



**RIC 2009
Emerging Mechanical
Issues – MOVs and EDGs**

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Topics for Discussion

- Motor Operated Valve (MOV) Degraded Magnesium Rotors
 - Operating experience/history
 - Failure mechanism and potential safety concern
 - NRC and industry response
- Diesel Fuel Oil Supply Concerns
 - Ultra Low Sulfur Diesel (ULSD) fuel
 - Biodiesel blend
 - NRC and industry response

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Magnesium Rotor Degradation in MOVs

Brief History

- 1985 – issue discovered during EQ tests
- Random motor failures have occurred since late 1980's
- Additional motor failures reported in 2005, 2006 and 2007
- Borescope inspections of motors initiated in 2007 by some licensees
 - 17 motors replaced because they failed inspection criteria

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Magnesium Rotor Degradation in MOVs

Failure mechanism

- Magnesium (vs. aluminum) rotors used in larger frame sizes may be susceptible to corrosion
- Caused by high temperature and high humidity environment with break in rotor protective coating (paint). High temperature from a motor stall event can cause paint to fail. Service environment can then induce corrosion.
- Distortion of rotor from corrosion causes contact with stator – short and motor failure

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Magnesium Rotor Degradation in MOVs



- Motor assembly showing rotor, cooling fins and stator windings

STATOR WINDINGS

ROTOR

COOLING FINNS

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Magnesium Rotor Degradation in MOVs



- Rotor close-up showing:

GAP IN PAINT ALLOWING CORROSION TO START

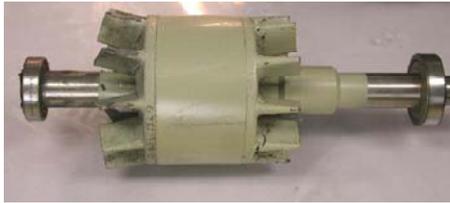
COOLING FIN DEFLECTION

CONTACT MARKS ON STATOR WINDINGS

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Magnesium Rotor Degradation in MOVs



- Removed rotor assembly showing severely deformed cooling fins on left end

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Magnesium Rotor Degradation in MOVs



- Damaged stator windings as a result of contact with rotor cooling fins
- Results in motor failure

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Magnesium Rotor Degradation in MOVs

Safety significance

- If undetected and uncorrected, can affect ability of MOVs to perform their design basis functions
- Potential “common cause” failure based on environmental conditions
- Degradation not detected by ASME inservice testing – until failure occurs

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Magnesium Rotor Degradation in MOVs

NRC & Industry Actions

- 3 NRC Information Notices (IN): 86-02, 2006-26 and recently, 2008-20
- NRC staff has discussed topic with industry: INPO, NEI Licensing Action Task Force, ASME O&M Code Committee, MOV Users Group, Inservice Testing Owners Group, BWROG, PWROG

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Magnesium Rotor Degradation in MOVs

NRC & Industry Actions (cont.)

- Vendor technical bulletins: GE SIL 425 (1985) and Limitorque Technical Update 06-01 (2006)
- BWROG Valve Technical Resolution Group developed guidelines to provide inspection criteria for rotors, inspection priority, disassembly and re-coating procedure
- PWROG indicated they plan to adopt applicable guidance contained in BWROG document

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Diesel Fuel Oil Supply Issues

- Recent Environmental Protection Agency (EPA) initiatives and rulemakings related to diesel fuel oil standards have the potential to effect operation of diesel engines in various nuclear facility applications.



- Emergency diesel generators
- Diesel-driven pumps
- Station blackout diesel generators
- Security diesel generators
- etc.

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Ultra Low Sulfur Diesel (ULSD) fuel oil

Background

- EPA rules require reduction in sulfur content for highway and non-road diesel fuels to 15 ppm (ULSD) by 2010
- Some nuclear facilities have already received ULSD shipments, and eventually shipments will be widespread

Potential Problems

- Reduction in energy content (BTU/gallon) – increased fuel consumption for same engine load
- Particulate buildup and microbial growth in storage tanks – potential to clog filters and injectors
- System leaks due to ULSD interaction with elastomer (rubber) seals
- Compatibility with lubricating oil – potential for deposits to build up behind piston rings, leading to scuffing of cylinder liner walls
- Not compatible with copper and zinc fittings – formation of sediments, gels and soaps

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Ultra Low Sulfur Diesel (ULSD) fuel oil

NRC & Industry Actions

- NRC issued IN 2006-22 (October 12, 2006)
- EPRI published "Guide for the Storage and Handling of Diesel Fuel Oil" (Rev. 3 - 2007). Joint Diesel Owners Group discussed at meetings.
- Some licensees revising calculations to reflect lower energy content in TS-required fuel oil supply volumes. Some revising TS to reflect number of days vs. number of gallons for fuel supply (TSTF-501 approach).
- Other potential licensee actions include use of fuel additives, change in lubricating oil, change in seals from rubber to viton, increased filter change/clean frequency.

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Biodiesel fuel oil blend (B5)

Background

- June 2008 – ASTM International D02 Main Committee approved a revision to the conventional petrodiesel standard specification (ASTM D975-08a)
- Revised standard now permits No. 2 diesel fuel to contain up to 5% biodiesel (B5) and still be considered the same without labeling the blend. Unlabeled shipments could start in Spring 2009.

Potential Problems

- B5 can have a cleaning effect that loosens accumulated sediment in storage tanks
- B5 has suspended particles of water from the manufacturing process which will eventually fall out of suspension and form "dirty water" in the storage tank
- B5 blend is biodegradable and the degradation is accelerated by the presence of water, heat, oxygen, and other impurities

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Biodiesel fuel oil blend (B5)

NRC & Industry Actions

- NRC Staff has interacted with INPO, NEI Licensing Action Task Force, ASME O&M Code Committee, Diesel Owners Groups on biodiesel issue
- NRC Regional inspectors made aware of issue
- EPRI "Guide for the Storage and Handling of Diesel Fuel Oil" discussed with Joint Diesel Owners Group
- IN 2009-02 describes issue
- Discussion with Owners Groups indicate most sites plan to work with suppliers to ensure B5 is *not* delivered
- Potential receipt testing changes to detect B5
- Potential system modifications – filters, seal and fitting material changes, addition of fuel/water separators, use of additives (biocide, moisture dispersant)

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Summary & Conclusion

- Challenging issues that could lead to common cause failures of equipment important to safety
- NRC and industry are engaging to raise awareness of potential problems and to take aggressive corrective/preventive actions, often through Owners Groups

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