Southern Nuclear

Vogtle Pre-Submittal Meeting (Part 2) to Revise Technical Specification 3.7.2, Main Steam Isolation Valves

August 2021

Meeting Purpose and Agenda

The purpose for this meeting is to discuss proposed amendment request to revise Technical Specification 3.7.2 to remove one of the two MSIV systems from the Limiting Condition for Operation

This meeting will cover the following topics:

- Current Design
- Proposed Design
- Proposed Technical Specification
- Technical Topics
- PRA Risk Insights
- Milestones

Issue

Problem Statement

There have been 6 trips at Vogtle since 2012 due to the inadvertent closure of one MSIV in a steam line

Proposed Resolution

Change the licensing basis and design from 2 MSIV systems per steam line to 1 MSIV system per steam line

- Reduces number of components that could cause inadvertent closure of MSIVs
- Reduces single point vulnerabilities
- Consistent with other PWRs

MSIV Safety Function

The function of the main steam isolation system is to limit blowdown to 1 steam generator in the event of a steam line break in order to

A. Limit the related effect upon the reactor core within specified fuel design limits

B. Limit containment pressure to a value less than 90 percent of design pressure

The isolation system provides positive shutoff with minimum leakage during postulated line severance conditions either upstream or downstream of the valves

Safety function will be preserved

Current Design

Current Design

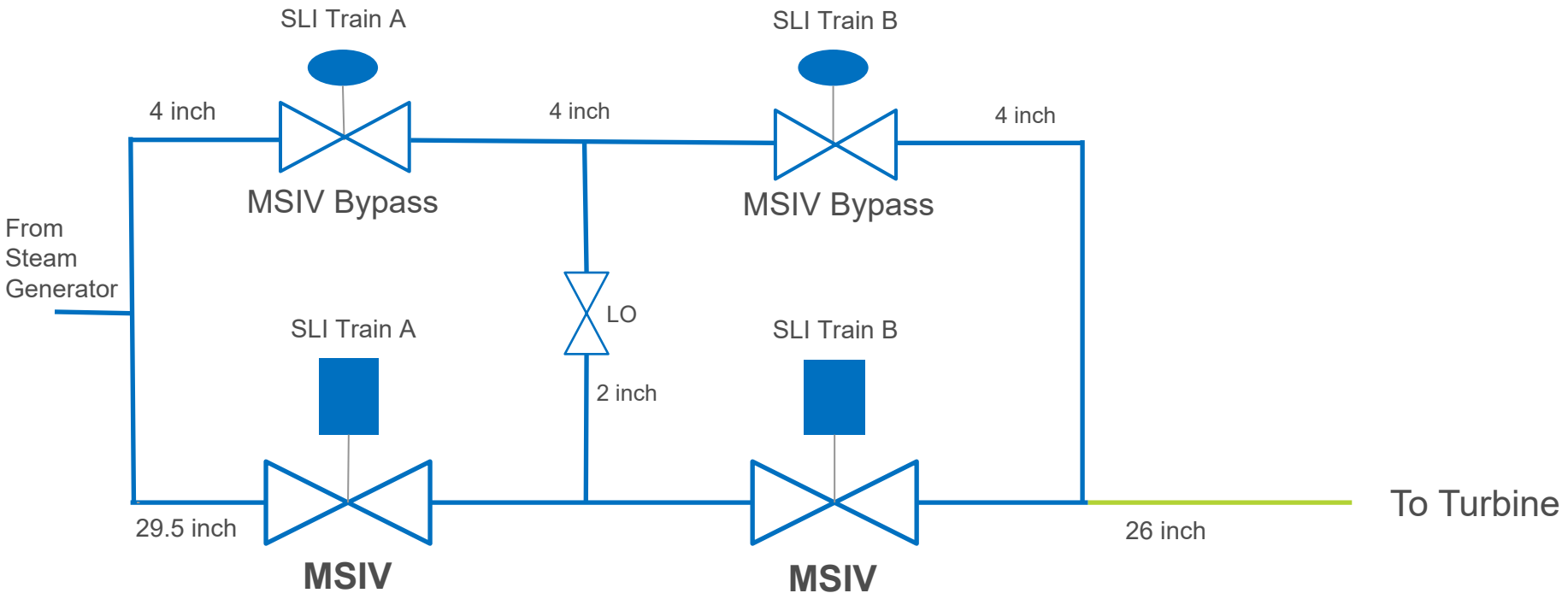
The main steam line isolation valves, MSIV bypass valves, and piping are designed to prevent uncontrolled blowdown from more than one steam generator

- For main steam line breaks upstream of an isolation valve, uncontrolled blowdown from more than one steam generator is prevented by the isolation valves in the unaffected steam lines and by the isolation valve in the affected line
- For main steam line breaks downstream of an isolation valve, blowdown from more than one steam generator is prevented by the main steam isolation valves on each main steam line
- Each MSIV and MSIV bypass valve in a steam line is actuated from a separate actuation train (SLI-A or SLI-B)

Current Design

- Each MSIV is a bidirectional gate valve composed of a valve body which is welded into the system pipeline
- Positive sealing can be maintained in either direction
- The MSIV bypass valves are used when the MSIVs are closed to permit warming of the main steam lines prior to startup
    - The bypass valves are air-operated globe valves
    - For emergency closure, the valve solenoid, when deenergized, will result in valve closure
    - Electrical solenoids are energized from a separate Class IE source

Current Design



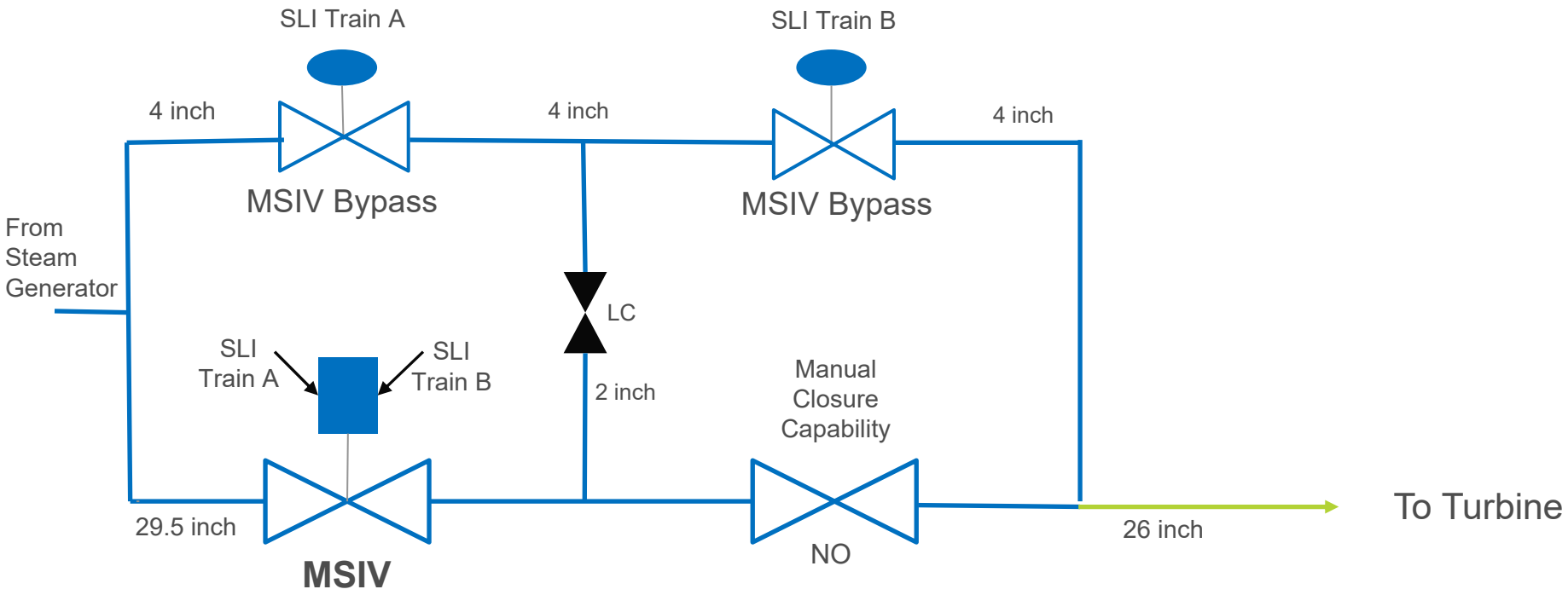
Vent, drain and other lines not shown for clarity
Not to scale

Proposed Design

Proposed Design

- Retain the existing inboard MSIVs – one per steam line
  - Bidirectional gate valve
- Eliminate existing outboard MSIV function
  - Retain outboard valve with capability for manual closure
  - Outboard valve will not receive SLI signal
- Retain both existing MSIV bypass valves
- Change actuation of MSIV closure to include both actuation trains on each inboard MSIV
  - MSIV bypass actuation does not change, as both valves remain in the steam line

Proposed Design

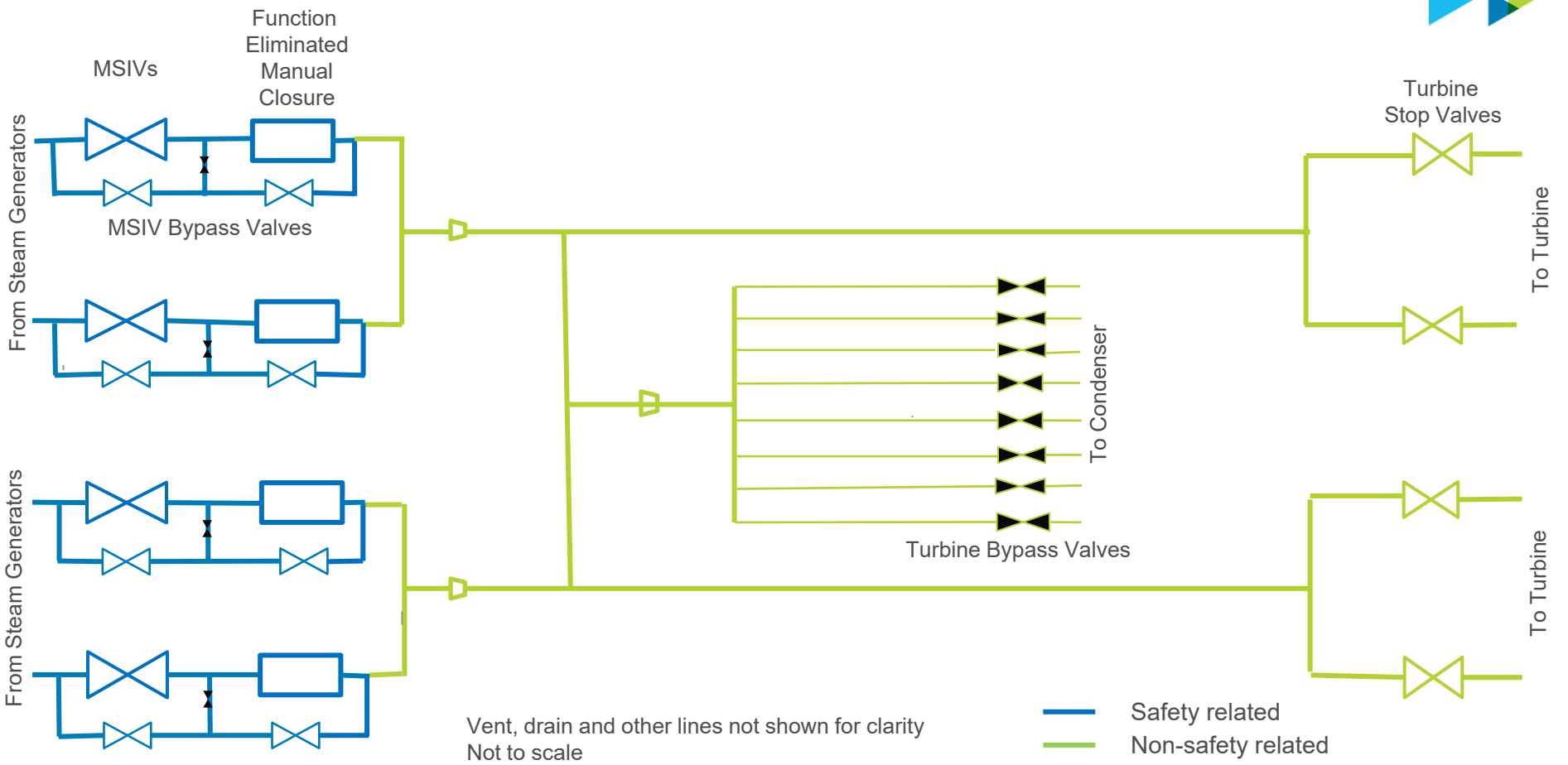


Vent, drain and other lines not shown for clarity
Not to scale

Future Licensing Basis

- SRP 10.3 - Assure that, in the event of a postulated break in a main steam line in a PWR plant, the design will preclude the blowdown of more than one steam generator, assuming a concurrent single active component failure
- In this regard, all main steam shutoff valves downstream of the MSIVs, the turbine stop valves, and the control valves are considered to be functional
- Each MSIV actuator is designed to accomplish its function with a single active component failure

Proposed Design



Current Technical Specification

TS Bases 3.7.2

The MSIV system consists of an MSIV and associated bypass valve

3.7.2 Main Steam Isolation Valves (MSIVs)

LCO 3.7.2 Two MSIV systems per steam line shall be OPERABLE.

APPLICABILITY: MODE 1,
MODES 2 and 3 except when one MSIV system in each steam line is closed.

ACTIONS

----------NOTE----------
Separate Condition entry is allowed for each steam line.

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One or more steam line with one MSIV system inoperable in MODE 1.	A.1 Restore MSIV to OPERABLE status.	72 hours OR In accordance with the Risk Informed Completion Time Program
B. ----------NOTES---------- 1. Not applicable when the second MSIV in one steam line is intentionally made inoperable. 2. The following Section 5.5.22 constraints are applicable: parts b, c.2, c.3, d, e, f, g, and h. --- One or more steam lines with two MSIV systems inoperable in MODE 1.	B.1 Restore one MSIV system to OPERABLE status in affected steam line.	4 hours OR In accordance with the Risk Informed Completion Time Program

Proposed Technical Specification

- LCO changed to replace two MSIV systems per steam line with four MSIVs and associated actuators and bypass valves – reflects one MSIV per steam line (four steam lines total)
- Current Required Actions B and D deleted
  - Not needed with only one MSIV per steam line
- Added actuator Conditions in accordance with TSTF-504
- Added bypass valve Condition
- Existing Surveillance Requirement updated to reflect LCO
- Added Surveillance Requirement for actuators
- Changes generally consistent with NUREG–1431 and TSTF-504

Proposed Technical Specification

3.7 PLANT SYSTEMS

3.7.2 Main Steam Isolation Valves (MSIVs)

LCO 3.7.2	Four~~Two~~ MSIVs and their associated actuator trains and associated bypass valves ~~systems per steam line sh~~shall be OPERABLE.
APPLICABILITY:	MODE 1, MODES 2 and 3 except when ~~one~~all MSIVs ~~system in each steam line is~~are closed.

ACTIONS

~~----------NOTE----------~~
~~Separate Condition entry is allowed for each steam line.~~
~~----------~~

Proposed Technical Specification

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One MSIV with one actuator train inoperable	A.1 Restore MSIV actuator train to OPERABLE status.	7 days
B. Two MSIV actuator trains inoperable on different MSIVs and on different trains.	B.1 Restore one MSIV actuator train to OPERABLE status.	72 hours
C. Two MSIV actuator trains inoperable on different MSIVs on the same train.	C.1 Restore one MSIV actuator train to OPERABLE status.	24 hours
D. Two MSIV actuator trains inoperable on the same MSIV.	D.1 Declare the affected MSIV inoperable.	Immediately

(continued)

Proposed Technical Specification

CONDITION	REQUIRED ACTION	COMPLETION TIME
E. Three or more MSIV actuator trains inoperable. OR Required Action and associated Completion Time of Condition A, B, or C not met.	E.1 Declare each affected MSIV inoperable.	Immediately
~~A~~F. One ~~or more steam line with one~~ MSIV ~~system~~ inoperable in MODE 1.	~~A~~F.1 Restore MSIV to OPERABLE status.	~~72~~8 hours OR In accordance with the Risk Informed Completion Time Program

Proposed Technical Specification

B. ~~----------NOTES----------~~ ~~1. Not applicable when the second MSIV in one steam line is intentionally made inoperable.~~ ~~2. The following Section 5.5.22 constraints are applicable: parts b, c.2, c.3, d, e, f, g, and h.~~ ~~----------~~ ~~One or more steam lines with two MSIV systems inoperable in MODE 1.~~	~~B.1 Restore one MSIV system to OPERABLE status in affected steam line.~~	~~4 hours~~ ~~OR~~ ~~In accordance with the Risk Informed Completion Time Program~~

Proposed Technical Specification

~~C~~G. Required Action and associated Completion Time of Condition FA ~~or B~~ not met.	~~C~~G.1 Be in MODE 2.	6 hours
~~D. One or more steam lines with one MSIV system inoperable in MODE 2 or 3.~~	~~D.1 Verify one MSIV system closed in affected steam line.~~	~~7 days~~ ~~AND~~ ~~Once per 7 days thereafter.~~

(continued)

Proposed Technical Specification

CONDITION	REQUIRED ACTION		COMPLETION TIME
H. ----------NOTE---------- Separate Condition entry is allowed for each bypass valve. ---------- One or more bypass valves inoperable.	H.1	Close the bypass valve.	7 days
	AND		
	H.2	Verify the bypass valve is closed.	Once per 7 days thereafter
~~E~~I. ----------NOTE---------- Separate Condition entry is allowed for each MSIV. ---------- One or more ~~steam lines with two~~ MSIVs ~~systems~~ inoperable in MODE 2 or 3.	I ~~E~~.1	Close MSIV.	84 hours
	AND		AND
	I.2	Verify ~~one~~ MSIV ~~system~~is closed ~~in affected steam line~~.	Once per 7 days thereafter
J~~F~~. Required Action and associated Completion Time of Condition H or I~~D or E~~ not met.	~~F~~J.1	Be in MODE 3.	6 hours
	AND		
	~~F~~J.2	Be in MODE 4.	12 hours

Proposed Technical Specification

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.7.2.1	----------NOTE---------- Only required to be performed in MODES 1 and 2. ---------- Verify closure time of each MSIV and bypass valve ~~system~~ is within limits on an actual or simulated actuation signal.	In accordance with the INSERVICE TESTING PROGRAM
SR 3.7.2.2	----------NOTE---------- Only required to be performed in MODES 1 and 2. ---------- Verify each actuator train actuates the MSIV to the isolation position on an actual or simulated actuation signal.	In accordance with the Surveillance Frequency Control Program

Technical Topics

Valve/Actuator Design

- Each MSIV is a bidirectional gate valve composed of a valve body which is welded into the system pipeline
- MSIV design function is not changed
- Actuators are being replaced with new design system media actuators
- Two redundant train-oriented steam line isolation signals (SLI-A, SLI-B) are initiated upon receipt of any of the following signals
    - High steam line pressure rate
    - Low steam line pressure
    - Containment high-2 pressure
    - Manual actuation
- Actuation signals are not changed

New Actuator Design

- System Media Actuated
- Dual Solenoid
- Train Separated

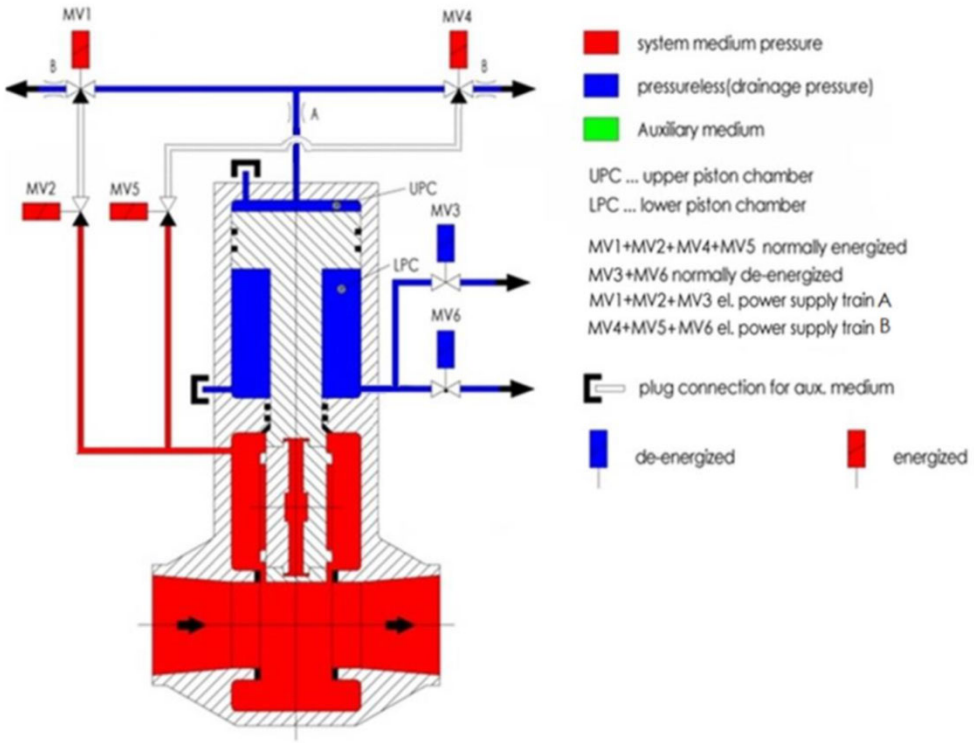


Figure 8. Keep Open Schematic

Single Failure

- No single active component failure will result in the failure of more than one main steam isolation valve to operate
- MSIV actuator closes valve assuming a single failure
    - Dual paths to supply steam for closure
- Train A and B closure signal to actuator
    - As with current design, signals are generated from separate instrumentation and powered by separate instrumentation control systems
- New design provides safety function assuming single active failure
    - New design credits operation of turbine stop valves, turbine bypass valves to limit blowdown to only one steam generator

Safety Analysis

Chapter 6 and Chapter 15 analyses have been evaluated/investigated to determine impact of the removal of the closure function of the outboard MSIV, specifically:

- Impact to mass and energy release and associated containment response
  - Reverse flow into containment due to single MSIV failure in ruptured loop
  - Small increases in peak containment temperature and pressure - FSAR to be updated to reflect updated analysis
- Impact to reactor response analysis
  - No impact
- Impact to radiological analyses resulting from secondary side transients
  - Bounded by current single failure assumption of stuck open atmospheric relief valve (ARV)
- SGTR Margin To Overfill (MTO) Analysis
  - Bounded by current single failure assumption of stuck open ARV
- Impact to environmental qualification of equipment
  - Increases in peak containment P/T are being addressed for impacted equipment

Seismic/ Pipe Rupture

- Confirm the main steam piping and support system will continue to withstand the dynamic effects of:
    - Quick valve closure of the MSIVs and turbine stop valves, and
    - Reaction forces of safety, atmospheric, and steam dump valves
- The piping containing the MSIVs qualifies as “No Break Zone” piping both before and after MSIV actuator replacement
- Pipe stress and pipe supports are within allowable load limits
- Seismic Category I design and evaluations complete for new enclosures and conduits

Mechanical

Mechanical systems review determined:

- HVAC has margin to accommodate heat gain due to addition of electrical components/panels
- Combustible load of affected fire areas/zones due to new material/components remain with allowable limits
- ISI/IST program to complete 10 CFR 50.55a evaluation for ISI/IST plan changes

Containment Isolation

Current Licensing Basis

- The containment penetrations associated with the secondary side of the steam generators are not subject to General Design Criterion 57
- The valves associated with these penetrations do not receive a containment isolation signal and are not credited with effecting containment isolation in the safety analyses
- The barriers against fission product release to the environment are the steam generator tubes and the piping associated with the steam generators
- No changes to the licensing basis for containment isolation are needed

Power Supplies

- Redundant power supplies and power trains operate the MSIVs and MSIV bypass valves to isolate safety and non-safety related portions of the system
- Impacts of the change in the actuator were evaluated
  - Battery chargers and 125-volt DC battery have adequate margin to accommodate the increase in load for providing power to solenoids
  - Control circuit surge protection devices add a short time delay prior to valve stroke which is accounted for in the valve closure time curve

Secondary System Performance – Turbine Stop Valves

- The flow of the main steam entering the high-pressure turbine is controlled by four stop valves and four governing control valves
- Each 28-in. stop valve is controlled by an electrohydraulic actuator, so that the stop valve is either fully open or fully closed
- The function of the stop valves is to shut off the steam flow to the turbine, when required
- The stop valves are closed within 0.3 s by actuation of the emergency trip system devices which are independent of the electronic flow control logic
- A reactor trip is one of the actuation signals for the turbine stop valves and is generated following a main steam line break
- The turbine stop valves are closed when the Unit is in Mode 2 or below
- The turbine stop valves are designed to close against full steam pressure supplied to the turbine

Secondary System Performance – Turbine Bypass Valves

- The system consists of a manifold connected to the main steam lines upstream of the turbine stop valves and of lines from the manifold with regulating valves to each condenser shell
- The system is designed to directly bypass 40 percent of the valve-wide-open main steam flow to the condenser
- The turbine bypass valves fail in the closed position on loss of instrument air or electrical supply to a valve
- The valves are capable of going from the fully open to the fully closed position within 5 sec after de-energization of the solenoid valves over the pressure range of 100 to 1185 psig
- Position switches are provided on the bypass valves, and fully open and fully closed position signals are transmitted to the main control room

PRA Risk Insights

PRA Risk Insights

- Not a risk-informed LAR, will include PRA insights consistent with SRP 19.2 Appendix D
- Modification will be assessed per model maintenance procedures for consideration of immediate update or scheduled update
- LAR will include a summary of design change risk significance (i.e., delta CDF and delta LERF associated with current MSIV configuration versus future modified MSIV configuration), and RICT impact
    - internal events (<1% increase in CDF & LERF)
    - internal flooding (<0.1% increase in CDF & LERF)
    - fire (<0.1% increase in CDF & LERF)
    - seismic (2.2% increase in CDF, 4% increase in LERF)

PRA Risk Insights

LAR will include information supporting RICT option for “one MSIV inoperable in MODE 1” condition (current TS has RICT option for “one or more steam line with one MSIV system inoperable in MODE 1”) for example:

- PRA success criteria, comparison with Design Basis success criteria
- Sample RICT calculations using conceptual impact model
- Total estimated CDF and LERF values from conceptual impact model
- Review for impact on seismic penalty factor
- Review for impact on analyses of external hazards
- Review for impact on uncertainty analysis

Milestones

Milestones

- Submit LAR by end of 3Q2021
- NRC approval requested 12 months after submittal
- Implement during Vogtle 1R24 (Spring 2023) and 2R23 (Fall 2023)

Questions?