Control Room Habitability

NRC/CRH Task Force Meeting
October 25, 2000

Agenda

Time	Topic	Responsible Party
8:00	Welcome and Introductory Remarks	NRC NEI
8:30	Overview of NEI 99-03 and Schedule	Kurt Cozens
9:00	Industry Survey Results	Jim Riley
9:20	**Key Issues**	
	Baseline Testing	Ken Taplett
	Periodic Assessment	Jerry Burford
	Smoke Inleakage	Mike Ruby
	Toxic Gas Assessment	Bob Campbell
	Technical Specification	Jerry Sims
11:00	Review of Revision to NEI 99-03	NRC
11:30	Lunch	--
1:00	Review of Revision to NEI 99-03 (Continued)	NRC
3:00	Implementation of NEI 99-03	NRC NEI
5:00	Adjourn	

Overview of Revised NEI 99-03

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Status

- Current draft - October 2000
  - Work in progress
  - Extensively rewritten --Addresses comments
- Overview of NEI 99-03
  - Purpose
    - Guidance on demonstrating adequate protection of CR operators
      - Radiological
      - Toxic gas
  - Scope
    - Existing licensing basis

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Key Elements

- Baseline test to measure CRE inleakage
- Periodic assessment of CR inleakage
- Existing toxic gas assessment remains valid
- Periodic reassessment of toxic gas
- Qualitative assessment of smoke infiltration
- Assesses if the limiting design basis accident has been evaluated
- Plant as-built configuration and operating procedures assessed
- Reduce unnecessary conservatism with more recent technical insights and methods for radiological dose assessments

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Document Structure

- Part 1, Background
  - Section 1, Introduction
  - Section 2, Regulatory Requirements and Guidance
  - Section 3, Industry Issues Associated with Control Room Habitability
- Part 2, Assessment Process
  - Section 4, Determining CRH Licensing Basis
  - Section 5, Comparing Existing Plant Configuration and Operations With Licensing Bases For CRH
  - Section 6, Industry Issue Applicability
  - Section 7, Air Inleakage
  - Section 8, Methodology for Dispositioning and Managing Discrepancies
- Part 3, Establishing and Maintaining CRH
  - Section 9, Long-Term CRH Program
- Appendices

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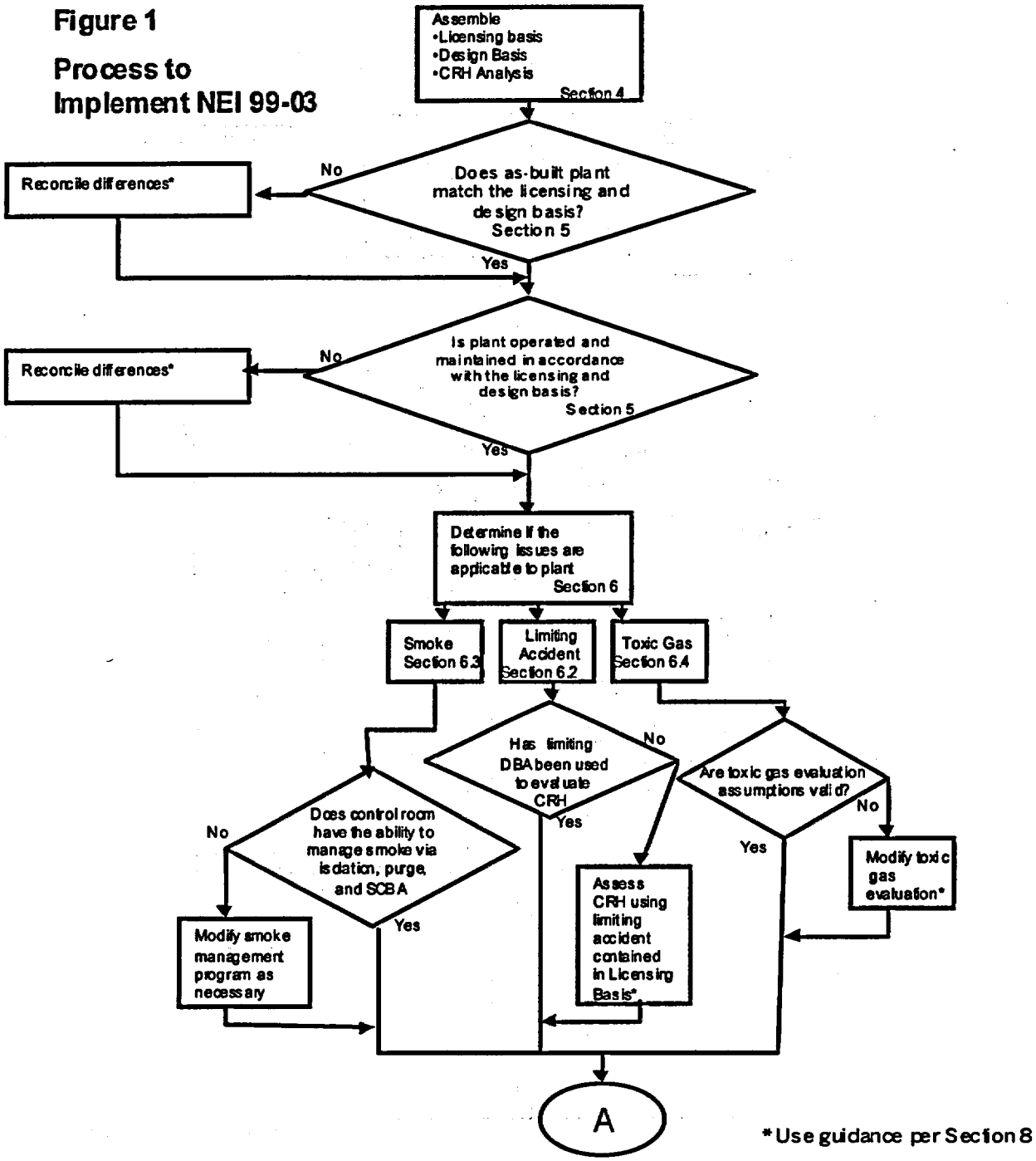
NEI 99-03 Process

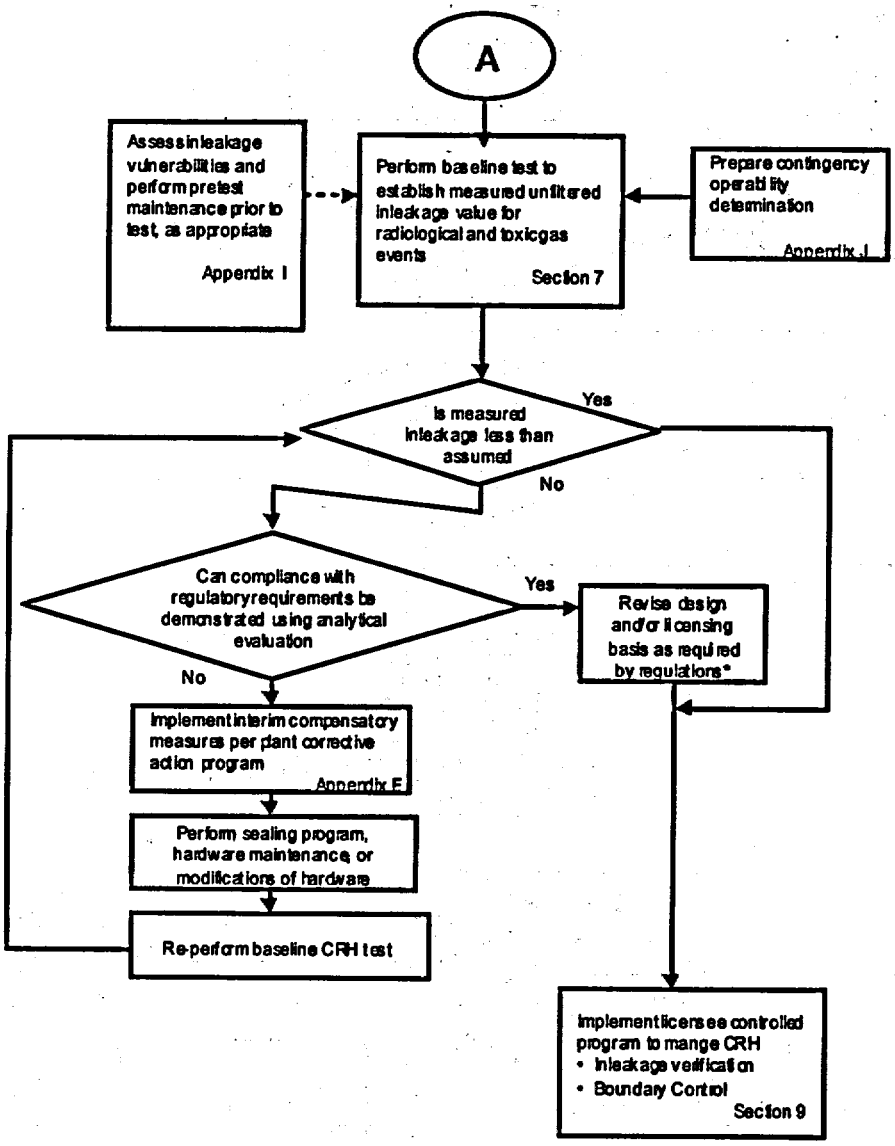
Figure 1

Process to Implement NEI 99-03



*Use guidance per Section 8

NEI 99-03 Process (continued)



*Use guidance per Section 8

Completion Schedule

- NRC/TF meeting -- October 25
  - Review October 2000 draft
- NEI Licensing Information Forum -- November 2, 2000
- NRC staff comments requested -- November 6
- ACRS meeting -- November 15
- Issue revised NEI 99-03 to Industry and NRC for review -- early December
  - Comments due February
- NRC formal review of NEI 99-03 -- late-March
  - 60 day review requested
- NRC/TF meeting to address comments -- mid-July
- Issue final NEI 99-03 -- Summer 2001
- Industry workshop -- Summer 2001

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CRH Industry Survey

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CRH Industry Survey

- Survey undertaken to:
  - Determine the degree of "interest" in the CRH topic in general
  - Inform the industry of the various aspects of CRH technical issues
  - Understand the industry perspective on key issues

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CRH Industry Survey

- Survey conducted from September 20 through October 13, 2000
- Responses requested from all nuclear utilities
  - 80% of reactor units responded
- Responses represent plant management views

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CRH Industry Survey

- Questions sought viewpoints on the major technical questions:
  - Baseline in-leakage testing
  - Periodic in-leakage reassessment
  - Toxic gas reassessment
  - Smoke infiltration
  - CRH Program Commitment
  - Acceptance of NEI 99-03

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CRH Industry Survey

- Baseline in-leakage testing:
  - CRH TF recommends that all plants establish a quantified value of in-leakage for their CR envelope
  - 50% of respondents agreed
  - Typical reasons for no baseline testing
  - Test options (if testing required):
    - Tracer gas - 33%
    - Component - 47%
    - Alternate - 7%

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CRH Industry Survey

- Periodic in-leakage reassessment
  - CRH TF recommends that in-leakage be reassessed periodically, not necessarily by testing
  - 75% of respondents agreed
  - Frequency determined on a case-by-case basis

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CRH Industry Survey

- Toxic gas reassessment
  - CRH TF recommends periodic toxic gas reassessment
  - Frequency depends on plant specific conditions
  - 96% of respondents agreed

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CRH Industry Survey

- Smoke infiltration into the CR
  - CRH TF recommends a qualitative assessment of vulnerability to smoke effects on CRH and remote shutdown panel access
  - 88% of respondents agreed

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CRH Industry Survey

- CRH Program
  - CRH TF recommends that plants commit to follow a CRH Program similar to that described in NEI 99-03
  - Survey options:
    - No Change
    - Program Commitment
    - Admin TS
    - TRM
    - TS Surveillance
  - 75% of respondents indicated willingness to make some form of commitment to a CRH program

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CRH Industry Survey

- Acceptance of NEI 99-03
  - CRH TF outlined NEI 99-03 content and process of development
  - CRH TF asked if utilities thought they would follow the CRH Program guidance as currently described in NEI 99-03
  - 55% said they would definitely or probably follow
  - 31% of respondents were unsure

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CRH Industry Survey

- What will be done with the survey results:
  - Used to inform the industry of the support behind various viewpoints
  - Provide a foundation for CRH TF positions on the technical issue
- Survey responses support recommendations in NEI 99-03

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Baseline Testing

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Baseline Testing

- NEI 99-03 recommends a baseline test to determine air in-leakage
- Baseline Test Attributes
  - Test is comprehensive
  - Performed to reflect accident configuration lineup
  - Tests performed in accordance with recognized standards
- Acceptable baseline test methods are:
  - Integrated tracer gas testing
  - Component testing
  - Alternative test method

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Testing Prerequisite (Appendix I)

- CR envelope
  - Walkdowns
  - Sealing
  - Refurbishment
  - Repair
- HVAC system aligned and balanced
- Contingency Plans (radiological and toxic gas)
  - Operability
  - Preliminary calculations to determine acceptable inleakage limits

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Tracer Gas Method

- Per ASTM E741, *Standard Test Methods for Determining Air Change in a Single Zone by Means of Tracer Gas Dilution*
  - All CR designs
  - Recommended for non-pressurized CR or large number of potential inleakage sources
- Back calculates unfiltered inleakage

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Tracer Gas Method (Continued)

- Key to success
  - Concentration uniform throughout CR volume
    - Sampling techniques
    - Sampling locations
    - Injection location
  - Determination of CR volume
  - Environmental effects (wind, temperature, pressurization flows)

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Component Test Method

- Only recommended for pressurized CRs
  - Key -- CR positive pressure to all adjacent areas
  - Likely uses -- CRs with small number of potential inleakage
- Three elements of test procedure
  - ID potential inleakage sources
  - Demonstrate that CR positive pressure to all adjacent areas
  - Measure unfiltered in-leakage vulnerable components
    - Total unfiltered inleakage

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Component Test Method (Continued)

- Key to success
  - Design
    - Majority of CR HVAC equipment internal
    - Minimal non-CR ventilation ducting or air systems penetrate CRE
    - Seam welded ventilation ducting
  - Test success
    - Demonstrating CR pressure positive to all adjacent areas
      - High precision with existing equipment
      - Multiple measurements taken
    - Understanding CR design and unfiltered inleakage vulnerabilities
    - Selecting proper pressure or vacuum decay test method (ASTM, ANS, ANSI, ASME) for each component (Table J-2)

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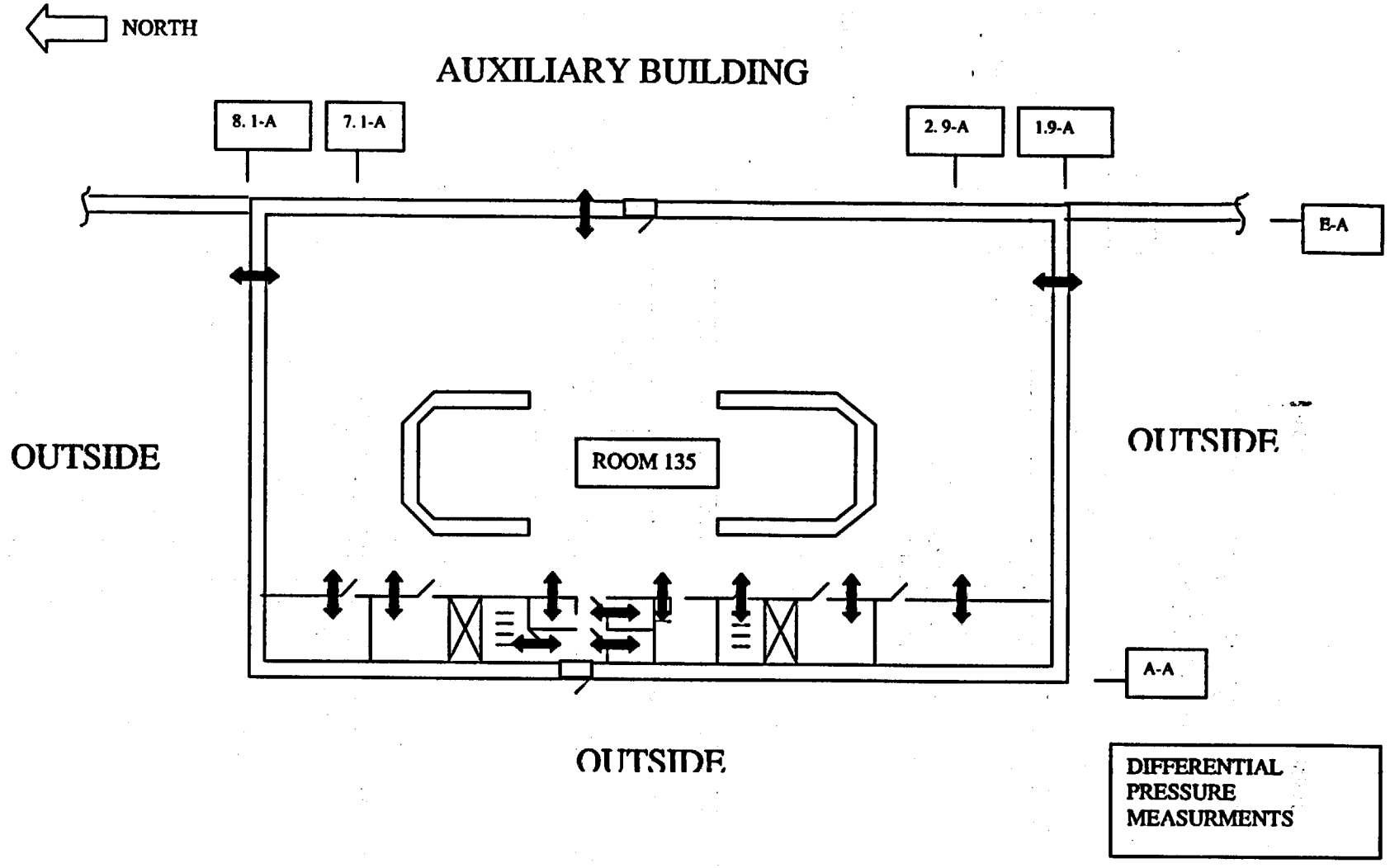
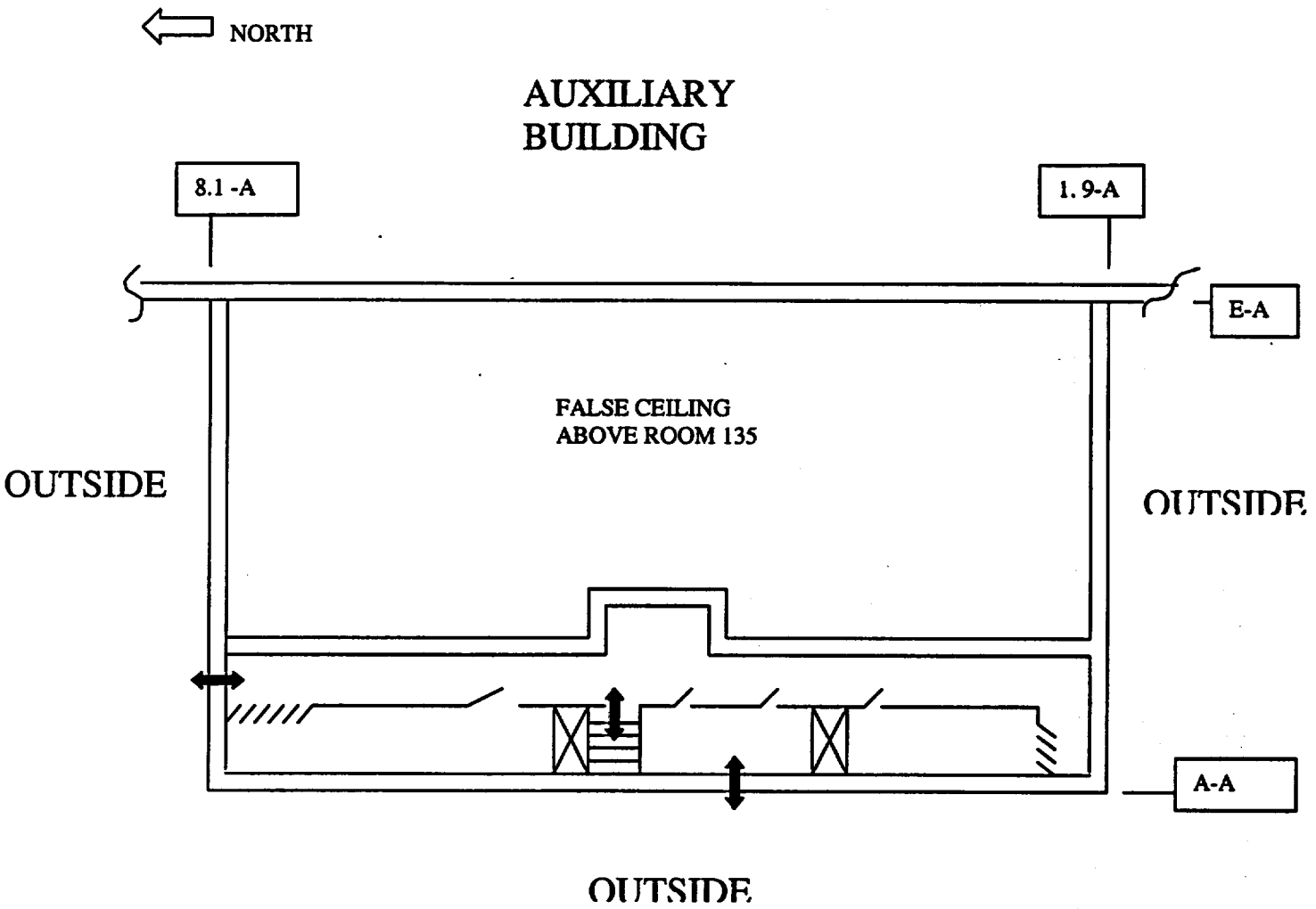
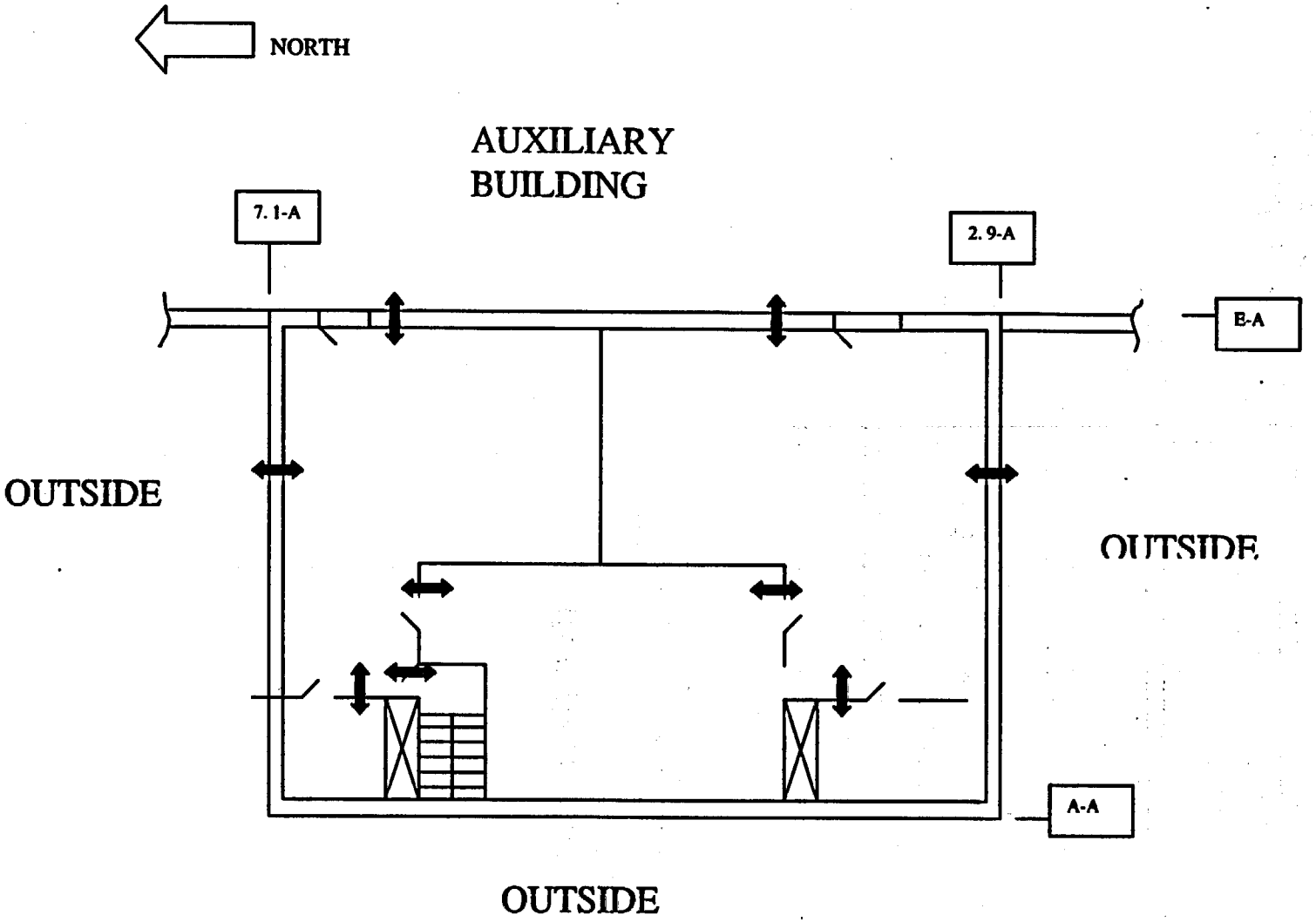


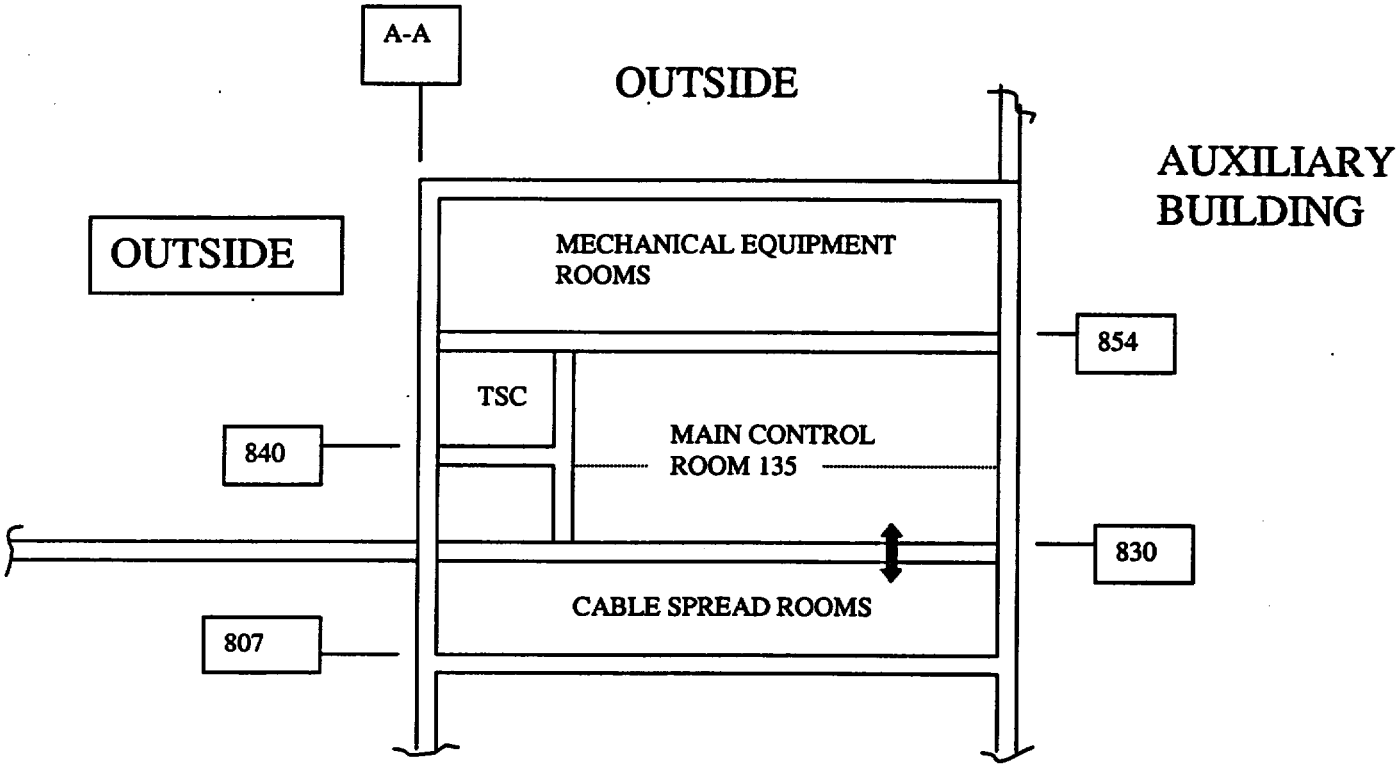
PLAN VIEW AT EL. 830' 0''



PLAN VIEW AT ELEVATION 840
(TSC ELEVATION)

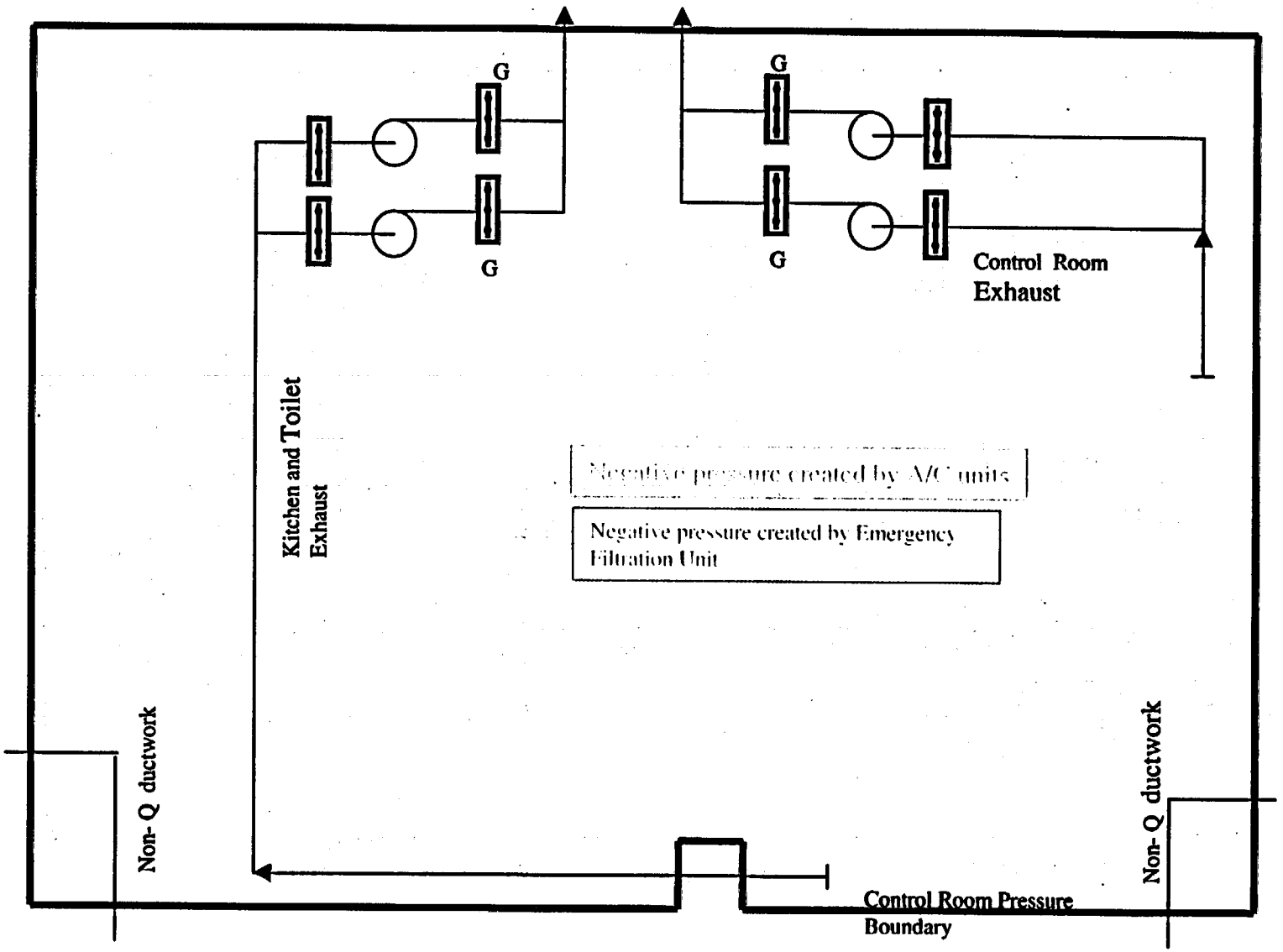


PLAN VIEW AT ELEVATION 854

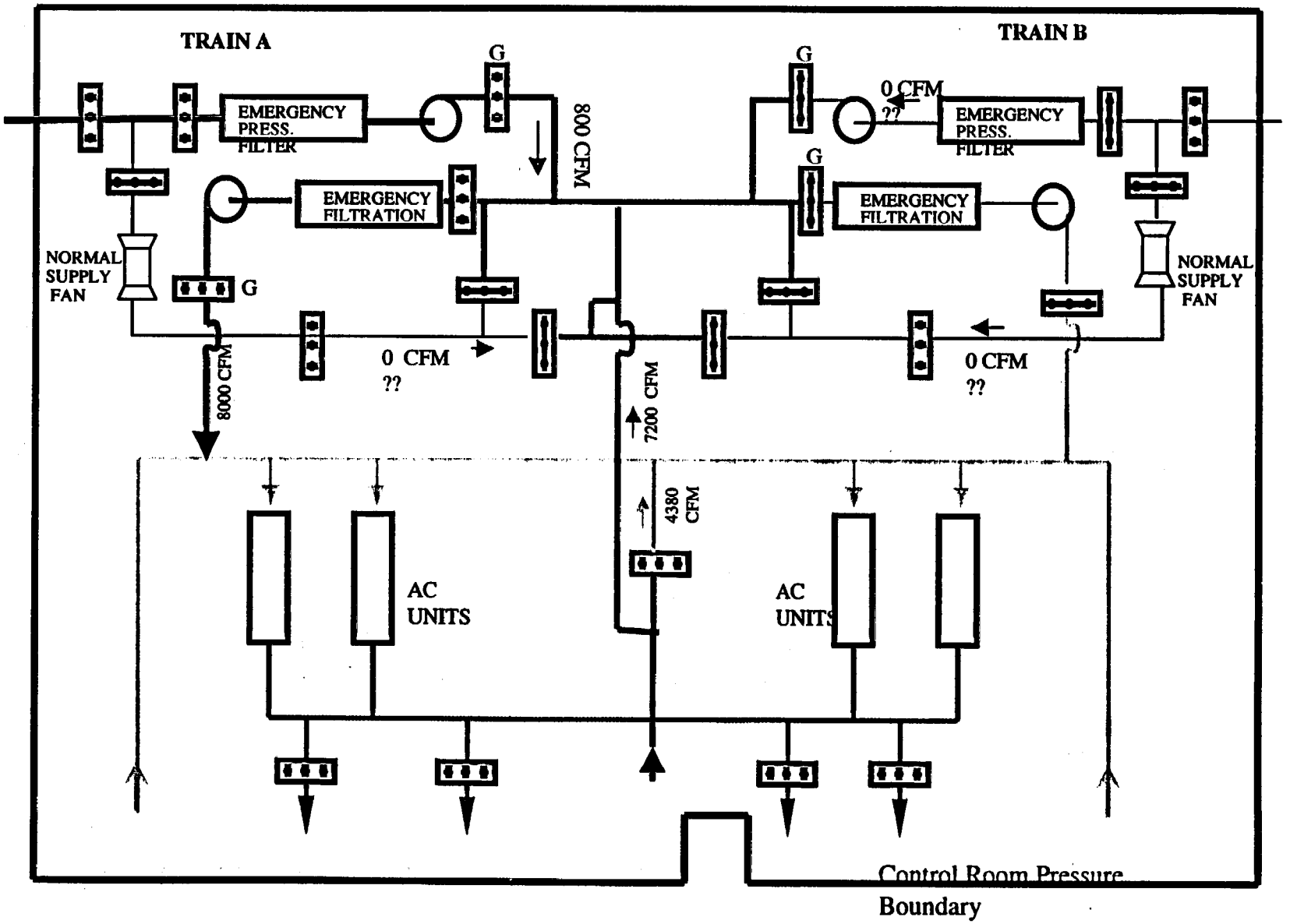


SECTION VIEW OF CONTROL BUILDING
VIEW LOOKING NORTH

Train A in Emergency Recirculation Train B OFF (All Exhaust Fans OFF)



Train A in Emergency Recirculation Train B OFF



Summary

- NEI 99-03 recommends quantifiable baseline testing
- Tracer gas and component testing are viable methods for measuring unfiltered CR inleakage

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Periodic Inleakage Assessment

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Periodic Inleakage Assessment

- NEI 99-03 recommends Periodic Inleakage Assessment
- Part of Control Room Integrity Program
- Combined evaluation / testing approach
  - Evaluate:
    - Significant degradation
    - Magnitude of vulnerability
    - Degree of available margin
  - Test, if indicated by evaluation

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Periodic Inleakage Assessment

- Establish Assessment frequency – plant-specific
  - Baseline Assessment findings
  - Baseline test result vs. analysis
  - Program effectiveness
  - Performance-based

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CR Smoke Infiltration

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CR Smoke Infiltration

- Testing results exhibited higher than anticipated in-leakage values.
- NEI 99-03 addresses smoke infiltration generically
- Qualitative guidance provided to assess smoke infiltration vulnerability:
  - plant layout,
  - potential fire scenarios,
  - procedures,
  - ventilation lineups,
  - SCBAs, and
  - training.

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CR Smoke Infiltration

- A success path for mitigation of smoke infiltration is provided
  - A progression of actions and decision making logic to assist the utilities in their evaluations.
  - Corrective actions if necessary

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CR Smoke Infiltration

- Quantitative guidance or design changes are not recommended because:
  - There are no design criteria for smoke, such as:
    - Characteristics
    - Concentrations
    - Location
    - Duration
    - Transport properties
- It is beyond the scope of the task force to develop a quantitative approach as described above

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Toxic Gas Assessment

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Toxic Gas Assessment

- Licensees have evaluated toxic gas events
  - Typically per Regulatory Guides 1.78 and 1.95
- Typical control room response to a toxic gas event is to isolate only
- Plant alignment is important when quantifying inleakage value for use in toxic gas analysis

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Toxic Gas Assessment

- Review existing toxic gas evaluation
  - Increased inleakage
  - New sources
- Periodic toxic gas re-assessment
  - Frequency based on plant-specific conditions
  - Increased inleakage
  - New sources

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Appendix H
Toxic Gas Assessments

- Provides guidance to assess CRH for a toxic gas event
- Assessments primarily based on RG 1.78, RG 1.95, and NUREG/CR-6624 plus plant specific commitments (if any)
  - Identify offsite and onsite hazards
  - Establish toxic limits
  - Provides screening criteria

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Appendix H
Toxic Gas Assessments
(continued)

- Detailed evaluations should consider:
  - Accident Type. Both maximum concentration and maximum concentration-duration accidents
  - Release Characterization
  - Atmospheric Dispersion
  - Control Room Air Infiltration

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Technical Specification

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Technical Specifications

- Several options considered
  - No change from existing requirements
  - Commitment to a CRH Program as described in NEI 99-03
  - Admin TS
  - Moving CR HVAC TS requirements into a TRM and adoption of periodic in-leakage assessment requirements
  - Adoption of an in-leakage surveillance in the current TS

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Technical Specifications

- Observations
  - CRH TF believes that a commitment to reassess CRH in-leakage periodically is the right thing to do
  - Current TS surveillances adequately address the operability of control room HVAC systems
  - CR in-leakage is a design input assumption and does not satisfy 50.36 criteria for inclusion as a TS

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Technical Specifications

- NEI 99-03 recommendations
  - Establish a CRH Program
- No Tech Spec changes
  - 75% of survey respondents agreed to some form of commitment to a CRH program
  - 40% of survey respondents preferred the TRM option
  - This may be a possibility for future enhancement of the CRH Program

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NRC Review of NEI 99-03

Mark Reinhart, Chief
Licensing Section
Probabilistic Safety Assessment Branch
U.S. Nuclear Regulatory Commission

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Unfiltered Inleakage Testing

- About 25% control rooms tested (E741)
- None satisfied analyses assumed value
- All satisfied Technical Specifications SR
- Each licensee was able to recover
  - New analyses
  - Restored boundary
- No plants shut down

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Current CRH Solution

Mar 1998	NRC invited Industry Interface
Jul 1998	Workshop
Sep 1998	Initial Interface Meeting
Aug 1999	First draft NEI 99-03 issued
Nov 1999	Commenced revision effort
Jan – Jun 2000	Monthly meetings
Oct 2000	New draft NEI 99-03

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Progress

- Open Dialogue
- Improved Awareness of Issue
- Concentration of Information
- Three Working Groups
  - Systems
  - Analyses
  - Licensing
- Significant Areas of Agreement
- NEI 99-03

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Five Primary Issues

- Testing
- Technical Specifications
- Package:
  - Analyses
  - Conservatisms
  - Non-Conservatisms
- GDC-19 and Adjacent Units
- Smoke

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NEI 99-03 Schedule

Oct 13, 2000	Draft to NRC
Oct 25, 2000	NRC initial feedback
Nov 15, 2000	ACRS Subcommittee Meeting
Nov 30, 2000	NRC complete feedback
Dec 7, 2000	NEI issue for industry comment; ACRS
Feb 15, 2001	Industry feedback to NEI
Mar 21, 2001	NEI issues for formal NRC review
May 21, 2001	NRC response
Jul 2001	NEI issue final
Fall 2001	NEI Workshop
Sep 2001	NRC issues draft Reg. Guide for comment

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3.7 PLANT SYSTEMS

3.7.10 Control Room Emergency Filtration System (CREFS)

LCO 3.7.10 Two CREFS trains shall be OPERABLE.

- NOTE -

The control room boundary may be opened intermittently under administrative control.

APPLICABILITY: MODES 1, 2, 3, 4, [5, and 6],
During movement [recently] of irradiated fuel assemblies.

ACTIONS

CONDITION	REQUIRED ACTION		COMPLETION TIME
A. One CREFS train inoperable.	A.1	Restore CREFS train to OPERABLE status.	7 days
B. Two CREFS trains inoperable due to inoperable control room boundary in MODES 1, 2, 3, or 4.	B.1	Establish temporary compensatory measures in accordance with the Control Room Boundary Integrity Program (CRBIP)	24 hours
	AND		
	B.2	Restore control room boundary to OPERABLE status.	14 days ~~24 hours~~
C. Required Action and associated Completion Time of Condition A or B not met in MODE 1, 2, 3, or 4.	C.1	Be in MODE 3.	6 hours
	AND		
	C.2	Be in MODE 5.	36 hours

ACTIONS (continued)

CONDITION	REQUIRED ACTION		COMPLETION TIME
D. Required Action and associated Completion Time of Condition A not met [in MODE 5 or 6], or during movement of [recently] irradiated fuel assemblies.	D.1	---------- - NOTE - [Place in toxic gas protection mode if automatic transfer to toxic gas protection mode is inoperable.] ---------- Place OPERABLE CREFS train in emergency mode.	Immediately
	OR		
	D.2	Suspend movement of [recently] irradiated fuel assemblies.	Immediately
E. Two CREFS trains inoperable [in MODE 5 or 6], or during movement of [recently] irradiated fuel assemblies.	E.1	Suspend movement of [recently] irradiated fuel assemblies.	Immediately
F. Two CREFS trains inoperable in MODE 1, 2, 3, or 4 for reasons other than Condition B.	F.1	Enter LCO 3.0.3.	Immediately

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.7.10.1	Operate each CREFS train for [≥ 10 continuous hours with the heaters operating or (for systems without heaters) ≥ 15 minutes].	31 days
SR 3.7.10.2	Perform required CREFS filter testing in accordance with the [Ventilation Filter Testing Program (VFTP)].	In accordance with [VFTP]

SURVEILLANCE REQUIREMENTS (continued)

	SURVEILLANCE	FREQUENCY
SR 3.7.10.3	Verify each CREFS train actuates on an actual or simulated actuation signal.	[18] months
SR 3.7.10.4	Verify control room boundary unfiltered inleakage ≤ [10] scfm in accordance with the CRBIP.	In accordance with the CRBIP.
	~~Verify one CREFS train can maintain a positive pressure of ≥ [0.125] inches water gauge, relative to the adjacent [turbine building] during the pressurization mode of operation at a makeup flow rate of ≤ [3000] cfm.~~	~~[18] months on a STAGGERED TEST BASIS~~

Technical Specifications 5.5 Administrative Controls, Programs and Manuals

5.5.16 Control Room Boundary Integrity Program (CRBIP)

The control room unfiltered inleakage shall be verified to be less than or equal to [design basis assumption] scfm in accordance with the following schedule.

Integrated testing method (ASTM E741 provides an acceptable method):

- Baseline
- Thereafter, each 3 years.
- If, subsequent to the Baseline test, the previous as found test was successful, the subsequent test interval is extended to each 5 years.
- If the previous two as found tests were not successful, the subsequent test interval is reduced to 1.5 years. Upon a successful as found test, the interval returns to 3 years, then as specified above.

Component testing method:

- Baseline (Integrated test)
- Baseline + 2 years (Components test)
- Next 2 years (Components test)
- Next 2 years (Integrated test)

Component testing may be a viable alternative to 100% integrated testing provided that:

- The licensee can demonstrate that its as designed, as built, and as operated control room boundary is such that the licensee can identify ≥ 90% of the potential control room boundary leakage paths.
- The licensee can correlate component leakage results to integrated leakage test results.

Compensatory Measures:

- Written procedure.
- Preplanned measures for radiological, toxic gas, fire generated toxic gas, smoke, temperature, humidity, and physical security challenges related to intentional or unintentional failure to maintain control room boundary integrity.
- Stationed dedicated watch for opening.
- Temporary use of KI or SCBA.
- Other?