



**Emergency Diesel Generator  
Planned Submittals  
June 10, 2008**

# NRC/NMC meeting

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## Agenda

Introductions

Opening Remarks – Jon Anderson

Background – Dave Carlisle

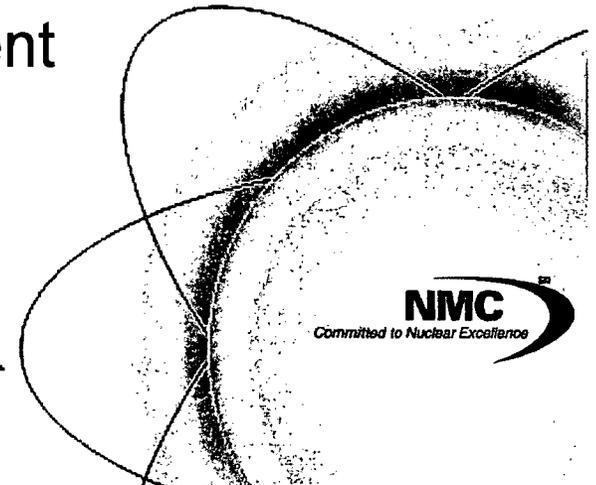
Overview EDG proposed TS changes – Dale Vincent

Decrease 24-month Test Loads – Dave Carlisle

Decrease Monthly Test Loads – Dave Carlisle

EDG proposed TS changes – Dale Vincent

Conclusions – Jon Anderson

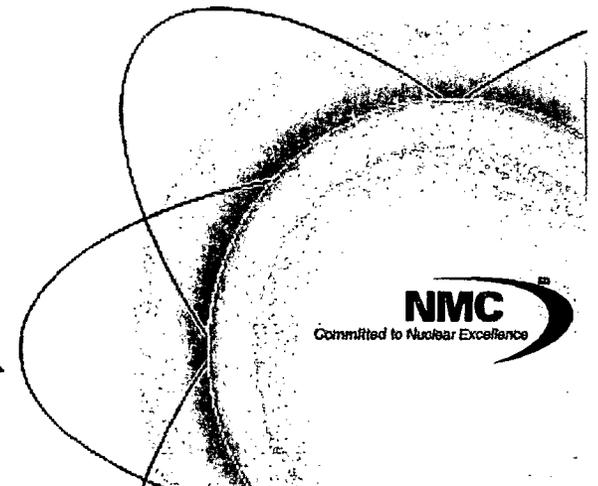


# Opening Remarks

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**EDG LARs are important:**

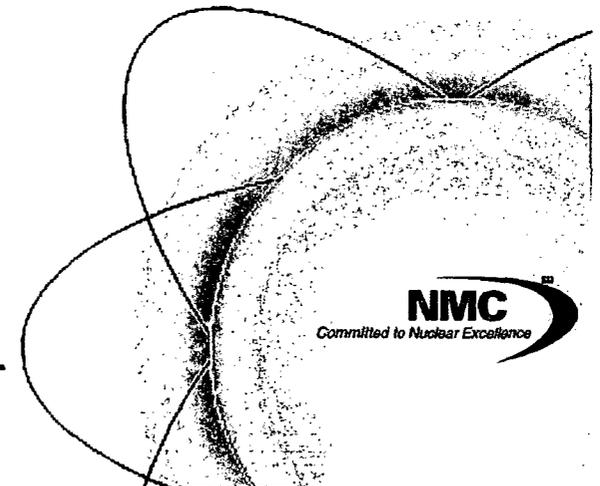
- Improve reliability by making EDG testing and maintenance more efficient
- Improve plant safety by making EDGs more available



# Meeting Purpose

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- Provide overview of proposed TS changes
  - Changes affect the same SRs in 3.8.1
- Focus on Unit 2 Test Load Reductions



# Background – 1

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## Safeguards AC Distribution

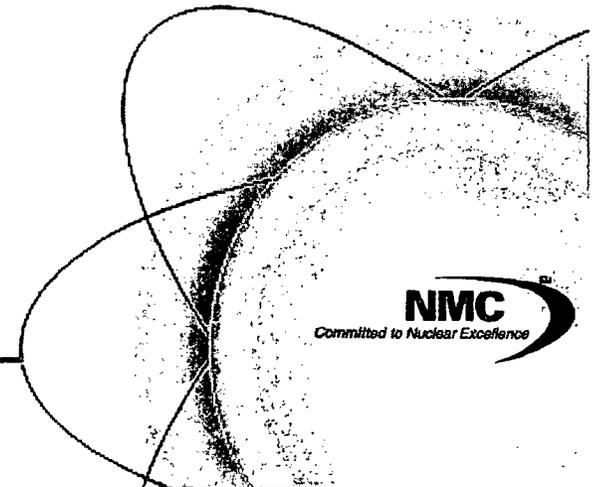
- Two independent 4 KV buses per unit
- Each safeguards 4 KV Bus has two paths from the offsite transmission system
- Each safeguards bus has one Emergency Diesel Generator (EDG)
- Each safeguards bus has a dedicated sequencer which senses UV/DV and transfers the bus to the alternate source or to the EDG

# Background – 2

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## Station Blackout Design

- Each safeguards bus has a bus-tie available to the same Train bus on the opposite unit
- Each EDG is capable of sequentially starting and supplying the safe shutdown (Mode 3) loads for its unit along with the essential loads of the same-Train opposite unit in the event of an SBO

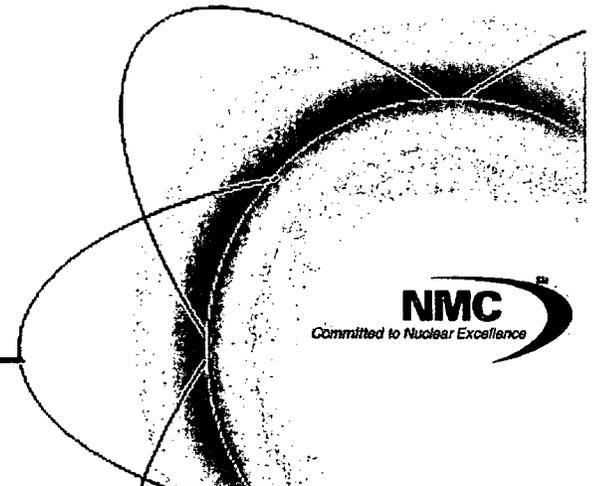


# Background – 3

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## Unit 1 EDG Features

- D1 and D2
- Fairbanks-Morse diesel generator sets
- Ratings
  - 3000 kW (1000 hour)
  - 2750 kW (continuous)
- Jacket cooling from cooling water (service water) system
- Independent fuel oil storage system
- Original installation

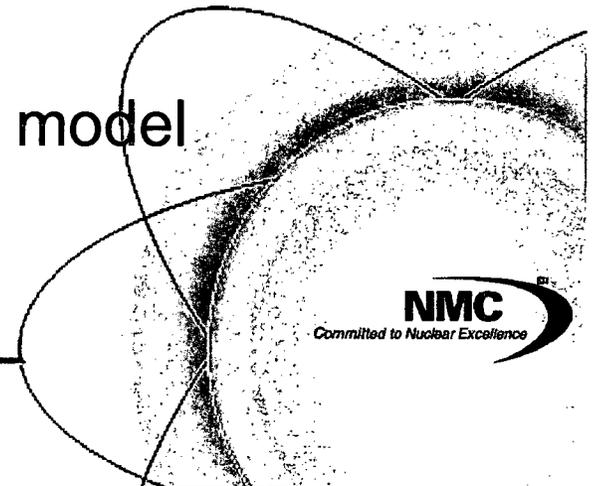


# Background – 4

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## Unit 2 EDG Features

- D5 and D6
- SACM (Wärtsilä) diesel generator sets
- Rating - 5400 kW (continuous)
- Radiator cooled
- Independent fuel oil storage system
- Installed 1992 for SBO Rule
- Similar EDGs used world-wide
- One other SACM EDG in USA – same model

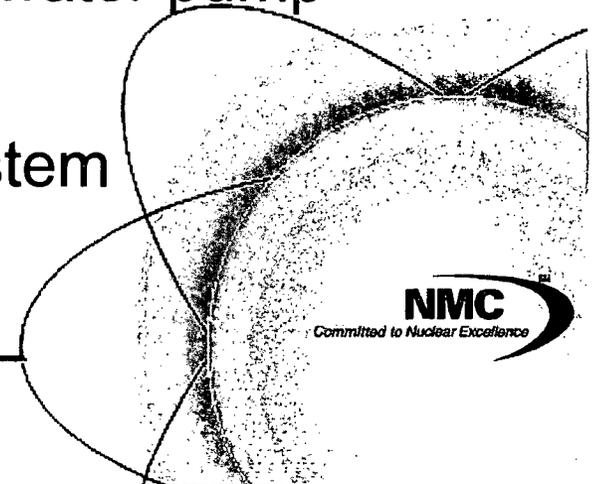


# Background – 5

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## Additional Robust Design Feature

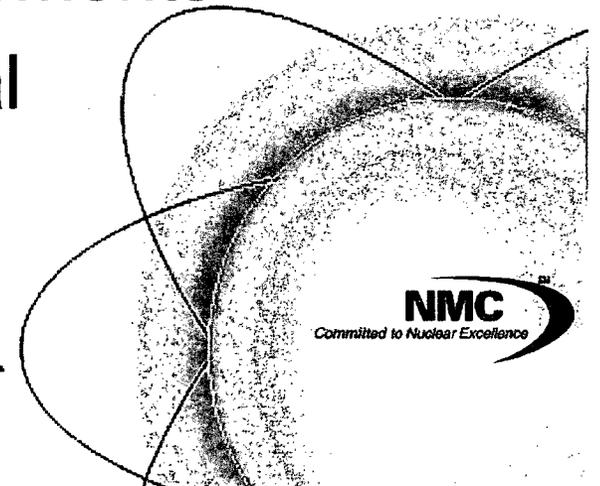
- Cooling Water System
  - Provides cooling to Unit 1 EDGs jacket cooling system
- Cooling Water System equivalent to Service Water System at other plants
- Two safeguards diesel-driven cooling water pumps
- One Safeguards motor-driven cooling water pump powered by D5 or D6
- Cooling Water System is a reliable system



# Overview EDG TS Changes -1

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- Decrease 24-hr Test Load on Unit 2 EDGs
- Decrease Monthly Test Load on Unit 2 EDGs
- Increase Monthly Test Load on Unit 1 EDGs
- Add Power Factor to 24-hr Test
- Reduce Frequency Band
- Revise Test Low Voltage Acceptance Criteria
- Revise Fuel Oil Storage Requirements
- Extend Trip Bypass Test Interval



# Overview EDG TS Changes -2

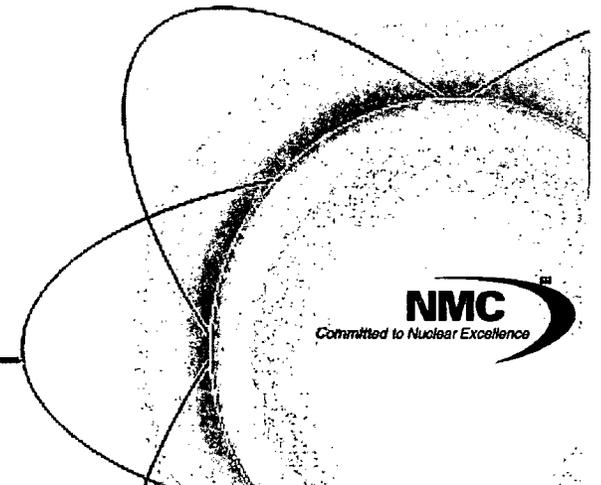
Issue	Affected TSs	Affected SRs	Affected Units
Increase test load	3.8.1	3.8.1.3	Unit 1
Add Power Factor	3.8.1	3.8.1.9	Both
Decrease 24-hr test load	3.8.1	3.8.1.9	Unit 2
Decrease monthly test load	3.8.1	3.8.1.3	Unit 2
Fuel oil storage	3.8.3	3.8.3.1	Both
Extend trip bypass test interval	3.8.1	3.8.1.8	Both
Frequency Band	3.8.1	3.8.1.2 3.8.1.6 3.8.1.9	Both
Test low voltage	3.8.1	3.8.1.2 3.8.1.6 3.8.1.9	Both

# Decrease 24-Month Test Load – 1

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## License Amendment Request

- Current TS require testing at 103 to 110% of continuous rating for 2-hour period
  - Range based on RG 1.9 Revision 2 (by reference to RG 1.108)
- Propose testing at 100 to 110% of continuous rating for 2-hour period

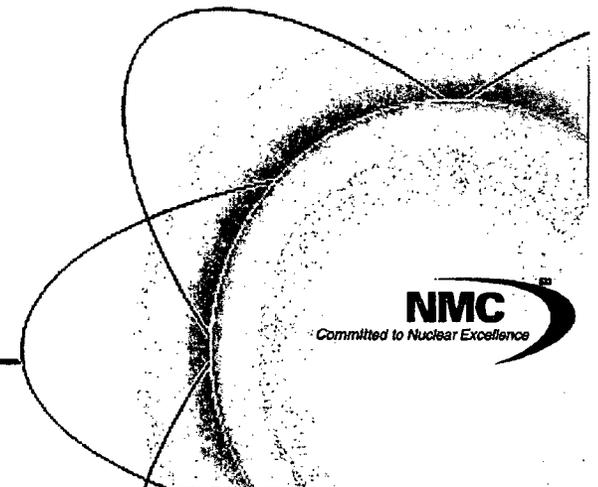


# Decrease 24-Month Test Load – 2

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## Benefits

- Less stress on the engines
- Reduced maintenance
- Increased availability

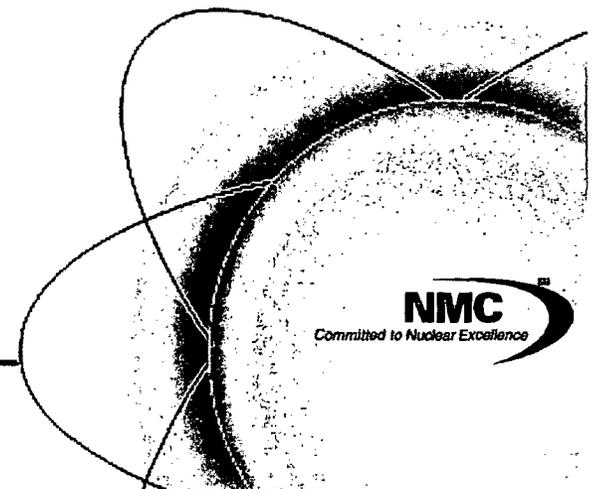


# Decrease 24-Month Test Load – 3

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## Adequacy

- 5400 kW - 100% of continuous rating
- 5400 kW significantly above design basis loads
  - LOOP = 2602 kW
  - LOOP + LOCA = 3609 kW
  - SBO = 3652 kW
- 5400 kW is 47% over SBO load

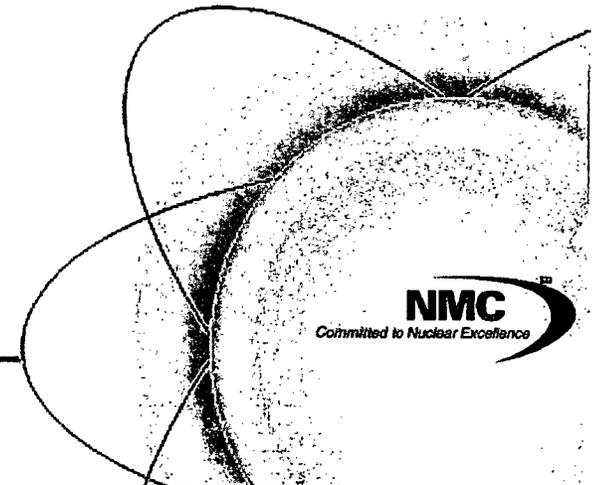


# Decrease 24-Month Test Load – 4

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## Conclusions

- Reduced test loads improves availability
- 5400 kW is well above the design basis loads
- Industry precedents for 24 month testing at less than 103%

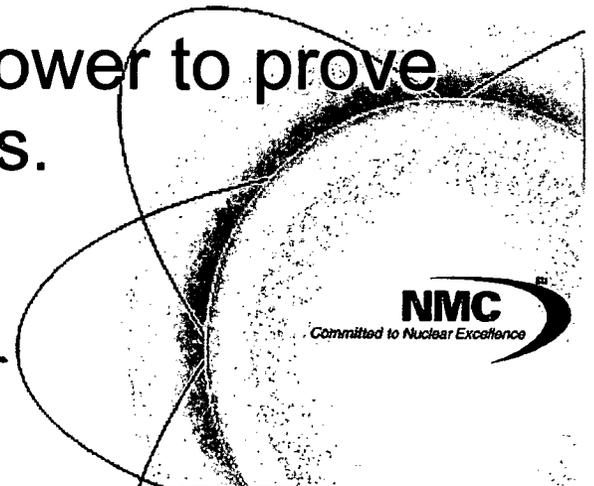


# Decrease Monthly Test Load – 1

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## License Amendment Request

- Currently TS require test at 5100 to 5300 kW ( 94 to 98% continuous rating)
- Propose TS revision to test at 4000 kW
- Commit to perform test at 5100 to 5300 kW monthly
- 4000 kW bounds design loads
- Unnecessary to test at 100% power to prove ability to meet PI's Design loads.

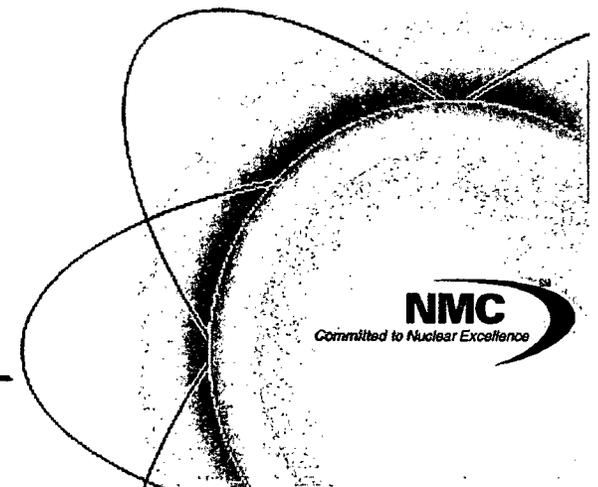


# Decrease Monthly Test Load – 2

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## Design Loads

- LOOP loads (Train A)(USAR Table 8.4-4)
  - 2602 kW
- LOCA + LOOP loads (Train A)(USAR Table 8.4-2)
  - 3609 kW
- SBO loads (Train B)(USAR Section 8.4.4)
  - 3652 kW

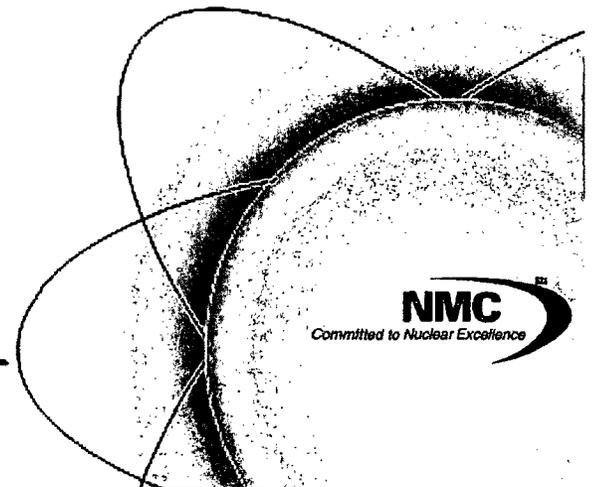


# Decrease Monthly Test Load – 3

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## Benefits

- Increase EDG availability
- More accurate troubleshooting
- More efficient maintenance execution

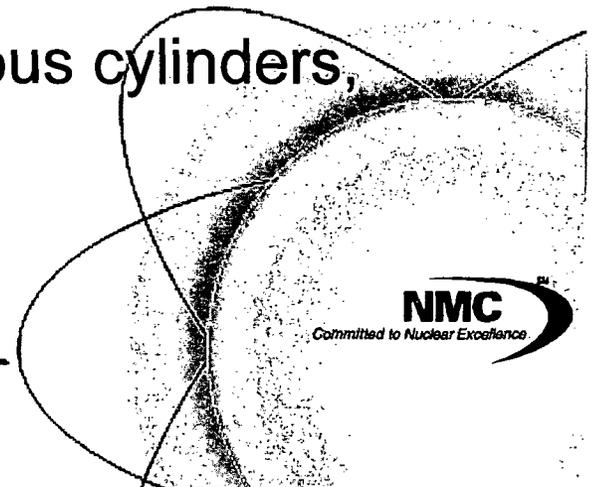


# Decrease Monthly Test Load – 4

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## Operating History

- Successful operation on HSDF from 1992 to 2001
- Federally Mandated sulphur reduction has required additional engine maintenance.
- 2001 D6 challenge, rebuilt engine and changed lube oil
- 2005 D5 challenge, refreshed engine
- 2006 D6 challenge, refreshed engine, managed oil level
- 2007 D5 challenge, replaced numerous cylinders, initiated modification.

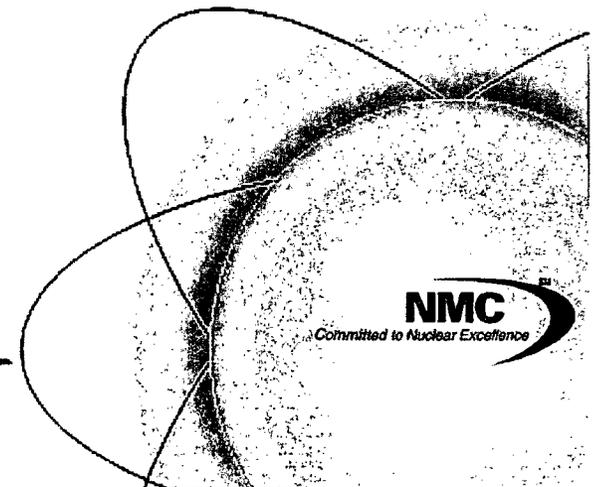


# Decrease Monthly Test Load – 5

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## Analysis

- All of these major problems are a result of the EPA reduction of sulphur content in the diesel fuel oil
- Problems only occurred above 5100 kW
- Engines operated normally when load reduced to 4000 kW
- Determined engines would have performed mission time

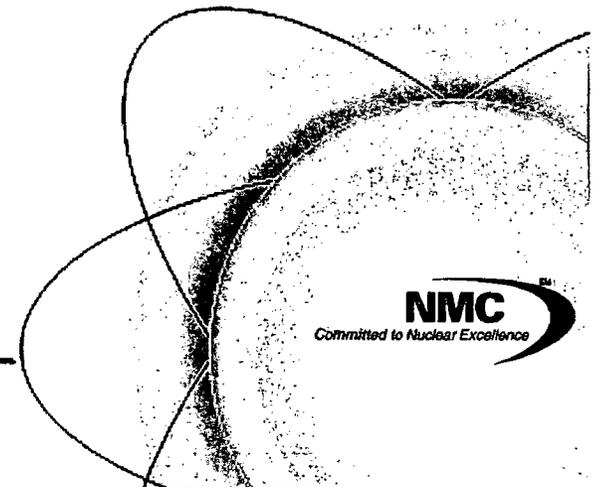


# Decrease Monthly Test Load – 6

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NMC is committed to maintain these EDGs

- Lube oil change performed in 2001
- Modified the manometer to increase accuracy performed in 2006
- Fuel oil additive performed in 2008
- Breather modification in study phase

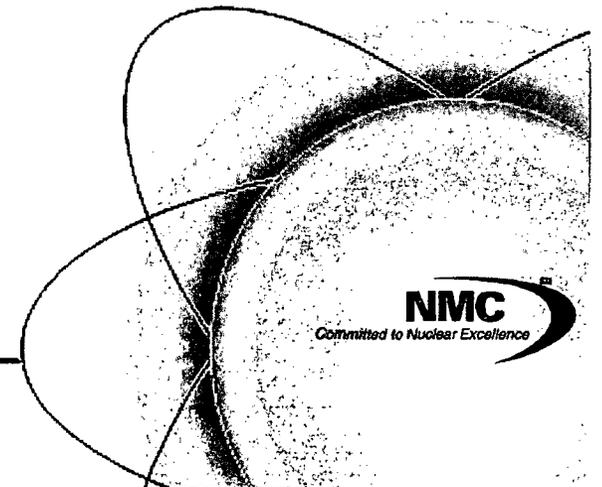


# Decrease Monthly Test Load – 7

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## Test at 5100 to 5300 kW

- Demonstrate that no problems are missed that could possibly be missed if the site was only testing at lower power
- Problems identified between 4000 kW and 5300 kW handled by CAP and Work Management processes at the next available opportunity



# Decrease Monthly Test Load – 8

## T. S. Limit: 5100-5300 kW

- Unnecessary to test at 5100 kW to prove operability at 3652 kW
- Results in Emergent Response
  - Increase Likelihood of human factors errors
  - Difficulty in completing repairs in 14 days
  - Increases Out of Service Time
- Resulted in three Unit 2 shutdowns
  - Challenges the organization
  - Cycles the plant
- Complies with RG Rev 2

## T. S. Limit: 4000 kW

- Testing sufficient to assure engine can operate above 3652 kW
- Allows for Planned Response
  - Parts availability
  - Staffing scheduling
  - Pre-staging
  - Rescheduling of other work
  - Can complete repairs in 14 days
- Allows for better troubleshooting and investigations
- Planned activities are executed
  - Safer
  - Better quality
  - More efficient
- Limited base line data at 4000 kW

# Decrease Monthly Test Load – 9

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## Precedent

- Calvert Cliffs has two SACM DG sets
- Operating with higher sulphur fuel oil and a lower TBN lubricating oil
- TS require monthly test at 4000 kW
- Perform monthly test at 90 to 100% continuous rating (5400 kW)
- Resolve issues identified above 4000 kW by CAP

# Decrease Monthly Test Load – 10

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## Conclusions

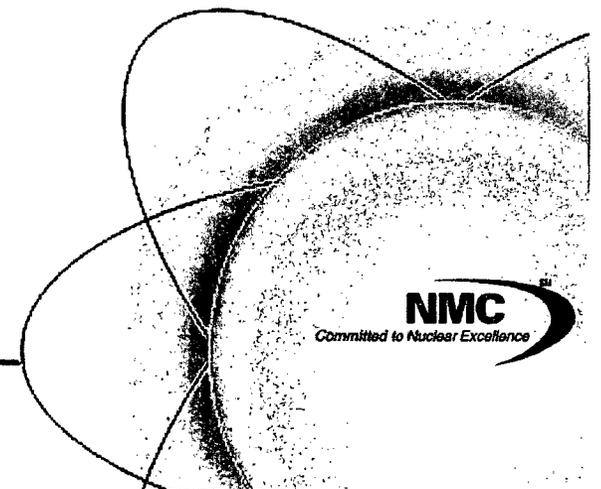
- Propose monthly TS test at 4000 kW
- Commit to monthly proof test at current TS loads
- 4000 kW bounds design basis loads
- Past problems due to EPA reduction of sulphur
  - this has been resolved (for the interim) by a sulphur addition agent
- Breather modification will eliminate the problem if we are unable to obtain an exemption from the EPA
- There is precedent for TS required monthly testing at 4000 kW
- TS monthly test at 4000 kW will provide adequate demonstration of EDG operability

# Combined LAR

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## Single combined LAR:

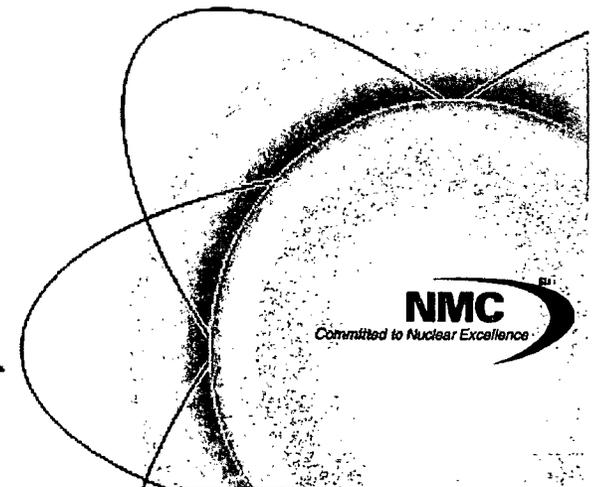
- SR 3.8.1.9 24-month test load reductions
- SR 3.8.1.3 monthly test load reductions
- Plan to submit 3<sup>rd</sup> quarter 2008



# Increase Monthly Test Load

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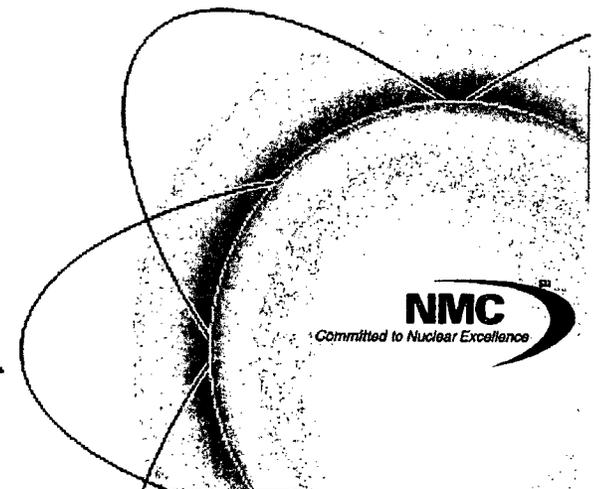
- Revise SR 3.8.1.3
- Applies to Unit 1 EDGs only
- Increase test load to 2500 kW (90% continuous rating)
- Submitted August 16, 2007



# Add Power Factor to 24-Month Test

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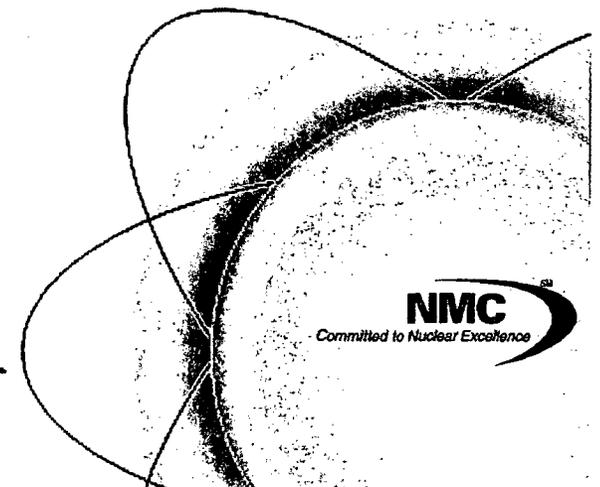
- Revise SR 3.8.1.9
- Applies to Unit 1 and Unit 2 EDGs
- Specify PF per guidance of NUREG-1431
- Submitted October 29, 2007



# Reduce Frequency Band - 1

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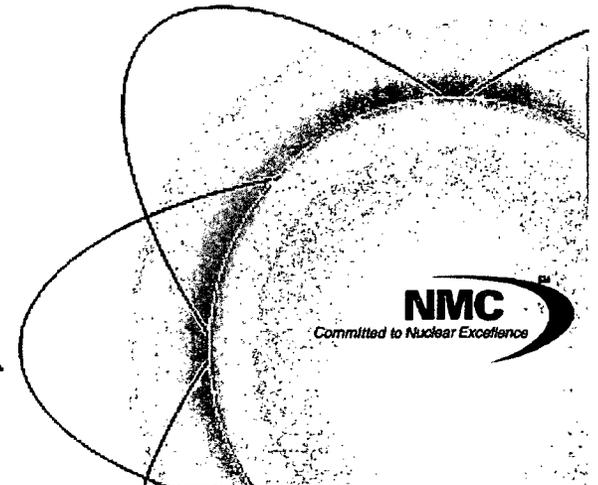
- Identified during CDBI preparations
- Evaluations performed at band limits
- Operation at low frequency reduces pump discharge head and flow
- Operation at high frequency
  - Increases diesel fuel oil consumption
  - Increases EDG load



# Reduce Frequency Band - 2

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- Narrow band to 59.5 Hz - 60.5 Hz
- Applies to SRs 3.8.1.2, 3.8.1.6, 3.8.1.9
- Applies to Unit 1 and Unit 2 EDGs
- LAR currently on hold
  - NEI initiative with NRC CRGR on industry wide issues



# Revise EDG Test Low Voltage

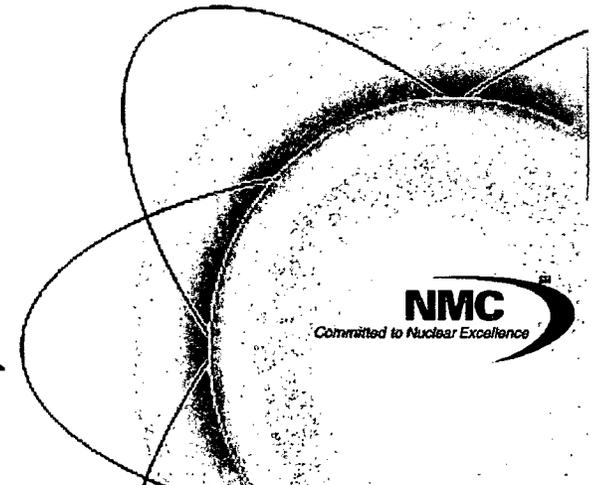
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- Identified in NRC IN 2007-09
- TS 3.3.4 requires UV relays to trip at 3944 V
- Increase low end of EDG Voltage test band to 3944 V
- Applies to SRs 3.8.1.2, 3.8.1.6 and 3.8.1.9
- Applies to Unit 1 and Unit 2 EDGs
- LAR currently on hold
  - NEI initiative with NRC CRGR on industry wide issues

# Relocate DFO Storage Volumes - 1

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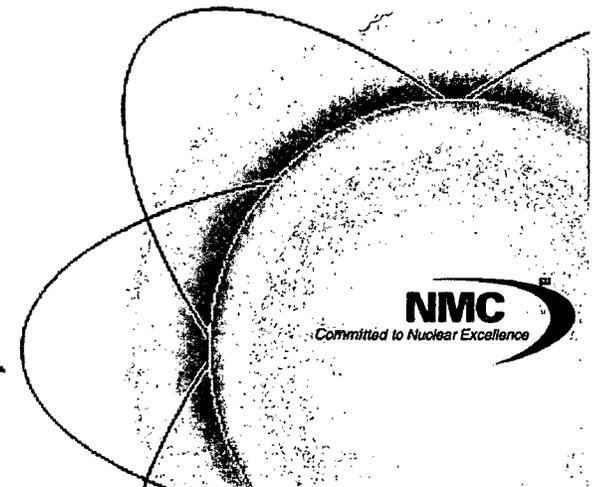
- Identified during CDBI preparations
- At upper end of frequency range burn more diesel fuel oil (DFO)
- Limited Unit 1 fuel oil margin
  - Additional loads may exceed limits
- Revise TS 3.8.3, SR 3.8.3.1
- LAR applies to Unit 1 and Unit 2 EDG DFO storage volumes



# Relocate DFO Storage Volumes - 2

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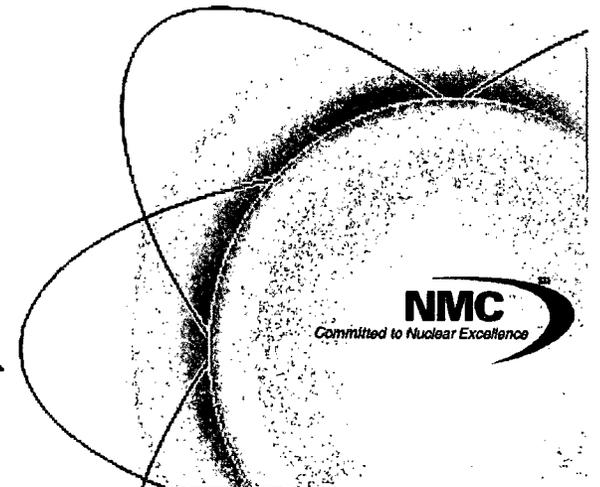
- Propose to use TSTF-501 model
- Number of days' storage requirements in TS
- LCO and SR
  - 14-day supply for single EDG
- Condition Statement
  - Required Action at 12-day supply
- DFO storage volumes in Bases
- Plan to submit July 2008



# Extend Trip Bypass Test Interval

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- Identified during EDG RCE
- Allows PM schedule extension without additional EDG testing
- Extend Frequency to 30 months (no extension)
- Based on GL 91-04 evaluations
- Applies to Unit 1 and Unit 2 EDGs
- Revise SR 3.8.1.8
- Plan to submit 4<sup>th</sup> quarter 2008



# Conclusion

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○ Open discussion

