

NEI and Sargent & Lundy Regulatory Assessment of Remote Plant Operations

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Project Overview

Project Purpose

Develop a report that evaluates key 10 CFR Part 50 and 10 CFR Part 52 requirements for a remote main control room.

Report Objectives

- Identify and evaluate key regulatory requirements and guidance relevant to a remote main control room.
- Emphasize unique regulatory compliance challenges or potential exemptions not typically encountered in conventional, on-site control room configurations.
- Support licensing and regulatory strategies for advanced plants with remote control rooms.

Report Scope

Report Topics Covered

1. Human Factors Engineering
2. Operator Roles and Staffing
3. Accident Response and Emergency Preparedness
4. Physical Security
5. Cybersecurity
6. Maintenance, Test, and Surveillance

Key Points

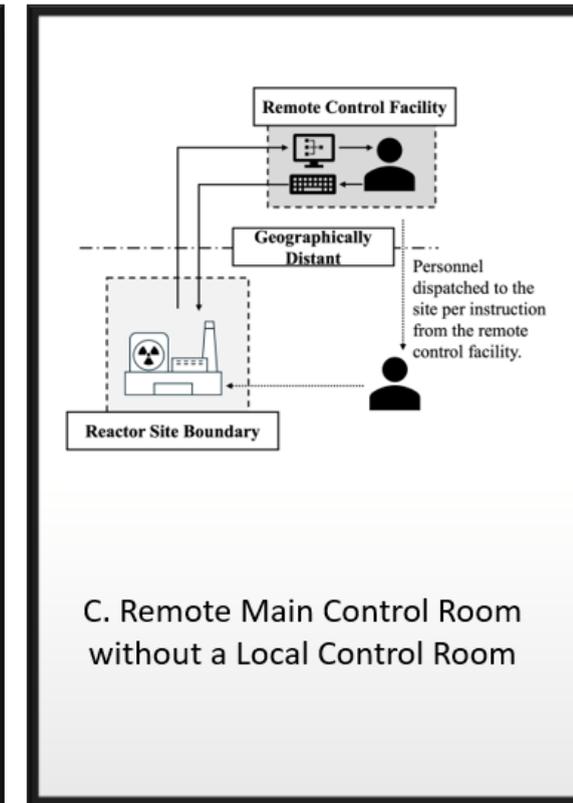
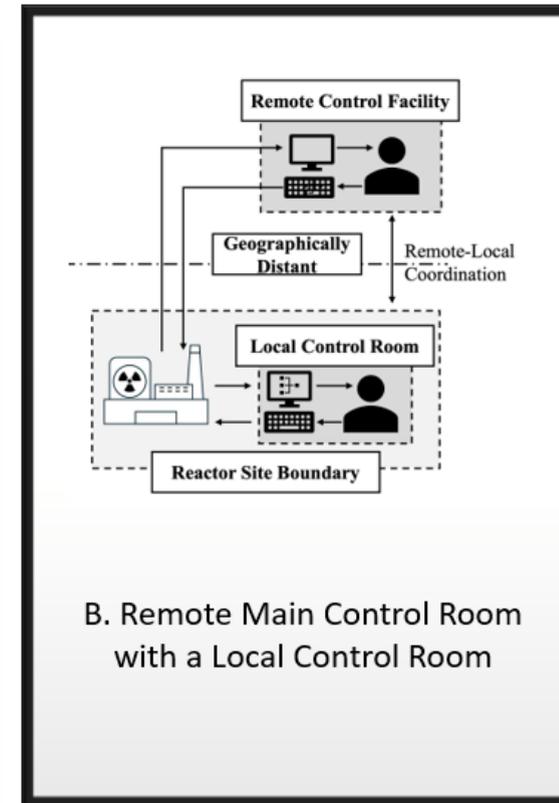
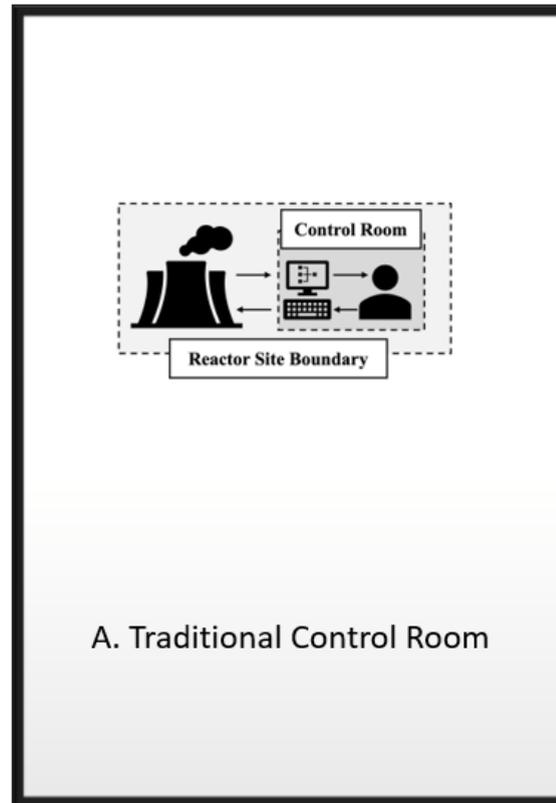
- Technology agnostic
- Focus is on issues specific to the remote location of the control room

Report Scope

Control Room: the area in a nuclear power plant from which most of the plant's power production and emergency safety equipment can be operated by remote control.

Remote Control Room: a full-scope control facility located outside the nuclear plant site boundary, from which licensed operators can monitor and control the plant under all conditions.

Multisite Deployment Model: the command and control of two or more units from a common control room where the units are located at two or more different sites.



Credit: <https://www.nrc.gov/docs/ML2517/ML25175A108.pdf>

Approach for Each Topic

1. Provide a Regulatory Overview
2. Identify Key Regulations and Guidance
3. Provide Guidance for Addressing Key Regulations
 - a) Identify Regulatory Precedent
 - b) Interpret Requirements Based on Current Guidance and Precedent
 - c) Identify Unique Considerations for Remote Operations
 - d) Identify the Level of Expected NRC Engagement
 - e) Identify the Probability of Regulatory Exemption
4. Build Upon Previously Published Industry Reports

See NEI Report “Regulations of Rapid High-Volume Deployable Reactors in Remote Applications (RHDRA) and Other Advanced Reactors” (Accession No. ML24213A337)

Human Factors Engineering

Regulations Covered

- GDC 19
- 10 CFR 50.34(f)
- 10 CFR 50.55a(h) / IEEE 603-1991

Topics Covered

- Existence of a Control Room and Alternate Shutdown Capability
- Application of HFE Principles
- Required Indications and Controls



Top Issues

- Alternate shutdown capability may take on a different form.
- Response time of credited manual actions may require more time.
- Workload, situation awareness, and HSI and procedure design for a single remote control room controlling multiple plants will include unique HFE-related challenges.

Operator Staffing and Roles

Regulations Covered

- 10 CFR 50.54(i) through (m)
- 10 CFR 50.120(b)(2)
- 10 CFR 55
- 10 CFR 50.34(b)(6)(i)

Topics Covered

- Staffing Requirements
- Operator Roles



Top Issues

- Most advanced designs support reduced staffing requirements; however, current regulatory structure will require NRC-approved alternatives or exemptions.
- Recent precedence indicates current NRC receptiveness to optimized operator staffing plans.

Emergency Planning

Regulations Covered

- 10 CFR 10.47 (several subsections)
- 10 CFR 52.17(b)(2)(i)
- 10 CFR 50, Appendix E, IV & V
- 10 CFR 50.160
- 10 CFR 50.33(g)(2)
- 10 CFR 50.54(q)

Topics Covered

- Emergency Plan
- Implementing Procedures



Top Issues

- Recently promulgated regulations (§ 50.33(g) and § 50.160) provide significant flexibility for remote based Emergency Planning.
- Emergency Planning can be greatly simplified if the EPZ does not extend beyond the site boundary.

Physical Security

Regulation Covered

- 10 CFR 73.55

Topics Covered

- Physical Barriers
- Target Set
- Access Control
- Search Programs



Top Issues

The off-site remote MCR configuration, combined with alternate shutdown capabilities, raises critical questions about:

- How and when critical SSCs are controlled
- The criteria used to screen out SSCs during Target Set development

Cyber Security

Regulation Covered

- 10 CFR 73.54 (emphasis on NEI 08-09)

Topics Covered

- Cybersecurity Program Framework
- Security Boundary Control & Remote Access
- Monitoring, Logging, & Alerting



Top Issues

- Remote Operation Expands the Attack Surface and Challenges Traditional Security Models.
- Addressing NEI 08-09 Requirements for Tailored Technical and Administrative Controls.
- Centralized Monitoring and Accurate Timestamping Are Essential for Forensic Integrity.
- Defense-in-Depth Control Must Be Reinterpreted for Remote Architectures.

Maintenance, Test, and Surveillance

Regulations Covered

- 10 CFR 50.65
- Appendix B to 10 CFR Part 50 (Criterion XI)
- Appendix A to 10 CFR Part 50
- 10 CFR 50.34(b)(6)(iii) and (iv)
- 10 CFR 52.79(a)(28) and (29)
- 10 CFR 50.55a(f) and 10 CFR 52.79(a)(11)
- 10 CFR 50.36



Topics Covered

- Maintenance Rule, Test, Tech Spec
Surveillances

Top Issues

- Relying on offsite operators could impact the frequency in which operators could support monitoring or preventative maintenance activities.
- Plant systems must be designed to allow for remote operations testing/maintenance support.
- Lack off operator onsite support for testing activities.

Summary

The following items are expected to pose the greatest regulatory challenges:

- Cyber Security - Given the expanded attack surfaces and increased reliance on wide-area networks, cybersecurity for remote MCRs is expected to need additional scrutiny under 10 CFR 73.54.
- Physical Security - Meeting the physical security requirements of 10 CFR 73.55 for a remote MCR demands establishing a Vital Area within a Protected Area, maintaining bullet-resisting barriers, enforcing strict access control to prevent unauthorized entry, implementing comprehensive search protocols to detect contraband, and ensuring robust protection of both the remote MCR and Alternate Shutdown Area during Target Set development.

Next Steps

Activity	Date
Complete initial draft of report	September 2025
Issue draft report to the NEI Operational Aspects of Advanced Reactors (OAAR) task force for comment.	October 2025
Final Report Issued	December 2025