RPAC 2025W Presentation
Occupational and
Public Radiation Safety

Industry ALARA Meeting

Occupational and Public Radiation Safety

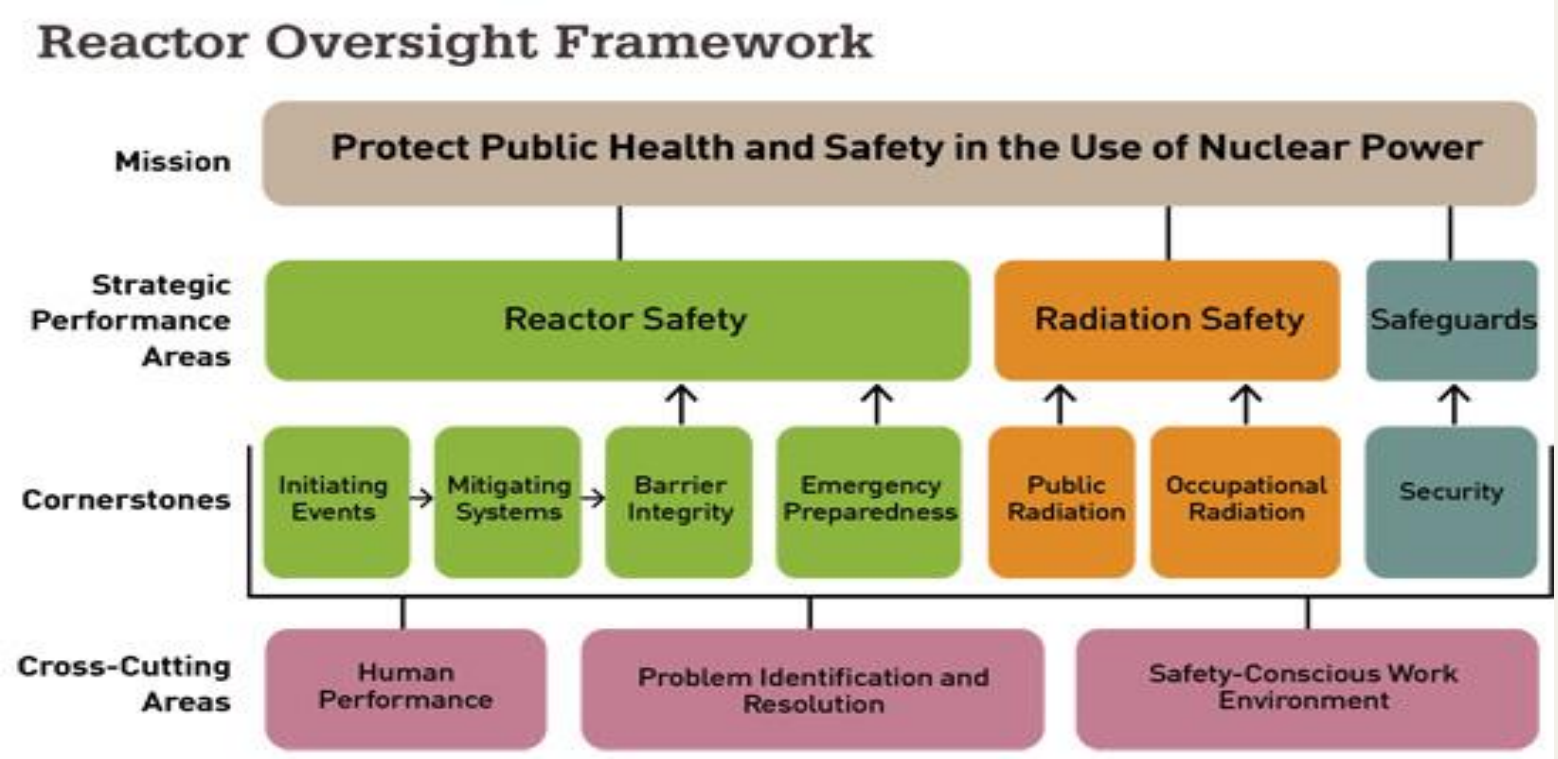
January 28-30, 2025

Occupational and Public Radiation Safety

At the Dock

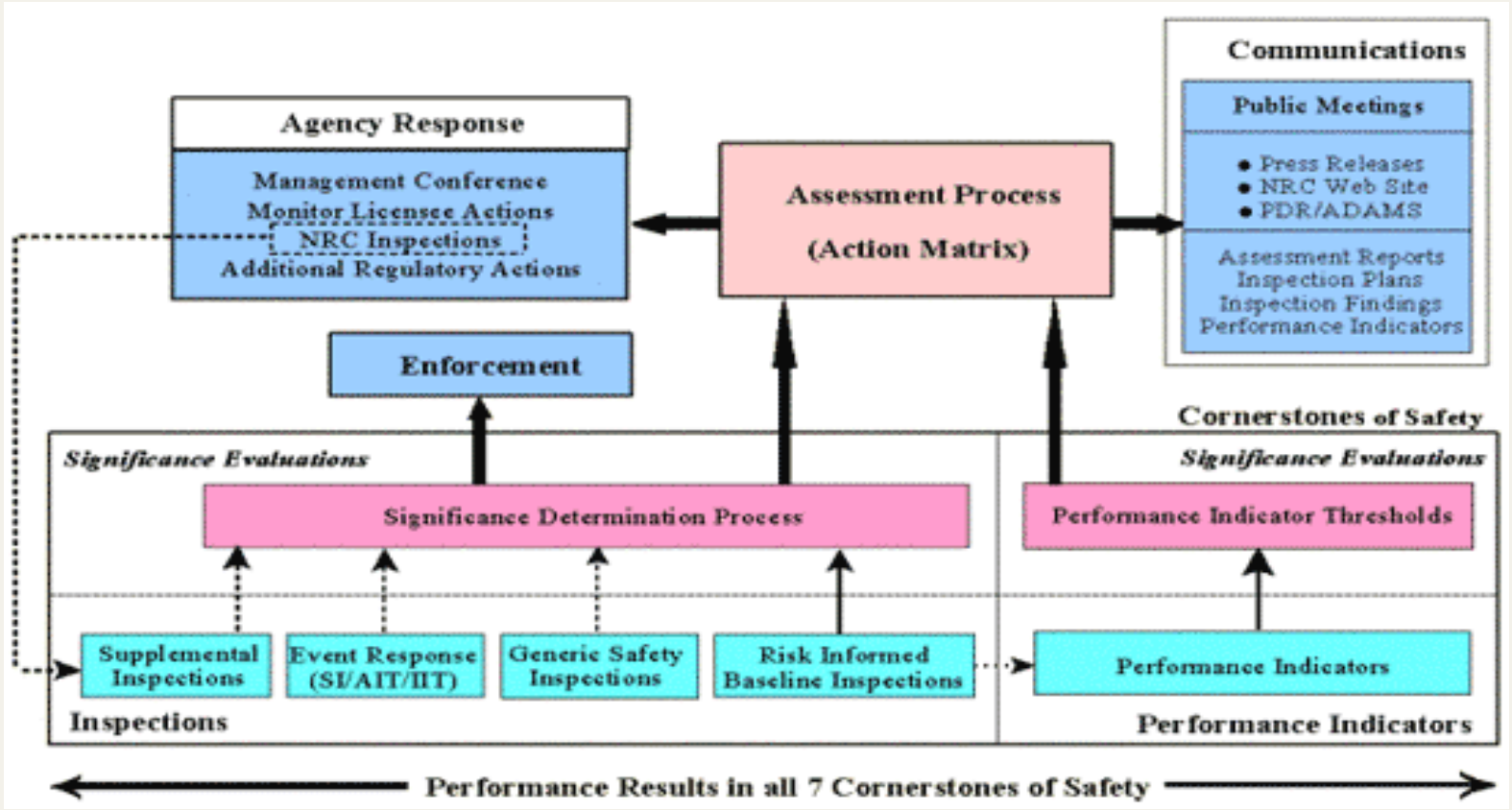
At Sea

Reactor Oversight Process



TWO of the Seven Cornerstones are Radiation Safety
Plus Part 37 (Security) and Radiation Monitors (EP)

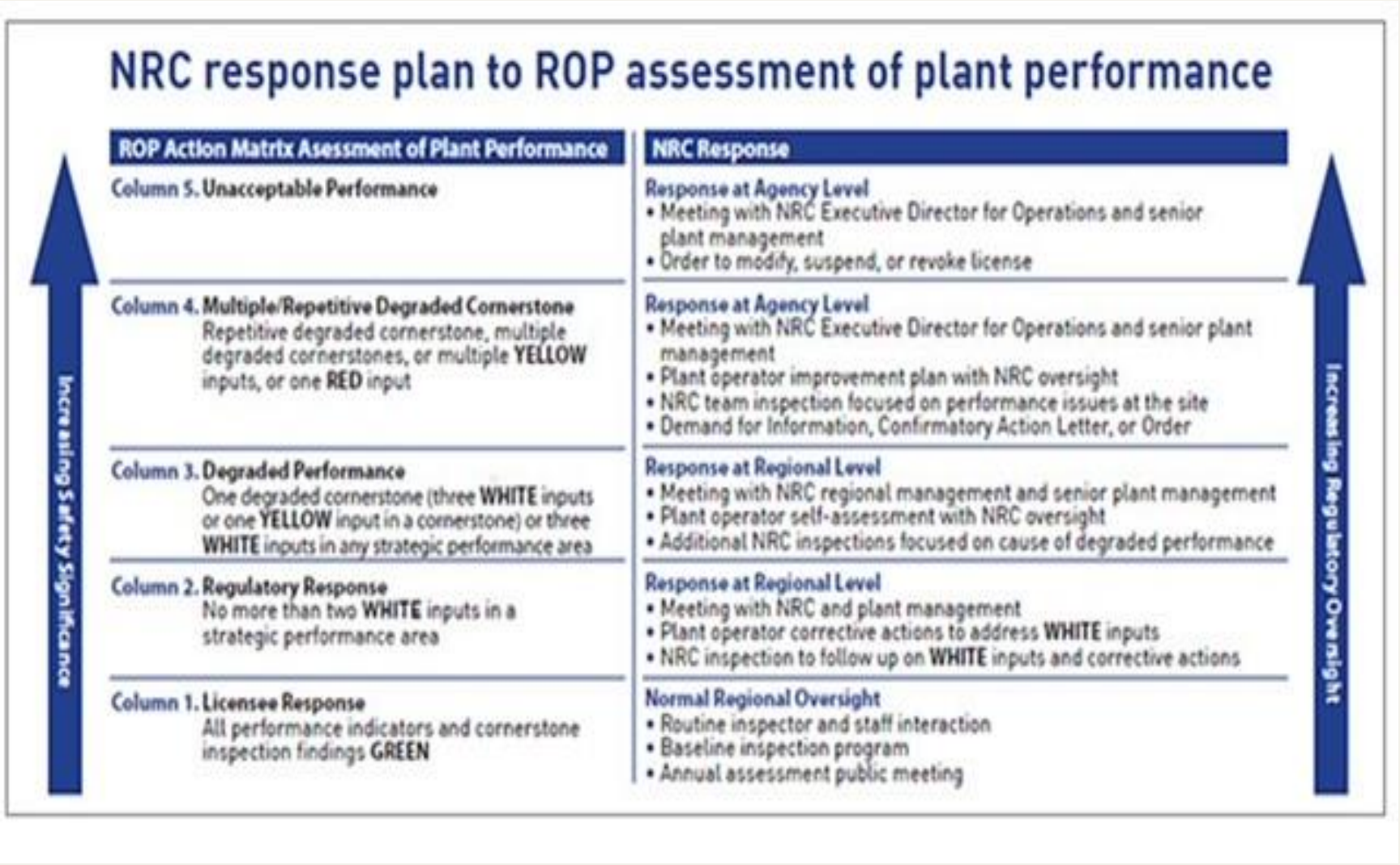
ROP Performance Assessment



Significance Determination Process

How the NRC categorizes inspection FINDINGS allows the NRC to Assess and Communicate Risk to all stakeholders.

ROP Performance Assessment



ROP Action Matrix by Column

Action Matrix by Column

Licensee Response (Baseline Inspection)	Regulatory Response (Response at Regional Level)	Degraded Performance (Response at Regional Level)	Multiple/Repetitive Degraded Cornerstone Column (Response at Agency Level)	Unacceptable Performance (Response at Agency Level)
Arkansas Nuclear 1	Catawba 2			
Arkansas Nuclear 2	Columbia Generating Station			

Perry Station – Column 3 on ORS Performance Indicators	RAM Shipping – Column 2
Columbia Airborne and Dose Assessment – Column 2	
Radiation Monitors – Column 2	Palisades EDEX Dose Monitoring – Column 2
Radiation Monitors – Column 2	

IMC 0612 App B 'Issue Screening Directions'

Guidance within the ROP to Trigger Traditional Enforcement

- Traditional Enforcement is applied to violations associated with
  - **(a) Willfulness,**
  - **(b) Impacted the Regulatory Process,**
  - **(c) Actual Safety Consequences, or**
  - **(d) A Violation w/o a Performance Deficiency, or Enforcement Discretion applies.**
- The term "willfulness" as used in this policy embraces a spectrum of violations ranging from deliberate intent to violate or falsify to and including careless disregard for requirements. Willfulness does not include acts which do not rise to the level of careless disregard.

TE Outside of the ROP

10 CFR 50.5 Deliberate Misconduct

(a) Any licensee, applicant for a license, employee of a licensee or applicant; … may not: (1) Engage in deliberate misconduct that causes or would have caused, if not detected, a licensee or applicant to be in violation of any rule, regulation, or order; or any term, condition, or limitation of any license issued by the Commission; or …

(b) A person who violates paragraph … may be subject to enforcement action in accordance with the procedures in 10 CFR part 2, subpart B.

10 CFR 50.7 Employee Protection (a) Discrimination by a Commission licensee, an applicant for a Commission license, or a contractor or subcontractor of a Commission licensee or applicant against an employee for engaging in certain protected activities is prohibited …

10 CFR 50.9 Completeness and Accuracy of Information (a) Information provided to the Commission by an applicant for a license or by a licensee or information required by statute or by the Commission's regulations, orders, or license conditions to be maintained by the applicant or the licensee shall be complete and accurate in all material respects …

Observed Gaps in RP Program Management

Licensed Bases and Regulatory Responsibilities

The License and Technical Specifications

- Organizational Independence
- Reg. Guide 1.8 " Qualification and Training of Personnel for Nuclear Power Plants" specific to the RPM Position
- HPPOS (Health Physics Position Papers)

NRC: Package ML101940006 -Power Reactor Operating Licenses and Technical Specifications.

Requirements of Reg. Guide 1.8 are applicable no matter what ANSI Standard commitments. (ANSI/ANS 3.1 1978 to 2014)

NPP Licenses (TS 5.2.1/TS 6.2.1)

Technical Specification 6.2.1 Onsite and Offsite Organizations

b. The *plant manager* shall be responsible for overall unit safe operation and shall have control over those onsite activities necessary for safe operation and maintenance of the plant.

d. The individuals who train the operating staff and *those who carry out health physics* and quality assurance functions may report to the appropriate onsite manager; however, they *shall have sufficient organizational freedom to ensure their independence from operating pressures.*

NRC NPP Licenses (TS 5.3.1/TS6.3.1)

- Technical Specification 6.3 Facility Staff Qualifications

  6.3.1 Each member of the facility staff shall meet or exceed the minimum qualifications of ***ANSI 18.1-1971 (ANSI 3.1)*** for comparable positions, *except for the individual designated as the* ***Radiation Protection Manager*** ***who shall meet or exceed the qualifications of Regulatory Guide 1.8, September 1975,***

Regulatory Guide 1.8, Personnel, Selection and Training, Sept. 1975

ML13038A100 Reg Guide 1.8 and RPM Quals 1975.pdf

- The Radiation Protection Manager should be an ***experienced professional in applied radiation protection at nuclear facilities*** dealing with radiation protection problems and programs similar to those at nuclear power stations.
- The RPM should be familiar with the ***design features*** **and** ***operations*** of nuclear power stations that affect the potential for exposures of personal to radiation.
- The RPM should have the technical competence to ***establish Radiation Protection programs*** and the supervisory capability to direct the work of professionals, technicians, … to implement the radiation protection programs.

Regulatory Guide 1.8, Personnel, Selection and Training, Sept. 1975

- The RPM should have a bachelor's degree or the equivalent in a science or engineering subject, including some formal training in radiation protection.
- The RPM should have at least five years-of *professional experience* in applied radiation protection.
- At least three years of this professional experience should be in applied radiation protection work in a nuclear facility dealing with radiological problems to those encountered in nuclear power stations, preferably in an actual nuclear power station.

Regulatory Guide 8.27

Regulatory Guide 8.27 “Radiation Protection Training for Personnel at Light-Water Cooled Nuclear Power Plants” (1981)

Section 4. Radiation Protection Staff

- Their knowledge should be of sufficient depth to qualify them to provide technical support to the training staff in the development and conduct of the radiation protection training.
- Further, they must be prepared to *develop, modify, and implement* the radiation protection program competently.

ML003739628 Reg Guide 8.27 RADIATION PROTECTION TRAINING FOR PERSONNEL AT LIGHT-WATER-COOLED NUCLEAR POWER PLANTS.pdf

Health Physics Position Papers

- HPPOS-018 A licensee proposed to allow a one-for-one substitution of an incumbent technician's experience for the Regulatory Guide's stated "... *at least 5 years of professional experience ....“*
  - Technician experience is not equivalent to professional experience.
- HPPOS-020 The requirement of a bachelor's degree is not considered to be germane to the specific functions of the Radiation Protection Manager (RPM).
  - The attributes of a good RPM are considered to be gained almost exclusively by specialized on-the-job, practical and supervisory experience rather than through the broad generalized academic training received by a person with a bachelor's degree.

Notice of Violation VIO 05000440/2015010-01

- Technical Specification (TS) 5.3.1 states: "Each member of the Unit staff shall meet or exceed the minimum qualifications of ANSI N 18.1-1 971 … except for the Radiation Protection Manager (RPM), who shall meet or exceed the qualifications of Regulatory Guide (RG) 1.8, September 1975 …
- RG 1.8, September 1975 requires at least 5 years of professional experience in applied radiation protection with at least 3 years of this professional experience in applied radiation protection work in a nuclear facility dealing with radiological problems similar to those encountered in nuclear power stations, preferably in an actual nuclear power station.
- Contrary to the above, since April 28, 2015, an individual was designated and performed the duties of the RPM failed to meet the professional experience as required by the TS 5.3.1 as specified in RG 1.8.
- This (Cited) violation is associated with a (Green) Significant Determination Process Finding.

Regulatory Guide 8.27

Regulatory Guide 8.27 “Radiation Protection Training for Personnel at Light-Water Cooled Nuclear Power Plants” (1981)

Section 4. Radiation Protection Staff

- Professional members of the staff will normally bring to the job the knowledge specified in Regulatory Guide 1.8, "Personnel Selection and Training.“ Many members of the radiation protection staff will have essentially unlimited access to all areas of the nuclear power plant *(i.e., freedom to go anywhere in the plant without escort or special instruction (e.g., without a radiation work permit)* ***and, therefore, responsible for their own radiological safety).***

10 CFR 1601
Control of access to high radiation areas

The licensee shall ensure that each entrance or access point to a high radiation area has one or more of the following features …

- *(a)(3) Entryways that are locked*, except during periods when access to the areas is required, with positive control over each individual entry.
- (c***) A licensee may apply to the Commission for approval of alternative methods for controlling access to high radiation areas.***
- (d) The licensee shall establish the controls required by paragraphs (a) and (c) of this section in a way that ***does not prevent individuals from leaving a high radiation area.***

Technical Specifications - High Radiation Area

- 6.12.1.b. Access to, and activities in, each such area shall be controlled by means of a *Radiation Work Permit (RWP) or equivalent* that includes specification of radiation dose rates in the immediate work area(s) and other appropriate radiation protection equipment and measures.

Technical Specifications - High Radiation Area

Regulatory Guide 8.10, “Operating Philosophy for Maintaining Occupational Radiation Exposures as Low as Is Reasonably Achievable” Revision 2

- Definitions - Radiation Work Permit (RWP): An *authorization by the licensee’s management* to perform a specific procedure involving radiation exposure of personnel in a particular area. *It contains detailed procedures for every aspect of the work to be done.*

Technical Specification 6.12.1.c
High Radiation Area

c. *Individuals qualified in radiation protection procedures* and personnel continuously escorted by such individuals *may be exempted from the requirement for an RWP or equivalent* while performing their assigned duties provided that they are otherwise following plant radiation protection procedures for entry to, exit from, and work in such areas.

- Atomic Energy Commission (AEC) - 1946-1975
  - Health Physic Society – 1955
  - National Registry of Radiation Protection Technologist – 1976
  - American Academy of Health Physics – 1982

NOTE THE DATES TO UNDERSTAND THE WORDING…..

Technical Specification 6.12.1.e

- *Except for individuals qualified in radiation protection procedures*, or personnel continuously escorted by such individuals, entry into such areas *shall be made only after dose rates in the area have been determined and entry personnel are knowledgeable of them*. These continuously escorted personnel will receive a pre-job briefing prior to entry into such areas. This dose rate determination, knowledge, and pre-job briefing does not require documentation prior to initial entry.

By the License

Summary

- … the radiation protection staff enter unknown conditions, within certain protective parameters, (Reg Guide 8.38 OPEX) to assess the radiological hazards.
- Then … the RP staff established the radiological controls (via the RWP as defined in Regulatory Guide 8.10 Operating Philosophy for Maintaining Occupational Radiation Exposures as Low as Is Reasonably Achievable) for workers to perform their tasks.

Technical Specifications

- This means that fully qualified ***ANSI RP Technicians are responsible for their own radiation safety,*** and by definition, enter unknown radiological conditions to establish the controls for other workers, prior to entry.
- Other personnel are either continuously escorted by an ANSI RP Technician or ***enter only after dose rates in the area have been determined; and they are knowledgeable of the radiological hazards, prior to the entry***.
- "***At Power" entries are particularly vulnerable to regulatory compliance***, given industry OPEX on radiation streaming from penetrations and the removal of rosewood shielding in the BWRs; neutron exposures, and industrial safety considerations, for the potential for safety relief valve lifts, SCRAMs, etc.
- <u>There is a fundamental difference between **establishing** radiological controls and **verifying** radiological conditions.</u>
    - Licensing Bases for EB 17-02 "Self-Protection for Radiological Work Activities"
        - 'New' initiative that reoccurs about Every 10 Years

10 CFR 20.1602

Control of Access to Very High Radiation Areas

- In addition to the requirements in § 20.1601, the licensee shall institute additional measures to ensure that an individual is not able to gain unauthorized or inadvertent access to areas in which radiation levels could be encountered at 500 rads (5 grays) or more in 1 hour at 1 meter from a radiation source or any surface through which the radiation penetrates.

NUREG 1736
Consolidated Guidance: 10 CFR Part 20

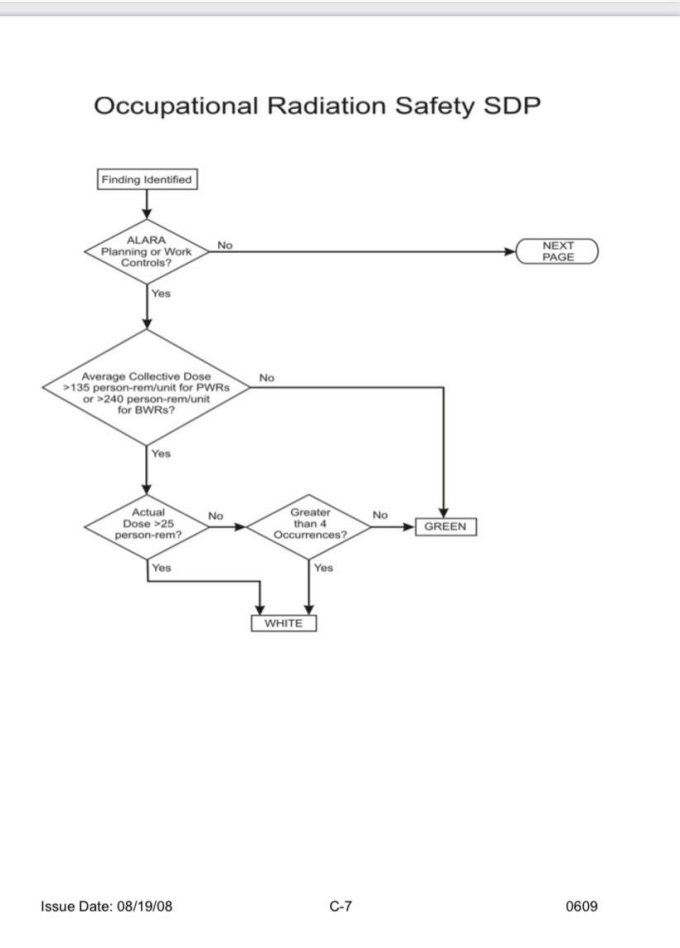
10 CFR 20.1602 - Guidance Statement:

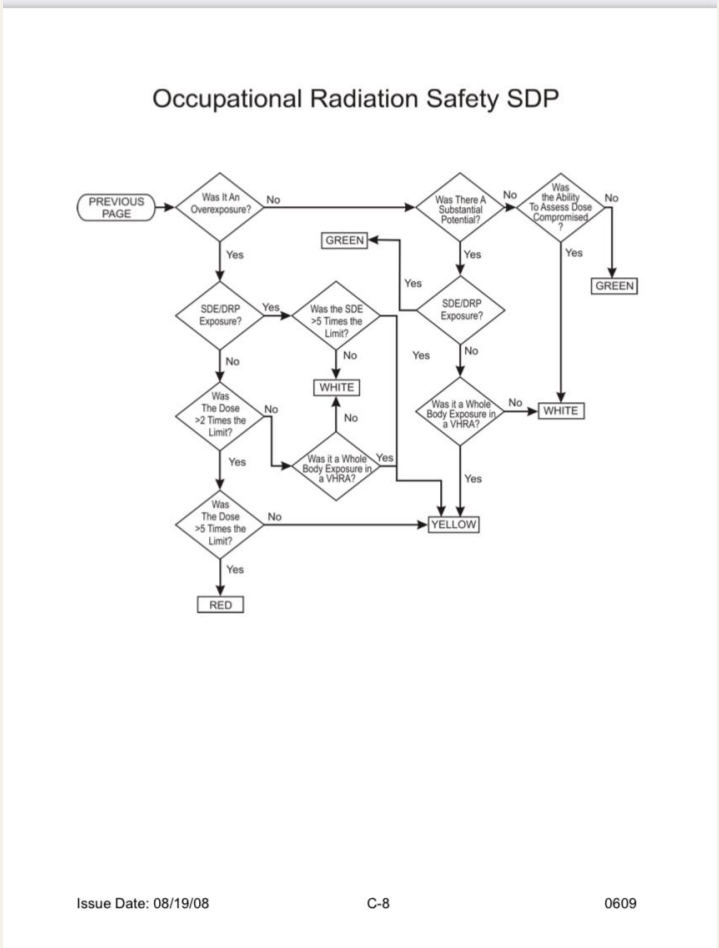
- VHRAs require much stricter controls, since failure to implement effective radiological controls adequately can result in individuals receiving doses that pose significant health risks, or even death. Because of the potential for life-threatening exposures to individuals, licensees must institute additional measures to ensure that individuals are not able to gain unauthorized or inadvertent access to VHRA.
- To the extent possible, *entry should be forbidden* unless there is a *sound operational or safety reason for entry.*

HPPOS 16
Applicability of Access Controls for Spent Fuel Pools

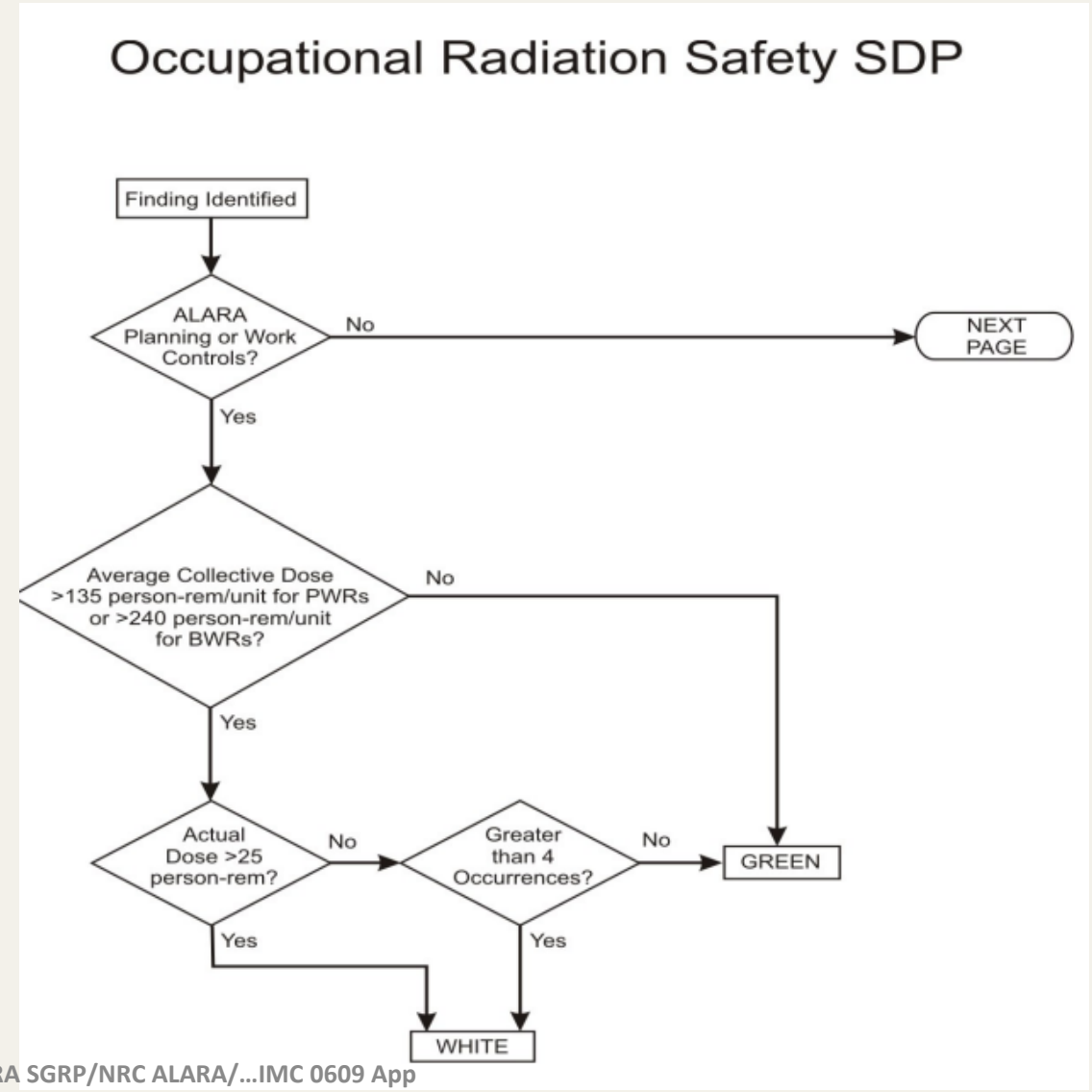
- Spent fuel pool areas are not high radiation areas due to the inaccessibility of highly radioactive materials stored in the pool.
- *If a diver enters the pool or upon movement of highly radioactive materials stored in the pool, then proper health physics controls must be instituted.*
- Materials in spent fuel pools that could cause an individual to receive a dose equivalent to the total body in excess of 100 mrem in one hour are normally ten or more feet below the surface of the pool.
- HPPOS-002 (IN 82-31) “Overexposure of Diver During Work in Fuel Storage Pool”

Occupational Radiation Safety Significance Determination Process





IMC 0609 Appendix C



ALARA Regulatory Basis

Title 10 CFR 20, “Standards for Protection against Radiation”

ALARA is an acronym for “As Low As Reasonably Achievable.”

Definition.

ALARA is defined as an approach to radiation protection to manage and control doses (both individual and collective) to the work force and the general public such that doses are kept as low as is reasonable, taking into account social, technical, economic, practical, and public policy considerations. ALARA is not a dose limit but a process, which has the objective of maintaining dose levels as far below applicable limits of 10 CFR20.

ALARA

- "ALARA is never the reason NOT to do work. **It is the way to do**, what you have to do, to maintain nuclear safety at the plants"

—Roger Pedersen, Senior Health Physicist,

—NRC, NRR, Program Office

Radiation Protection Timeline

- **Nothing New…..**
- 1896 – American engineer Wolfram Fuchs gave first recognized radiation protection advice:
  - Make exposure as short as possible.
  - Do not stand within 12 inches of the X-ray tube.
  - Coat the skin with Vaseline and leave an extra layer on the most exposed areas.

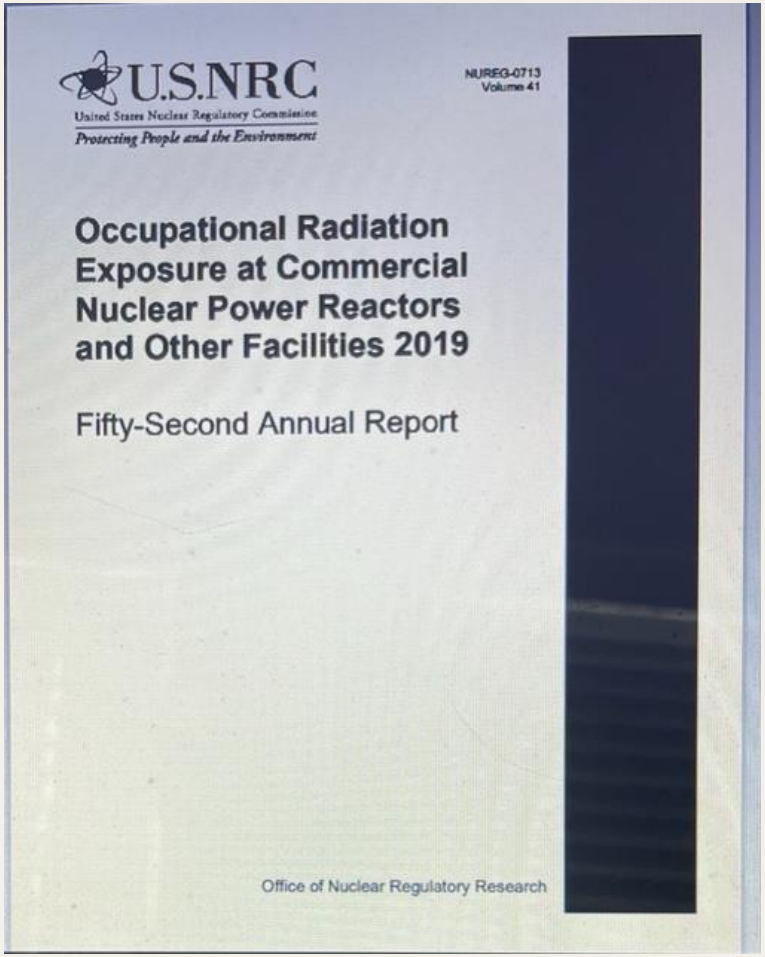
  "Time, Distance, and Shielding"

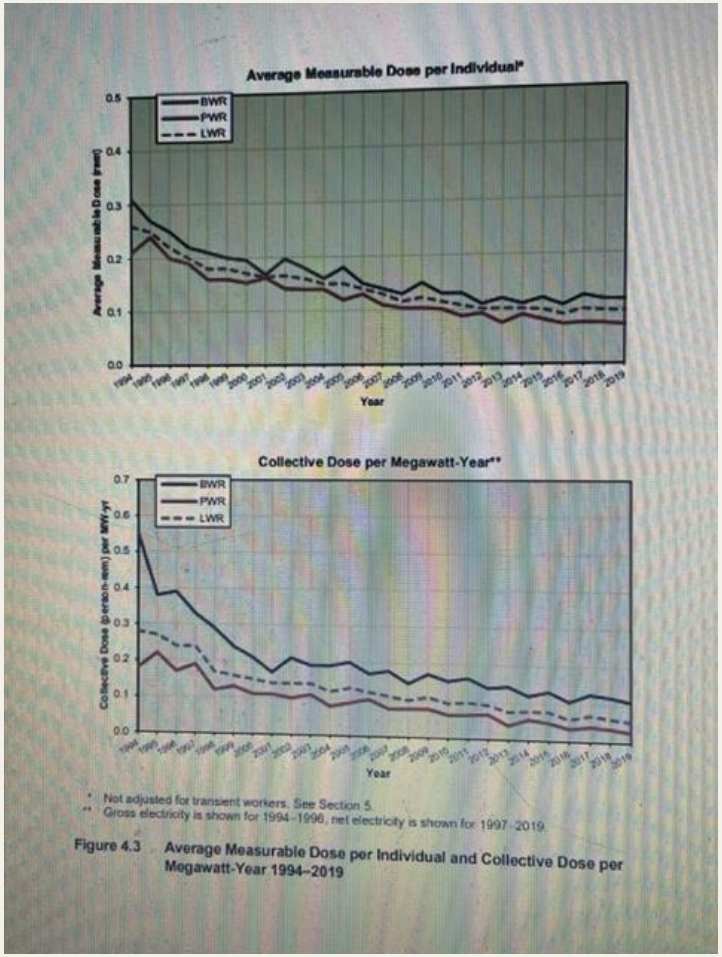
ALARA Concepts

Transition from Time, Distance and Shielding to:

- Radiological and Industrial Safety Risk Recognition and Mitigation,
- Detailed Work Planning,
- Work Sequencing (Vertical and Horizonal Work Control)
- Source Term Reduction and Management
- Work Execution Monitoring and Control,
- Event Mitigation, and
- Exposure Controls.

NUREG 0713 Data





INSPECTION PROCEDURES

- What your NRC Inspector is Doing
  - 71124.01 “Radiological Hazard Assessment and Exposure Controls”
  - ~~71124.02 “ALARA Planning and Controls”~~
  - 71124.03 “In-Plant Airborne Radioactivity Control and Mitigation”
  - 71124.04 “Occupational Dose Assessment”
  - 71124.05 “Radiation Monitoring Instrumentation”
  - 71124.06 “Radioactive Gaseous and Liquid Effluent Treatment”
  - 71124.07 “Radiological Environmental Monitoring Program”
  - 71124.08 “Radioactive Solid Waste Processing and Radioactive Material Handling Storage”

NRC Inspection Procedure (IP) 71124.02
“Occupational ALARA Planning and Controls”

- Now Deleted
  - –NUREG 0713 “Occupational Radiation Exposure at Commercial Nuclear Power Reactors and …”
- Significant Activities moved to IP 71124.01 "Radiological Hazard Assessment and Exposure Controls”

A Nuclear Electric Factory

- Collective Radiation Exposure (CRE) has been deemphasized by the industry in recent years. (NUREG 0713)
  - Senior managers (and Board of Directors) often prefer to talk in terms of radiological risk, as opposed to CRE.
  - CRE as a performance metric is often an indicator of nuclear safety
    - Source Term impact on Reactor Coolant Pump Seal and Valve Performance (Cobalt and Colloid Contaminants)
      - A colloid is a mixture in which one substance consisting of microscopically dispersed insoluble particles is suspended throughout another substance. Some definitions specify that the particles must be dispersed in a liquid,[1] while others extend the definition to include substances like aerosols and gels.
    - Palisades Reactor Head Repairs

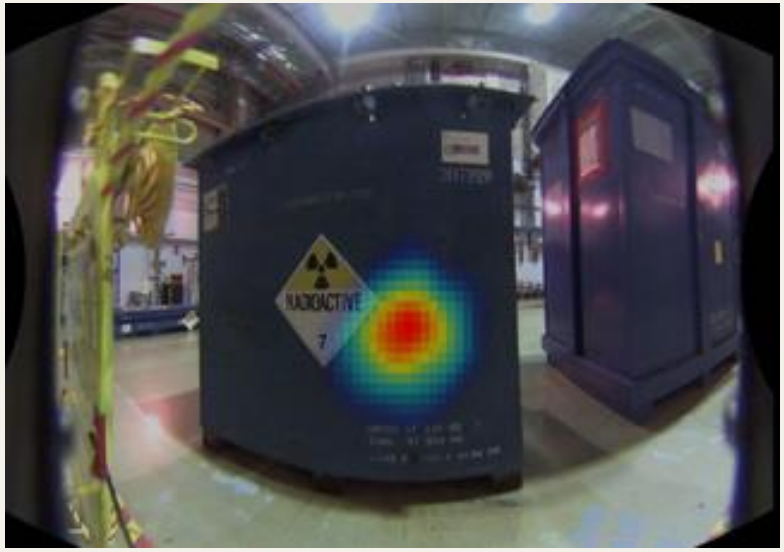
10 CFR 20.1003 Definitions

- **Total Effective Dose Equivalent (TEDE)** means the sum of the effective dose equivalent (for external exposures) and the committed effective dose equivalent (for internal exposures).

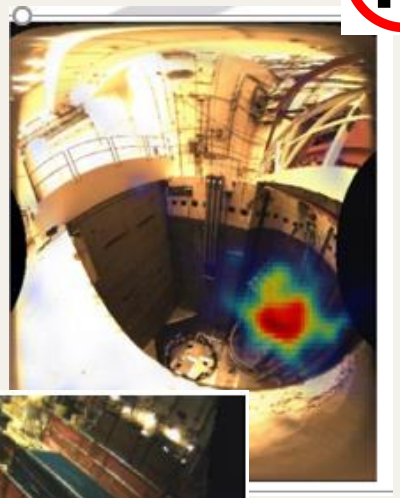
- **Survey** ***means an evaluation*** of the radiological conditions and potential hazards incident to the production, use, transfer, release, disposal, or presence of radioactive material or other sources of radiation. When appropriate, such an evaluation includes a physical survey of the location of radioactive material and measurements or calculations of levels of radiation, or concentrations or quantities of radioactive material present.

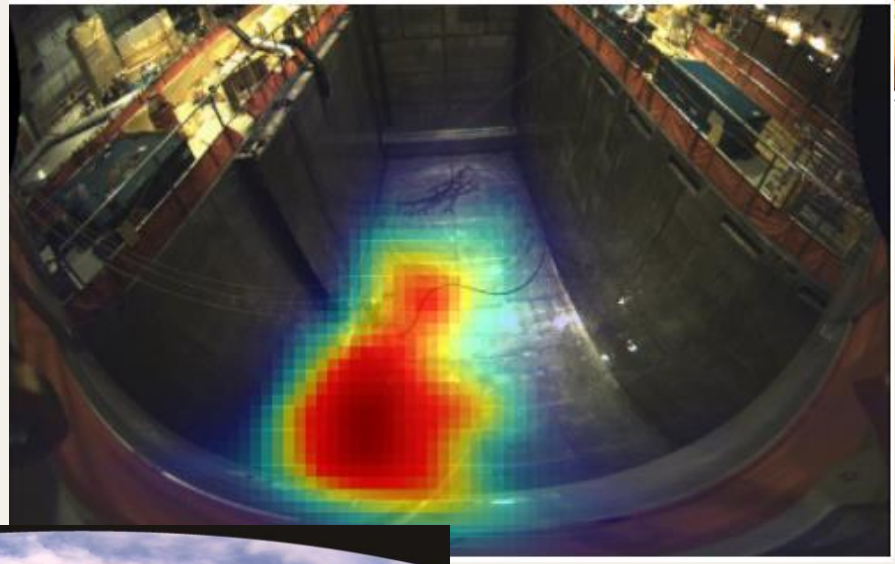
CZT and $100k one Crystal $150k+ 4 Crystals for low energy C057

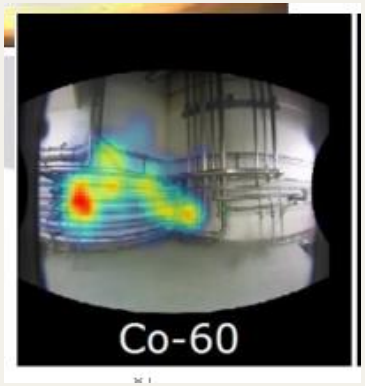
- *Spectroscopic imaging detectors* that takes a visual image and overlays it with a radionuclide specific heat map. This produces a visual means of communicating radiation fields and can provide verification of traditional dose rate surveys.
  - Risk management: RAM Shipments, Cavity Decon, Shielding Assessments, Critical Path (OCC) Management

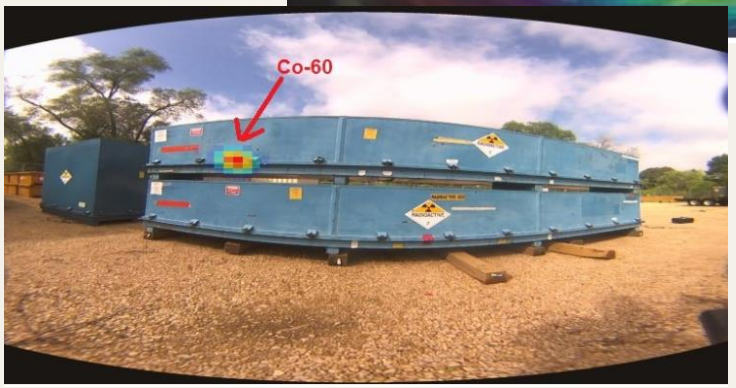


Cadmium Zinc Telluride (CZT) camera (courtesy of H3D, Inc)









NRC Regulatory Guide 8.15, "Acceptable Programs for Respiratory Protection" (TEDE ALARA)

Regulatory Position C.2. - ALARA Requirement

- 10 CFR 20.1101(b), licensees must use, to the extent practical, procedures and engineering controls based on sound radiation protection principles to achieve occupational doses that are ALARA.
- 10 CFR 20.1702, licensees are to limit intakes by means of engineering controls or procedures, along with the use of respirators, consistent with maintaining the TEDE ALARA.

Regulatory Guide 8.15

TEDE ALARA:

- Evaluation consider;
  - Respirator Inefficiency (per NUREG/CR-0041)
    - The more complex the task or the more communication needed, the greater the inefficiency
    - More protective respirators generally slow down a worker more than less protective devices
    - Work environment can add to the complexity of the evaluation (i.e. cold, heat, humidity)

Regulatory Guide 8.15

TEDE ALARA continued;

- Evaluation consider;
  - Inefficiency (per NUREG/CR-0041)
    - **Inefficiency factor of up to 15% is reasonable** (use of larger factors needs justification)
      - Prior experience, professional judgment, time-motion studies, mock-ups, etc.
    - ***Monitor and adjust factors as job progresses***
    - However removing of respirators in the middle of a job may not be practical
    - **Apply lessons to future work, as appropriate**
      - **Post Job ALARA Reviews, Post Outage Report**

Regulatory Guide 8.15

TEDE ALARA continued;

- Evaluation consider;
  - NRC encourages licensee judgment in the decision to require the use of respirators where they may not be justified by the ALARA evaluation, or to not use them when their use would reduce dose but decrease worker industrial safety. (NUREG/CR-0041)
    - Heat stress,
    - heat relief,
    - skill of worker,
    - post-work consequences (personnel decon, portal monitor issues, psychological strain on workers, etc.)

Inspection Procedure 71124 Attachment 01
Radiological Hazard Assessment and Exposure Controls (January 1, 2022)

71124.01-01 Inspection Objectives

- 01.01 Review and assess licensee performance in assessing the radiological hazards in the workplace associated with licensed activities and the implementation of appropriate radiation monitoring and exposure controls.
- 03.04 Radiological Hazards Control and Work Coverage Sample
  - Verify the licensee controls radiological hazards during radiological work.

  Specific Guidance
  - a. Consider if radiological controls are implemented commensurate with the radiological hazard. Adequate radiological controls include performing required surveys (e.g., radiation, contamination and airborne), radiation protection job coverage (e.g., audio and visual surveillance for remote job coverage), contamination controls and stop work criteria.
  - b. Consider if the licensee has integrated radiological work controls and ALARA requirements into work packages, work procedures and/or RWP documents.

ip71124-01 RADIOLOGICAL HAZARD ASSESSMENT AND EXPOSURE CONTROLS.docx

10 CFR 20.1701 Use of process or other engineering controls.

- The *licensee shall use,* to the extent practical, process or other engineering controls (e.g., containment, decontamination, or ventilation) to control the concentration of radioactive material in air.

10 CFR 20.1702 (a) When it is not practical to apply process or other engineering controls … increase monitoring and limit intakes by one or more of the following means

- (1) Control of access;
- (2) Limitation of exposure times;
- (3) Use of respiratory protection equipment; or
- (4) Other controls.

10 CFR 20.1703 Use of individual respiratory protection equipment.

- If the licensee assigns or permits the use of respiratory protection equipment … (a) The licensee shall use only respiratory protection equipment that is tested and certified by the National Institute for Occupational Safety and Health (NIOSH) …

Air Sampling and Workplace Monitoring

RWCU Work Platform

Work Zone Air Sample to assess the effectiveness of the engineering controls in use (Glove Bags, HEPA Units, Containments, etc.) IAW
10CFR 20.1701 'Use of Process or Other Engineering Controls'; and
10 CFR 20.1702 'Use of Other Controls' (Control of Access, Use of Respiratory Protection Equipment, etc.)

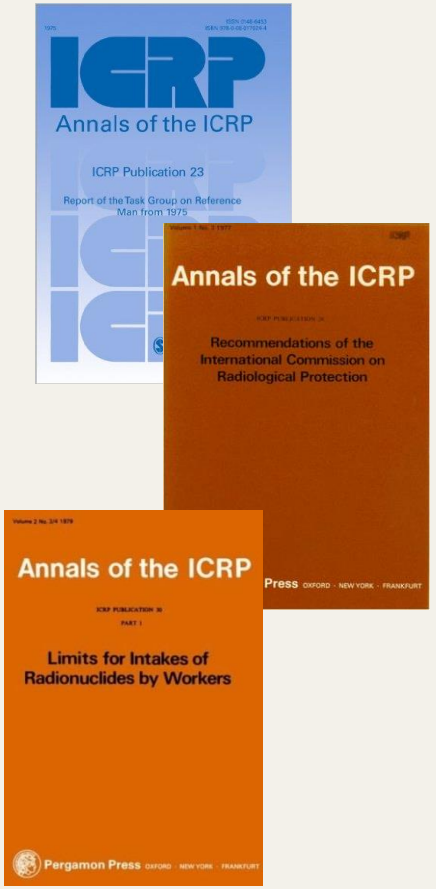
Personal Air Sample (Lapel Air Sample) / Dosimeter on the worker to assess Breathing Zone Airborne Concentrations IAW
10CFR 20.1204 'Determination of Internal Exposure '

General Area Air Sample to demonstrate Compliance to
10 CFR 20.1902.d "Posting of Airborne Radioactivity Areas'

Alarming CAM (Continuous Air Monitor) to assess airborne radiological hazards for appurtenant people in the general area and are NOT directly involved in the airborne generating work activities.
10 CFR 20.1501.a 'Each Licensee shall make ... surveys ... that may be necessary to comply with the requirements of this part ...'
10 CFR 20.1702 'Use of Other Controls' (Control of Access, Use of Respiratory Protection Equipment, etc.)

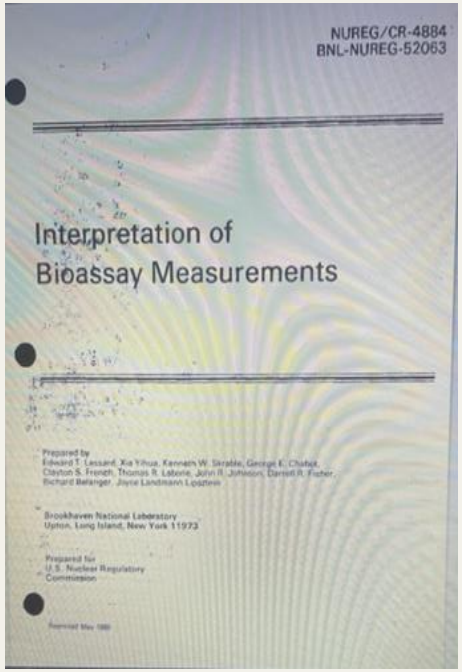
Basis for Internal Dose Regulations

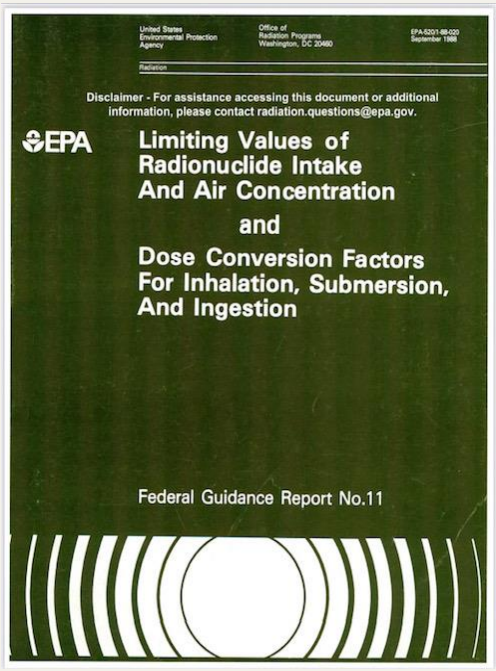
- Current NRC regulations based on ICRP recommendations from the 1970's.
  - ICRP 23, Reference Man – 1975.
  - ICRP 26, Recommendations of the International Commission of Radiological Protection – 1977.
  - ICRP 30, Limits for Intakes of Radionuclides by Workers – 1979 to 1982.
- Limits based on intake vs. body burden.



Determining Models

- NRC Endorsed
  - Use ICRP 30 models for initial and low dose assignments.
    - NUREG 4884 for Intake Retention Fraction (IRF) values.
    - Federal Guidance Report (FGR) 11 or 10CFR20 for Dose Conversion Factors (DCFs).





Managing Risk

- Place information where the user has ready access
  - Industry OPEX – Perry SRM
  - Integrate radiological and industrial safety risk into a comprehensive safety plan. (Sometimes the ALARA Plan).
    - Heat Stress, Water Access, Protective Clothing Reduction, Climbing / Fall Hazards, Oil / Slip Hazards, etc.

- What is a "Good" ALARA Plan
  - Vet with Fleet, Industry, and INPO
  - ANO RCP Oil Add and Initial Drywell Entry
    - U2 Initial Containment Survey
    - Oil Add for 2P-32C Documents

Observed Gaps in RP Program Management

Integrated risk management (industrial safety, radiological safety, nuclear safety, and enterprise risk)

- Understanding the site administrative processes for integrated risk management and mitigation.
- Impact of ALARA planning on the work control milestones that ensure effective outage / project planning.
- On Schedule is the safest place to be.

Integrated risk management (industrial safety, radiological safety, nuclear safety, and enterprise risk)

- Managing ALARA work sequencing and ALARA Plan implementation, and through the Station ALARA Committee and fleet challenge boards.
- Embedding Critical Radiation Safety Controls into Work Packages as ‘critical Steps’ with appropriate sign-offs.

Outage Readiness

- Socialize and Brief the Station and Corporate Senior Management Team and the OCC Staff weeks before the outage to ensure OCC / Senior Management Involvement
  - Contingency Plans / Radiological Controls (Briefings, Hold Points, Stop Work, etc.)
  - Full Transparency - No Surprises at 07:00 Phone Call
  - Post in the OCC
  - Develop Reference Books for OCC Use
- These are not RP department issues, they impact the entire site / enterprise

Manage the Chaos

Some Tips …

- Stay in Role
- Drive for Results
  - Drive the processes… Its offense, not Defense.
  - Drive outcomes … **Don’t let events drive You.**
- Manage Stress
  - Avoid running to your ‘Comfort Zone’.
- Maintain Context in Defining Success
  - Budgets pass, events are gifts that keep on giving.

Outage Readiness

- Embed at least 72 hours for Diving Preps:
  - Tritium Bioassay Preps
  - Multi-Badging Preps
  - Area Surveying
  - Area Vacuuming and Clean-Up
  - 10 CFR 20.1602 and Discrete Radioactive Particle (DRP) Barrier Construction
- At least 72 hours after the start of the outage, reevaluate exposure estimates using post shut down surveys (after crud burst cleanup lockout window complete for PWRs; after BRAC surveys for BWRs). Dose rates should be evaluated with the Station ALARA Committee.
  - If outage estimates increase because of elevated dose rates, contingency plans should be initiated. Additional recovery plans should be developed based on any unexpected conditions.

Managing Radiological Risk

- Ramp up = Ramp Down
  - Plant Z at 02:00 Hours
    - OCC wants to work on LSIVs w/ SGs Empty
    - Work Package, RWP and the ALARA Plan were approved by the SVP and SAC ….. So the Undo would also take SVP and SAC approval (at 02:00 Hours)
    - **Better decisions** are made by an integrated group, rather than a **select few.**
- Remember the Regulatory Bases
  - Plant A at 01:00 Hours – OCC wants to Enter Containment to Start Building scaffold to do … SOMETHING….
    - R.G 8.10 "Radiation Work Permit (RWP): An authorization by the licensee's management to perform a specific procedure involving radiation exposure of personnel in a particular area. It contains detailed procedures for every aspect of the work to be done."

Some Tricks to the Trade

- Write RWPs / ALARA Plans, and embed actionable items work controls in work packages. Focus on the audience.
- Use Operating Experience (Site, INPO, NRC)
  - This is a 50+ Year Old Industry. Not Much is New
- Parallelism in RWP Packages / Work Documents
  - Stop / Halt / Abort / Cease / Pause / End
  - Stop Work or Hold Point
- Need to charge radiation safety initiatives to major projects (EDs, cameras, remote monitoring, Exit Monitors, etc.)
- Work packages need to go cradle to grave
  - Cut Out and Replace Valve through Waste Disposal

Some Tricks to the Trade

- Run computer checks on:
  - % to ED Set Points on Dose and Dose Rate Alarms
  - Workers on wrong project tasks/RWPs.
- Monitor Chemistry Parameters Closely. Specifically changes in Source Term (Ag-101m, Moisture Carry Over, Failed Fuel, etc.)
- Spot surveys of incoming vendor equipment. (You don't want to buy what you don't have to…) Perfect for a CZT..
- Lots of work packages will be going in and out of the CA. Some have purchased a hefty copier to scan paper that can't make it out.
- Shrink wrapped in the past. Will we need to order shrink wrap?
- *Slings will often be going in and out. What is our release plans?*
- Script briefings
- Water available in the RCA when necessary
- Random Field checks of worker knowledge…
  - Managers at RCA Control Points

Observed Gaps in RP Program Management

The Reactor Oversight Process for Radiation Safety

IMC 0612 Issue Screening.docx

Performance Deficiency (PD): The licensee's failure to satisfy one or more regulatory requirements or self-imposed standards where such failure was reasonably foreseeable and preventable.

Finding: A performance deficiency that is determined to be More-than-Minor in accordance with IMC 0612, Appendix B "Issue Screening"

Radiation Safety M/MTM Mental Model

Significant Radiological Hazard	Barriers	Very High Radiation Area	Locked High Radiation Area	High Radiation Area	Radiation Area	Radioactive Material Control Area	Restricted Area	Owner Controlled Area	Unrestricted Area
		Occupational Exposure Control ←				Public Exposure Control →			

NRC IMC 0612, App E "Examples of Minor Issues"

NRC Inspects the Licensee to their expected outcomes

- Changing a car tire in 20 minutes, verses NASCAR in Seconds.

A Performance Deficiency (PD) occurred in ALARA planning and/or job execution that resulted in the actual collective dose exceeding the planned (or adequately re-planned), intended dose for a work activity.

- MINOR IF:
  - The actual collective dose was ≤ 5 person-rem, OR the actual collective dose was greater than 5 rem but did not exceed the planned (or adequately re-planned), intended dose by more than 50 percent.

Managing Performance

- Dr. Morris Massey said we are basically who we were when we were eight years old except for one exception, a **significant emotional event (SEE).**
  - Individuals who experience a significant emotional event, at any age, *may change their foundational belief or value system.*
  - In other words, it is possible for a deeply significant, emotional event to change what we believe and how we act.

Safety First!

- Personnel injuries are life changing events
- Time lost to an accident will outweigh time lost to schedule delays.
- *On schedule is the safest place to be*.
  - Schedule is laterally, horizontally, and cross-disciplined reviewed.
  - Schedule is risk-informed, vetted, resource loaded, and logic-tied.

Safety First!

- Manage the behaviors, not the outcomes.
  - Dropped Object Issues.
- Develop Forcing Functions to drive Peer-to-Peer Coaching.
- Accountability is NOT Discipline

Observed Gaps in RP Program Management

Public Radiation Safety Cornerstone

- Regulatory Bases of the Effluent and Environmental Monitoring Program
  - Generic Letter 89-01 Implementation of Programmatic and Procedural Controls for Radiological Effluent Technical Specifications
  - NUREG 1301 ODCM Guidance PWRs
  - NUREG 1302 ODCM Guidance BWRs
  - RETS (Sampling Requirements, Land Use Census, Environmental Dosimetry)
- Resulting in multiple Green and White Finding in Radiation Monitoring Instrumentation

10 CFR 20.1003 Definitions

- **Restricted area** means an area, *access to which is limited by the licensee for the purpose of protecting individuals against undue risks from exposure to radiation and radioactive materials.* Restricted area does not include areas used as residential quarters, but separate rooms in a residential building may be set apart as a restricted area.

- **Site boundary** means that line beyond which the land or property is *not owned, leased, or otherwise controlled by the licensee.*

- **Unrestricted area** means an area, *access to which is neither limited nor controlled by the licensee.*

10 CFR 20.1003 Definitions

- Monitoring (radiation monitoring, radiation protection monitoring) *means the measurement* of radiation levels, concentrations, surface area concentrations or quantities of radioactive material and *the use of the results* of these measurements to evaluate potential exposures and doses

https://www.nrc.gov/reading-rm/doc-collections/cfr/part020/part020-1

Palisades White Finding 2014010 Comp Ability to Assess Dose ML14336A624.pdf

Public Radiation Safety Significance Determination Process

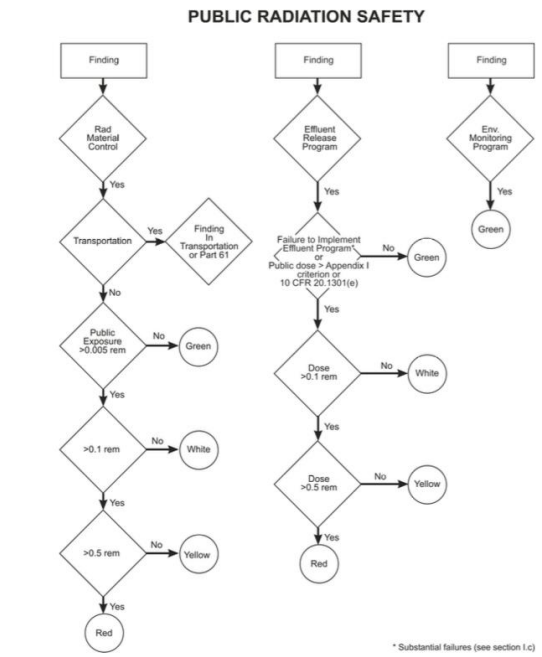
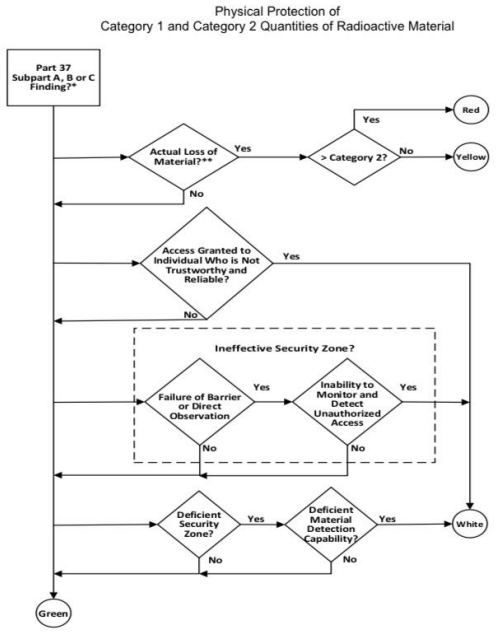


Figure 1 Rad Material Control, Effluent Release Program and Environmental Monitoring Program SDP Flowchart



*Failures to respond or report per 10 CFR 37.49(d) or 10 CFR 37.81 shall be dispositioned using Traditional Enforcement as violations that may impact the ability of the NRC to perform its regulatory oversight function
**Consult with NRC Office of Investigations prior to dispositioning findings associated with actual cases of theft, diversion or sabotage of radioactive materials

Figure 6 Part 37 Subpart A, B or C Finding SDP Flowchart

Key Radiation Safety OPEX

- Braidwood Tritium and the Impact on Industry
- Davis Besse Reactor Head
- Individual Escalated Enforcement Actions
- Perry (In-Core Detectors) ML11187A121
- Perry Rad Waste Resin Spill IR 05000440/2012005
  - Role and Responsibilities of the Plant Manager and the Radiation Protection Manager
- Dresden (Airborne)
  - ML15117A595 Dresden Airborne Green Finding.pdf
- Columbia IR 05000397/2021090 {Preliminary White Finding (OE 500760)}

Key Radiation Safety OPEX

OPEX Revisited

- Palisades EDEX IR05000255/2014010
- Palisades Spacers IR 05000255/2008011
- River Bend (Diving and 10 CFR 20.1602)…
  - EA-97-192 - Calvert Cliffs 1 & 2 (Baltimore Gas & Electric Company) | NRC.gov
- Robinson (Core Barrel – Belly Box)
- RP Instruments
  - Waterford-3 IR 05000382/2022501
  - Waterford-3 IR 05000382/2022090
  - Grand Gulf IR 05000416/2015001 and IR 05000416/2017012 Cited NOV CHRRM Repetitive NRC Issue.
- RAM Shipping
  - Vogtle ML15022A678 / ML 15258A572

Observed Gaps in RP Program Management

Foundational Technical Knowledge

1) Isotopic (MCA) Data Interpretations
   - WBCs, Effluent Release Permits, Internal Dose Assessments
2) Instrument Calibrations (Primary Cal Standards, Repeatable Geometries, NUREG 737 Instrument Requirements)

Health Physics Position Papers

- Health Physics Positions Based On 10 CFR Part 20 | NRC.gov
- HPPOS-238 “Health Physics Position on ***Task Qualification of HP Technicians***
  - Health Physics Technicians (HPTs) ***may independently perform specific tasks or job assignments if they meet the required prerequisites*** and complete the required task qualifications of their plant training programs.
  - ***There are certain tasks and job assignments, however, that require in-depth knowledge and can only be performed by fully qualified ANSI technicians.***

Health Physics Position Papers

- Health Physics Positions Based On 10 CFR Part 20 | NRC.gov
- HPPOS-238 “Health Physics Position on Task Qualification of HP Technicians
  - Each Institute of Nuclear Power Operations (INPO) accredited licensee training program will vary somewhat in its approach on qualifying its HPTs. However, each program should be based on a systems approach to training (SAT). The SAT should include the following key areas: how were criteria derived to select tasks to be done without supervision, and how are HPTs evaluated against these criteria to permit / authorize them to work unsupervised.