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Graded Regulatory Oversight of Nuclear Installations

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Oversight Programs

- Operating reactors
- Reactors under construction
- Fuel cycle facilities
- Research & Test reactors
- Decommissioning

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Regulations

- Title 10 of the Code of Federal Regulations
  - Part 50 – Licensing of Production and Utilization Facilities (Existing operating power reactors, RTRs); General Design Criteria
  - Part 52 – Licenses, Certifications, and Approvals for Nuclear Power Plants (New power reactors [combined construction and operating license])
    - Early site permits
    - Design certification
  - Part 70 – Domestic Licensing of Special Nuclear Material (fuel cycle facilities)

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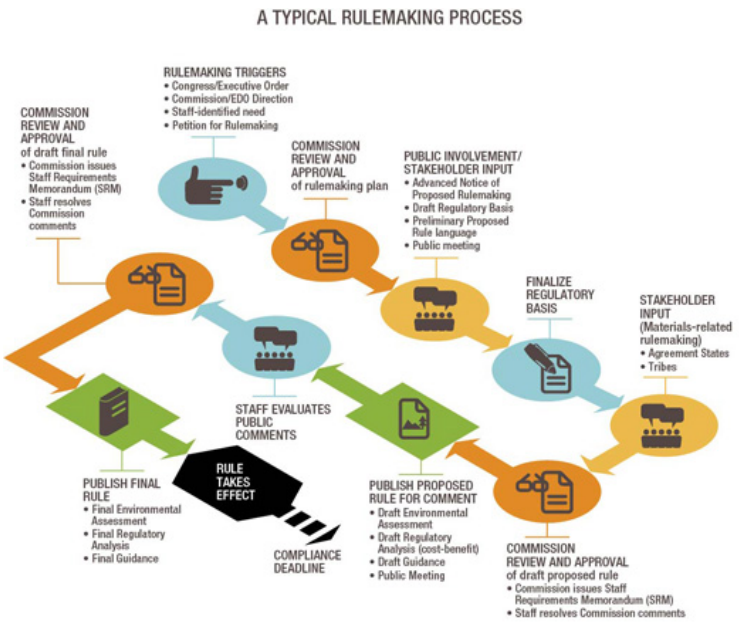
Regulations

- New rules
  - Regulatory basis – issue may have an impact on public health and safety
  - Regulatory analysis (cost-benefit)
  - Commission decision



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Regulations

- Exemptions
  - 10 CFR 50.12 – Commission may grant exemptions from requirements
    - will not present an undue risk to the public health and safety;
    - compliance would result in undue hardship or other costs that are significantly in excess of those contemplated when the regulation was adopted
    - the exemption would result in benefit to the public health and safety that compensates for any decrease in safety

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Authority

- Atomic Energy Act of 1954
  - The Commission is authorized to issue licenses to persons applying therefor to transfer or receive in interstate commerce, manufacture, produce, transfer, acquire, possess, use, import, or export under the terms of an agreement for cooperation arranged pursuant to section 123, utilization or production facilities for industrial or commercial purposes.
  - The Commission is authorized to issue licenses for utilization and production facilities for research and development purposes. In issuing licenses under this subsection, the Commission shall impose the minimum amount of such regulations and terms of license as will permit the Commission to fulfill its obligations.

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Authority

- Energy Reorganization Act of 1974
  - The Nuclear Regulatory Commission shall have licensing and related regulatory authority pursuant to chapters 6, 7, 8, and 10 of the Atomic Energy Act of 1954.
  - License renewals are delegated to Office Directors
    - NRR - Principal licensing and regulation involving construction and operation of nuclear reactors
    - NMSS - Principal licensing and regulation involving all facilities associated with the processing, transport, and handling of nuclear materials

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Review and Assessment of Facilities

- Standard Review Plans
  - NRC does not use a graded approach for the SRP
  - Based on addressing the regulatory requirements as discussed within the FSAR
  - Different SRPs for different types of facilities (operating reactors (NUREG-0800), non-power reactors (1537),decomm reactors (1727), fuel cycle facilities (1520), spent fuel storage (1567)) – based on radiological risk to public

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Design Considerations

- Defense-in depth – any single failure of any active component will not prevent safe reactor shutdown or result in unsafe conditions
- Safety-related systems, structures, and components
  - the integrity of the reactor coolant pressure boundary;
  - the capability to shut down the reactor and maintain it in a safe shutdown condition; or
  - the capability to prevent or mitigate the consequences of accidents.
- Non-safety-related systems, structures, and components whose failure could prevent satisfactory accomplishment of any of the above functions.

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Inspection Oversight

- Factors
  - Facility type (operating reactors, decomm, RTRs, etc)
  - Risk (safety and security)
    - Probabilistic Risk Assessment (PRA)
    - Phase (construction, operation, decomm)
  - Performance
    - Within a certain level of safety performance, licensees will address their performance issues without additional NRC engagement beyond the baseline inspection program. Agency action beyond the baseline inspection program will normally occur only if assessment input thresholds are exceeded.

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Operating Reactors

- Reactor Oversight Process (ROP)

  The NRC's program to inspect, measure, and assess the safety and security performance of commercial nuclear power plants and to respond to any decline in performance

- ROP Objectives
  - Risk-informed
  - Objective
  - Predictable
  - Understandable
  - Open & transparent

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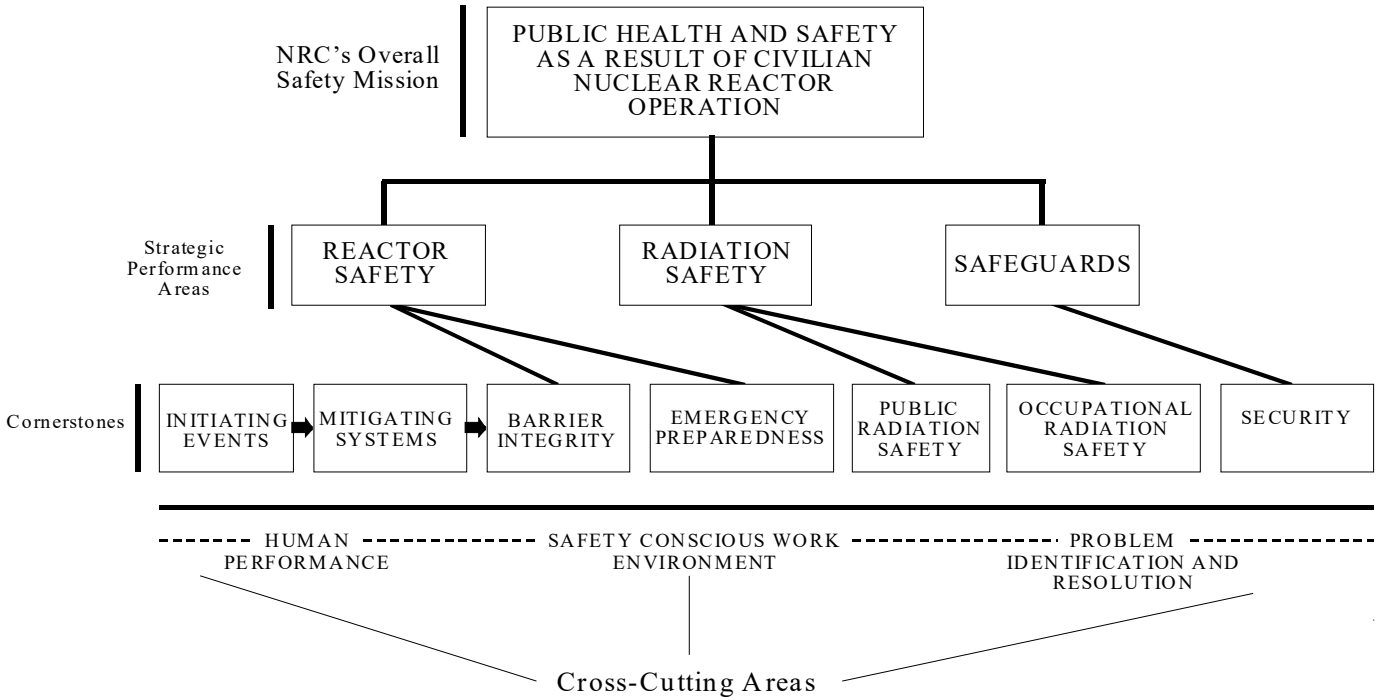
Regulatory Framework

Exhibit 1: REGULATORY FRAMEWORK



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ROP Supports the Mission

- Acceptable performance in the cornerstones, as measured by the Performance Indicators (PIs) and the risk-informed baseline inspection program, provides assurance to the NRC that reactors are being safely operated and that we are meeting our mission to protect the public health and safety, and the environment.

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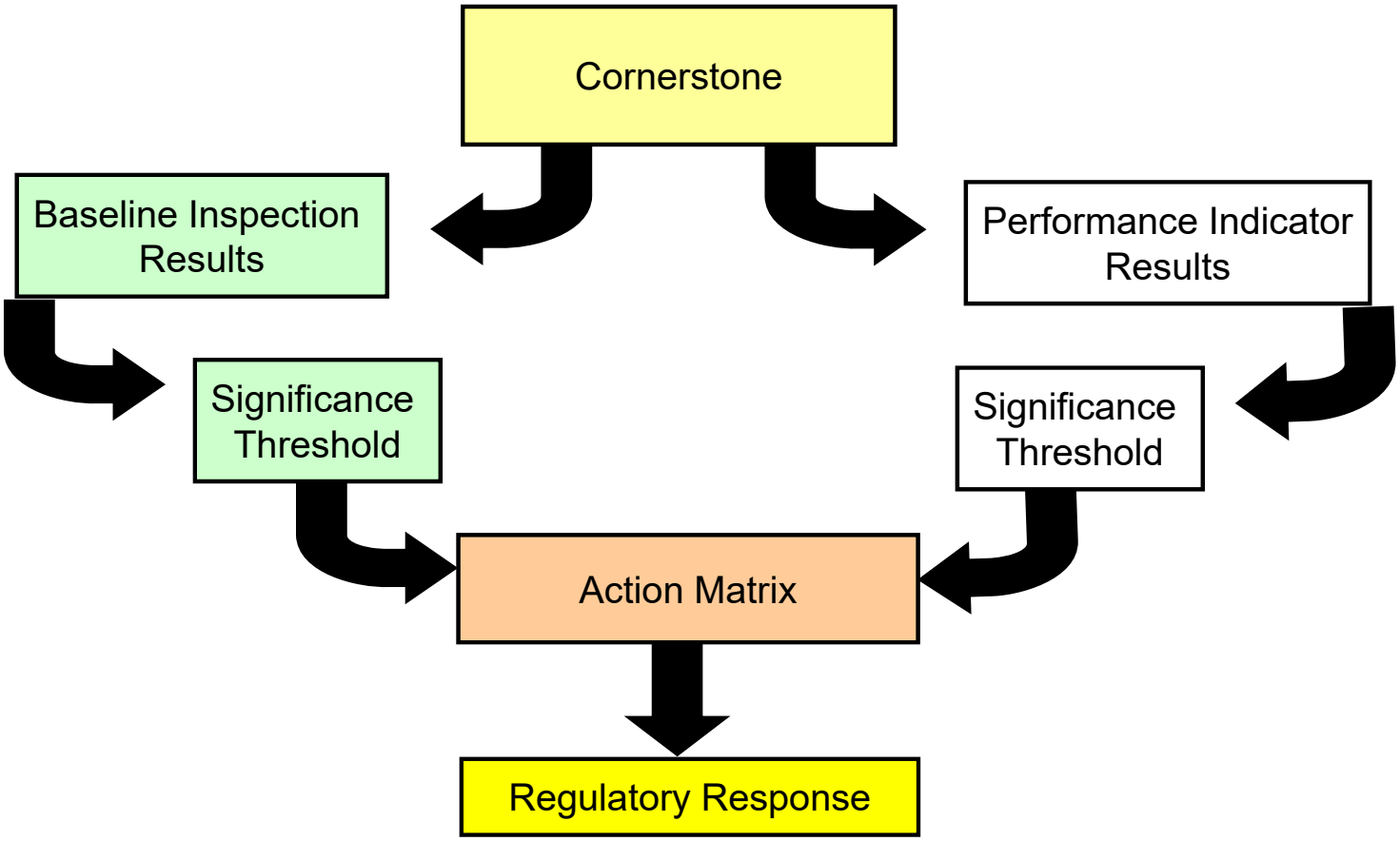
ROP Simplified



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Inspection Program

- Baseline
  - Every plant gets this (risk-informed, performance based
- Supplemental
  - Response to performance issues (graded response)
- Infrequent, Reactive, & Generic Inspections
  - Infrequent: e.g., Steam Generator replacement
  - Reactive: Response to events
  - Generic: follow-up on generic or certain safety issues

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Inspection Findings

- Issue of concern
- Performance deficiency
  - Failure to meet a requirement (violation) *or* self-imposed standard that licensee should have prevented
- Minor/more-than-minor determination
  - Finding = more-than-minor performance deficiency
- Significance Determination Process (SDP) then performed to assess significance of licensee performance deficiency.

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Significance Determination Process (SDP)

- Objectives
  - Characterizes the safety and/or security significance of an inspection finding
  - Communication of results consistent with established significance thresholds
  - Risk-informed, but methodology depends on the affected cornerstone
    - Deterministic (e.g., emergency preparedness, security, etc.)
    - PRA-centric (e.g., initiating events, mitigation systems, barrier integrity)

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Significance Thresholds

Green: Very low risk significance (e.g., ΔCore Damage Frequency (CDF) ≤ 1.0E-6; ΔLarge Early Release Frequency (LERF) ≤ 1.0E-7)
White: low to moderate risk significance (e.g., 1.0 E-6 < ΔCDF ≤ 1.0E-5; ΔLERF ≤ 1.0E-6)
Yellow: substantial risk significance (e.g., 1.0E-5 < ΔCDF ≤ 1.0E-4; ΔLERF ≤ 1.0E-5)
Red: high risk significance (e.g., ΔCDF > 1.0E-4; ΔLERF > 1.0E-5)

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Performance Indicators (PIs)

- PI data submitted by licensees.
- They provide indication of problems that, if uncorrected, may increase the probability and/or the consequences of an off-normal event.
- For some PIs, White/Yellow or Yellow/Red thresholds were not identified, because the indicators could not be directly tied to risk data.

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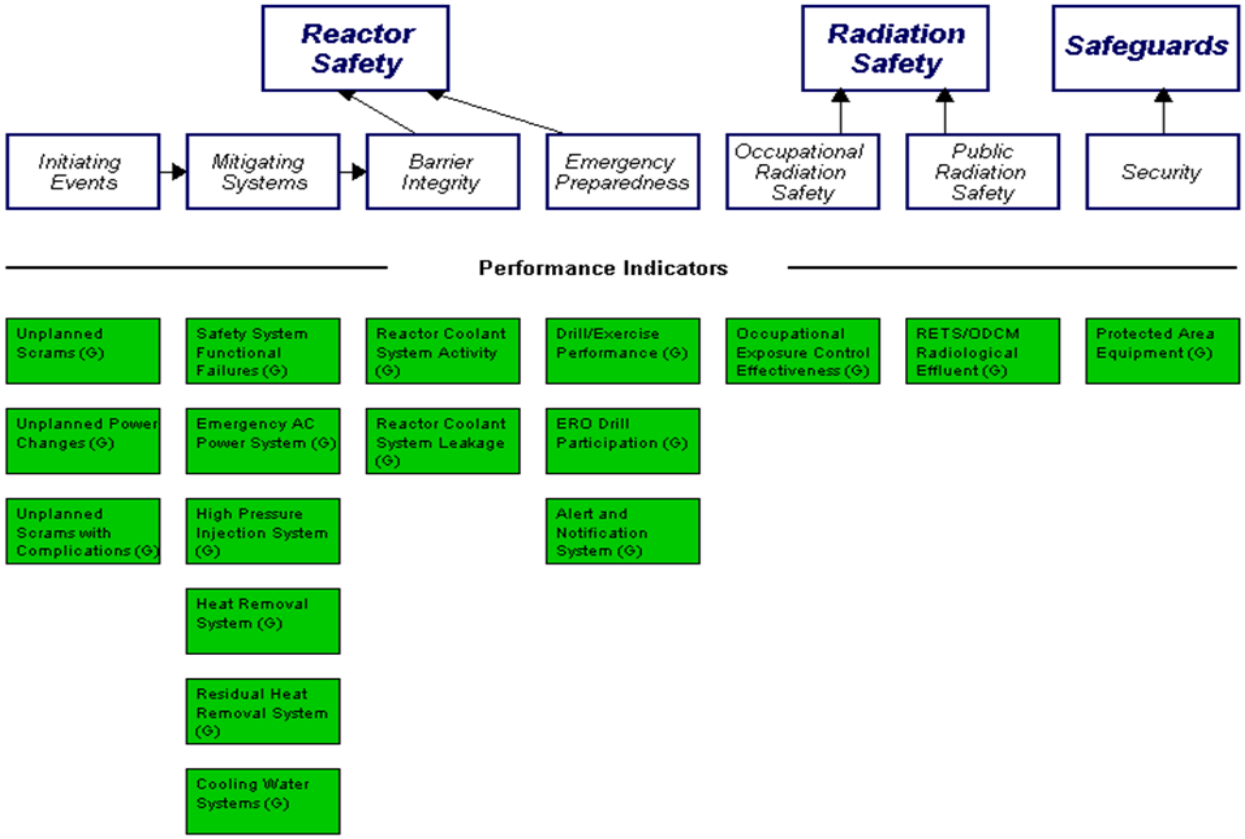
Performance Indicators (PIs)



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PI Thresholds

Green: performance within an expected performance level where the associated cornerstone objectives are met
White: performance outside an expected range of nominal utility performance but related cornerstone objectives are still being met
Yellow: related cornerstone objectives are being met, but with a minimal reduction in the safety margin
Red: significant reduction in safety margin in the area measured by the performance indicator

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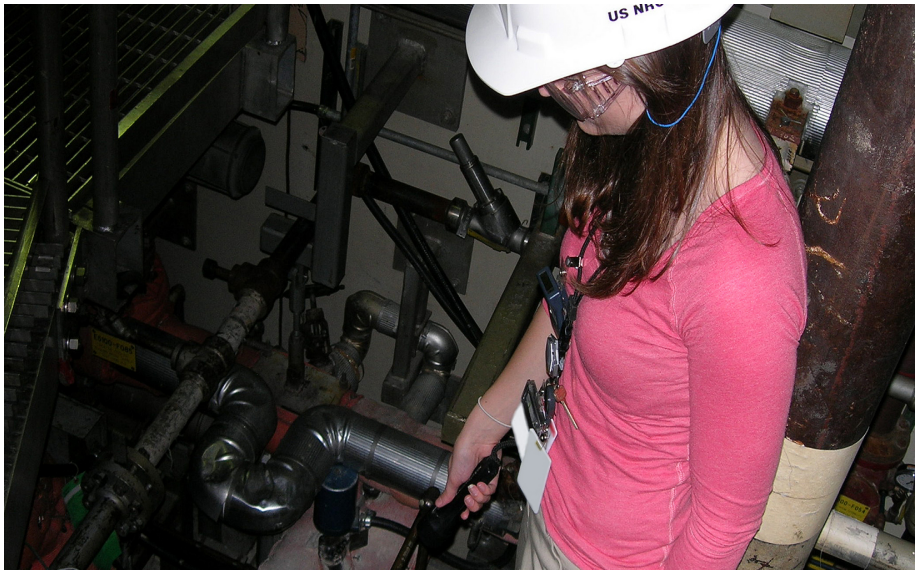
Performance Assessment

- Described in IMC 0305, Operating Reactors Assessment Program
- PIs and inspection findings (Action Matrix inputs) considered for an overall assessment of licensee performance



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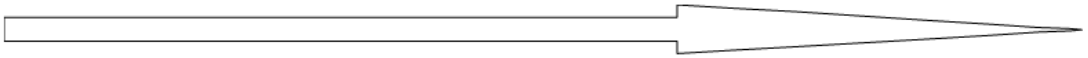
Action Matrix

- Action Matrix uses a graded approach to characterize performance and determine NRC response.

Licensee Response	Regulatory Response	Degraded Performance	Multiple/Repetitive Degraded Cornerstone	Unacceptable Performance
Column 1	Column 2	Column 3	Column 4	Column 5



- Increasing safety significance
- Increasing NRC inspection efforts
- Increasing NRC/licensee management involvement
- Increasing regulatory actions

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Action Matrix

		Licensee Response Column (Column 1)	Regulatory Response Column (Column 2)	Degraded Performance Column (Column 3)	Multiple/Repetitive Degraded Cornerstone Column (Column 4)	Unacceptable Performance Column (Column 5)	IMC 0350 Process[1]
RESULTS		All assessment inputs (performance indicators and inspection findings) green; Cornerstone objectives fully met	One or Two white inputs in a strategic performance area; Cornerstone objectives met with minimal degradation in safety performance	One degraded cornerstone (3 white inputs or 1 yellow input), or Any 3 white inputs in a strategic performance area; Cornerstone objectives met with moderate degradation in safety performance	Repetitive degraded cornerstone, Multiple degraded cornerstones, Multiple yellow inputs, or One red input; Cornerstone objectives met with longstanding issues or significant degradation in safety performance	Overall unacceptable performance; Plants not permitted to operate within this band; Unacceptable margin to safety	Plants in a shutdown condition with performance problems are placed in the IMC 0350 process
RESPONSE	Regulatory Performance Meeting	None	Branch Chief or Division Director meets with licensee	Regional Administrator or designee meets with senior licensee management.	EDO/DEDO or designee meets with senior licensee management	EDO/DEDO or designee meets with senior licensee management	RA/EDO or designee meets with senior licensee management
	Licensee Action	Licensee corrective action	Licensee root cause evaluation and corrective action with NRC oversight	Licensee cumulative root cause evaluation with NRC oversight	Licensee performance improvement plan with NRC oversight		Licensee performance improvement & restart plan with NRC oversight
	NRC Inspection	Risk-informed baseline inspection program	Baseline and supplemental inspection (IP 95001)	Baseline and supplemental inspection (IP 95002)	Baseline and supplemental inspection (IP 95003)		Baseline and supplemental as practicable; Special inspections per restart checklist.
	Regulatory Actions[2]	None	Supplemental inspection only	Supplemental inspection only; Plant discussed at AARM if conditions met	10 CFR 2.204 DFI; 10 CFR 50.54(f) letter; CAL/Order; Plant Discussed at AARM	Order to modify, suspend, or revoke license; Plant discussed at AARM	CAL/Order requiring NRC approval for restart; Plant discussed at AARM
COMMUNICATION	Assessment Letters	Branch Chief or Division Director reviews and signs assessment letter w/ inspection plan	Division Director reviews/signs assessment letter w/ inspection plan	Regional Administrator reviews/signs assessment letter w/ inspection plan	Regional Administrator reviews/signs assessment letter w/ inspection plan		N/A. RA or 0350 Panel Chairman review/ sign 0350-related correspondence
	Annual Involvement of Public Stakeholders	Various public stakeholder options involving the senior resident inspector or Branch Chief	Various public stakeholder options involving the BC or DD	Regional Administrator or designee discusses performance with senior licensee management	EDO/DEDO or designee discuss performance with senior licensee management		N/A. 0350 Panel Chairman conducts periodic public status meetings
	External Stakeholders[3]	None	State Governors	State Governors, DHS, Congress	State Governors, DHS, Congress	State Governors, DHS, Congress	
	Commission Involvement	None	None	Possible Commission meeting if licensee remains for 3 years	Commission meeting with senior licensee management within 6 months.[4]	Commission meeting with senior licensee management	Commission meetings as requested; Restart approval in some cases.
	INCREASING SAFETY SIGNIFICANCE →						

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Reactors Under Construction

- cROP (Construction Reactor Oversight Program)
- Oversight of new reactor construction mimics ROP; described in IMC 2505
- Inputs are inspection findings; no Performance Indicators
- Construction Significance Determination Process is used to conclude significance of inspection findings
- Performance assessment using Construction Action Matrix

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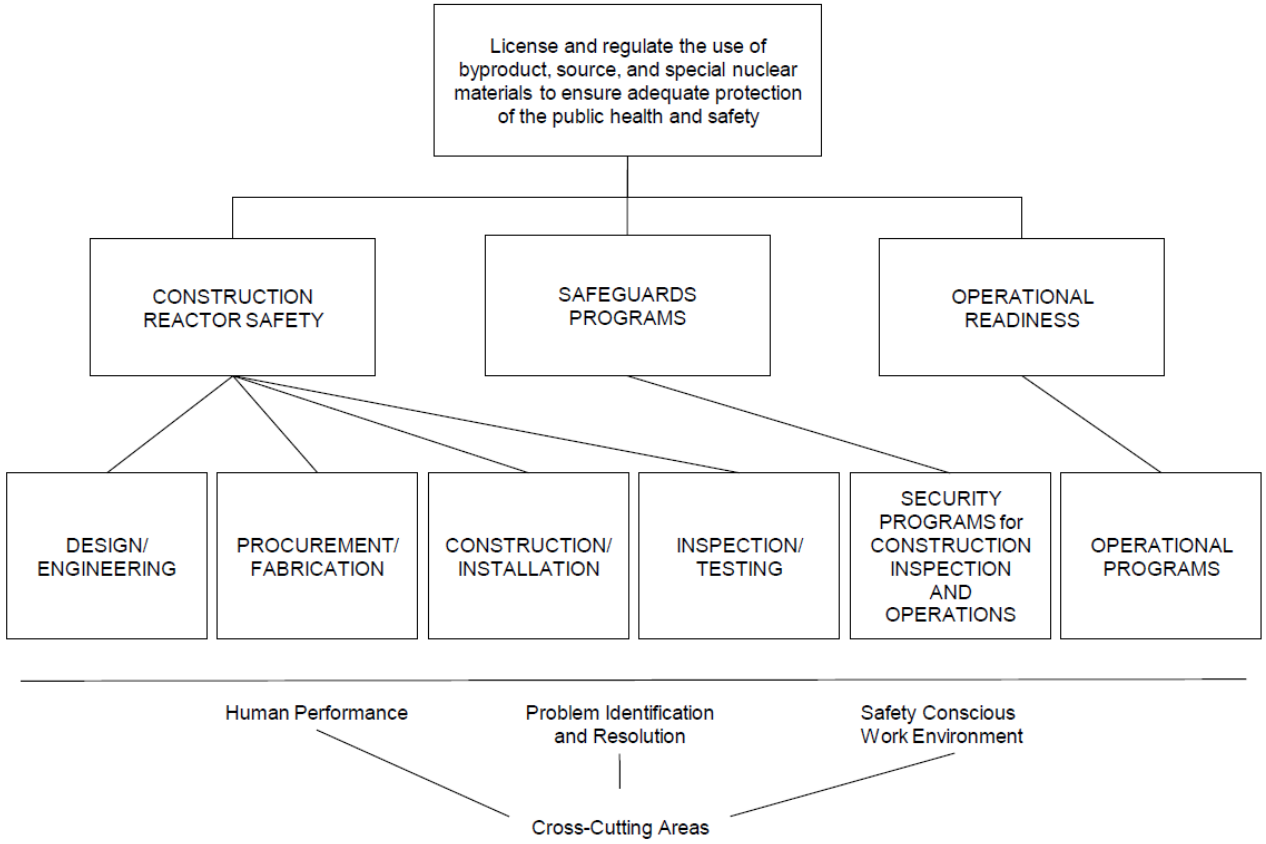
Regulatory Framework - Construction



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Construction Action Matrix

EXHIBIT 2 - Construction Action Matrix

		Licensee Response Column (Column 1)	Regulatory Response Column (Column 2)	Degraded Performance Column (Column 3)	Multiple/ Repetitive Degraded Cornerstone Column (Column 4)	Unacceptable Performance Column (Column 5)
RESULTS		All Inspection Findings Green; Cornerstone Objectives Fully Met	One or Two White Findings in a strategic performance area; Cornerstone objectives met with minimal degradation in safety performance	One degraded cornerstone (3 white findings or 1 yellow finding) or any 3 white findings in a strategic performance area; Cornerstone objectives met with moderate degradation in safety performance	Repetitive degraded cornerstone, multiple degraded cornerstones, multiple yellow findings, or 1 red finding; Cornerstone objectives met with longstanding issues or significant degradation in safety performance	Overall unacceptable performance; Construction suspended in the area of concern
RESPONSE	Regulatory Performance Meeting	None	BC or DD Meet with Licensee	RA/DRAC (or Designee) Meet with Senior Licensee Management.	EDO/DEDO (or Designee) meet with Senior Licensee Management	EDO/DEDO (or Designee) Meet with Senior Licensee Management
	Licensee Action	Licensee Corrective Action	Licensee Root cause Evaluation and corrective action with NRC Oversight	Licensee cumulative root cause evaluation with NRC Oversight	Licensee Performance Improvement Plan with NRC Oversight	Licensee Performance Improvement Plan / Construction Restart Plan with NRC Oversight
	NRC Inspection	Risk-Informed Baseline Inspection Program	Baseline and supplemental inspection procedure 90001	Baseline and supplemental inspection procedure 90002	Baseline and supplemental inspection procedure 90003	Baseline and Supplemental as Practicable, Plus Special Inspections per Construction Restart Checklist.
	Regulatory Actions[1]	None	Supplemental inspection only	Supplemental inspection only Plant Discussed at AARM if Conditions Met	-10 CFR 2.204 DFI -10 CFR 50.54(f) Letter - CAL/Order Plant Discussed at AARM	Order to Modify, Suspend, or Revoke Licensed Activities Plant Discussed at AARM
COMMUNICATION	Assessment Letters	BC or DD review/sign assessment letter (w/ inspection plan)	DD review/sign assessment letter (w/ inspection plan)	DRAC review/sign assessment letter (w/ inspection plan)	RA review/sign assessment letter (w/ inspection plan)	RA review/sign assessment letter (w/ inspection plan)
	Public Stakeholders	Various public stakeholder options (see section 12) involving the SRI or BC	Various public stakeholder options (see section 12) involving the BC or DD	RA/DRAC (or Designee) Discuss Performance with Senior Licensee Management	EDO/DEDO (or Designee) Discuss Performance with Senior Licensee Management	EDO/DEDO (or Designee) Discuss Performance with Senior Licensee Management
	External Stakeholders[2]	None	State Governors	State Governors, DHS, Congress	State Governors, DHS, Congress	State Governors, DHS, Congress
	Commission Involvement	None	None	Possible Commission Meeting	Commission Meeting with Senior Licensee Management Within 6 mo.[3]	Commission Meeting with Senior Licensee Management
	INCREASING SAFETY SIGNIFICANCE→					

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Fuel Facilities Oversight

- IMC 2600, “Fuel Cycle Facility Operational Safety and Safeguards Inspection Program”
  - Core Inspections, including Resident Inspections where applicable
  - Plant Specific Reactive Inspections
  - Plant Specific Supplemental Inspections
  - Generic Safety Issue Inspections
- Security inspections graded based on category of facility (Cat I, Cat II, Cat III

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Fuel Facilities Oversight

- Assessing Performance
  - Licensee Performance Reviews (LPR) – IMC 2604
  - Performance Areas
    - Safety operations
    - Safeguards
    - Radiological Controls
    - Facility Support
    - Other Areas

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Area Needing Improvement (ANI)

- Performance area with a single safety-significant or security-significant issue or significant recurring or cross-cutting issue(s), requiring substantive corrective actions or actions to prevent recurrence.
- Whether an ANI exists should be determined by assessing the significance of the plant issues and/or cited violations with a common cause or theme which indicate a need for additional focus by the licensee or NRC.
- In the identification of an ANI, the staff should evaluate the amount of inspection resources that should be recommended for the current or upcoming inspection schedule. Staff should discuss the types of inspections that may be necessary to address an ANI (i.e., additional hours to the inspection program, Problem Identification and Resolution (PI&R), Safety Culture inspection, etc.).

Assessment Public Meeting

Number of ANIs	LPR Public Meeting Led by:	NRC Senior Management
0	Branch Chief or designee	N/A
1	Branch Chief	Up to Division Director
2	Branch Chief	Up to Regional Administrator

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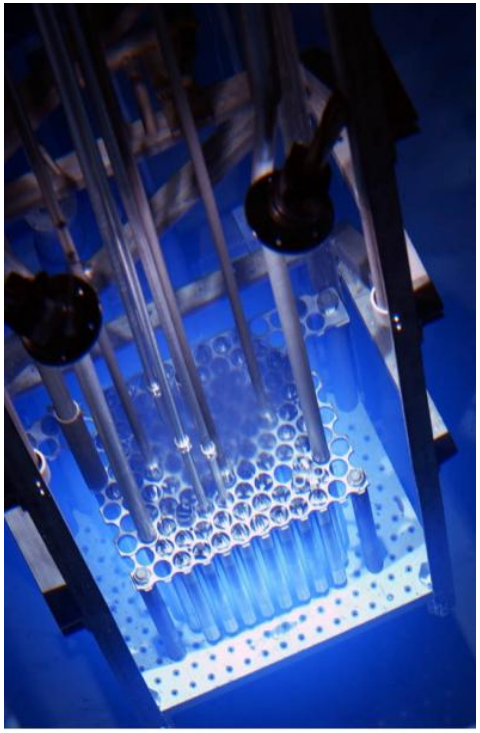
Research Reactors Inspection

- The NRC Inspection Manual Chapter 2545 provides guidance for the scheduling, conduct, and implementation of NRC inspections.
- Inspections
  - direct observations of licensed activities
  - interviews with personnel
  - review of facility records
  - focus on the observation of licensee activities important to safe and secure operation.
- The inspection process applies a graded approach to both safety and security inspection.
- In the case of security, the graded approach is based on the quantity, type (U-233, U-235, and Pu) and isotopic enrichment of the special nuclear material.



The TRIGA Reactor Core

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Research Reactors Inspection

- The NRC uses a graded approach in its inspection program, i.e., less frequent and detailed inspections at facilities that pose a lower risk.
- There are two types of inspection programs for operating research and test reactors:
  - For reactors licensed to operate at power levels of 2 megawatts or greater, the inspection program is completed annually.
  - For reactors licensed to operate at power levels below 2 megawatts, the inspection program is completed every two years.

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Research Reactors Security Inspections

- For Cat I RTRs, the safeguards portion of the inspection program will be completed annually.
- For Cat II RTRs, the safeguards portion of the inspection program will be completed biennially.
- For Cat III RTRs, the safeguards portion of the inspection program will be completed triennially.

Note: Each site is routinely visited (at least annually) by inspectors for security or other types of inspections (i.e. safety, health physics)

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Decommissioning Oversight

- The overall inspection effort is divided into functional area assessments to inspect licensee performance, identify performance trends, preclude problems, identify weaknesses, and foster corrective actions to contribute to public health and safety and the protection of the environment during the decommissioning process.
  - Plant Status
  - Modifications, Maintenance, and Surveillance
  - Problem Identification and Resolution
  - Radiation Protection

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Decommissioning Oversight

- Core inspections = routine inspections
- Discretionary inspections = reactive inspections
- The scope and frequency of inspections specified in the site-specific master inspection plan should be based on licensee performance, staffing plans, effectiveness of management oversight and contractor control, and the timing and scheduling of significant decommissioning activities.
- Reduced EP and security requirements

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Enforcement

- SDP (Greater-than-Green = escalated enforcement)
- Traditional enforcement
  - Non-cited violation (Green, or SL IV)
  - Cited violation

With Corrective Action Program	No CAP
Failure to restore compliance	Failed to identify
Failure to place in CAP	Failed to correct
Repetitive & NRC identified	Repetitive
Willful	Willful

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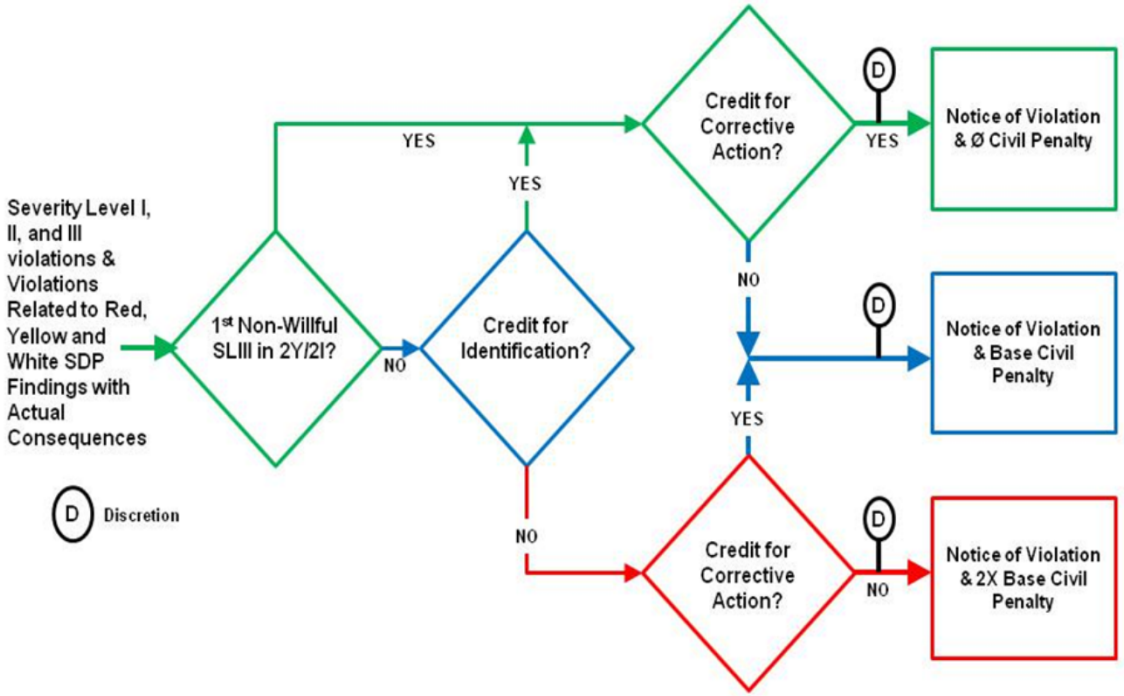
Enforcement

- Civil Penalties



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Communications

- Factors affecting type and frequency of communications
  - Licensee performance (Action Matrix)
  - Stakeholder engagement
  - Technical issues (alkali-silica reaction at Seabrook)
  - Event response

References

Contact

Dan Merzke – USNRC; 301-415-1457; Daniel.Merzke@nrc.gov

Internet…

- Inspection Manual (Chapters and Procedures)
  http://www.nrc.gov/reading-rm/doc-collections/insp-manual/

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References

- Reactor Oversight Process
  - NUREG-1649, “Reactor Oversight Process”
  - IMC 0308, “Reactor Oversight Process (ROP) Basis Document”
- Performance Indicators
  - IMC 0608, “Performance Indicator Program”
  - NEI 99-02, “Regulatory Assessment Performance Indicator Guideline”
- Inspection Program
  - IMC 2515, “Light-Water Reactor Inspection Program -- Operations Phase”
  - IMC 0612, Appendix B, “Issue Screening”
- Significance Determination Process
  - IMC 0609, “Significance Determination Process”
- Assessment Program
  - IMC 0305, “Operating Reactor Assessment Program”

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References

- Fuel Facility Oversight
  - IMC 2600, “Fuel Cycle Facility Operational Safety and Safeguards Inspection Program”
  - IMC 2604, “Licensee Performance Review”
- Research Reactors
  - IMC 2545, “Research and Test Reactor Inspection Program”
- Decommissioning Power Plants
  - IMC 2561, “Decommissioning Power Reactor Inspection Program”

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Materials Oversight

- IMC 2800, "Materials Inspection Program"
  - Inspection program for licensees authorized to possess, use, transfer, and dispose of radioactive material associated with various types of use, i.e., industrial, academic, research and development, manufacturing, distribution, irradiators, well logging, industrial radiography, medical programs, various types of service (i.e., leak testing of sealed sources, calibration of instruments, servicing of devices, collection and repackaging of radioactive waste for final disposal), and transportation.
  - Inspections generally performed on an unannounced basis.

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Materials Oversight

- Routine Inspections
  - Activities or program areas most commonly associated with measures that prevent overexposures, medical events, or release, loss, or unauthorized use of radioactive material
    - security and control of licensed material
    - shielding of licensed material
    - comprehensive safety measures
    - radiation dosimetry program
    - radiation instrumentation and surveys
    - radiation safety training and practices
    - management oversight
    - licensed activities performed by contracted personnel

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Materials Oversight

- Routine Inspections
  - If the inspector determines that the licensee did not meet the performance expectation for a given focus area, the inspector should conduct a more thorough review of that aspect of the licensee's program. The increased inspection effort may include additional sampling, determination of whether the licensee's procedures are appropriate, and a review of selected records maintained by the licensee documenting activities and outcomes.

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Materials Oversight

- Reactive Inspections
  - Inspections performed to follow up on incidents (e.g., medical event, overexposure, perceived concerns arising from a licensee's response to a generic letter or bulletin, loss or release of radioactive materials)
- Inspections After Escalated Enforcement
  - A special inspection that focuses on the licensee's corrective actions in response to Severity Level III or above violation(s).

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Materials Oversight

- The interval between inspections may be reduced (shortened) and inspections conducted more frequently than specified in the priority system on the basis of poor licensee performance. The main consideration in reducing the inspection interval should be evidence of moderate to severe problems in the licensee's radiation safety program.