November 14, 2006 Meeting With NRC

Overview of the August 29, 2006 Plant Hatch Alternative Source Term Submittal

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Enclosure 2

Agenda

- Introduction
- Scope
- Design Basis Accident Modeling
- Polestar Methods of Activity Removal
- Crediting of Turbine Building HVAC
  - Passive Ventilation Study
  - Ductwork Description and Seismic Verification
  - Air Supply and Seismic
  - Power Supply and Seismic
- Standby Liquid Control System Assessment
- Technical Specification Changes
- Conclusion

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Introduction

- **Purpose of Alternative Source Term (AST) NRC Submittal**
  - Address Control Room Habitability GL 2003-01
  - Address Hatch unique MCR location inside Turbine Building
  - Replace by May 31, 2010 interim licensing basis of 110 cfm MCR unfiltered inleakage (based on potassium iodide)

- **AST provides the margin needed to bound 15 cfm (5 cfm actual inleakage plus 10 cfm for ingress/egress)**
  - AST based limiting MCR unfiltered inleakage 115 cfm (10 cfm for ingress/egress)
  - Considers the impact of additional identified secondary containment bypass paths (0.9% increases to 2%)
  - Considers bypass paths that go thru turbine building
  - MCR/TSC Atmospheric Dispersion Factors updated with ARCON96 based on 3 years of data

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Scope – AST Mitigating Features

- **Full scope AST submittal – all 4 BWR DBAs analyzed**
  - LOCA is limiting DBA for main control room (MCR) inleakage
  - FHA requires no mitigating features
- **Remaining mitigating feature (not listed below) is use of sodium pentaborate for suppression pool pH control post-LOCA**

	LOCA (fuel damage)				MSLB (no fuel damage)			CRDA (fuel damage)		
Mitigating Feature	MCR	TSC	EAB/ LPZ Ground	EAB/ LPZ Elev.	MCR	TSC	EAB/ LPZ	MCR	TSC	EAB / LPZ
Drywell sprays and natural deposition	✓	✓	✓	✓						
MSIV leakage deposition in steam lines & condenser	✓	✓	✓							
Secondary containment bypass leakage deposition in condenser	✓									
TB fan starting at 8 hr at a rate of 15,000 cfm	✓				✓			✓		

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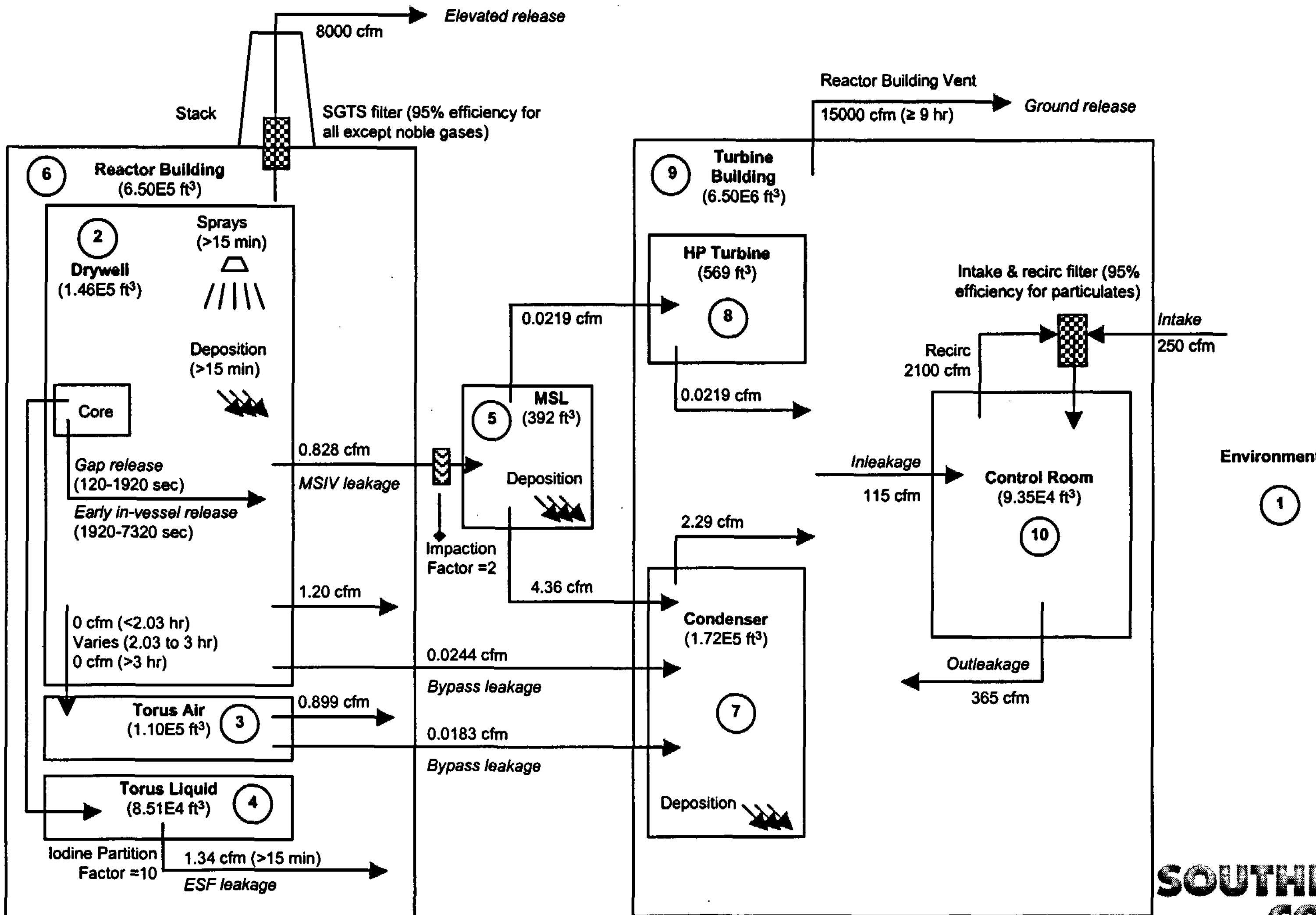
Scope - Seismic

- **AST submittal includes 3 types of seismic evaluations and supporting EPRI report**
  - Unit 1 Main Steam Isolation Valve Alternate Leakage Treatment Path
  - Units 1 and 2 Seismic Verification of Potential Secondary Containment Bypass Leakage Paths Terminating at the Main Condenser
  - Units 1 and 2 Seismic Verification of the Turbine Building Exhaust Ductwork
    - Application of EPRI Technical Report 1007896 titled "Seismic Evaluation Guidelines for HVAC Duct and Damper Systems"

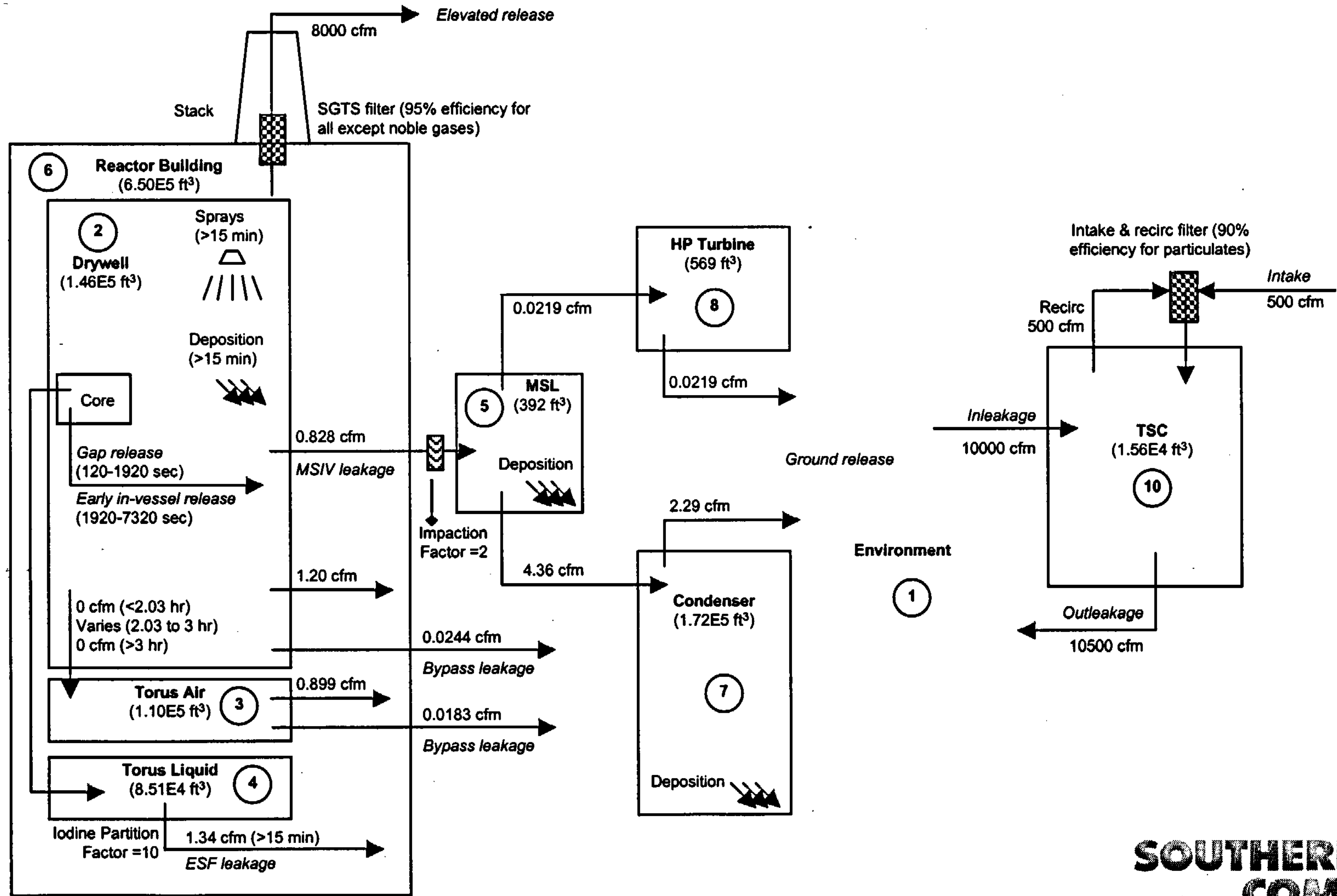
DBA Dose Modeling – Overview

- **Objective is to determine the maximum MCR inleakage without exceeding the dose limit of 5 rem TEDE**
  - LocaDose computer program is used to calculate doses for LOCA, CRDA, MSLB, and FHA based on the methodology of Regulatory Guide 1.183
- **For MCR dose calculations, activity is released into the turbine building for three of the accidents (LOCA, CRDA, MSLB)**
  - Since the activity concentration within the turbine building is higher than outside, all the MCR inleakage is assumed to be from the turbine building
  - Since FHA release is not into the turbine building, MCR inleakage is assumed to be from outside
  - For all accidents, TSC and offsite doses are calculated assuming no holdup in turbine building
- **Maximum MCR inleakage is determined to be 115 cfm for LOCA, 155 cfm for CRDA, 150 cfm for MSLB, and unlimited for FHA**
  - TSC and offsite doses are within acceptance criteria

DBA Dose Model for LOCA - MCR



DBA Dose Model for LOCA – TSC & Offsite



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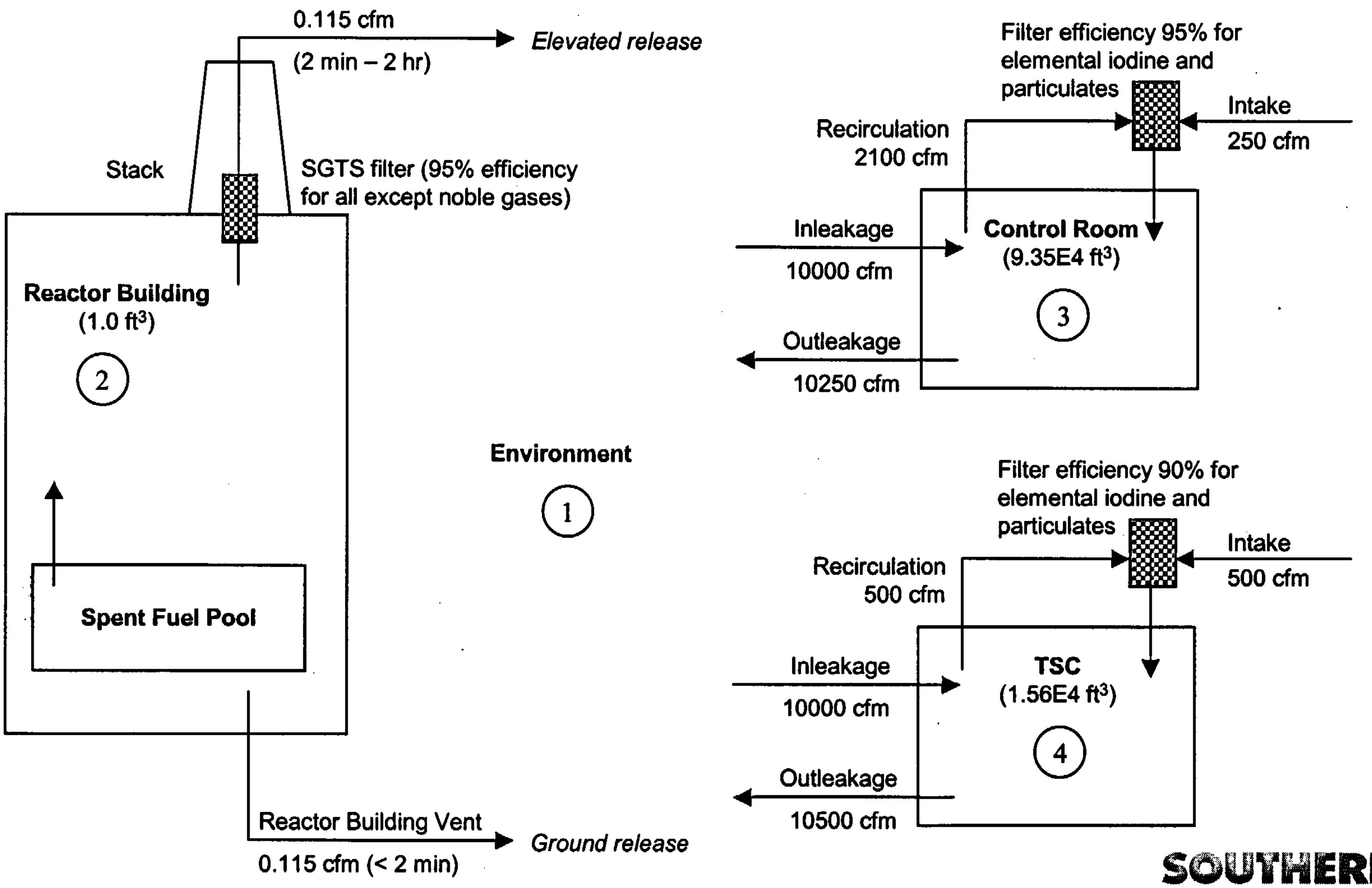
DBA Dose Model for FHA



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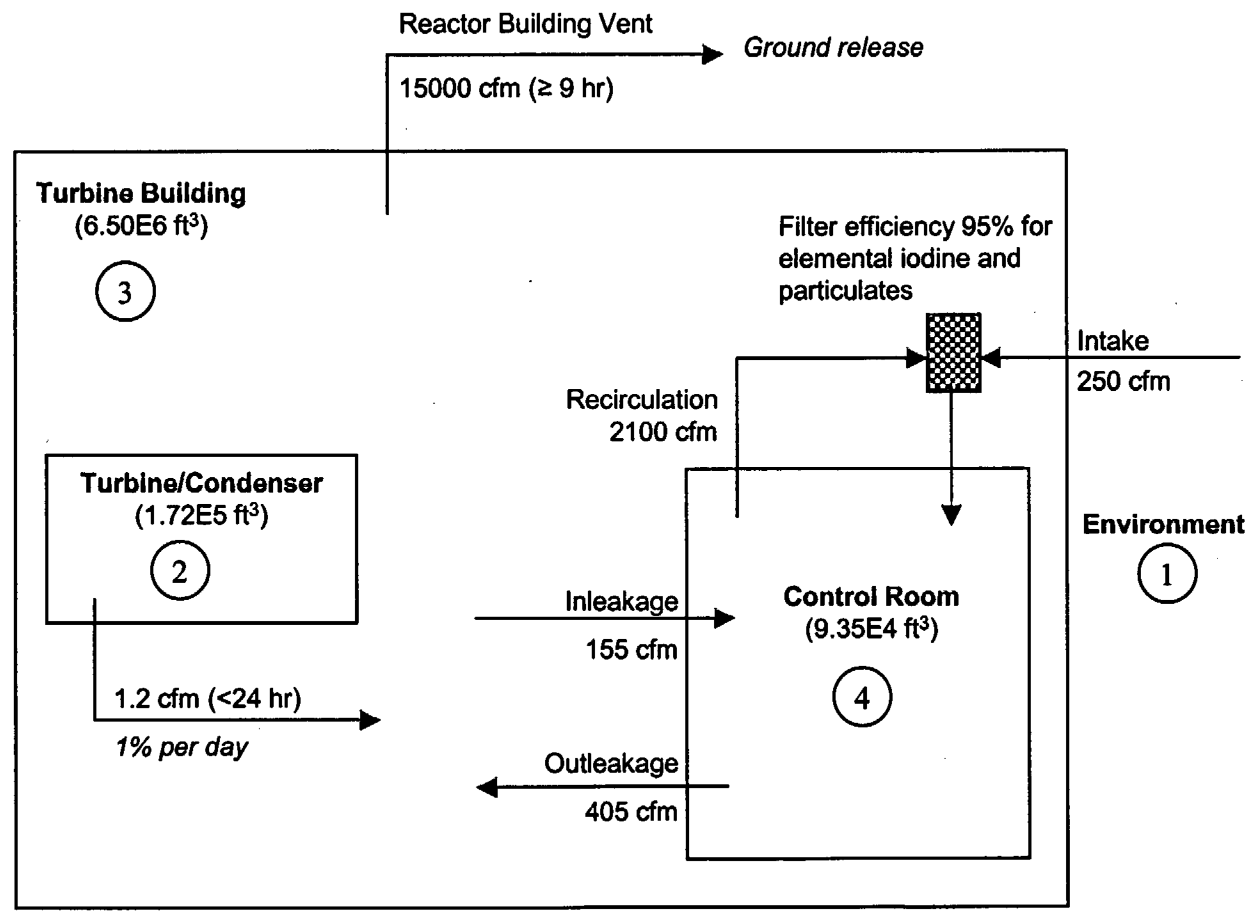
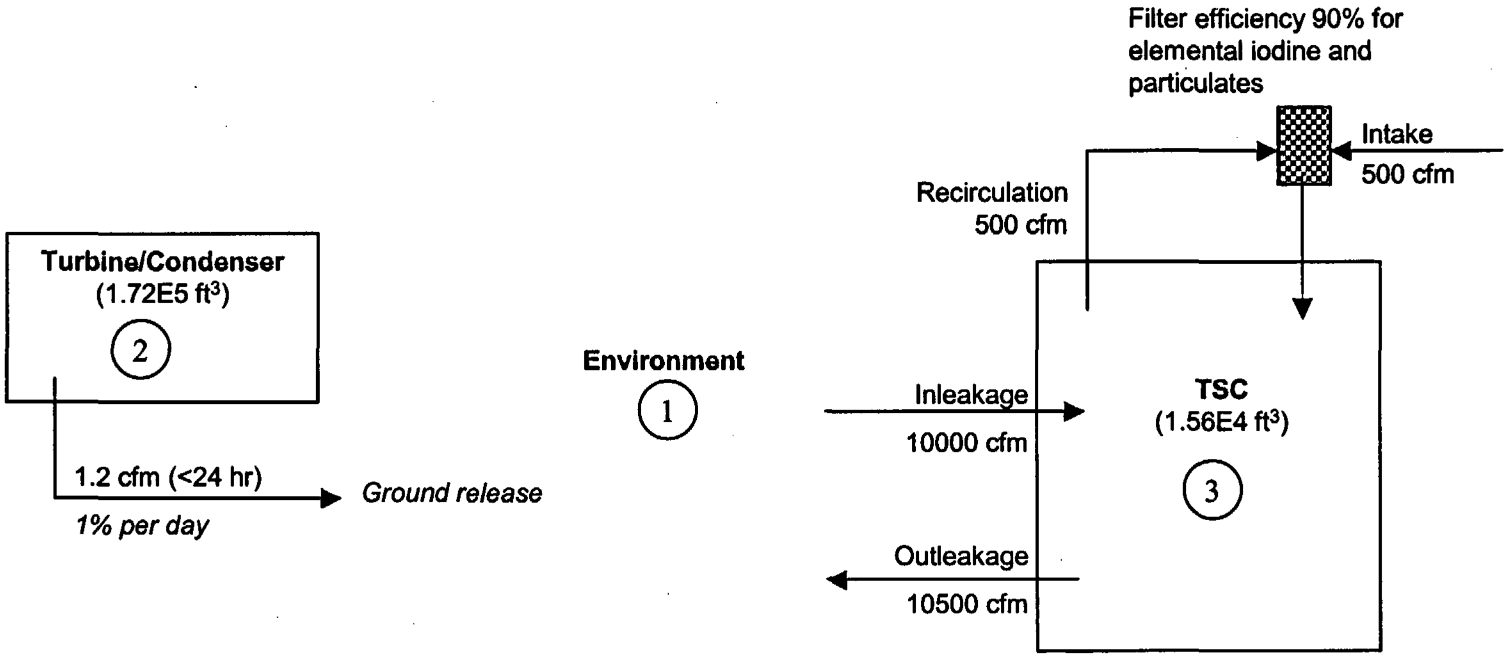
DBA Dose Model for CRDA – MCR



DBA Dose Model for CRDA – TSC & Offsite



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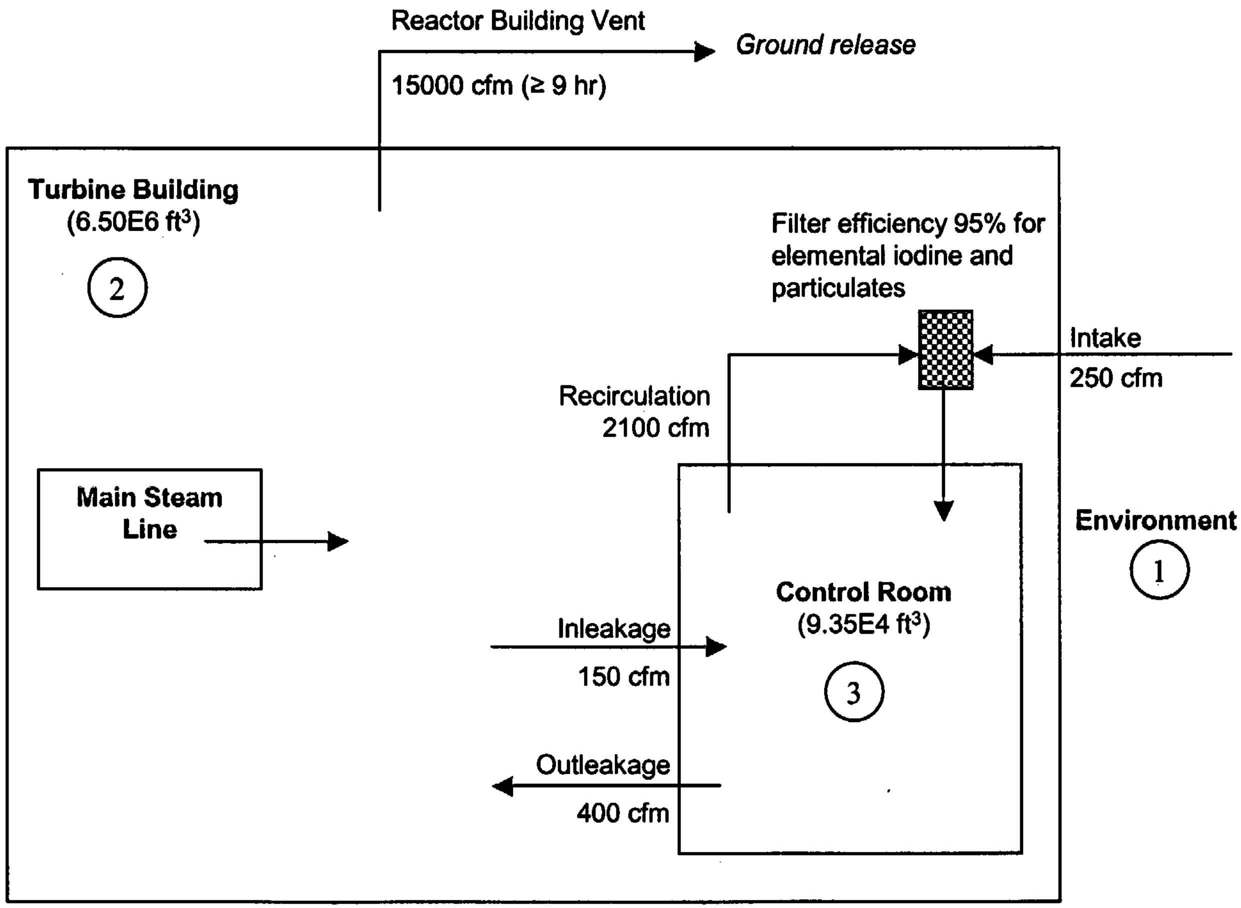
DBA Dose Model for MSLB – MCR



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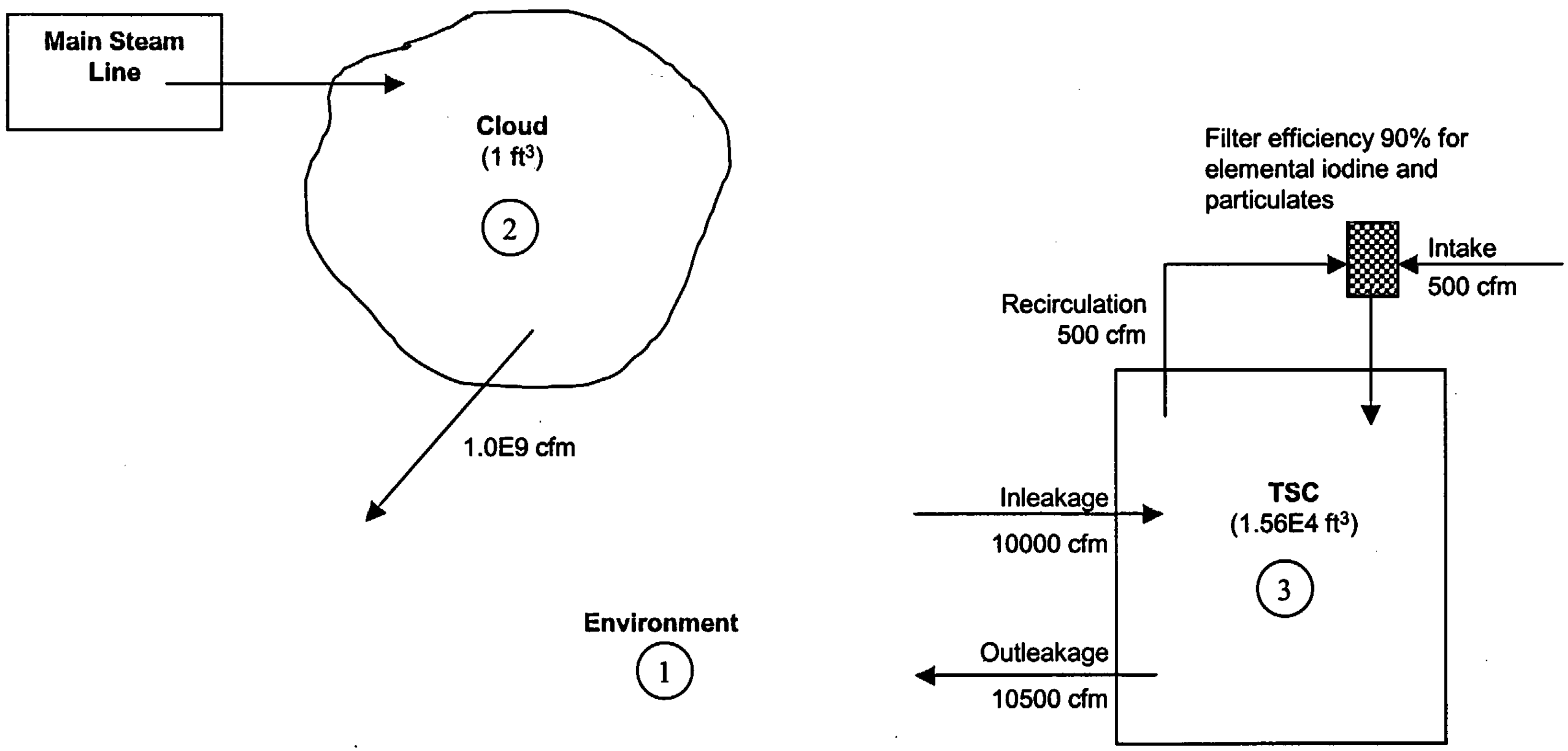
DBA Dose Model for MSLB – TSC & Offsite



Polestar Methods for Activity Removal

- **Polestar Methods**
  - Credit for activity removal by DW spray and sedimentation in steam lines/main condenser (if open pathway to main condenser can be assured and steam lines/main condenser are seismically rugged)
  - STARNAUA for aerosol removal by sedimentation and spray
  - Credit for aerosol impaction in MSIV leakage pathway (DF of 2 at first closed MSIV)
  - Assumption that elemental iodine will adsorb onto surface of dispersed aerosol (i.e., elemental iodine removal rate that of aerosol except not greater than λ = 20 per hour)
  - pH calculated using STARpH
  - DF for elemental iodine calculated on basis of pH = 8.3 at 24 hours (end of spray removal period for elemental iodine) - no DF limit for particulate

Polestar Methods for Activity Removal

- **History and precedent for use of the STARNAUA computer code**
  - AP-600/AP-1000
    - AP-600: first application of STARNAUA for aerosol activity removal
    - Extensive NRC review with Sandia Nat'l Lab (Dr. Powers) as NRC contractor
  - Perry – first application of AST to an operating plant – reviewed by RES
  - Columbia – STARNAUA results used to justify modified NRC methods for steam line deposition to account for drywell spray credit
  - Oyster Creek (currently under review)
    - Close parallel to Hatch
    - No control room filtration whatsoever – 14,000 cfm outside air
- **Credit for drywell spray accepted on VY and Columbia**
- **Credit for removal in steam lines and main condenser accepted on VY and Browns Ferry (but not using STARNAUA)**

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Polestar Methods for Activity Removal

	DW Spray	Main Cond	STARNAUA	NRC SE
AP-600/1000[1]			X	X
Perry	X[2]		X	X
BFN		X		X
VY	X	X		X
Columbia	X		X[3]	X[4]
Oyster Creek	X		X	
Hatch	X	X	X	

1: Advanced PWR (passive plant). 2: MkIII containment uses containment spray, not DW spray. 3: Used to adjust documented NRC-RES acceptance basis for Perry to account for DW spray. 4: SE completed by Dose Assessment Branch.

Polestar Methods for Activity Removal

- **STARNAUA Inputs**
  - Initial aerosol size distribution and mass based on fuel melt experiments
  - Spray flow (one pump) and fall height - 33% reduction to account for local impingement and drywell structures below spray pattern
  - Spray droplet size increased to account for one pump
  - Spray starts 15 minutes after start of accident (13 minutes after start of release with high radiation in drywell – same basis as VY/Columbia)
  - DW thermal-hydraulic conditions (pressure/temperature/rh) from MAAP4
  - Steam line temperature assumed same as normal operation
- **Conservative aerosol impaction DF of 2 based on compilation of experimental data and models for inertial impaction filters**
  - Aspiration efficiency = 50% (very high for expected leak path conditions)

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Polestar Methods for Activity Removal

- **Modeling of Steam Lines**
  - Leak path could actually plug and reduce or eliminate gaseous release as well as particulate release (not credited)
  - Aerosol leakage from drywell reduced by a factor of 2 for steam line STARNAUA cases
  - Size distribution taken from output of STARNAUA DW spray case
  - Same process repeated for downstream steam line control volumes and for main condenser control volume (except for factor of 2 reduction in leaked mass)
  - Only horizontal projection of steam lines credited for aerosol deposition
  - Elemental iodine deposition in steam lines not credited except for DF of 2 at inlet (treated as deposited on aerosol at inlet to main steam lines but not in steam lines due to superheat and potential for re-evolution)

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Polestar Methods for Activity Removal

- **STARpH used for suppression pool pH calculation**
- **Previously applied to**
  - Perry
  - Oyster Creek
  - Hope Creek and Salem
  - Browns Ferry
  - Waterford 3
  - Columbia
- **pH = 8.3 at 24 hours**
- **pH greater than 7 for full 30 days (no iodine re-evolution in containment considered)**

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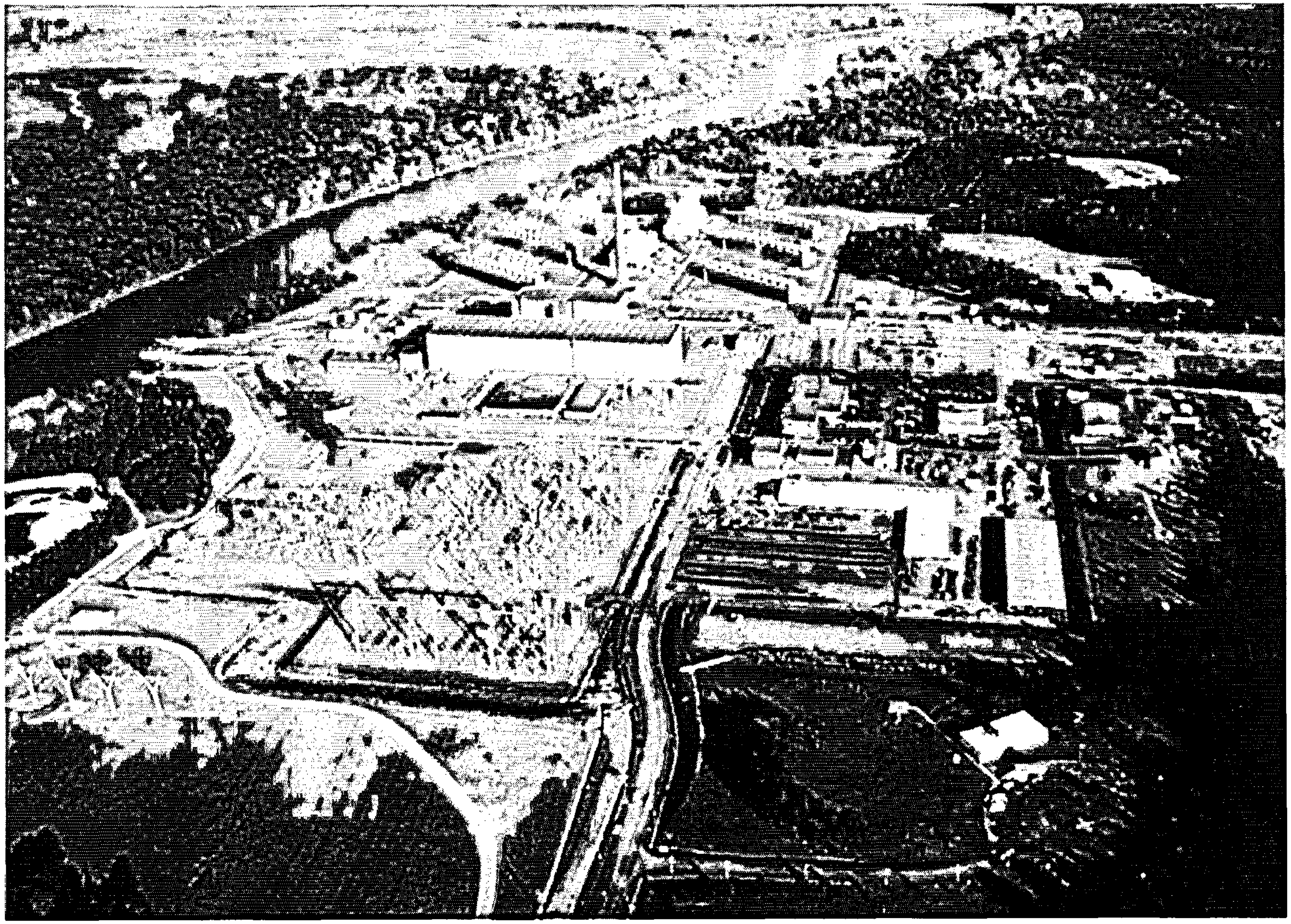
Dose Methodology Wrap-up

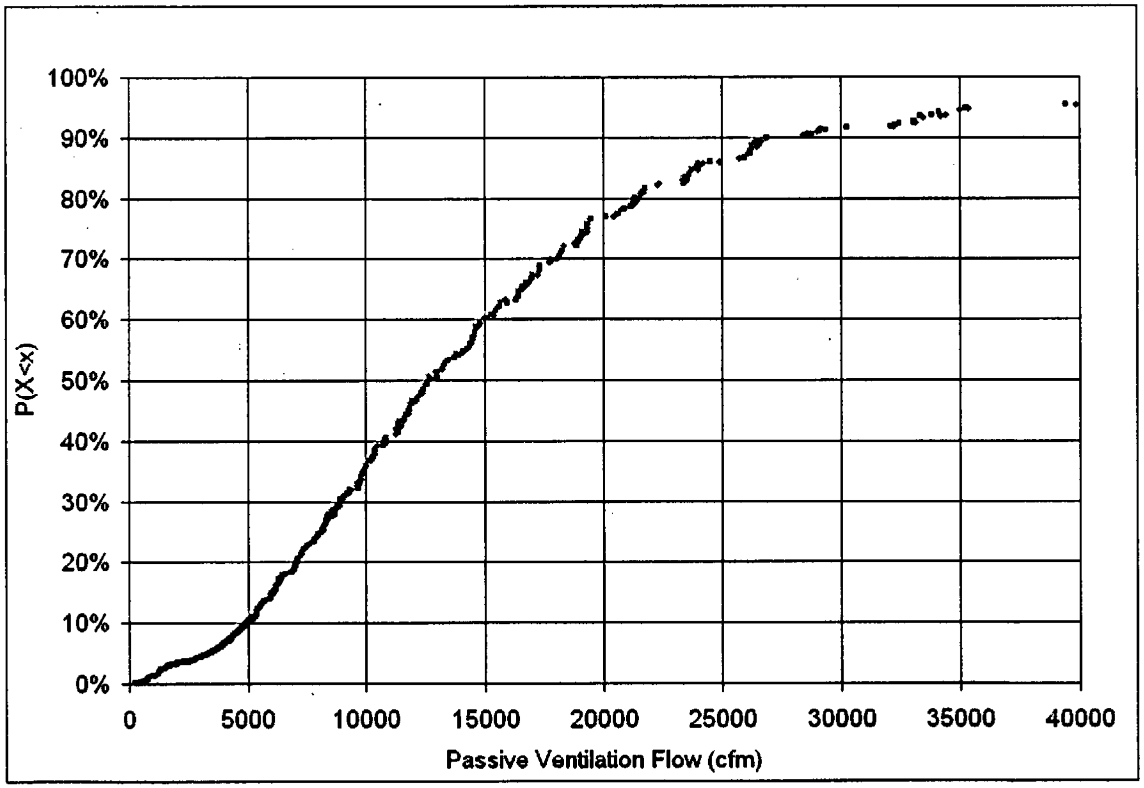


Passive Ventilation Study of Turbine Building

- **Observation that commercial/industrial structures typically "breathe" naturally at 2-10 volumes per day (sometimes as much as 1 volume per hour but large buildings tend to be less)**
- **Function of**
  - Wind speed (external pressure magnitude)
  - Wind direction (pressure distribution)
  - Façade effective leakage area and building openings
  - Inside vs. outside temperature (stack effect) ignored in study
- **CpCalc+ code developed by Politecnico di Torino (Turin, Italy) for the EU used to obtain pressure distribution**
  - Expressed as Cp (multiplier for dynamic pressure)
- **Effective leakage area = mean value for concrete panel construction = 4 cm^2/m^2 from NISTIR 6585**

Passive Ventilation Study of Turbine Building

- Variability in passive ventilation rate based on Hatch site-specific wind speed/direction
- Passive rates appear comparable to forced 15,000 cfm rate used in dose analysis
  - 5th %tile: 3300 cfm
  - 10th %tile: 4900 cfm
  - 20th %tile: 7000 cfm
  - 40th %tile: 10700 cfm
- Includes effect of partially-opened railroad bay doors
- Supports 70 cfm unfiltered inleakage



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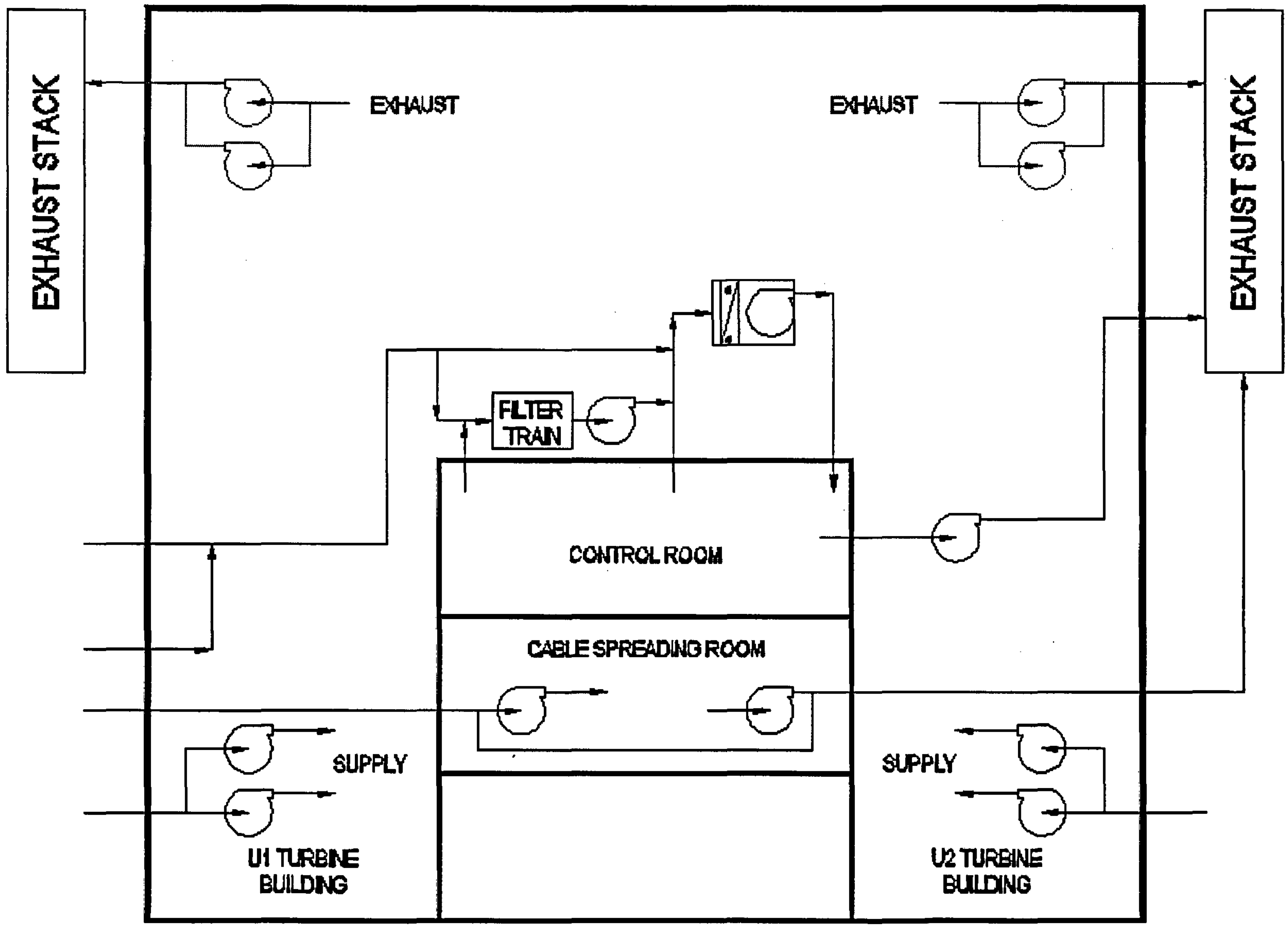
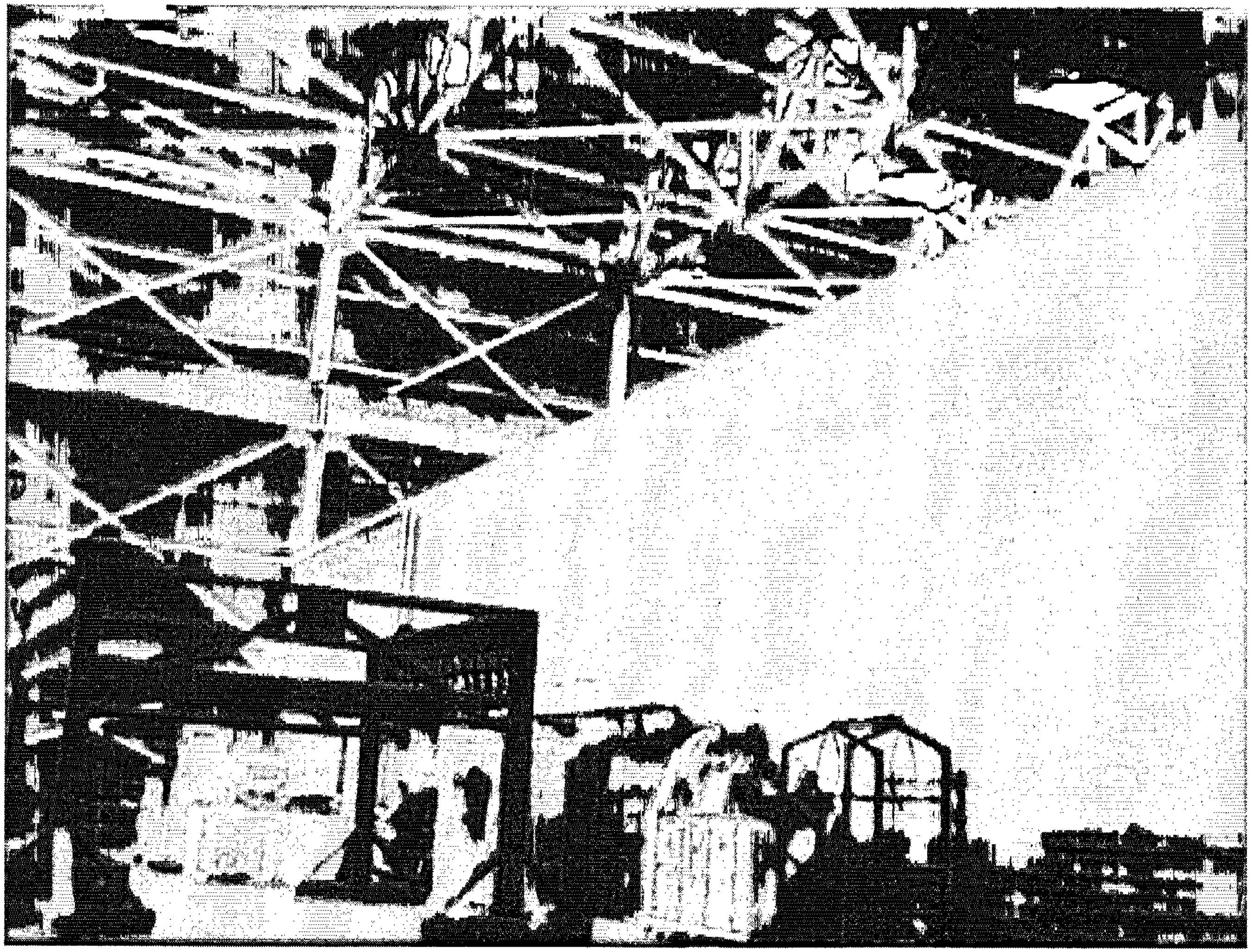
TURBINE BUILDING HVAC CONFIGURATION





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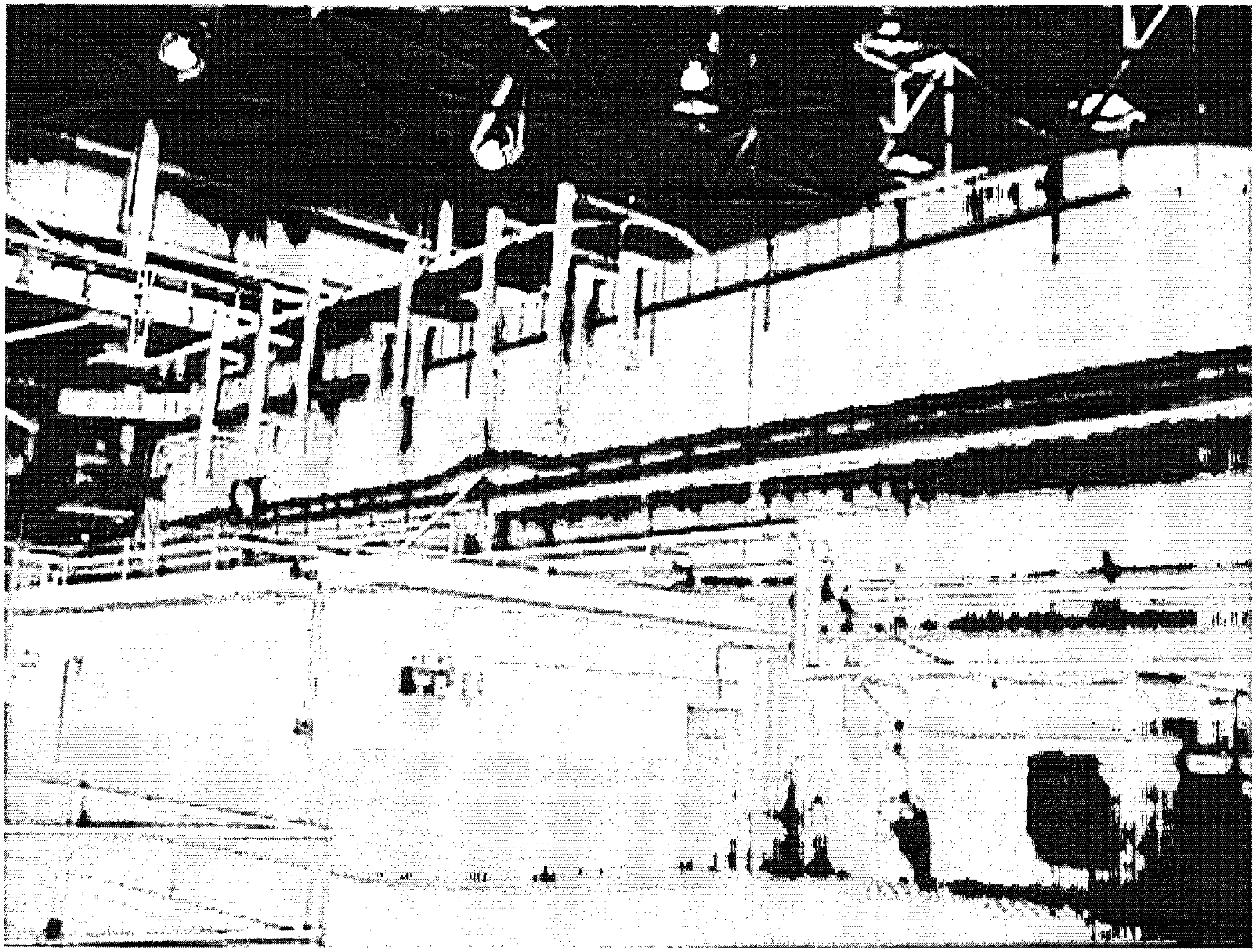

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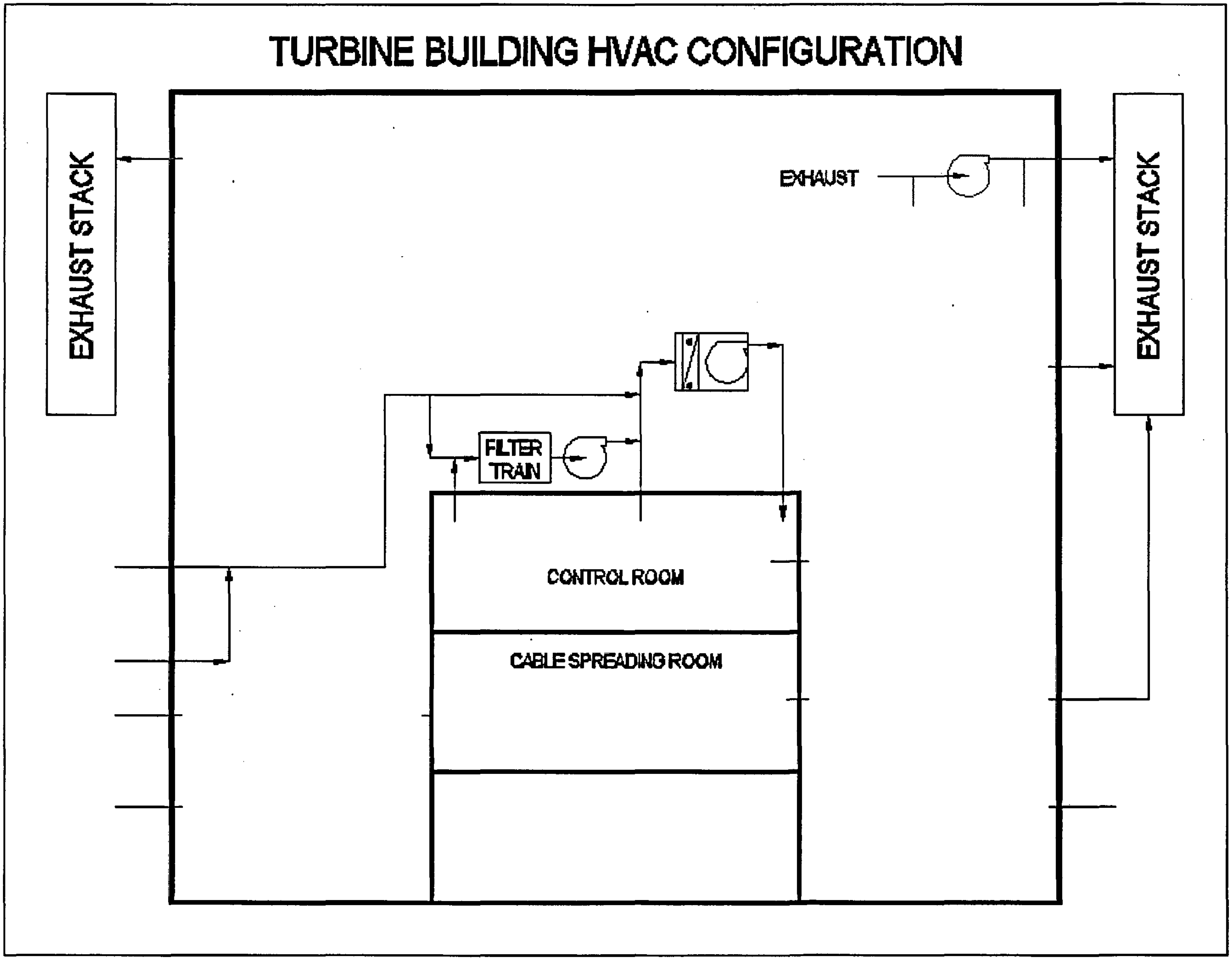
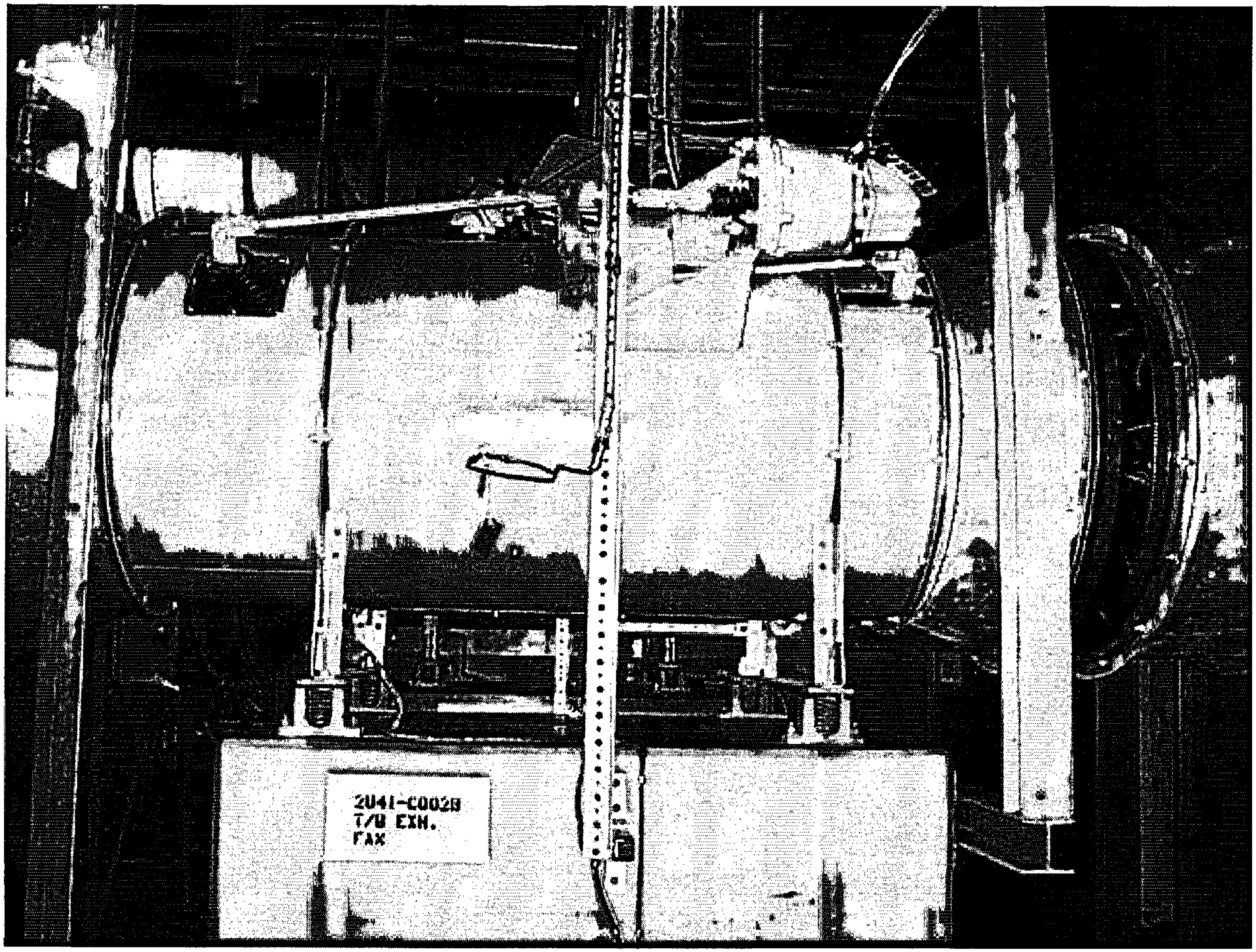


TURBINE BUILDING HVAC CONFIGURATION
EXHAUST STACK
EXHAUST
EXHAUST STACK
FILTER TRAIN
CONTROL ROOM
CABLE SPREADING ROOM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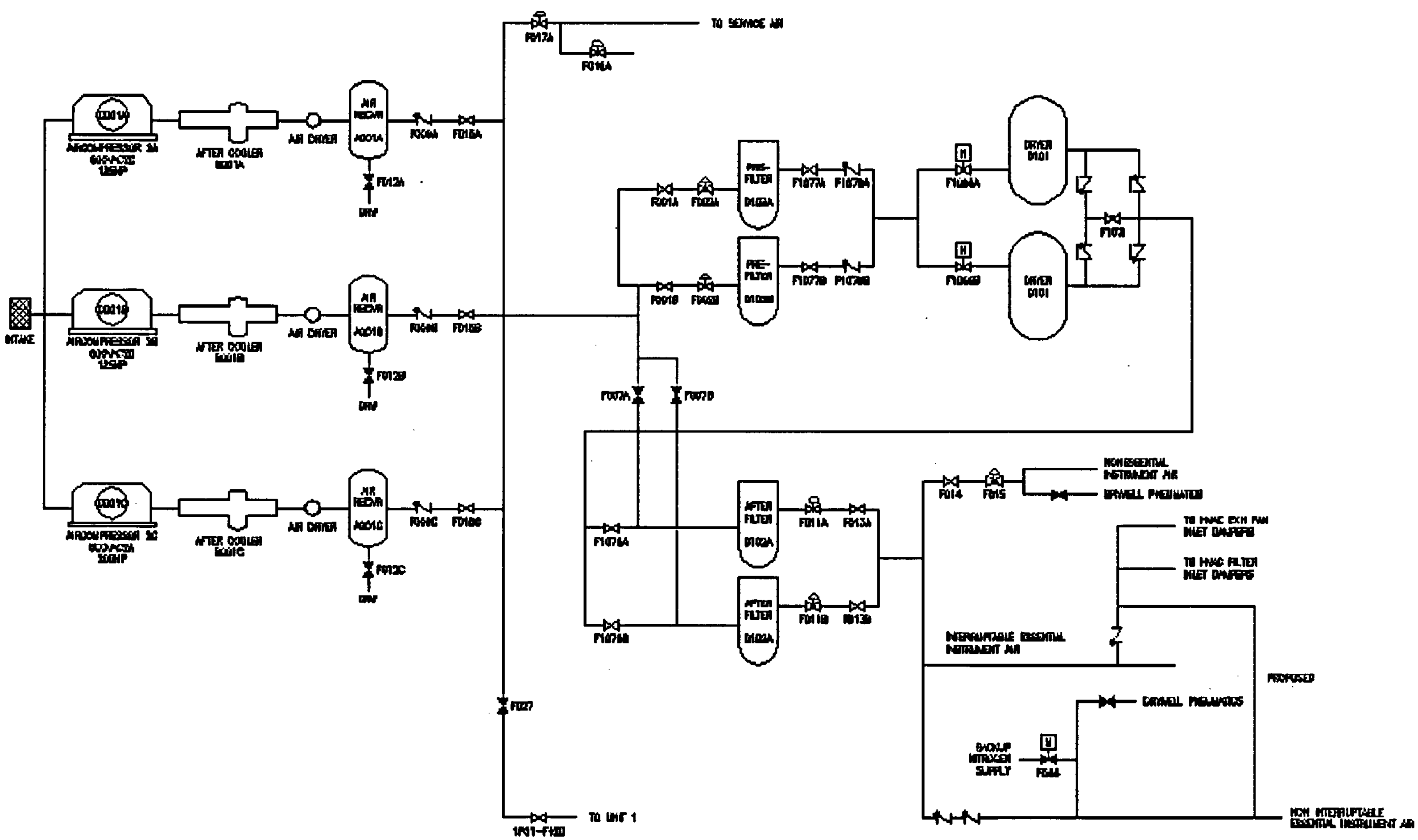
Seismic Verification of TB HVAC

- **Scope:**
  - Seismic verification of required portions of exhaust HVAC ductwork including supports & anchorage to assure structural and pressure integrity
  - Seismic verification of associated dampers, filters, and fans to assure structural and pressure integrity
- **Methodology:**
  - Primarily based on earthquake experience & similar in concept to the SQUG GIP seismic verification of raceway systems
  - EPRI Technical Report 1007896 “Seismic Evaluation Guidelines for HVAC Duct & Damper Systems” April 2003
    - Peer reviewed by Dr. Robert P. Kennedy February 2004

Seismic Verification of TB HVAC cont.

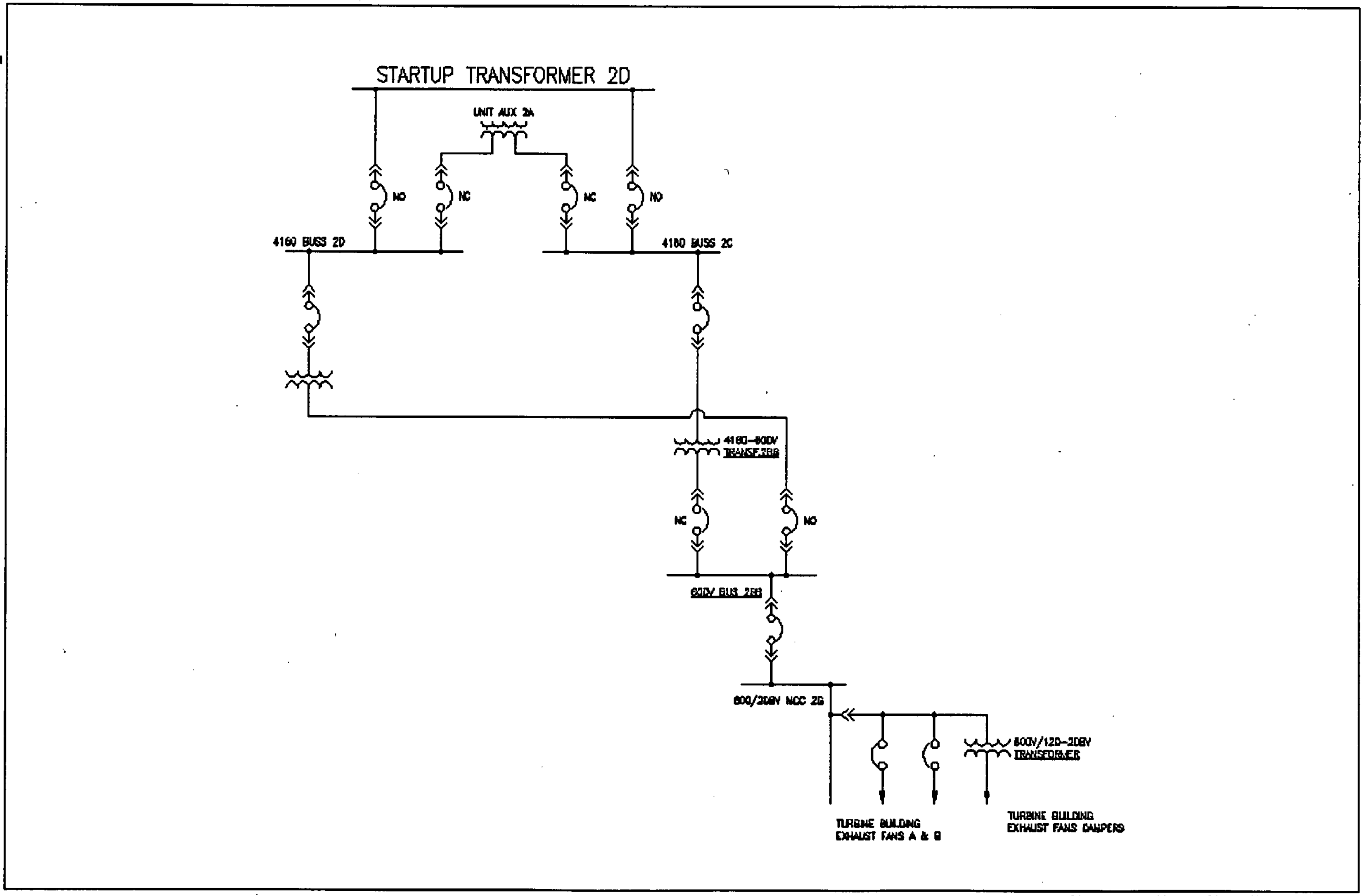
- **Methodology cont'd:**
  - Seismic verification performed by two SQUG Seismic Capability Engineers meeting required experience and training requirements
  - Methodology includes
    - documentation & applicability reviews
    - detail in-plant seismic walkdowns using screening criteria
    - identification of potential failure modes (outliers)
    - analytical review of bounding sample of duct runs and supports/anchorage
    - resolution of outliers by further analysis or plant mods
    - documentation
    - independent peer review of the Hatch seismic verification
  - SQUG GIP used for seismic verification of associated Equipment, e.g., fans.

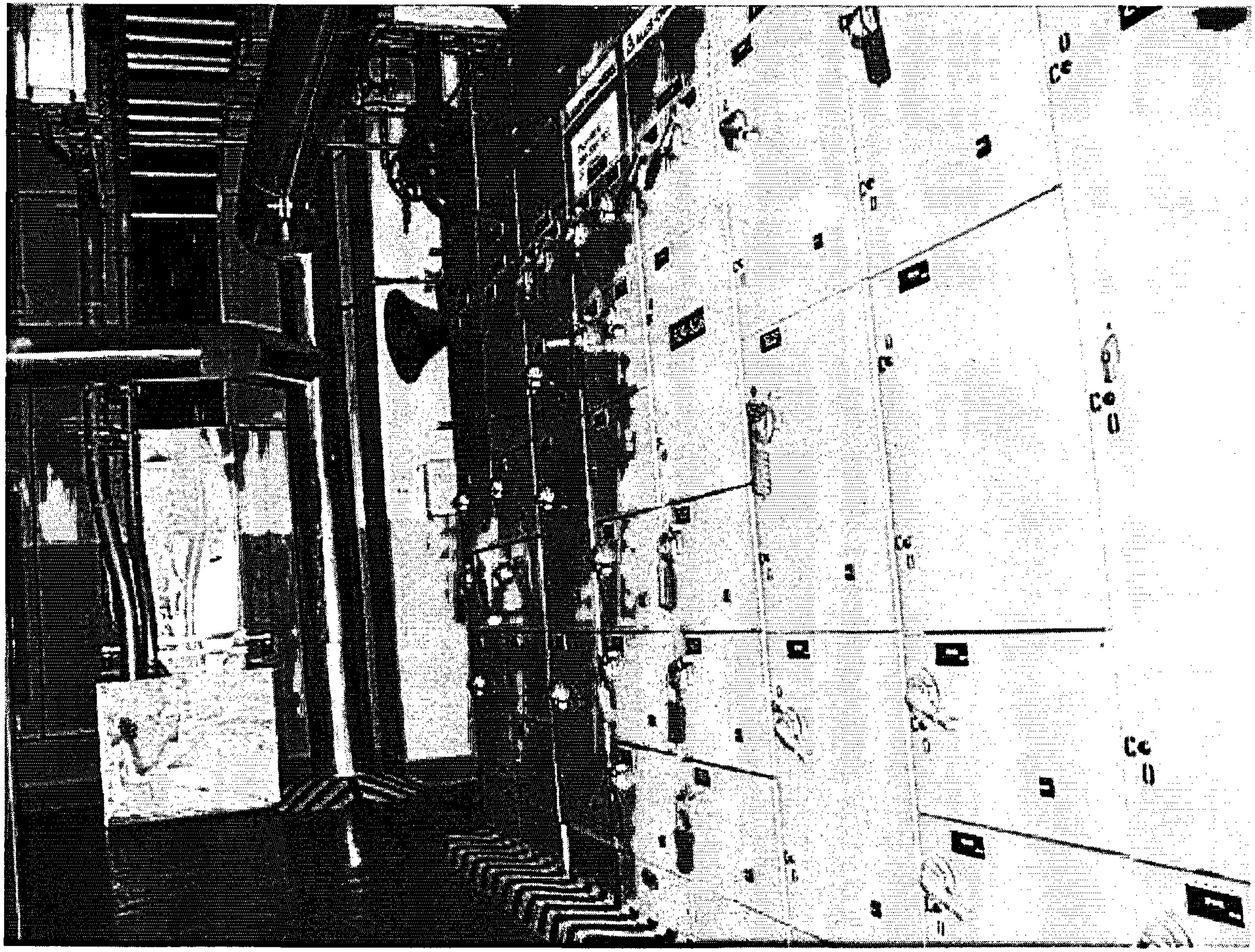
SERVICE AND INSTRUMENT AIR FLOWPATH (UNIT 2)



Turbine Building HVAC Air Supply

- The air for all Turbine Building HVAC dampers is supplied by interruptible instrument air. Failures can occur by:
  - A break in the compressed air system.
  - A mechanical or electrical failure.
  - A major air dryer failure.
- Procedural guidance will be implemented to prevent cross-tie operation should an accident occur on one unit.
- A single failure in any unit can result in complete loss of both exhaust trains on the affected unit.
- Modifications to supply non-interruptible air to the Turbine Building HVAC dampers will be implemented by the end of 2009.
- No single failures exist that would impact both unit's Turbine Building exhaust capability.


STARTUP TRANSFORMER 2D
UNIT AUX 2A
NO
NC
NC
NO
4160 BUSS 2D
4160 BUSS 2C
4160-600V
TRANSF.2BB
NC
NO
600V BUS 2BB
600/208V MCC 2G
600V/120-208V
TRANSFORMER
TURBINE BUILDING
EXHAUST FANS A & B
TURBINE BUILDING
EXHAUST FANS DAMPERS



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Turbine Building HVAC Power Supplies

- No common power supplies exist through the start-up auxiliary transformers which would result in loss of both units' Turbine Building HVAC system.
- A single failure in any unit can result in complete loss of both exhaust trains on the affected unit.
- The only common mode issue that would affect both units is a seismic event.
- Unit 2 and Unit 1 Electrical MCCs will be walked down during the 2007 and 2008 outages and seismically evaluated.

Diesel Generator Loading

- Diesel generator loading is approaching its rating limits.
- Calculations show current KW loading above continuous ratings for some scenarios.
- Operators would be forced to make hard choices and be more selective in load reductions.
- Adding Turbine Building fan motors will require the diesel generators to operate within their overload rating.
- Operating in the overload rating reduces the life of the machine.

- *The operators should not be required to make hard choices to remove safety related pumps from service in order to load the Turbine Building fans on the safety related buses.*

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Standby Liquid Control System Assessment

- **SLC function is control of the pH in the suppression pool following a design-basis LOCA.**
- **SLC assessed to confirm reliability to perform its AST function per NRC review guidelines, "Guidance on the Assessment of a BWR SLC System for pH Control."**
  - SLC pumps and valves are powered from the standby AC power supply and from separate buses.
  - SLC is seismically qualified in accordance with Reg. Guide 1.29 and App. A to 10 CFR Part 100.
  - SLC is incorporated into the plant's ASME Code ISI and IST Programs.
  - SLC is incorporated into the plant's Maintenance Rule Program.
  - SLC meets 10 CFR 50.49.
    - Environmental conditions are considered mild environment for SLC components.
    - SLC associated cables are environmentally qualified.
  - Although SLC is subject to a single failure, non-redundant active components are reliable to perform the AST function.
    - Injection check valves are shown to be highly reliable.
    - Although SLC initiation control switch failure is unlikely, it is located in the Main Control Room which is continually manned with provisions in place for manual SLC initiation.

Technical Specification Changes

- **AST implementation includes the following key technical specification changes:**
  - Standardize MSIV total allowed leakage rates between units at 100 scfh
  - DEI-131 specific activity of reactor coolant revised from 4.0 µCi/gm to 2.0 µCi/gm
  - Add secondary containment bypass leakage to Unit 1 and increase value for Unit 2 (2% for both units)
  - Add drywell spray Technical Specification
  - TS Bases changes to reflect AST

Conclusion

- Open Discussion
- Questions

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