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CAROLINA POWER & LIGHT COMPANY

H. B. ROBINSON STEAM ELECTRIC PLANT, UNIT NO. 2

PLANT OPERATING MANUAL

VOLUME 3
PART 3

OMM-048

WORK COORDINATION & RISK ASSESSMENT

REVISION 0

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Summary of Changes

Revision	Comments
Rev 0	This new procedure was developed because PLP-056 is being deleted as part of the new work process. The items associated with scheduling work are included in ADM-NGGC-0104. This OMM describes the responsiblities of the Operations Personnel in the work managment process and includes the on-line risk matrix.

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1.0 PURPOSE

The purpose of this procedure is to provide guidelines for operations personnel involved with the work coordination and risk assessment process. Guidance is given to maximize the reliability and availability of systems and components which are identified as risk significant in ADM-NGGC-0101, Maintenance Rule Program, while the plant is operating at power. The matrix in Attachment 10.2 applies to power operations and will be used as a guide when operating between 200°F and 547°F. These guidelines are designed to support maintenance on a system or major plant component and Maintenance Rule system work.

2.0 REFERENCES

2.1 ADM-NGGC-0104, Work Management Process

2.2 ADM-NGGC-0101, Maintenance Rule Program

2.3 CR 96-00219, Expectations for Out of Service Time for Safety Related Equipment

2.4 SOER 96-01, Control Room Supervision, Operational Decision-Making, and Teamwork, (Recommendation 2C: Risk Assessment of On-line Maintenance)

2.5 Oliver, Rudy E. II, "Probabilistic Safety Assessment Guidelines for Performance of On-line Maintenance at H.B. Robinson Steam Electric Plant 2, Revision 1" June 13, 1997. Serial: NF-97A-0176; File: NF-907.09

3.0 RESPONSIBILITIES

3.1 Plant General Manager

3.1.1 Review and approve "high risk" evolutions and outages.

3.1.2 Review and approve schedules that affect equipment on both safety trains.

3.1.3 Review and approve all work that could result in exceeding any Risk Significant system unavailability or reliability goal.

3.1.4 Approve of safety equipment/system if the scheduled duration is > 50% of the allowed out of service time.

3.1.5 Approve on-line maintenance of risk-significant SSC combinations not previously evaluated as acceptable per the on-line risk matrix.

3.2 Superintendent - Work Coordination

3.2.1 Coordinate on-line work schedules to integrate work activities and long range plans.

3.2.2 Ensure that the work management process functions are coordinated and managed by the Work Control Center.

3.2.3 Determine when a Probabilistic Safety Assessment (PSA) review of the schedule is required and initiate the review.

3.2.4 Ensure that the risk matrix requirements concerning on-line maintenance and emergent work are met.

3.2.5 Review upcoming scheduled work for train conflicts, priority scheduled items and clearance/post-maintenance testing coordination.

3.2.6 Direct and coordinate the activities of Work Week Managers in the development of weekly schedules.

3.2.7 Approve work to be done outside normal train week, for example, A train work in a B train week.

3.2.8 Consider and arrange Operations contingency actions with the appropriate Superintendent - Shift Operations. Contingency actions include providing extra personnel or people with special skills or experience. Contingencies may also include arranging simulator time and additional training as appropriate.

3.3 Work Week Manager

3.3.1 Review WR/JOs identified for work in their assigned work week and schedule them in a logic that directly supports Maintenance Rule requirements, referring to the matrix (Attachment 10.2).

3.3.2 Develop and approve weekly schedules with input from the Project Managers, System Engineer, Schedulers, and Maintenance.

3.3.3 Work with Maintenance and Project Managers in determining resource requirements.

3.3.4 Lead schedule review meetings and ensure groups involved in the support of the schedule fully understand and are able to meet their responsibilities.

3.3 Work Week Manager

3.3.5 Review weekly schedules based on risk from an Operation's perspective. Examples of things to consider are:

1. Operation's resources such as the number of operators that will be needed to support the scheduled work.

2. Review the total scope of the work that has been scheduled for the day of the system outage to ensure that Operations can support the additional activities as well.

3. Use the risk matrices in Attachment 10.2 to evaluate the risk significance of the scheduled work.

4. Consider combinations of work in the schedule to ensure risks outside of the risk matrix do not create additional burdens on the unit personnel.

3.3.6 Review possible Operations contingency actions and when needed include these in the schedule or in communications with the affected Superintendent Shift Operations.

3.3.7 Review scheduled work against effects on boration, dilution, pressure control, operator work arounds, and heat removal capabilities.

3.4 Superintendent - Shift Operations

3.4.1 Review possible contingency actions that could be taken should plant problems occur. This may include a consideration of same train equipment failures and opposite train equipment failures as well as plant transients and trips.

3.4.2 Review and be ready to follow and support the networked items for Operations as shown in the schedule. Deviations from the schedule should be made only if they add overall efficiency to the process. This does not preclude delaying the start of a system outage or a return to service if it is determined that there is a problem with proceeding. This would be appropriate if a plant transient or equipment failure were to occur. Notification should be made to the Work Week Manager and affected work groups. Recommendations to delay starting work may also come from the Project Manager, Implementor and so forth, and problems should be fully resolved prior to commencing work.

3.4 Superintendent - Shift Operations

3.4.3 Remain cognizant of the risk significance of the plant configuration during the shift and the changes incurred due to planned or emergent system outages.

3.4.4 Coordinate with Maintenance, Work Week Manager, and WCC to respond if other equipment associated with the Maintenance Rule fails during the scheduled maintenance.

3.5 Work Control Center SRO

3.5.1 Review the approved schedule and determine the activities scheduled to be released for work and ensure that scheduled items are included in the Plan of the Week Schedule.

3.5.2 Perform a final review of the work to ensure that current plant conditions support accomplishment of the work as currently scheduled.

3.5.3 Authorize the Clearance to be hung.

3.5.4 Notify the Control Room Supervisor of work authorized that may affect the control room operations (e.g., activity that can cause an alarm or a change in instrument readings).

3.5.5 Consider whether written contingency plans, including compensatory measures and contingencies, would be appropriate for risk-significant SSCs that are taken out of service, or whether a pre-job briefing would be sufficient.

3.5.6 Approve Fix-It-Now Team work items daily.

4.0 PREREQUISITES

N/A

5.0 PRECAUTIONS AND LIMITATIONS

N/A

6.0 SPECIAL TOOLS AND EQUIPMENT

N/A

7.0 ACCEPTANCE CRITERIA

N/A

8.0 INSTRUCTIONS

8.1 Scheduling On-Line Maintenance using the RNP On-line Risk Matrix

8.1.1 During schedule development and implementation, an assessment of the total plant equipment out of service is performed. The matrix in Attachment 10.2 is used as one input in this assessment.

8.1.2 The matrix does not stand alone when evaluating the risk of on-line maintenance. Other qualitative issues that should be considered when scheduling on-line maintenance include ALARA, Maintenance Rule impact, weather conditions, various plant end states (e.g., unplanned shutdowns or plant trips, entry into the Emergency Plan, emergency notifications, small radioactive releases), containment integrity, industrial safety, and plant safety risks due to fires or seismic events.

8.1.3 Matrix Limitations

1. The matrix applies only to power operation and only for combinations of one or two system trains unavailable at a time. The matrix results are not to be extended for evaluating system or train combinations of greater than two. (Although, they can be used for evaluating priorities for emergent equipment failures) If three or more risk-significant system or train functions need to be unavailable at the same time, then further analysis must be performed to determine the risk insights.

2. The matrix provides best estimate severe accident risks only, and does not necessarily protect defense-in-depth or other safety considerations. The matrix does not necessarily provide the most limiting requirements. These must be determined through a combination of technical specifications, the matrix, and other design basis documentation.

8.1.4 Maintenance Rule Scheduling Guidelines

1. Combinations on Table 2 of the matrix designated with "N" represent the highest plant risk.

2. When referring to the matrix to determine appropriate on-line maintenance, it is important to remember that all risk-significant functions listed in ADM-NGGC-0101, Attachment 1, which are not represented on the matrix, are assumed to be available.

3. Maintenance on Maintenance Rule risk-significant systems not represented on the matrix should not be conducted concurrently with maintenance on other risk-significant systems unless adequate defense-in-depth exist.

4. Maintenance on Maintenance Rule non-risk-significant systems should be evaluated qualitatively to determine the overall plant safety impact. Consider the following in this evaluation:

   a. Pay particular attention to evolutions that may increase the probability of a reactor trip or other transient while risk-significant on-line maintenance is being performed. This includes surveillance tests that do not render equipment inoperable, but could result in a plant trip or other event.

   b. Be aware of the risk significance of the intended equipment unavailability and the impact on the Operators ability to control the plant, mitigate events, or place and maintain the unit in a shutdown condition.

   c. Evaluate worst-case scenarios and discuss in advance (e.g., during pre-job briefings) how Operators would respond given the unavailability of certain equipment.

   d. Determine whether compensatory measures are warranted for the proposed plant configuration to ensure that back-up systems are available and functional.

   e. In the event of an emergent failure, take action to ensure the emergent failure is repaired expeditiously or the planned maintenance is terminated expeditiously.

8.1.5 Scheduling Requirements

1. Prior to scheduling risk-significant SSCs for removal from service, the work activities shall be evaluated to determine whether the resulting plant configuration is acceptable from a risk perspective. The matrix of risk significant combinations in Attachment 10.2 shall be used to assist in this. This matrix identifies unacceptable combinations of equipment whose removal could result in unnecessary and in some cases unacceptable levels of risk. This review will ensure that undue risk is not created as a result of removing multiple systems from service and from removing combinations of equipment that significantly increase risk.

8.1 Scheduling On-Line Maintenance using the RNP On-line Risk Matrix

a. The intersection of the row and column in Table 2 contains an "N" (for Not Recommended) if the combination of equipment function out of service (for up to 72 hours) would be considered risk significant.

8.1.5 Scheduling Requirements

b. If Table 2 contains an "N" for the combination, Table 3 can be used to determine the length of time that the equipment can be out of service before the combination is considered risk significant. An "X" in Table 3, indicates that the combination is not recommended for on-line maintenance.

c. For combinations not allowed by both Tables 2 and 3, or not otherwise previously evaluated as acceptable, Plant General Manager approval should be obtained prior to scheduling work.

d. For voluntary entry into a combination listed above, the PSA group should also be contacted prior to the activity to examine the risk impact. Also, contingency plans should be established.

e. Consider whether written contingency plans, including compensatory measures, would be appropriate for risk-significant systems that are taken out of service on-line or whether a pre-job briefing would be sufficient.

f. Work such as visual inspections that do not require a clearance or do not render equipment unable to perform its function may be scheduled any time.

2. System and train unavailability must be effectively managed to minimize risk during maintenance activities.

3. Inoperability and unavailability shall be minimized. This can be facilitated by proper planning and staffing.

4. LCOs shall not be abused by repeated LCO entry and exit to accomplish tasks that cannot be completed within the time limits of the LCO.

5. Consideration should be given to the potential for overloading a skill or unit to the point where they feel pressured to complete the schedule. It must be recognized that allowing this to happen increases the chance for error.

8.1 Scheduling On-Line Maintenance using the RNP On-line Risk Matrix

6. In taking the items above into account, work on a single system and train of equipment should be grouped as much as possible with other work that affects operability. This approach tends to reduce risk exposure by reducing the total number of LCOs.

8.1.6 Emergent Work

1. In case of emergent equipment unavailability, a review of the equipment functions already unavailable should be performed by the SSO or CRSS. Potential high risk situations need to be identified and non-quantifiable factors and contingency plans evaluated. An example of a non-quantifiable factor would be the need to shutdown the plant if the repair is not expedited. Plant shutdowns introduce additional risk by challenging safety systems which in itself is not quantifiable. The potential risk significant configurations need to be avoided or limited in duration as much as possible.

8.2 System Outage Scheduling Process

8.2.1 Schedule Preparation/Development

During the preparation of on-line schedules there is a constant sensitivity towards minimizing risk and maintaining Maintenance Rule systems available. This sensitivity is one part of the scheduling process. Close attention must also be given to plant personnel safety, work quality, the working environment, and ALARA concerns.

1. System/component work scope is determined as follows:

   a. Maintenance work will be sequenced with Operation's testing as much as possible.

   b. WCC and WWM will work closely with Maintenance, E&RC, Engineering and Operations to identify the maximum amount of work that can safely be completed. Responsible Engineers should help to determine work to be accomplished to reduce unavailability and increase reliability.

c. Approximately five weeks before a planned system outage, a preliminary work list will be reviewed by both the Work Week Manager and the Responsible Engineer. Inputs from the Responsible Engineer should be provided during the week to ensure the input is incorporated in the preliminary task list. This should include all outstanding corrective and preventive maintenance that requires a clearance or LCO and any Engineering Service Requests that are scheduled to be worked on the system. Unavailability and reliability are the priority mechanisms to determine work scope.

d. Action on inputs from Responsible Engineers, Operations and Maintenance should be completed in two weeks. WCC will take any additional information they have been provided and will target all of the WR/JOs for the planned week.

2. From the preliminary work list a preliminary plan of the week should be developed by the Work Week Manager with input as described above.

a. The preliminary plan of the week should be easy to use and as simple as possible. Those individuals expected to follow the plan of the week must understand the importance of their tasks in relation to the work scope as a whole.

b. The plan of the week should be credible but aggressive. It should be based on the best information available, reviewed and accepted by those actually responsible for performing and supporting the work.

c. The level of detail should be clear enough to show all major activities and their sequence. Most importantly, the logic should be very clear in where the transfers are from one group to another in the performance of the individual activities.

d. Specific items to be considered for the plan of the week are as follows:

1) Setup and staging.

2) Prefabrication work.

3) Clearance hanging and system draining.

4) Work should be shown in parallel when crew resources allow to reduce outage length.

5) Items that will be performed by different skills should have their own activity where practical.

6) Shift turnovers that could affect work progress should be shown.

7) Valve lineups should be shown when they could be significant.

8) Items such as material receipt and procedure changes should be shown when they could affect the success of task completions.

9) Post maintenance testing should be scheduled.

10) Cleanup and breakdown when it will be significant.

11) Show clear distinctions between operable and available when applicable.

12) Resources should be shown to allow analysis of manpower requirements.

13) ALARA effects and contingency actions to reduce dose.

14) Special requirements for support such as Radiation Control, Security coverage or special permitting to perform the activities.

15) If maintenance is to be performed that will pre-condition any safety related component and a surveillance test is also scheduled for that component, then the appropriate surveillance test should be performed prior to the maintenance. Post-maintenance testing may still be required after the maintenance.

e. The approved preliminary plan of the week should be integrated into the final plan of the week such that the work items show on the day they will be worked.

f. As the preliminary plan of the week is being reviewed, the Implementor should consider any preparation or prefabrication work that will have to be done. The Implementor should also consider when to start staging and any support needed that has not been identified.

8.2 System Outage Scheduling Process

3. Individual fragnet schedules should be produced for scheduled on-line work activities that require a Limited Condition for Operation (LCO) that will result in a mode change if the action statement is not satisfied, a reactor power reduction (such as the routine OST-551, Turbine Valve and Trip Functional Test), or significant coordination among units, and other items on an as needed basis. These fragnets will be included in the weekly schedule.

    a. Project Managers will be listed on the fragnet by scheduling personnel. For minor fragnets requiring less than one shift to perform, the project manager can be the working supervisor for the main activity on the fragnet or the responsible engineer, if appropriate. For more significant fragnets that take more than one shift to complete (such as EDG overhaul), the project manager(s) should not be the responsible engineer or the working supervisor. The project manager in this case should be a detached individual(s) that can concentrate on the oversight function. The project manager is responsible for pre-planning necessary to develop the fragnet, coordinating work activities, providing project status to management and at work coordination meetings, and identifying problems in the Corrective Action Program, if necessary. (CR 96-00219)

    b. Significant fragnets will be in level 3 detail and include pre-fabrication, clearance hanging and removal, all work activities, post-maintenance testing, and return to service. A task list can be used for items that do not affect the critical path and are of short duration or limited resource requirements.

4. Any items that are not ready to work should be closely tracked and where appropriate, action items should be created. The Project Manager and the Work Week Manager should ensure that these items are ready to work by the release of the final schedule.

5. The integration of ESRs into system outages requires a coordinated effort between the Work Week Managers and Engineering. Work Coordination should coordinate the integration of ESRs into the schedule.

6. After the T-2 meeting (schedule review meeting 2 weeks prior to the system outage), the scope of the outage should be considered frozen and any additions should be approved by the Project Manager and the Work Week Manager.

8.2.2 Schedule Execution

1. At least one day prior to the planned system outage a review of plans, preparations and contingencies should be conducted.

2. The Project Manager should review details of the schedule and fragneted items with all involved groups. Discussion should include defining the exact system outage start time, clearance hanging sequence, WR/JO package delivery and pickup and material staging.

3. Detailed review of contingency plans should be conducted by all involved. This review should be coordinated by the Project Manager.

4. Operations, the Implementors and the Project Managers should work to meet the start and completion times that were agreed to in the fragnet. Project Managers should attempt to track actual start and completion times to support better estimates for future system outages. Collecting these times will also help during the post system outage critique.

5. As the system outage progresses the Project Manager should stay abreast of the progress of critical and noncritical path activities. Periodic updates to the Control Room and other groups involved with subsequent activities will help ensure that good coordination occurs. As jobs are closed Operations should be ready to perform post maintenance testing to restore operability.

8.3 Contingency Planning

A contingency plan for all planned system outages should be developed. In addition, all high risk evolutions should have a contingency plan. The scope of this plan should be determined by the Project Manager and the Responsible Engineer when applicable. It is incumbent upon everyone involved with the system outage to consider what their response will be if additional equipment failures occur during the system outage.

8.3.1 Consideration should be given to other work that is going on at the time of the system outage. It may be possible to stop that work or move it along faster if plant-related problems occur.

8.3.2 Failures during retesting should be considered. If failures occur, necessary personnel should be available to respond.

8.3.3 If work is being done on safety-related equipment and other failures occur, the Maintenance Rule matrix should be referenced to help determine risk significance and aid in prioritizing work activities to reduce risk. This will normally be done by Operations.

8.3 Contingency Planning

8.3.4 Operations should consider shift briefings and training as ways to be better prepared for the system outage.

8.3.5 Maintenance should consider contingencies to take if additional equipment failures occur.

8.3.6 Written guidance and briefings can be very helpful in heightening awareness and determining contingency actions and in making sure they are fully understood. It is beneficial for the Project Manager to brief all of the involved personnel as a team.

8.3.7 In cases where there is a significant economic impact as a result of the system outage such as the removal of a feedwater train component from service, a fully developed outage plan may be warranted. The decision to develop a plan for the system outage should be made by the Project manager.

8.3.8 For difficult, high dose and high risk jobs, mockups may be beneficial for Maintenance teams to practice and prepare.

8.3.9 In reviewing actions during contingency planning consideration should be given to weather-related problems that could affect the planned work or could cause grid instabilities.

8.3.10 As a result of the reviews listed above, additional people may need to be available to carry out the planned contingencies. Consideration should be given to where to obtain additional people.

8.3.11 Because of the complex nature of some on-line work consideration should be given to contacting a vendor or technical representative.

8.3.12 If it is decided that certain jobs are too risky to be done on-line, the WR/JOs should be coded for an outage and submitted on an Outage Scope Change Request if needed.

8.4 Work Coordination Meetings and the Schedule Exception Process

8.4.1 The Daily Schedule Review meeting is normally chaired by Work Week Manager. Attendees are expected to be prepared to discuss specific items as necessary. The following groups should be represented:

- Operations
- Maintenance
- Engineering
- Planning
- E&RC
- Scheduling
- Security
- Computer Support

8.4.2 The following topics should be covered:

- Status of any active LCOs
- Status of load dispatcher alerts
- Status of Emergent Work List
- Review of work items that are in progress, as required
- Review of work items that did not start or finish as scheduled
- Review of the next day's work
- Identify work items that can not be performed as scheduled
- Resolution of any action items
- Review FIN Team work activities, as needed

8.4.3 A daily morning coordination meeting should be conducted to review new work activities. All units involved in the schedule execution should be represented at the meeting. The following specific items should be discussed:

1. Work activities which should be rescheduled and urgent or emergent items or problems that occurred during the night that need to be worked in addition to those scheduled.

2. Scheduled activities that the WCC was unable to prepare for work, remove from service or support for other groups to accomplish due to change in plant conditions, scheduling conflicts, or other events that prevent schedule compliance, and the reason these problems occurred.

3. Review of WR/JOs generated since the last working day.

8.4 Work Coordination Meetings and the Schedule Exception Process

8.4.4 New work activities identified after approval and issue of the schedule may be added to the Emergent Work List provided approval is obtained from appropriate Operations and Scheduling management. It is intended that the Emergent Work List be reserved for those activities that cannot wait for the normal scheduling process due to their near-term impact on plant operation. Review of items on the Emergent Work List should be performed at either the Daily Schedule Review meeting or the morning coordination meeting. Attachment 10.3 Can be used as a guide for emergent work items.

8.4.5 To allow for emergent changes to the schedule, any person that identifies an item that could impact the schedule should immediately notify the WCC or Operations work management representative, as appropriate, (without waiting until the next scheduled meeting) to provide the maximum amount of time to evaluate the situation. When necessary due to plant impact, Operations management may approve and add activities to the Emergent Work List outside of these meetings.

8.4.6 If a schedule is reissued during the work week to reflect changes in the approved schedule, work activities on the Emergent Work List may be integrated into the new approved schedule prior to issue, if desired.

8.4.7 Priority 4 work that does not require scheduling may be used as fill-in work at any time and is not required to be placed on the Emergent Work List.

8.4.8 If equipment failure precludes following the schedule (example, 'B' train component fails during and 'A' train week), routine work may be added to the Emergent Work List only if it will not interfere with the current LCO. Before any work that requires an LCO is added to the Emergent Work List, it should be risk reviewed by Operations to ensure there is no previously scheduled work for that day which will create a scheduling conflict.

8.4.9 If work needs to be rescheduled, the Work Week Manager will coordinate with the schedulers to appropriately reschedule work.

9.0 RECORDS

N/A

10. ATTACHMENTS

10.1 Definitions/Acronyms

10.2 PSA of On-Line Maintenance For H.B. Robinson Steam Electric Plant Unit 2

10.3 Emergent Work Checklist

DEFINITIONS/ ACRONYMS

1. Defense in Depth

   Multiple methods for meeting a safety function such as decay heat removal. If a major component or train is to be removed from service consideration should be given to operability and functionality of backup equipment.

2. Emergent Work

   New or revised non-discretionary work identified during the performance of a scheduled outage activity that requires completion during the system outage.

3. High Risk Jobs

   Those jobs that present increased potential for reactor or turbine trip, reportable ESF actuation or activation of AMSAC system. Actions such as normal MSTs and PMs would not normally be considered however these tests in combination with other repairs and "non-standard" testing (such as special tests) may create high risk. These can be identified by anyone involved in the planning process.

4. Matrix

   Attachment 10.2, H.B. Robinson Steam Electric Plant On-Line System Matrix

5. Fragnet

   The schedule arranged in a logical way showing activities and their sequence and interrelationships for the purpose of identifying the Critical Path (longest duration path), monitoring progress, and providing a base for contingency planning.

6. Risk Significant Systems, Structures, or Components

   Those SSCs that are significant contributors to risk and are so designated in ADM-NGGC-0101.

7. PSA

   Probabilistic Safety Assessment

8. WCC

   Work Control Center

DEFINITIONS/ ACRONYMS

9. System Outage

   Any removal of a train, major portion or major component of a system while operating the plant at power.

10. Available

    In service providing a safety function, or can be placed in service by immediate manual or automatic actuation.

PSA of On-Line Maintenance For H.B. Robinson Steam Electric Plant Unit 2

1.0 INTRODUCTION

This document identifies the risk impact of various combinations of equipment safety functions being unavailable due to maintenance during reactor critical and power operation ("on-line maintenance"). The risk measure for this analysis is core damage frequency (CDF), as calculated using the current probabilistic safety analysis (PSA) model of the Robinson plant. While this analysis provides risk insights that can be obtained in no other way, it is intended that the information contained in this document be used in conjunction with design basis information, operational experience, and engineering judgment to determine the extent and scope of any planned on-line maintenance activity. Because the PSA only measures risk and not defense in depth, the allowed out of service times presented in this document may be different than those of the plant's technical specifications. This document shall not be used as a basis for LCO extension but should be observed when the recommended limits of this document are more restrictive than the limits imposed by technical specifications.

2.0 METHODOLOGY

2.1 Determination of Train Combinations for On-line Maintenance

Systems identified as risk-significant contributors to core damage by the maintenance rule expert panel were evaluated for on-line maintenance impact on core damage risk. These systems were broken down into two major trains and separated on the 12-week on-line schedule. This schedule was used to determine the presentation of results.

Note that the 12-week on-line schedule contains some systems or trains that are maintained on-line but whose function is not impaired by the maintenance action. These systems were not included in the PSA analysis, since the PSA considers the impact of unavailable functions when determining risk impact. However, some maintenance actions, even if they do not render the system incapable of performing its accident mitigation function, may increase the likelihood of a transient or other initiating events. Systems or trains in this category were included in the analysis.

2.2 Calculation of Core Damage Frequencies

In order to determine the risk impact of planned maintenance, a "baseline" core damage frequency was required. This baseline core damage frequency served as the basis for determining whether the calculated risk increase for a given equipment configuration was risk-significant or non-risk-significant. This baseline CDF was determined by setting all unavailability events in the PSA model to the "in service" value of zero. The model was then quantified to obtain the baseline CDF.

In order to assess the relative impact of performing on-line maintenance on a single system or a pair of systems, the system train function was made unavailable. All other system functions in the PSA model except those being taken out for on-line maintenance were made available. The PSA model was then solved for this combination of equipment out of service to determine the new core damage frequency for that condition.

If maintenance could increase the likelihood of a transient or other initiating event, this impact had to be considered in the analysis. This was addressed by assuming that the maintenance would cause the appropriate initiating event in the model to increase in frequency by a factor of ten. An example of this "environmental event" would be work on Reactor Protection Logic. While planned logic testing at power would not remove the reactor trip function, the likelihood of a reactor trip initiating event is considered greater than during periods when no testing is conducted. Another example is switchyard work. Switchyard work is not considered risk-significant in itself and is not included in the matrices. However, switchyard work in combination with EDG or AFW steam driven pump maintenance is highly risk-significant due to the increased risk of a station blackout and should be avoided.

2.3 Determination of Significant Risk Increase due to On-line Maintenance

There are several criteria for determining whether a given risk increase is risk-significant or non-risk-significant. The criteria utilized in this analysis were based on the EPRI PSA Applications Guide. Three thresholds for risk-significance were applied in the present analysis:

- The instantaneous value of CDF calculated for the given condition should not be above 1E-3 per year.

- The change in core damage probability for the condition, which is the product of the instantaneous CDF increase (over the baseline) for the given condition and the length of time the condition would exist, should not be allowed to exceed 1E-6 without consideration of additional, non-quantifiable factors.

- The change in core damage probability for the condition may exceed 1E-6 provided: 1) the change in core damage probability does not exceed 1E-5; 2) additional, non-quantifiable factors (possibly including contingency measures) are considered; and, 3) an appropriate level of management approval is obtained.

These three thresholds were applied, using the calculated CDF for each combination of equipment functions unavailable, the baseline CDF with no equipment in test or maintenance, and an assumed equipment unavailable time of 72 hours.

3.0 RESULTS

3.1 Assumptions and Considerations

This analysis does not consider all risk significant systems identified by the maintenance rule expert panel, but rather is limited to potentially risk significant systems whose maintenance activities may contribute to core damage through unavailability of system train functions. Some electrical systems whose functions are not made unavailable while on-line are not included in the list of system train functions. These systems are discussed in Section 3.2 and in the Notes on Table 1.

The EPRI PSA applications guide recommends an evaluation of Large Early Release Frequency (LERF) for applications. A review of the level 2 (containment performance) PSA analysis reveals that functional failures of containment safeguards systems (containment isolation, containment spray, containment fan coolers) do not significantly contribute to the potential for large early releases from severe accidents. LERF scenarios are dominated by interfacing-system LOCAs (RHR-750/751) and steam generator tube ruptures , which by nature create a release path. The status of the containment safeguards systems have little impact on large early releases, and would not be considered risk-significant based on their limited impact on the PSA results.

Since the on-line maintenance matrix was quantified with core damage as the end-state, containment systems were not included on the matrix. However, if consideration is given to potential performance degradation of containment isolation, the frequency of large early releases would increase. Therefore, maintenance activities that render a containment isolation valve open (non-isolatable) or that compromise Main Steam isolation via the SRVs, PORVs or MSIVs should not be done while any core-damage mitigating system function listed in Table 1 is unavailable.

For the purposes of calculating the change in core damage probability, an out of service time of 72 hours was assumed for each combination of equipment evaluated. While instantaneous CDF and increase in core damage probability (delta CDF * time out of service) were considered, the cumulative risk associated with on-line maintenance activity over the entire cycle was not included. The impact of maintenance activity on initiating event frequencies, where applicable, was assumed to be an increase by a factor of ten.

As stated in the introduction, this analysis is intended to be used in conjunction with design basis information, operational experience, and engineering judgment to determine the extent and scope of any planned on-line maintenance activity.

3.2 Presentation of Results

The results of the analysis are presented in matrix format to facilitate determination of the risk significance of system train functions being unavailable. Because of the amount of information resulting from this study, a number of different views of the results are presented. The matrices and other information are contained in Tables 1 through 3.

Table 1 lists the maintenance events that were analyzed. The table lists the maintenance event description, the system or train accident mitigation function, and the assumed impact on initiating events, if applicable. The table details the safety function to be maintained for combinations that are considered risk significant. A number of power systems, that will not have planned maintenance out of service time, have been removed from the matrix: 4KV AC (5170), 480V AC (5175 non-safety related), 208/120V AC (5185), and transformers and switchyard (5120). However, testing of these systems may introduce risk of undervoltage initiators. Therefore, work on the AFW steam driven pump and the EDGs should not be performed in conjunction with maintenance or test on these systems due to the risk increase of a station blackout.

Table 2 is the primary on-line maintenance risk matrix. It is made up of three separate matrices: One for train A equipment, one for train B equipment, and one for "cross-train" equipment. These matrices list the maintenance events across the top and down the left side. The intersection of the row and column contains an "N" (for Not recommended) if the combination of equipment out of service (for up to 72 hours) would be considered risk significant. If the intersection cell is blank, then the combination of equipment functions unavailable is considered non-risk significant, provided that the time the equipment function is unavailable is less than or equal to 72 hours.

Table 3 is a supplemental matrix which shows the number of hours that a combination of equipment can be unavailable before the change in core damage probability (delta CDF * time) would exceed 1E-6. Note that the 1E-6 core damage probability threshold is only one part of the analysis. Cells marked with an X should not be scheduled because the instantaneous CDF would exceed the 1E-3 threshold.

Table 3 should only be used in three cases: 1) to evaluate emergent issues for configuration time limits and risk insights for prioritizing work; 2) to determine the allowed hours when a system train function or combination of functions are shown as allowed on Table 2 but the planned work will exceed 72 hours; 3) to determine the allowed hours for combinations marked as "N" on Table 2 (see insights below).

Maintenance that exceeds the allowed hours in Table 3 will place the plant in a potentially risk significant configuration and is not recommended. Planning maintenance to exceed the hours in Table 3 should be accompanied with plant general manager approval and a review of non-quantifiable factors (e.g. reason maintenance is necessary on-line). Any maintenance, planned or emergent, which exceeds the hours in Table 3 should be accompanied with risk insights from PSA, and development of contingency plans.

3.3 Use of the On-line Maintenance Matrices

The matrices apply only for reactor critical and power operation (all trips and actuation signals in place) and only for combinations of one or two system trains at a time. If three or more system train functions need to be unavailable at the same time, then further analysis needs to be performed.

The matrices only address best estimate risk and not defense in depth. The most limiting configurations must be determined through a combination of Technical Specifications, the matrix, and other design basis documents.

When using these results to determine appropriate on-line maintenance, it is important to remember that all functions listed in Table 1 which are not designated as unavailable are assumed to be functional. The scope of this application assumes that equipment must be available to provide its safety function. The definition of available is any system, structure, or component that is either in service providing the safety function, or can be placed in service by immediate manual or automatic actuation. If the system, structure or component (SSC) is in service providing the safety function, some components may be defeated such that the ability to maintain the function is not degraded. Existing plant procedures shall be used to determine the availability of an SSC.

In case of emergent equipment unavailability, a review of the equipment functions already unavailable must be performed. Potential high risk situations need to be identified and non-quantifiable factors and contingency plans must be identified. An example of a non-quantifiable factor would be the need to shutdown the plant if the repair is not expedited. Plant shutdowns introduce additional risk through challenging safety systems which in itself is not quantifiable. The potential risk significant configurations need to be avoided or limited in duration as much as practical. It is not recommended to intentionally enter into potentially risk significant configurations.

3.4 Insights

System function unavailability limits (both singles and doubles) that are less than 72 hours on Table 3 ("N" on Table 2) add to total cumulative annual risk limit (a change in annual CDF of 3E-5/yr) at a very high rate. Each entry on Table 3 adds as 1E-6 to that value if the full time is used. Using the full time is not prohibited; however, to minimize the accumulation of risk, these configurations should be carried out and terminated expeditiously and limited in occurrences.

Table 1. Matrix Event Description and Safety Function

SYS	TRAIN (Note	MATRIX EVENT DESCRIPTION	SHORT NAME (see matrices)	TRAIN SAFETY FUNCTION To Be Maintained for Not Recommended Combinations	MODELLING NOTES
1080	A	RPS Channel A Logic In Test & Maintenance (Includes RX Trip Bkr 1065, And Safeguards	RPS CHANNEL A	Prevent Inadvertent RX Trip, Provide RX Trip and Safeguards Actuation Logic on Valid Transient. (See Note	Conservatively assumed train A SI actuation signal Fails, Increase frequency of ATWS and RX Trip.
2005	A	RCS PZR PORV Train A Unavailable (RC-456, N2 Header, Block Valve RC-536)	RCS PZR PORV 456	Provide a Bleed Path for Feed and Bleed Cooling, and Maintain RCS Integrity.	Assumes PORV or Block Valve will not open. Stuck open Block Valve not analyzed. See Block Valve
2045	A	RHR Train A Unavailable	RHR PUMP A	Provide RCS Inventory Control and Decay Heat Removal	
2060	A	CVCS Charging Pump B Unavailable (Train A)	CVCS CHGP B	Provide RCP Seal Injection. If removal of function is permitted, prevent total loss of CVCS which could lead to a	Increased frequency of total loss of CVCS initiator not included.
2080	A	SI Pump A Unavailable (Train A)	SI PUMP A	Provide RCS Inventory Control	Pump B can be swapped to the A train to maintain function.
3020	A	S/G A PORV RV-1 Unavailable (Includes Specific IA Support Manifold)	S/G A PORV RV-1	Provide Ability for Cooldown From Hot to Cold Shutdown	Open function failed: Results conservative by allowing reclose failures in cutsets.
3020	A	S/G B PORV RV-2 Unavailable (Includes Specific IA Support Manifold)	S/G B PORV RV-2	Provide Ability for Cooldown From Hot to Cold Shutdown	Open function failed: Results conservative by allowing reclose failures in cutsets.
3020	A	S/G C PORV RV-3 Unavailable (Includes Specific IA Support Manifold)	S/G C PORV RV-3	Provide Ability for Cooldown From Hot to Cold Shutdown	Open function failed: Results conservative by allowing reclose failures in cutsets.
3050	A	MFW Pump Train A Unavailable	MFWP A	Prevent Loss Causing Plant Trip, and mitigate ATWS or Loss of AFW	Assumes A train MFW or CND pumps are unavailable and increased frequency of Total Loss of MFW
3065	A	AFW MD Pump Train A Unavailable (Includes Actuation Channel)	AFW MDP A	Automatically Deliver Condensate From the CST to the S/Gs Following a Plant Trip (See Note 4)	
3065	A	AFW SD Pump Train Unavailable	AFW SDP	Automatically Deliver Condensate From the CST to the S/Gs Following a Plant Trip (See Notes 4 and 5)	Pump is unavailable when 2 or 3 S/Gs are unavailable to supply steam or receive flow via MS-V1-8A,B,C or
4060	A	SW Pump A Unavailable	SW PUMP A	Provide Cooling for Safety Related Equipment, Prevent Loss of SW Initiator	
4060	A	SW Pump B Unavailable	SW PUMP B	Provide Cooling for Safety Related Equipment, Prevent Loss of SW Initiator	
4080	A	CCW Pump A Unavailable (Train DS)	CCW PUMP A	Provide Cooling for Safety Related Equipment, Prevent Loss of CCW Initiator	
4080	A	CCW Pump B Unavailable (Train A)	CCW PUMP B	Provide Cooling for Safety Related Equipment, Prevent Loss of CCW Initiator	
5095	A	EDG A Unavailable (Includes Room Cooling 8210, And Fuel Oil 5100)	EDG A	Provide Power to the Emergency Bus (See Note 5)	

Table 1. Matrix Event Description and Safety Function

SYS	TRAIN (Note	MATRIX EVENT DESCRIPTION	SHORT NAME (see matrices)	TRAIN SAFETY FUNCTION To Be Maintained for Not Recommended Combinations	MODELLING NOTES
5175	A	480V Emergency Bus E1 In Test Or Maintenance, Assumed Available	EMERGENCY BUS E1	Prevent Bus Undervoltage Initiator and Provide Power to Emergency Bus and Safety Related MCC Loads	Assumes increased frequency of Loss of Emergency Bus E1 Initiator.
5235	A	DC, One Train A Battery Charger Unavailable	DC BAT CHG A/A1	DC Bus Must be Available to Provide Control Power. (See Note 3)	Assumes increased frequency of Loss of DC Bus A Initiator.
6135	A	Air Compressor A Unavailable	AIR COMP A	Prevent Loss of Instrument Air, and Provide Instrument Air to S/G PORVs and CVCS	Increased frequency of loss of Instrument Air initiator not included.
6135	A	Air, Primary Air Compressor Unavailable	AIR COMP PRIM	Prevent Loss of Instrument Air, and Provide Instrument Air to S/G PORVs and CVCS	Increased frequency of loss of Instrument Air Initiator not included.
6175	A	Fire Pump, Engine Driven Unavailable	FIRE PUMP DIESEL	Provide Alternate Cooling to SI, AFW, and Charging Pumps	
6270	A	Deepwell Pump B Unavailable	DEEPWELL PUMP B	Provide Makeup to CST or Alternate AFW Supply	Matrices entries are based on both A and B Deepwell Pumps unavailable for conservatism
1080	B	RPS Channel B Logic In Test & Maintenance (Includes RX Trip Bkr 1065, And Safeguards	RPS CHANNEL B	Prevent Inadvertent RX Trip, Provide RX Trip and Safeguards Actuation Logic on Valid Transient.	Conservatively assumed train B SI actuation signal fails, Increase frequency of ATWS and RX trip.
2005	B	RCS PZR PORV Train B Unavailable (RC-455C, N2 Header, Block Valve RC-535)	RCS PZR PORV 455C	Provide a Bleed Path for Feed and Bleed Cooling, and Maintain RCS Integrity Given a Stuck Open PORV.	Assumes PORV or Block Valve will not open. Stuck open Block Valve not analyzed.
2005	B	Both RCS PZR Block Valves Closed But Available	RCS BLOCK VALVES	Provide at Least One Path to Mitigate a Pressure Challenge	Assumes PORV is operable when Block Valve is open. See Block Valve entry below.
2045	B	RHR Train B Unavailable	RHR PUMP B	Provide RCS Inventory Control and Decay Heat Removal	
2060	B	CVCS Charging Pump A Unavailable (Train DS)	CVCS CHGP A	Provide RCP Seal Injection. If removal of function is permitted, prevent total loss of CVCS which could lead to a	
2060	B	CVCS Charging Pump C Unavailable (Train B)	CVCS CHGP C	Provide RCP Seal Injection. If removal of function is permitted, prevent total loss of CVCS which could lead to a	
2080	B	SI Pump C Unavailable (Train B)	SI PUMP C	Provide RCS Inventory Control	Pump B can be swapped to the B train to maintain function.
3050	B	MFW Pump Train B Unavailable	MFWP B	Prevent Loss Causing Plant Trip, and mitigate ATWS or Loss of AFW	Assumes B train MFW or CND pumps are unavailable and increased frequency of total loss of MFW initiator.
3065	B	AFW MD Pump Train B Unavailable (Includes Actuation Channel)	AFW MDP B	Automatically Deliver Condensate From the CST to the S/Gs Following a Plant Trip	
4060	B	SW Pump C Unavailable	SW PUMP C	Provide Cooling for Safety Related Equipment, Prevent Loss of SW Initiator	

Table 1. Matrix Event Description and Safety Function

SYS	TRAIN (Note	MATRIX EVENT DESCRIPTION	SHORT NAME (see matrices)	TRAIN SAFETY FUNCTION To Be Maintained for Not Recommended Combinations	MODELLING NOTES
4060	B	SW Pump D Unavailable	SW PUMP D	Provide Cooling for Safety Related Equipment, Prevent Loss of SW Initiator	
4080	B	CCW Pump C Unavailable (Train B)	CCW PUMP C	Provide Cooling for Safety Related Equipment, Prevent Loss of CCW Initiator	
5095	B	EDG B Unavailable (Includes Room Cooling 8210, And Fuel Oil 5100)	EDG B	Provide Power to the Emergency Bus (See Note 5)	
5098	B	DSDG (Includes DS Fuel Oil 5100) Unavailable	DSDG	Provide Power to the DS Bus	Taking out the DSDG is not as limiting as taking out the DS Bus.
5114	B	DS Bus Unavailable	DS BUS	Provide Power to Chg Pump A, CCW Pump A (Alternate for SW Pump D, MCC5 and Deepwell Pumps)	Taking out the DS Bus takes out the DSDG, CCWA, CVCS CHGP A and can be considered one function.
5175	B	480V Emergency Bus E2 In Test Or Maintenance, Assumed Available	EMERGENCY BUS E2	Prevent Bus Undervoltage Initiator and Provide Power to Emergency Bus and Safety Related MCC Loads	Assumes increased frequency of Loss of Emergency Bus E2.
5235	B	DC, One Train B Battery Charger Unavailable	DC BAT CHG B/B1	DC Bus Must be Available to Provide Control Power. (See Note 3)	Assumes increased frequency of Loss of DC Bus B Initiator.
6135	B	Air Compressor B Unavailable	AIR COMP B	Prevent Loss of Instrument Air, and Provide Instrument Air to S/G PORVs and CVCS	Increased frequency of loss of Instrument Air Initiator not included.
6135	B	Air Compressor D Unavailable	AIR COMP D	Prevent Loss of Instrument Air, and Provide Instrument Air to S/G PORVs and CVCS	Increased frequency of loss of Instrument Air Initiator not included.
6175	B	Fire Pump, Motor-Driven Unavailable	FIRE PUMP MOTOR	Provide Alternate Cooling to SI, AFW, and Charging Pumps	
6270	B	Deepwell Pump A Unavailable	DEEPWELL PUMP A	Provide Makeup to CST or Alternate AFW Supply	
6270	B	Deepwell Pump C Unavailable	DEEPWELL PUMP C	Provide Makeup to CST or Alternate AFW Supply	

Notes:

1. Trains as designated by 12 week on-line schedule.
2. Do not perform RPS channel logic test for combinations designated as not allowed. Matrix assumes that test does not remove RX trip and actuation function.
3. Both battery chargers for that train must be available for maintenance combinations designated as not allowed.
4. The CST must be available to provide suction to the AFW pumps otherwise all three pumps are considered unavailable.
5. A number of power systems, that will not have planned maintenance unavailabilities, are not included on the matrix: 4KV AC (5170), 480V AC (5175 non-safety-related), 208/120V AC (5185) and transformers and switchyard (5120). However, testing or maintenance activities on these systems may introduce additional risk of an undervoltage initiator. Therefore, do not perform testing or maintenance activities on these systems while performing EDG or AFW SDP maintenance due to the increased risk of a station blackout.
6. Maintenance activities that render any containment system or train unavailable should not be performed while the core-damage mitigating system functions listed in this table are unavailable. This includes any containment isolation valve open (non-isolable) also to include those maintenance activites that compromise Main Steam isolation via the SRVs, PORVs or MSIVs. This also includes any maintenance perfomed containment cooling or pressure control systems such as Containment Sprays, Containment Fan Coolers and Service Water Booster Pumps.

Table 2. Matrix Showing Not Recommended Combinations

Train A Matrix

N - Not Recommended Based on 72 Hour Unavailability Time. Review Table 3 for Allowed Hours if UnavailabilityTime Will Be Less Than 72 Hours.

For Allowed Combinations, Review Table 3 If Planned Unavailability Time Exceeds 72 Hours.

		RPS CHANNEL A	RCS PZR PORV 456	RHR PUMP A	CVCS CHGP B	SI PUMP A	S/G A PORV RV-1	S/G B PORV RV-2	S/G C PORV RV-3	MFWP A	AFW MDP A	AFW SDP	SW PUMP A	SW PUMP B	CCW PUMP A	CCW PUMP B	EDG A	EMERGENCY BUS E1	DC BAT CHG A/A1	AIR COMP A	AIR COMP PRIM	FIRE PUMP DIESEL	DEEPWELL PUMP B
		1080	2005	2045	2060	2080	3020	3020	3020	3050	3065	3065	4060	4060	4080	4080	5095	5175	5235	6135	6135	6175	6270
RPS CHANNEL A	1080											N											
RCS PZR PORV 456	2005										N	N											
RHR PUMP A	2045						N	N	N		N	N											
CVCS CHGP B	2060																						
SI PUMP A	2080																						
S/G A PORV RV-1	3020			N							N	N											
S/G B PORV RV-2	3020			N							N	N											
S/G C PORV RV-3	3020			N							N	N											
MFWP A	3050										N	N											
AFW MDP A	3065		N	N			N	N	N	N		N									N		
AFW SDP	3065	N	N	N			N	N	N	N	N						N						
SW PUMP A	4060																						
SW PUMP B	4060																						
CCW PUMP A	4080															N							
CCW PUMP B	4080														N								
EDG A	5095											N											
EMERGENCY BUS E1	5175																						
DC BAT CHG A/A1	5235																						
AIR COMP A	6135																						
AIR COMP PRIM	6135										N												
FIRE PUMP DIESEL	6175																						
DEEPWELL PUMP B	6270																						

Table 2. Matrix Showing Not Recommended Combinations

Train B Matrix

N - Not Recommended Based on 72 Hour Unavailability Time. Review Table 3 for Allowed Hours if UnavailabilityTime Will Be Less Than 72 Hours.

For Allowed Combinations, Review Table 3 If Planned Unavailability Time Exceeds 72 Hours.

		RPS CHANNEL B	RCS PZR PORV 455C	RCS BLOCK VALVES	RHR PUMP B	CVCS CHGP A	CVCS CHGP C	SI PUMP C	MFWP B	AFW MDP B	SW PUMP C	SW PUMP D	CCW PUMP C	EDG B	DSDG	DS BUS	EMERGENCY BUS E2	DC BAT CHG B/B1	AIR COMP B	AIR COMP D	FIRE PUMP MOTOR	DEEPWELL PUMP A	DEEPWELL PUMP C
		1080	2005	2005	2045	2060	2060	2080	3050	3065	4060	4060	4080	5095	5098	5114	5175	5235	6135	6135	6175	6270	6270
RPS CHANNEL B	1080																						
RCS PZR PORV 455C	2005									N													
RCS BLOCK VALVES	2005																						
RHR PUMP B	2045									N													
CVCS CHGP A	2060																						
CVCS CHGP C	2060															N							
SI PUMP C	2080																						
MFWP B	3050									N													
AFW MDP B	3065		N		N				N		N	N		N		N				N			
SW PUMP C	4060									N		N		N							N		
SW PUMP D	4060									N	N			N							N		
CCW PUMP C	4080															N							
EDG B	5095									N	N	N			N	N							
DSDG	5098													N									
DS BUS	5114						N			N			N	N									
EMERGENCY BUS E2	5175																						
DC BAT CHG B/B1	5235																						
AIR COMP B	6135																						
AIR COMP D	6135									N													
FIRE PUMP MOTOR	6175										N	N											
DEEPWELL PUMP A	6270																						N
DEEPWELL PUMP C	6270																					N	

Table 2. Matrix Showing Not Recommended Combinations

Train A By Train B Matrix

N - Not Recommended Based on 72 Hour Unavailability Time. Review Table 3 for Allowed Hours if UnavailabilityTime Will Be Less Than 72 Hours.

For Allowed Combinations, Review Table 3 If Planned Unavailability Time Exceeds 72 Hours.

		RPS CHANNEL B	RCS PZR PORV 455C	RCS BLOCK VALVES	RHR PUMP B	CVCS CHGP A	CVCS CHGP C	SI PUMP C	MFWP B	AFW MDP B	SW PUMP C	SW PUMP D	CCW PUMP C	EDG B	DSDG	DS BUS	EMERGENCY BUS E2	DC BAT CHG B/B1	AIR COMP B	AIR COMP D	FIRE PUMP MOTOR	DEEPWELL PUMP A	DEEPWELL PUMP C
		1080	2005	2005	2045	2060	2060	2080	3050	3065	4060	4060	4080	5095	5098	5114	5175	5235	6135	6135	6175	6270	6270
RPS CHANNEL A	1080									N													
RCS PZR PORV 456	2005									N													
RHR PUMP A	2045				N					N				N									
CVCS CHGP B	2060																						
SI PUMP A	2080							N						N									
S/G A PORV RV-1	3020				N			N		N	N	N		N									
S/G B PORV RV-2	3020				N			N		N	N	N		N									
S/G C PORV RV-3	3020				N			N		N	N	N		N									
MFWP A	3050																						
AFW MDP A	3065		N		N					N	N	N		N		N	N	N			N		
AFW SDP	3065	N	N		N				N	N	N	N		N							N		
SW PUMP A	4060											N		N									
SW PUMP B	4060											N		N									
CCW PUMP A	4080												N										
CCW PUMP B	4080												N			N							
EDG A	5095				N					N	N	N		N	N	N							
EMERGENCY BUS E1	5175										N	N					N						
DC BAT CHG A/A1	5235									N	N	N						N					
AIR COMP A	6135																						
AIR COMP PRIM	6135																						
FIRE PUMP DIESEL	6175																				N		
DEEPWELL PUMP B	6270																					N	N

Table 3. Matrix Showing Allowable Hours for Plant Configurations to Remain Non-Risk Significant (Delta CDP<1E-06)

Train A Matrix

Exceeding these allowed hours require PGM approval, review of non-quantifiable factors, contingency planning and PSA insights. X - Risk Significant Exceeds Maximum Instantaneous CDF of 1E-3 and SHOULD BE AVOIDED.		RPS CHANNEL A	RCS PZR PORV 456	RHR PUMP A	CVCS CHGP B	SI PUMP A	S/G A PORV RV-1	S/G B PORV RV-2	S/G C PORV RV-3	MFWP A	AFW MDP A	AFW SDP	SW PUMP A	SW PUMP B	CCW PUMP A	CCW PUMP B	EDG A	EMERGENCY BUS E1	DC BAT CHG A/A1	AIR COMP A	AIR COMP PRIM	FIRE PUMP DIESEL	DEEPWELL PUMP B
		1080	2005	2045	2060	2080	3020	3020	3020	3050	3065	3065	4060	4060	4080	4080	5095	5175	5235	6135	6135	6175	6270
RPS CHANNEL A	1080	875	123	134	855	326	119	119	119	380	78	71	638	638	508	519	154	793	676	771	568	647	316
RCS PZR PORV 456	2005	123	535	140	522	320	109	109	109	116	64	36	438	438	337	337	152	499	456	311	172	441	286
RHR PUMP A	2045	134	140	166	165	159	22	22	22	131	63	57	155	155	148	149	103	163	158	160	145	156	135
CVCS CHGP B	2060	855	522	165	9921	501	137	137	137	844	102	98	1997	1997	1239	551	188	5076	2469	4887	2600	2083	680
SI PUMP A	2080	326	320	159	501	508	76	76	76	322	87	82	420	420	372	378	178	480	436	477	440	422	298
S/G A PORV RV-1	3020	119	109	22	137	76	137	93	93	119	59	57	130	130	125	125	79	135	131	135	132	130	115
S/G B PORV RV-2	3020	119	109	22	137	76	93	137	93	119	59	57	130	130	125	125	79	135	131	135	132	130	115
S/G C PORV RV-3	3020	119	109	22	137	76	93	93	137	119	59	57	130	130	125	125	79	135	131	135	132	130	115
MFWP A	3050	380	116	131	844	322	119	119	119	863	16	52	635	635	532	543	156	782	673	779	690	642	378
AFW MDP A	3065	78	64	63	102	87	59	59	59	16	102	9	96	96	95	95	72	101	99	98	71	98	89
AFW SDP	3065	71	36	57	98	82	57	57	57	52	9	98	86	85	91	92	14	94	83	90	80	96	86
SW PUMP A	4060	638	438	155	1997	420	130	130	130	635	96	86	2124	93	786	867	180	1778	1270	1679	1289	938	506
SW PUMP B	4060	638	438	155	1997	420	130	130	130	635	96	85	93	2124	837	867	180	1777	1270	1679	1289	952	506
CCW PUMP A	4080	508	337	148	1239	372	125	125	125	532	95	91	786	837	869	19	155	1025	840	1092	927	841	462
CCW PUMP B	4080	519	337	149	551	378	125	125	125	543	95	92	867	867	19	853	167	1173	943	1162	961	880	470
EDG A	5095	154	152	103	188	178	79	79	79	156	72	14	180	180	155	167	189	185	178	182	178	134	127
EMERGENCY BUS E1	5175	793	499	163	5076	480	135	135	135	782	101	94	1778	1777	1025	1173	185	5861	2017	3386	2098	1752	628
DC BAT CHG A/A1	5235	676	456	158	2469	436	131	131	131	673	99	83	1270	1270	840	943	178	2017	2641	1586	1472	1284	82
AIR COMP A	6135	771	311	160	4887	477	135	135	135	779	98	90	1679	1679	1092	1162	182	3386	1586	5611	321	1729	623
AIR COMP PRIM	6135	568	172	145	2600	440	132	132	132	690	71	80	1289	1289	927	961	178	2098	1472	321	2791	1318	583
FIRE PUMP DIESEL	6175	647	441	156	2083	422	130	130	130	642	98	96	938	952	841	880	134	1752	1284	1729	1318	2204	542
DEEPWELL PUMP B	6270	316	286	135	680	298	115	115	115	378	89	86	506	506	462	470	127	628	82	623	583	542	693

Table 3. Matrix Showing Allowable Hours for Plant Configurations to Remain Non-Risk Significant (Delta CDP<1E-06)

Train B Matrix

Exceeding these allowed hours require PGM approval, review of non-quantifiable factors, contingency planning and PSA insights. X - Risk Significant Exceeds Maximum Instantaneous CDF of 1E-3 and SHOULD BE AVOIDED.		RPS CHANNEL B	RCS PZR PORV 455C	RCS BLOCK VALVES	RHR PUMP B	CVCS CHGP A	CVCS CHGP C	SI PUMP C	MFWP B	AFW MDP B	SW PUMP C	SW PUMP D	CCW PUMP C	EDG B	DSDG	DS BUS	EMERGENCY BUS E2	DC BAT CHG B/B1	AIR COMP B	AIR COMP D	FIRE PUMP MOTOR	DEEPWELL PUMP A	DEEPWELL PUMP C
		1080	2005	2005	2045	2060	2060	2080	3050	3065	4060	4060	4080	5095	5098	5114	5175	5235	6135	6135	6175	6270	6270
RPS CHANNEL B	1080	875	123	402	167	607	844	551	441	95	106	102	520	99	205	107	591	780	771	531	166	698	316
RCS PZR PORV 455C	2005	123	534	92	158	406	509	395	119	65	118	114	341	119	177	127	413	498	311	178	150	446	286
RCS BLOCK VALVES	2005	402	92	1956	198	913	1653	876	420	106	140	134	636	75	256	163	943	1539	1266	582	189	1322	520
RHR PUMP B	2045	167	158	198	221	199	219	195	169	70	90	87	192	77	124	96	197	214	210	185	107	210	169
CVCS CHGP A	2060	607	406	913	199	1556	380	812	705	116	137	92	807	91	253	172	891	1447	1476	788	187	1138	515
CVCS CHGP C	2060	844	509	1653	219	380	6801	1291	1041	122	149	142	546	115	247	49	1553	4277	4547	1232	205	2612	673
SI PUMP C	2080	551	395	876	195	812	1291	1464	612	98	137	131	733	108	235	149	812	1217	1122	707	183	1088	482
MFWP B	3050	441	119	420	169	705	1041	612	1089	24	133	127	625	105	225	141	682	946	966	626	175	798	235
AFW MDP B	3065	95	65	106	70	116	122	98	24	123	64	63	113	61	82	51	115	118	88	51	77	119	105
SW PUMP C	4060	106	118	140	90	137	149	137	133	64	150	37	136	66	97	79	139	147	148	125	67	142	78
SW PUMP D	4060	102	114	134	87	92	142	131	127	63	37	143	130	56	96	79	128	140	141	120	64	136	76
CCW PUMP C	4080	520	341	636	192	807	546	733	625	113	136	130	897	107	216	X	780	1146	1164	689	181	740	471
EDG B	5095	99	119	75	77	91	115	108	105	61	66	56	107	116	28	26	109	114	114	107	74	112	100
DSDG	5098	205	177	256	124	253	247	235	225	82	97	96	216	28	279	172	243	270	269	233	120	262	202
DS BUS	5114	107	127	163	96	172	49	149	141	51	79	79	X	26	172	172	130	153	168	148	92	165	115
EMERGENCY BUS E2	5175	591	413	943	197	891	1553	812	682	115	139	128	780	109	243	130	1661	1350	1376	754	185	1124	475
DC BAT CHG B/B1	5235	780	498	1539	214	1447	4277	1217	946	118	147	140	1146	114	270	153	1350	5207	2998	1100	201	2173	613
AIR COMP B	6135	771	311	1266	210	1476	4547	1122	966	88	148	141	1164	114	269	168	1376	2998	5611	324	201	2364	623
AIR COMP D	6135	531	178	582	185	788	1232	707	626	51	125	120	689	107	233	148	754	1100	324	1298	180	963	219
FIRE PUMP MOTOR	6175	166	150	189	107	187	205	183	175	77	67	64	181	74	120	92	185	201	201	180	207	197	161
DEEPWELL PUMP A	6270	698	446	1322	210	1138	2612	1088	798	119	142	136	740	112	262	165	1124	2173	2364	963	197	3458	14
DEEPWELL PUMP C	6270	316	286	520	169	515	673	482	235	105	78	76	471	100	202	115	475	613	623	219	161	14	693

Table 3. Matrix Showing Allowable Hours for Plant Configurations to Remain Non-Risk Significant (Delta CDP<1E-06)

Train A By Train B Matrix

Exceeding these allowed hours require PGM approval, review of non-quantifiable factors, contingency planning and PSA insights. X - Risk Significant Exceeds Maximum Instantaneous CDF of 1E-3 and SHOULD BE AVOIDED.		RPS CHANNEL B	RCS PZR PORV 455C	RCS BLOCK VALVES	RHR PUMP B	CVCS CHGP A	CVCS CHGP C	SI PUMP C	MFWP B	AFW MDP B	SW PUMP C	SW PUMP D	CCW PUMP C	EDG B	DSDG	DS BUS	EMERGENCY BUS E2	DC BAT CHG B/B1	AIR COMP B	AIR COMP D	FIRE PUMP MOTOR	DEEPWELL PUMP A	DEEPWELL PUMP C
		1080	2005	2005	2045	2060	2060	2080	3050	3065	4060	4060	4080	5095	5098	5114	5175	5235	6135	6135	6175	6270	6270
RPS CHANNEL A	1080	107	123	402	167	607	844	455	441	95	106	102	520	99	205	107	591	780	771	531	166	698	316
RCS PZR PORV 456	2005	123	259	447	160	407	509	400	119	65	118	114	341	119	177	127	414	498	311	178	150	446	286
RHR PUMP A	2045	134	141	128	X	153	165	150	135	70	79	77	149	21	105	85	152	162	160	145	93	160	135
CVCS CHGP B	2060	855	521	1790	220	764	1261	1368	1058	122	150	143	1304	110	248	83	1591	4577	4887	1255	205	2971	680
SI PUMP A	2080	326	320	268	155	405	498	X	349	99	117	112	378	23	182	128	398	475	477	373	148	454	298
S/G A PORV RV-1	3020	119	109	129	23	128	136	67	123	65	72	70	125	63	93	77	128	135	135	125	83	133	115
S/G B PORV RV-2	3020	119	109	129	23	128	136	67	123	65	72	70	125	63	93	77	128	135	135	125	83	133	115
S/G C PORV RV-3	3020	119	109	129	23	128	136	67	123	65	72	70	125	63	93	77	128	135	135	125	83	133	115
MFWP A	3050	380	116	382	163	603	833	535	88	96	129	124	544	102	214	144	183	479	779	533	168	670	378
AFW MDP A	3065	78	64	92	69	97	101	95	85	10	61	59	95	22	75	63	17	27	98	89	68	100	89
AFW SDP	3065	71	36	75	62	97	97	88	60	10	43	42	92	12	146	110	75	86	90	76	66	96	86
SW PUMP A	4060	638	437	1068	202	951	1951	909	749	117	97	70	868	67	241	100	661	1641	1679	708	124	1222	506
SW PUMP B	4060	638	437	1068	202	966	1951	909	748	117	97	71	868	63	234	99	661	1641	1679	708	124	1222	506
CCW PUMP A	4080	508	337	619	190	217	1216	712	610	113	136	130	18	96	215	172	711	1089	1092	671	180	721	462
CCW PUMP B	4080	519	337	589	192	806	1276	733	625	113	136	130	20	86	176	X	729	1137	1162	689	181	710	470
EDG A	5095	154	152	140	71	129	175	94	162	40	47	39	146	X	31	27	150	183	182	166	99	181	127
EMERGENCY BUS E1	5175	793	499	1591	215	1493	4709	1226	927	94	25	25	1065	113	270	131	16	3234	3386	1127	150	2283	628
DC BAT CHG A/A1	5235	676	455	1196	198	1139	2379	837	283	21	34	34	868	111	257	136	996	48	1586	590	163	1628	82
AIR COMP A	6135	771	311	1266	210	1476	4547	1122	966	88	148	141	1164	114	269	168	1376	2998	5611	324	201	2364	623
AIR COMP PRIM	6135	568	172	738	186	1166	2500	976	817	113	144	137	963	112	258	163	908	1569	321	155	194	1612	583
FIRE PUMP DIESEL	6175	647	440	1104	203	1345	2018	923	758	117	137	92	882	92	264	165	998	1688	1729	854	17	1450	542
DEEPWELL PUMP B	6270	316	286	520	169	515	673	482	235	105	78	76	471	100	202	115	475	613	623	219	161	14	14

ATTACHMENT 10.3
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Emergent Work Checklist

1. All Technical Specification Limiting Conditions for Operations (LCO)
2. Load threatening conditions
3. Items causing loss of megawatts (>1MWe)
4. Items affecting personnel safety
5. Items which impede critical path work
6. Regulatory Items
7. Security Compensatory Posts
8. Operation hardships (e.g., requiring manning a position due to equipment out of service)
9. Fire Protection Equipment failures which render a major component out of service
10. Equipment-out-of-service which could lead to a LCO (e.g., one of three charging pumps out of service)
11. Items preventing Liquid or Gas Releases
12. Operations concerns which are brought to managements attention and are not resolved in a timely manner
13. All AC/DC grounds which are not identified or isolated
14. Annunciator Grounds