

# Proposal to Revise LCO 3.0.3

March 5, 2020

**Dwi Murry, TSTF (Westinghouse Plants)**

# BACKGROUND

## LCO 3.0.3

## PWR

When an LCO is not met and the associated ACTIONS are not met, an associated ACTION is not provided, or if directed by the associated ACTIONS, the unit shall be placed in a MODE or other specified condition in which the LCO is not applicable. Action shall be initiated within 1 hour to place the unit, as applicable, in:

- a. MODE 3 within 7 hours,
- b. MODE 4 within 13 hours, and
- c. MODE 5 within 37 hours.

Exceptions to this Specification are stated in the individual Specifications.

Where corrective measures are completed that permit operation in accordance with the LCO or ACTIONS, completion of the actions required by LCO 3.0.3 is not required.

LCO 3.0.3 is only applicable in MODES 1, 2, 3, and 4.

## BWR

When an LCO is not met and the associated ACTIONS are not met, an associated ACTION is not provided, or if directed by the associated ACTIONS, the unit shall be placed in a MODE or other specified condition in which the LCO is not applicable. Action shall be initiated within 1 hour to place the unit, as applicable, in:

- a. MODE 2 within [7] hours,
- b. MODE 3 within 13 hours, and
- c. MODE 4 within 37 hours.

Exceptions to this Specification are stated in the individual Specifications.

Where corrective measures are completed that permit operation in accordance with the LCO or ACTIONS, completion of the actions required by LCO 3.0.3 is not required.

LCO 3.0.3 is only applicable in MODES 1, 2, and 3.

## LCO 3.0.3 Requirements

- LCO 3.0.3 requires a plant shutdown due to three conditions:
  1. An LCO is not met and the associated Actions are not met
    - In STS plants, this is uncommon as most specifications incorporate actions to exit the Applicability or default actions when the actions are not met.
  2. An associated Action is not provided:
    - In STS plants, unusual except for dual train systems that don't include an Action for two inoperable trains (such as fluid systems).
    - In general, the BWR STS provides actions for all trains inoperable, in more TS than the PWR STS, avoiding LCO 3.0.3 entry.

## LCO 3.0.3 Requirements

### 3. If directed by the associated ACTIONS

- Some TS direct entry into LCO 3.0.3, for example:
  - Loss of all required RCS leakage detection monitors.
  - ECCS available flow less than 100% flow equivalent to a single ECCS train.
  - Loss of three or more required AC sources.
  - Loss of two or more electrical distribution subsystems that result in a loss of safety function.

## LCO 3.0.3 Time to Prepare

- The original STS LCO 3.0.3 (1975) required being in Hot Standby (Mode 3) within 1 hour for PWRs and within 6 hours for BWRs.
- In 1980, the BWR and PWR STS were revised to require initiating action to shutdown the unit within 1 hour, and
  - PWRs: Be in Mode 3 in the next 6 hours.
  - BWRs: Be in Mode 2 in the next 6 hours.
- The Bases stated that the one hour was to prepare for an orderly shutdown and to coordinate with the load dispatcher to ensure the stability of the electrical grid.

## LCO 3.0.3 Exception

- LCO 3.0.3 is not always applicable.
- In the PWR STS, Actions for all Auxiliary Feedwater Pumps inoperable are modified with a Note that states, “LCO 3.0.3 and all other LCO Required Actions requiring MODE changes are suspended until one AFW train is restored to OPERABLE status.”
- The Bases state, “In this case, LCO 3.0.3 is not applicable because it could force the unit into a less safe condition.”

# PROBLEM STATEMENT



## Problem Statement

The current LCO 3.0.3 requirements are based on out-of-date assumptions regarding plant operation.

A rapid shutdown of the reactor may not be the safest action to take when the TS requirements are not met.

## Changes in Plant Operation

- When the 1-hour allowance was added in 1980, industry average nuclear capacity factors were less than 60% and plant shutdowns were common.
- Current industry capacity factors are very high (> 92%) and many plants operate from refueling to refueling without a shutdown.

## Changes in Plant Operation

- In the last 10 years (approximately 1000 reactor-years), there have only been 92 plant shutdowns required by TS.
- However, many shutdowns occurred at the end of a Completion Time and the licensee has time to anticipate and prepare for the shutdown.
- Only about a third of the TS-required shutdowns were emergent, immediate actions.
  - Only 15 plant shutdowns under LCO 3.0.3 have been initiated in the last 10 years.
  - Only 7 shutdowns have been completed in the same period.
- TS required shutdowns are not equally distributed across the industry.

## Changes in Plant Operation (continued)

Number of TS-Required Shutdowns 2010-2019	Number of Plants	Percent of Fleet	
0	18	30%	} 92%
1	19	31%	
2	10	16%	
3	9	15%	
4	2	3%	
5	1	< 2%	
6	1	< 2%	
7	1	< 2%	

More than 90% of the fleet has experienced three or less TS-required shutdowns in the last 10 years.

## Changes in Plant Operation

- A plant shutdown required by TS is time-critical.
  - Human Reliability Analysis reveals that time-critical actions are more error prone.
- Infrequently performed actions are more error prone.
- A plant shutdown under LCO 3.0.3 is both infrequent and time critical.
- Licensees have implemented training and preparation recognizing that a plant shutdown is an infrequent operational occurrence.

## Changes in Plant Operation

Comparing an example plant preparation for a normal shutdown versus a shutdown under LCO 3.0.3:

### Scheduled Shutdown

- An operating crew is called in for a full shift to train in the simulator and on procedures.
- The trained crew takes the shift at 6pm, shutdown begins at 8pm, and trip occurs at midnight.
- Reactor engineering is also engaged and provides support.
- Typical crew: 3 ROs, a Control Room Supervisor, a Shift Manager, an STA, an Operations Manager, and 2 training instructors (for simulator).

### LCO 3.0.3 Shutdown

- Any on-site SROs and ROs are called to relieve the on-shift operating crew.
- If possible, the on-shift crew reports to the simulator for any training that can be completed within about an hour, then reports back to the unit for the shutdown.
- If the LCO 3.0.3 shutdown occurs during off hours, then the operating crew is responsible for the pre-job briefs and for the shutdown of the unit.
- Crew size is whoever is available and can be minimum staff.

## Shutdown is Not Always the Safest Action

- LCO 3.0.3 is based on the assumption that an immediate plant shutdown is the safest course of action if the TS requirements are not met. However:
  - Most TS equipment is in standby (e.g., ECCS components, emergency power) and inoperability does not threaten stable plant operation.
  - A plant shutdown from full power to cold shutdown is a major plant evolution that exercises an array of plant equipment and procedures.

## Shutdown is Not Always the Safest Action

- Transition from a full power state to shutdown and return to full power takes the plant through a series of transitions.
  - e.g., Mode 1 to hot shutdown, cooldown to residual heat removal, transition to cold shutdown.
- Operators must manually take systems out of service and start systems in rapid succession.
- The plant risk associated with those transitions varies depending on the inoperable equipment and any equipment out of service for maintenance.
  - Equipment out of service for maintenance may need to be returned to service ahead of schedule or left out of service to focus on the unplanned shutdown.



## Shutdown is Not Always the Safest Action

- The NRC's Notice of Enforcement Discretion guidance recognizes that a plant shutdown is not always the safest course of action:

The NRC has historically recognized that the two safest modes for operating a nuclear power plant are either Mode 5 (shut down) or Mode 1 (operating at power). *Transitions between these two modes may introduce situations or configurations that involve an increase in risk.* The NRC expects its licensees to comply with all applicable requirements (i.e., regulations, license conditions, etc.) However, *circumstances may arise at an operating NPP where compliance with a TS LCO or a license condition would result in an unnecessary transient without a corresponding health and safety benefit...*

## Conclusion

The timeframes in LCO 3.0.3 create an infrequently used, time-critical plant evolution.

In most cases it may not be the safest course of action.

# PROPOSAL

## TSTF Proposal

- The TSTF proposes to modify LCO 3.0.3 to provide 24 hours to prepare for a plant shutdown.
  - 24 hours is a reasonable period to:
    - Bring a full operating crew on site to support the shutdown.
    - Bring in simulator staff to support simulator exercises.
    - Conduct simulator training scenarios to prepare the crew for the shutdown.
    - Perform just-in-time procedure reviews to prepare for the shutdown.
    - Coordinate with the load dispatcher to replace the generation.
      - More complex with today's multiple supplier grids.

## TSTF Proposal

- During the proposed 24 hour preparation time, risk must be assessed and managed.
- The requirement that risk be assessed and managed was added to:
  - LCO 3.0.4 (Mode changes),
  - LCO 3.0.8 (Snubbers),
  - LCO 3.0.9 (Barriers), and
  - SR 3.0.3 (Missed Surveillances).
- Risk is assessed using the existing Maintenance Rule tools, which are well established and readily available to operators.

## TSTF Proposal

- The use of risk management actions are also well established to mitigate the risk of the inoperable equipment.
  - Risk management actions are taken to:
    - Reduce the likelihood of initiating events;
    - Reduce the likelihood of the unavailability of redundant trains; and
    - Increase the likelihood of successful operator actions in response to an initiating event.

## TS Markup

When an LCO is not met and the associated ACTIONS are not met, an associated ACTION is not provided, or if directed by the associated ACTIONS, the unit shall be placed in a MODE or other specified condition in which the LCO is not applicable. *Risk shall be assessed and managed and* action shall be initiated within ~~±~~ *24 hours* to place the unit, as applicable, in:

### PWR

- a. MODE 3 within ~~7~~ *30* hours,
- b. MODE 4 within ~~13~~ *36* hours, and
- c. MODE 5 within ~~37~~ *60* hours.

### BWR

- a. MODE2 within [~~7~~ *30*] hours,
- b. MODE 3 within ~~13~~ *36* hours, and
- c. MODE 4 within ~~37~~ *60* hours

## Wider Implications

- The TSTF recognizes that there are other TS with shutdown requirements applicable in less than 24 hours.
- The TSTF is still considering whether to address those specific conditions in the same Traveler that addresses LCO 3.0.3 or in separate, system-specific travelers.



## Next Steps

- The TSTF would like to obtain feedback from the NRC on the proposed change.
- A TSTF traveler will be developed and submitted this year.

# DISCUSSION