

HANDOUTS FROM THE LICENSEES  
(WOLF CREEK NUCLEAR OPERATING CORPORATION AND  
UNION ELECTRIC COMPANY)  
FOR THE MEETING ON AUGUST 16, 2006  
ON THE MAIN STEAM ISOLATION VALVE (MSIV) OPERABILITY

1. MSIV/MFIV OPERATION, 24 pages (Wolf Creek Nuclear Operating Corporation)
2. MSIV ACTUATOR ISSUE - SUMMARY AND HISTORY FOR CALLAWAY, 4 pages  
(Union Electric Company)



# MSIV/MFIV OPERATION AGENDA

August 16, 2006

- Introductions/Purpose of Meeting
- MSIV/MFIV Description and Operation
- Design Bases
- Safety Analyses
- Technical Specifications
- Conclusion



## PURPOSE OF MEETING

- Provide WCNOC's basis for MSIV/MFIV OPERABILITY with one actuation train out of service
  - Provide a description of the design and operation of the MSIVs/MFIVs
  - Provide a description of the analysis supporting MSIV/MFIV operability
  - Discuss associated Technical Specifications compliance

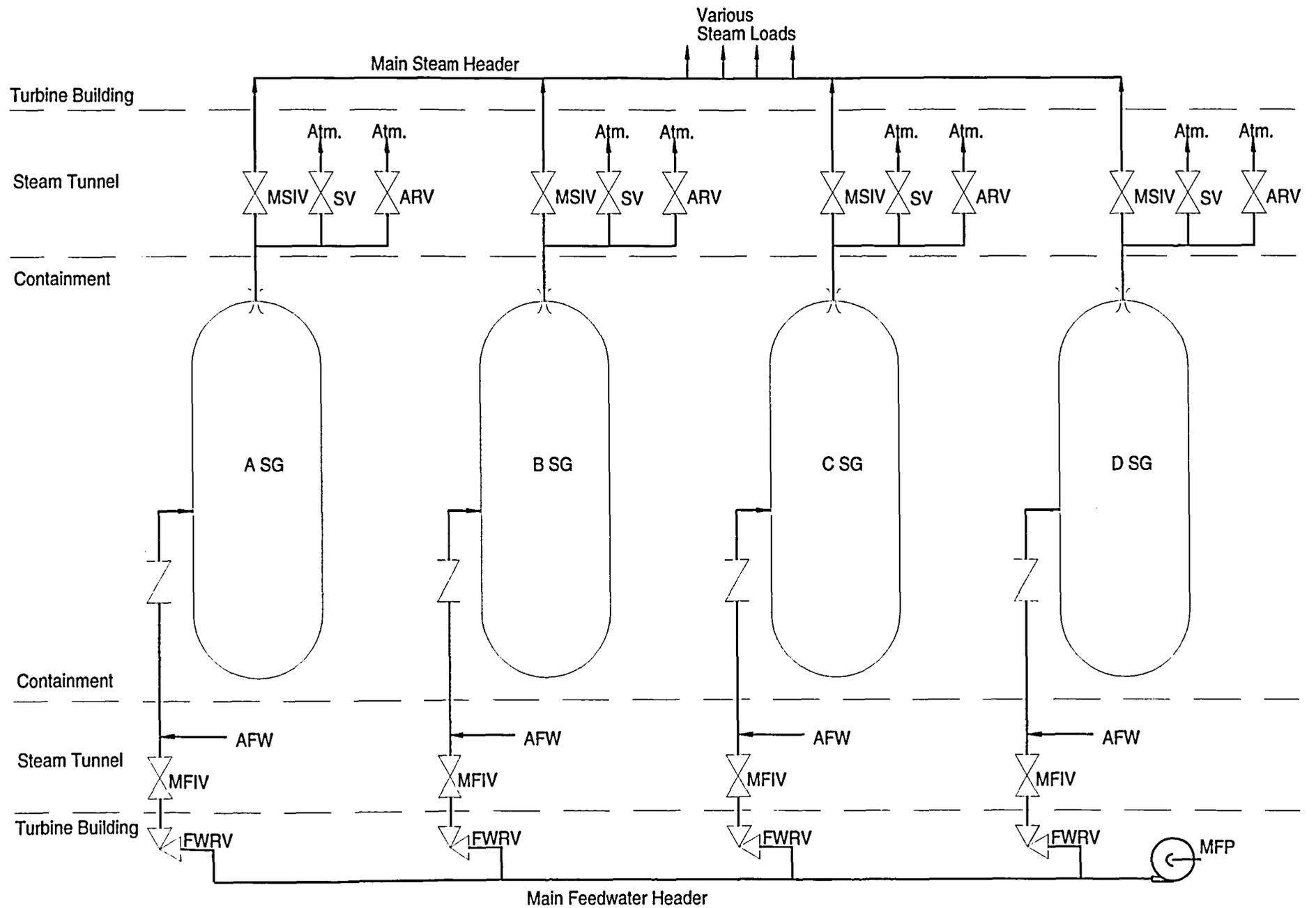


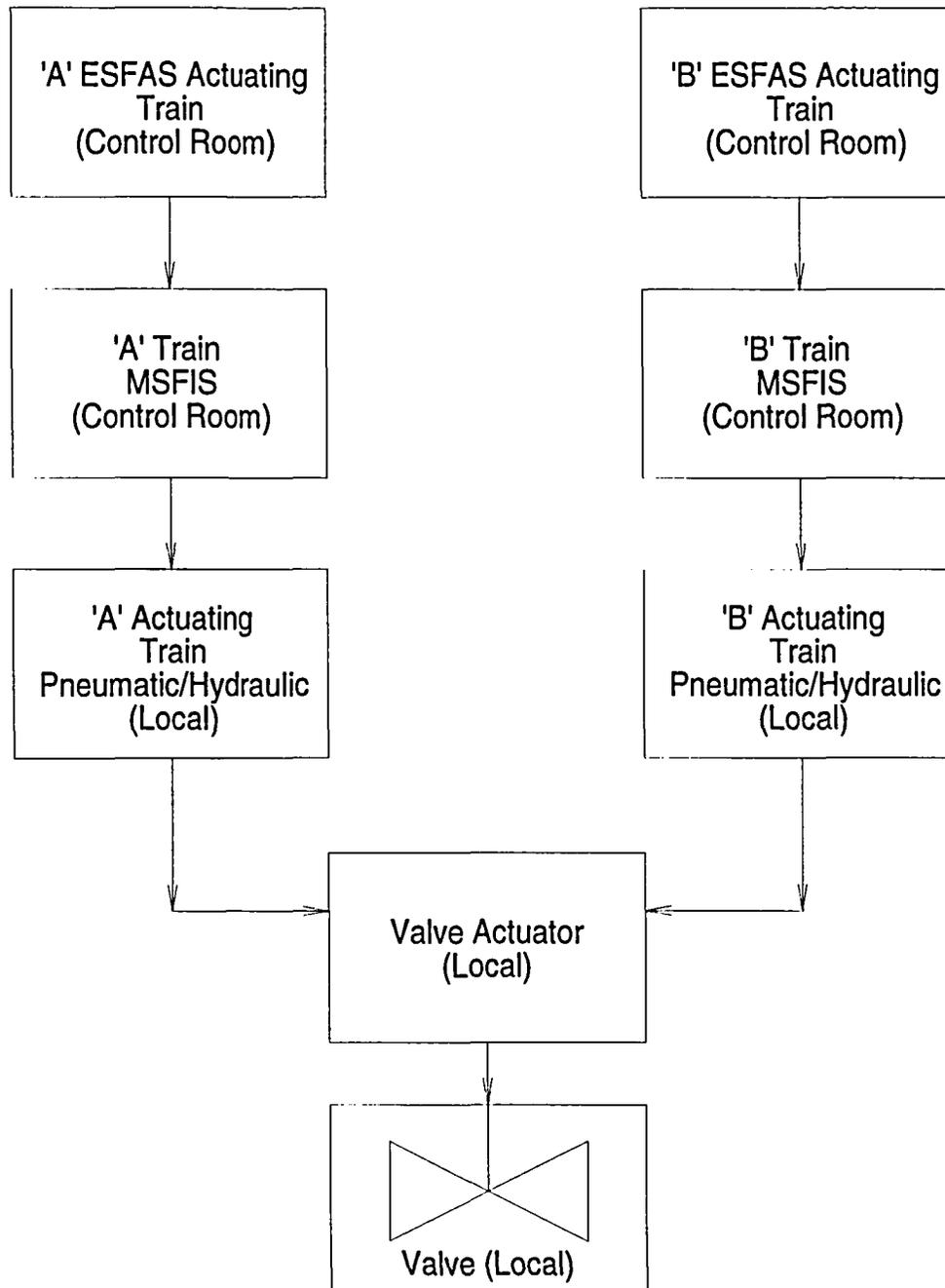
# MSIV/MFIV

## DESCRIPTION/OPERATION

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- One MSIV installed in each of the four main steam lines
- One MFIV installed in each of the four main feedwater lines
- Bidirectional, double disc, parallel slide gate valves
- Designed to close between 1.5 and 5 seconds to isolate line breaks on either side of valve
- Each valve equipped with two redundant electric / pneumatic / hydraulic actuation trains such that either actuation train can independently perform the safety function to fast-close the valve on demand
- Both actuation trains simultaneously receive the actuation signal









# MSIV/MFIV DESCRIPTION/OPERATION

- Pneumatic/Hydraulic Actuation Trains
  - High Pressure energy stored in hydraulic accumulator
  - Operation of solenoid valves results in pneumatic operation of the hydraulic 4-way valves
  - Under Fast Close demand, high pressure hydraulic fluid of accumulator is directed to the top of the valve actuator piston
  - Each accumulator contains sufficient stored energy and volume to fully close the valve



# MSIV/MFIV DESCRIPTION/OPERATION

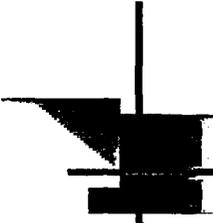
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- MSIV/MFIV Actuation Trains
- Engineered Safety Features Actuation System (ESFAS) and Main Steam and Feedwater Isolation System (MSFIS)
  - Main Steam Line Isolation Signal
    - Ctmr Pressure
    - Low Steam Line Pressure
    - High Steam Pressure Rate
  - Feedwater Isolation Signal
    - Safety Injection Signal
    - SG high-high level
    - SG low-low level
    - Reactor Trip with low Tavg



# DESIGN BASES

- Safety Design Bases
  - MSIVs
    - Provides for isolation of the secondary side of the steam generator to deal with leakage or malfunctions and to isolate non-safety related portions of the system
    - Prevent uncontrolled blowdown from more than one steam generator in the event of a main steamline break
  - MFIVs
    - Provide pressure boundary for Aux Feedwater injection
    - Terminate feedwater addition to limit mass/energy release from a break



# DESIGN BASES

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- Safety Design Bases (cont)
  - Main Steam and Feedwater Isolation System
    - Isolates the main steam and feedwater when required
    - No single failure can prevent any valve from performing its required function



## SAFETY ANALYSES

- Accident analyses crediting closure of MSIVs and MFIVs only require 3 of the 4 valves close to meet acceptance criteria of the event analysis
- Most limiting event analysis is the Main Steam Line Break (MSLB)



# MAIN STEAM LINE BREAK

- MSLB mass and energy release analysis
  - Assess the effect of a high energy line break on the containment
  - Number of cases run by the analysis to determine limiting conditions
  - Limiting case includes combination of several failures that adversely affect the containment pressure and temperature response



# MAIN STEAM LINE BREAK

- MSLB mass and energy release analysis (cont)
  - Faulted loop MSIV fails to close
    - Steam released to ctmt directly from faulted SG
    - Steam released to ctmt is supplemented by steam residing in the unisolable steamline
  - Non-faulted loop MSIVs close isolating faulted loop from other loops
    - Blowdown from multiple SGs prevented by closure of MSIV for each non-faulted SG



## MAIN STEAM LINE BREAK

- MSLB mass and energy release analysis (cont)
  - Faulted loop MFIV fails to close
    - Mass/Energy added to ctmt from hot water in feedwater piping
  - Non-faulted loop MFIV close
    - Terminates feedwater flow
    - Provides boundary for AFW addition to non-faulted SG



# MAIN STEAM LINE BREAK

- MSLB mass and energy release analysis (cont)
  - MSIV failure on any other loop will result in reduced mass/energy at the break and less limiting results
  - MFIV failure on any other loop will result in reduced mass/energy at the break and less limiting results
  - Conclusion - MSIV and MFIV failure on the faulted loop scenario has been conservatively accounted for in the MSLB analysis for the limiting containment pressure case



## OTHER ANALYSIS

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- Three categories:
  - Events where MSIV and MFIV do not close during the event (no effect)
  - Events where MSIV or MFIV failure to close will mitigate the response
  - Events where transfer of single failure to the MSIV or MFIV mitigates the response



## SINGLE FAILURE

- In absence of single failure, with one actuating train out of service, all valves will close
- A single failure is required for a valve to fail to close with one actuating train out of service
- Due to the configuration, any single failure can prevent only one valve from closing
- Thus, as a minimum, with single failure, 3 valves will always close
- Depending upon the failure, the degraded valve may or may not be the one that fails to close



# TECHNICAL SPECIFICATIONS

- 10 CFR 50.36 - the TSs will be derived from the analyses and evaluation included in the safety analysis report, and amendments thereto, .....
- WCGS TSs support the language chosen (i.e., the singular 'an' vs. plural in SR 3.7.2.2) based on the design and analysis



# TECHNICAL SPECIFICATIONS

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- Section 1.1, Definitions

OPERABLE-OPERABILITY - A system, subsystem, train, component, or device shall be OPERABLE or have OPERABILITY when it is capable of performing its specified safety function(s) and when all necessary attendant instrumentation, controls, normal or emergency electrical power, cooling and seal water, lubrication, and other auxiliary equipment that are required for the system, subsystem, train, component, or device to perform its specified safety function(s) are also capable of performing their related support functions.

- SR 3.0.1 - SRs shall be met.... Failure to meet a Surveillance, whether such failure is experienced during the performance of the Surveillance or between performances of the Surveillance, shall be failure to meet the LCO.



# TECHNICAL SPECIFICATIONS

- TS 3.7.2, "Main Steam Isolation Valves (MSIVs)," LCO 3.7.2 requires four MSIVs be OPERABLE
- TS 3.7.2 LCO Bases, states in part:
  - "This LCO requires that four MSIVs in the steam lines be OPERABLE. The MSIVs are considered OPERABLE when the isolation times are within limits, and they close on an isolation actuation signal."
  - TS LCO Bases includes guidance on MSIV OPERABILITY with one actuation train inoperable
- Procedure AP 26C-004, TS OPERABILITY
  - Provides additional guidance when determining OPERABILITY for 2 or more valve actuator configurations out of service (this guidance supplements the TS Bases)



# TECHNICAL SPECIFICATIONS

- SR 3.7.2.2 requires verifying each MSIV actuates to the isolation position on an actual or simulated actuation signal
  - Testing normally performed in MODE 3 during startup from refueling when conditions are consistent with those under which the acceptance criteria was generated
  - Testing verifies isolation time, verifies valve actuates to isolation position on an actuation signal, verifies trip actuating device for manual initiation function
  - Testing performed on each train (i.e., 4 valves at a time). Each train is tested due to the redundancy and capability of each actuation train to close the valve



# TECHNICAL SPECIFICATIONS

- Surveillance testing (cont)
  - If valve does not close (i.e., it does not meet the stroke time and does not actuate to the isolation position) - the valve is declared inoperable - it is undetermined at the time of the test the cause for the valve failing to fully close
  - SR 3.7.2.2 only requires that the valve actuate to the isolation position - it does not require the testing of both actuation trains
  - Both actuation trains are conservatively tested even though only one actuation train is required to support the valve performing its specified safety function



## CONCLUSION

- Each MSIV/MFIV has 2 redundant actuation trains
- Only one actuation train required to close each valve
- An MSIV/MFIV is OPERABLE with one actuation train out of service since the valve is capable of performing its specified safety function(s) assuming a single failure. The valve will perform its isolation function within the bounds of the accident analysis.



## CONCLUSION

- SR 3.7.2.2 is met with an actuation train out of service.
  - The SR requires actuation of each valve to the isolation position on an actual or simulated actuation signal.
  - With one actuation train of one valve out of service on a single valve, the valve will still actuate to the isolation position on an actual actuation signal.
- Safety analyses functional requirement is 3 MSIVs and 3 MFIV must close to assure the acceptance criteria is met
- One actuating train out of service on an MSIV/MFIV will not prevent a minimum of 3 MSIV/MFIV from closing assuming a single failure

# MSIV Actuator Issue - Summary and History for Callaway

## Initial Efforts to Address MSIV Actuator Inoperability

- MSIV actuator inoperability initially addressed in surveillance procedure used to perform testing on the MSIVs (i.e., OSP-AB-V0001, "Main Steam Valve Operability") during 1980s.
- Technical Specification interpretation (TSI) created 1991 timeframe
- TSI rolled into Operations surveillance procedure during Callaway conversion to Improved Technical Specifications (ITS).
- Requirements for MSIV actuators incorporated into Chapter 16 of the FSAR (the equivalent of a TRM, ORM, etc. at other plants) in 2004 timeframe.

## Technical Specification Interpretation (TSI)

- Based on redundancy of actuator design (i.e., recognizing that only one MSIV actuation train is needed for the associated MSIV to close on demand, so that an MSIV is still operable with only one actuator train inoperable).
- An inoperable MSIV actuator train (due to insufficient accumulator pressure, for example) was not viewed to be equivalent to an MSIV itself being inoperable. The MSIV actuator trains were not explicitly addressed by TS 3.7.2.
- Both actuators (for each MSIV) continued to be tested during the performance of applicable surveillances on the MSIVs. Wording in Bases for SR 3.7.2.1 suggested need to do this, but not taken to mean that SR had to be satisfied via both actuators each time. The SR could be met with one/either actuator.
- As an additional prudent measure, TSI was revised (1997 timeframe) in order to impose an allowed outage time (AOT) of 68 hours (in addition to the 8-hour AOT specified for an inoperable MSIV itself) for an inoperable MSIV actuator train. This restriction was considered to be above and beyond the TS requirements for the MSIVs.

## Issue Identified in 2005

- Corrective action document (CAR 200500238) initiated January 2005 to address concerns identified with the basis for the Chapter 16 MSIV actuator requirements/provisions.
- NRC Resident Inspector staff identified issue with respect to the Chapter 16 provisions.
- Various interactions took place with NRR and Region.
- License Amendment Request (LAR) OL-1262 prepared and submitted May 26, 2005.
- Standing Order developed to provide provisions and actions for plant Operators to follow in the event an MSIV actuator(s) is declared inoperable (while requested license amendment was pending).

## Subsequent Developments & Current Status

- NRC position expressed in Inspection Report exit meeting conducted on September 26, 2005.
- Refueling Outage (RF-14) - Fall 2005.
- License Amendment 172 issued June 16, 2006.
- Remains as an NRC Unresolved Item at this time.