# SHUTDOWN SAFETY MANAGEMENT PROGRAM

## 1. PURPOSE

1.1. This procedure defines the key safety functions and the safety level colors for Dresden Station.

1.2. This procedure provides guidance for the manual determination of Shutdown Safety Colors.

1.3. This procedure applies to the planning, scheduling, and execution of work on a unit already in or expected to be in a shutdown mode of operation. It does not apply to Unit 1, which is permanently shutdown.

1.4. This procedure is the site specific procedure that implements corporate shutdown safety management program procedure OU-AA-103. Implementation of both procedures is required to ensure full compliance with the shutdown safety program.

## 2. TERMS AND DEFINITIONS

2.1. **Key Safety Functions**:

1. AC Power – Section 4.4
2. Decay Heat Removal – Section 4.5
3. Fuel Pool Cooling – Section 4.6
4. Inventory Control – Section 4.7
5. Vital Support Systems – Section 4.8
6. Reactivity Control – Section 4.9
7. Containment – Section 4.10

2.2. **Safety Level Colors**:

2.2.1. Dresden uses the N system as described below:

1. N = Given Plant conditions, the minimum number of pathways required to safely protect a key Safety Function.

2. Safety Level Colors are assigned as follows:

| TOTAL NUMBER OF PATHWAYS AVAILABLE | NO HIGH RISK ACTIVITIES ARE INPROGRESS WHICH AFFECT THE KEY SAFETY FUNCTION BEING EVALUATED | HIGH RISK ACTIVITIY IN PROGRESS WHICH AFFECTS THE KEY SAFETY FUNCTION BEING EVALUATED |
|---|---|---|
| N+2 | Green | Green |
| N+1 | Green | Yellow |
| N | Yellow | Orange |
| <N | Red | Red |

2.3. **Available**: For the purposes of this procedure, a system, structure or component (SSC) along with its necessary auxiliary systems, controls, instrumentation and power supplies is capable of performing its intended function and can be placed in service by immediate manual (simple operator actions) or automatic means. **(CM-3)**

2.4. **Containment closure**: The action to secure secondary containment and its associated structure, systems, and components as a functional barrier to fission products release under existing plant conditions (i.e., Time to Boil).

2.5. **Contingency Plan:** A plan of actions to:

1. Provide response actions for postulated events that would present a challenge to Key Safety Functions.

2. Maintain Defense-in-Depth by alternate means when pre-outage planning reveals that specified systems, structures, or components will be unavailable.

3. Restore Defense-in-Depth when system availability drops below the planned Defense-in-Depth during the outage.

4. Minimize the likelihood of a loss of Key Safety Functions during higher-risk evolutions.

2.6. **Decay Heat Removal (DHR) Capability:** The ability to maintain reactor coolant system and spent fuel pool temperature and/or pressure below specified limits following a shutdown.

1. Mode 4 and 5 – ability to maintain < 212º F

2. Mode 3 – ability to reach < 212º F within reasonable time unless plans are to remain in mode 3

2.7. **Defense-in-depth**: For the purpose of managing risk during shutdown, Defense-in-Depth is the concept of providing systems, structures, and components to ensure backup of Key Safety Functions using redundant, alternate, or diverse methods.

2.8. **Elevated Risk**: Any ORANGE or RED shutdown safety status.

2.9. **First Time Evolutions**: Those activities (affecting Shutdown Safety) that have never been conducted on the equipment.

2.10. **Forced Outages**: For the purpose of managing risk during shutdown any outage that requires unit shutdown and entry into modes of operation for which the SSMP is applicable, and were not identified and planned at least one month in advance of the outage.

2.11. **High Risk Activity:** Activities, plant configurations, or conditions during shutdown where the plant is more susceptible to an event causing the loss or challenge to a Key Safety Function.

2.12. **Inventory Control:** Measures established to ensure that irradiated fuel assemblies remain adequately covered to maintain heat transfer and shielding capabilities.

2.13. **Limiting Condition for Operation (LCO) 3.0.4.b**: LCO 3.0.4.b allows entry into a MODE or other specified condition in the Applicability with inoperable equipment required by TS, provided that a risk assessment demonstrates the acceptability. OU-AA-103 attachment 1 must be completed if LCO 3.0.4.b is implemented. Additional guidance and restrictions are provided in OU-AA-103.

2.14. **Lowered Inventory:** Level at or below the flange, fuel in the vessel and RPV head de-tensioned.

2.15. **Procedural and Paragon model changes:** content (philosophical) changes to the site-specific procedure and PARAGON outage models must be approved by SSRB.

2.16. **Protected Equipment:** Equipment (or systems) whose availability has been physically identified as essential to ensure either defense-in-depth of a Key Safety Function is maintained or overall risk levels are maintained. **(CM-3)**

2.17. **Reactivity Control:** Measures established to preclude inadvertent criticality, power excursions or losses of shutdown margin, and to predict and monitor core behavior.

2.18. **Time to Boil**: Given the plant configuration, decay heat load, and location of the fuel from the previous operating cycle, the time it would take to reach bulk coolant saturation temperature with **no** Decay Heat Removal systems in operation. Consider the reactor and spent fuel pool separately or as one body depending on plant conditions.

2.18.1. **Short Time to Boil periods**: The periods from when the Reactor is shut down until the fuel pool gates are removed, and from fuel pool gates installation until Rx startup are considered to be Short Time to Boil periods.

2.18.2. **Long Time to Boil period**: Period between fuel pool gates removal and installation.

2.19. **Time to Uncover the Core:** Given the plant configuration, decay heat load, and location of the fuel from the previous operating cycle, the time it would take to reduce the reactor vessel inventory to the top of the active fuel by boiling.

2.20. **Schedule Changes**: A schedule change as it relates to the SSMP is an alteration in the sequencing for removal / restoration of equipment or an alteration in the sequencing of plant configuration changes for those activities that support Key Safety Functions and thus alters their relationship from the previously approved schedule. Shifting of equipment removal / restoration or plant configuration changes forward or backward in time does **not** constitute a schedule change as long as their relationship to the previously approved sequence in the outage network remains intact.

2.21. **Switchyard Work Affecting Shutdown Safety**: Work in the Switchyard(s) that significantly increases the potential for initiating a Loss of Off-Site Power event, or loss of power to a component that may affect shutdown safety. **(CM-3)**

## 3. GENERAL GUIDELINES AND POLICIES

3.1. OU-AA-103, SHUTDOWN SAFETY MANAGEMENT PROGRAM provides additional guidance. Both procedures should be reviewed and implemented when addressing shutdown safety conditions.

3.2. ENSURE to review Dresden's response to SOER 09-1 prior to revising this procedure to verify no commitments will be impacted by the change. If any of the SOER will be affected then follow the process for commitment changes.

3.3. **Equipment Availability**: The following guidelines will be used to determine availability of equipment:

3.3.1. Procedures, standing orders, work instructions or briefed contingency plans (reviewed and approved) exist for using the equipment to meet its intended function. **(CM-3)**.

3.3.2. A system does **not** need to be operable as defined in the Technical Specifications to be considered available.

3.3.3. Credit may be taken for reasonable actions either in the control room or in-plant.

3.3.4. When determining "Reasonable Actions" the time required to place the equipment in service to maintain the Key Safety Function should be considered. An example would be Time to Boil compared to the time required to place a Decay Heat Removal (DHR) system in service.

3.3.5. The time it takes to restore the equipment shall not exceed half the time equipment is required to be placed in operation (time to boil and core uncovery time) unless otherwise specified in the procedure (such as, time to secure secondary containment shall not exceed time to boil).

3.3.6. Motor operated valves (such as LPCI injection, Core Spray injection, SDC) with de-energized power source (480V AC feed breaker or MCC) may be considered available if all of the following conditions are met: **(CM-3)**

1. Meet the availability definition above
2. Can be manually operated
3. Not being worked on

4. They are not the only train supporting the key safety function. Example is when MCCs 28-7/29-7 are de-energized, then one of the core spray or condensate pumps must be available.

5. No high risk evolutions impacting the associated key safety function in progress.

3.3.7. A system may be considered available with a portion of the system out of service as long as the system can still perform its intended function. **(CM-3)**

1. A LPCI pump may be considered available with the minimum flow or test valve out of service as long as the pump functionality and injection path are not impacted.

3.3.8. A system cannot be considered available if its functionality is removed (e.g. clearance applied, drained, breached, etc.). **(CM-3)**

3.3.9. Credit may also be taken for temporary alterations (e.g., power supplies), contingency plans, and line-ups, provided procedural guidance or work instructions are available, reviewed and approved. Credited temporary power or temporary back-up equipment must be installed and tested to consider a component available. **(CM-3)**

3.3.10. Time to secure secondary containment shall not exceed the time to boil for the current plant conditions.

3.3.11. Since time to boil will be zero while in mode 3, the following criteria will be used to define the availability of decay heat removal equipment in the event SDC and/or RWCU trip or have to be temporarily removed from service.

1. Both secondary and primary containment are maintained.

2. If tripped, the cause of the trip is quickly identified and isolated.

3. There is reasonable assurance that the equipment can be restarted and the unit will reach cold shutdown condition within reasonable time.

4. Actions to restore the system are simple and use approved procedures or approved written instructions.

3.3.12. A system/pump may be considered available during divisional Bus Under-voltage and ECCS Integrated Functional (UV) Test even with their breaker racked in test or manual injection valves shut under the following guidelines:

1. The UV can be stopped at any time.
2. Actions can be immediately initiated to rack in breaker and/or open the valves.
3. Approved instructions are available to re-establish the injection path.
4. Operators are briefed prior to the start of the UV test.
5. At least one other injection source capable of injection to vessel (other than systems associated with UV test) must also be available.
6. At least one other Decay Heat Removal system or loop (other than systems associated with UV test) must be available.

3.3.13. A pump control switch may be in pull-to-lock (PTL) and still be considered 'available' as long as there are no Clearance Order cards preventing the use of the pump.

3.4. **Lowered Inventory**:

3.4.1. Efforts shall be made to minimize periods of lowered inventory conditions. **(CM-3)**

3.4.2. Reactor Cavity Draindown SHALL be considered as infrequently performed activity (IPA).

3.4.3. Lowered inventory conditions, other than the normal cavity flood up and draindown, SHALL be clearly identified in the outage schedule. **(CM-3)**

3.5. **Operations SHALL notify the Shutdown Risk Manager:**

3.5.1. Prior to making shutdown safety related equipment unavailable unless previously planned.

3.5.2. Immediately any time shutdown safety related equipment is found or made unavailable due to a failure or emergent work.

3.6. **Shutdown Safety Management Plan (SSMP):**

3.6.1. All Dresden Station Refuel Outages and Planned Outages containing significant work on systems that support Key Safety Functions shall have the Shutdown Risk Plans reviewed and approved by the PORC Committee.

3.6.2. Following approval of the outage specific Shutdown Safety Management Plan (SSMP), additional changes that impact Key Safety Functions will be reviewed and approved by the SSRB. **(CM-3)**

3.6.3. If the SSMP has been reviewed and approved by PORC, the SSRB should consider whether these changes should be presented to PORC. Things to address when considering if a second PORC will be required:

1. Impact on the overall unit color.
2. Impact on the individual KSF color.
3. Changes to contingency plans required for ORANGE or RED conditions.
4. Major changes to the SSMP.

3.6.4. A copy of the SSMP SHALL be maintained in the OCC and Main Control Room. The shutdown risk manager will update these copies as changes are made and as deemed necessary. **(CM-3)**

3.6.5. The plan shall include, at a minimum, the following: **(CM-3)**

1. Overall profile for the shutdown unit. This can be in the form of a color printout of PARAGON risk level analysis (preferred) or similar profile such as shutdown risk schedule.
2. Overall profile for the opposite unit. This can be in the form of a color printout of PARAGON risk level analysis (preferred) or similar profile such as online risk schedule.
3. Shutdown safety review. This includes a summary of the overall unit status and a brief description for each of the KSF.
4. Contingency plans.
5. Other pertinent information such as high risk evolutions.

3.6.6. The Shutdown Safety Manager SHALL provide shutdown risk information to OCC and Operations shift personnel via formal briefings each shift and as risk conditions change. In addition, the Shutdown Safety Manager SHALL provide look-ahead analysis of proposed schedule changes and prepares Shutdown Safety Review Board review packages.

3.6.7. At least once per day (or as emergent conditions dictate), the Shutdown Risk Manager, or designee, shall analyze the updated schedule using either PARAGON or Attachment 1 or 2 (Equipment Availability) and provide a SSMP analysis look-ahead to the site. At a minimum, the SSMP analysis will include the following:

1. A color print out of the PARAGON Risk Level Analysis or a copy of the shutdown risk schedule (hammocks) if PARAGON is not available for at least the next 24 hours.

2. A summary of available KSF systems/equipment/trains

3. A list of Protected Equipment

4. Time to boil and core uncovery time

5. Any additional pertinent information as deemed necessary (high risk evolutions, minimum equipment required to prevent color change, major upcoming evolutions that may impact shutdown safety, moderator and fuel pool temperature).

3.7. Any deviations from defense-in-depth attributes contained in INPO 06-008, Guidelines for the Conduct of Outages at Nuclear Power Plants, must be thoroughly understood and approved by senior managers. **(CM-3)**

3.8. First time evolutions to be evaluated for risk impact and, if appropriate, conducted during Long Time to Boil periods and not in lowered inventory condition. **(CM-3)**

3.9. **Contingency Plans**:

3.9.1. Contingency plans should be prepared prior to the pre-outage shutdown safety risk assessment and other independent assessments. **(CM-3)**

3.9.2. Contingency plans will be generated:

1. As required by OU-AA-103, Shutdown Safety Management Program.

2. For ORANGE and RED conditions **(CM-3).**

3. When shutdown risk is YELLOW and defense-in-depth for the particular key safety function is reduced to one normal method or equipment.

4. Additional contingency plans may be established as deemed necessary by the SSRB for YELLOW or GREEN conditions **(CM-3)**.

3.9.3. Contingency plans shall address actions to restore equipment needed for key safety functions and/or the use of alternate and backup equipment **(CM-3)**.

3.9.4. OP-DR-104-1001, SHUTDOWN RISK MANAGEMENT CONTINGENCY PLANS, outlines contingency plans for the various key safety functions.

3.10. **Defense-in-depth**:

3.10.1. The ultimate goal is to maintain a full compliment of equipment and functions required for all of the key safety functions or, at a minimum, for all key safety functions to remain GREEN. All efforts shall be made to restore unavailable equipment and/or functions in an expeditious manner and, as practical, to maintain all key safety functions GREEN. **(CM-3)**

3.10.2. During outage planning, the minimum requirement to avoid risk color change shall be identified (attachment 5) and included in the SSMP.

3.10.3. During outage executions, compliance with defense-in-depth shall be verified once per shift or before major safety system availability drops below the planned defense-in-depth. This may be performed by running PARAGON or use of the equipment availability checklist. This requirement applies for all refuel outages and, when deemed necessary by the Shutdown Safety Review Board (SSRB), during maintenance and forced outages.

3.11. **High Risk Activities**:

3.11.1. When determining if a “High Risk Activity” exists, consider any work or condition that has a reasonable potential to reduce the number of systems being taken credit for to support a Key Safety Function. An example would be the performance of work that has a reasonable potential to cause the loss of a Decay Heat Removal system that is being taken credit for, and reasonable actions to restore the system cannot be maintained.

3.11.2. High risk activity review SHALL be conducted in accordance with OU-AA-103, Shutdown Safety Management Program.

3.11.3. Concurrent high risk activities affecting the same key safety function should be avoided if possible. **(CM-3)**

3.11.4. If an activity/evolution is deemed high risk to shutdown safety, then it should be input into PARAGON via the scheduling tools and results should be evaluated.

3.11.5. All high risk evolutions shall be identified (attachment 4) during outage planning and included in the SSMP.

3.12. **Heavy Loads**:

3.12.1. If a heavy lift is scheduled and the drop zone could affect equipment that is monitored by decay heat removal key safety function (KSF), then identify a minimum set of safe shutdown equipment that will remain available to provide continued decay heat removal for the shutdown unit.

3.12.2. If a drop could damage a containment boundary and containment is required, then a High Risk Activity shall be considered for the containment KSF.

3.12.3. If a drop could damage an un-isolable reactor vessel or fuel pool boundary, then a Potential to Drain Activity shall be considered for the affected KSF.

3.12.4. Engineering controls such as additional barriers to prevent damage from a drop may be used. These controls may eliminate the need to consider equipment unavailable, schedule a High Risk Activity, or schedule a Potential to Drain Activity.

3.12.5. For heavy lifts performed in support of an outage that could affect equipment on the operating unit, notify the on line risk manager to perform the necessary risk assessment for the impending activities.

3.13. Events may occur that could place the shutdown unit in a condition outside the bounds of shutdown risk management procedures.

Example – defense in depth requirement is met, however, due to unforeseen condition (equipment failure, human performance or others), the associated Key Safety Function requirement is no longer met (A rod out block is enforced, but rods were withdrawn due to a mechanical failure or human performance). In this event, the following actions SHALL be implemented:

1. Shutdown Safety Review Board (SSRB) will immediately convene and evaluate the condition

    A. Following the decision tree in attachment 3, and based on the definition and intent of the Key Safety Function, determine the applicable actions.

    B. Engineering assistance (such as Nuclear Engineer for reactivity KSF) may be required to evaluate the condition and determine appropriate actions.

2. The event SHALL be discussed with senior management and concurrence of senior management must be obtained.

3. Complete attachment 1 of OU-AA-103 to document the condition and actions taken.

3.14. **Protected Equipment**:

3.14.1. Equipment shall be designated as protected pathway and posted as governed by OP-AA-108-117, PROTECTED EQUIPMENT PROGRAM, and the following guidelines:

1. Orange and Red conditions **(CM-3)**
2. At a minimum, one in-service decay heat removal train must always be protected. **(CM-3)**
3. At a minimum, one reactor inventory make-up train and required support systems with fuel in the reactor vessel.
4. At a minimum, one spent fuel pool cooling train once core offload starts until the time to boil in the spent fuel pool is greater than 24 hours
5. A loss of running or in service equipment (SDC pump when on, 4KV bus when required energized) will cause a color change to ORANGE or RED. **(CM-3)**
6. Available off site power source when off site power is down to a single source (line or breaker).
7. As deemed necessary by SSRB. **(CM-3)**

3.14.2. Work on or near (within 2 feet) protected equipment will generally not be allowed unless otherwise allowed by OP-AA-108-117.

3.15. **Switchyard Work Affecting Shutdown Safety**:

3.15.1. All switchyard work will be controlled per OP-AA-108-107-1002, INTERFACE AGREEMENT BETWEEN EXELON ENERGY DELIVERY AND EXELON GENERATION FOR SWITCHYARD OPERATIONS.

3.15.2. Efforts shall be made to schedule switchyard work affecting Shutdown Safety (e.g AC Source) during periods of Long Time to Boil and when not in lowered inventory conditions. **(CM-3)**

3.15.3. Efforts shall be made NOT to schedule high risk switchyard work with other AC power high risk evolutions such as undervoltage testing. An evaluation of concurrent AC and switchyard high risk evolutions shall be completed prior to execution. **(CM-3)**

3.15.4. Switchyard high risk evolutions SHALL be avoided when either DIV 1 or DIV 2 AC power is not available. Station Manager's approval MUST be obtained if this condition cannot be met.

3.16. **On line Unit Interface**

3.16.1. Prior to the start of the outage, an interface agreement between the shutdown unit and the on line unit shall be completed between the Cycle Manager, Station Risk Engineer and Shutdown Safety Manager. The agreement will ensure integration of the on line and shutdown risk assessment models.

3.16.2. Opposite unit impact:

1. The Shutdown Safety Manager SHALL inform the on line Cycle Manager of all outage activities that may impact on line risk.

2. Prior to the outage, the SSM shall review all on line activities during the outage to ensure the KSF are not impacted by the on line work.

3. All shutdown safety activities impacting the opposite unit risk shall be coded and identified in the outage schedule.

4. **MAIN BODY**

4.1. All Dresden Station Refuel Outages and Planned Outages containing significant work on systems that support Key Safety Functions shall have the Shutdown Risk Plans reviewed and approved by the PORC Committee.

4.2. **Manually Determining Shutdown Safety Colors**

4.2.1. To manually determine the Key Safety Function Shutdown Safety Colors, go to each of the 7 Key Safety Functions and perform the following:

1. Utilize the Schedule and Attachment 1 or 2, as necessary to determine equipment availability.

2. Select the Applicable Mode and Plant Condition that matches the existing plant conditions.

3. Determine how many of the pieces of the listed equipment are available and determine the total point value for that Key Safety Function.

4. Determine if a High Risk Activity, which affects the Key Safety Function, is in progress.

5. Using the Key Safety Functions table select the appropriate column and point value.

6. Go to the last column on the right side where the risk level color is listed.

4.3. Unit Risk Level Determination

4.3.1. If AC power key safety function is Yellow, then the overall Unit Shutdown Risk level is Yellow.

4.3.2. For all safety functions other than AC, if there are less than 2 Yellow Safety Functions and No Orange OR Red: The Unit Shutdown Risk Level is Green

4.3.3. If there are 2 OR more Yellow Safety Functions and NO Orange OR Red: The Unit Shutdown Risk Level is Yellow

4.3.4. If there is an Orange Safety Function and NO Red Safety Function: The Unit Shutdown Risk Level is Orange

4.3.5. If there is a Red Safety Function: The Unit Shutdown Risk Level is Red.

4.3.6. Unplanned color changes:

1. Notify outage manager or his designee.
2. Notify the Plant Manager for entry into an ORANGE or RED condition.
3. Initiate an IR.
4. Review OP-AA-106-101-1001, Event Response Guidelines, to determine if a PROMPT INVESTIGATION is required.

## 4.4. AC Power Key Safety Function

### 4.4.1. Guidelines

1. There will always be at least two independent power supplies to at least one 4kv Vital Bus.

2. In Modes 4 and 5 the Reserve Aux. Transformer, or Unit Aux. Transformer (back feed mode), or Vital Bus Crosstie Breakers from the other unit will be available.

3. Diesel Generators: (Unit SBO DG, 2/3 EDG, Unit EDG)

    A. There will be at least one EDG or SBO Diesel Generator available at all times.

    B. With only one DG available, AC function shall be no better than YELLOW

    C. With no DG available the AC Key Safety Function shall be no better than ORANGE.

    D. During Short Time to Boil or Lowered inventory periods with no DG available the AC Key Safety Function shall be no better than RED.

    E. DGs do not have to be capable of Auto closing on the bus to be considered available. Credit is taken for manual breaker alignment. Manual breaker alignment is allowed for the DGs just as it is allowed for Bus and Unit cross-tie capability. DGs are typically considered available during performance of Diesel surveillances, including UV test.

4. Every attempt should be made to schedule work on Vital Buses and their associated Emergency Diesel Generators concurrently. Bus relay work and testing should be scheduled in the work window for the component affected.

5. Work on major electrical equipment should be avoided during lowered inventory periods or when time to boil is short.

6. Off-site power:

   A. Ring bus work should be coordinated with availability of off-site power feeds to ensure adequate availability at all times

   B. Station Transformers can only be considered available when there is an off-site supply of power to that transformer. It is important to be aware of off-site power supplies when determining transformer availability.

   C. Work to be performed in the switchyard should be coordinated with the rest of the outage schedule so that High Risk Activities are not performed during periods of high risk in the plant or when redundant power trains are out of service. Ensure adequate emergency power during periods of high risk in the switchyard. **(CM-3)**

   D. Because the off-site transmission lines feeding power to the station are maintained and under the control of the load dispatcher, and not the station Shift Manager, it is imperative that there is sufficient coordination between onsite and off-site personnel to prevent reductions in available off-site power sources below determined safe shutdown levels. **(CM-3)**

   E. When coordinating work on transmission lines and work on station equipment, it is important to ensure that station configurations are maintained in a status to permit off-site power feed to the station. **(CM-3)**

   F. Because the weather has the potential to adversely affect high voltage transmission lines, it is important to regularly monitor weather forecasts to ensure adequate sources of off-site power are maintained in periods of inclement weather.

   G. All efforts shall be made to maintain two CB's available at all times to provide power to the available transformer (see list below) with at least one in-service line providing power through each CB. In the event that only one of the listed CBs is available for an outage unit's energized transformer, **THEN** this condition shall be considered as a high risk and the available off site power source shall be protected. **(CM-3)**
      - TR 21 – CB 1-2, 1-7 (unit on backfeed)
      - TR 22 – CB 2-3, 3-4
      - TR 31 – CB 9-10, 10-11 (unit on backfeed)
      - TR 32 – CB 4-8, 8-9, 8-15

H. When required to establish protective pathways on Off-Site line(s), Bulk Power must be notified so the TSO will not inadvertently remove the line from service from the other end. Bulk Power shall be notified following removal of protected pathways.

4.4.2. Assessment of AC Power Shutdown Safety Color

1. Primary Power Supplies

A. TR 21 in Back Feed mode or TR 22 in normal mode of operations fed from the 345KV yard.

1. 345kv Line 0302 – will be counted any time it is available
2. 345kv Line 1220 – will be counted any time it is available
3. 345kv Line 1221 - will be counted any time it is available
4. 345kv Line 1222 - will be counted any time it is available
5. 345kv Line 1223 - will be counted any time it is available
6. 345kv Line 8014 - will be counted any time it is available
7. 345kv Line 2311 - will be counted any time it is available

B. TR 22 in normal mode of operations fed from the 138kv Yard.

1. 138kv Line 1210 - will be counted any time it is available
2. 138kv Line 1207 - will be counted any time it is available
3. 138kv Line 1206 - will be counted any time it is available
4. 138kv Line 1205 - will be counted any time it is available
5. 138kv Line 0904 - will be counted any time it is available
6. 138kv Line 0903 - will be counted any time it is available

C. TR 31 in Back Feed mode or TR 32 in normal mode of operations fed from the 345kv Yard.

1. 345kv Line 0302 - will be counted any time it is available
2. 345kv Line 1220 - will be counted any time it is available
3. 345kv Line 1221 - will be counted any time it is available
4. 345kv Line 1222 - will be counted any time it is available
5. 345kv Line 1223 - will be counted any time it is available
6. 345kv Line 8014 - will be counted any time it is available
7. 345kv Line 2311 - will be counted any time it is available.

2. Alternate Power Supplies

A. Emergency Diesel Generator 2/3 will be counted any time it is available.

B. Emergency Diesel Generator 2 will be counted any time it is available.

C. Emergency Diesel Generator 3 will be counted any time it is available.

D. Station Blackout Diesel Generator 2 will be counted any time it is available.

E. Station Blackout Diesel Generator 3 will be counted any time it is available.

F. Bus 23-1 to 33-1 Cross-tie will be counted any time Vital Buses 23-1 and 33-1 and both Division I Cross-tie breakers are available.

G. Bus 24-1 to 34-1 Cross-tie will be counted any time Vital Buses 24-1 and 34-1 and both Division II Cross-tie breakers are available.

3. Applicable Modes: 3, 4, 5, & De-fueled

   A. Determine the total number of AC Power Supplies by adding the following equipment that is available:

      1. Unit Aux. Transformer (Back feed mode) - 2 points
         - If ONLY one CB is available **THEN** this condition shall be considered as high risk.

      2. Reserve Aux. Transformer - 2 points
         - If ONLY one CB is available **THEN** this condition shall be considered high risk.

      3. Unit Emergency Diesel Generator - 1 point

      4. Shared Emergency Diesel Generator – 1 point

      5. Unit Station Blackout Diesel Generator - 1 point

      6. Division I 4KV Unit Cross Tie Breakers - 1 point

      7. Division II 4KV Unit Cross Tie Breakers - 1 point

   B. Determine availability of diverse power sources. If diversity is not available, then determine if time to boil is short or long.

   C. Determine if any High Risk Activities affecting the AC Power Key Safety Function are in progress.

D. Use the table below to determine the Shutdown Safety Color

| **AC Power Key Safety Function**<br>**Applicable Modes: 3, 4, 5, & De-fueled** | | | | | |
|---|---|---|---|---|---|
| **Power Sources**<br>**Diversity Available** | | **Power Sources**<br>**Diversity NOT Available** | | | |
| | | **Long Time to Boil AND not in Lowered Inventory Condition** | | **Short Time to Boil OR Lowered Inventory** | |
| **NO HIGH RISK ACTIVITIES IN PROGRESS** | **HIGH RISK ACTIVITIES IN PROGRESS** | **NO HIGH RISK ACTIVITIES IN PROGRESS** | **HIGH RISK ACTIVITIES IN PROGRESS** | NA | **ASSIGNED SAFETY LEVEL COLOR** |
| 4 points | 5 points | NA | NA | NA | GREEN(*) |
| 3 points | 4 points | NA | NA | NA | YELLOW(*) |
| 2 points | 3 points | ≥2 points | ≥3 points | NA | ORANGE(*) |
| ≤ 1 point | ≤ 2 points | ≤ 1 point | ≤ 2 points | YES | RED(*) |

(*) **NOTES:**

1. Both 4KV AC divisions are required for GREEN condition.
2. A minimum of 2 Diesel Generators must be available to be GREEN.
3. AC key safety function can be no better than ORANGE with NO DG.
4. AC key safety function can be no better than ORANGE with NO off site power available.

5. Diversity rules:

   A. Three diverse groups apply:

      1. **"OSP"** - Offsite power through the Auxiliary Transformer TR 21(22)/TR 31(32) or opposite unit Aux. or Reserve Aux. transformer through the 4 KV cross tie.

      2. **"SBO DG"** – Outage unit SBO DG

      3. **"EDG"** - EDG 2/3 or Outage Unit EDG

   B. Two of the above 3 groups are required to consider diversity is available.

   C. For condition of Short Time to Boil **OR** Lowered Inventory, at least two of the three diversity groups must be present or risk will be RED.

   D. For conditions of Long Time to Boil **AND** not Lowered Inventory, at least two of the three diversity groups must be present or risk will be no better than ORANGE.

## 4.5. Reactor Decay Heat Removal Key Safety Function

### 4.5.1. Guidelines

**CAUTION (CM-3)**

Prior to relying on Fuel Pool Cooling or Shutdown Cooling in the FPC Mode as the only systems for Reactor Decay Heat Removal, a Decay Heat Removal Analysis MUST be performed.

1. The periods from when the Reactor is shutdown until the fuel pool gates are removed and from fuel pool gates installation until Rx startup are considered to be Short Time to Boil periods. Any time other than that defined by Short Time to Boil is considered to be Long Time to Boil period.

2. In Modes 4 and 5, Shutdown Cooling Loops that are lined up to Fuel Pool Cooling are still available to the Reactor (SDC Mode).

3. The planned removal of Shutdown Cooling Loops from service should NOT be scheduled during Modes 3, 4, and 5 unless absolutely necessary, to ensure maximum redundancy of the Decay Heat Removal System. **(CM-3)**

4. During short time to boil or lowered inventory conditions, a diesel generator must be available to power the SDC pump to consider a Shutdown Cooling Loop available.

5. Activities that may impact the decay heat removal systems/components should be scheduled during periods of Long Time to Boil, high coolant inventory, component is secured, or defueled conditions. Contingency plans should be in place if activities that potentially impact decay heat removal systems must be scheduled during periods of Short Time to Boil or reduced inventory.

6. At the beginning of each shift, when decay heat removal equipment is required to be in service, a NSO and NLO shall be designated and briefed to restore decay heat equipment. Brief shall include: **(CM-3)**

    A. Applicable procedure(s) and recovery actions.

    B. Current conditions such as time to boil, core uncovery time, available equipment and functions.

    C. Describe and prioritize the available alternate cooling methods to employ for the current conditions including use of contingency systems and components to provide sufficient defense-in-depth.

    D. Personal safety precautions for the possible plant conditions.

    E. Actions to restore secondary containment, if breached.

4.5.2. Assessment of Decay Heat Removal Shutdown Safety Color

1. Primary Sources

    A. ‘A’ Shutdown Cooling in SDC Mode will be counted any time it is available.

    B. ‘A’ Shutdown Cooling in FPC Mode will be counted any time it is available in Modes 4 and 5.

    C. ‘B’ Shutdown Cooling in SDC Mode will be counted any time it is available.

    D. ‘B’ Shutdown Cooling in FPC Mode will be counted any time it is available in Modes 4 and 5.

    E. ‘C’ Shutdown Cooling in SDC Mode will be counted any time it is available.

    F. ‘C’ Shutdown Cooling in FPC Mode will be counted any time it is available in Modes 4 and 5.

2. Alternate Sources

A. 'A' Shutdown Cooling in FPC Mode will only be counted after the cavity is flooded and fuel pool gates are removed or forced circulation is established.

B. 'B' Shutdown Cooling in FPC Mode will only be counted after the cavity is flooded and fuel pool gates are removed or forced circulation is established.

C. 'C' Shutdown Cooling in FPC Mode will only be counted after the cavity is flooded and fuel pool gates are removed or forced circulation is established.

D. Reactor Water Cleanup System will be counted whenever it is available.

E. 'A' Fuel Pool Cooling will only be counted after the cavity is flooded and fuel pool gates are removed or forced circulation is established.

F. 'B' Fuel Pool Cooling will only be counted after the cavity is flooded and fuel pool gates are removed or forced circulation is established.

G. Main steam electromatic relief valves (ERV) as directed in DOP 1000-07, Alternate Shutdown Cooling, will be counted whenever available in **modes 3 & 4 only** with the following restrictions:

1. 2 ERVs available (B, C, D, E)

2. 1 LPCI pump available for vessel make up and torus cooling.

3. 2 CCSW pumps available for torus cooling.

H. LPCI/CCSW as directed per OP-DR-104-1001 and DOP 1900-03 will be counted whenever available in **modes 4 & 5 only** with the following restrictions:

1. One LPCI loop available to support reactor cavity drain down through SDC

**AND**

2. A second LPCI loop available for injection through a LPCI heat exchanger with one LPCI pump and one CCSW pump for cooling.

3. Applicable Modes 3, 4, & 5 with Fuel Pool Gates installed (Short Time to Boil):

   A. Determine the availability of:

      1. Shutdown Cooling trains available to the Reactor - 1 point each

      2. Reactor Water Clean Up System – ½ point (provided RWCU is available in the blowdown mode and its heat removal capability as listed in ECR #379206 is equivalent to ½ the current reactor decay heat load.

      3. Main steam electromatic relief valves (ERV) – 1 point (**Modes 3 & 4 ONLY.** See restrictions in the previous section, Alternate Sources).

      4. LPCI/CCSW – 1 point (**Modes 4 & 5 ONLY.** See restrictions in the previous section, Alternate Sources).

   B. Determine if any High Risk Activities affecting the Decay Heat Removal Key Safety Function are in progress.

   C. Use the table below to determine the Shutdown Safety Color.

| **Reactor Decay Heat Removal Key Safety Function**<br>**Applicable Modes 3,4, & 5 with Fuel Pool Gates Installed** | | |
|---|---|---|
| **SHORT TIME TO BOIL PERIODS** | | |
| **NO HIGH RISK ACTIVITIES IN PROGRESS** | **HIGH RISK ACTIVITIES IN PROGRESS** | **ASSIGNED SAFETY LEVEL COLOR** |
| 2 1/2 points | 3 1/2 points | GREEN |
| 2 points | 3 points | YELLOW |
| 1 point | 2 points | ORANGE |
| 0 points | 1 point | RED |

4. Applicable Mode: 5 with Reactor Cavity Flooded and Fuel Pool Gates removed:

   A. Determine the availability of:

      1. Fuel Pool Cooling Trains (1 pump and 1 heat exchanger) - 1/2 point each

      2. Shutdown Cooling Loops aligned to Fuel Pool Cooling - 1/2 point each

      3. Reactor Water Clean Up System – ½ point (provided RWCU is available in the blowdown mode and its heat removal capability as listed in ECR #379206 is equivalent to ½ the current reactor decay heat load.

      4. Shutdown Cooling Loops available to the Reactor -1 point each

   B. Determine if any High Risk Activities affecting the Decay Heat Removal Key Safety Function are in progress.

   C. Use the Table below to determine the Shutdown Safety Color:

| **Reactor Decay Heat Removal Key Safety Function**<br><br>**Applicable Mode: 5 with Reactor Cavity Flooded and Fuel Pool Gates Removed** | | |
|---|---|---|
| **LONG TIME TO BOIL PERIODS** | | |
| **NO HIGH RISK ACTIVITIES IN PROGRESS** | **HIGH RISK ACTIVITIES IN PROGRESS** | **ASSIGNED SAFETY LEVEL COLOR** |
| 1-1/2 points | 2-1/2 points | GREEN (*) |
| 1 point | 2 points | YELLOW |
| 1/2 point | 1-1/2 points | ORANGE |
| 0 points | ≤1 point | RED |

(*) Risk level can be no better than YELLOW if a single failure results in going from GREEN to RED (e.g. one SDC cooling pump available and no fuel pool cooling or RWCU).

## 4.6. Fuel Pool Cooling Key Safety Function

### 4.6.1. Guidelines

1. During refueling operations, the period from when the first Fuel Bundle is unloaded from the Reactor until the Reactor Core is reloaded is considered to be the High Fuel Pool Decay Heat period. Any time other than that defined by High Fuel Pool Decay Heat is considered to be a Low Fuel Pool Decay Heat period.

2. Prior to the start of fuel offload verify: **(CM-1) (CM-3)**

   A. The ability to align a spare loop of SDC to the Spent Fuel Pool within 8 hours of the loss of the operating Shutdown Cooling loop in FPC Assist mode is maintained.

   **OR**

   B. Engineering evaluation determined that it is acceptable NOT to have a backup SDC loop in the fuel pool assist mode available within eight hours while fuel is offloaded from the RPV for the upcoming outage. This evaluation will be performed prior to the refuel outage and specify the acceptable time limit for alignment of the SDC Loop to Fuel Pool Assist (FPA) Mode, based upon current fuel offload calculations, if required.

3. All planned activities, which impact the functionality of the Fuel Pool Cooling system, will be completed before the start of the outage, with the exception of Electrical Bus Outages. **(CM-3)**

4. The only Fuel Pool Cooling system work permitted during the outage will be that which is to correct emergent problems. This work will be considered high priority.

5. At such time that calculations determine the amount of decay heat in the fuel pool to be low, relaxed Defense in Depth measures may be taken.

6. To consider a Shutdown Cooling Loop available during fuel pool high decay heat periods either the Unit SBO Diesel Generator or the associated Emergency Diesel Generator can supply power to it.

4.6.2. Assessment of Fuel Pool Cooling Shutdown Safety Color

1. Primary Fuel Pool Cooling Supply

   A. 'A' Fuel Pool Cooling will be counted any time it is available.

   B. 'B' Fuel Pool Cooling will be counted any time it is available.

   C. 'A' Shutdown Cooling in FPC Mode will be counted any time the loop is available and the SDC to FPC spectacle flange is rotated to open.

   D. 'B' Shutdown Cooling in FPC Mode will be counted any time the loop is available and the SDC to FPC spectacle flange is rotated to open.

   E. 'C' Shutdown Cooling in FPC Mode will be counted any time the loop is available and the SDC to FPC spectacle flange is rotated to open.

2. Alternate Sources

   A. 'A' Shutdown Cooling will be counted any time the loop is available, the SDC to FPC spectacle flange is rotated to blind or the 1901-20 and 1901-64 valves are closed, the cavity is flooded and fuel pool gates are removed or forced circulation is established.

   B. 'B' Shutdown Cooling will be counted any time the loop is available, the SDC to FPC spectacle flange is rotated to blind or the 1901-20 and 1901-64 valves are closed, the cavity is flooded and fuel pool gates are removed or forced circulation is established.

   C. 'C' Shutdown Cooling will be counted any time the loop is available, the SDC to FPC spectacle flange is rotated to blind or the 1901-20 and 1901-64 valves are closed, the cavity is flooded and fuel pool gates are removed or forced circulation is established.

   D. Reactor Water Cleanup System will be counted any time it is available, the cavity is flooded and fuel pool gates are removed or forced circulation is established.

3. Applicable Modes: 3, 4, and 5 with the Reactor Cavity NOT Flooded

   A. Determine the number of Fuel Pool Cooling systems which are available:

      1. Fuel Pool Cooling Trains - 1 point each

      2. Shutdown Cooling aligned to Fuel Pool Cooling - 1 point each

   B. Determine if any High Risk Activities affecting the Fuel Pool Cooling Key Safety Function are in progress.

   C. Use the table below to determine the Shutdown Safety Color:

| **Fuel Pool Cooling Key Safety Function**<br>**Applicable Modes: 3, 4, and 5 with the Reactor Cavity NOT Flooded** | | |
|---|---|---|
| **NO HIGH RISK ACTIVITIES IN PROGRESS** | **HIGH RISK ACTIVITIES IN PROGRESS** | **ASSIGNED SAFETY LEVEL COLOR** |
| 2 points | 3 points | GREEN |
| 1 point | 2 points | YELLOW |
| 0 points | 1 point | ORANGE |
| N/A | 0 points | RED |

4. Applicable Modes: 5 and De-fueled with the Reactor Cavity Flooded.

    A. Determine the number of Fuel Pool Cooling systems which are available.

        1. Shutdown Cooling in the Fuel Pool Cooling Mode – 1 point each

        2. Fuel Pool Cooling Trains - ½ point each

        3. Shutdown Cooling Trains Available with Fuel Pool Gates removed or forced circulation establish - ½ point each

        4. Reactor Water Clean Up System – ½ point (provided RWCU is available in the blowdown mode and its heat removal capability as listed in ECR #379206 is equivalent to ½ the current reactor decay heat load.

    B. Determine if the Fuel Pool Decay Heat is High or Low

    C. Determine if any High Risk Activities affecting the Fuel Pool Cooling Key Safety Function are in progress.

D. Use the table below to determine the Shutdown Safety Color:

| **Fuel Pool Cooling Key Safety Function**<br>**Applicable Modes: 5 and De-fueled with the Reactor Cavity Flooded** | | | | |
|---|---|---|---|---|
| **LOW DECAY HEAT PERIODS** | | **HIGH DECAY HEAT PERIODS** | | |
| **NO HIGH RISK ACTIVITIES IN PROGRESS** | **HIGH RISK ACTIVITIES IN PROGRESS** | **NO HIGH RISK ACTIVITIES IN PROGRESS** | **HIGH RISK ACTIVITIES IN PROGRESS** | **ASSIGNED SAFETY LEVEL COLOR** |
| 1 point | 1-1/2 points | 2-1/2 points | 3 points | GREEN (*) |
| 1/2 point | 1 point | 2 points | 2-1/2 points | YELLOW |
| 0 | ≤1/2 point | 1-1/2 points | 2 points | ORANGE |
| N/A | N/A | 1 point | 1-1/2 points | RED |

(*) Risk level can be no better than YELLOW if a single failure results in going from GREEN to RED (e.g. high decay heat condition, 2 FPC pumps available with one SDC loop available to both fuel pool and cavity decay heat removal).

4.7. Inventory Control Key Safety Function

4.7.1. Guidelines

1. Work and testing on systems connected to the Reactor Coolant System will be performed such that no water movement will occur except as intended.

    A. As much work and testing, as practicable, will be performed isolated from the Reactor Coolant System.

    B. Systems will be verified filled and vented prior to stroking the boundary valves.

2. Lowered inventory conditions:

    A. Efforts shall be made to minimize periods of lowered inventory conditions. **(CM-3)**

    B. High-risk activities and major work on electrical distribution systems should be deferred to periods other than during a lowered inventory condition, if possible. An evaluation of the risk and impact shall be performed if this condition cannot be met.

3. To consider Core Spray or LPCI pumps available:

    A. The watertight doors must be available to be closed (when there is a large volume of water in the torus that will result in an overflow from the torus basement into the corner rooms due to a torus leak) AND

    B. Torus level above 10’4” or CST contains 140,000 gal. (230,000, if the other unit is running) AND

    C. The discharge lines are maintained full AND

    D. During short time to boil or lowered inventory conditions, a diesel generator must be available to power the LPCI and Core Spray pumps to consider them available.

4. CRD, Condensate Transfer, Clean Demin, and the Fire System are considered emergency sources of makeup and are not considered available systems during normal shutdown. These systems may be used as part of contingency plans.

5. If LPCI Injection valves are unavailable in one loop, LPCI Loop Select logic will be forced to select the available loop as the injection path for LPCI to be considered available.

6. Make up pump control switches may be in pull-to-lock (PTL) and still be considered 'available' as long as there are no Clearance Order cards preventing the use of the pump.

7. ECCS system may be considered available as an injection system even with its full flow test valve and/or minimum flow valve OOS, provided the ECCS system is otherwise available.

    A. Due to the limited flow through the minimum flow valve, it may be OOS open or closed to consider the pump available.

    B. Due to the high flow through the test valve, it can only be taken OOS in the closed position to be able to consider the pump available.

4.7.2. Assessment of Inventory Control Shutdown Safety Color

1. Primary Sources

    A. ‘A’ Core Spray will be counted any time it is available.

    B. ‘B’ Core Spray will be counted any time it is available.

    C. ‘A’ LPCI will be counted any time it is available.

    D. ‘B’ LPCI will be counted any time it is available.

    E. ‘C’ LPCI will be counted any time it is available.

    F. ‘D’ LPCI will be counted any time it is available.

    G. The Condensate System will be counted as one source any time one pump is running or the system is vented and pressurized and a flow path to the reactor, including a source of water, are available.

2. Applicable Modes: 3

   A. Determine the availability of the following systems:

      1. Core Spray Systems - 1 Point each

      2. LPCI Sub Systems - 1 Point each
         - A Sub System = at least 1 pump and an injection path.

      3. Condensate System - 1 Point total

   B. Determine if any Potential to Drain activities or High Risk Activities affecting the Inventory Control Key Safety Function are in progress.

   C. Use the table below to determine the Shutdown Safety Color:

| **Inventory Control Key Safety Function**<br><br>**Applicable Modes: 3** | | |
|---|---|---|
| **NO POTENTIAL TO DRAIN OR HIGH RISK ACTIVITIES IN PROGRESS** | **POTENTIAL TO DRAIN OR HIGH RISK ACTIVITIES IN PROGRESS** | **ASSIGNED SAFETY LEVEL COLOR** |
| 4 points | 5 points | GREEN |
| 3 points | 4 points | YELLOW |
| 2 points | 3 points | ORANGE |
| 1 point | 2 points | RED |

3. Applicable Modes: 4 and 5

   A. Determine the availability of the following pumps and flow paths:

      1. Core Spray Pumps and flow paths - 1 point each

      2. LPCI Pumps with flow paths - 1 point each

      3. The Condensate System - 1 point ONLY

   B. Determine if the Fuel Pool Gates are in or out.

   C. Determine if any Potential to Drain activities or High Risk Activities affecting the Inventory Control Key Safety Function are in progress.

   D. Use the table below to determine the Shutdown Safety Color:

| **Inventory Control Key Safety Function**<br>**Applicable Modes: 4 and 5** | | | | |
|---|---|---|---|---|
| **FUEL POOL GATES IN (CM-3)** | | **FUEL POOL GATES OUT** | | |
| **NO POTENTIAL TO DRAIN OR HIGH RISK ACTIVITIES IN PROGRESS** | **POTENTIAL TO DRAIN OR HIGH RISK ACTIVITIES IN PROGRESS** | **NO POTENTIAL TO DRAIN OR HIGH RISK ACTIVITIES IN PROGRESS** | **POTENTIAL TO DRAIN OR HIGH RISK ACTIVITIES IN PROGRESS** | **ASSIGNED SAFETY LEVEL COLOR** |
| 3 points | 4 points | 2 points | 3 points | GREEN |
| 2 points | 3 points | 1 point | 2 points | YELLOW |
| 1 point | 2 points | 0 points | 1 point | ORANGE |
| 0 points | 1 point | N/A | 0 points | RED |

4. Applicable Modes: De-fueled

   A. Determine the availability of the following pumps and flow paths:

      1. Core Spray Pumps and flow paths - 1 point each

      2. LPCI, pumps with a flow path - 1 point each

      3. The Condensate System - 1 point ONLY

   B. Determine if any Potential to Drain activities or High Risk Activities affecting the Inventory Control Key Safety Function are in progress.

   C. Use the table below to determine the Shutdown Safety Color:

| **Inventory Control Key Safety Function<br>Applicable Modes: De-fueled** | | |
|---|---|---|
| **NO POTENTIAL TO DRAIN OR HIGH RISK ACTIVITIES IN PROGRESS** | **POTENTIAL TO DRAIN OR HIGH RISK ACTIVITIES IN PROGRESS** | **ASSIGNED SAFETY LEVEL COLOR** |
| 1 point | ≥2 points | GREEN |
| 0 points | 1 point | YELLOW |
| N/A | 0 points | ORANGE |

## 4.8. Vital Support Key Safety Function

### 4.8.1. Guidelines

1. 2/3 RBCCW pump will be considered available when either 4KV feed from bus 24-1 or 34-1 is available.

2. 2/3 service water pump will be considered available when either 4KV feed from bus 24 or 34 is available.

### 4.8.2. Assessment of Vital Support Shutdown Safety Color

1. Primary Sources

   A. Unit 2(3)A RBCCW Pump will be counted whenever it is available.

   B. Unit 2(3)B RBCCW Pump will be counted whenever it is available.

   C. The 2/3 RBCCW Pump will be counted whenever it is available.

   D. 2A Service Water Pump will be counted whenever it is available.

   E. 2B Service Water Pump will be counted whenever it is available.

   F. 3A Service Water Pump will be counted whenever it is available.

   G. 3B Service Water Pump will be counted whenever it is available.

   H. 2/3 Service Water Pump will be counted whenever it is available.

2. Applicable Modes: 3, 4, 5, & De-fueled

   A. Determine the availability of the following cooling trains:

      1. Unit 2, 2/3, and 3 Service Water Pumps. - 1 Point each

      2. Outage Unit and 2/3 RBCCW Pumps. - 1 Point each

   B. Determine if any High Risk Activities affecting the Vital Support Key Safety Function are in progress.

   C. Use the table below to determine the Shutdown Safety Color:

| **Vital Support Key Safety Function**<br>**Applicable Modes: 3, 4, 5, & De-fueled** | | | | |
|---|---|---|---|---|
| **RBCCW PUMPS** | | **SERVICE WATER PUMPS** | | |
| **NO HIGH RISK ACTIVITIES IN PROGRESS** | **HIGH RISK ACTIVITIES IN PROGRESS** | **NO HIGH RISK ACTIVITIES IN PROGRESS** | **HIGH RISK ACTIVITIES IN PROGRESS** | **ASSIGNED SAFETY LEVEL COLOR** |
| 3 points | N/A | 4 points | 5 points | GREEN |
| 2 points | 3 points | 3 points | 4 points | YELLOW |
| 1 point | 2 points | 2 points | 3 points | ORANGE |
| 0 points | ≤1 point | ≤1 point | ≤2 points | RED |

## 4.9. Reactivity Control Key Safety Function

### 4.9.1. Guidelines

1. The Reactivity Control Key Safety Function identifies specific equipment, which is or is not available, to determine the risk level. Because specific equipment is identified, the point system is NOT used.

2. All reactivity control actions are planned and well controlled with procedures and the Unit Supervisor in complete command and control. Any manipulations, which affect any parameter of reactivity, are monitored to ensure reactivity is added from a single source only.

3. All transfer of special nuclear material and reactivity control shall be in accordance with approved Move Sheets per NF-AA-310.

4. Work or testing, which does not impact the 'all rods in' condition or indication, may be done at any time.

5. Prior to control rod withdrawal from an empty cell, that cell shall be verified empty of its 4 fuel bundles (T.S. 3.10.5). All rods must be inserted to reload fuel (other than spiral reload following a full core offload).

6. Prior to control rod withdrawal from a cell containing fuel assemblies in Mode 5, core verification will be performed per NF-AA-330 AND either analytical Shutdown Margin (SDM) of 0.38 $\Delta K/K$ will be verified OR a Single Rod Sub-Critical Demonstration will be performed, along with the remaining actions required by T.S. 3.10.4.

    A. The Core Verification from the previous cycle remains valid until any fuel assembly has been added to the core OR any fuel assembly has been shuffled in the core.

    B. Analytical SDM is assumed to be met at all times during fuel moves based on the evaluation performed prior to the start of the fuel moves. If a bundle were to be mispositioned or unable to be placed in the desired core location, the shuffle would stop until an evaluation is performed by NF.

7. SRM's will only be counted if two (2) or more are available.

8. Fuel Moves are defined as any movement of irradiated fuel bundles over irradiated fuel in the reactor vessel or fuel pool which have the potential to damage fuel.

9. Core Alterations are defined as per Technical Specification 1.1. The movement of control rods in an empty cell is not considered a core alteration.

10. All Rods In is defined as all rods fully inserted, regardless of whether the cell contains fuel assemblies or is empty.

4.9.2. Assessment of Reactivity Control Shutdown Safety Color

1. Primary Sources

   A. Source Range Monitors

   B. All Rods Inserted

   C. Neutron Monitoring Shorting Links

   D. Shutdown Margin Demonstration

   E. Single Rod Sub-criticality Demonstration

   F. Grapple Refuel Interlocks

   G. One Rod Out Interlock

   H. Rod Block Inserted

2. Applicable Modes: 3 & 4

   A. Determine the availability of the following:

      1. All Rods Inserted (Window Green regardless of the status of One Rod Out Permit or SRMs Available.)

      2. Rod Block Inserted (Window Green regardless of the status of One Rod Out Permit or SRMs Available.)

      3. One Rod Out Permit

      4. SRMs Available

   B. Determine if any High Risk Activities affecting the Reactivity Control Key Safety Function are in progress.

C. Use the table below to determine the Shutdown Safety Color:

| **Reactivity Control Key Safety Function**<br>**Applicable Modes: 3 & 4** | | | | |
|---|---|---|---|---|
| **NO HIGH RISK ACTIVITIES IN PROGRESS** | | **HIGH RISK ACTIVITIES IN PROGRESS** | | **ASSIGNED SAFETY LEVEL COLOR** |
| **All rods inserted OR Rod out Block inserted** | **N/A** | **All rods inserted OR Rod out Block inserted** | **N/A** | **GREEN** |
| **One Rod Out Permit Available** | **≥ 3 SRMS** | **One Rod Out Permit Available** | **≥ 3 SRMS** | **GREEN** |
| **One Rod Out Permit Available** | **2 SRMS** | **N/A** | **N/A** | **YELLOW** |
| **One Rod Out Permit Available** | **<2 SRMS** | **N/A** | **N/A** | **ORANGE** |
| **One Rod Out Permit Unavailable** | **N/A** | **One Rod Out Permit Available** | **≤ 2 SRMS** | **RED** |
| **N/A** | **N/A** | **One Rod Out Permit Unavailable** | **N/A** | **RED** |

3. Applicable Mode: 5 with NO Fuel Moves in the RPV OR Core Alterations

   A. Determine the availability of the following:

      1. All Rods Inserted

      2. Rod Block Inserted

      3. One Rod Out Permit

   B. Use the table below to determine the Shutdown Safety Color:

| **Reactivity Control Key Safety Function**<br>**Applicable Mode: 5 with NO Fuel Moves in the RPV OR Core Alterations** | |
|---|---|
| **CONTROL ROD INTERLOCKS** | **ASSIGNED SAFETY LEVEL COLOR** |
| **All Rods Inserted OR Rod Block Inserted OR One Rod Out Permit Available** | **GREEN** |
| **All Rods NOT Inserted AND Rod Block NOT Inserted AND One Rod Out Permit Unavailable** | **YELLOW** |

4. Applicable Modes 5 with Fuel Moves in the RPV and/or Core Alteration:

   A. Determine the availability of the following equipment/condition:

      1. All Rods Inserted

      2. Rod Block Inserted

      3. One Rod Out Permit

      4. SRMs Available

      5. Refueling Interlocks

      6. Shutdown Margin

      - During and in between fuel moves (fuel shuffle #1 & #2) – Analytical SDM of .38 ΔK/K shown for every core configuration change that places a fuel assembly into a new core location (Refer to step 4.9.1.6.B).
      - After all fuel moves (completion of fuel shuffle #2) OR prior to pulling a control rod in a fueled cell –
        - Core Audit Completed AND Analytical SDM of .38 ΔK/K

          **OR**
        - Single Rod Sub-Critical Demonstrated.

   B. Determine if any High Risk Activities affecting the Reactivity Control Key Safety Function are in progress. **Any High Risk Activities will result in a RED Window.**

C. Use the table below to determine the Shutdown Safety Color:

| **Reactivity Control Key Safety Function**<br><br>**Applicable Mode: 5 with Fuel Moves in the RPV AND/OR Core Alterations** | | |
|---|---|---|
| **Fuel moves and Control Rod Movement OR during CRD Removal with fuel in the cell** | **When Cycling Control Rods OR when Fuel is moved with NO rod movement** | **ASSIGNED SAFETY LEVEL COLOR** |
| **N/A** | **7.5** | **GREEN** |
| **7** | **7** | **YELLOW** |
| **6** | **6** | **ORANGE** |
| **5** | **5** | **RED** |
| **Any High Risk Activity** | | **RED** |

| Value | Safety Function Paths/Systems/Method |
|---|---|
| 1.0 | At least 2 SRM indications, alarms, and rod blocks functional. During Core Alterations, 1 SRM must be functional in the Core Alteration quadrant and another SRM in an adjacent quadrant. |
| 0.5 | An additional ½ point may be credited if a minimum of 3 SRM indications, alarms, and rod blocks are functional supporting Core Alterations. |
| 1.0 | "One Rod Out" interlock functional (may be bypassed per T.S. 3.10.5 for associated rods), or Refueling interlocks functional as required by Technical Specification, or Mode Switch controlled in Shutdown as required by refueling procedures. |
| 5.0 | "Control Rods Fully Inserted" (NOTE: Can take credit for this with a single control rod removed from a fueled cell per Tech Spec, or multiple rods in defueled cells removed per Tech Spec, or with single control rod cycling in progress).<br><br>-OR- |
| 4.0 | All Control Rods NOT fully inserted AND Shutdown Margin IS met. |

NOTES:

1. Reactivity Control level can be no better than Yellow when performing either of the following (maintain high level of sensitivity and awareness during multiple evolutions that directly impact or could impact reactivity in an event of an error):

   - Fuel moves (in RPV or fuel pool) and Control Rod movement.

   - OR -

   - Control Rod Drive removal in a loaded cell as allowed by Tech Specs

2. This Reactivity Control assessment does not apply for:

   - Control Rod Blade Removal in unloaded fuel cells
   - Control Rod Drive Mechanism Removal in unloaded fuel cells
   - Cycling drives in unloaded fuel cells

## 4.10. Containment Key Safety Function

### 4.10.1. Guidelines

1. The Containment Key Safety Function identifies specific equipment, which is or is NOT available to determine the risk level. Because specific equipment is identified, the point system is NOT used.

2. DAP 07-44, Control of Temporary Openings in Secondary Containment During Performance of Work Packages, Surveillances, or Other Procedures, shall control all openings in Secondary Containment.

3. The following guidelines must be followed when breaching secondary containment: **(CM-3)**

   A. Breach of secondary containment should be avoided during short time to boil periods.

   B. The time to secure secondary containment shall not exceed the time to boil.

   C. Approved written instructions ready for re-establishing secondary containment.

   D. Operations and work group are briefed.

4.10.2. Assessment of Containment Shutdown Safety Color

1. Primary Sources

A. Primary Containment will be counted available whenever the physical condition is in compliance with Technical Specifications.

B. Secondary Containment will be counted available when one of the following conditions is met.

1. Whenever the physical condition is in compliance with Technical Specifications **(CM-2)**

2. During events of short duration where Secondary Containment dp is less than .25 inch of vacuum water gauge. This condition will NOT be considered a High Risk Activity.

3. Whenever the physical condition is NOT in compliance with Technical Specifications for less than 4 hours. This condition will be considered a High Risk Activity.

C. SBGT ‘A’ will be counted whenever it is available.

D. SBGT ‘B’ will be counted whenever it is available.

2. Applicable Modes: 3

A. Determine the availability of:

1. Primary Containment

2. Secondary Containment

3. Standby Gas Treatment Trains

B. Determine if any Potential to Drain activities or High Risk Activities affecting the Containment Key Safety Function are in progress.

C. Use the table below to determine the Shutdown Safety Color:

| **Containment Key Safety Function**<br><br>**Applicable Modes: 3** | | | |
|---|---|---|---|
| **NO POTENTIAL TO DRAIN OR HIGH RISK ACTIVITIES IN PROGRESS** | **POTENTIAL TO DRAIN OR HIGH RISK ACTIVITIES IN PROGRESS** | **STANDBY GAS TREATMENT TRAINS AVAILABLE** | **ASSIGNED SAFETY LEVEL COLOR** |
| **Primary Containment AND Secondary Containment Available** | **N/A** | **2** | **GREEN** |
| **Primary Containment AND Secondary Containment Available** | **N/A** | **1** | **YELLOW** |
| **N/A** | **Primary Containment AND**<br><br>**Secondary Containment Available** | **2** | **YELLOW** |
| **N/A** | **Primary Containment AND Secondary Containment Available** | **1** | **ORANGE** |
| **Primary Containment AND Secondary Containment Available** | **Primary Containment AND Secondary Containment Available** | **0** | **RED** |
| **Primary Containment OR Secondary Containment Unavailable** | **Primary Containment OR Secondary Containment Unavailable** | **N/A** | **RED** |

3. Applicable Modes: 4, 5 and De-fueled with NO Potential to Drain Activities in progress.

    A. Determine the availability of:

        1. Secondary Containment

        2. Standby Gas Treatment Trains

    B. Use the table below to determine the Shutdown Safety Color:

| **Containment Key Safety Function**<br><br>**Applicable Modes: 4, 5 and De-fueled with NO Potential to Drain Activities in progress.** | | |
|---|---|---|
| **SECONDARY CONTAINMENT AVAILABLE** | **STANDBY GAS TREATMENT TRAINS AVAILABLE** | **ASSIGNED SAFETY LEVEL COLOR** |
| YES | ≥1 | GREEN |
| YES | 0 | YELLOW |
| NO | N/A | YELLOW |

4. Applicable Modes: 4, 5, with Potential to Drain Activities in progress

   A. Determine the availability of:

      1. Secondary Containment

      2. Standby Gas Treatment Trains

   B. Determine if any High Risk Activities affecting the Containment Key Safety Function are in progress.

   C. Use the table below to determine the Shutdown Safety Color:

| **Containment Key Safety Function**<br><br>**Applicable Modes: 4, 5, and De-fueled with Potential to Drain Activities in progress** | | | |
|---|---|---|---|
| **NO HIGH RISK ACTIVITIES IN PROGRESS** | **HIGH RISK ACTIVITIES IN PROGRESS** | | |
| **SECONDARY CONTAINMENT AVAILABLE** | **SECONDARY CONTAINMENT AVAILABLE** | **STANDBY GAS TREATMENT TRAINS AVAILABLE** | **ASSIGNED SAFETY LEVEL COLOR** |
| YES | N/A | 2 | GREEN |
| YES | N/A | 1 | YELLOW |
| N/A | YES | 2 | YELLOW |
| N/A | YES | 1 | ORANGE |
| YES | YES | 0 | RED |
| NO | NO | N/A | RED |

5. **DISCUSSION:**

5.1.1. Equipment Availability Through Simple Operator Actions **(CM-3)**

1. Examples of what may be considered as simple operator actions:

    A. Manually opening and closing a MOV

    B. Valving in a pump (open suctions and/or discharge valve) as long as the pump was not OOS for maintenance or drained

    C. Installation and removal of electrical jumper to bypass interlocks

    D. Turning a 480V MCC breaker on or off

    E. Energizing temporary power source that has been installed and verified functional

2. Examples of what may **NOT** be considered as simple operator actions:

    A. Fill and vent of a system/equipment after draining for maintenance or testing.

    B. Clear a tag out and return equipment to service.

    C. Hooking up temporary power or TMOD

    D. Equipment trip or system isolation which requires troubleshooting

    E. Going on backfeed or coming off backfeed

5.1.2. Safety Level Colors

1. **GREEN:** Based on the combination of available pathways and activity types, a failure or error could be easily mitigated without presenting a significant challenge in that Key Safety Function. This represents optimal defense-in-depth with all or nearly all mitigation equipment available. Generally this means that there are at least N+2 pathways.

2. **YELLOW:** Based on the combination of available pathways and activity types, a failure or error can still be mitigated but might present a challenge in that Key Safety Function. This represents minimal defense-in-depth with more than the minimum of "N" pathways available. There is generally some redundancy – at least N+1 pathways.

3. **ORANGE**: Based on the combination of available pathways and activity types, a failure or error would potentially lead to the loss of the Key Safety Function. This represents no defense-in-depth, i.e., generally only N (minimum pathways) are available to provide the safety function.

4. **RED**: Based on the combination of available pathways and activity types, the Key Safety Function is potentially not maintained. This represents a condition in which the safety function is not supported relative to its success criteria, i.e., generally fewer than N pathways available.

5.1.3. AC Power

1. Due the importance of the AC power KSF and its impact on other KSF, the risk level in certain situations was reduced to the next level as a conservative approach and to raise level of awareness. Examples:

    A. The point system allows the color to be yellow with NO DG or NO off site power available. The decision was made to default to no better than orange in this condition.

    B. The point system allows the AC KSF to remain GREEN with one of the 4KV divisions not available. The decision was made to be no better than yellow in this condition.

2. The opposite unit SBO DG may be considered as a diverse source in a contingency plan but will not be credited as an AC source. The following restrictions apply:

    A. **Unit 2** - to allow diversity group credit for SBO DG3, both EDG3 and the Div. 1 cross-tie must also be available.

    B. **Unit 3** - to allow diversity group credit for SBO DG2, both EDG2 and the Div. 1 cross-tie must also be available

3. The SBO diesel generators are considered as a diverse power supply as compared to the emergency diesel generators:

    A. The SBO DGs are in different locations.

    B. The SBO DGs are air cooled versus water-cooled and have a different engine configuration.

    C. The SBO DGs controls are different from the EDG (electronic versus electrical).

    D. The SBO DGs governing system is different from the EDG (electronic versus mechanical).

5.1.4. Decay Heat Removal

1. Long time to boil is limited to the period when the reactor cavity is flooded and fuel pool gates are removed. Once the gates are removed, reactor cavity time to boil increases to approximately 10 hours. This time is sufficient to allow actions to restore decay heat removal capability. As such, the time to boil is considered long.

2. RWCU availability:

    A. EC #379206 was performed by Engineering to determine RWCU heat removal capability. The results indicate a wide range of decay heat removal capabilities dependant on the reactor water temperature, RWCU mode of operation (normal or blowdown) and RBCCW temperature.

        1. Normal mode of operation (recirculation back to the reactor) – the heat removal capability is low such that no credit will be taken for system operation in this mode.

        2. Blow down mode – EC #379206 provides tables and graphs for the various conditions to be considered to determine the RWCU heat removal capability. Restrictions were included in the calculations to avoid system high temperature isolation (150º F) and prevent exceeding heat exchanger design temperature. The calculations were based on 70º F RBCCW temperature.

    B. In addition to EC #379206, current reactor (and fuel pool, if the fuel pool gates are removed) decay heat values will also be needed to determine if RWCU can be credited as a viable decay heat removal system. These values are normally provided by Nuclear Engineering prior to each refuel outage as part of ADHR calculations. For all other outages, new calculations will have to be provided by Nuclear Engineering.

    C. The system will be given a maximum of ½ point if its heat removal capability as listed in EC #379206 is ≥ ½ the current reactor (and fuel pool, if the fuel pool gates are removed).

3. Use of ERVs as a decay heat removal system is controlled under DOP 1000-07, Alternate Shutdown Cooling. It is limited to ONLY modes 3 & 4 and requires the availability of at least 1 LPCI pump and 2 CCSW pumps for RPV injection and torus cooling. A minimum of 2 ERVs required ensures redundancy and decay heat removal capability.

4. Use of LPCI as a decay heat removal system was evaluated under EC evaluation # 381208. The EC is based on the use of torus water for make up to the reactor without torus cooling. Additional restriction is added in the procedure to require CCSW for torus cooling to ensure long term availability of LPCI in the drain down mode as a decay heat removal system. One LPCI loop will be used to drain down the reactor through SDC while the other LPCI loop will be used for vessel make up and torus cooling. The system will be placed in operation using applicable operating procedures. Use of LPCI/CCSW is directed under OP-DR-104-1001 and DOP 1900-03 andis restricted to mode 4 & 5 by operations due to the risk in mode 3.

5.1.5. **Attributes of Excellent Defense-in-Depth Programs:** (as listed in INPO 06-008, Guidelines for the Conduct of Outages at Nuclear Power Plants)

1. Station management is involved in developing, monitoring, and validating the outage defense-in-depth plan.

2. The defense-in-depth program is proceduralized and establishes system and support system requirements for each safety function, contingency systems, mitigation strategies, and training for station personnel, especially operations and supplemental personnel.

3. Shutdown safety is integrated into the outage schedule to ensure sufficient defense-in-depth. Independent reviews verify that the defense-in-depth plan is appropriate.

4. Compliance with the defense-in-depth plan is verified at least once per shift and before major safety systems or components are removed from service.

5. The shutdown safety program is designed such that as much defense-in-depth as is achievable is established and maintained.

6. Contingency plans and temporary measures are used to improve defense-in-depth when required safety system availability drops below the planned defense-in-depth level.

7. Emergent work, expanded scope, and major schedule changes are reviewed prior to schedule issuance to ensure defense-in-depth levels are maintained.

8. Clear ownership for shutdown safety is established within the line organization.

9. Defense-in-depth and outage risks are clearly communicated and understood at appropriate levels of the organization.

## 6. COMMITMENTS

6.1. ` CM-1, Letter Dated November 18, 1996 from John B. Hosmer to US NRC. Subject "Response to NRC Final Report on Spent Fuel Storage Pool Safety Issues" (Step 3.7.1.2). Commitment Change Tracking #09-19.

6.2. CM-2, Letter RS-05-114 dated August 22, 2005 (Step 3.11.2.1.B.1)

6.3. CM-3, SOER 09-1, Shutdown Safety

## 7. REFERENCES

7.1. OU-AA-103, Shutdown Safety Management Program

7.2. OU-AA-103-1001, Shutdown Safety Plan Independent Reviews

7.3. OP-DR-104-1001, Shutdown Risk Management Contingency Plans

7.4. OP-AA-106-101-1001, Event Response Guidelines

7.5. OP-AA-108-117, Protected Equipment Program

7.6. NF-AA-330, Special Nuclear Material Physical Inventories

7.7. ER-AA-600-1023, ORAM-SENTINEL and PARAGON Model Capability

7.8. ER-AA-600-1043, Shutdown Risk Management Interface

7.9. OP-AA-108-107-1002, Agreement Between Exelon Energy Delivery and Exelon Generation for Switchyard Operations

7.10. CRM Update Form DR-CRM-009

7.11. FASA 89764-04, Self-Assessment Final Report

7.12. ATI #117038-11, Resolve Deficiencies Identified in Design Basis Maint. FASA

7.13. INPO SER 2-08, Reduced Shutdown Safety Margins

7.14. INPO SOER 09-1, Shutdown Safety

7.15. NUMARC 91-06, Guidelines for the Management of Planned Outages at Nuclear Power Plants

7.16. INPO 06-008, Guidelines for the Management of Planned Outages at Nuclear Power Plants

7.17. Dresden UFSAR Section 9.1.2.3.1 and 9.1.3.1

7.18. DOP 1000-07, Alternate Shutdown Cooling.

7.19 EC evaluation # 381208.

## 8. ATTACHMENTS

8.1. Attachment 1 – Unit 2 Equipment Availability

8.2. Attachment 2 – Unit 3 Equipment Availability

8.3. Attachment 3 – Decision Tree for Conditions Outside the Bounds of Shutdown Risk Management Procedures

8.4. Attachment 4 – High Risk Activities

8.5. Attachment 5 - Minimum Requirement to Prevent Risk Color Change

## ATTACHMENT 1
## Unit 2 Equipment Availability
## Page 1 of 2

| | Available / Yes | Unavailable / No | | Available / Yes | Unavailable / No |
|---|---|---|---|---|---|
| **Electrical Distribution** | | | 125vdc Bus 2A-2 | | |
| Unit 2 Res Aux Xfmr (TR22) | | | 125vdc Bus 2B-1 | | |
| Unit Aux Xfmr Backfeed (TR21) | | | 125vdc Bus 2B-2 | | |
| Unit 3 Res Aux Xfmr (TR32) | | | 125vdc Rx Bldg Dist Pnl | | |
| Unit 3 Aux Xfmr Backfeed (TR31) | | | | | |
| 4kv Bus 23 | | | 125vdc Battery Chgr (1) | | |
| 4kv Bus 24 | | | 24/48vdc Battery | | |
| 4kv Bus 23-1 | | | 24/48vdc Bus 2A | | |
| 4kv Bus 24-1 | | | 24/48vdc Bus 2B | | |
| 4kv Bus 33 | | | 24/48vdc Battery Chgrs (4) | | |
| 4kv Bus 34 | | | **Off Site Power** | | |
| 4kv Bus 33-1 | | | 345kv Line 0302 | | |
| 4kv Bus 34-1 | | | 345kv Line 1220 | | |
| 4kv Bus 23-1 to 33-1 Xtie | | | 345kv Line 1221 | | |
| 4kv Bus 24-1 to 34-1 Xtie | | | 345kv Line 1222 | | |
| 4kv Bus 61 | | | 345kv Line 1223 | | |
| 4kv Bus 40 | | | 345kv Line 8014 | | |
| EDG 2 | | | 345kv Line 2311 | | |
| EDG 2/3 to unit 2 | | | 345kv Ring Bus Bkr 1-2 | | |
| SBO DG Unit 2 | | | 345kv Ring Bus Bkr 1-7 | | |
| EDG 3 | | | | | |
| EDG 2/3 to unit 3 | | | | | |
| SBO DG Unit 3 | | | | | |
| 480v Bus 28 | | | 345kv Ring Bus Bkr 2-3 | | |
| 480v Bus 29 | | | 345kv Ring Bus Bkr 3-4 | | |
| 480v Bus 28 to 29 Xtie | | | 345kv Ring Bus Bkr 4-5 | | |
| 480v MCC 28-1 | | | 345kv Ring Bus Bkr 5-6 | | |
| 480v MCC 28-2 | | | 345kv Ring Bus Bkr 6-7 | | |
| 480v MCC 28-3 | | | 345kv Ring Bus Bkr 4-8 | | |
| 480v MCC 28-7 | | | 345kv Ring Bus Bkr 8-9 | | |
| 480v MCC 29-1 | | | 345kv Ring Bus Bkr 8-15 | | |
| 480v MCC 29-2 | | | 345kv Ring Bus Bkr 11-14 | | |
| 480v MCC 29-3 | | | 345kv Ring Bus Bkr 10-11 | | |
| 480v MCC 29-4 | | | 345kv Ring Bus Bkr 9-10 | | |
| 480v MCC 29-7 | | | 345kv Ring Bus Disc 14-15 | | |
| 480v MCC 29-8 | | | 138kv Line 0904 | | |
| 480v MCC 29-9 | | | 138kv Line 1205 | | |
| Unit 2 Essential Service Bus | | | 138kv Line 1210 | | |
| Unit 2 Instrument Bus | | | 138kv Line 0903 | | |
| 250vdc Battery | | | 138kv Line 1206 | | |
| 250vdc Bus 2 | | | 138kv Line 1207 | | |
| 250vdc Bus 2A | | | | | |
| 250vdc Bus 2B | | | 138kv Bkr 1-2 | | |
| 250vdc Battery Chgr (1) | | | 138kv Bkr 2-3 | | |
| 125vdc Main or Alt Battery | | | 138kv Bkr 3-4 | | |
| 125vdc Bus 2A-1 | | | | | |

# ATTACHMENT 1
## Unit 2 Equipment Availability
## Page 2 of 2

| | Available / Yes | Unavailable / No | | Available / Yes | Unavailable / No |
|---|---|---|---|---|---|
| ***Decay Heat Removal / Fuel Pool Cooling** | | | | | |
| SDC Inlet from Rx A loop | | | 2A FPC Pump and Hx | | |
| SDC Inlet from Rx B loop | | | 2B FPC Pump and Hx | | |
| SDC Return to Rx A loop | | | 2A SDC to FPC | | |
| SDC Return to Rx B loop | | | 2B SDC to FPC | | |
| SDC Pump 2A to Reactor | | | 2C SDC to FPC | | |
| SDC Pump 2B to Reactor | | | 2 ERVs (circle) | B C D E | |
| SDC Pump 2C to Reactor | | | 1 LPCI pump (circle)[1] | A B C D | |
| RWCU | | | CCSW pumps** (circle) [1] | A B C D | |
| Fuel Pool Gates Out | | | LPCI injection loops[1] | A B | |
| **Containment** | | | | | |
| Primary Containment | | | | | |
| Secondary Containment | | | **Reactivity Control** | | |
| SBGT Train A | | | All Rods Fully Inserted | | |
| SBGT Train B | | | SRM 21 | | |
| **Inventory Control** | | | SRM 22 | | |
| LPCI Pump 2A | | | SRM 23 | | |
| LPCI Pump 2B | | | SRM 24 | | |
| LPCI Pump 2C | | | | | |
| LPCI Pump 2D | | | Rod Block Manually Inserted | | |
| Div 1 LPCI Injection | | | One Rod Out Permit | | |
| Div 2 LPCI Injection | | | Refuel Interlocks | | |
| Div 1 LPCI Crosstie | | | | | |
| Div 2 LPCI Crosstie | | | **Vital Support** | | |
| LPCI Loop Select forced to Div 1 | | | 2A RBCCW Pump | | |
| LPCI Loop Select forced to Div 2 | | | 2B RBCCW Pump | | |
| Core Spray 2A | | | 2/3 RBCCWPump | | |
| Core Spray 2B | | | 2A Serv Wtr Pump | | |
| Torus level >10'4" **OR** CST >= 140,000 gals (230,000 gals if U3 is running) | | | 2B Serv Wtr Pump | | |
| Condensate System | | | 2/3 Serv Wtr Pump | | |
| 2A Rx Feed Header | | | 3A Serv Wtr Pump | | |
| 2B Rx Feed Header | | | 3B Serv Wtr Pump | | |
| **Plant Status** | | | | | |
| Mode | | | | | |
| Moderator Temperature | | | | | |
| Fuel Pool Temperature | | | | | |
| Time To Boil | | | | | |
| Time to Core Uncovery | | | | | |
| Protected Pathways | | | | | |

* NLO and NSO briefed at the beginning of the shift for restoration of SDC if it were lost.

** One LPCI pump & two CCSW pumps (same division) required to credit ERV as a decay heat removal system

[1]Both LPCI injection loops, one LPCI and one CCSW pump (same division) required to credit LPCI (in drain down mode) as a decay heat removal system.

Completed By: _____Date:_____Time:_____

## ATTACHMENT 2
## Unit 3 Equipment Availability
## Page 1 of 2

| | Available / Yes | Unavailable / No | | Available / Yes | Unavailable / No |
|---|---|---|---|---|---|
| **Electrical Distribution** | | | 125vdc Bus 3B-1 | | |
| Unit 3 Res Aux Xfmr (TR32) | | | 125vdc Bus 3B-2 | | |
| Unit Aux Xfmr Backfeed (TR31) | | | 125vdc Rx Bldg Dist Pnl | | |
| Unit 2 Res Aux Xfmr (TR22) | | | 125vdc Battery Chgr (1) | | |
| Unit 2 Aux Xfmr Backfeed (TR21) | | | | | |
| 4kv Bus 23 | | | 24/48vdc Battery | | |
| 4kv Bus 24 | | | 24/48vdc Bus 3A | | |
| 4kv Bus 23-1 | | | 24/48vdc Bus 3B | | |
| 4kv Bus 24-1 | | | 24/48vdc Battery Chgrs (4) | | |
| 4kv Bus 33 | | | **Off Site Power** | | |
| 4kv Bus 34 | | | 345kv Line 0302 | | |
| 4kv Bus 33-1 | | | 345kv Line 1220 | | |
| 4kv Bus 34-1 | | | 345kv Line 1221 | | |
| 4kv Bus 23-1 to 33-1 Xtie | | | 345kv Line 1222 | | |
| 4kv Bus 24-1 to 34-1 Xtie | | | 345kv Line 1223 | | |
| 4kv Bus 71 | | | 345kv Line 8014 | | |
| 4kv Bus 40 | | | 345kv Line 2311 | | |
| EDG 3 | | | 345kv Ring Bus Bkr 1-2 | | |
| EDG 2/3 to unit 3 | | | 345kv Ring Bus Bkr 1-7 | | |
| SBO DG Unit 3 | | | 345kv Ring Bus Bkr 2-3 | | |
| EDG 2 | | | | | |
| EDG 2/3 to unit 2 | | | | | |
| SBO DG Unit 2 | | | | | |
| 480v Bus 38 | | | 345kv Ring Bus Bkr 3-4 | | |
| 480v Bus 39 | | | 345kv Ring Bus Bkr 4-5 | | |
| 480v Bus 38 to 39 Xtie | | | 345kv Ring Bus Bkr 5-6 | | |
| 480v MCC 38-1 | | | 345kv Ring Bus Bkr 6-7 | | |
| 480v MCC 38-2 | | | 345kv Ring Bus Bkr 4-8 | | |
| 480v MCC 38-3 | | | 345kv Ring Bus Bkr 8-9 | | |
| 480v MCC 38-4 | | | 345kv Ring Bus Bkr 8-15 | | |
| 480v MCC 38-7 | | | 345kv Ring Bus Bkr 11-14 | | |
| 480v MCC 39-1 | | | 345kv Ring Bus Bkr 10-11 | | |
| 480v MCC 39-2 | | | 345kv Ring Bus Bkr 9-10 | | |
| 480v MCC 39-3 | | | 345kv Ring Bus Disc 14-15 | | |
| 480v MCC 39-7 | | | 138kv Line 0904 | | |
| Unit 3 Essential Service Bus | | | 138kv Line 1205 | | |
| Unit 3 Instrument Bus | | | 138kv Line 1210 | | |
| 250vdc Battery | | | 138kv Line 0903 | | |
| 250vdc Bus 3 | | | 138kv Line 1206 | | |
| 250vdc Bus 3A | | | 138kv Line 1207 | | |
| 250vdc Bus 3B | | | | | |
| 250vdc Battery Chgr (1) | | | 138kv Bkr 1-2 | | |
| 125vdc Main or Alt Battery | | | 138kv Bkr 2-3 | | |
| 125vdc Bus 3A-1 | | | 138kv Bkr 3-4 | | |
| 125vdc Bus 3A-2 | | | | | |

# ATTACHMENT 2
## Unit 3 Equipment Availability
## Page 2 of 2

| | Available / Yes | Unavailable / No | | Available / Yes | Unavailable / No |
|---|---|---|---|---|---|
| ***Decay Heat Removal / Fuel Pool Cooling** | | | | | |
| SDC Inlet from Rx A loop | | | 3A FPC Pump and Hx | | |
| SDC Inlet from Rx B loop | | | 3B FPC Pump and Hx | | |
| SDC Return to Rx A loop | | | 3A SDC to FPC | | |
| SDC Return to Rx B loop | | | 3B SDC to FPC | | |
| SDC Pump 3A to Reactor | | | 3C SDC to FPC | | |
| SDC Pump 3B to Reactor | | | 2 ERVs (circle) | B C D E | |
| SDC Pump 3C to Reactor | | | 1 LPCI pump (circle)[1] | A B C D | |
| RWCU | | | CCSW pumps** (circle) [1] | A B C D | |
| Fuel Pool Gates Out | | | LPCI injection loops[1] | A B | |
| **Containment** | | | | | |
| Primary Containment | | | | | |
| Secondary Containment | | | **Reactivity Control** | | |
| SBGT Train A | | | All Rods Fully Inserted | | |
| SBGT Train B | | | SRM 21 | | |
| **Inventory Control** | | | SRM 22 | | |
| LPCI Pump 3A | | | SRM 23 | | |
| LPCI Pump 3B | | | SRM 24 | | |
| LPCI Pump 3C | | | | | |
| LPCI Pump 3D | | | Rod Block Manually Inserted | | |
| Div 1 LPCI Injection | | | One Rod Out Permit | | |
| Div 2 LPCI Injection | | | Refuel Interlocks | | |
| Div 1 LPCI Crosstie | | | | | |
| Div 2 LPCI Crosstie | | | **Vital Support** | | |
| LPCI Loop Select forced to Div 1 | | | 3A RBCCW Pump | | |
| LPCI Loop Select forced to Div 2 | | | 3B RBCCW Pump | | |
| Core Spray 3A | | | 2/3 RBCCW Pump | | |
| Core Spray 3B | | | 2A Serv Wtr Pump | | |
| Torus level >10'4" **OR** CST >= 140,000 gals (230,000 gals if U2 is running) | | | 2B Serv Wtr Pump | | |
| Condensate System | | | 2/3 Serv Wtr Pump | | |
| 3A Rx Feed Header | | | 3A Serv Wtr Pump | | |
| 3B Rx Feed Header | | | 3B Serv Wtr Pump | | |
| **Plant Status** | | | | | |
| Mode | | | | | |
| Moderator Temperature | | | | | |
| Fuel Pool Temperature | | | | | |
| Time To Boil | | | | | |
| Time to Core Uncovery | | | | | |
| Protected Pathways | | | | | |

* NLO and NSO briefed at the beginning of the shift for restoration of SDC if it were lost.

** One LPCI pump & two CCSW pumps (same division) required to credit ERV as a decay heat removal system

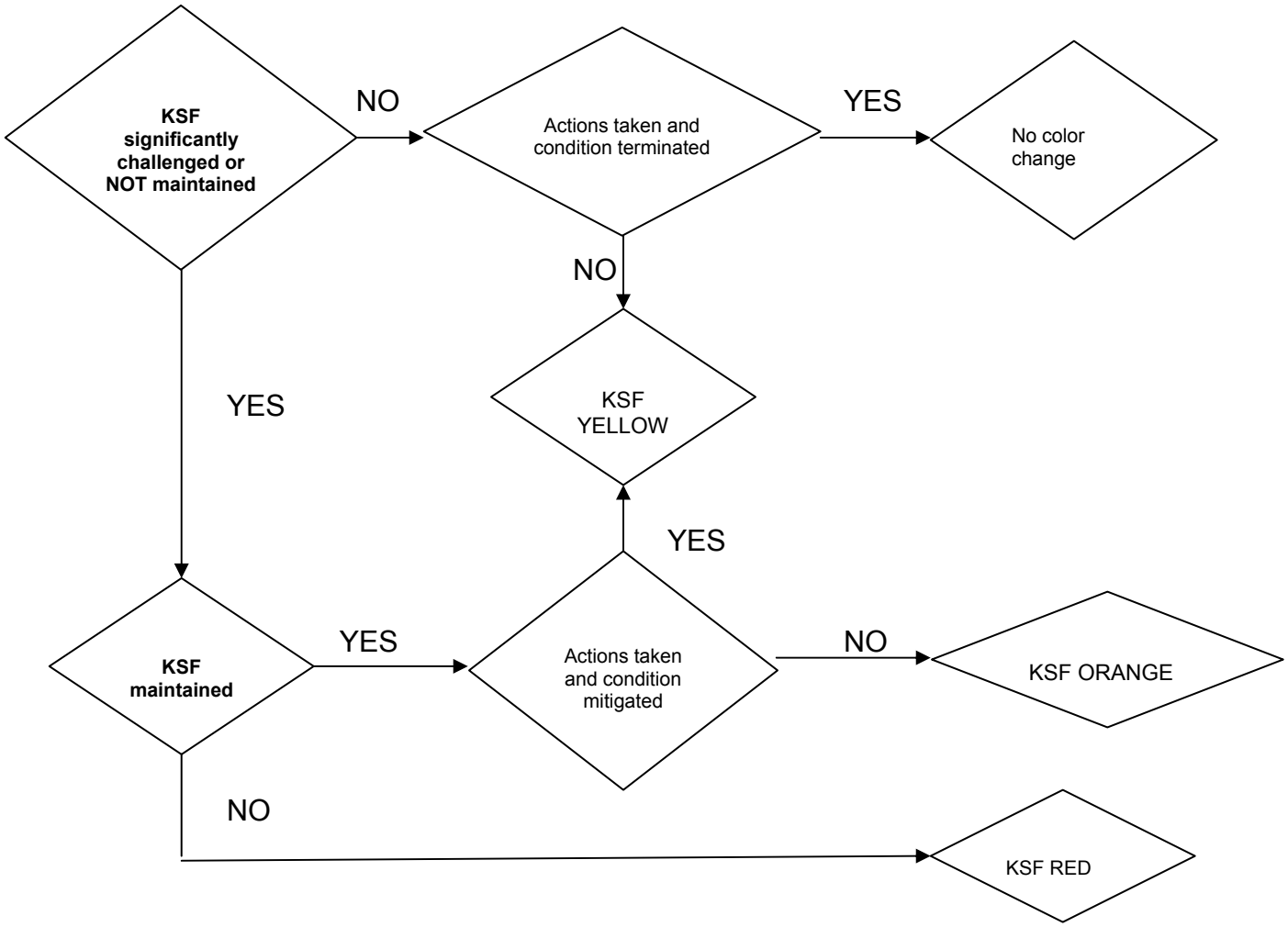
[1]Both LPCI injection loops, one LPCI and one CCSW pump (same division) required to credit LPCI (in drain down mode) as a decay heat removal system.

Completed By: _____ Date: _____Time:_____

## ATTACHMENT 3

Decision tree for conditions **outside the bounds**

of shutdown risk management procedures




## NOTES

- Unlike normal shutdown risk assessment, this attachment addresses conditions after the fact and where the required equipment/condition is available but did not prevent the event.

- If the KSF color is already higher than what is determined in this evaluation, then the KSF SHALL remain at the higher status color.

- If a KSF color change results, then it will be in effect for the duration of the event. Once the event is terminated the KSF will return to the previous designation or as determined by the SSRB.

- Actions taken may be automatic or manual and must be completed within reasonable time.

# ATTACHMENT 4

## High Risk Activities

| Activity Name* | Description | Comments** |
|---|---|---|
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* Activity name as listed in the schedule (ORAM hammock)

** Comments to address condition and applicable compensatory/contingency plans.

## ATTACHMENT 5

## Minimum Requirement to Prevent Risk Color Change

| Key Safety Function | Conditions | Minimum Required | Comments |
|---|---|---|---|
| AC Power | | | |
| | | | |
| | | | |
| Shutdown Cooling | | | |
| | | | |
| | | | |
| Fuel Pool Cooling | | | |
| | | | |
| | | | |
| Inventory Control | | | |
| | | | |
| | | | |
| Vital Support | | | |
| | | | |
| | | | |
| Containment | | | |
| | | | |
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