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NRC Update on ALARA Regulatory Activities

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Acronyms

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- HPT- Health Physics Technician
- Yr – year
- CAP – corrective action program
- PI – Performance Indicator
- PWR – pressurized water reactor
- BWR – boiling water reactor
- RCS – reactor coolant system
- SFP – spent fuel pool
- CRDM – control rod drive mechanism

Acronyms

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- Rx – Reactor
- NRC – Nuclear Regulatory Commission
- ALARA – As Low As Is Reasonably Achieveable
- REMP – Radiological Environmental Monitoring Program
- LLW – Low Level Waste
- RAM – Radioactive Material
- RWP – Radiation Work Permit

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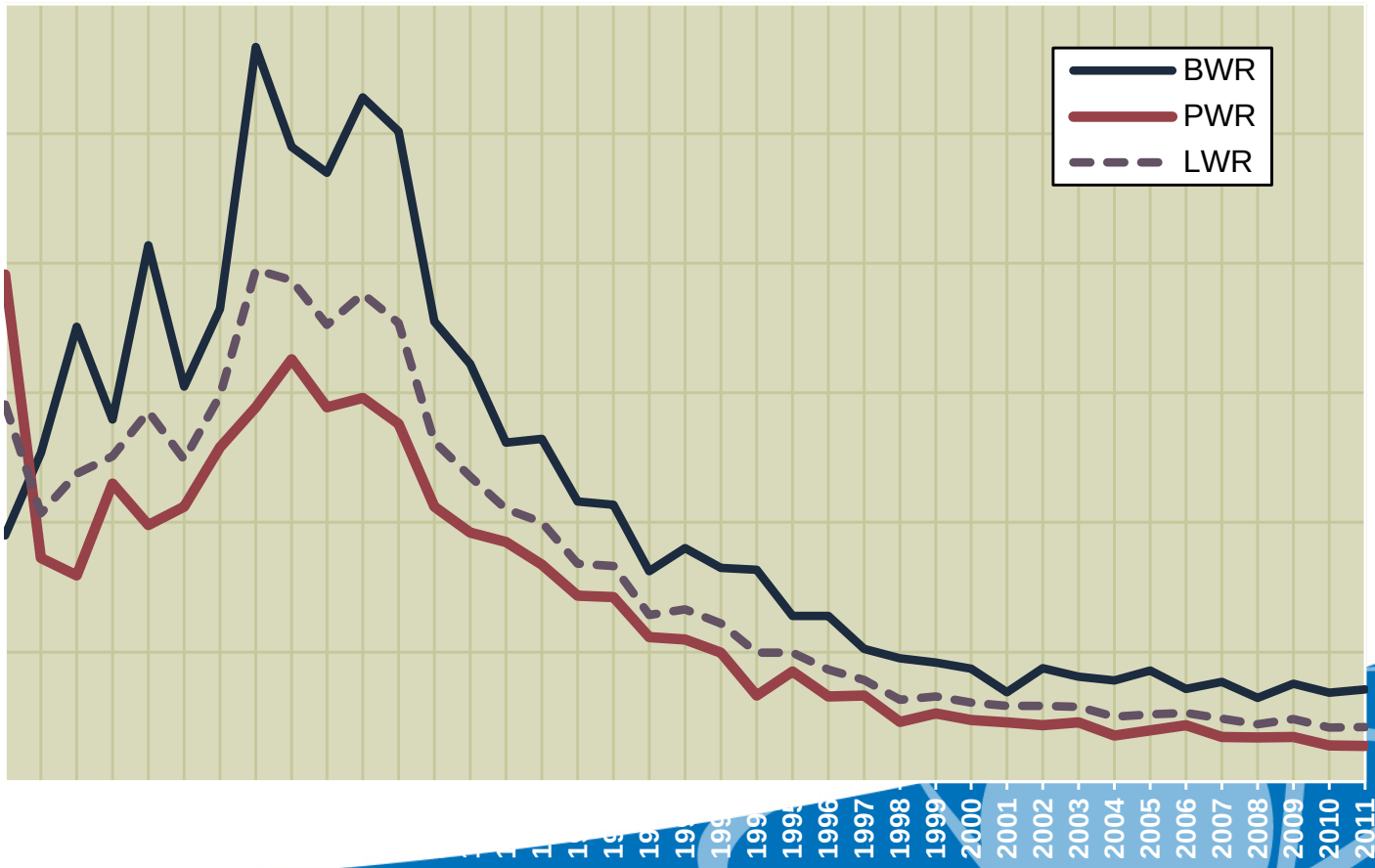
Collective Dose 1973 – 2011

(Preliminary NUREG-0713)



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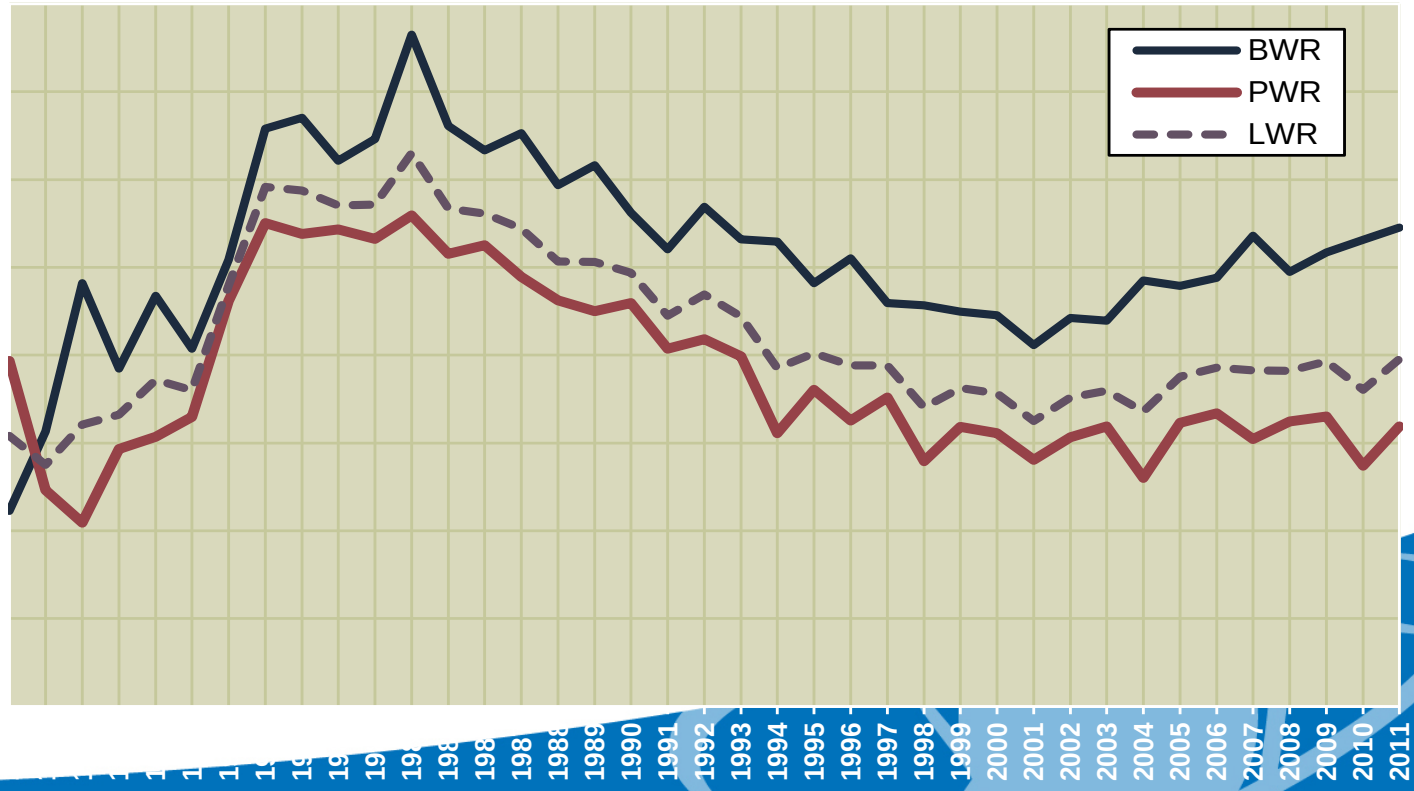
Average Number of Workers per Rx 1973 – 2011 *(Preliminary NUREG-0713)*



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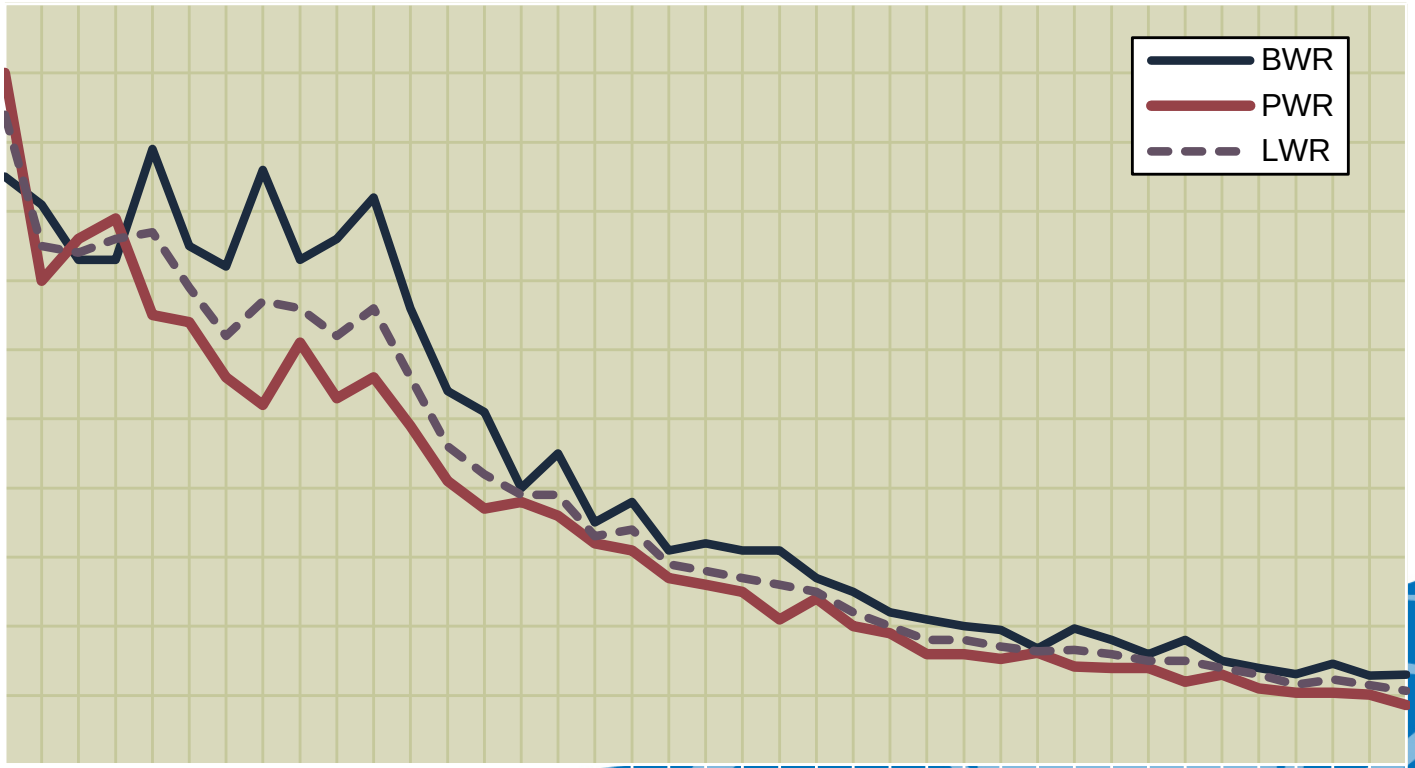
Average Measurable Dose / Worker 1973 – 2011 *(Preliminary NUREG-0713)*



*Not adjusted for transient workers.

In 2010, NRC revised the Radiation Safety Inspection Procedures 71124

- .01 Hazard Assessment and Exp. Control
- .02 ALARA Planning and Controls
- .03 Airborne Radioactivity Control
- .04 Occupational Dose Assessment
- .05 Radiation Monitoring Instrumentation
- .06 Effluents
- .07 REMP
- .08 LLW, Transportation & RAM Control

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Inspection Module .02 – ALARA

- Review ALARA work plans & RWPs
- Determine if work activities are reasonably grouped
- Review ALARA work plans and dose estimates
- Review dose reduction strategies

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ALARA Inspection Items

- Verify Dose Estimates
- Process for Adjusting Exposure Estimates
- Radiation Worker & HPT Performance
- Source Term Reduction and Control
- Use of Corrective Action Program

ALARA Inspection

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- Determine plant's quartile for 3 yr dose average
- Schedule inspection hours (biennial)
  - Top quartile – 44 inspection hours
  - Mid quartiles – 54 inspection hours
  - Lowest quartile – 64 inspection hours
- Adjust as appropriate based on the plant source term and overall ALARA effectiveness

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BWR Quartile Data

2009-2011

	Plant Name	Three Year Coll. TEDE per Reactor Year 2009-2011	Percent Change From 2008-2010	2008-2010 Quartile (if changed)
1st Quartile	GRAND GULF	80.058	-38% ▼	2
	FITZPATRICK	96.741	-34% ▼	3
	OYSTER CREEK	96.847	-36% ▼	3
	LIMERICK 1,2	97.826	1% ▲	-
	HATCH 1,2	101.464	-2% ▼	-
	SUSQUEHANNA 1,2	101.954	-4% ▼	-
2nd Quartile	FERMI 2	106.472	-3% ▼	-
	DRESDEN 2,3	113.657	6% ▲	1
	HOPE CREEK 1	118.316	-3% ▼	-
	DUANE ARNOLD	123.490	2% ▲	-
	BROWNS FERRY 1,2,3	133.516	-13% ▼	3
	QUAD CITIES 1,2	141.413	2% ▲	3

BWR Quartile Data 2009 - 2011

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3rd Quartile	NINE MILE POINT 1,2	142.895	-6% ▼	-
	VERMONT YANKEE	147.852	-8% ▼	4
	PEACH BOTTOM 2,3	153.284	24% ▲	2
	MONTICELLO	155.579	71% ▲	1
	RIVER BEND 1	157.005	-18% ▼	4
	CLINTON	165.470	5% ▲	4
4th Quartile	LASALLE 1,2	170.270	14% ▲	3
	PILGRIM	177.119	70% ▲	1
	BRUNSWICK 1,2	189.805	2% ▲	-
	COOPER STATION	221.527	-2% ▼	-
	COLUMBIA GENERATING	231.844	68% ▲	2
	PERRY	318.337	37% ▲	-

< *Average 143.49*

PWR Quartiles 2009 to 2011

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	Plant Name	Three-Year Coll. TEDE per Reactor Year 2009-2011	Percent Change From 2008-2010	2008-2010 Quartile (if changed)
1st Quartile	PRAIRIE ISLAND 1,2	27.759	-29% ▼	-
	SUMMER 1	29.920	-16% ▼	-
	COOK 1,2	30.075	-10% ▼	-
	PALO VERDE 1,2,3	30.210	-27% ▼	-
	ROBINSON 2	32.063	-40% ▼	2
	FARLEY 1,2	33.446	-2% ▼	-
	WATTS BAR 1	40.353	-14% ▼	-
	INDIAN POINT 3	42.289	69% ▲	-
	HARRIS	42.901	-4% ▼	-
	BRAIDWOOD 1,2	46.015	-11% ▼	2
	COMANCHE PEAK 1,2	46.157	-5% ▼	-
2nd Quartile	KEWAUNEE	46.767	-9% ▼	-
	MCGUIRE 1,2	46.789	-14% ▼	-
	CALLAWAY 1	47.924	32% ▲	1
	VOGTLE 1,2	47.966	-6% ▼	-
	GINNA	48.563	-1% ▼	-
	SOUTH TEXAS 1,2	49.687	-14% ▼	3
	SALEM 1,2	50.955	-40% ▼	4
	SEABROOK	52.484	-6% ▼	3
	TURKEY POINT 3,4	52.549	-10% ▼	3
	CATAWBA 1,2	53.123	-9% ▼	3

PWR Quartiles 2009 to 2011

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3rd Quartile	ARKANSAS 1,2	53.165	-20% ▼	-
	CALVERT CLIFFS 1,2	53.262	7% ▲	2
	SEQUOYAH 1,2	55.525	8% ▲	2
	BEAVER VALLEY 1,2	57.784	-3% ▼	-
	POINT BEACH 1,2	58.108	5% ▲	2
	NORTH ANNA 1,2	58.530	9% ▲	2
	OCONEE 1,2,3	61.802	-1% ▼	-
	BYRON 1,2	63.995	37% ▲	1
	FORT CALHOUN	66.636	-8% ▼	-
	SAN ONOFRE 2,3	67.865	-19% ▼	4
4th Quartile	MILLSTONE 2,3	68.368	-20% ▼	-
	SURRY 1,2	69.758	-8% ▼	-
	INDIAN POINT 2	71.392	-38% ▼	-
	WOLF CREEK 1	72.704	22% ▲	3
	DIABLO CANYON 1,2	82.486	-29% ▼	-
	CRYSTAL RIVER 3	87.519	-3% ▼	-
	ST. LUCIE 1,2	104.241	41% ▲	3
	WATERFORD 3	120.018	-9% ▼	-
	THREE MILE ISLAND 1	136.850	45% ▲	-
	PALISADES	169.607	0%	-
	DAVIS-BESSE	180.359	-6% ▼	-
	Average per Reactor-Year	**59.704**	**-7%** ▼	

< *Average 59.704*

Philosophy of Screening Performance Deficiencies

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- Radiation Protection is a series of radiological barriers and protective measures

- Barriers include worker training, procedures, ALARA programs, surveys, worker briefings, postings, monitoring

General Screening Criteria

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- A performance deficiency in one barrier by itself is a minor reduction in overall adequacy of protection
  - More than one barrier, or a loss of a significant barrier, is generally “More-Than-Minor”
  - Screening depends on circumstances, and the NRC inspector’s evaluation of its significance

ALARA Violations

- Violations and “regulatory” compliance are based on whether licensees have adequate procedures to track and reduce collective dose
- Regulatory compliance is not based on whether individual doses are the absolute minimum, or use of all possible ALARA methods

Individual exposures

- An unintended exposure of one individual is evaluated under the performance indicator program (not under the ALARA program)

- Example: A worker gets “unintended exposure” (e.g., alarming dosimeter alarm)
    - More than 100 mrem unintended dose is PI occurrence
    - Otherwise, NRC expects licensees to use CAP program and fix problem

ALARA - Collective Dose

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- Performance Deficiency screening:
  - Minor if: ≤ 5 rem collective dose, or
  - Minor if: ≥ 5 rem, but ≤ 50% above the planned, intended collective dose
  - At least Green Finding if: ≥ 5 rem dose AND ≥ 50% greater than planned, intended collective dose

Example: Inadequate job execution

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- Performance deficiency in shielding installation
  - Shielding package not installed, original dose estimate exceeded
  - If the actual dose > 5 rem, but was less than 50% of revised, justifiable dose estimate, then it's a "minor" performance deficiency, use CAP
  - If the actual dose > 5 rem, AND ≥ 50% greater than planned, intended collective dose, then it's at least a Green Finding

White Findings

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- Does 3 yr rolling average exceed industry averages?
  - PWRs – 135 rem
  - BWRs – 240 rem
  - If not exceeded, then Green Finding
- If PWR > 135 rem or BWR > 240 rem
  - Did actual dose exceed 25 rem?
    - No, then a Green finding
    - Yes, then a White finding
  - Were there more than 4 occurrences where actual dose > 5 rem and > 50% above dose estimate?
    - No, then a Green finding
    - Yes, then a White finding

Licensee-identified vs. self-revealing or NRC identified

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- If the performance deficiency is licensee-identified and entered into CAP program, then the “Finding” is not issued
- If the performance deficiency was either:
  - 1) self revealing or
  - 2) NRC identified,
    then the “Finding” is issued

Last 12 month ALARA Findings

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- #1 Inadequate work planning
- #2 RCS clean-up
- #3 Inadequate work planning
- #4 Inadequate work planning
- #5 Poor job execution
- #6 Inadequate work planning

#1 – Inadequate work planning

ML12038A231

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- BWR Recirc pump replacement
  - Estimated 15.8 rem, took 39.2 rem
  - Inadequately evaluated interferences & unidentified scaffold needs
  - Insufficient outage schedule coordination
  - Green finding

#2 - Inadequate RCS Clean-up

ML12039A087

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- Letdown flow-rate decreased during crud burst with no action to restore flow-rate for 20 hours
- Caused crud deposition in steam generators & increased dose rates
- Collective dose > 5 rem and > 50% of estimated dose
- Green finding

#3 – Inadequate work planning

ML12216A055

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- Refuel floor work
  - RWP combined dose estimate 25 rem, took 45 rem
  - Rx Head work, estimated at 14 rem, took 24 rem.
  - Higher doses rates, longer work durations
  - Expanded work scope took 9 of the 10 rem, but the increases were not fully understood nor justified
  - Dose revision packages and ALARA committee minutes did not show compensatory measures nor justifiable dose increases
  - Green finding

#4 - Inadequate work planning

First example – BWR : ML12304A062

- Condensate System repairs
  - Vendor job - Estimated 41K hours and took 163K hours
  - Dose estimate was 10.5 rem and took 22.6 rem
  - Vendor and workers were “new-to-nuclear”
  - Licensee failed to provide contractor oversight
  - Green finding

#4 - Inadequate work planning

Second example – BWR ML12304A06

- Wet-work (In-vessel, SFP, and equipment pool)
  - Dose estimate was 3.5 rem and took 11.7 rem
  - Some justified increase in work scope
  - Inadequate planning, the job was based on previous Outage work scope & rad conditions
  - Green finding

#5 - Inadequate work planning and poor job execution ML120440682

- Rx Head disassembly – 4 stuck CRDMs
  - Estimated dose 8.4 rem and took 14 rem
  - Dose rates and hours were higher than planned
  - Failed to stop work and perform in-process reviews per ALARA procedure
  - Exceeded 5 rem and 50%
  - Green finding

#6 - Inadequate work planning

ML12314A296

- Valve work - dose estimated at 2.1 rem and took 7.6 rem
- Work activities were not planned efficiently; e.g., nonsafety-related gaskets were used, inadequate walk-downs
- Inadequate communication between maintenance and RP, i.e., ALARA planners were unaware of the full work scope
- An increase in work scope is a legitimate reason for revising a dose estimate. However, the licensee did not plan the additional work. Instead, licensee only raised the dose estimate as the dose accrued
- Green finding

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Questions and Discussion

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