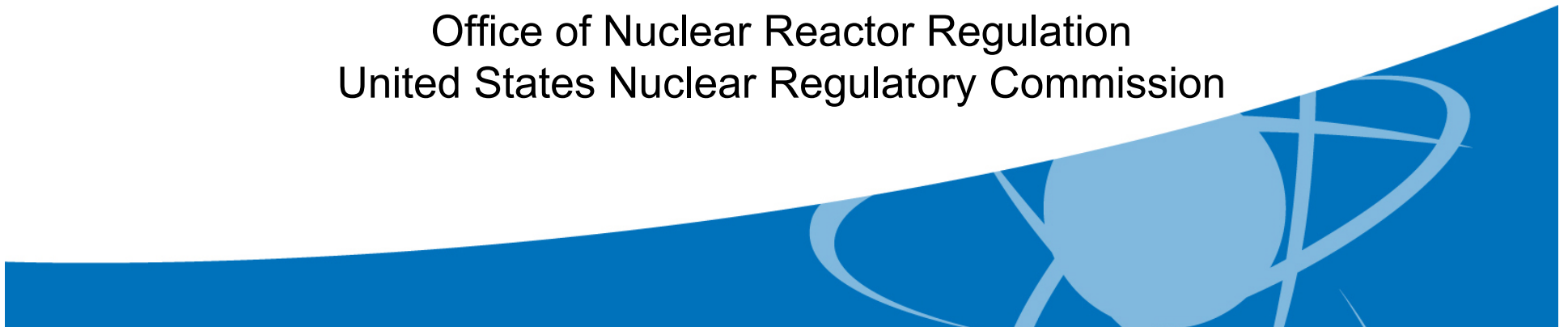


ALARA from a Regulatory Perspective

January 9, 2018

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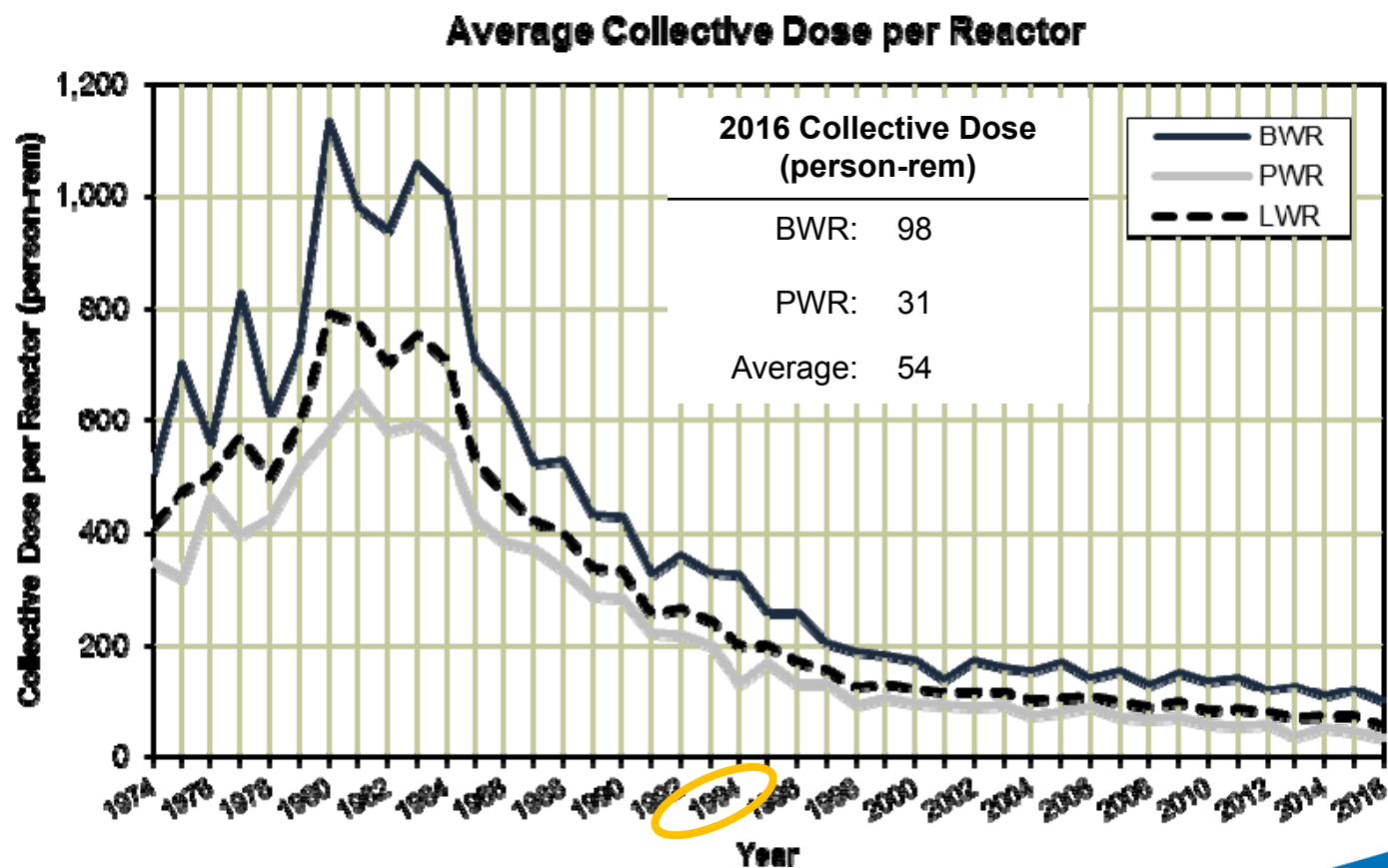


Regulatory Framework

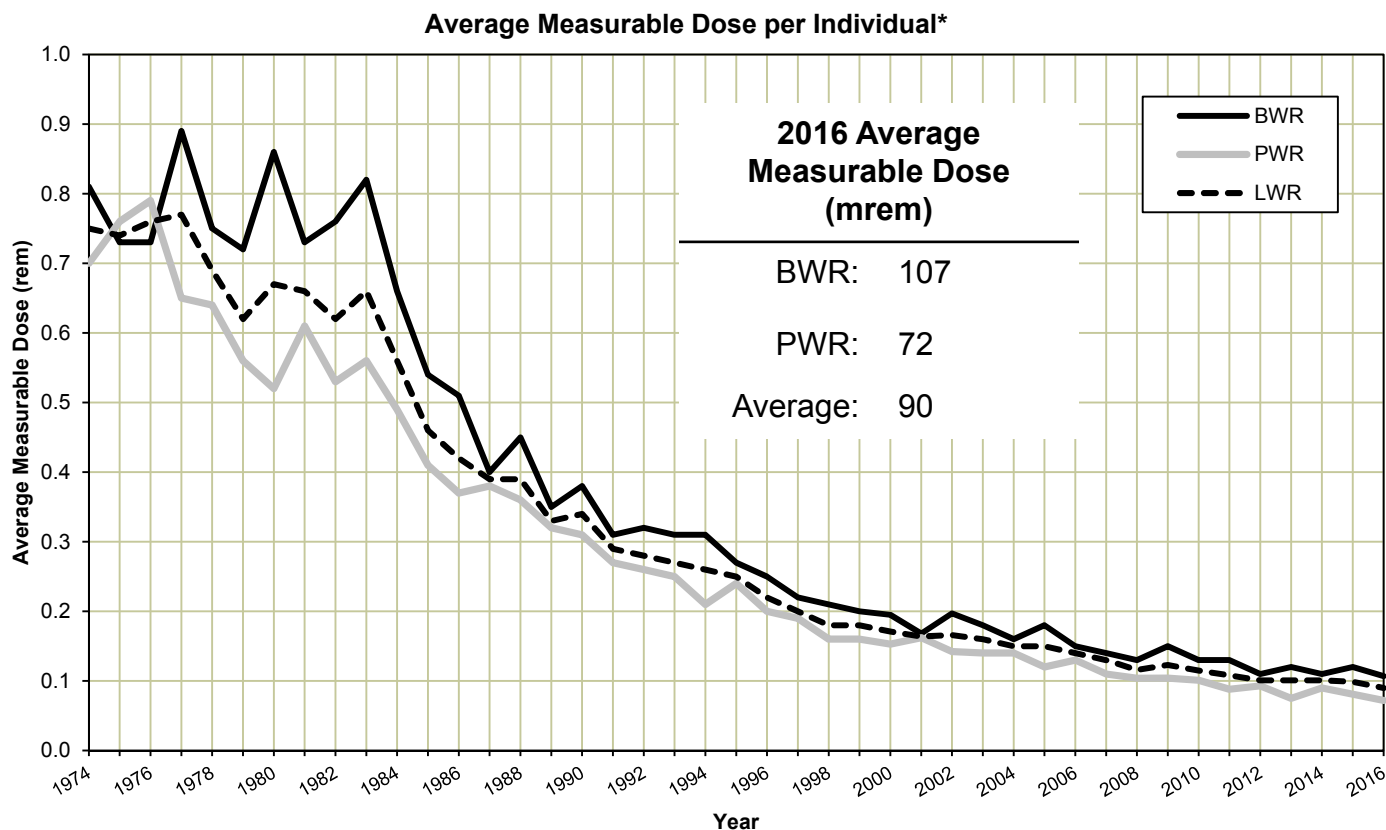


- *Licensees shall use, to the extent practical, procedures and engineering controls...* to achieve occupational doses that are ALARA (10 CFR 20.1101)
- For occupational ALARA programs...
 - Compliance is judged on whether the licensee has incorporated measures to track and if necessary to reduce exposures not whether exposures represent absolute minimum (56 FR 23360, May 21, 1991)
- NRC oversight is performance-based and risk-informed
 - What is “Reasonably Achievable”?
 - Collective dose is factored into evaluation of occupational ALARA programs under the Reactor Oversight Process (ROP)

U.S. Commercial LWR Collective Dose 1974 – 2016



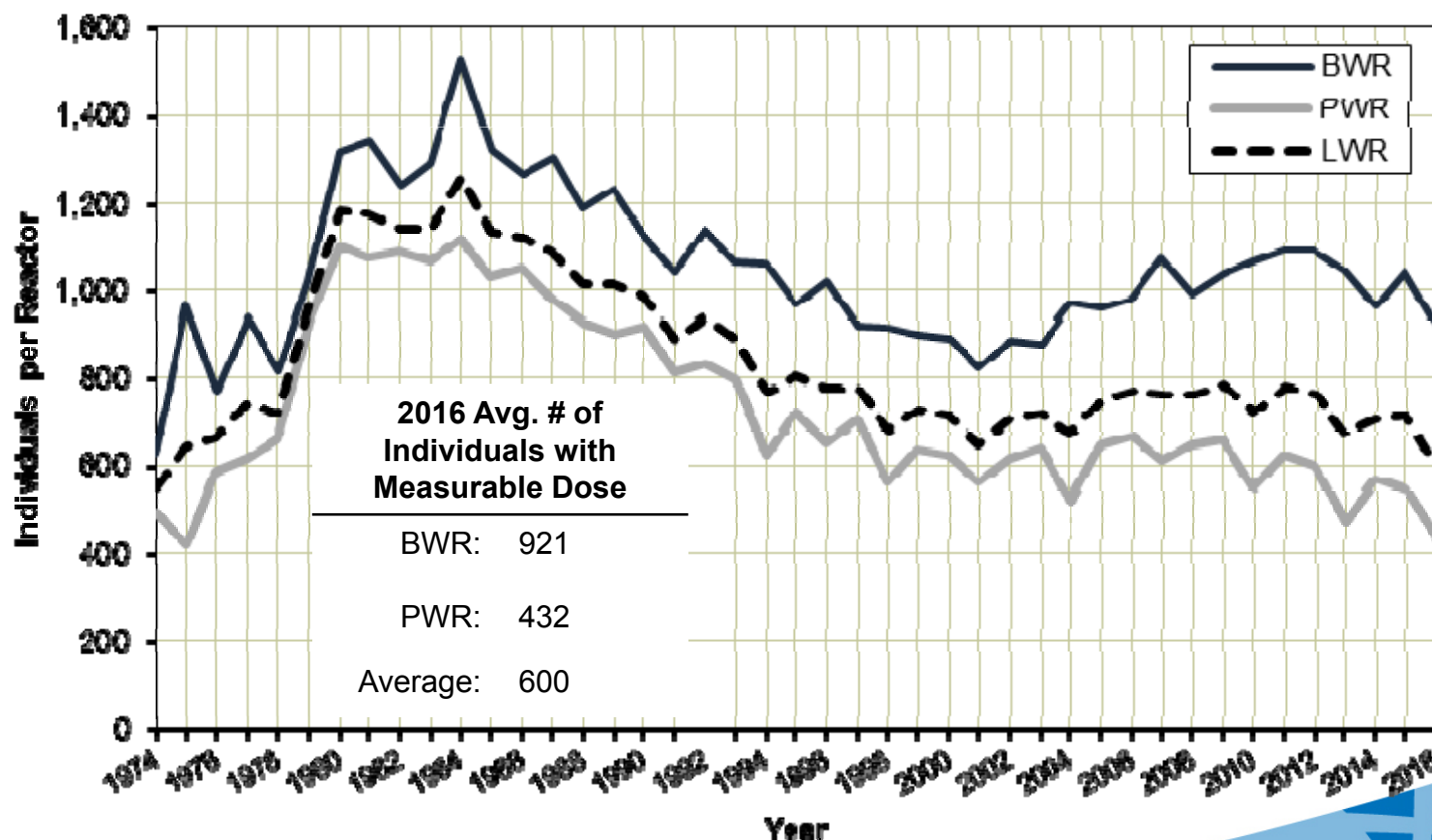
Average Measurable Dose per Worker 1974 – 2016



* Not adjusted for transient workers.

Average Number of Workers with Measurable Dose 1974 – 2016

Average Number of Individuals with Measurable Dose per Reactor



Oversight of Occupational ALARA



- ALARA Planning is an Inspectable Area under the ROP
- Inspection Procedure 71124.02 (revised Jan. 2018)
 - Radiological Work Planning
 - Verification of Dose Estimates
 - Implementation of ALARA Work Controls
 - Radiation Worker Performance
 - Problem Identification and Resolution
- Industrywide data is used to develop plant-specific, three year averages for collective dose and to develop dose quartiles
 - Guides planning of inspection efforts
 - Used in assessment of inspection finding significance

ALARA Inspections

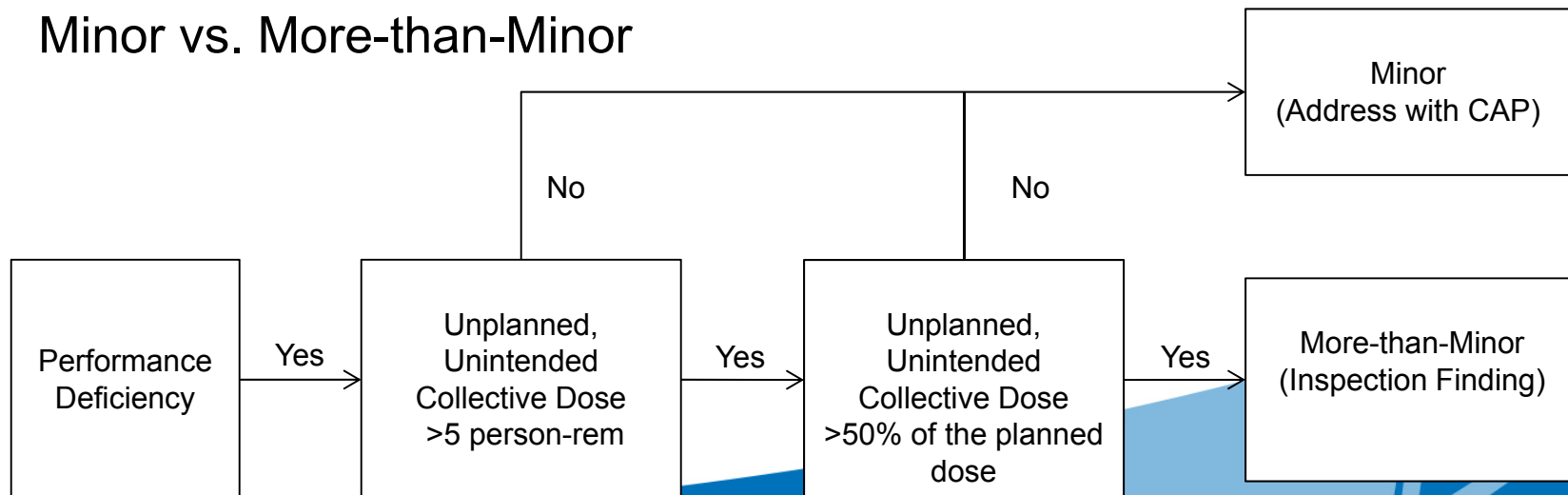


- Inspection effort generally determined by licensee quartile standing
 - Also consider scope of radiological work and trends
 - IP 71124.02 (revised Jan. 2018) biennial hours range from 32 to 60 (average 46)
 - Licensees in lowest dose [highest dose] quartile should get the minimum [maximum] inspection effort
 - Licensees in middle two quartiles should get 46 hours (adjusted for effectiveness of ALARA and source-term-reduction efforts)
- Plant-specific, three year average is used to assess significance of ALARA Findings

ALARA Issue Screening



- ALARA Findings: More-than-Minor, performance deficiencies that concern *unplanned, unintended occupational collective dose resulting from a deficiency in ALARA planning or work control* (IMC 0609 App C)
- Performance Deficiency: Failure to meet a requirement or self-imposed standard where the cause was reasonably within the licensee's ability to foresee and correct; and thus prevent (IMC 0612)
- Minor vs. More-than-Minor



ALARA Significance Determination Process



- If plant-specific, three year average is \leq threshold, significance of ALARA finding is assessed to be Green (IMC 0609)
 - Boiling Water Reactor: 240 person-rem
 - Pressurized Water Reactor: 135 person-rem
- If plant-specific, three year average is $>$ threshold, consider the magnitude of the issue and collective dose associated with recent issues
 - Magnitude of issue: Did actual dose exceed 25 person-rem?
 - No, then a Green finding
 - Yes, then a White finding
 - Consider recent issues: Were there more than 4 occurrences where actual dose $>$ 5 person-rem and $>$ 50% above dose estimate?
 - No, then a Green finding
 - Yes, then a White finding

Boiling Water Reactor Quartiles

BWR Quartiles	Plant	Three Year Collective TEDE per Reactor Year 2014-2016 (person-rem)
1 st Quartile	Top	50
	Bottom	72
2 nd Quartile	Top	78
	Bottom	110
3 rd Quartile	Top	110
	Bottom	133
4 th Quartile	Top	142
	Bottom	201 (IMC 0609 threshold is 240)
Average per Reactor-Year		110

Pressurized Water Reactor Quartiles

PWR Quartiles	Plant	Three Year Collective TEDE per Reactor Year 2014-2016 (person-rem)
1 st Quartile	Top	20
	Bottom	30
2 nd Quartile	Top	30
	Bottom	38
3 rd Quartile	Top	39
	Bottom	46
4 th Quartile	Top	47
	Bottom	241 (IMC 0609 threshold is 135)
Average per Reactor-Year		42

How to Give us Feedback



- Inspectors
- Conferences
- Reactor Oversight Process Monthly Public Meeting
- Write a Letter
 - Raise an Issue
 - Request a Meeting
- Public Comment Periods on Published Documents

Questions and Discussion

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Regulatory Panel