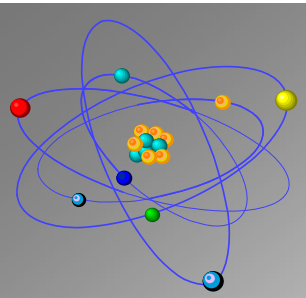
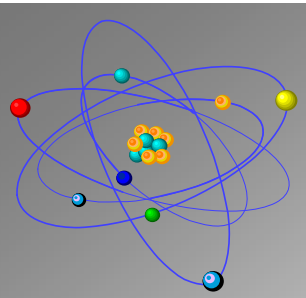


North Anna Power Station
ECCS PREACS Filtration

June 24, 2009
One White Flint North

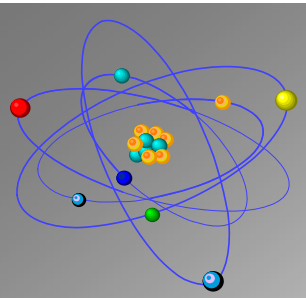


ECCS PREACS

Purpose of Technical Specification changes:

1) Specifically address the filtration function of the ECCS Pump Room Exhaust Air Cleanup System

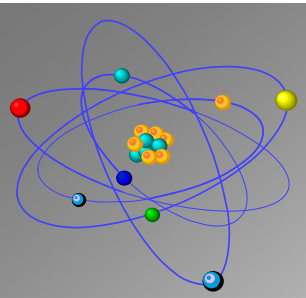
2) Reconcile TS with the associated design and licensing basis assumptions.



ECCS PREACS

NRC concerns from 2/19/09 teleconference :

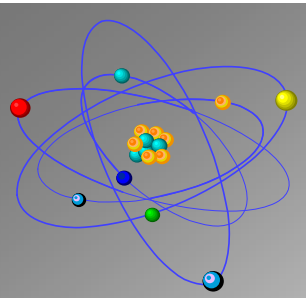
- *Sufficient justification for the proposed completion time for one train of ECCS PREACS inoperable*
- *Reference to UFSAR Figure 15.4-110*
- *Description of the surveillance requirements that will assure ECCS leakage does not exceed the unfiltered leakage limit*



ECCS PREACS

Changes will add actions to determine if filtration is required:

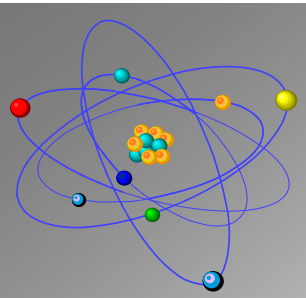
- *New Condition B – One train inoperable due to filtration capability*
- *New Condition C – Two trains inoperable due to filtration capability*
- *Modified Condition D – Two trains inoperable due to ECCS pump room boundary*



ECCS PREACS

Emergency Core Cooling System Pumps are located:

- *Within Auxiliary Building, Charging Pump cubicles*
  - *High Head Safety Injection (charging) pumps*
- *Within Safeguards Building of each unit*
  - *Outside Recirc Spray pumps*
  - *Low Head Safety Injection pumps*



ECCS PREACS

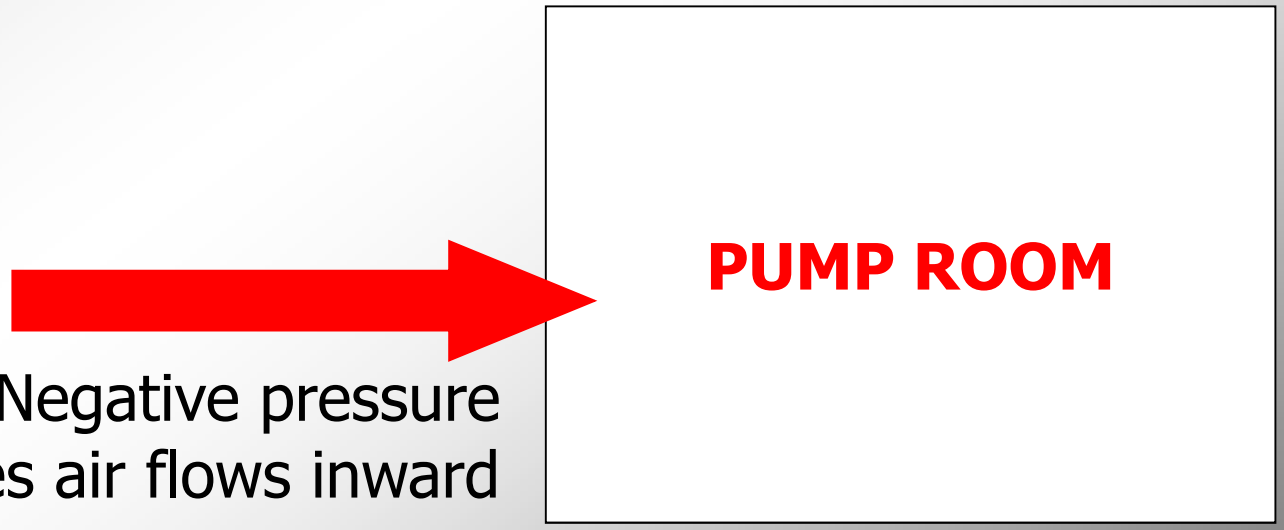
System Design is Unique.

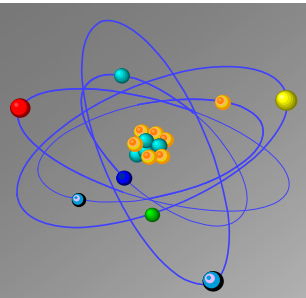
The system is made up of three subsystems, which operate both during normal operations and during accident conditions:

- *Unit 1 Safeguards Building Exhaust*
- *Unit 2 Safeguards Building Exhaust*
- *Auxiliary Building Central Exhaust (shared between units)*

ECCS PREACS

- *System is once-through exhaust-only ventilation*
- *Maintains negative pressure in pump rooms*





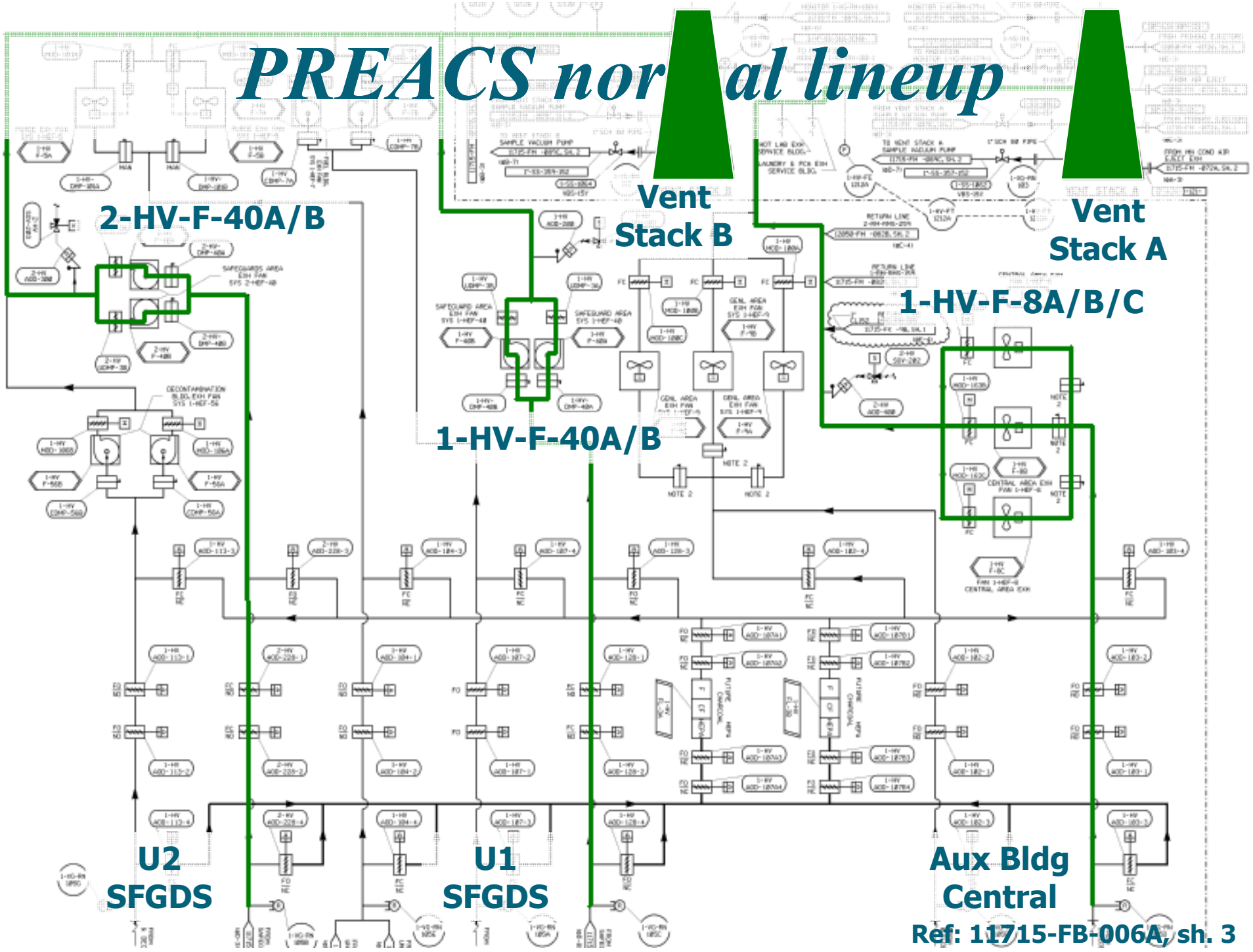
ECCS PREACS

ECCS PREACS is interconnected with other subsystems which are shutdown during accident conditions.

Each subsystem can be diverted through common filter banks

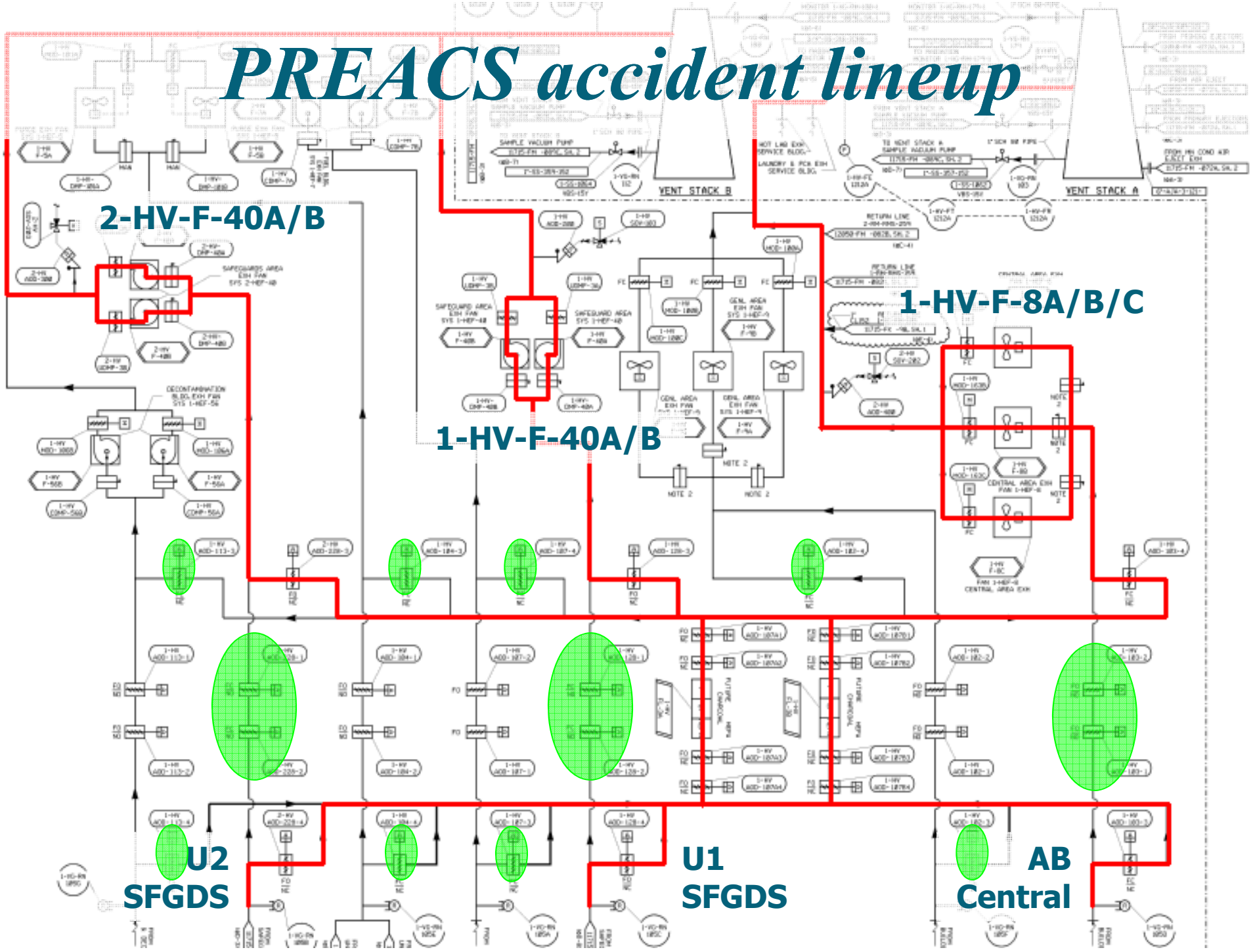
Each subsystem has two or three exhaust fans

PREACS normal lineup



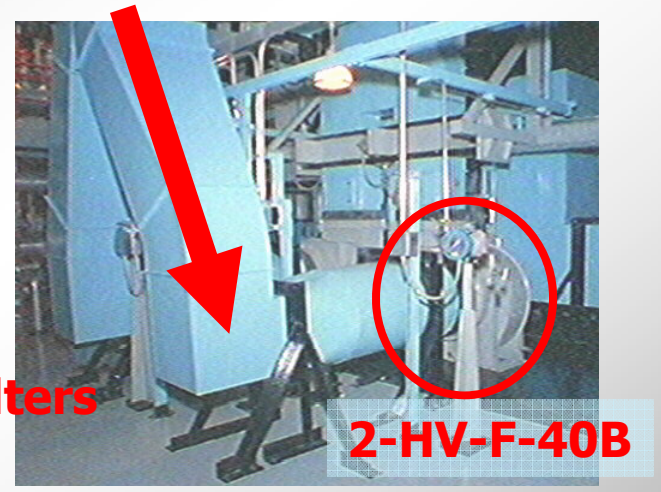
Ref: 11715-FB-006A, sh. 3

PREACS accident lineup

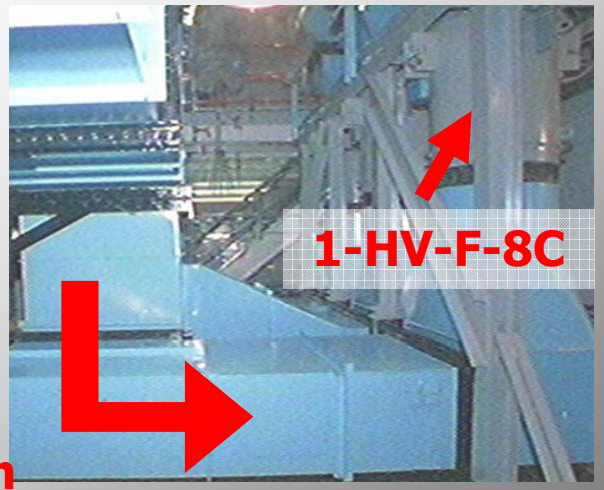


ECCS PREACS

- Safeguards Area Ventilation subsystems (one for each Unit)



- Auxiliary Building Central Exhaust subsystem (shared between Units)



PREACS accident functions:

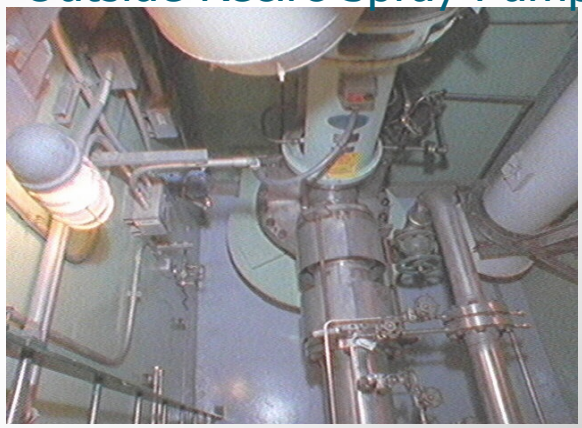
1) Provide particulate filtration and iodine adsorption of ECCS Pump Rooms to ensure Control Room Operator and EAB/LPZ doses are below regulatory limits

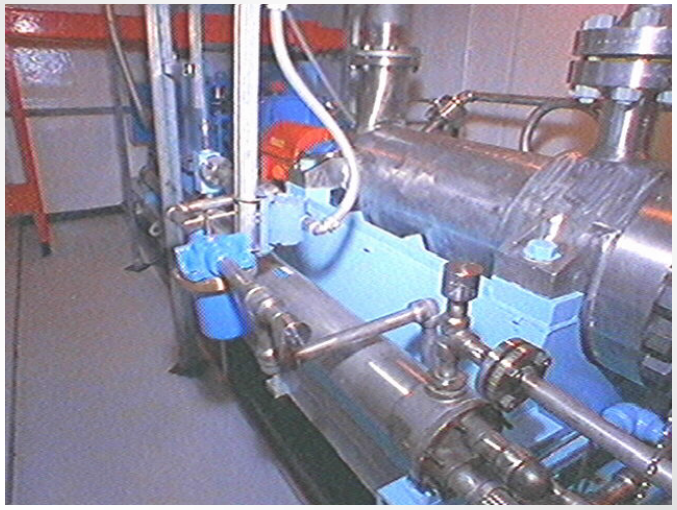
Auxiliary Building Filter
1-HV-FL-3B

PREACS accident functions:

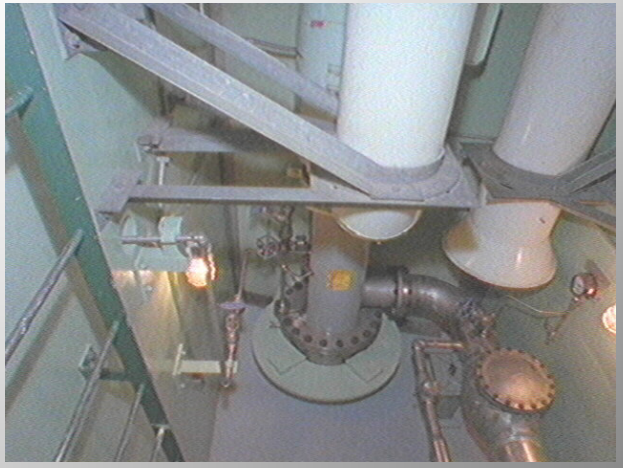
2) Provide ventilation (cooling) to ECCS Pump Rooms

Outside Recirc Spray Pumps

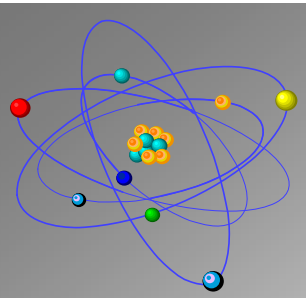




HHSI (Charging) Pumps



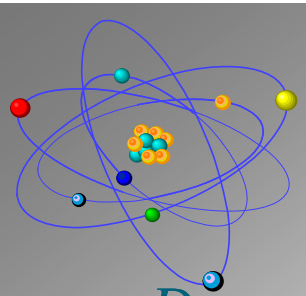
LHSI Pumps



ECCS PREACS:

Cooling:

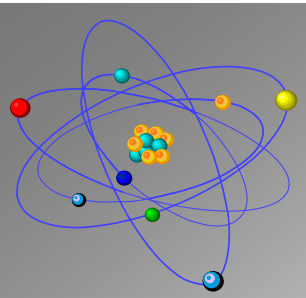
- *Provide greater than the minimum-required air flow from Safeguards Building, within 60 minutes of an accident.*
- *Minimum air flow for charging pump cubicles is provided by internal fans on the charging pumps.*
- *Other interconnected systems are shutdown/isolated during accident*



ECCS PREACS

Dose Consequences. Analyses confirm that off-site dose and dose to CR operators are maintained within regulatory limits. Assumptions:

- *ECCS PREACS is only assumed in LOCA analyses*
- *PREACS is aligned at 60 minutes post-LOCA*
- *Filtration is only assumed if ECCS leakage > 3400 cc/hr (operational limit is 1700 cc/hr)*
- *PREACS charcoal & HEPA filter efficiencies = 98% for aerosols; 95% for elemental iodine; 90% for organic iodides*
- *Filtration assumed for 30 days post-accident*



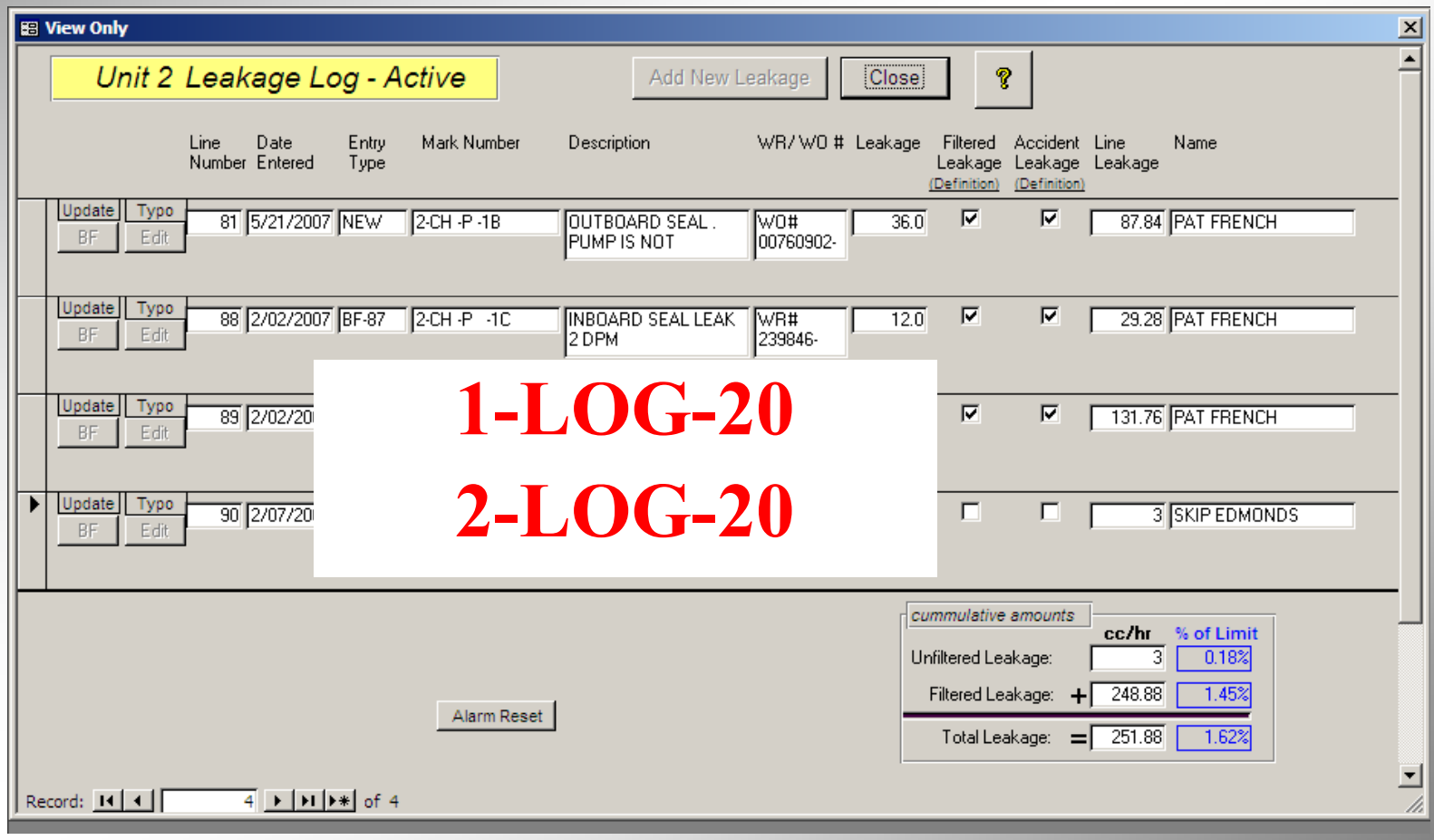
ECCS PREACS

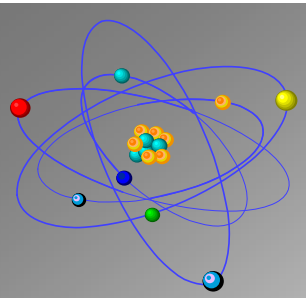
ECCS leakage is a parameter that is periodically monitored by Operations & documented in Operations logs

Logged as one total within ECCS pump rooms (where exhaust air is filtered) and second total outside of pump rooms

Log includes adjustment by calculation to worst-case accident conditions

Operations monitors and logs ECCS leakage rates



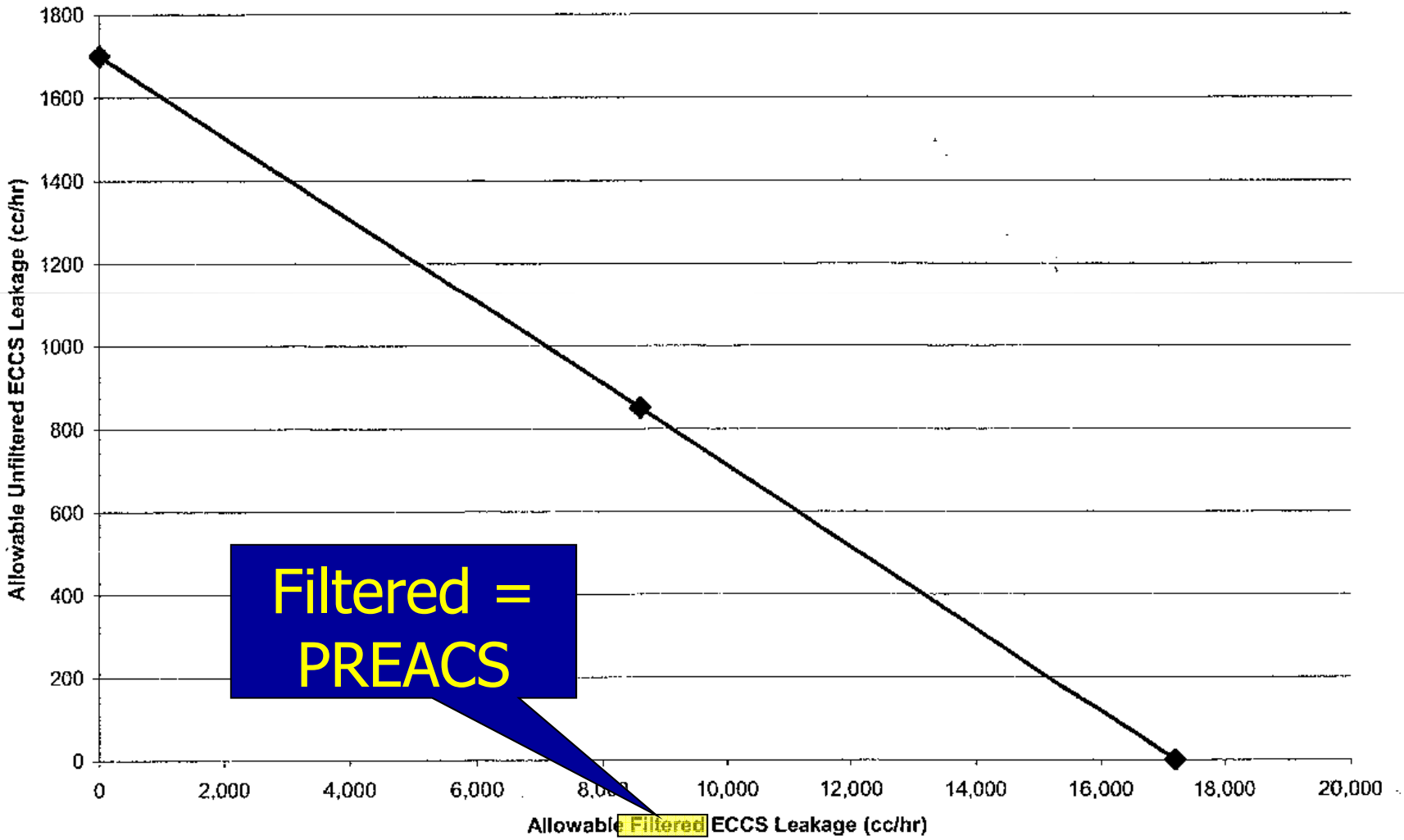


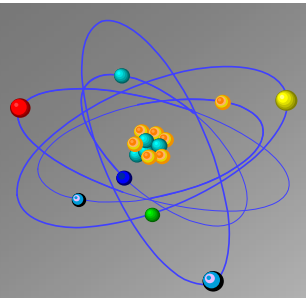
ECCS PREACS

Location determines filtered vs. unfiltered leakage:

- *Areas where exhaust air is filtered :*
  - *Charging pump cubicles*
  - *Safeguards Building*
- *Areas where exhaust air is unfiltered:*
  - *Other Aux Building areas*
  - *Quench Spray Pump House*

Figure 15.4-111
ACCEPTABLE ECCS LEAKAGE, COMBINED FILTERED AND UNFILTERED FLOWS, FOR CONTROL ROOM INLEAKAGE OF 250 CFM

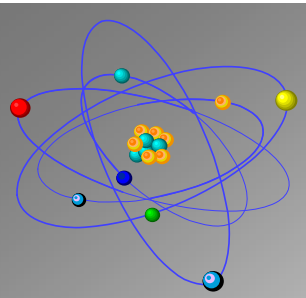




ECCS PREACS

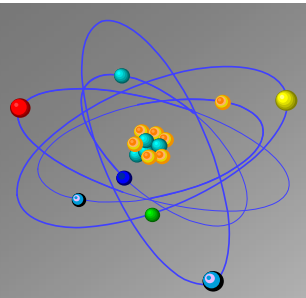
ECCS leakage log history:

- *Normal total leakage is < 500 cc/hr (usually 100-300 cc/hr)*
- *Occasionally components having leakage of 500-1000 cc/hr are noted and promptly repaired*
- *Prior issue with excessive leakage on Charging pump seals was resolved through modification (2003-05) & procedures*
- *Only twice recently has there been individual component leakage > 1700 cc/hr, but it was isolated within a shift (a valve in 2003 and a pump in 2005)*



ECCS PREACS

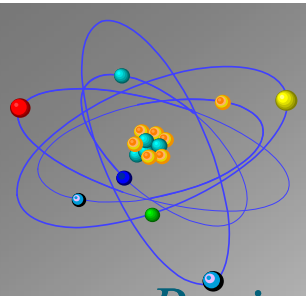
- *Original system design criteria was based on 900 cc/hr maximum potential leakage to atmosphere*
- *Current design criteria is shown in UFSAR Figure 15.4-111 (from 1,700 cc/hr unfiltered leakage to 17,000 cc/hr filtered leakage)*



ECCS PREACS

ECCS Leakage has been evaluated for the post-LOCA pump mission time:

- *LHSI & OSRS pumps have tandem seal design, with clean water source supplied to an annular volume between the inboard and outboard seals. Prevents excessive seal wear.*
- *Evaluations have been completed for GSI-191 of the HHSI Pump Seals to show that DBA-generated debris will not cause mechanical seal leakage to exceed limits during the pump mission time.*



ECCS PREACS

Basis for extended Completion Time:

- *Margin between operating limits and actual dose limits*
- *Operating history shows ECCS leakage is normally low, & sudden changes in ECCS leakage > limits are not expected*
- *Unnecessary two-unit shutdown has associated risks*
- *System design is unique with several dampers that could have leak-by affecting both trains. TS 3.0.3 has been entered multiple times because of this.*
- *Time needed to complete repairs may be significant*