

Advanced Reactor Stakeholder Public Meeting

October 30, 2024

[Microsoft Teams Meeting](#)

Bridge line: 301-576-2978

Conference ID: 248 924 550 24#



Time	Agenda	Speaker
9:50 - 10:00 am	<i>Advanced Reactor Ready Slides</i>	
10:00 - 10:15am	Opening Remarks	NRC
10:15 - 10:35 am	Section 401 of the ADVANCE Act of 2024	NRC
10:35 – 11:00 am	Advanced Reactor Licensing Update	NRC (Josh Borrromeo)
11:00 a.m. – 1:00 pm	LUNCH	
1:00 - 3:00 pm	Advanced Reactor Fire Brigade Sizing Analysis	NEI/Jensen Hughes
3:00 -3:15 pm	Public Comment Period	Public
3:15 pm	Closing Remarks/Adjourn	

Opening Remarks



Advanced Reactor Program Recent Highlights



**Accelerating Deployment of Versatile, Advanced
Nuclear for Clean Energy Act of 2024
(ADVANCE Act of 2024)**

Section 401

**Advanced Methods of Manufacturing and
Construction for Nuclear Energy Projects**

Periodic Advanced Reactor Stakeholder Meeting
October 30, 2024

Meeting Purpose

- Introduce ADVANCE Act Section 401
- Present NRC response goals

Opening Remarks and Background

By January 2025, the NRC will submit a report to Congress that will:

Examine:

- unique licensing issues or requirements relating to the use, for nuclear energy projects, of:
 - Advanced manufacturing process
 - Advanced construction techniques
 - Rapid improvement or iterative innovation process

Examine:

- Requirements for nuclear-grade components in manufacturing and construction
- Potential use of standard materials, parts, or components in manufacturing and construction
- Potential use of standard materials to support or encapsulate new materials not yet in codes
- Requirements related to the transportation of a fueled advanced nuclear reactor core

Identify:

- Safety aspects of advanced manufacturing processes and advanced construction techniques that are not addressed by existing codes and standards
- Based on the results of the NRC's examination:
 - Options for addressing the issues, requirements, and opportunities
 - How domestic nuclear manufacturing and construction developers are impacted
 - Extent to which Commission action is needed for implementation

NRC Response Goals

Develop graded options with the potential to increase efficiency and reliability of review:

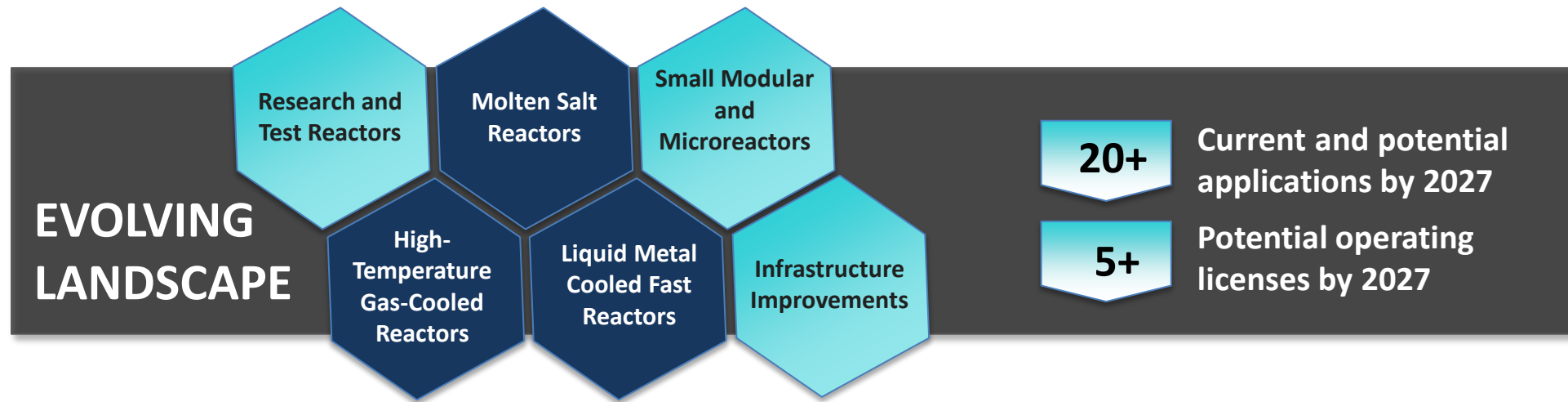
- Clarify areas of flexibility in regulations
- Develop options that produce actionable guidance and review criteria for both technology neutral and technology specific topics.
- Develop options to enable use of alternate codes and standards in a consistent and efficient way (guidance, regulation, etc.)

Closing Remarks

Recently Completed and Current Reviews

Project	Schedule Established	Safety Review (Targeted/Completed)	Environmental Review (Targeted/Completed)
Kairos Hermes 1 CP	December 2021	September 2023 / June 2023	September 2023 / August 2023
Kairos Hermes 2 CP	October 2023	November 2024 / July 2024	August 2024 / August 2024
Abilene Christian University CP	December 2022	September 2024 / September 2024	April 2024 / March 2024
TerraPower – Kemmerer Unit 1 CP	June 2024	August 2026 / Ongoing	May 2026 / Ongoing

Advanced Reactors by the Numbers



15+ Entities actively engaged in pre-application activities

100+ Topical reports and white paper reviews completed

40+ Topical reports and white papers under evaluation

LUNCH BREAK

Meeting will resume at 1:00 pm EDT

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Fire Brigade Staffing Analysis

Alan Campbell / Liz Kleinsorg

October 30, 2024



Fire Brigade Staffing

- Overview of Technical Report
 - Background
 - Regulation and guidance document review
 - Regulatory submittals and approval process
 - Advancements in technology and analysis techniques
 - Risk-informed, performance-based fire response evaluation process

Regulations and Guidance

Regulations

- The following regulations apply to the Advanced Reactor Fleet
 - 10 CFR 50.48, Fire Protection
 - Appendix A to 10 CFR 50, General Design Criteria for Nuclear Plants, Criterion 3, Fire Protection
 - Regulatory Guide (RG) 1.232, Principal Design Criteria for Non-Light-Water Reactors
- Conclusion: There are no regulations that require a specific classification and complement of fire brigade for the Advanced Reactor Fleet.

NRC Guidance Documents

- Regulatory Guide 1.189, Fire Protection for Nuclear Power Plants **does** specify a five-person fire brigade. However, as stated in RG 1.189:

...Methods and solutions that differ from those set forth in RGs will be deemed acceptable if they provide a basis for the findings required for the issuance or continuance of a permit or license by the Commission.

NRC Guidance Documents

- DANU-ISG-2022-09, Advanced Reactor Content of Application Project, Risk-Informed, Performance-Based Fire Protection Program (for Operations), provides guidance regarding potential acceptance criteria for alternate fire response strategies:

...Applicants considering fire protection programs that do not rely on these measures (for example, an onsite fire brigade) should demonstrate their ability to safely shut down the facility and minimize radioactive releases to the environment in the event of a fire without the excluded measures...

Other Nuclear Guidance Documents

- Section 8 of RG 1.189 provides guidance for fire protection for new reactors and emphasizes the integration of fire protection requirements into the planning and design phase for the plant. Specifically, Section 8.2, Enhanced Fire Protection Criteria states:
New reactor designs should ensure that safe shutdown can be achieved by assuming that all equipment in any one fire area will be rendered inoperable by fire and that reentry into the fire area for repairs and operator actions is not possible. Additionally, new reactor designs should ensure that smoke, hot gases, or the fire suppressant will not migrate into other fire areas to the extent that they could adversely affect safe-shutdown capabilities, including operator actions.

NEIL Loss Control Manual 5.3.11.1

An ACCEPTABLE structural Fire Brigade SHALL be provided.

The station may elect to have another recognized fire suppression organization respond to emergencies as the primary responder. This is ACCEPTABLE to NEIL if ACCEPTABLE response plans are written and implemented. As a minimum, fire response plans utilizing organizations other than the recognized plant Fire Brigade SHALL include the following:

- *Indication of a fire, off-site org SHALL be notified immediately*
- *Verification via periodic drills that the responding org arrives within ACCEPTABLE period*
- *Verification responding org will respond in full turnout gear with at least 5 qualified members*
- *Verification that the responding org will respond to the site with compatible equipment*
- *A written fire pre-plan SHALL be made available.*
- *A fire drill SHALL be conducted at least annually*

Pertinent Industry Guidance

- The CSA N293, Fire protection for nuclear power plants, Clause 12.1.2.2 SMRs states in part

Fire response capability shall be provided based on the analysis of Clause 12.1.3 (Fire Response Needs Analysis)

Notes:

- 1. The intent of this Clause is to provide a fire response capability and capacity commensurate with the hazards and risks associated with the technology, location or siting (e.g., taking into consideration the local response capability), environmental protection needs, protection of personnel, protection of occupants, and protection of the public*

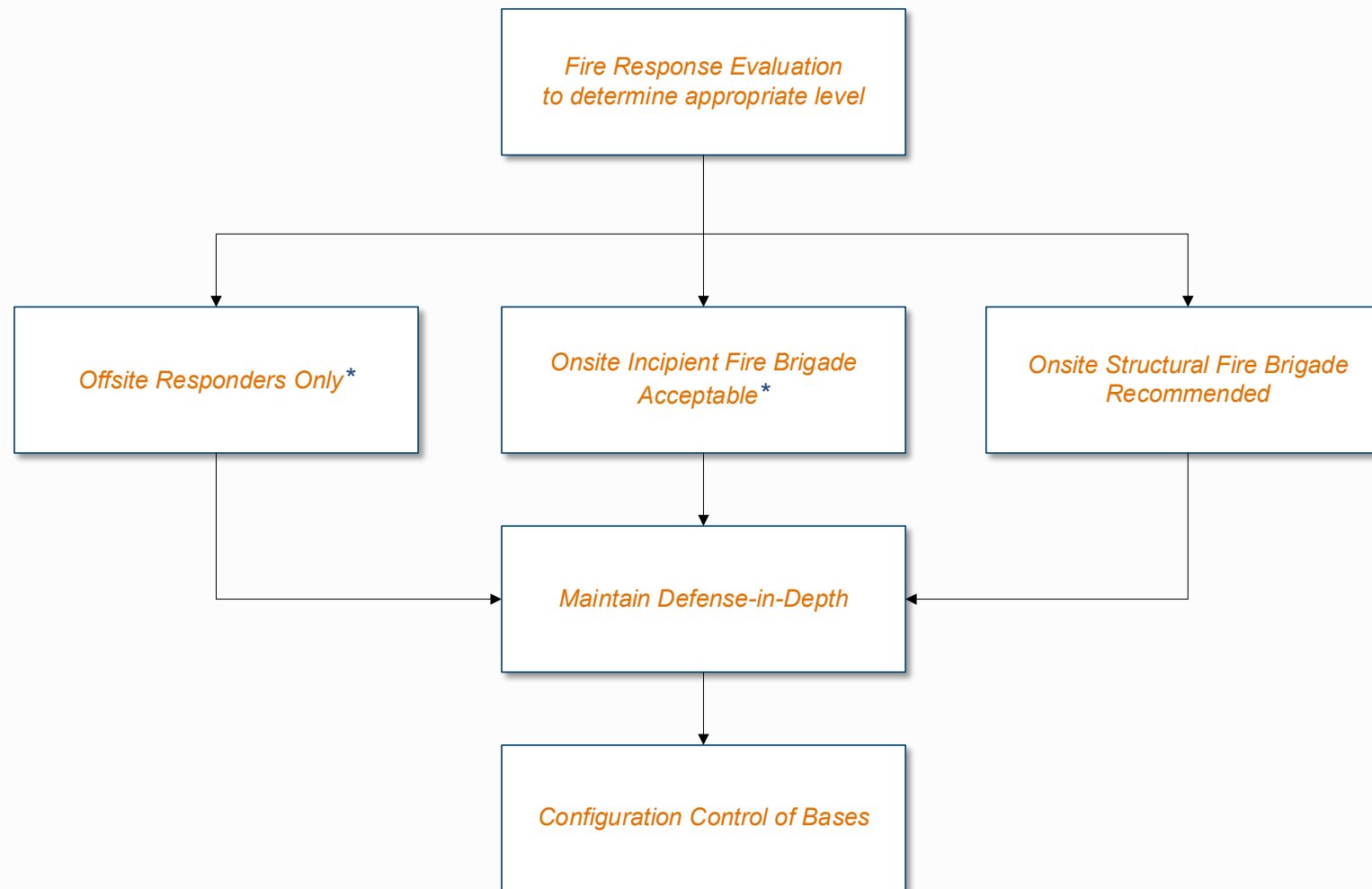
Regulatory submittal + approval process

Regulatory submittal

- Licensing Options for Advanced Reactor Fleet:
 - 10 CFR Part 50, Domestic Licensing of Production and Utilization Facilities, or
 - 10 CFR Part 52, Licenses, Certifications, and Approvals for Nuclear Power Plants
- Information to support the fire protection program will be similar
 - A description and analysis of the fire protection design features for the plant necessary to comply with General Design Criterion 3 of appendix A to this part*
 - A description and analysis of the fire protection design features for the plant necessary to comply with § 50.48 and a description of the fire protection program required by § 50.48 and its implementation*

Fire Response Evaluation

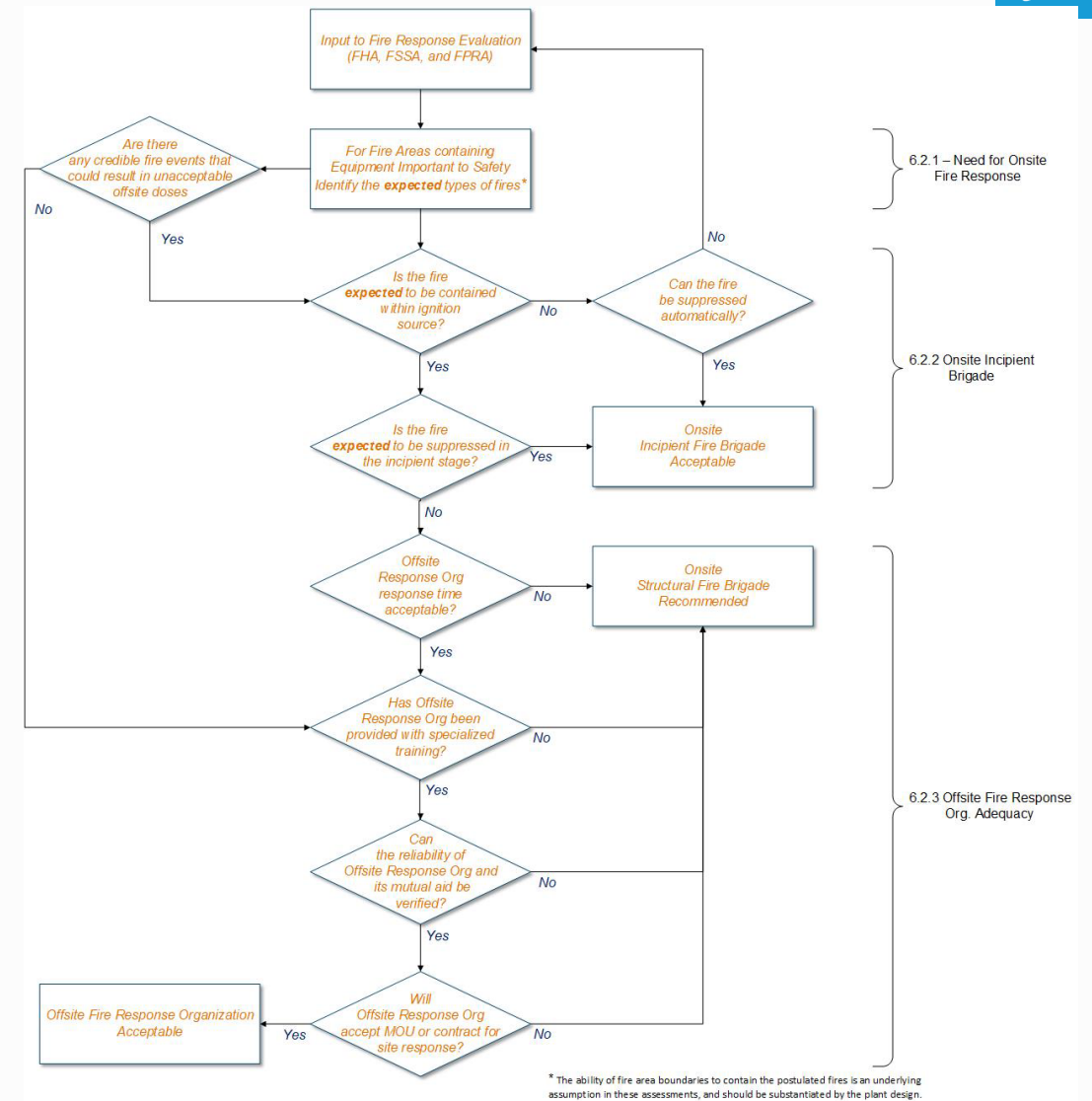
Overview of RI-PB Fire Response Evaluation



**Offsite fire response organization acceptable*

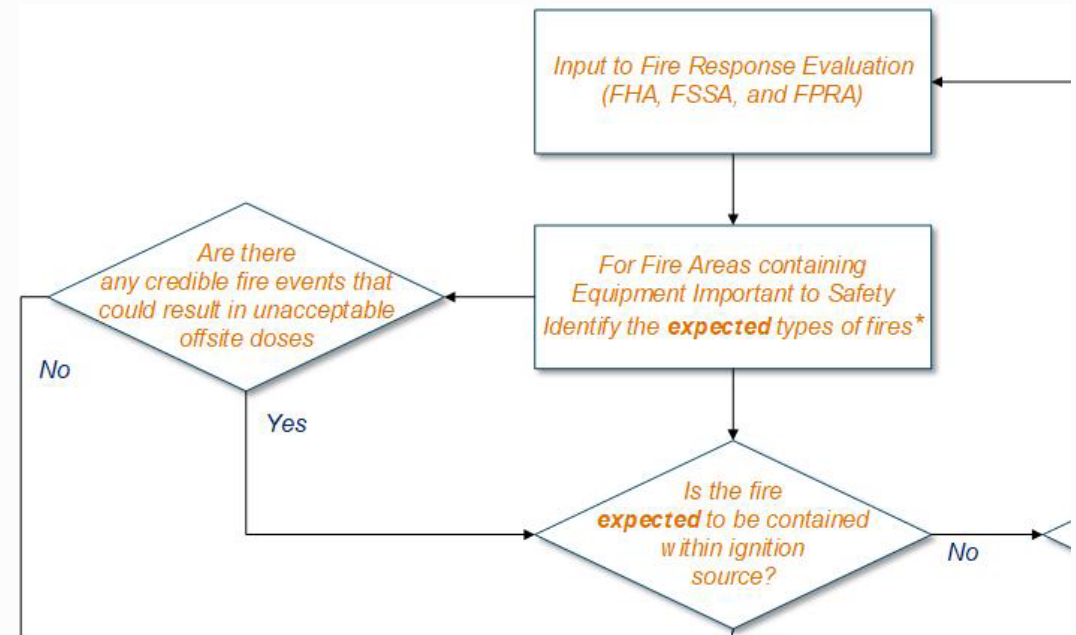
Fire Response Evaluation Process

- Plant specific input:
 - Fire Safe Shutdown Analysis
 - Fire PRA (if performed)
 - FHA
- Process
 - Address need for onsite response
 - Address potential for onsite incipient brigade
 - Assess the acceptability of the offsite response capability



Offsite Responders Only

- Any fire-induced damage will not result in a public dose to exceed 10 mSv (1 rem) total effective dose equivalent at the site boundary for 96 hours
- Pre-determined, prompt protective measures are established
- Ensure adequacy of offsite responders

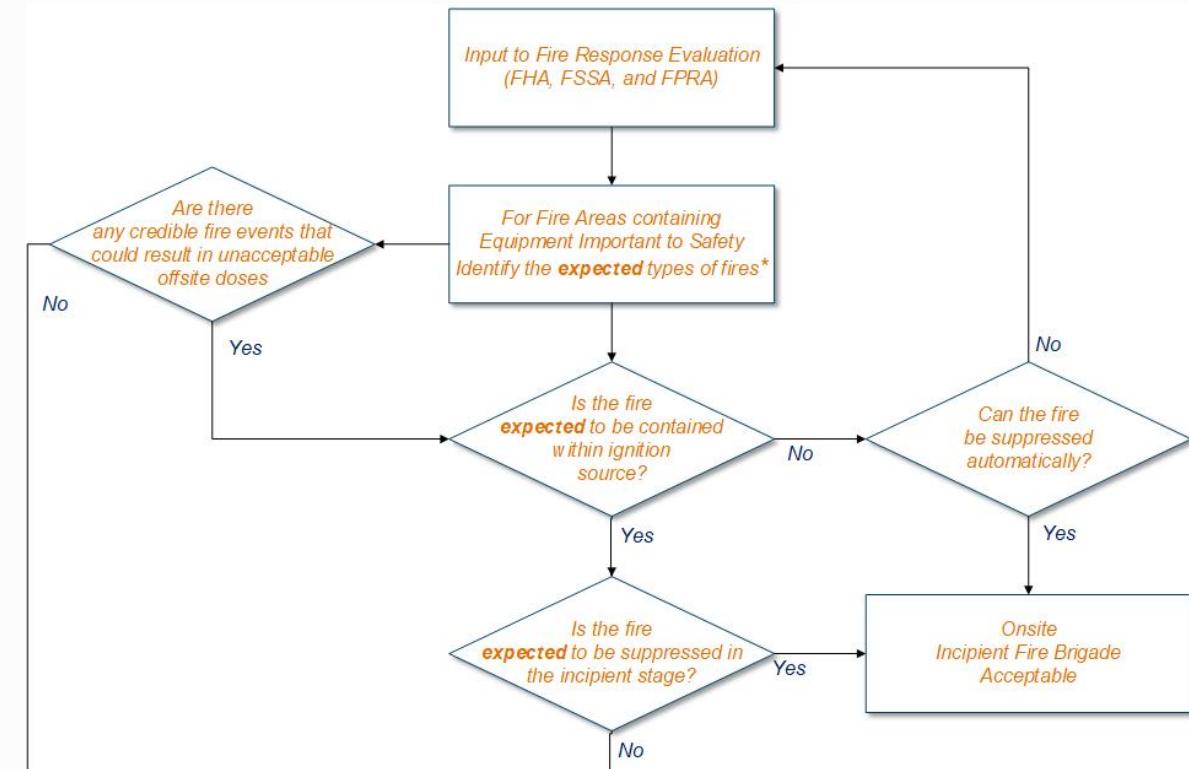


Onsite Incipient Fire Brigade

- The incipient stage fire is defined in NFPA 600 as
A fire which is in the initial or beginning stage and which can be controlled or extinguished by portable fire extinguishers, Class II standpipe, or small hose systems without the need for protective clothing or breathing apparatus.

Onsite Incipient Fire Brigade

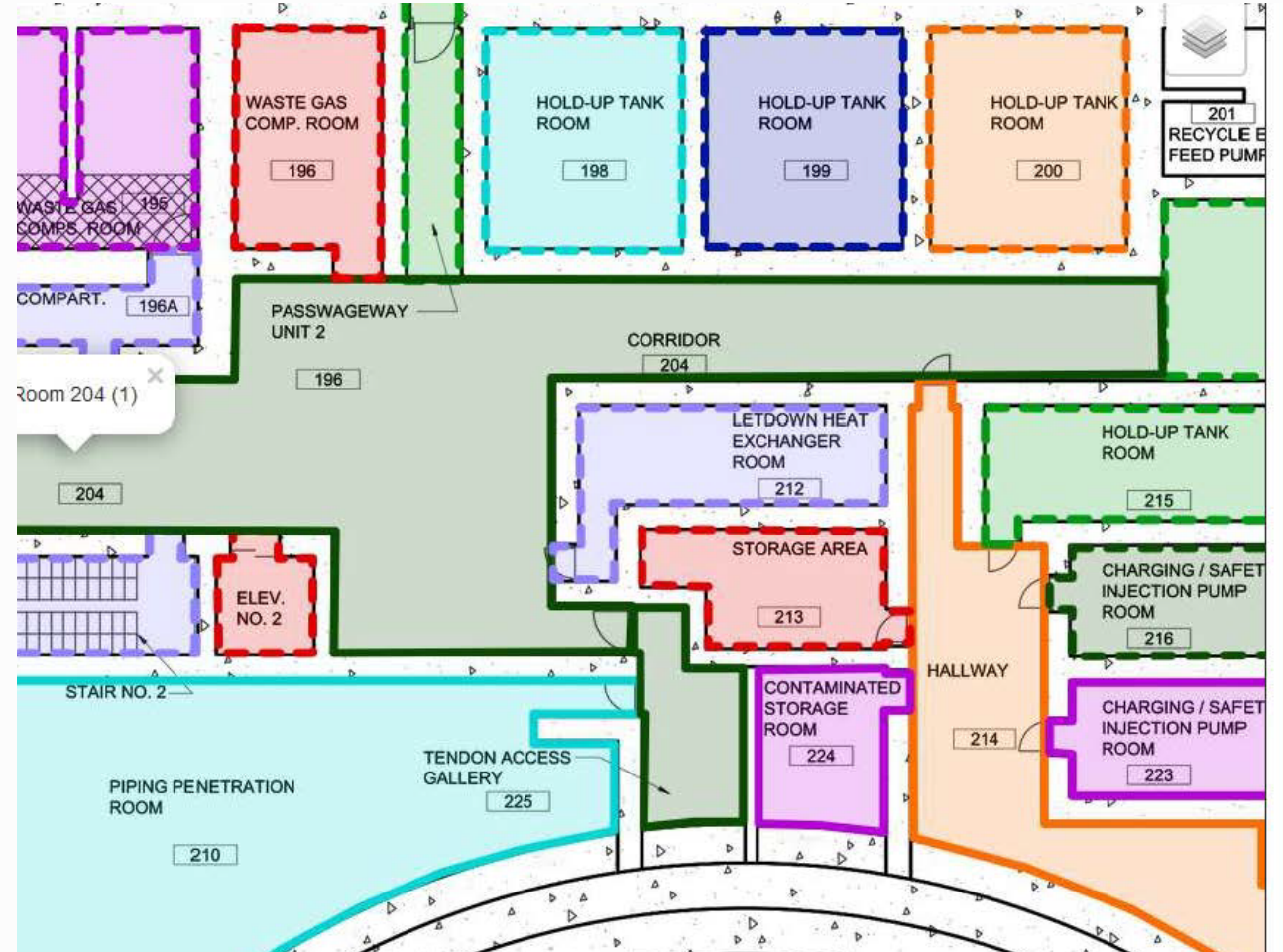
- The types of fires expected in the fire areas of concern.
- Whether the types of fire can propagate beyond the ignition source.
- Is the fire expected to be identified in the incipient stage?
- If the fire is expected to progress, evaluate the detection and/or automatic suppression to address uncertainty.



Fire Areas of Concern

- Fire Areas which contain equipment important to safety
- Following enhanced guidance Section 8.2 of RG 1.189

One success path should be free of fire damage without re-entry into the fire area

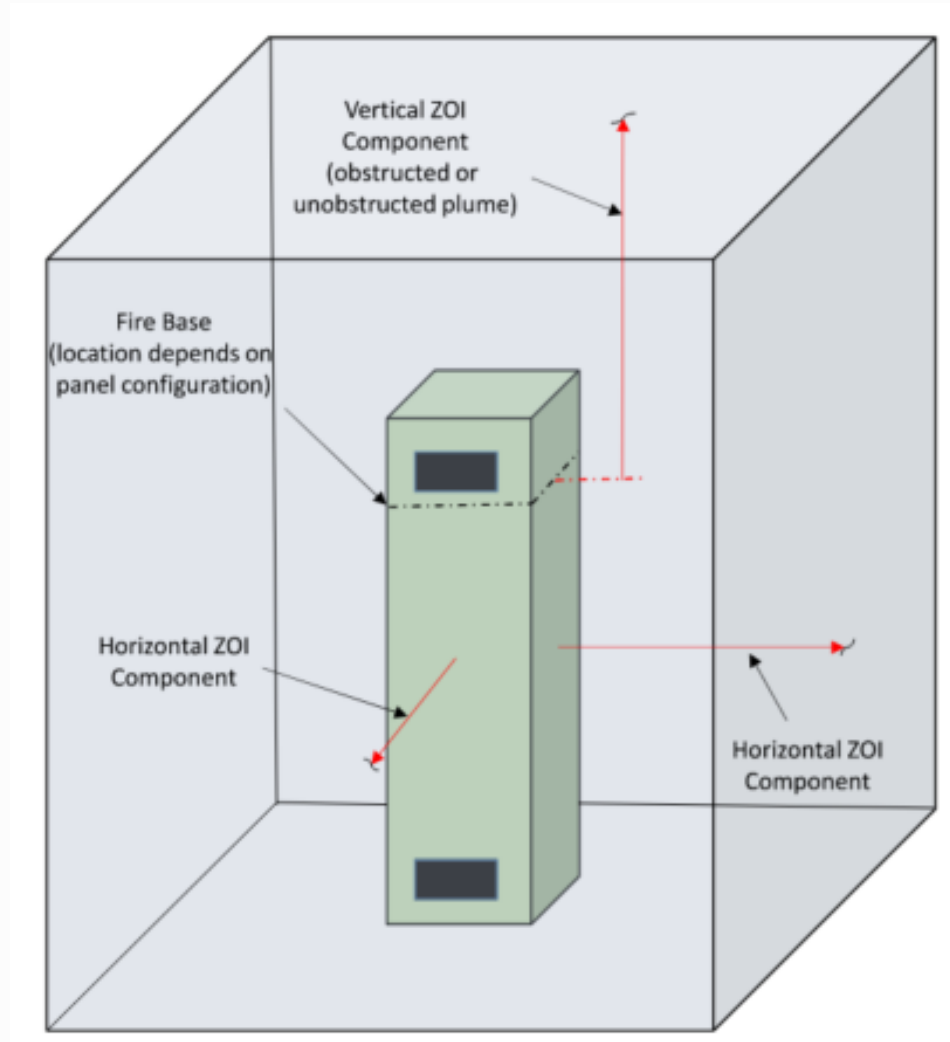


Types of fires expected in FAs of concern

- Electrical cabinets
- High energy arcing faults
- Diesel generators
- Air Compressors
- Electric motors larger than 5 HP
- MG Sets
- Off-gas/H₂ recombiners
- Transformers
- Batteries (i.e., Station battery banks)
- Pumps with electric motors larger than 5 hp
- Ventilation subsystems
- Boilers
- Turbine Generator

Propagate beyond Ignition Source?

- Fire Events Database
 - Not challenging / Potentially challenging
- Minimize potential during design phase
 - Use Zone of Influence concept

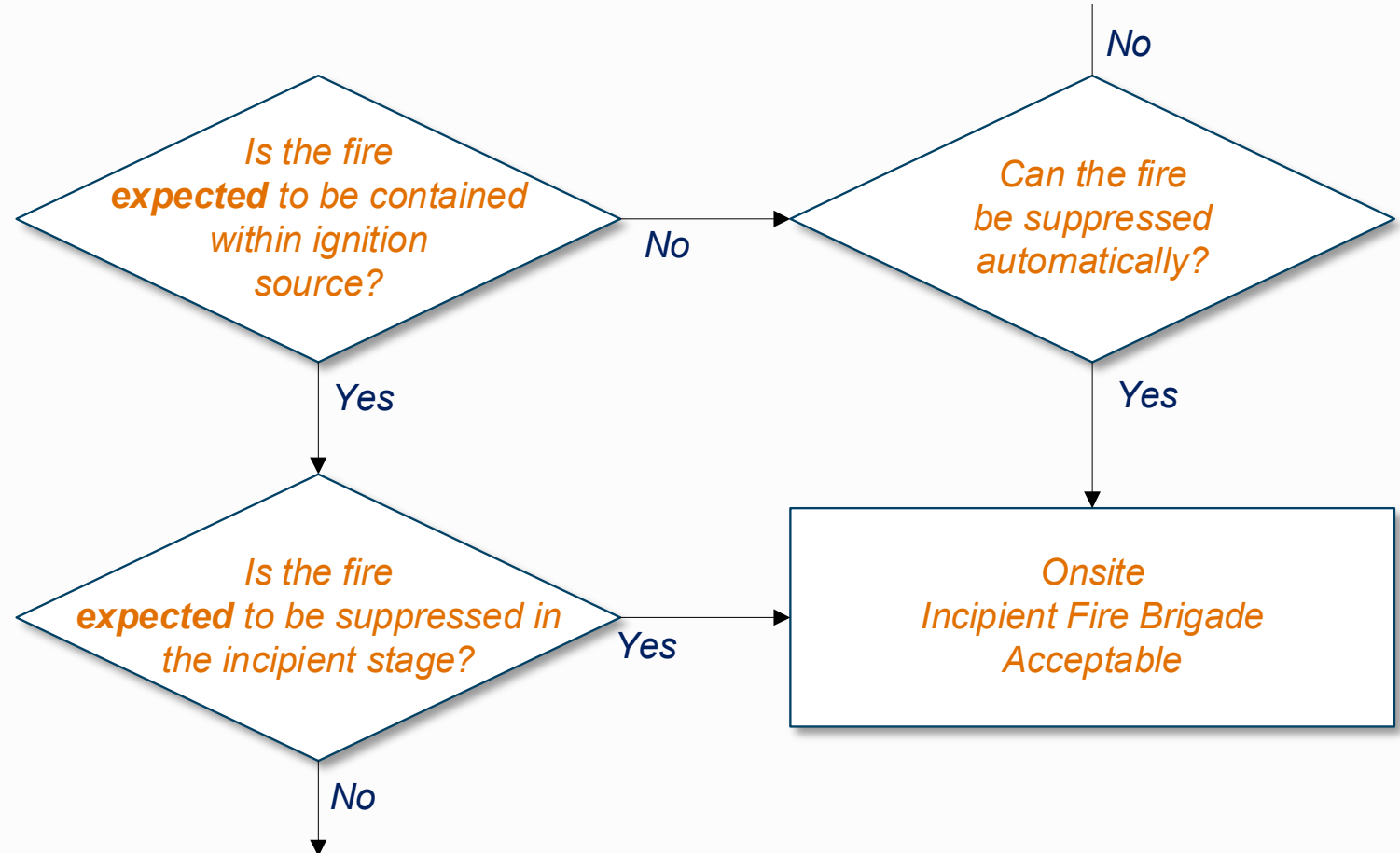


Personnel Detection

- A reviews of fire events determined multiple ignition sources have been detected by plant personnel
 - Observed with electrical cabinets as documented in NUREG-2230
- Plant personnel detection is applicable to most ignition sources.
 - But, not applicable to:
 - ◆ HEAF
 - ◆ Transformer – Catastrophic,
 - ◆ Transformer – Non-catastrophic, and
 - ◆ Yard Transformer (Others)
 - ◆ These events are primarily detected by equipment failure alarms

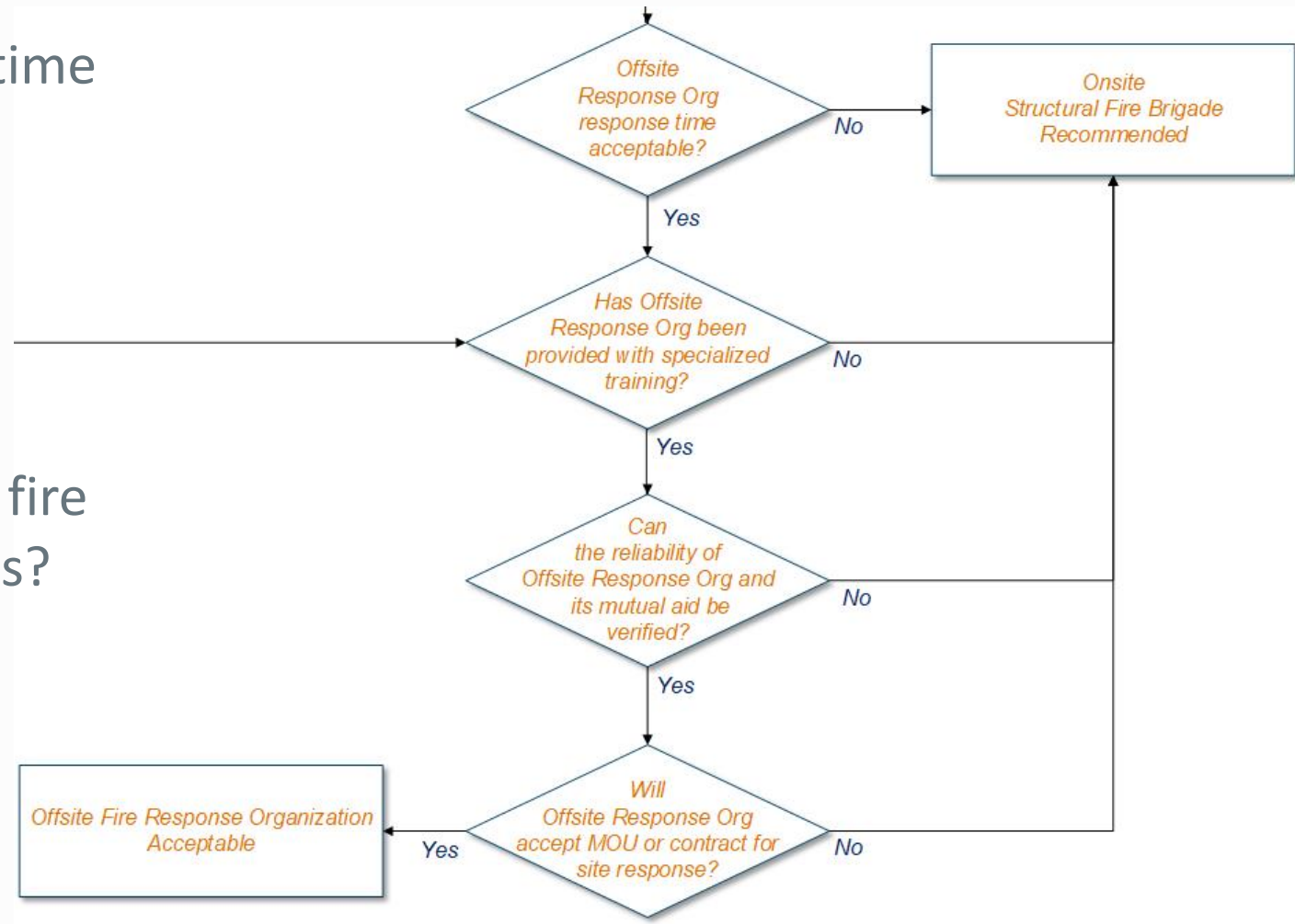
Suppressed Automatically?

- Lastly, if we think that a fire may propagate beyond the ignition source – can the fire be suppressed automatically....



Acceptability of Offsite Responders

- Identify the desired fire response time
- What is the distance of the facility from response organization and response time?
- Do the postulated fires require specialized training beyond offsite fire response organization's capabilities?
- Can the reliability of the offsite responders be verified?
- MOU to guarantee response and service level?



Maintain Basis for Acceptability

- The site fire protection program plan should identify:
 - An individual with overall responsibility for the fire protection program.
 - An individual with the necessary level of understanding of the plant be available to oversee the fire response.
 - A process for maintaining configuration control of the fire protection program.
 - A method for ongoing demonstration of capability of the offsite fire response to effectively respond to fire events.

Defense-in-Depth

- Prevent fires from starting
 - Designed plant appropriately
 - Programmatic controls in place
- Detect rapidly, control, and extinguish promptly those fires that do occur
 - Design phase minimizes the probability that fires will propagate beyond the ignition source
 - Provide detection and suppression as necessary
 - Ensure fires not detected/suppressed in the incipient stage are separated from fire areas that contain equipment important to safety
- Provide protection for SSCs important to safety so that a fire that is not promptly extinguished by the fire suppression activities will not prevent the safe shutdown of the plant.
 - Meet the enhanced design guidance of RG 1.189 Section 8.2

Next Steps

Public Comments



Closing Remarks

Next Advanced Reactor Stakeholder Meeting on December 12, 2024

