

# DIABLO CANYON POWER PLANT

## Risk-Informed Technical Specification Completion Times (TSTF-505) License Amendment Request

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# Agenda

- Status of PRA Model
- Fire Impact on Risk-informed Completion Time (RICT) Calculations
- NFPA-805 Modifications
- Status of LAR Commitments
- Draft License Condition Language
- I&C Questions
- Discussion and Staff Feedback

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## LARs

- PG&E submitted TSTF-505 LAR on November 25, 2013
- NFPA-805 LAR submitted June 26, 2013

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## Status of PRA model

- Current model consists of Internal Events, Internal Flooding, Seismic, and Fire
- Open peer review findings committed to be resolved at the time of TSTF-505 LAR submittal are now addressed and resolved in current PRA model
  - Open peer review items (14 total) were identified in commitment 10 in Enc. 4 of TSTF-505 LAR

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# Fire impact on RICT calculations

- NFPA-805 fire model credits several future plant changes to address fire risk
  - Modification to Address Loss of RCP Seal Cooling
    - Planned modification to address is installation of Westinghouse Safe Shutdown Reactor Coolant Pump (RCP) seals [fall 2015 (Unit 1), spring 2016 (Unit 2) outages]
  - Electrical Raceway Fire Barrier System (ERFBS) (fall 2015, spring 2016 outages)

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# Fire impact on RICT calculations

- NFPA-805 fire model credits several future plant changes to reduce fire risk
  - Hot Shutdown Panel modifications (spring 2016 and spring 2017 outages)
  - Incipient Fire Detection added within cable spreading and Solid State Protections System (SSPS) rooms (spring 2017 and spring 2018 outages)

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# Measures to Address Fire Risk

- Interim compensatory actions to manage fire risk prior to modifications are being actively implemented consistent with NFPA-805 LAR commitments
- In addition, the following fire compensatory measures will be taken in the interim during use of a RICT:
  - For the ERBFS modifications
    - Welding and cutting will be prohibited in fire-areas pre-identified for each RICT
  - For Hot Shutdown Panel modifications
    - A continuous fire watch will be stationed in the cable spreading rooms
    - Operators will be briefed every shift on the manual actions that are required for remote shutdown

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# Measures to Address Fire Risk

- In addition, the following fire compensatory measures will be taken in the interim during use of a RICT:
  - For Incipient Fire Detection modifications
    - A continuous fire watch will be stationed in the cable spreading and SSPS rooms and cabinets with incipient detection credited in the PRA model used to calculate the RICT will be routinely monitored with portable incipient detectors



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# Incipient Detection Compensatory Measures

- PRA modeling used for the RICT program during a RICT prior to installation of modifications:
    - For Hot Shutdown Panel modifications
      - PRA model will credit for the hot shutdown panel with manual actions for remote shutdown
    - For Incipient Fire Detection modifications
      - PRA model will only credit incipient detection for a subset of cable spreading room and SSPS room risk-significant cabinets that are routinely monitored with portable incipient detectors
  - RICT calculations are performed crediting NFPA-805 modifications where compensatory measures are in place (consistent with configuration risk management practices endorsed by RG 1.160)
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## Status of TSTF-505 LAR Commitments

- Regulatory Commitments (10) identified in Enclosure 4 of TSTF-505 LAR
- Status of each commitment is summarized below
- Commitment 1 – Plant procedures for changes affecting equipment within the scope of the Configuration Risk Management Program
  - Complete – Design Change procedure requires changes that can impact plant PRA to be evaluated by PRA group

# Status of TSTF-505 LAR Commitments

- Commitment 2 – PRA model logic for pressurizer heaters
  - Complete – PRA model (that will be used for RICT Program) updated to include logic that fails secondary heat removal when all 4 pressurizer heater banks are not functional
- Commitment 3 – Inclusion of shared systems/equipment between units in procedures for risk managed actions (RMAs)
  - Complete – The RICT Program procedures developed identify shared systems/equipment for RMAs

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## Status of TSTF-505 LAR Commitments

- Commitment 4 – PRA model for containment sump recirculation time for small LOCAs
    - Complete – PRA model (that will be used for RICT Program) updated to include logic for increased human error failure probability for aligning cold leg recirculation when the containment fan coolers fail and containment spray is successful
  - Commitment 5 – ECCS charging pump recovery factor when pump is unavailable
    - Complete – PRA model (that will be used for RICT Program) updated to include logic such that ECCS pump recovery factor is 1.0 when pump unavailable
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## Status of TSTF-505 LAR Commitments

- Commitment 6 – Mission time for DGs and fuel oil transfer pumps when 230 kV offsite power source is unavailable
  - Complete – PRA model (that will be used for RICT Program) updated to include 24-hour mission time to DGs and fuel oil transfer pumps when 230 kV offsite power source is unavailable
- Commitment 7 – Assume inoperability of auxiliary saltwater (ASW) train if vacuum breakers inoperable
  - Complete – The RICT Program procedures developed require to assume inoperability of the ASW train if one or more vacuum breakers inoperable

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## Status of TSTF-505 LAR Commitments

- Commitment 8 – Continuous Fire watch for Cable Spreading and SSPS rooms when RICT is in effect until Hot Shutdown Panel and Incipient Detection modifications implemented
    - Will be proposed as license condition with additional compensatory measures described previously
  - Commitment 9 – Prohibition of welding and cutting activities in select fire areas when RICT is in effect until ERBFS and Circuit Re-routing (Unit 2) modifications implemented
    - Circuit Re-routing (Unit 2) modification is being replaced with same ERBFS modification as Unit 1
    - Will be proposed as license condition
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## Status of TSTF-505 LAR Commitments

- Commitment 10 – Open peer review findings and observations (14 total)
  - Complete – Open peer review findings and observations have been addressed and resolved in the current PRA model which will serve as the Configuration Risk Management Program (CRMP) used for RICT Program

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# Status of TSTF-505 LAR Commitments

## □ Commitment Summary

- 8 of 10 Regulatory Commitments are complete
- 2 Regulatory Commitments related to compensatory measures until NFPA-805 modifications are in place are open and will be included in proposed license conditions
- Risk-managed TS will only be used with the approval of a PG&E officer and only following an appropriate readiness review to ensure all commitments are met.



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# Draft License Condition

## (x) TSTF-505, Revision 1

Pacific Gas and Electric shall implement and maintain in effect all provisions of the approved Technical Specification Task Force TSTF-505, Revision 1, "Provide Risk-Informed Extended Completion Times- RITSTF Initiative 4b", as specified in the license amendment request dated November 25, 2013, supplemented by letters dated xxx, and as approved in the safety evaluation dated xxx.

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# Draft License Condition

## (x)(a) Transition License Conditions

1. If core damage frequency exceeds  $1 \times 10^{-4}$  / yr or large early release frequency exceeds  $1 \times 10^{-5}$  / yr, the licensee shall implement the Electrical Raceway Fire Barrier System (Units 1 and 2), Hot Shutdown Panel (Units 1 and 2), and Incipient Detection (Units 1 and 2) modifications described in Table S-2 of Attachment S of Enclosure 1 of Pacific Gas and Electric letter dated June 26, 2013, to complete the transition to full compliance with 10 CFR 50.48(c) prior to startup from the twentieth refueling outage for each Unit. The licensee shall maintain appropriate compensatory measures in place until completion of these modifications.

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# Draft License Condition

## (x)(a) Transition License Conditions

2. Prior to the Electrical Raceway Fire Barrier System (Units 1 and 2) modifications being implemented, any time a Risk-Informed Completion Time is in effect, welding and cutting activities will be prohibited in the following fire areas :

- Unit 1, Fire Areas 3-BB. Elevation 115
- Unit 2, Fire Area 5-B-4

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# Draft License Condition

## (x)(a) Transition License Conditions

3. Prior to the Hot Shutdown Panel modifications being implemented, any time a Risk-Informed Completion Time is in effect, a continuous fire watch will be established in the Cable Spreading rooms.

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# Draft License Condition

## (x)(a) Transition License Conditions

4. Prior to the Incipient Detection Panel modifications being implemented, any time a Risk-Informed Completion Time is in effect, a continuous fire watch will be established in the Cable Spreading and Solid State Protection rooms and cabinets with incipient detection credited in the PRA model used to calculate the RICT will be routinely monitored with portable incipient detectors.

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## I&C Questions - “Loss of Specified Safety Function”

- Based on 7/16/15 call on draft follow-up I&C questions dated 7/9/15 and the 7/23 TSTF meeting, the statements were made by NRC:
    - Determination of “loss of specified safety function” in the TSTF-505 TS Section 5.5 is not obvious when protection and control systems share components
    - Determination of “loss of specified safety function” needs to include consideration of a random failure in the control portion of the system (while in the TS Action)
    - RICT is not allowed in condition where there is a “total loss of safety function”
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## I&C Questions - “Loss of Specified Safety Function”

- ❑ The basis for the position was stated to be the requirements of the following instrumentation design requirements
  - Institute of Electrical and Electronics Engineers (IEEE) 279-1971 Clause 4.7, “Control and Protections System Interaction,” Clause 4.7.3, “Single Random Failure”,
  - IEEE 603-1991, Various Clauses
  - GDC 21, 22, and 24.

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## I&C Questions - “Loss of Specified Safety Function”

- PG&E believes the instrument design requirements are met by
  - Design of an instrumentation system with built in redundancy and diversity
  - TS 3.3.1 and 3.3.2 LCO requirements for minimum number of instrument channels required to be operable, for the protection functions that include equipment that is used for both protection and control purposes
  - TS Bases reference IEEE 279-1971



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## I&C Questions - “Loss of Specified Safety Function”

- PG&E believes the instrument design requirements are met by
  - For parameters used for input to the Solid State Protection System and a control function, TS
    - Require four channels with a two-out-of-four logic to provide the required reliability and redundancy, or
    - Require three channels with a two-out-of-three logic and a Digital Feedwater Control System (DFWCS) with a median/signal select (MSS) feature that prevents control/protection interaction even though there are only three inputs, and

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## I&C Questions - “Loss of Specified Safety Function”

- PG&E believes the instrument design requirements are met for Diablo Canyon by
  - For parameters used for input to the Solid State Protection System and a control function, TS
    - For the backup Pressurizer Water Level – High Function requires three channels with a two-out-of-three logic
      - Pressurizer Water Level – High Function is a backup function to other primary functions required by TS 3.3.1
    - Each instrument circuit can withstand both an input failure to the control system, which may then require the protection function actuation, and a single failure in the other channels, as stated in TS 3.3.1/3.3.2 Bases

## I&C Questions - “Loss of Specified Safety Function”

- The following FSAR events credit a TS 3.3.1 RTS function as a primary function and Pressurizer Water Level – High Function as a backup function
  - Uncontrolled Rod Withdrawal at Power, primary function -Power-Range High-Flux (High Setting)
  - Uncontrolled Boron Dilution At Power, primary function - Power-Range High-Flux (High Setting)
  - Loss of External Electrical Load and/or Turbine Trip, primary function - Pressurizer Pressure – High
  - Loss of Normal Feedwater Flow, primary function - SG Low-Low Level RT and AFW Actuation
  - Loss of Non-Emergency AC Power to the Station Auxiliaries, primary function - turbine trip

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## I&C Questions - “Loss of Specified Safety Function”

- The need to assume a random failure in the control portion of the system, while in the TS Action, is not consistent with past NRC statements contained in Generic Letter 80-30 that states
  - “...The specified time to take action, usually called the equipment out-of-service time, is a temporary relaxation of the single failure criterion, which, consistent with overall system reliability considerations, provides a limited time to fix equipment or otherwise make it OPERABLE. If equipment can be returned to OPERABLE status within the specified time, plant shutdown is not required.”

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## I&C Questions - “Loss of Specified Safety Function”

- The need to assume a random failure in the control portion of the system, while in the TS Action, is not consistent with past NRC statements contained in Inspection Manual Chapter 0326 Section C.01 “Relationship between the General Design Criteria (GDC) and the Technical Specifications” that states
  - “The TSs typically allows a facility to continue to operate for a specified time with only one train of a two-train safety system operable. In that case, the GDC are met because the system design provides the necessary redundancy. The TSs permit the operation of the system with only a single train based on an evaluation of the protection provided by the unique system lineup for the specified period.”

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## I&C Questions - “Loss of Specified Safety Function”

- The requirement to assume an additional random failure in the control portion of the system, while in the TS Action, is inconsistent with a Risk-informed approach for determination of TS Required Action Completion Times approved as part of TSTF-505.
  - Additional failure is not assumed for any other TSTF-505 TS Actions for equipment that has control systems (e.g., DGs)
- This introduces an unnecessary complexity and human performance burden in RICT Program implementation to licensed Senior Reactor Operators (since this would not be required for any other TS Actions)

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## I&C Questions - RICT not Allowed for “Total Loss of Safety Function”

- “PRA Functional” for RTS/ESFAS
  - TSTF-505 and NEI 06-09 process allows differentiation between PRA functional and non PRA functional status for inoperable SSCs
  - TSTF-505 TS Section 5.5 RICT Program specifically allows RICT to be used when there is a loss of safety function for emergent conditions “if one or more of the trains are considered PRA functional as defined in Section 2.3.1 of NEI 06-09”
    - Basis – Basic function as modeled in PRA will be performed

## I&C Questions - RICT not Allowed for “Total Loss of Safety Function”

- “PRA Functional” for RTS/ESFAS
  - Applied to each functional unit in TS Tables 3.3.1-1 and 3.3.2-1
- When is TS Action for two or more channels inoperable, the reactor trip or ESFAS actuation signal for each TS function must be able to be generated using remaining OPERABLE and/or PRA Functional channels, including channels in tripped position:
  - For “x of y” logic (eg., 2 of 4), at least “x” channels must be OPERABLE or PRA Functional
  - If one instrument channel input is in tripped position, then “x-1” channels must be OPERABLE or PRA Functional



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## I&C Questions - RICT not Allowed for “Total Loss of Safety Function”

- “PRA Functional” for RTS/ESFAS
  - For individual instrument channels declared inoperable:
    - In most cases the inoperable instrument channel will also not be PRA-functional
      - Examples: Instrument physically breaks, instrument cannot be calibrated, instrument reading outside expected range
    - Examples where channel is PRA-functional are slightly non-conservative setpoint, response time slightly exceeding TS limit, channel in trip (previously provided in PG&E Letter dated 5/28/15)

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## I&C Questions - RICT not Allowed for “Total Loss of Safety Function”

- “PRA Functional” for RTS/ESFAS
    - NEI 06-09 requires a documented basis for PRA functionality decisions
      - If PRA functionality cannot be documented, instrument must be assumed to not be PRA functional
    - Licensed operators can make PRA functionality decisions within one hour to use a RICT
      - Operators already make equipment functionality decisions on daily basis as part of tracking availability to meet the Maintenance Rule and the Mitigating Systems Performance Indicator
      - Operators already need to make decisions related to equipment status within 15 minutes to make Emergency Plan classifications
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## I&C Questions

- PG&E believes the follow-up draft I&C questions received 7/9/15 are not needed for a TSTF-505 application and should not be issued
- PG&E requests NRC TS Branch confirm if the term “loss of specified safety function” in the TS Section 5.5 contained in TSTF-505 needs to include consideration of a random failure in the control portion of the system (while in the TS Action)
- PG&E desires TSTF-505 LAR be approved in November 2015 as currently scheduled

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## I&C Questions

- If failure an additional instrument failure needs to be assumed, PG&E plans to address staff position through an additional TS Section 5.5.20.f change
- New TS 5.5.20 *f. concepts*:
  - Applies to RTS/ESFAS functions for which instrumentation is also used for control functions
  - Proposed to require one additional OPERABLE or PRA Functional instrument channel in TS 5.5.20
  - Ensures single instrument channel failure while RICT is in effect does not result in loss of TS function
  - Maintains TS function to mitigate control system transient initiated by additional instrument channel failure
  - Alternative provided to place control system in manual control

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# I&C Questions

- *Draft TS change to address control and protection issue*

*5.5.20 f. For the following Technical Specification Conditions and associated RTS and ESFAS functions for which the instrumentation provides one or more control functions, either: 1) sufficient channels for actuation of the associated RTS or ESFAS function shall be OPERABLE and/or "PRA functional" assuming one additional single failure of an OPERABLE or "PRA Functional" channel occurs, or 2) the plant equipment which is controlled by the associated instrumentation is placed in manual control:*

- ❑ *TS 3.3.1 Condition F for Table 3.3.1-1 Function 2a;*
- ❑ *TS 3.3.1 Condition H for Table 3.3.1-1 Functions 2b, 3, 6, 7, 8b, and 14a;*
- ❑ *TS 3.3.1 Condition Q for Table 3.3.1-1 Functions 8a and 9;*
- ❑ *TS 3.3.2 Condition G for Table 3.3.2-1 Functions 1d, 1e(1), 4d(1), and 6d(1);*  
*and*
- ❑ *TS 3.3.2 Condition R for Table 3.3.2-1 Function 5b.*

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# Staff Feedback

- Staff Feedback