

Fundamentals of Emergency Preparedness

National Radiological
Emergency Preparedness Conference
April 10, 2017

Presenters

- Robert Kahler, Branch Chief
- Todd Smith, EP Specialist
- NSIR/DPR/POB
 - Office of Nuclear Security & Incident Response
 - Division of Preparedness & Response
 - Policy and Oversight Branch



Agenda

- Role of the NRC in the Federal Government
- Introduction and History of EP at NRC
- EP Philosophy
- EP Regulations and Guidance
- EP Inspection Program and Enforcement
- FEMA and Offsite Preparedness



Role of the NRC in the Federal Government

Executive Branch

- Created to “execute” the law
- Run the day-to-day activities of the government
- Comprised of several different entities:
 - Executive Office of the President
 - Support staff and Councils
 - Executive departments
 - e.g., Department of State, Department of Defense
 - Independent agencies and government corporations
 - e.g., NRC, Tennessee Valley Authority (TVA)
 - Quasi-Official agencies
 - e.g., Smithsonian Institution



Departments

- Heads of executive departments are members of Cabinet
- Cabinet members appointed by President
 - Confirmed by simple majority of Senate
- Cabinet members serve for that President while in office
 - President can remove member without consulting Senate
- These departments are sensitive to political factors and partisan politics
- Examples



Independent Agencies

- Commissioners/Administrators typically appointed by President
 - Confirmed by simple Senate majority to fixed terms
 - President cannot remove from position
 - Requires act of Congress for removal
- Established and given authority and direction by Congress
 - Includes power of rulemaking
 - Matters too complex for ordinary legislation
- Agency rules (or regulations)
 - Authority derives from federal law
 - Code of Federal Regulations

Independent Agencies

- Not under direct control of President
 - Partisan politics have less effect on daily operations or policy
- Examples
 - National Aeronautics and Space Administration
 - Federal Communications Commission
 - National Transportation Safety Board
 - U.S. Postal Service
 - Peace Corps
 - Federal Reserve
 - Central Intelligence Agency
 - Social Security Administration
 - Nuclear Regulatory Commission



Atomic Energy Act of 1954

Made development of
commercial nuclear
energy possible

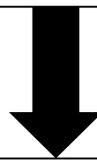


Atomic Energy Commission (AEC)

- development and production of nuclear weapons
- development and regulation of civilian uses of nuclear materials
- Sought to ensure public health and safety without inhibiting nuclear industry growth

Energy Reorganization Act of 1974

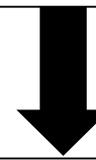
Addressed conflict of interest between
regulating & promoting nuclear power



Nuclear Regulatory Commission

(Independent agency)

- license and regulate civilian nuclear materials
 - may enter into agreements to delegate authority over some materials to states
- license and regulate civilian nuclear facilities
- does not regulate defense nuclear facilities



Department of Energy *(Cabinet agency)*

- development and production of nuclear weapons
- promotion of nuclear power
- other energy-related work

The Commission

- NRC headed by five Commissioners
 - President appoints Commissioners
 - Confirmed by Senate
 - Five-year terms
 - Term can be renewed
 - President designates one Commissioner as Chairman
 - Official Commission spokesperson
 - President can change Chairman designation at any time
 - President can not add or remove Commissioners without the consent of Congress
 - No more than 3 of the 5 Commissioners can be of the same political party
 - Policy decisions by the Commission require a majority vote



NRC Commissioners



**Chairman
Kristine L.
Svinicki**

Appointment:
June 2012
Term Ending:
June 2017



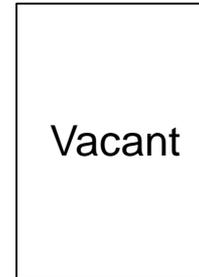
**Commissioner
Stephen G.
Burns**

Appointment:
November 2014
Term Ending:
June 2019



**Commissioner
Jeff
Baran**

Appointment:
January 2015
Term Ending:
June 2018



NRC Staff

- Approximately 3800 staff working at NRC HQ in Rockville, MD, four regional offices, and a training center:
 - Region I King of Prussia, PA
 - Region II Atlanta, GA
 - Region III Lisle, IL
 - Region IV Arlington, TX
 - Technical Training Center, Chattanooga, TN
- Directed by Executive Director for Operations (EDO)
 - carries out policies and decisions of Commission



Introduction and History of Emergency Preparedness

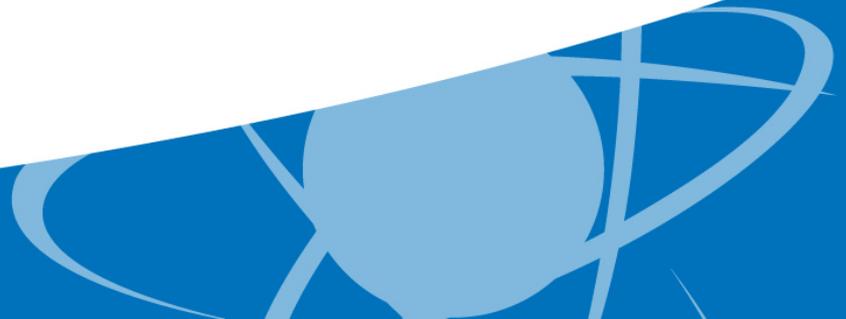
What is Emergency Preparedness?

Emergency preparedness is a state of readiness to respond to a potential radiological accident to protect the health and safety of the public and facility employees.



Why Prepare?

- Prudent
 - Prepare for emergency, regardless of likelihood
- Planning
 - Develop strategy with supporting infrastructure in place
- Training and practice
 - Develop and maintain responder expertise
- Examples:
 - Emergency Plan
 - NRC Incident Response Center
 - Fire drill



Emergency Preparedness

- The overall objective of EP at NRC is to ensure that there is reasonable assurance that adequate protective measures can and will be taken in the event of a radiological emergency
 - Reasonable Assurance finding is made before a nuclear facility is licensed
 - Inspected over the lifetime of that facility
- Meeting this objective requires adequate preparedness both onsite and offsite.



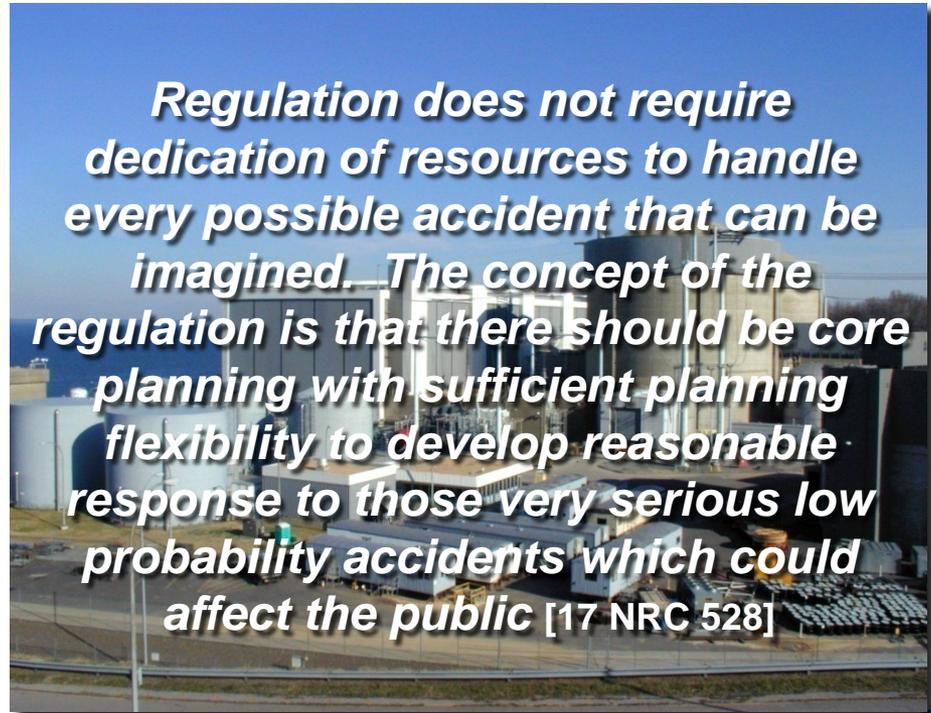
Emergency Preparedness

- ✓ is a defense-in-depth program
- ✓ is a last line of defense
- ✓ is not based on the probability of any accident occurring
- ✓ addresses a spectrum of potential accident events from anticipated operational transients through severe accidents
- ✓ requires constant state of readiness
- ✓ the scope and nature of the preparedness depends on the potential hazards presented by the class of facility



Regulations

- Establishes what are adequate measures
 - Planning
 - 10 CFR 50.47
 - 10 CFR 50.54
 - Appendix E
 - Supporting Guidance



Clarifications

- Focus on commercial nuclear power plants
 - (There are EP requirements for other NRC-licensed facilities.)
- EP is for **ALL** initiating events
 - Operational accident, natural disaster, or terrorist attack
 - Regardless of cause, EP objective is the same
 - Radiological consequences of hostile action can be no greater than operational reactor event
- EP and Incident Response are **NOT** the same
 - EP creates the response framework
 - Incident Response is the action itself
 - NRC role during Incident Response
 - Provide assistance and expertise
 - Evaluate licensee response
 - Interface with Federal family

History of EP Requirements

- 1958 – Atomic Energy Commission (AEC)
 - Outlines procedures for radiological emergency response
 - Emergency plans were vague, sketchy, and low in priority
 - Emphasis was placed on plant design adequacy
- 1966 – Advisory Committee on Reactor Safeguards (ACRS)
 - Raised concern regarding adequacy of emergency planning as plant size increased
- 1970 – AEC drafted guidelines for public comment
 - Existing requirements improved
 - New Appendix E to 10 CFR Part 50
 - Approved by Commission in December, 1970



History of EP Requirements

- 1970 – Appendix E to 10 CFR Part 50

ONSITE

- Assign duties and authorities of emergency response personnel
- Arrangements for working with local, State and Federal agencies to notify and evacuate the public
- Procedures for training personnel
- Conduct of drills and exercises



History of EP Requirements

- 1970 – Appendix E to 10 CFR Part 50

OFFSITE (licensees were responsible)

- Traffic Control
- Fire Protection
- Medical Support
- Decontamination
- Evacuation
 - Provide for transportation, shelter, food, sanitation



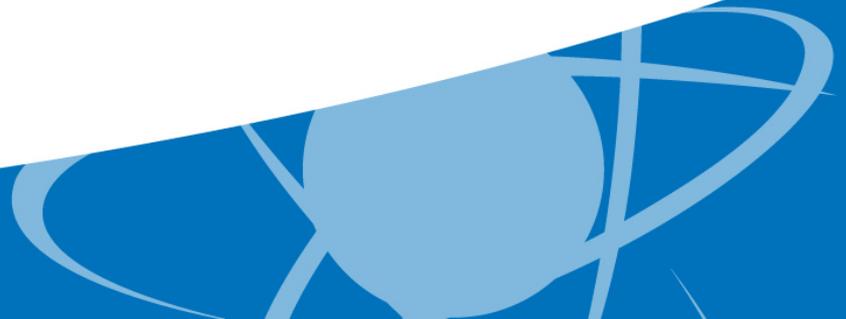
History of EP Requirements

- 1973 – AEC designated as lead agency for radiological emergency planning
 - AEC issues guidance to State and local governments
 - checklist of 154 items
 - Emphasized that emergency plans should cover most serious “design basis” accidents
- 1975 – January 19th
 - Nuclear Regulatory Commission created
 - Focused attention on protecting public health and safety



History of EP Requirements

- 1977 – NRC publishes Regulatory Guide 1.101
 - Detailed information on emergency plan content
- 1978 – NRC-EPA task force developed
 - NUREG-0396 created
 - Emergency Planning Zones (EPZs) created
 - Spectrum of accidents (not the source term from a single accident sequence) should be considered in developing a basis for emergency planning



History of EP Requirements

- Creation of FEMA
 - Before 1979, emergency response activities were fragmented
 - 100+ federal agencies involved
 - Compounded complexity of federal disaster relief efforts
 - National Governor's Association asked President Jimmy Carter to centralize Federal emergency functions
 - 1979 executive order merged disaster-related responsibilities into a new Federal Emergency Management Agency (FEMA)



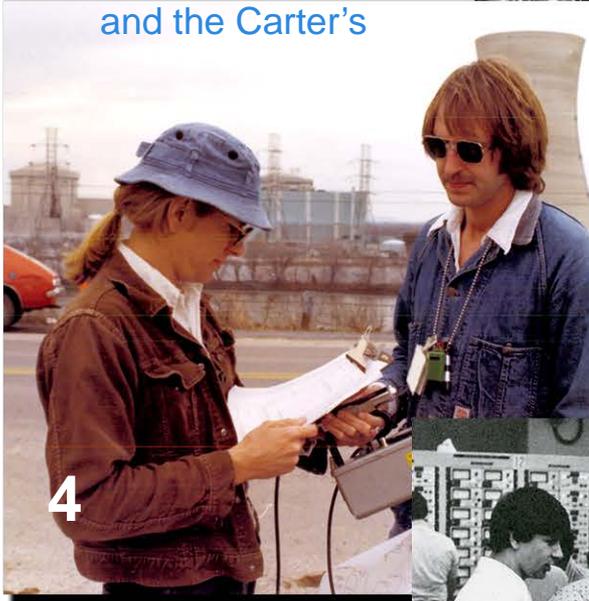
1. The "JIC"
2. Gov. Thornburg and Pres. Jimmy Carter
3. Harold Denton and the Carter's



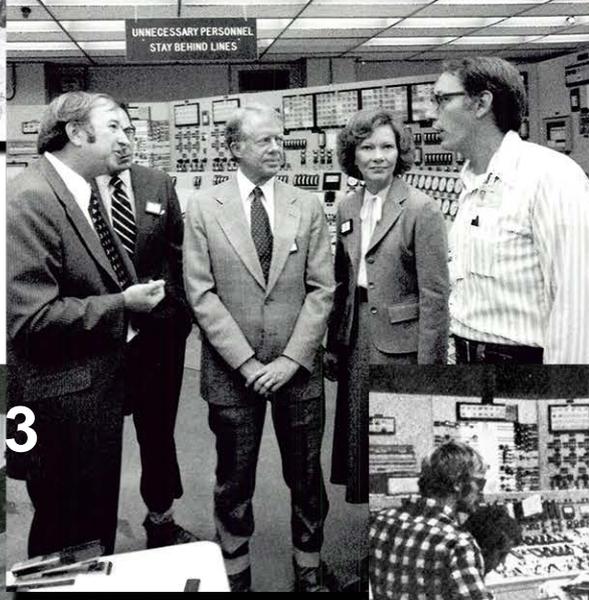
1



2



4



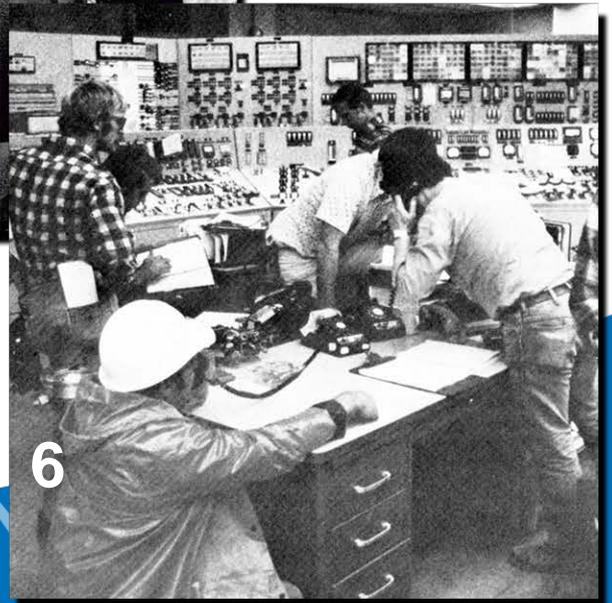
3



4. Rad Techs
5. Unit 2 CR (G. Miller plant mgr. on left)
6. Unit 2 Control Room



5



6

History of EP Requirements

- Post-Three Mile Island
 - General Accounting Office (GAO) recommends State/local emergency plans meet NRC guidelines
 - GAO urged adoption of EPZ concept
 - GAO called for measures to better inform the public
 - Kemeny Commission report (TMI investigation)
 - FEMA designated lead agency for offsite oversight
 - MOU delineating FEMA and NRC roles
 - NRC retained responsibility for judging whether or not the “overall state of emergency preparedness” was satisfactory for licensing, considering FEMA findings regarding offsite preparedness



History of EP Requirements

- 1980 – NRC authorization bill mandates stricter EP requirements
 - Licenses contingent on approved State/local plans
 - Concern State/local governments have veto authority
 - Congress declined to expand NRC’s authority to provide emergency plans for States that refused to cooperate
 - Legislation failed 3 times
 - Owners of existing plants had until April 1, 1981 to develop adequate plan



History of EP Requirements

- 1982 – FEMA finds State/local plans deficient for Indian Point Units 2 & 3
 - Westchester County evacuation uncertainties
 - Rockland County refusal to participate in drill
 - State of New York substituted for Rockland County
 - Commission voted 3-2 to allow operation
 - NRC staff discussed creation of 2-mile “prompt” action zone within EPZ
 - Congress did not approve



History of EP Requirements

- 1982 – Shoreham
 - Consultant concluded 10 mile EPZ was inadequate
 - 25% of residents would leave island
 - Suffolk County executive and New York governor refused to cooperate with emergency planning efforts
 - Long Island Lighting Co (LILCO) argued State/local agencies were misusing NRC's regulations
- 1986 – Seabrook
 - Controversy of evacuation/sheltering of beaches
 - Massachusetts refused to participate in exercise, would not prepare plans
 - Utility requested exemption to NRC's rules
 - Argued 2 mile EPZ was sufficient
- 1986 – Chernobyl

History of EP Requirements



Seabrook Siren Trucks

History of EP Requirements

- 1987 – Realism Rule
 - Allows issuance of license in the absence of State/local government cooperation **if**:
 - Applicant made good faith effort to obtain cooperation
 - Applicant prepared achievable emergency with “likely State or local response to an actual emergency”
 - Based on assumption that State/local governments would protect public during event

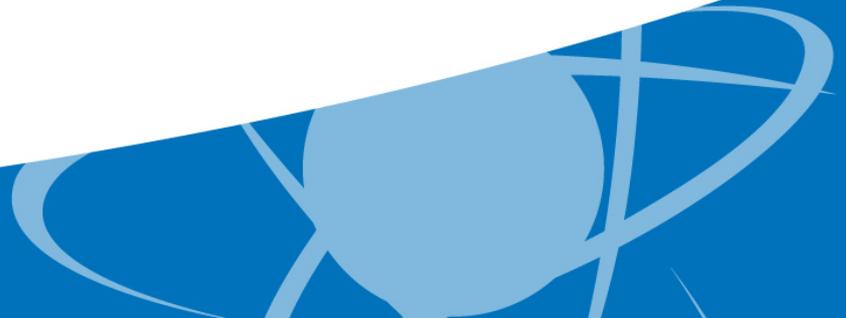


History of EP Requirements

- 1992 – Turkey Point & Hurricane Andrew
 - Clarified roles between NRC and FEMA
 - FEMA reasonable assurance determination
 - MC 1601, “Communication Protocol For Assessing Offsite Emergency Preparedness Following a Natural Disaster”
 - FEMA Disaster Initiated Reviews (DIR)
- 2000 – Reactor Oversight Process (ROP)
 - Emergency Preparedness is one of seven cornerstones

History of EP Requirements

- September 11th, 2001
 - NRC Operations Center activated for several months
- February 25th, 2002
 - Order issued to all nuclear power plants
 - Interim Compensatory Measures (ICM's)
 - Three emergency preparedness items



History of EP Requirements

- 2004
 - Need for larger focus and increased communication of EP
 - Created Division of Preparedness and Response in Nuclear Security and Incident Response (NSIR)
 - EP staff rose from ~10 to >30 HQ employees
- 2005
 - Bulletin 2005-02, “Emergency Preparedness and Response Actions for Security-Based Events”
 - Comprehensive review of EP regulations and guidance



History of EP Requirements

- March 11, 2011
 - Fukushima
 - Tsunami caused by earthquake damaged four reactor units
 - Core melt damage at three units
 - Offsite evacuations
 - NRC Ops Center activated 24/7 for two months
 - Near Term Task Force Recommendations
 - Plant modifications
 - EP to be enhanced to address multiple-unit events
- November 23, 2011
 - EP rule published in Federal Register
 - Effective date – December 23, 2011
 - Implementation dates vary by rulemaking topic

BREAK

NEXT

EP Philosophy



EP Philosophy

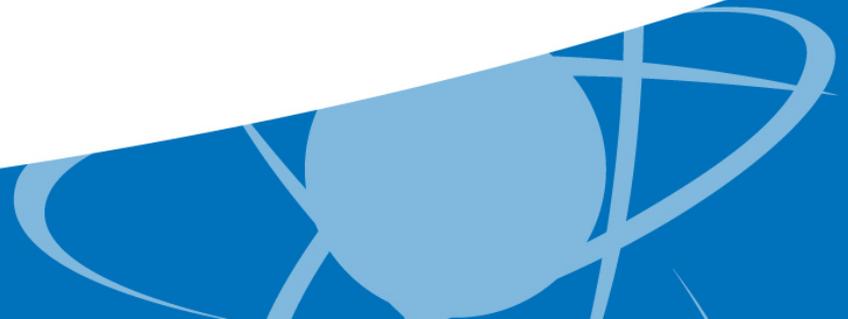
Topics:

- Defense-in-Depth
- Protective Action Guides
- Emergency Planning Zones
- Offsite EP concepts
- Emergency Response Facilities
- Onsite EP concepts
- Emergency plans
- Emergency classes
- Emergency Action Levels



Defense-in-Depth Safety Philosophy

- High quality design and construction
 - Design for maximum safety in normal operations
 - Provide protective safety systems to minimize damage, assuming upsets will occur
 - Provide additional safety system, assuming that some protective systems may fail simultaneously
- Redundant and diverse safety systems
- Containment structures
- Emergency planning



Planning:

- reduces complexity of decision making during an emergency
- simplifies choice of possible responses
- removes non-viable alternatives from consideration during the response





Protective Action Guides

Protective Action Guide (PAG) is the projected dose from unplanned release at which a specific protective action to reduce or avoid dose is recommended

- Used as guidance for triggering appropriate protective actions to minimize dose
- Balances the benefit of dose reduction against the risks of implementing the action
- At PAG levels, no health effects detectable, even for sensitive populations, such as pregnant women



Protective Action Guides

- Established by the EPA and FDA
- Current guidance: EPA-400, January 2017
- Based on *projected* dose
 - does not count dose already received
- PAGs are not “bright lines” and circumstances may warrant a lower or higher action level



Plume Exposure Pathway EPZ

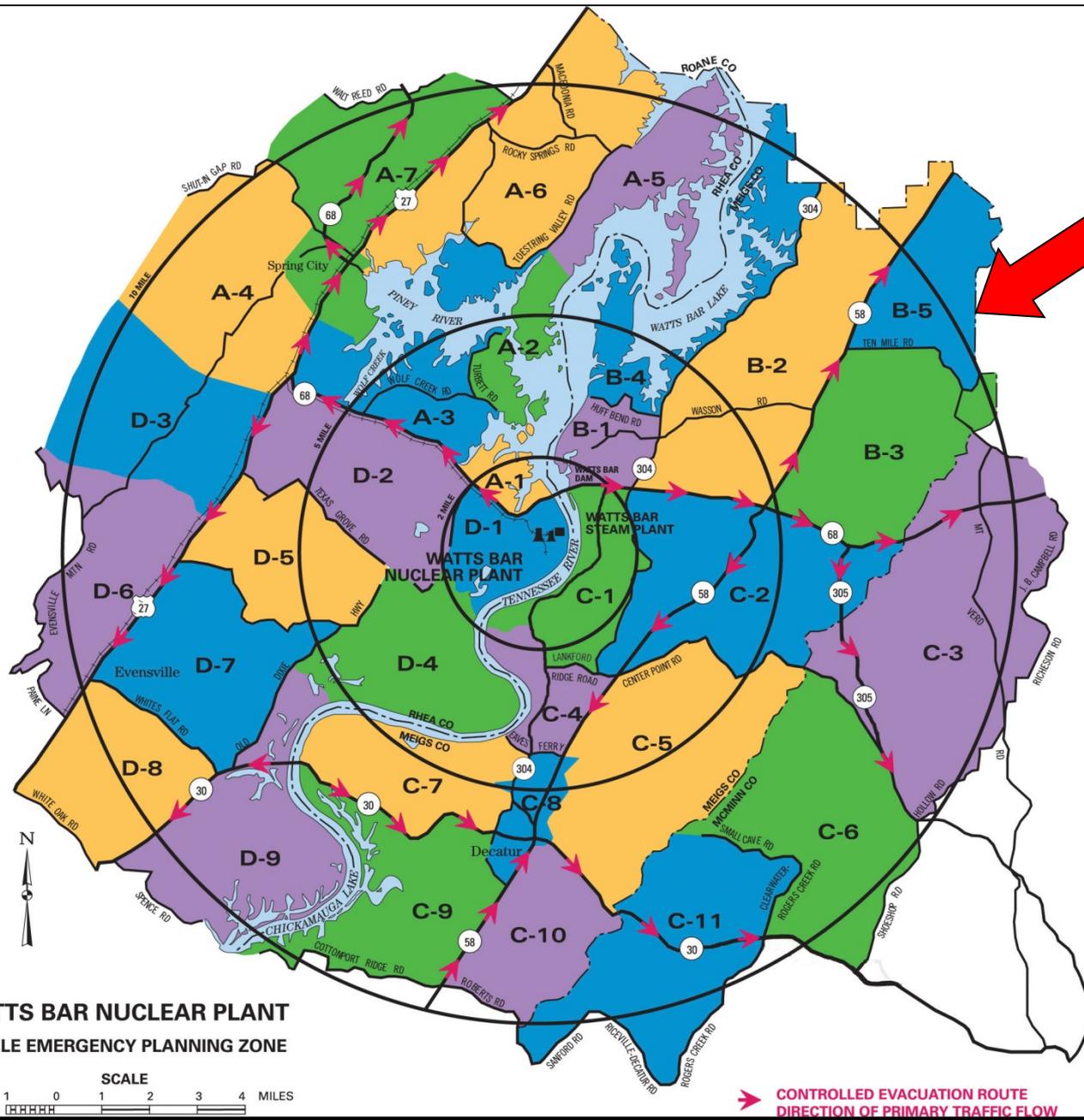
- Area requiring immediate protective actions
- Approximately 10 miles in radius
- Size based upon:
 - Projected doses from most severe accidents do not exceed EPA PAGs outside EPZ
 - Detailed planning in 10 mile EPZ provides substantial base for expansion, should it be necessary



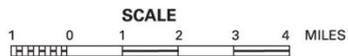
10-mile radius

Note that the EPZ can be slightly larger or smaller than 10-miles to take advantage of recognizable geopolitical boundaries

EPZ may be divided into subzones defined by geopolitical boundaries or topography that are easily recognizable to the public



WATTS BAR NUCLEAR PLANT
10 MILE EMERGENCY PLANNING ZONE



➔ CONTROLLED EVACUATION ROUTE
➔ DIRECTION OF PRIMARY TRAFFIC FLOW

Plume Exposure Pathway EPZ

- Response capabilities within EPZ
 - Prompt decision making for public protective actions
 - Development of evacuation plans
 - Public information program
 - Prompt public alerting and notification
 - 24/7 communication capability with State/local officials
 - Monitoring of offsite radiological release
 - Activating & maintaining emergency operations centers



Ingestion Exposure Pathway EPZ

- Protect from consumption of contaminated food
 - Considerable time to act (typically State level)
- Approximately 50 miles in radius
 - Size based upon:
 - Contamination will not exceed PAGs beyond 50 miles
 - Particulate material would be deposited within 50 miles
 - Likelihood of exceeding ingestion PAGs at 50 miles is comparable to exceeding plume exposure PAGs at 10 miles



Licensee Emergency Response Facilities (ERFs)*

- Control Room (CR)
- Technical Support Center (TSC)
- Operations Support Center (OSC)
- Emergency Operations Facility (EOF)
- Alternate facility(ies)
- Joint Information Center (JIC)

*actual facility names may vary from site to site

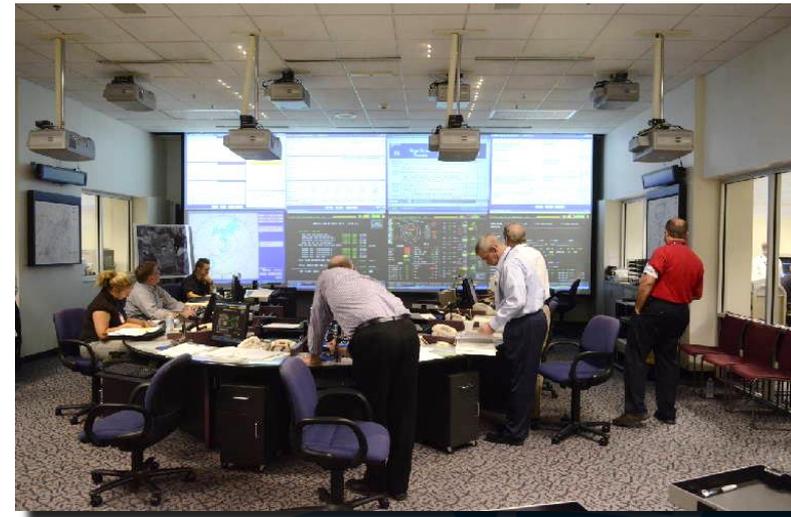
Control Room

- Initial Emergency Response Functions
- Emergency Declaration
- Offsite Notifications
- PAR, if needed
- Augmented at Alert
- Mitigate Accident and Consequences



Technical Support Center

- TSC reduces congestion and confusion in Control Room (CR)
- Located near CR for ready access
- Monitor, diagnose, and mitigate
 - Access to technical data
 - Access to plant instrumentation
 - Engineering support for CR
 - Onsite Radiological Monitoring
- Habitability
- Reliable power



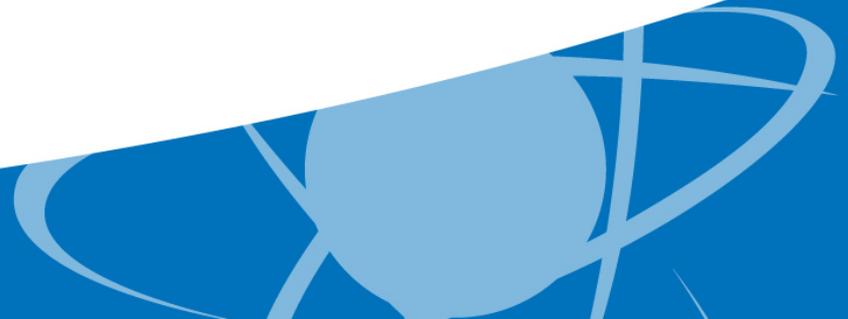
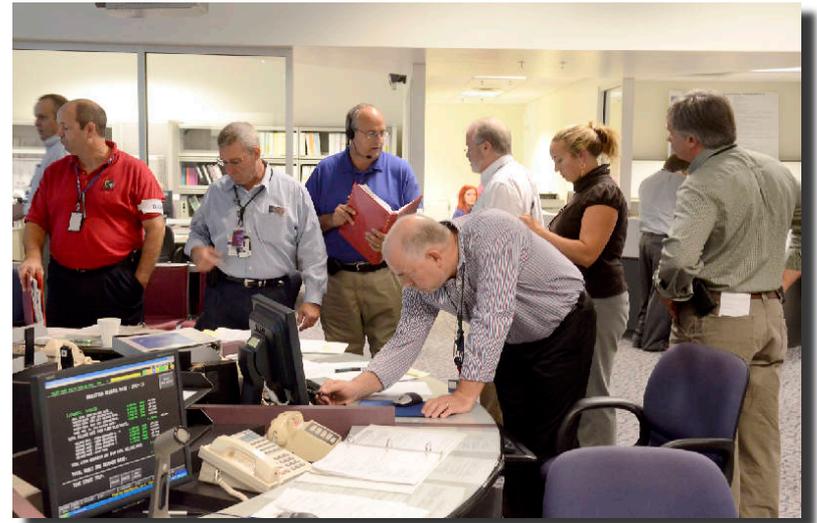
Operations Support Center

- OSC reduces congestion and confusion in Control Room
- Emergency response craft personnel
 - coordination by operations staff and TSC
- Coordination of damage control teams
- Health Physics briefings



Emergency Operations Facility

- EOF interfaces with offsite agencies; outward focus
- Response functions
 - Emergency Director
 - Communications
 - Public information
 - Accident analysis
 - Dose assessment
 - Offsite monitoring
 - PAR development/decisions
 - State and county liaisons
 - Support to TSC



Joint Information Center Joint Information Systems

- Coordinates dissemination of public information
- State/county liaisons
- Media liaisons
- Media briefings and news conferences



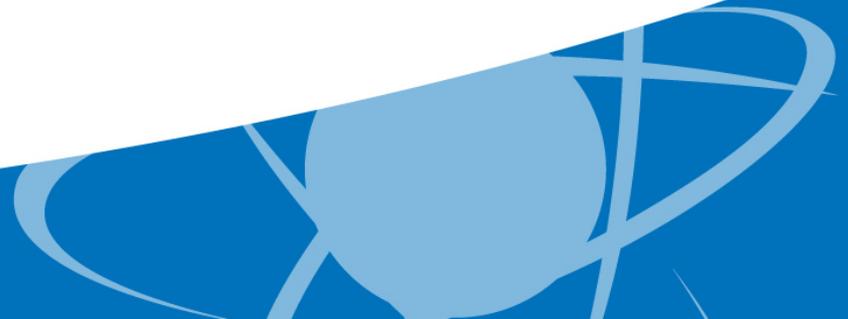
Emergency Classifications

- Provide a basis for a progressive response to an event
- Four classification levels
 - Unusual Event (UE)
 - Alert
 - Site Area Emergency (SAE)
 - General Emergency (GE)



Unusual Event Definition

- Events are in progress or have occurred which indicate a ***potential degradation of the level of safety of the plant*** or indicate a security threat to facility protection.
- No release expected



Alert Definition

- Events are in progress or have occurred which involve actual or potential ***substantial degradation of the level of safety of the plant*** or a security event that involves probable life threatening risk to site personnel or damage to site equipment because of malicious dedicated efforts of a hostile act.
- Any release is expected to be a small fraction of EPA PAG levels



Site Area Emergency Definition

- Events are in progress or have occurred which involve actual or likely ***major failures of plant functions needed for protection of the public*** or security events that result in intentional damage or malicious acts: (1) toward site personnel or equipment that could lead to the likely failure of, or; (2) prevents effective access to, equipment needed for the protection of the public.
- Any release is not expected to exceed EPA PAG levels near the site boundary

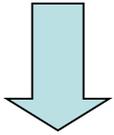
General Emergency Definition

- Events are in progress or have occurred which involve an actual or imminent ***substantial core degradation or melting with the potential for loss of containment integrity*** or security events that result in an actual loss of physical control of the facility.
- Releases can be reasonably expected to exceed EPA PAG levels offsite
- NOTE: a GE does **NOT NECESSARILY** mean that a release is in progress

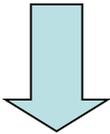


Flow of Events

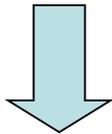
- Initiating Conditions



- Emergency Action Levels



- Emergency Classifications



- Offsite Actions, if necessary



Initiating Condition

An event or condition that corresponds with the definition of one of the four emergency classification levels

- An IC can be expressed by:
 - Measurable parameter (RCS temperature)
 - Event (fire, flood, security)
 - Barrier breach
 - Fuel
 - RCS
 - Containment



Emergency Action Level

A predetermined, site-specific, observable threshold for an IC that, when met or exceeded, places the plant in a given emergency classification level

- One or more EALs for each IC
 - EALs may utilize:
 - Instrument readings or status indications
 - Observable events
 - Results of calculations or analyses
 - Entry into particular plant procedures
 - Occurrence of natural phenomena



Excerpt of Typical EAL Scheme

ECL: General Emergency

AGI

Initiating Condition: Release of gaseous radioactivity resulting in offsite dose greater than 1000 mrem TEDE or 5000 mrem thyroid CDE

Operating Mode Applicability: All

Emergency Action Levels (1 or 2 or 3)

- (1) Reading on radiation monitor HVS-RM-1001A greater than 15,000 CPM for 15 minutes or longer.
- (2) Dose assessment using actual meteorology indicates doses greater than 1000 mrem TEDE or 5000 mrem thyroid CDE
- (3) Field survey results indicate greater than 1000 mrem/hr expected to continue for 60 minutes

Basis:

Facility Staffing vs Classification

| | UE | Alert | SAE | GE |
|----------|---------------------------|---|---|--------------------------|
| ERO | On-shift staff | Augmented | Augmented | Augmented |
| Facility | Control Room (control) | TSC/OSC (turnover/control) EOF (staffing) | TSC/OSC (control) EOF (turnover/control) | TSC/OSC/EOF (control) |
| ORO | Notified | Staffing | Preliminary Protective Actions | Protective Actions |

BREAK

NEXT

EP Regulations and Guidance

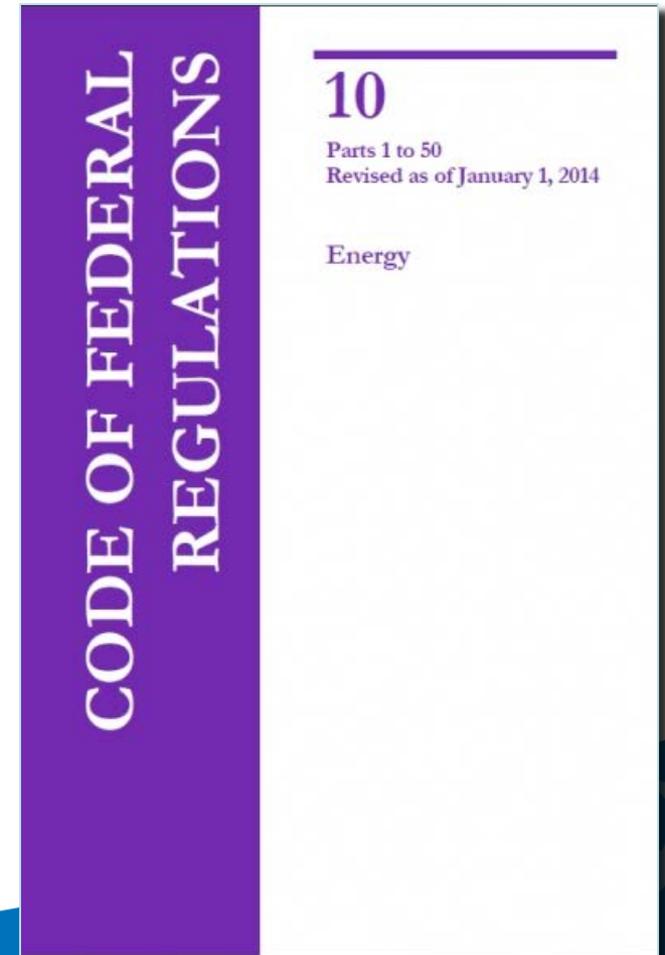


EP Regulations and Guidance

EP Regulations

Title 10, Code of Federal Regulations, Part 50

- 10 CFR 50 Appendix E
- 10 CFR 50.47(b)
-- the 16 planning standards
- 10 CFR 50.54(q)
- 10 CFR 50.54(t)
- 10 CFR 50.72



10 CFR 50 Appendix E

Emergency Planning and Preparedness for Production and Utilization Facilities”

- Contains requirements for emergency plans for all applications under Part 50 and Part 52
 - Binding on license applicants and licensees
- Invokes the planning standards in §50.47(b) for power reactors, and contains **supporting requirements**
- Emergency plans are a part of power reactor applicant’s Final Safety Analysis Report (FSAR), Chapter 13

10 CFR 50.47(b)

- 16 Planning Standards
 - Must be met in licensee and State and local emergency plans
 - Planning standards applicable to OROs provided in 44 CFR 350.5
 - High-level, broadly worded set of standards
 - Supplemented by requirements in Appendix E
 - Supporting guidance in NUREG-0654/FEMA-REP-1 and FEMA REP Manual
 - Power reactor sites only



10 CFR 50.47(b)(1)

Primary responsibilities for emergency response by the nuclear facility licensee and by State and local organizations within the EPZs have been assigned, emergency responsibilities of the various supporting organizations have been specifically established, and each principal response organization has staff to respond and to augment its initial response on a continuous basis.

- **Translated:**
 - Responsibilities for onsite/offsite personnel/organizations are established to support 24/7 coverage
- **Examples:**
 - Emergency response organizational chart
 - Position descriptions



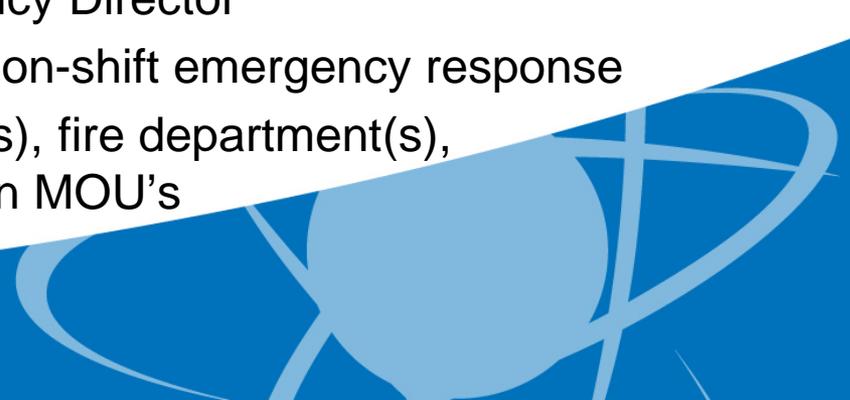
10 CFR 50.47(b)(2)

On-shift facility licensee responsibilities for emergency response are unambiguously defined, adequate staffing to provide initial facility accident response in key functional areas is maintained at all times, timely augmentation of response capabilities is available and the interfaces among various onsite response activities and offsite support are specified.

- **Translated:**

- Transition from normal duties to emergency responsibilities; ensuring sufficient on-shift emergency staff at all times; timely augmentation of on-shift staff; and identifying offsite emergency resources

- **Examples:**

- Shift Manager becomes Emergency Director
 - Shift staffing schedule to support on-shift emergency response
 - Identify local ambulance agency(s), fire department(s), police, hospital(s), etc., and obtain MOU's
- 

10 CFR 50.47(b)(3)

Arrangements for requesting and effectively using assistance resources have been made, arrangements to accommodate State and local staff at the licensee's near-site EOF have been made, and other organizations capable of augmenting the planned response have been identified.

- **Translated:**

- Federal, State, and local governmental assistance is arranged with space available in EOF for their response and other technical organizations as needed by the plan

- **Examples:**

- | | |
|------------------------|---------------------|
| ■ INPO | ■ State Officials |
| ■ Utility Owners Group | ■ Local Officials |
| ■ Coast Guard | ■ Federal Officials |

10 CFR 50.47(b)(4)

A standard emergency classification and action level scheme, the bases of which include facility system and effluent parameters, is in use by the nuclear facility licensee, and State and local response plans call for reliance on information provided by facility licensees for determinations of minimum initial offsite response measures.

- ***Translated:***
 - Ability to classify an emergency via a standard scheme
- ***Examples:***
 - Emergency Action Levels
 - ORO Standard Operating Plans (SOPs) entry conditions

10 CFR 50.47(b)(5)

Procedures have been established for notification, by the licensee, of State and local response organizations and for notification of emergency personnel by all organizations; the content of initial and follow-up messages to response organizations and the public have been established; and the means to provide early notification and clear instruction to the populace within the plume exposure pathway EPZ have been established.

- **Translated:**
 - Capability to provide notification and response instructions to onsite/offsite emergency response personnel and the public.
- **Examples:**
 - Call out list
 - Notification Forms
 - EAS Messages
 - Alert and Notification Systems (ANS)
 - Tone Alert Radios

10 CFR 50.47(b)(6)

Provisions exist for prompt communications among principal response organizations to emergency personnel and to the public

- ***Translated:***
 - Have plans for contacting all necessary OROs and emergency personnel
- ***Examples:***
 - Pagers, Cell Phones, Blackberries
 - NRC Emergency Notification System
 - Direct ringdown phones from licensee to counties/States



10 CFR 50.47(b)(7)

Information is made available to the public on a periodic basis on how they will be notified and what their initial actions should be in an emergency, the principal points of contact with the news media for dissemination of information during an emergency are established in advance, and procedures for coordinated dissemination of information to the public are established.

- **Translated:**
 - Information on nuclear power plant emergencies shall be provided annually to the general public and the media
- **Examples:**
 - JICs
 - Phone Books
 - Annual Mailers, Calendars
 - Annual Media Training

10 CFR 50.47(b)(8)

Adequate emergency facilities and equipment to support the emergency response are provided and maintained.

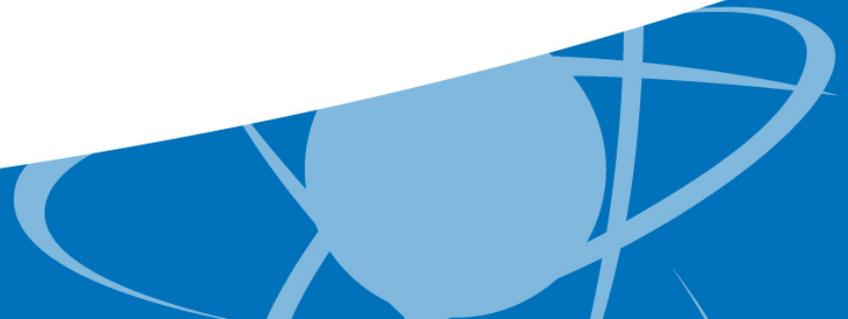
- ***Translated:***
 - Provide and maintain all facilities and equipment necessary to support emergency response at all times.
- ***Examples:***
 - TSC, EOF, OSC, EMAs
 - Air Samplers, Computers, FAX machines, UPS
 - Met towers



10 CFR 50.47(b)(9)

*Adequate methods, systems, and equipment for **assessing and monitoring actual or potential offsite consequences of a radiological emergency condition** are in use.*

- ***Translated:***
 - Ability to monitor and assess radiological release
- ***Examples:***
 - Dose modeling software
 - Radiation monitors
 - Field monitoring teams



10 CFR 50.47(b)(10)

A range of protective actions has been developed for the plume exposure pathway EPZ for emergency workers and the public. In developing this range of actions, consideration has been given to evacuation, sheltering and as a supplement to these, the prophylactic use of potassium iodide as appropriate. Evacuation time estimates have been developed by applicants and licensees. Licensees shall update the evacuation time estimates on a periodic basis. Guidelines for the choice of protective actions during an emergency, consistent with Federal guidance, are developed and in place, and protective actions for the ingestion exposure pathway EPZ appropriate to the locale have been developed.

- **Translation:**

- Have a set of preplanned protective actions (that must consider evacuation and sheltering – potassium iodide is a possible supplement, but not a replacement) that can be implemented based on radiological conditions for both EPZs

- **Examples:**

- Evacuation sector maps
- Onsite Assembly Areas
- List of Dairy Farms within 50 miles



10 CFR 50.47(b)(11)

Means for controlling radiological exposures, in an emergency, are established for emergency workers. The means for controlling radiological exposures shall include exposure guidelines consistent with EPA Emergency Worker and Lifesaving Activity Protective Action Guides.

- ***Translated:***

- Have a plan for protecting and directing plant personnel that must respond to radiological hazards during an emergency and base it on the EPA guidance

- ***Examples:***

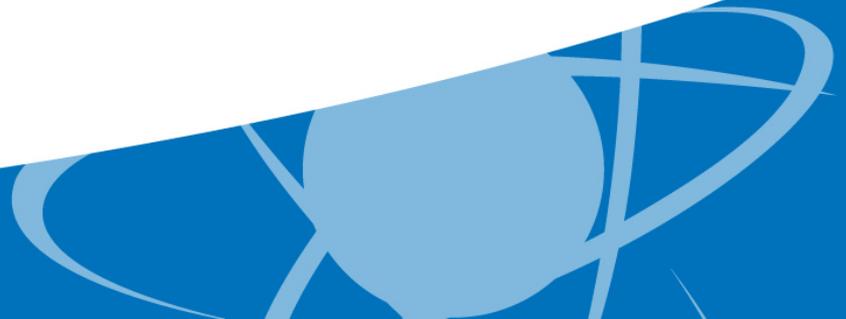
- Life-saving dose levels identified and who can authorize entry
- Emergency worker dosimetry both onsite and offsite



10 CFR 50.47(b)(12)

*Arrangements are made for **medical services for contaminated injured individuals.***

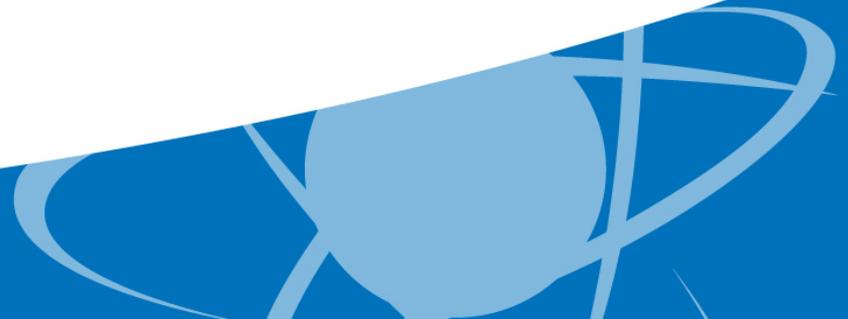
- ***Translated:***
 - Arrangements made with ambulance and hospitals responsible for contaminated personnel
- ***Examples:***
 - Evaluated drills with ambulance and hospital personnel
 - Onsite emergency medical squads



10 CFR 50.47(b)(13)

General plans for recovery and reentry are developed.

- ***Translated:***
 - Create a framework for recovering from an emergency
- ***Examples:***
 - Event termination and/or de-escalation criterion pre-established in the emergency plan



10 CFR 50.47(b)(14)

Periodic exercises are (will be) conducted to evaluate major portions of emergency response capabilities, periodic drills are (will be) conducted to develop and maintain key skills, and deficiencies identified as a result of exercises or drills are (will be) corrected.

- ***Translated:***

- Evaluated and training exercises/drills are conducted to identify and correct weaknesses and maintain proficiency

- ***Examples:***

- Onsite ERO drills
- Biennial Evaluated Exercise (FEMA)
- Licensed Operator Requal (LOR) Drills
- Fire Drills
- Critiques



10 CFR 50.47(b)(15)

Radiological emergency response training is provided to those who may be called on to assist in an emergency.

- ***Translated:***

- Training to onsite and offsite emergency response personnel

- ***Examples:***

- Fire department training on decontamination efforts
- Classroom training on classifying emergencies



10 CFR 50.47(b)(16)

*Responsibilities for **plan development and review** and for distribution of emergency plans are established and **planners are properly trained**.*

- **Translation:**
 - An emergency planning department is established with qualified personnel
- **Examples:**
 - Initial and continuous training of EP department staff
 - Annual review of emergency plan



10 CFR 50.54(q)*

- §50.54, Conditions of Licenses
 - Requirements on every reactor licensed under Part 50 or Part 52
- §50.54(q), Emergency Plan
 - §50.54(q)(1) defines terminology used in the rule
 - §50.54(q)(2) states that licensees shall **follow** and **maintain the effectiveness** of emergency plans which meet the requirements in Appendix E, and for power reactors, the planning standards of §50.47(b)

*Most EP violations are cited against §50.54(q)



10 CFR 50.54(q)

- §50.54(q)(3) and (4) provide a process enabling licensees to make certain changes to emergency plan without prior NRC approval as long as it does not:
 - represent a **Reduction in Effectiveness** (RIE) of the plan, and,
 - the plan continues to meet the **requirements in Appendix E**, and for power reactors, the **planning standards of §50.47(b)**
- Changes that do not meet these criteria must be submitted for prior NRC review as a license amendment



10 CFR 50.54(t)

- Periodic review of licensee's EP program
- Conducted by persons having no direct responsibility for implementation of Emergency Preparedness Program
- Evaluation of licensee's drills and exercises and emergency response capabilities
- Adequacy of interface with offsite agencies
- Results of review and recommendations are documented
 - Reported to management
 - Retained for 5 year period
 - Report is made available to State and local governments

10 CFR 50.72 - Notifications

- Emergencies
 - Notify NRC immediately following notification of State and local agencies and not later than one hour after declaration
 - NRC is not a first-responder
 - Immediately notify NRC of emergency class escalation
 - Maintain open line with NRC
- Non-emergency events
 - EP related eight hour report: 10 CFR 50.72(b)(3)(xiii)
 - Any event that results in a major loss of:
 - emergency assessment capability
 - offsite response capability
(e.g., alert and notification system)
 - offsite communications capability

EP Guidance

- Regulatory Guide 1.101
- Regulatory Guide 1.219
- NSIR/DPR-ISG-001
- NUREG-0654/FEMA-REP-1
- NUREG-0396 (EPA 520/1-78-018)
- NUREG-0696
- EAL Scheme Guidance

Regulatory Guide 1.101

Emergency Planning and Preparedness in Support of Nuclear Power Reactors

Issued to provide an acceptable method for licensee compliance with regulations for the content of emergency plans

- Revision 1 (1977)
 - Criteria for plans to cope with emergencies and serious accidents emphasized need for procedures to implement drills and exercises
- Revision 2 (1981)
 - Endorsed NUREG-0654/FEMA-REP-1
- Revision 3 (1992)
 - Endorsed NUMARC/NESP-007, Methodology for Development of EALs
 - Could use either 0654 or 007, but not portions of both
- Revision 4 (2003)
 - Endorsed NEI 99-01, Methodology for Development of EALs
- Revision 5 (2005)
 - Draft guidance for co-located licensees

Regulatory Guide 1.219

Guidance on making Changes to Emergency Plans for Nuclear Power Reactors

Issued to provide an acceptable method for licensee compliance with 10 CFR 50.54(q), as amended in November 2011

- Section C.1, General Guidance
 - Overall high level guidance
- Section C.2, Changes for Which Prior Interface with NRC Staff is Recommended
- Section C.3, Emergency Plan Change Evaluation Terminology
 - Expands on definitions in 10 CFR 50.54(q)
- Section C.4, Emergency Planning Functions
 - Planning standard-specific guidance for evaluating plan changes
- Section C.5, Review Process
 - Step-by-step instructions



NSIR/DPR-ISG-001

Interim Staff Guidance: Emergency Planning for Nuclear Power Plants

Issued to provide an acceptable method for licensee compliance with the new and amended requirements issued in November 2011

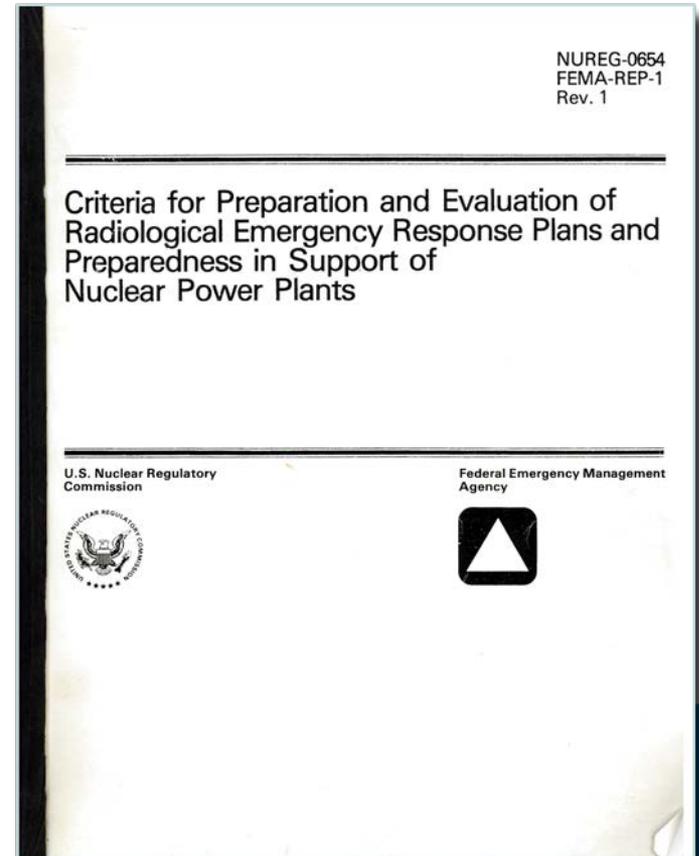
- **Content**
 - On-Shift Staffing Analysis
 - Emergency Response Organization Augmentation at Alternative Facility
 - Licensee Coordination with Offsite Response Organizations
 - Protective Actions for Onsite Personnel
 - Challenging Drills and Exercises
 - Emergency Declaration Timeliness
 - EOF—Performance-Based Approach
 - Backup Means for Alert and Notification Systems
 - ORO Event Response Integration with Nuclear Power Plants



NUREG-0654/FEMA-REP-1

Criteria for Preparation and Evaluation of Radiological Emergency Response Plans and Preparedness in Support of Nuclear Power Plants

- Product of joint NRC/FEMA Steering Committee
- Licensee guidance for complying with 10 CFR 50.47(b) and App E
- ORO guidance for complying with 44 CFR 350.5
- ***Under revision at this time***



NUREG-0654/FEMA-REP-1

- Section I – Planning Basis
- Section II – Planning Standards & Evaluation Criteria
 - Elements A – P

| <u>Evaluation Criteria</u> | <u>Applicability and Cross Reference to Plans</u> | | |
|--|---|--------------|--------------|
| | <u>Licensee</u> | <u>State</u> | <u>Local</u> |
| 2. Each licensee shall establish an Emergency Operations Facility from which evaluation and coordination of all licensee activities related to an emergency is to be carried out and from which the licensee shall provide information to Federal, State and local authorities responding to radiological emergencies in accordance with NUREG-0696, Revision 1. | X _____ | | |
| 3. Each organization shall establish an emergency operations center for use in directing and controlling response functions. | | X _____ | X _____ |
| 4. Each organization shall provide for timely activation and staffing of the facilities and centers described in the plan. | X _____ | X _____ | X _____ |

NUREG-0396 (EPA 520/1-78-016)

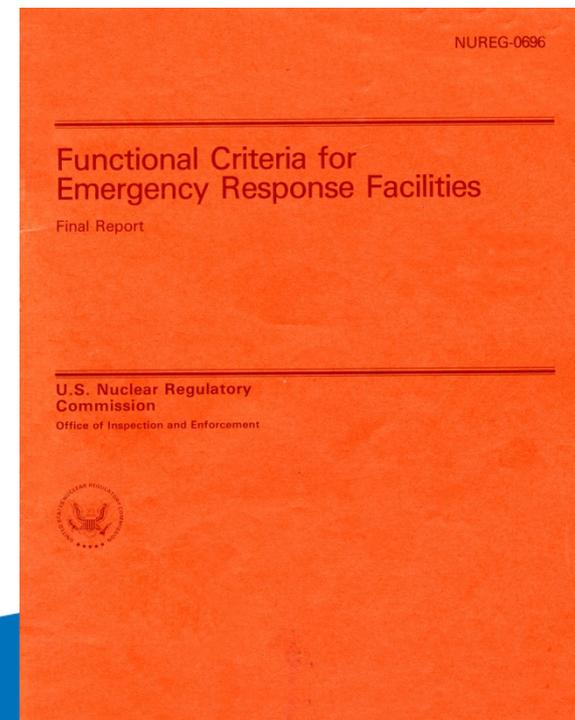
- Joint NRC/EPA Task Force formed in 1976
- Issued December 1978
- NRC endorsed NUREG-0396 as policy in 44 FR 61123
- Determined the appropriate degree of emergency response planning efforts around nuclear power plants
- Introduced generic Emergency Planning Zones (EPZs) concept as basis for planning of response actions
- Provides basis for Federal/State/local government emergency response



NUREG-0696

Functional Criteria for Emergency Response Facilities

- February 1981
- Safety Parameter Data System (SPDS)
- Guidance on emergency response facility design, location, functions, capabilities
 - Control Room (during an emergency)
 - Technical Support Center (TSC)
 - On-Site Operations Center (OSC)
 - Emergency Operations Facility (EOF)
- Integrated support to the Control Room
- Updated in NSIR/DPR-ISG-01



Other NUREGs

- NUREG/CR-7002
 - *Criteria for Development of Evacuation Time Estimate Studies*
- NUREG/CR-7032
 - *Developing an Emergency Risk Communication (ERC)/Joint Information Center (JIC) Plan for a Radiological Emergency*
- NUREG/CR-7033
 - *Guidance on Developing Effective Radiological Risk Communication Messages: Effective Message Mapping and Risk Communication with the Public in Nuclear Plant Emergency Planning Zones*
- NUREG-0737, Supp. 1
 - *Clarification of TMI Action Plan Requirements*



EAL Scheme Guidance

- NUREG-0654 Appendix 1, “*Emergency Action Level Guidelines for Nuclear Power Plants*”
- NUMARC/NESP-007, “*A Methodology for Development of Emergency Action Levels*”
 - Re-worked NUREG-0654 Appendix 1, adding:
 - Initiating conditions and example EAL
 - More logical arrangement of conditions
 - Mode applicability
 - Implemented fission product barrier matrix
 - Added bases for all EALs
 - Removed many (but not all) EALs based on Technical Specifications



EAL Scheme Guidance

- NEI 99-01, *“Methodology for Development of Emergency Action Levels”*
 - Added EALs for permanently shutdown reactors and dry cask spent fuel storage
 - Improvements to NUMARC/NESP-007
 - Endorsed by RG 1.101, rev. 4
 - Now on Revision 6
- NEI-07-01, Rev. 0, *“Methodology for Development of Emergency Action Levels Advanced Passive Light Water Reactors”*
 - *Developed for AP-1000 and ESBWR reactors*
- Cannot mix portions of methodologies

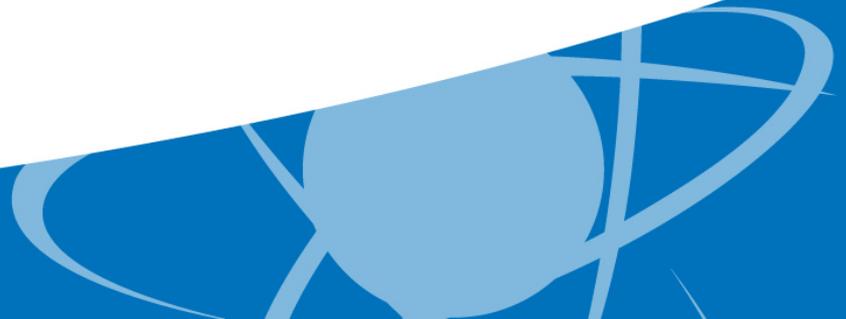


Generic Communications

- NUREG
- Interim Staff Guidance
- Regulatory Guide
- Bulletin
- Information Notice
- Regulatory Issue Summary
- 10 CFR 50.54(f) letter

A complete list of EP-related generic communications can be found at:

<http://www.nrc.gov/about-nrc/emerg-preparedness/regs-guide-comm/ep-generic-comm.html>



NUREG Functions

- Public outreach information
- Regulatory support
- Technical analyses and research results
- Action plans and guidance
- Generic technical issue resolution
- Team reports
- Other agency administrative information



NUREG Types

- Publications prepared by NRC
Example: NUREG-0696
- Brochures prepared by NRC staff
Example: NUREG/BR-0314
- Conference proceedings prepared by NRC or contractors
Example: NUREG/CP-XXXX
- Publications prepared by NRC contractors
Example: NUREG/CR-7002
- Publications resulting from international agreements
Example: NUREG/IA-XXXX



NUREG Uses

- NRC staff guidance and instructions
- Licensing action procedures and acceptance criteria
- Staff suggested course of action
- Not a substitute for regulations
- No compliance required
- Licensees may propose alternatives



Interim Staff Guidance (ISG)

- Clarify issues not in Standard Review Plan (SRP) or NUREG
- Fills the gap between revisions
- NSIR/DPR-ISG-01
- Not a substitute for regulations
- No compliance required
- Licensees may propose alternatives



Regulatory Guide (RG)

1. Power reactors
2. Research and test reactors
3. Fuels and materials facilities
4. Environmental and siting
5. Materials and plant protection
6. Products
7. Transportation
8. Occupational health
9. Antitrust and financial review
10. General



RG Functions

- Acceptable methods to implement regulations
- Evaluation techniques for specific problems or postulated accidents
- Contains data required for reviewing permit and license applications
- Not substitute for regulations
- No compliance required
- Licensees may propose alternatives



Bulletin Types

- Addresses significant and urgent issues in safety, security, or safeguards
- Urgent compensatory actions



Bulletin Functions

- May request actions, information, analyses, or new / revised commitments
- May NOT request long term actions
- May NOT require actions or commitments



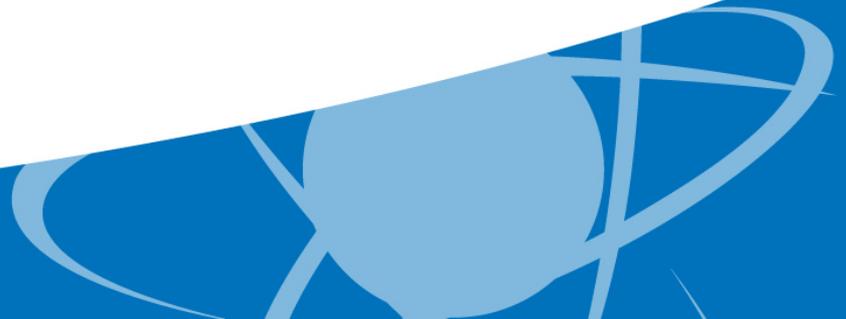
Information Notice (IN)

- Recently identified significant operating experience (OE)
- Recently completed research results
- Licensees evaluate information notices for applicability
- IN 2005-19, *“Effect of Plant Configuration Changes on the Emergency Plan”*



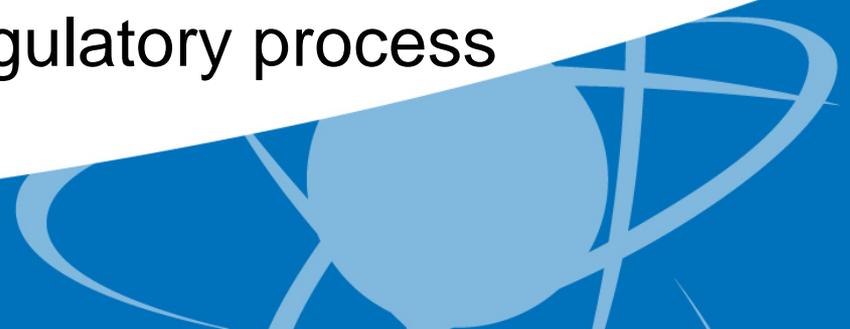
Regulatory Issue Summary (RIS)

- Includes a broad range of subjects with generic applicability
- Does not involve a request for action or information unless it is voluntary



RIS Functions

- Informs licensees of technical or policy positions not previously communicated or fully understood
- Reports NRC endorsement of industry developed documents
- Solicit voluntary pilot program participation
- Informs licensees of regulatory relief opportunities
- Announces regulatory documents issuance
- Requests voluntary submittal of information for NRC administration of regulatory process



BREAK

NEXT

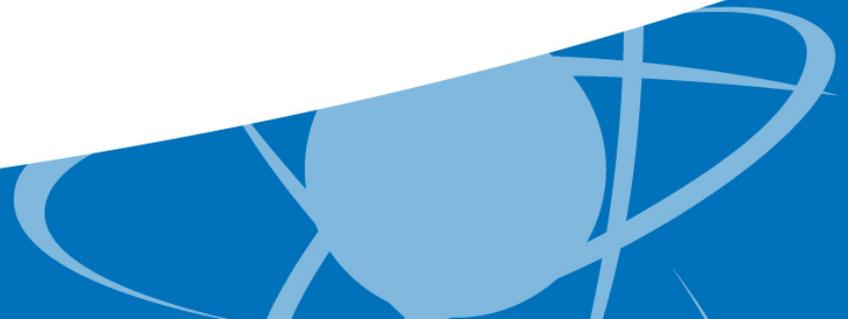
EP Inspection Program and Enforcement



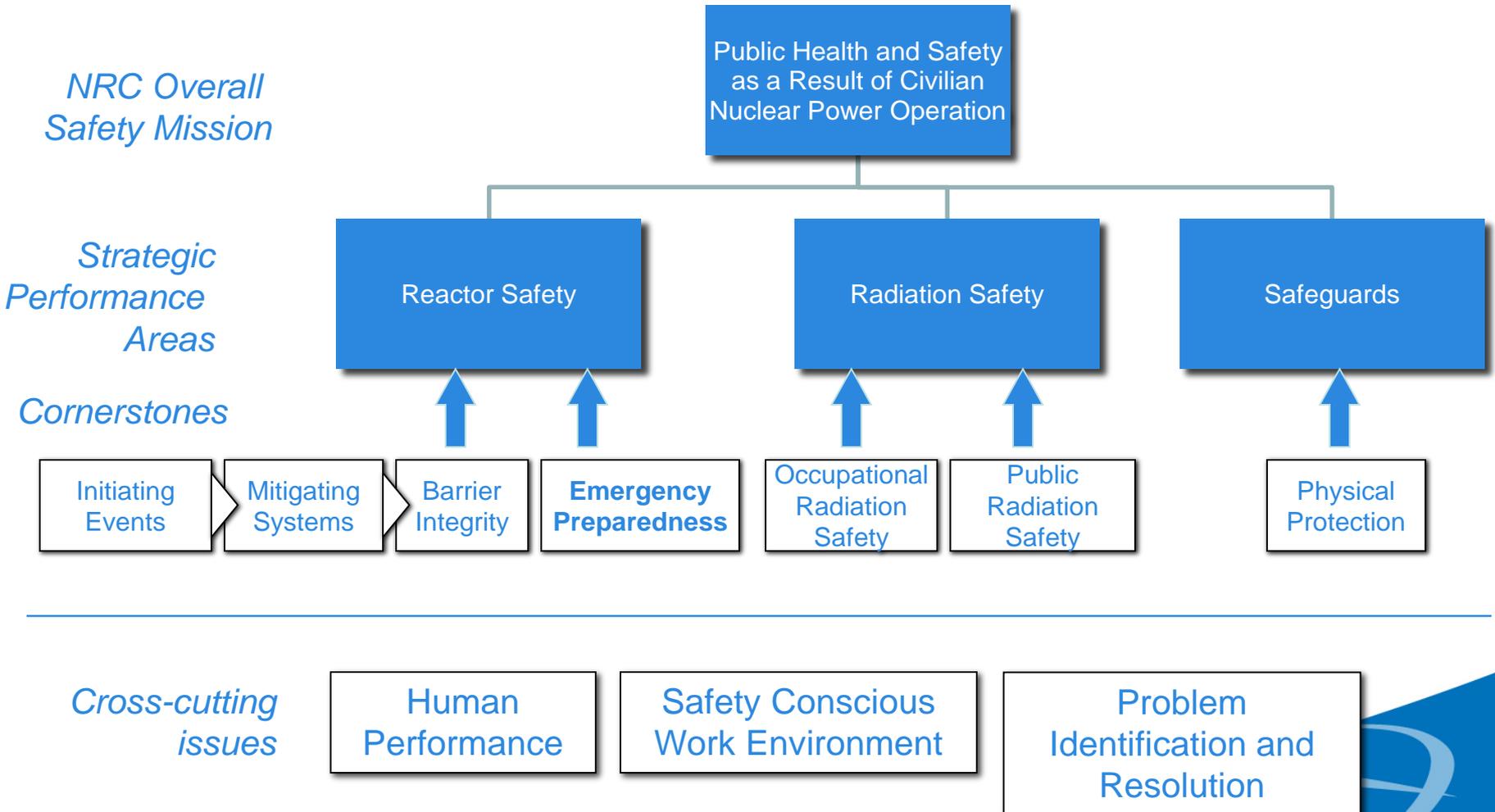
EP Inspection Program and Enforcement

Topics:

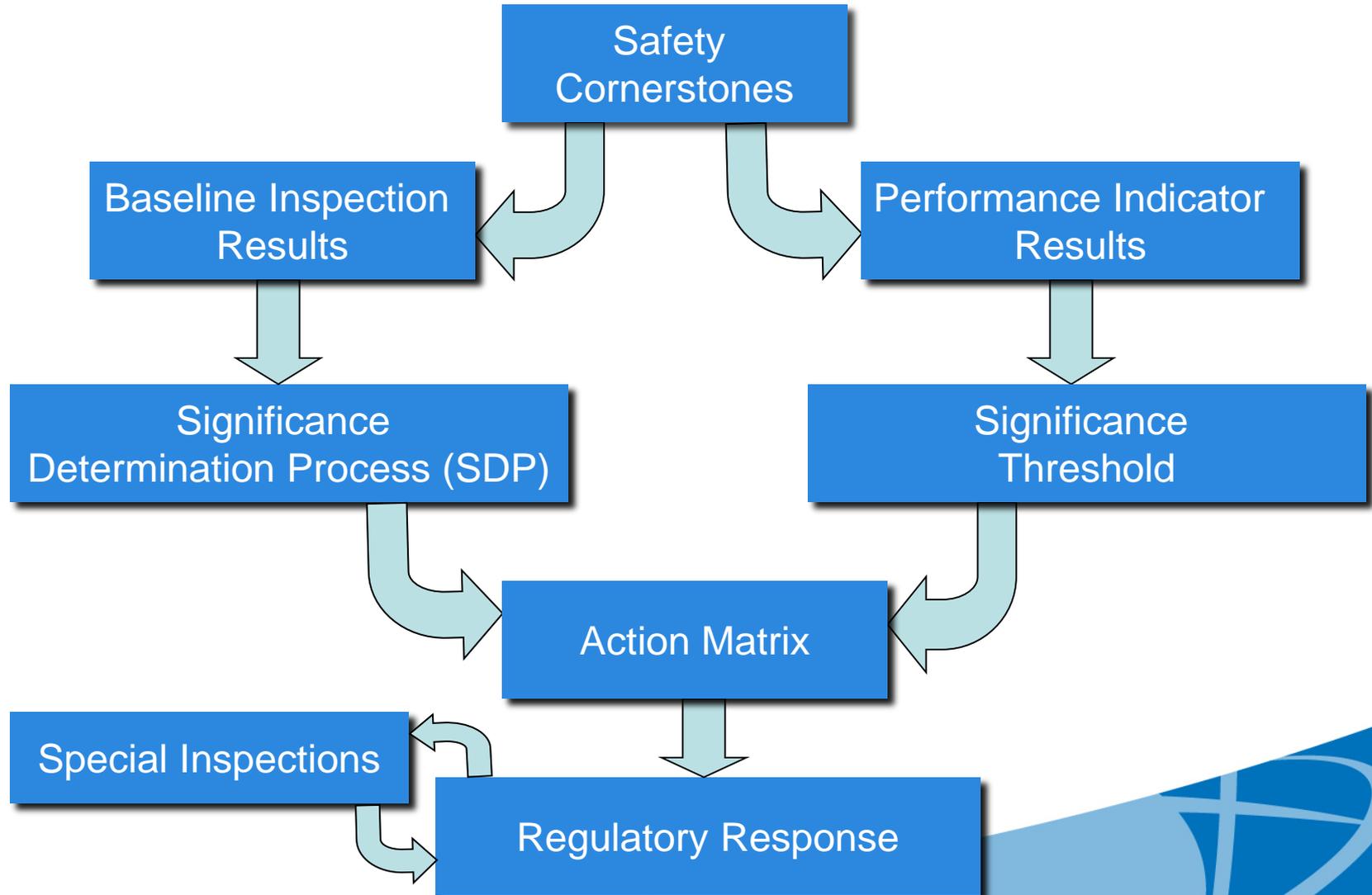
- ROP Framework
- EP Performance Indicators
- EP Baseline Inspection Program
- EP Significance Determination Process



Oversight Framework

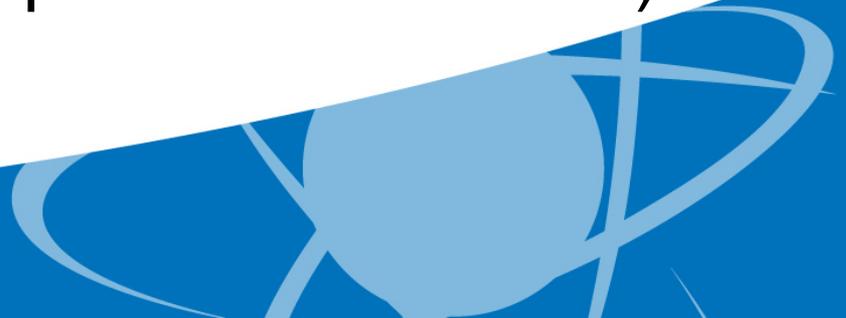


Performance Assessment



Significance Levels

- **Green** Very low safety significance (licensee response band)
- White Low to moderate safety significance (increased regulatory response band)
- **Yellow** Substantial safety significance (required regulatory response band)
- **Red** High safety significance (unacceptable performance band)



Emergency Preparedness Cornerstone

- 3 Performance Indicators
- Baseline Inspection Program



Performance Indicators

- Drill and Exercise Performance (DEP)
- Emergency Response Organization Drill Participation (ERO)
- Alert and Notification System Performance (ANS)

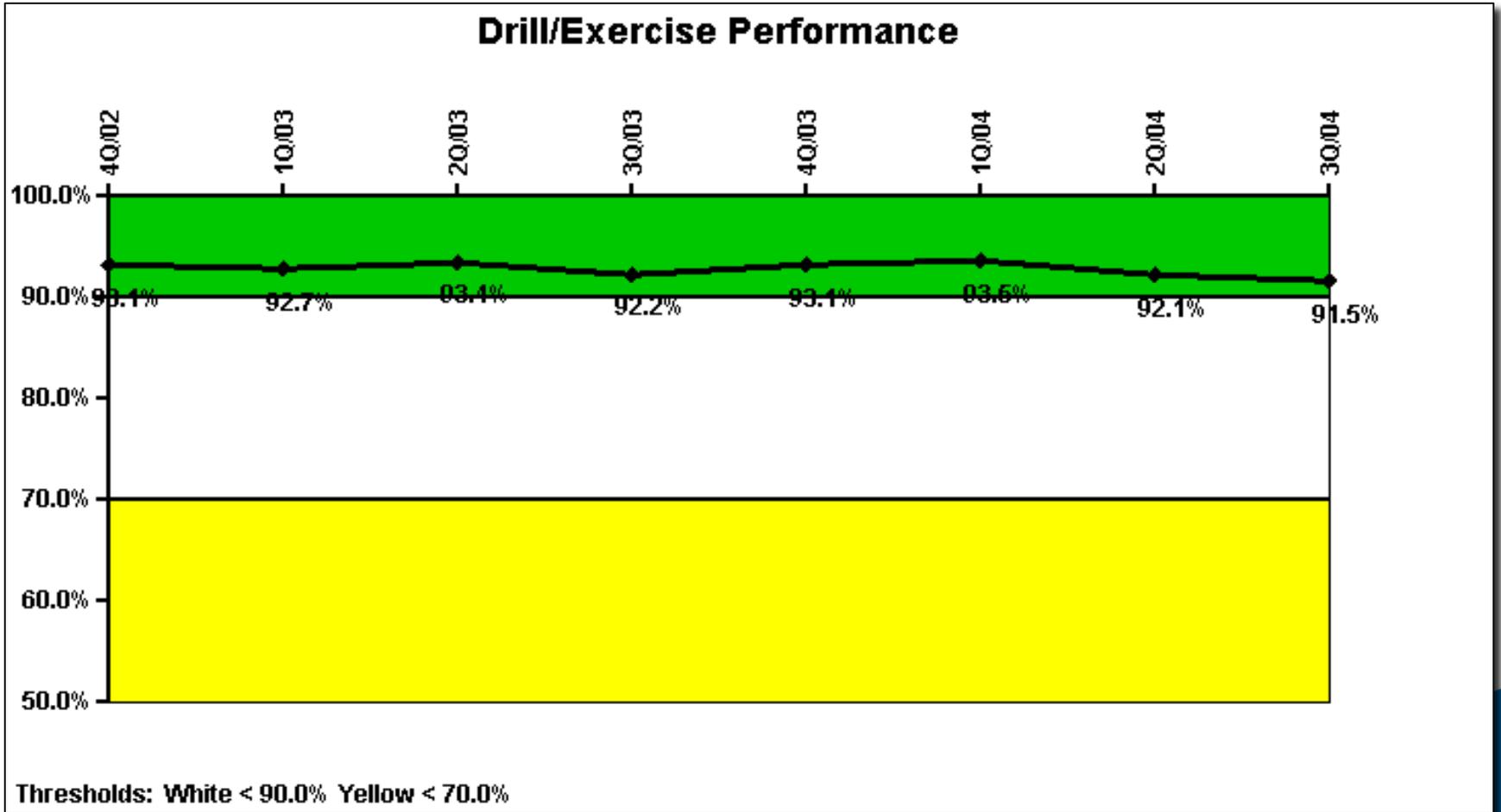


Drill and Exercise Performance (DEP) PI

- Monitors timely and accurate licensee performance in drills and exercise when presented with “opportunities” for classification, notification, and protective action recommendations (PARs)
- 90% Green/White threshold
$$\frac{\text{\# of timely \& accurate classifications, notifications \& PARs (calculated over previous 8 quarters)}}{\text{\# of total opportunities}}$$



DEP PI Example



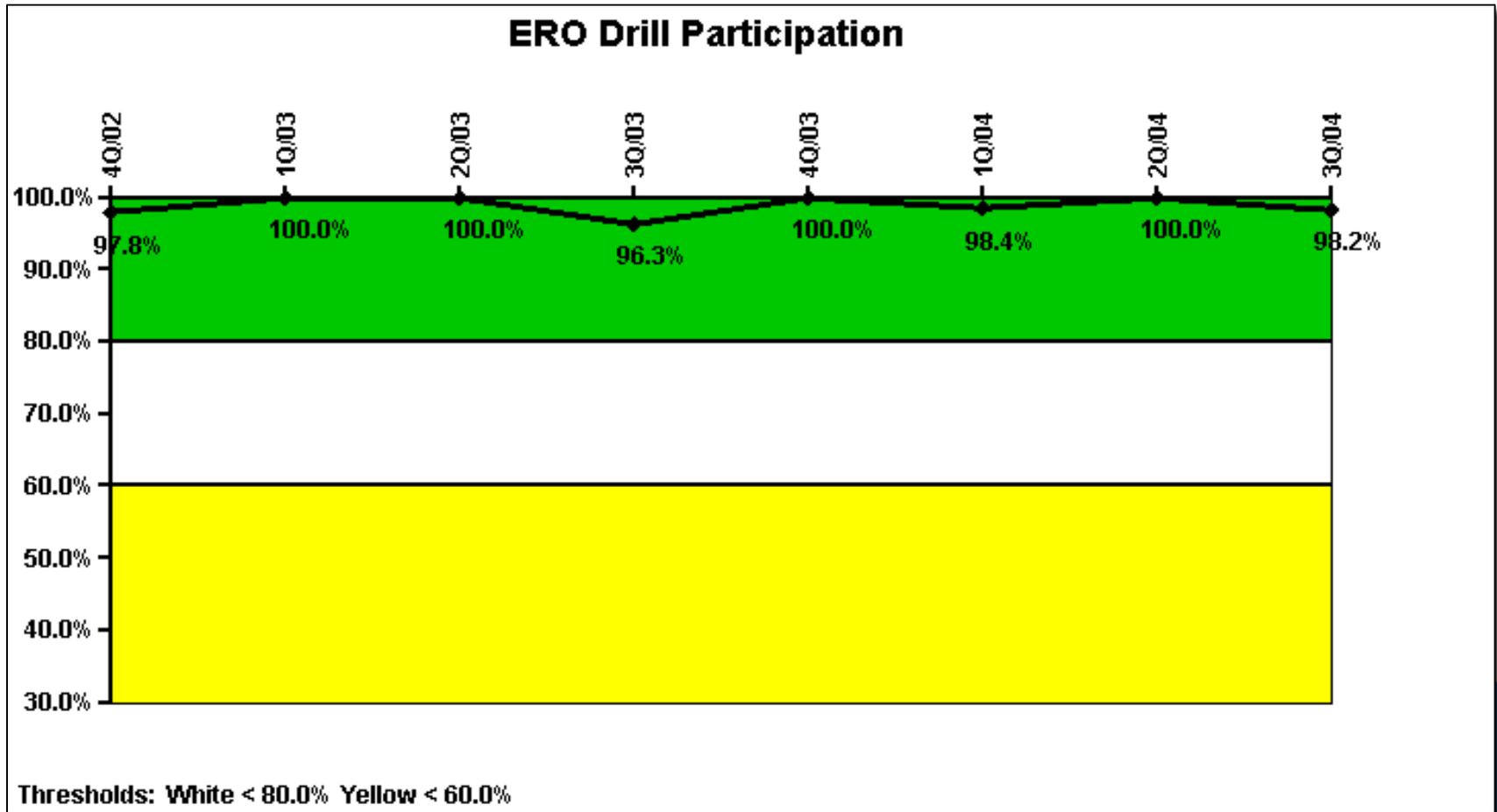
Emergency Response Organization (ERO) PI

- Percentage of ERO members assigned to fill key positions who have participated in a performance-enhancing drill/exercise
- 80% Green/White threshold

of ERO members assigned to fill key positions that have participated in a drill (calculated over 8 quarters)

total number of key positions assigned to ERO members

ERO PI Example

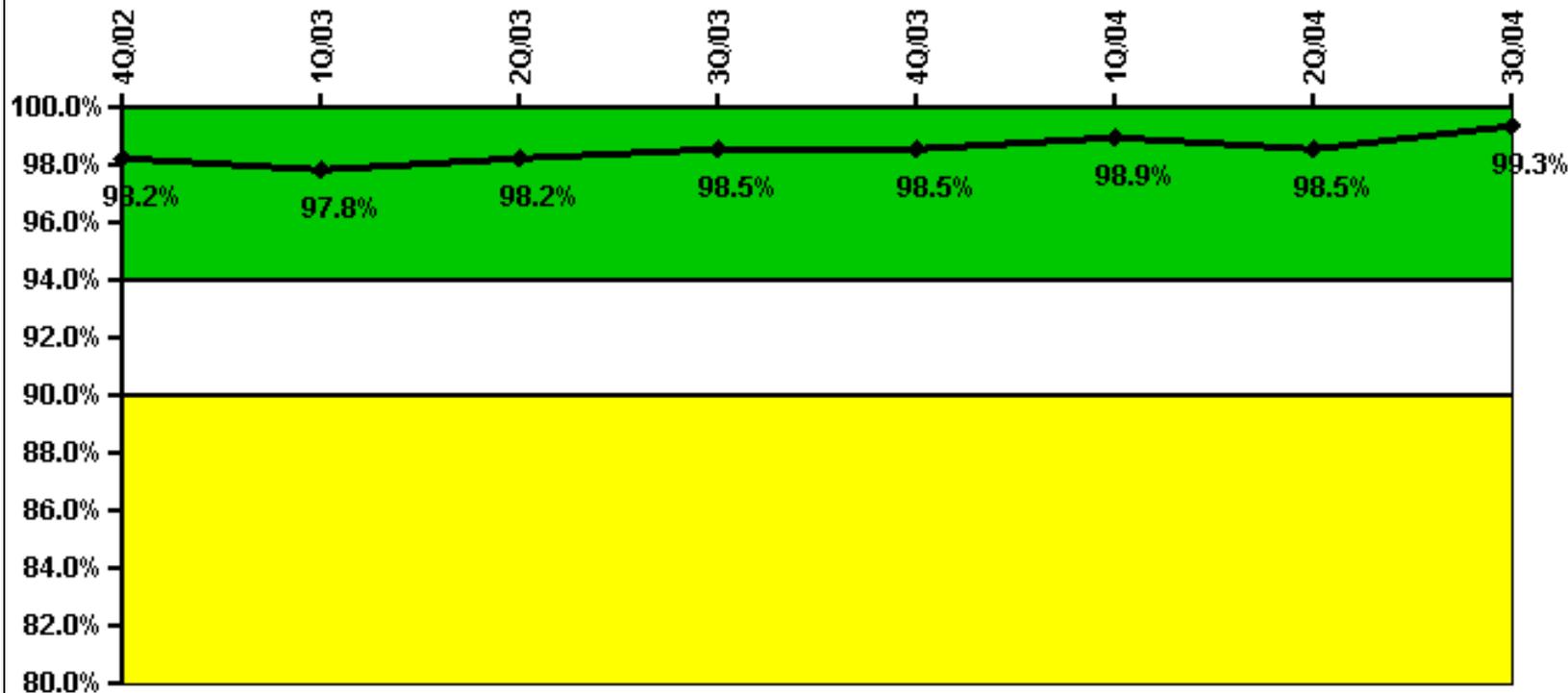


Alert & Notification System (ANS) PI

- Monitors the reliability of offsite ANS
- Periodic tests are the regularly scheduled tests (documented in the licensee's test plan or guidelines) that are conducted to actually test the ability of the sirens to perform their function (e.g., silent, growl, siren sound test).
- 94% Green/White threshold
$$\frac{\text{\# of successful siren tests (calculated over 4 quarters)}}{\text{\# of total number of siren tests}}$$

ANS PI Example

Alert & Notification System



Thresholds: White < 94.0% Yellow < 90.0%

Baseline Inspections

- IP 71114 Attachments .01 - .08
 - Exercise Evaluation (biennial exercise)
 - Alert and Notification System Testing
 - Emergency Response Organization Augmentation
 - Emergency Action Levels And Plan Changes
 - Maintenance of Emergency Preparedness
 - Drill Evaluation (resident inspector)
 - Exercise Evaluation (hostile action)
 - Scenario Evaluation



Significance Determination Process

- Precepts
 - EP is a defense-in-depth measure
 - Emergency Plan being implemented in response to event (*probability of event is 1.0*)
 - EP SDP makes a ***qualitative predictive*** evaluation of the impact of the finding on the licensee's capability to implement its E-plan should an accident occur
 - Risk to public health and safety increased due to lack of fully functioning defense-in-depth feature



Risk Significant Planning Standards (RSPSs)

- Origins of the RSPSs
 - During the development of the EP Cornerstone, the most risk-significant EP elements were identified as being distinct from other EP elements
 - Developed by a group of EP subject matter experts, including NRC staff and industry stakeholders, with input from members of the public
 - EP SDP methodology recognizes findings in the identified risk-significant elements as being more significant
- *Classification* - (b)(4); Emergency Action Level Classification Scheme
- *Notification* - (b)(5); Prompt notification of offsite officials and the public
- *Dose Assessment* - (b)(9); Dose assessment capabilities
- *Protective Action Recommendations* - (b)(10); Range of protective actions for 10 mile EPZ

BREAK

NEXT

FEMA and Offsite Preparedness

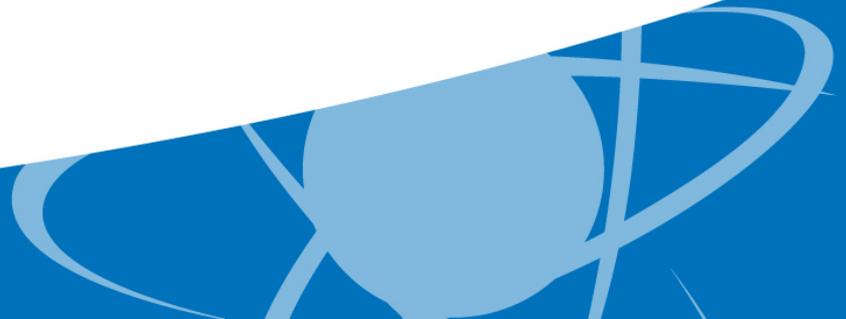
Non-Power Reactor EP



FEMA and Offsite Preparedness Non-Power Reactor EP

Role of FEMA

- Determination of “Reasonable Assurance” for offsite emergency response plans
- Two basic parts:
 - Initial and annual review of State and local emergency plans for a radiological emergency at a commercial nuclear power facility
 - Assess the demonstration of State and local government capabilities to effectively implement their plans to protect the health and safety of the public



Reasonable Assurance

- Following TMI, Commission issued regulations stating:
 - “no operating license for a nuclear power reactor will be issued unless a finding is made by the NRC that there is **reasonable assurance** that adequate protective measures can and will be taken in the event of a radiological emergency”
- Adequacy of Reasonable Assurance
 - Requires NRC to make a predictive finding that there are no undue risks to public safety. It does **not require zero risk**.



Reasonable Assurance

- NRC bases findings on review of FEMA findings and determinations as to whether State and local plans are adequate and capable of being implemented
- In addition, NRC assesses whether the onsite plan is adequate and capable of being implemented
- Adequate emergency plans are in place
 - Adequate staff and facilities to implement plan
 - Emergency plans are workable



Withdrawal of Reasonable Assurance

- FEMA identifies a deficiency
 - FEMA starts a 120-day clock for the State/locals to correct the problem
 - Licensee, NRC, State, locals notified within 10 days
 - After 60 days, a progress report is made
- After the 120 days is up, FEMA withdraws reasonable assurance
- NRC then starts its own 120-day clock for the licensee to correct the problem or face Commission action
 - Total time from deficiency to agency action = 240 days*

*10 CFR 50.54(s)(3) does allow Commission take other action within its authority or at any other time specified in the rule.



Realism Rule

What happens if a State or local government refuses to participate in emergency planning?

- 10 CFR 50.47(c)(1)
 - Provides means for an applicant to obtain a license when State or local governments decline or fail to participate adequately in offsite emergency planning
 - Applicant/licensee may:
 - Demonstrate that deficiencies in emergency plans are not significant
 - Show that adequate interim compensatory actions have been or will be taken promptly
 - Assert that other compelling reasons exist that would permit plant operations



Realism Rule

- Compensatory actions may be required for licensing
 - May involve some form of utility offsite plan
 - Guidance contained in NUREG-0654/FEMA-REP-1, Rev. 1, Supp. 1
- NRC recognizes that in an actual emergency, State and locals will exercise best efforts to protect the public
 - Hence, 10 CFR 50.47(c)(1) is known as the “realism” rule
- Historical Perspective
 - Shoreham
 - New York did not support the licensing of Shoreham on Long Island (applicant agreed not to operate the plant in exchange for the \$6B cost being passed on to Long Island residents).
 - Seabrook (NH/MA) licensed under this rule
 - Massachusetts did not support the licensing of Seabrook which is located in New Hampshire, 2 miles from the Massachusetts State line

Realism Rule

- MA did not allow Seabrook to install sirens in the MA portion of the EPZ
 - The applicant purchased truck mounted sirens that could be dispatched into MA if needed
 - The applicant pre-positioned the trucks and 24/7 crews to carry out the alerting.



Realism Rule

- Executive Order 12657
 - Directs FEMA to assist licensees when State & locals decline or fail to participate
 - 44 CFR 352 contains procedures for requesting FEMA assistance
 - Contingent on licensees making maximum use of its resources & extent of licensee compliance with 10 CFR 50.47(c)(1)
 - To date, the Order has not been invoked



The NRC/FEMA Interface

- Memorandum of Understanding (MOU)
 - Clarifies roles & responsibilities
 - FEMA
 - NRC
 - Joint
 - MOU first issued January 1980
 - Appendix A to 44 CFR 353
 - Revision June 1993
 - New Revision December 2015
 - FEMA Rulemaking

MOU for Radiological Emergency Planning & Preparedness

- Areas of Cooperation
 - NRC licensing reviews
 - FEMA Review of offsite plans & preparedness
 - Preparation for & evaluation of joint exercises
 - Withdrawal of reasonable assurance
 - Emergency planning & preparedness guidance
 - Public information & education programs
 - Recovery from disasters affecting offsite emergency preparedness



FEMA/NRC Steering Committee

- Focal point of coordination
- Serves to implement points in the MOU
- Examples of Recent Issues
 - EP Rulemaking
 - NUREG-0654/FEMA-REP-1 Revision
 - Alert and Notification Systems
 - Hostile action based EP exercises
 - New reactor license applications
 - Decommissioning facilities



Federal Radiological Preparedness Coordinating Committee (FRPCC)



- FEMA Lead (44 CFR 351.10 & .11)
- Meets quarterly
- Many federal agencies are represented
- Assists FEMA in providing policy direction for Federal assistance to State & locals
- Coordinates research & study efforts
- Assists in resolving issues related to final FEMA approval of a State plan



Regional Assistance Committee (RAC)

- FEMA Lead (44 CFR 351.10 & .11)
- One in each FEMA Field Office (10)
- Federal participation
- Assists State and local government officials in the development & review of their radiological emergency plans
- Observes exercises to evaluate adequacy of plans
- NRC is represented on the RAC by the Regional State Liaison Officer



Contact Information

Robert Kahler

Office: (301) 287-3756

email: robert.kahler@nrc.gov

Todd Smith

Office: (301) 287-3744

email: todd.smith@nrc.gov

