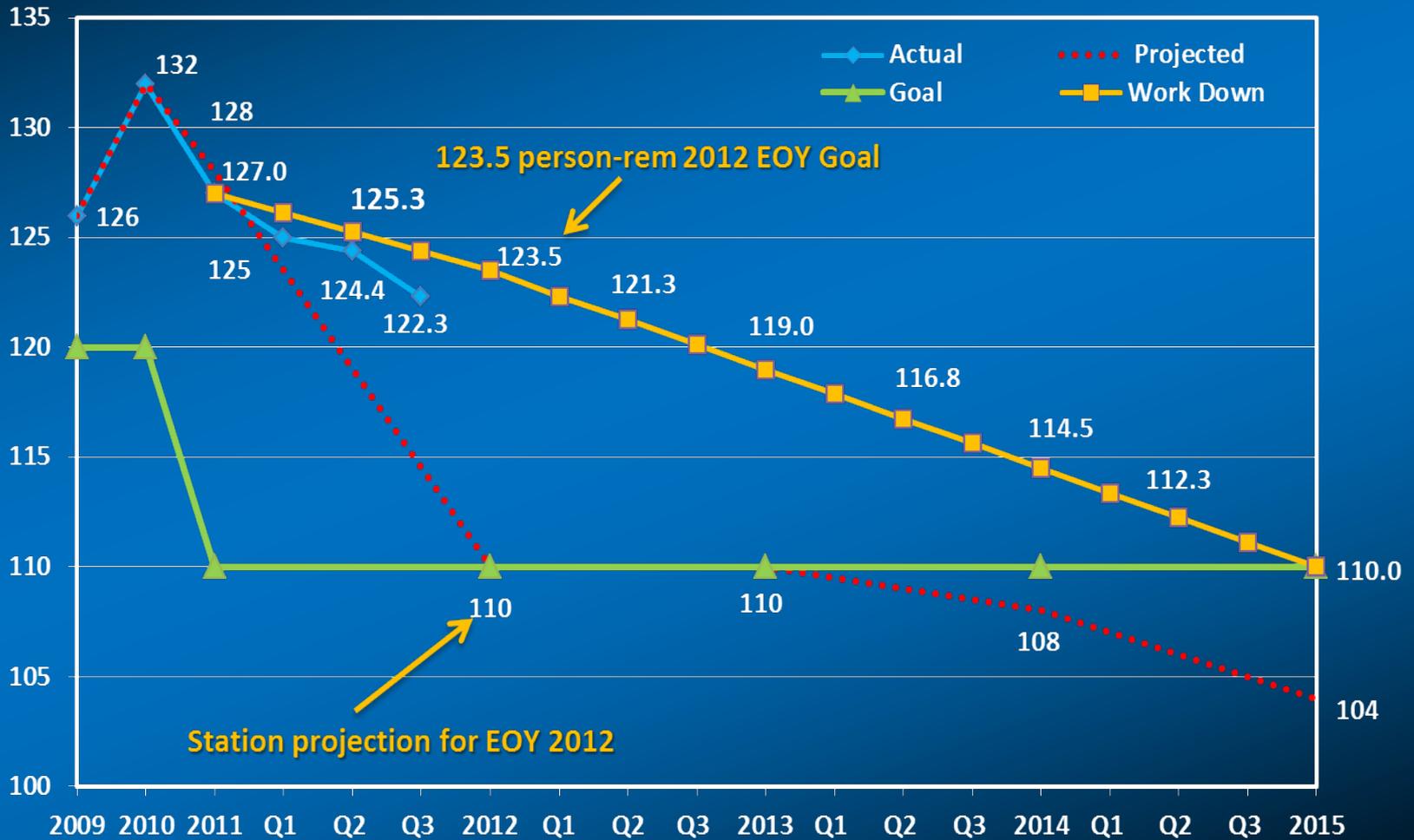
U.S. Collective Radiation Exposure (BWR)

Median Values

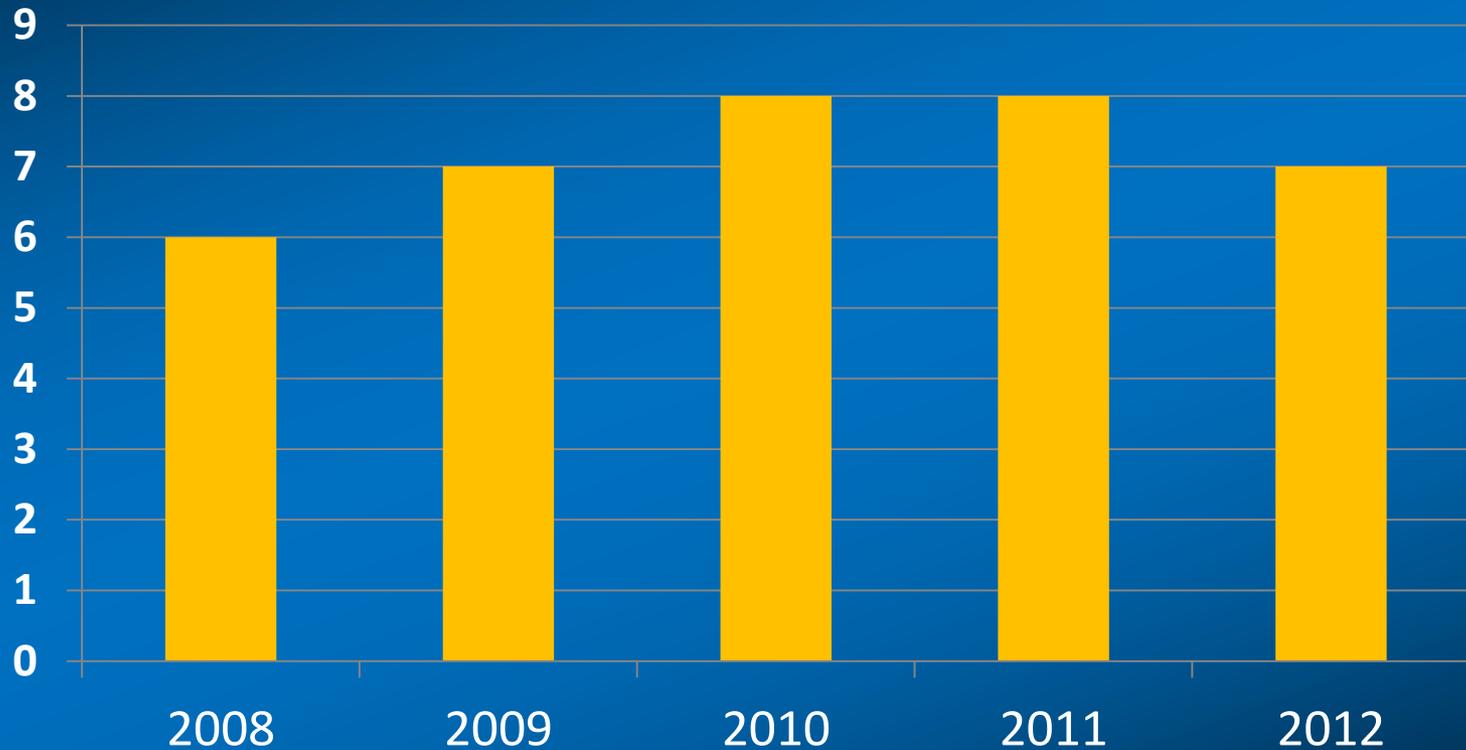
Third Quarter 2012



BWR CRE Progress 3rd 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 AFIs

- ❑ 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*

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Questions & Comments