COMANCHE PEAK NUCLEAR POWER PLANT

STATION ADMINISTRATION MANUAL

QUALITY RELATED

MAINTENANCE EFFECTIVENESS MONITORING PROGRAM

PROCEDURE NO. STA-744

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PREPARED BY (Print):	Jim Mercer	EXT.	5314
TECHNICAL REVIEW BY (Print):	Chris Miller	EXT.	0663
APPROVED BY:	D. C. Kross	DATE:	02/13/09
	PLANT MANAGER		

1.0 PURPOSE

The purpose of this procedure is to assess maintenance activity effectiveness and impact on safe, reliable plant performance as a basis for making necessary improvements.

1.1 Attachments/Forms

The attachments/forms listed below do not require SORC approval when being modified and issued per STA-202:

- Attachment 8.A "Scope of SSCs in the Maintenance Rule Program"
- Attachment 8.B "Maintenance Effectiveness Monitoring Guide"
- Attachment 8.C "Functional Failure Guide
- Attachment 8.D "Goal Setting and Monitoring"
- Attachment 8.E "Performance Criteria Guide"
- Attachment 8.F "Maintenance Rule Review Panel"
- Attachment 8.G "Periodic A3 Maintenance Effectiveness Assessment Guide"
- Attachment 8.H "Structural Monitoring Inspection Guide"
- STA-744-1 "System,/Train Level Performance Criteria Worksheet"
- STA-744-2 "Structural Monitoring Area Inspection Form"
- STA-744-3 "Structure Inspection Checklist"
- STA-744-4 "Vertical Tanks Inspection Checklist"
- STA-744-5 "Component Supports Inspection Checklist"
- STA-744-6 "Door Inspection Checklist"
- STA-744-7 "Structural Monitoring Area Walkdown Form"

2.0 APPLICABILITY

2.1 This procedure applies to all structures, systems, and components (SSC) within the scope of the Maintenance Rule for CPNPP Units 1 and 2.

2.2 This procedure applies to review of industry and CPNPP experience on SSCs not within the scope of the Maintenance Rule to identify the need for scoping adjustments.

3.0 REFERENCES

3.1 STA-206 "Review of Vendor Documents and Vendor Technical Manuals"

3.2 STA-309, "Master Equipment List"

3.3 STA-421 "Initiation of SmartForms"

3.4 STA-422 "Processing SmartForms"

3.5 STA-606 "Control of Maintenance and Work Activities"

3.6 STA-627 "Control of Planned Outages"

3.7 WCI-203 "Weekly Surveillances/Work Scheduling"

3.8 WCI-606 "Work Control Process"

3.9 WCI-608 "Work Order Closure"

3.10 STA-426 "Industry Operating Experience Program"

3.11 NUMARC 93-01 "Industry Guideline for Monitoring the Effectiveness of Maintenance at Nuclear Power Plants"

3.12 10CFR50.65 "Requirements for Monitoring the Effectiveness of Maintenance at Nuclear Power Plants"

3.13 Regulatory Guide 1.160 "Monitoring the Effectiveness of Maintenance at Nuclear Power Plants"

3.14 INPO 98-001 "Equipment Performance and Information Exchange System (EPIX) Reporting Requirements"

3.15 Reg. Guide 1.182, "Assessing & Managing Risk Before Maintenance Activities at Nuclear Power Plants"

3.16 CPNPP Commitments:

CDF-REG-03171 "Participation in EPIX"

CDF-REG-03173 "Future Changes Recommended by INPO or EPIX Users Group"

CDF-REG-03174 "Procedures are being developed for the prep. & transmittal of EPIX"

CDF-REG-07336 "Test Intervals"

CDF-REG-23900 "AIT/AFW (ENF.CONF.): System Engineering Resp (SDAR-CP-89-15)"

CDF-REG-26852 "Early Implementation of Main Rule on EDG and Support Systems"

CDF-REG-18061 "Vendor Interface Program"

CDF-REG-26173 "CPSES Maintenance and Surveillance Program (FSAR)"

4.0 DEFINITIONS/ACRONYMS

4.1 Action level criteria - Maintenance Rule criteria set lower than the Performance criteria to call attention to a developing trend.

4.2 Equipment Performance and Information Exchange System (EPIX) - An Institute of Nuclear Power Operations (INPO) industry-wide data system designed to share failure and reliability data along with operating experience on components that are important to Nuclear Plant safety and reliability.

4.3 Event - A Maintenance Rule database record describing a possible equipment unavailability or failure. Event sources include SmartForms, Work Orders, LCOARs and clearances.

4.4 Functional Failure - A failure of a structure, system, or component such that a system or train is not capable of performing its intended function(s). Function refers to the function(s) of a system or train causing that system or train to be included in the scope of the Maintenance Rule. The Functional Failure Guide, Attachment 8.C provides examples and guidance for determining functional failures.

4.5 Goal - The end objective toward which effort to improve performance is directed when an SSC provides unsatisfactory performance. Goals are typically established to determine effectiveness of corrective actions.

4.6 Maintenance - The aggregate of those functions required to preserve or restore safety, reliability, and availability of plant structures, systems, and components. Maintenance includes not only activities traditionally associated with identifying and correcting actual or potential degraded conditions (i.e., repair, surveillance, diagnostic examinations and preventive measures) but extends to all supporting functions for the conduct of these activities.. Supporting functions include functions such as maintenance scheduling, procedure preparation, training and preventive maintenance activity identification.

4.7 Maintenance Preventable Functional Failure (MPFF) - A functional failure where the failure cause is attributable to maintenance or lack thereof.

4.8 Maintenance Rule Review Panel (MRRP) - A group of individuals knowledgeable in plant operations, design, risk analysis, and maintenance. The experience and knowledge of these individuals are utilized as expert opinions.

4.9 MRule Manager - A web based software tool (referred throughout as the Maintenance Rule Database) used to manage aspects of the Maintenance Rule (10CFR50.65). This includes system, structure and component (SSC) scoping, monitoring against specific performance criteria, and programmatic reporting. MRule Manager also has the capability to monitor and trend user defined performance parameters including equipment condition data.

4.10 Master Equipment List (MEL) - A computer database which uniquely identifies permanent plant equipment , components, and subcomponent-related information based upon the current configuration of the plant.

4.11 Performance Criteria - The standard against which performance is measured for Maintenance Rule structures, systems, and components. Performance criteria should correspond to necessary performance of system/train functions in the scope of the Maintenance Rule.

4.12 Probabilistic Safety Assessment (PSA) - A Probabilistic model created to assess nuclear power plant risks. Probabilistic Risk Analysis (PRA) and Individual Plant Examination (IPE) are terms used interchangeably with PSA in the nuclear industry.

4.13 Repeat Functional Failure - A subsequent loss of function attributable to the same cause that has previously occurred. A second or subsequent loss of function that results from a different cause is not considered a repeat FF. Similar to a Repetitive MPFF, except not necessarily maintenance preventable. Used with certain component level reliability criteria.

4.14 Repetitive MPFF (RMPFF) - A subsequent loss of function attributable to the same maintenance related "Direct Cause" and "Basic Cause" that occurred on the same component TYPE within the past 24 months. A second or subsequent loss of function that results from a different maintenance related "Direct/Basic Cause" is not considered a repetitive MPFF.

- Basic Cause - Cause description used to assist in narrowing the cause of an error. An example of a basic cause is "Procedure Followed Incorrectly". More than one basic cause may be associated with an event.

- Direct Cause - the final action, equipment failure or malfunction that caused the event to occur, e.g., a pump failed to start due to a loose wire caused by improper installation; a valve failed to open due to high torque caused by lack of lubrication. Typically, the direct cause is the one action that, had it not occurred, the event would not have occurred.

4.15 Required Operational Hours - The number of hours that the SSC serves a safety function. Determination of required operational hours should include consideration that an SSC may be used for establishment of backup success paths or compensatory measures. Required operational hours may include times beyond those for which SSC operability is required by Technical Specifications.

4.16 Risk Assessment Matrix - A pre-analyzed list of system combinations for simultaneous removal from service that addresses cumulative effects on plant risk. The Risk Assessment Matrix is used to evaluate the risk impact of scheduled and emergent work activities.

4.17 Risk Significant SSCs - Those SSCs that are significant contributors to risk as determined by PSA and expert opinion methods.

4.18 Standby Function - A standby function is one that is not operating and only performs its intended function when initiated by either an automatic or manual demand signal. Being in standby during certain plant modes and in operation during other plant modes is possible for a function.

4.19 Structures, Systems and Components (SSC) - Portions of a nuclear power plant considered for inclusion in the Maintenance Rule.

4.20 Unavailability - The time an SSC is not capable of performing its intended function, as a fraction of the total time the function is required, whether the unavailability is planned (e.g., for maintenance) or results from a failure.

4.21 Unit Cycle Maintenance Plan (UCMP) - A scheduling plan with designated work windows containing pre-determined unavailability durations.

4.22 Vendor Equipment Technical Information Program (VETIP) - A program developed by the Nuclear Utility Task Action Committee (NUTAC) in response to the concerns on vendor information and interface addressed in Section 2.2.2 of Generic Letter 83-28, "Required Actions Based on Generic Implications of Salem ATWS Events".

5.0 RESPONSIBILITIES

5.1 Director, Site Engineering

Responsible for:

- Maintaining this procedure current
- Approving Required Periodic Maintenance Effectiveness Assessment
- Approving members of the Maintenance Rule Review Panel
- Designating an EPIX and Maintenance Rule Coordinator

5.2 Manager, System Engineering

Responsible for:

- SSC scope and performance criteria
- Ensuring work request, work orders and CAP documents are reviewed to identify functional failures and maintenance preventable functional failures
- Ensuring SSC performance is assessed to identify trends and actions needed
- Maintaining and providing technical directions in Attachment 8.H, "Structural Monitoring Inspection Guide"

5.3 Manager, Westinghouse Engineering Services - Texas

Responsible for:

- Identification of PSA changes that potentially affect risk significance and performance criteria determinations
- Performing risk assessment reviews of the Unit Cycle Maintenance Plan (UCMP) and the Risk Assessment Matrix
- Performing risk assessment reviews of work scenarios not covered by the UCMP or Risk Assessment Matrix

5.4 Maintenance Rule Review Panel

Responsible for:

- Program oversight & approvals per Attachment 8.F, "Maintenance Rule Review Panel" including:
- Review and approval of Maintenance Rule system function scoping
- Review and approval of Maintenance Rule performance criteria
- Maintenance Rule risk significance determinations
- Review and approval of Maintenance Rule goals and the transition between (a)(1) and (a)(2) and vise versa
- Review of Maintenance Rule periodic assessments

5.5 Responsible Work Organizations

Responsible for:

- Identification of component failures addressed on work orders, work request, and/or SmartForms

5.6 Director, Operations

Responsible for:

- Recording inoperability data used for unavailability determinations for risk significant and standby Maintenance Rule systems
- Assuring the risk impact of emergent work is assessed

5.7 Manager, Work Control / Outage

Responsible for:

- Considering reliability, availability and other performance criteria when making work scheduling decisions affecting plant, system, train or component performance for SSCs within the scope of the Maintenance Rule

- Performing evaluations of work schedules using risk assessment guidance of the Unit Cycle Maintenance Plan, Risk Assessment Matrix and reviews by the Risk and Reliability Group for SSCs within the scope of the Maintenance Rule

- Specifying actions for cases where plant work activities produce a negative impact on risk

- Assessing the total effect on safety caused by equipment removed from service for SSCs within the scope of the Maintenance Rule per WCI-203

5.8 EPIX Coordinator

Responsible for:

- Developing, maintaining, and monitoring for completeness, quality and timeliness of the EPIX component failure and reliability data reportable under INPO 98-001

- Evaluation of changes to techniques or procedures recommended by INPO to EPIX or the Consolidated Data Entry (CDE) System for incorporation as appropriate

- Producing and distributing EPIX based reports to support user needs

- Serve as the utility administrative interface with INPO on EPIX related matters

5.9 Maintenance Rule Coordinator

Responsible for:

- Assisting system engineers in establishing and changing performance criteria and action levels for (a)(2) SSC's
- Administration of the Maintenance Rule database
- Assisting system engineers with the establishment of (a)(1) goals for monitoring the effectiveness of corrective actions in the restoration of acceptable performance
- Teaming with responsible system engineers to prepare input to the System Health Report
- Collecting and forwarding requests for scoping, performance criteria and risk significance changes to the MRRP for review and approval
- Facilitating Maintenance Rule Review Panel meetings, including agendas, minutes and action items
- Participating in Maintenance Rule related industry activities
- Monitoring Plant Level Performance Criteria
- Preparing Program Health Reports

5.10 System Engineer

Responsible for:

- Ensuring SmartForms exist to document MPFF's and performance that has exceeded the performance criteria

- Tracking/Dispositioning all MPFF related SmartForms for his/her system(s)/train(s) to assure completion of a cause analysis and that a repetitive MPFF determination is made

- Ensuring repetitive MPFFs are evaluated on a SmartForm to determine why previous corrective actions did not correct the problem

- Reviewing potential Functional Failure and Unavailability events via the Maintenance Rule Software

- Processing Maintenance Rule database reports and reviewing the report data to detect system performance anomalies

- Identifying needed system function scope changes, potential risk significance changes and needed train and component performance criteria changes (includes initiation of new "Draft Performance Criteria in the Maintenance Rule database)

- Presenting requested scoping and performance criteria changes to the Expert Panel

- Processing SmartForms for required scoping and performance criteria changes

- Assuring correct Maintenance Rule tag/system scoping assignment in the MAXIMO MEL

5.11 System Engineering SMART Team Manager

Responsible for:

- Ensuring that inspection of buildings and structures are performed per Attachment 8.H, "Structural Monitoring Inspection Guide", and in a satisfactory and timely manner.

6.0 INSTRUCTIONS

6.1 General

6.1.1 Maintenance Rule structure, system and component (SSC) scoping, risk significance and performance criteria development should be consistent with NUMARC 93-01, and shall comply with Regulatory Guide 1.160 and 10CFR50.65.

6.1.1.1 Exceptions to NUMARC 93-01 shall be approved via SmartForm EVAL & documented in procedure & guides.

6.1.2 The CPNPP Master Equipment List (MEL) should be used to identify component tags considered potentially within the scope of the Maintenance Rule.

6.1.3 Monitoring guidance is provided in the Maintenance Effectiveness Monitoring Guide, Attachment 8.B.

6.2 Monitoring of Functional Failures (FF)

6.2.1 Equipment failures should be identified at the component tag level by responsible work organizations for entry into the maintenance management database in compliance with STA-606, WCI-606 and WCI-608.

6.2.2 Work Orders, Work Request and SmartForms involving equipment failures should be reviewed by System Engineering to identify system/train functional failures within the scope of the Maintenance Rule and which of those functional failures constitute MPFFs and RMPFFs.

6.2.2.1 The system function database should be used to help identify component failures which result in a system/train functional failure.

6.2.2.2 Functional failures should be identified in the Maintenance Rule computer software and a determination made to identify MPFFs and RMPFF's as described in the Functional Failure Guide, Attachment 8.C.

NOTE: Maintenance Preventable Functional Failures (and repetitive MPFF) examples are provided in the Functional Failure Guide, Attachment 8.C.

6.2.2.3 System Engineering shall ensure identified MPFFs are documented on a SmartForm. If a SmartForm already exists for the failure, System Engineering may choose to add an activity for the identified MPFF to that existing SmartForm in lieu of initiating a new SmartForm.

6.2.2.4 The organization assigned the SmartForm activity for the MPFF shall ensure a cause analysis is performed per STA-422 and necessary corrective actions are identified and implemented.

6.2.3 The organization assigned the SmartForm activity for a MPFF should ensure necessary corrective actions are complete for the MPFFs.

6.2.4 The organization assigned the SmartForm activity for a MPFF should ensure a determination is performed as to whether a MPFF is a repetitive MPFF as defined in the Functional Failure Guide, Attachment 8.C. As part of the cause analysis, the organization responsible for the SmartForm activity for a MPFF should include an evaluation as to why the previous corrective actions failed to prevent repetition and identify appropriate corrective actions.

6.2.5 Maintenance Rule functional failures and MPFFs information shall be entered into the INPO EPIX program by personnel trained in EPIX reporting, under the supervision of the EPIX Coordinator, in accordance with the reporting requirements of INPO 98-001.

6.3 Monitoring Against Performance Criteria

NOTE: This section provides monitoring consistent with 10CFR50.65 paragraph (a)(2).

NOTE: Performance criteria guidance is provided in the Performance Criteria Guide, Attachment 8.E.

6.3.1 Operations shall record SSC out of service times to provide System Engineering with operability data needed to determine unavailability time.

6.3.2 System Engineering should trend and assess plant, system, train and component level performance criteria data and:

- Recommend actions which will result in cost effective improvements to performance including such things as PM program changes, design changes, maintenance practice changes, and operating practice changes
- Identify trends along with recommended actions to prevent exceeding performance criteria

6.3.3 System Engineering should ensure plant, system, train and component level performance monitoring results are available to management.

6.3.4 Work Control and responsible work organizations should consider reliability, availability and other performance criteria when making work scheduling decisions that affect plant, system, train or component performance.

6.3.5 If a plant, system, train or component performance value is not consistent with corresponding established performance criteria, then System Engineering should make a determination of whether the performance criteria was exceeded, and identify the cause(s). If that determination reveals that one or more performance criteria were not met, then System Engineering should initiate a SmartForm/ SmartForm activity to document goal setting and monitoring.

6.3.6 In addition to monitoring system performance through performance criteria, System Engineering should trend or monitor system and equipment performance through the System Health process to identify and address potential precursors to performance problems.

6.3.7 For systems whose maintenance rule reliability performance criteria is less than 1 functional failure and whose performance has been categorized as "red" in System Health, the System Engineer should determine whether that performance warrants a classification of (a)(1) in the Maintenance Rule.

6.4 Goal Setting and Monitoring

NOTE: This section provides monitoring consistent with 10CFR50.65 paragraph (a)(1).

NOTE: Goals are established for use when monitoring progress of the corrective actions taken to bring about necessary improvements in maintenance program effectiveness. Goal setting guidance is addressed in "Goal Setting and Monitoring", Attachment 8.D.

NOTE: Completing the "Goal Setting and Monitoring" Evaluation and Obtaining MRRP approval should be timely and generally should be completed within 90 days from the designation of (a)(1) status.

6.4.1 System Engineering should establish performance goals on SmartForms/SmartForm activities that address conditions which exceed established Maintenance Rule Performance criteria. A goal record should be initiated in the Maintenenace Rule Database to track the (a)(1) Status Record

6.4.2 If the need for a goal is identified in Step 6.4.1, but is later determined to be not applicable, then justification should be documented on a SmartForm activity and approved by the Maintenance Rule Review Panel.

NOTE: Maintenance Rule Review Panel approval in situations where goals are not applicable ensures the justification is adequate and consistent with program requirements.

6.4.3 Goal setting or modification:

6.4.3.1 Shall be established commensurate with safety and, where practical, take into account industry-wide operating experience

6.4.3.2 Should be approved by the Maintenance Rule Review Panel

6.4.3.3 Goal monitoring duration should have the reason or basis documented

6.4.3.4 (a)(1) Goal Record in the Maintenance Rule Database should be updated by the Maintenance Rule Coordinator as corrective Action and monitoring status changes.

6.4.4 Performance should be monitored against the goal(s) and corrective actions assessed for effectiveness by System Engineering in a manner that provides documentation and a means of recognizing performance trends so progress toward satisfactory performance can be tracked.

> NOTE: A negative trend is deemed to exist when the monitoring and assessments indicate corrective actions established are/will be ineffective in achieving the goal in question.

6.4.5 System Engineering should ensure appropriate actions are taken when negative trends toward goals are observed.

6.4.6 If a goal is not met or becomes unachievable, then a SmartForm or SmartForm activity shall be initiated to have the responsible organization determine why and identify corrective actions including determining if goals need to be modified.

NOTE: In many cases, a goal will be based upon the normal performance criteria already applied to the system. When a "surveillance period" is used, it should correspond with a surveillance test that would detect failures causing the goal to be established.

6.4.7 System Engineering should consider a goal to be met and may discontinue monitoring performance against that goal if any of the following criteria are satisfied:

- Performance relative to the goal is acceptable for three surveillance periods where the surveillance periodicity is equal to or less than a six month interval;
- Performance relative to the goal is acceptable for two successive surveillances where the surveillance periodicity is greater than six months but no greater than two fuel cycles; or
- Performance meets acceptance criteria specified when the goal was originally created.
- An approved and documented evaluation is completed that concludes the cause which resulted in establishment of goals is known and eliminated and thus monitoring against goals is unnecessary.

6.4.8 If any of the conditions above are met, then the Maintenance Rule Review Panel may approve return of the SSC to the standard (a)(2) performance criteria monitoring.

6.5 Periodic Maintenance Effectiveness Assessments

6.5.1 A Maintenance Effectiveness Assessment shall be performed by System Engineering approximately once every refueling cycle, but not to exceed 24 months. The various areas to be assessed may be assessed individually or collectively, together or separately in time. The assessment shall include:

6.5.1.1 Evaluating each goal for its continued applicability for the subject SSCs.

6.5.1.2 Evaluating thc performance of SSCs subject to goals and associated monitoring to determine how effective corrective actions have been in improving performance.

6.5.1.3 Evaluating performance of SSCs subject to performance criteria only. The evaluation should identify the need for adjustments/improvements to SSC performance and performance criteria and the effectiveness of any corrective actions taken for MPFFs or adverse performance trends.

6.5.1.4 Evaluating ongoing Industry Operating Experience Report reviews to determine if appropriate maintenance and monitoring program adjustments were identified and implemented.

6.5.1.5 Evaluating the effectiveness of maintenance program actions initiated to optimize availability and reliability. (Reference Section 6.6.2)

6.5.1.6 Evaluating maintenance of Maintenance Rule SSC Scope. (Reference Section 6.3.2)

6.5.1.7 Evaluating the effectiveness of maintenance scheduling activities in managing the overall impact of maintenance activities on risk.

6.5.2 The Periodic A3 Maintenance Effectiveness Assessment Guide, Attachment 8.G should be referenced for details.

6.6 <u>SSC Scope, Performance Criteria and Risk Significance Changes</u>

<u>NOTE</u>:	The scope of SSCs within the Maintenance Rule is described in Attachment 8.A. Performance criteria is addressed in the Performance Criteria Guide, Attachment 8.E.

6.6.1 Performance criteria shall be established per Attachment 8.E, Performance Criteria Guide

6.6.2 System Engineering should identify needed system function scope and potential risk significance changes and system, train and component performance criteria changes. Identification should be accomplished through:

- Industry Operating Experience Report reviews
- Design Modification reviews
- Emergency Operating Procedure change reviews
- Review of SmartForms for failures of SSCs outside of the scope of the Maintenance Rule which prevent the performance of safety related functions or cause scrams or safety system actuations
- Periodic assessments per Section 6.5
- Review of Design Basis Document changes
- Review of FSAR changes

NOTE: The evaluation process for proposed changed to performance criteria always consider the balance of unavailability and reliability.

6.6.2.1 System Engineering should initiate and process a SmartForm for documenting scoping and performance criteria changes per Attachment 8.E, Performance Criteria Guide.

6.6.2.2 System Engineering should forward proposed risk significance, scoping and performance criteria changes to the Maintenance Rule Review Panel for review and approval.

6.6.2.3 Short-Term Supplemental Performance Criteria

Additional or "supplemental" unavailability Performance Criteria may be established to monitor the effectiveness of one-time or rarely occurring maintenance activities. Such criteria shall be established per Attachment 8.E, "Performance Criteria Guide" and approved by the Maintenance Rule Review Panel.

NOTE: Supplementing the normal Performance Criteria for unavailability should be an infrequent situation and is not intended to permit exceeding the established unavailability Performance Criteria.

6.6.3 Maintenance Rule performance criteria and system function scoping data base changes should be reviewed and approved by the Maintenance Rule Review Panel and accomplished using a SmartForm.

6.6.3.1 Changes should be reviewed by System Engineering to:

- Verify compliance with requirements and commitments
- Ensure programmatic acceptability
- Ensure potential risk significance changes are identified per Step 6.6.2.2
- Ensure adequate performance criteria and data exists for scope changes
- Ensure performance criteria changes are evaluated to ensure parameters and values have adequate basis including consistency with PSA assumptions

6.6.4 The Maintenance Rule Review Panel should accomplish system function risk significance determinations:

6.6.4.1 Risk and Reliability should identify Probabilistic Safety Assessment (PSA) changes that potentially affect risk significance determinations.

6.6.4.2 The Maintenance Rule Review Panel should assess risk significance determinations to identify changes needed. The following issues should be assessed in the determination process:

- Scoping changes that potentially affect risk significance
- Modifications that potentially affect risk significance
- PSA changes that potentially affect risk significance
- CPNPP operating experience that potentially affects risk significance

(6.6.4.2 continued)

- CPNPP system performance that potentially affects risk significance
- Industry Operating Experience that potentially affects risk significance
- Changes proposed by System Engineering

6.6.4.3 The computer database used to track risk significant system functions should be updated by Engineering to reflect approved Maintenance Rule risk significance determination changes.

6.7 Evaluation of Equipment to be Removed From Service

6.7.1 Work Control shall assess the total effect on safety caused by removing equipment from service during plant operations per WCI-203. The assessment should be accomplished by:

6.7.1.1 Reviewing work, testing and schedules to ensure the accomplishment will:

- Maintain or increase reliability;
- Maintain system/train availability and other Maintenance Rule performance parameters within performance criteria and goals;
- Result in acceptable risk as determined through risk assessment guidance (risk categories in terms of core damage frequency and containment integrity) of the Risk Assessment Matrix and reviews by the Risk and Reliability Group.

6.7.1.2 Specifying and taking actions for cases where plant work activities produce a negative impact on risk.

6.7.2 The Risk and Reliability Group should:

- Perform risk assessment reviews of the Unit Cycle Maintenance Plan (UCMP) and the Risk Assessment Matrix relative to Probabilistic Safety Assessment (PSA) results and assumptions;

- Perform risk assessment reviews relative to PSA results and assumptions when Work Control identifies work scenarios not covered by the UCMP or Risk Assessment Matrix.

6.7.3 Operations should assure the risk impact of emergent work is assessed.

6.7.4 Evaluations of SSC's to be removed from service during outage conditions should be conducted per STA-627 "Control of Planned Outages".

6.8 Structural Monitoring

6.8.1 Structural Monitoring shall be conducted per Attachment 8.H, Structural Monitoring Inspection Guide

7.0 FIGURES

None

8.0 ATTACHMENTS/FORMS

8.1 Attachments

Attachment 8.A	"Scope of SSCs in the Maintenance Rule Program"
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Attachment 8.H,	"Structural Monitoring Inspection Guide"

8.2 Forms

STA-744-1	System/Train Level Performance Criteria Worksheet
STA-744-2	Structural Monitoring Area Inspection Form
STA-744-3	Structure Inspection Checklist
STA-744-4	Vertical Tanks inspection Checklist
STA-744-5	Component Supports Inspection Checklist
STA-744-6	Door Inspection Checklist
STA-744-7	Structural Monitoring Area Walkdown Form

9.0 RECORDS

None

ATTACHMENT 8.A
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SCOPE OF SSCs IN THE MAINTENANCE RULE PROGRAM

Maintenance Rule scoping at CPNPP has been performed and is maintained at the system function level by performing an assessment of system functions using the criteria below. All SSCs within the scope of the Maintenance Rule are encompassed by system functions which have been input to the system function database.

Structures, Systems and Components are within the scope of the Maintenance Rule if they are:

(a) Safety-related SSCs relied upon to remain functional during and following design basis events; or

(b) Nonsafety-related SSCs relied upon to mitigate accidents or transients as described in the CPNPP FSAR; or

(c) Nonsafety-related SSCs that are used in Emergency Operating Procedures and provide significant value to accident mitigating functions; or

(d) Nonsafety-related SSCs whose failure prevents safety-related SSCs from fulfilling their safety-related function; or

(e) Nonsafety-related SSCs whose failure causes scrams or actuates safety systems.

Note: The determination of hypothetical failures that could result from system interdependencies but have not been previously experienced or received prior engineering evaluation is not required in (d) and (e) above.

Note: Refer to NUMARC 93-01 and Regulatory Guide 1.160. (Scoping as approved by the baseline NRC inspection demonstrates acceptable application of these documents.)

MAINTENANCE EFFECTIVENESS MONITORING GUIDE

1.0 PURPOSE

The purpose of this guide is to provide information, guidance and instructions to assist the system engineer in the implementation of the Maintenance Effectiveness Monitoring Program (MEMP) monitoring requirements.

2.0 INSTRUCTIONS AND INFORMATION

2.1 Monitoring Data

2.1.1 Events requiring monitoring are automatically imported into the Maintenance Rule database.

2.1.2 The Maintenance Rule Coordinator or designee should produce any special monthly reports necessary to monitor review backlogs and support the review process. Support reports include those to support monitoring of pseudo systems such as Containment Isolation and the Westinghouse 7300 system.

2.2 Event Review

2.2.1 System Engineer should review events in Maintenance Rule database to identify system functional failures, maintenance preventable functional failures and unavailability using the Functional Failure Guide, Attachment 8.C. It is recommended that these reviews be performed promptly to insure Maintenance Rule status of SSC's and systems functions is known.

MAINTENANCE EFFECTIVENESS MONITORING GUIDE

2.2.2 Prepare and submit a SmartForm using STA-421 for each MPFF identified (Note: If a SmartForm already exists for the failure, the existing SmartForm can be used to allow for cause determination).

The System Engineer is responsible for tracking all MPFF related SmartForms for his/her system(s)/train(s). The engineer should also ensure that a cause analysis is performed for each MPFF and that a repetitive MPFF determination is made.

If the MPFF is repetitive, the system engineer should contact the organization responsible for the cause analysis and ensure an evaluation is performed to determine why the previous corrective actions failed to prevent repetition. The system engineer should assign goals with assistance from the Maintenance Rule Coordinator if the MPFF is repetitive.

The system engineer is also responsible for insuring that corrective actions prompted by the SmartForm are completed in a timely manner.

<u>NOTE</u>: 1) Containment isolation functional failures are monitored in the pseudo containment isolation system, CZ.

2) Some breaker and electrical isolation failures are identified in their MEL scoped system but monitored in the system that supplies the power. These and similar situations are identified in the system scoping and performance criteria.

2.3 Monitoring System Performance Against Performance Criteria

Performance Criterion Action Levels are established for function sets to provide a warning to prevent exceeding the performance criteria.

MAINTENANCE EFFECTIVENESS MONITORING GUIDE

Conscientious maintenance of a current Maintenance Rule database by the system engineer will provide up-to-date reports that can be used to determine the status of a system's health by comparing current performance with the predetermined performance criteria and action levels. The system engineer can use the comparison as a basis for recommending corrective actions to prevent exceeding action levels or performance criteria. Instructions for producing Maintenance Rule reports are contained in the Mrule Manager User's Guide.

The system engineer should also trend the results of appropriate predictive maintenance, preventive maintenance, surveillance and calibrations of equipment impacting System Health functions in each system to identify potential precursors to performance problems.

If a performance criteria is exceeded, the system engineer should determine the cause and initiate a SmartForm to determine corrective actions and set goals per STA-744 Section 6.4 and Attachment 8.D, Goal Setting and Monitoring.

2.4 Goal Setting or Modification

Guidelines for setting and modifying MR goals are provided in STA-744 and Attachment 8.D "Goal Setting and Monitoring".

The system engineer should establish the goals on a SmartForm evaluation and obtain concurrence from the Maintenance Rule Review Panel. The same process should be utilized to modify goals. The goals should be used to monitor the effectiveness of corrective actions that will be taken to restore acceptable performance.

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2.5 Goal Monitoring

2.5.1 The Maintenance Rule Coordinator should insure the information associated with goals and their status in the Maintenance Rule (a)(1) area of the Maintenance Rule database is updated to reflect current status.

2.5.2 The system engineer should ensure that appropriate actions are taken when negative trends away from established goals for his/her system(s)/train(s) are observed by:

- • Informing the MRule Coordinator and System Engineering Management if it is apparent the goals cannot be accomplished

- • Initiate "Goal Setting and Monitoring Evaluation" changes and process through the MRRP for change approval.

2.5.3 If an established goal is not met or becomes unachievable, then a SmartForm shall be initiated to have the responsible organization determine why and identify corrective actions including determining if goals need to be modified.

2.6 Goal Removal

Conditions required for discontinuing monitoring and the removal of goals is given in STA-744, Section 6.4. Performance data (functional failures, unavailability, etc.) should not be altered or reset once goals are met.

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2.7 System Health Report

The entry of failure and unavailability data into the Maintenance Rule database will provide accurate reports that should be used as input to the System Health Report.

2.8 SSC Scope, Performance Criteria and Risk Significance

2.8.1 Review for needed changes:

The system engineer should identify needed system function scope, performance criteria and potential risk significant changes for his/her system(s)/train(s). Identification should be accomplished through:

- Industry Operating Experience Reviews (IOER's). The system engineer should review each IOER received from nuclear overview that is applicable to his/her system for scope impact. SSC's at CPNPP that have not been scoped within the Maintenance Rule (STA-744, section 6.6) may need to be placed in scope based upon experience with similar SSC's at other plants (e.g. have caused trips)

- Modification review process. Review modifications that affect the system for impact

- Review of Emergency Operating Procedure changes forwarded to the system engineer per ODA-204

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(2.8.1 continued)

- A review of SmartForms for failures of SSC's outside of the scope of the Maintenance Effectiveness Monitoring Program which prevent the performance of safety related functions or cause scrams or safety system actuations. This is accomplished by a review of the SmartForms in Lotus Notes and a review of the Maintenance Effectiveness Assessment (see STA-744, section 6.5) results

- A review of Design Basis Document changes for impact. Pay particular attention to system function changes that may affect scoping

- Review of applicable FSAR change notifications. Pay particular attention to system function changes that may affect scoping.

2.8.2 Review for MEL changes

Although defined in the MEL and discussed in the Maintenance Effectiveness Monitoring Program scoping files and DBD's, it is a part of the system engineer's responsibility to identify, negotiate, and redefine system boundaries for his or her systems as needed.

Needed changes to the MEL should be processed per STA-309, Master Equipment List.

2.8.3 Scoping and Performance Criteria Changes:

Required Maintenance Effectiveness Monitoring Program scoping and performance criteria changes will be made to the Maintenance Rule database by creating and processing a SmartForm to document the changes.

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2.8.4 Risk Significant Changes:

Risk significant changes should be forwarded to the Maintenance Rule Review Panel for review and approval. Approved changes will be made to the Maintenance Rule database by creating and processing a SmartForm to document the changes.

2.8.5 Change review:

The Maintenance Rule Coordinator should review all proposed changes to:

- Verify compliance with requirements and commitments such as 10 CFR 50.65, Reg Guide 1.160 and NUMARC 93-01.
- Verify programmatic acceptability by assuring that the changes meet the intent of STA-744 and that changes are consistent with other systems.
- Ensure potential risk significance changes (increase or decrease) that could affect the risk of core damage or release of radioactive material are identified.
- Ensure adequate performance criteria and data exists for scope changes and verify the SmartForm documentation includes adjustments to performance criteria and history reviews if needed.
- Ensure performance criteria changes are evaluated to ensure parameters and values have adequate basis including consistency with PRA assumptions.

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2.9 Management Interface

System performance, trending and goal status is reported to management through the respective system health report. For this reason the system engineer should assure an accurate and prompt monthly performance analysis review.

3.0 Unavailability Evaluations

> NOTE: Unavailability begins when an SSC is made or found to be unavailabile, unless a previous time can be identified when it is known to become unavailabl (e.g., found to have been incorrectly repaired on a known date). The counting of "fault recovery time" or half the time from discovery of a failure back to when the SSC was last verified operable, is not required for Maintenance Rule monitoring purposes. Unavailability ends when an SSC is restored to a condition in which it can perform its intended function - even if post-

3.1 Unavailability Considerations

Unavailability is considered in two cases:

A. Maintenance activities

Equipment out of service (e.g. tagged out) for corrective or preventive maintenance is considered unavailable.

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B. Testing

- SSCs out of service for testing are considered unavailable, unless the test configuration is automatically overridden by a valid starting signal, or the function can be promptly restored either by an operator in the control room or by a dedicated operator stationed locally for that purpose.

- Restoration actions must be contained in a written procedure, must be uncomplicated (a single action or a few simple actions), and must not require diagnosis or repair.

- Credit for a dedicated local operator can be taken only if (s)he is positioned at the proper location throughout the duration of the test for the purpose of restoration of the train should a valid demand occur.

- The intent is to allow licensees to take credit for restoration actions that are virtually certain to be successful (i.e., probability nearly equal to 1) during accident conditions.

FUNCTIONAL FAILURE GUIDE

1.0 PURPOSE

The purpose of this guide is to provide guidance for the determination of Functional Failures (FFs), Maintenance Preventable Functional Failures (MPFFs) and Repetitive Maintenance Preventable Functional Failures (RMPFFs).

2.0 FUNCTIONAL FAILURES

A Functional Failure is the failure of an SSC such that the system or train is not capable of performing its intended function(s). "Function" refers to the function(s) of a system/train causing that system/train to be included within the scope of the Maintenance Rule (10CFR50.65). Refer to Maintenance Rule Scoping Matrix for a complete listing of system functions identified as in-scope of the rule for CPNPP. In general, all unintended or unplanned failures or condition of an SSC within the scope of the maintenance rule that have caused or would have caused failure of a MR function should be considered a MRFF.

When a functional failure occurs during a test, the failure must be evaluated to determine whether the same functional failure would have occurred during a "true" demand (i.e., in the absence of the test conditions) if so, the failure would be considered a functional failure.

An SSC found failed as part of maintenance activities (e.g., during an outage), would be considered a functional failure, unless it can be shown that the failed condition occurred directly as part of the intended maintenance activity.

> NOTE: See Attachment 8.H, Section 11.0 for guidance on Functional Failure determination of structures and components.

> NOTE: Failures of SSC's may occur during all modes of plant operation. Each failure must be evaluated to determine if the failure could have occurred during a required operational mode, if so, the failure should be considered a Functional Failure.

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Examples of Functional Failures:

Event	Comments
A SI pump motor failed to start on demand due to bearing seizure caused by contaminated oil.	Safety injection system provides for the injection of borated water into the reactor coolant following a DBE. Loss of an SI pump results in the loss of one train of SI. For purposes of the Maintenance Rule SI is monitored at the train level. Thus failure of a SI pump to start is considered a "Functional Failure."
During shutdown operations, a RHR pump fails during operation due to degraded motor windings tripping the power supply breaker on overload.	RHR pumps are required for decay heat removal during shutdown operations. Loss of an RHR pump results in the loss of one train of RHR. For purposes of the Maintenance Rule, RHR is monitored at the train level. Thus failure of a RHR pump is considered a "Functional Failure."
During a routine surveillance test, a containment isolation valve closes in 10.9 seconds, failing the test.	The containment isolation valve is required to close within 10 seconds (per design requirements). Failure to do so would be considered a "Functional Failure." (Note: failure of IST requirements alone may not necessarily constitute a "FF").
An operator failed to re-open the SI pump discharge valve during removal of a clearance tag.	With the SI discharge valve closed, the train is inoperable. For purposes of the Maintenance Rule SI is monitored at the train level. Thus failure to "restore" system/train following maintenance activity is considered a "Functional Failure."
Lube oil analysis reveals bearing degradation that could lead to failure. Component remains in-service and subsequent bearing failure occurs.	Loss of the Main Turbine lube oil system results in a derate and possible plant trip. This would be considered a functional failure of the Lube oil bearing.

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Event	Comments
Dirty potentiometer in the EHC causes erratic control of the Main Turbine and a subsequent load reduction.	Failure of the potentiometer resulted in a derate. Since the EHC system is in-scope of the Maintenance Rule. This failure would be considered a "Functional Failure."
During outage maintenance activities, an SI hot leg injection path check valve is found "Stuck" closed.	The SI injection function requires two of two hot leg injection paths to be available. This would be considered a "Functional Failure."

Examples that are not Functional Failures:

Event	Comments
SI train fails a surveillance operability test due to low flow.	Subsequent engineering analysis demonstrates that the recorded flow rate would have met the system design requirements. Thus the train function was not lost, hence no "Functional Failure."
A diesel generator is leaking oil, and operations elects to declare it inoperable to allow for investigation.	Although the Diesel Generator was removed from service for troubleshooting. The Diesel Generator could have performed its intended function were it left in service, hence no "Functional Failure."
Lube oil analysis reveals bearing degradation that could lead to failure (if not corrected). Component is removed from service to replace bearing.	The bearing degradation was identified as part of routine preventative maintenance activities. Thus a potential in-service failure was avoided. This would not be considered a "Functional Failure."[1]

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Event	Comments
During a routine surveillance a Breaker closes in 2.5 seconds, failing the test.	The test procedure requires the breaker to close within a 3 to 5 second band. Engineering evaluation determines that this particular breaker is not sequenced, thus closure within a time shorter that the procedure is conservative, in this particular case failure of the surveillance would not be considered a "Functional Failure."
During scheduled preventative maintenance activities, a SI Motor-operated valve is determined to be "Stuck" in the open position.	The in-scope functions for the SI system require a flow-path from the RWST to the RCS. The valve has failed in the desired position, hence would not be considered a "Functional Failure." (Note: if the valve was also a Containment isolation (CZ) valve, although it is not a "FF" for the SI function, it would be considered an "FF" for the CZ function).
During outage maintenance activities, an SI cold leg injection path check valve is found to be "Stuck" closed.	The SI injection function (as modeled in the IPE) requires two of the four cold leg injection paths to be available. Although the check valve failed a single injection path, the failure did not result in the loss of a Maintenance Rule function (due to redundancy/diversity). This would not be considered a "Functional Failure."[1]
A valve fails its post maintenance stroke test.	Since the valve was never returned to service (declared operable by operations) following maintenance, this would not be considered a functional failure.

1 Although this is not considered a "Functional Failure" the system engineer should track these SSC failures to assure that they are not pre-cursors to subsequent generic problems.

FUNCTIONAL FAILURE GUIDE

3.0 MAINTENANCE PREVENTABLE FUNCTIONAL FAILURES (MPFFs)

An evaluation as to whether or not the failure was maintenance preventable is required. Maintenance Preventable Functional Failures (MPFFs) include any failures that result from; 1) any maintenance related error by personnel involved in the maintenance activity; 2) any error by operations (or other department) when performing/supporting maintenance type activities, e.g., greasing a motor, post maintenance activities, improperly positioning a valve, etc.; or 3) failure of maintenance activities to identify and ensure correction of degraded plant conditions.

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Examples of Maintenance Preventable Functional Failures:

Component	Direct Cause	Basic Cause
Failed Windings	The motor failed due to over greasing by a mechanic not referring to the applicable procedure.	"Failure to Follow Procedure" The procedure includes guidance for the volume of grease to be used.
Containment Hatch	Hatch Door seals leaked during testing due to lack of seal integrity caused by improper washers being installed on closure bolts.	"Personnel Error" and "Failure to Follow Procedure" The washers provided by the warehouse were flat washers. The procedure required compression belleville washers.
MOV	Failed to stroke due to high torque, caused by lack of gearbox lubrication.	"Inadequate PM" No PM existed to lubricate gearbox, despite vendor recommendations to do so.
Solenoid Valve	Air-operated valve failed monthly stroke test due to incorrect solenoid valve being installed.	"Failure to Follow Procedure" and "Inadequate Post Maintenance Testing" The procedure included the model number of the solenoid valve. Operations was required to perform post-maintenance testing to assure operability prior to returning to service.

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Component	Direct Cause	Basic Cause
SI System	One train of the SI system was left inoperable due to the discharge valve being left closed following restoration from a preventative maintenance activity.	"Improper Restoration Following Maintenance" The operator failed to follow the restoration procedure, resulting in this standby train being declared operable, when in fact it would not have performed its intended function if demanded.

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Examples that are not Maintenance Preventable Functional Failures:

Events that are not Maintenance Preventable Functional Failures include those that; 1) were caused in the process of operating the plant; 2) occurred during the repair process; 3) caused by inadequate design (assuming no prior knowledge); or 4) were attributable to external events that cannot be prevented or mitigated and are outside the design assumptions.

Component	Direct Cause	Basic Cause
Air Compressor Unloader	Compressor diaphragm failed due to fatigue with the exact cause not being known.	"Unknown" An evaluation of appropriate depth did not find the cause. No corrective action could be identified to prevent recurrence.
Pump	Fails to start on demand due to seized wear ring, caused by improper wear ring material.	"Procurement Error" In accordance with vendor documentation the correct wear ring was installed. Since no maintenance activities would have detected abnormal wear, this is not considered an MPFF. However, if the event should repeat, then it would be considered an MPFF (prior knowledge).

3.1 Functional losses that occur after an inadequate design has been identified require evaluation to determine if they are MPFFs. If reasonable mitigating corrective actions could have been taken, e.g., enhanced preventive maintenance that was not implemented, subsequent failures should normally be considered as MPFFs. If no effective mitigative actions can be taken to prevent recurrence, subsequent events are not MPFFs. Implementation of design changes is based on safety significance, capital budget, etc. It is assumed that the design change prioritization process is effective. Inadequacy in this process is not within the scope of the Maintenance Rule.

FUNCTIONAL FAILURE GUIDE

4.0 REPETITIVE-MPFFs

The decision making process for repetitive MPFFs must ensure problems are properly evaluated for corrective action. To be repetitive MPFF events must have: 1) occurred on the same type of components; 2) had the same direct cause; 3) had the same basic cause; and 4) occurred within the past 24 months. The basic premise of identifying repetitive MPFFs is that the action taken to correct the cause of the first MPFF was ineffective or not implemented in a timely fashion. The following examples demonstrate the decision making process:

4.1 A system functional failure occurs because of high torque on an MOV. This high torque was caused by lack of gearbox lubrication that was due to no preventive maintenance being performed. This is an MPFF. The direct cause is failure of the MOV to stroke due to lack of lubrication. The basic cause is "Inadequate Preventive Maintenance".

Within 24 months a subsequent system functional failure occurs due to inadequate lubrication of an MOV in another system. This event is repetitive because the corrective action after the first event, modification of the preventive maintenance program was not applied to other similar applications (similar MOVs in a similar environment requiring lubrication). An accurate definition of direct cause is necessary to limit the scope of repetitive events. Identification at the basic cause only, is too broad to normally be addressed by corrective action.

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The following table describes these events:

The Following are Repetitive Events

Event	Component Type	Direct Cause	Basic Cause
Loss of System Function	MOV	An MOV failed to stroke due to high torque, caused by lack of gearbox lubrication.	The basic cause is "Inadequate PM". (No PM to lubricate gearbox).
Loss of System Function (Within 24 months of previous event).	MOV	An MOV failed to stroke due to high torque, caused by lack of gearbox lubrication.	The basic cause is "Inadequate PM". (Not implementing PM to lubricate gearbox).

4.2 A system functional failure is caused by over torquing an Engineered Safeguards actuated pump control circuit terminal strip screws when lifting and landing leads during monthly surveillance testing. The direct cause is screws being stripped during surveillance testing. The basic cause could be "Inadequate Procedure" guidance to prevent over torquing. The basic cause might also be "Personnel Error", "Inadequate Training" or "Design (requiring leads to be lifted for testing)". Each of these basic causes is an MPFF.

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A Plant Design Change is being planned to install connectors so that leads are not lifted during testing. Within 24 months, a subsequent system functional failure occurs due to over torquing the same terminal screws. This event would be repetitive because the procedure identified in the first event had not been changed and/or notification of appropriate personnel ("Lessons Learned") was not effective. This event would not be repetitive if the procedure had been effectively changed and in the subsequent event, the worker had not followed the procedure, or used an out of date procedure that did not include the torquing requirement. Note that this subsequent event would also have been repetitive if it had occurred in another system with similar operating conditions, e.g., lifting of leads to perform surveillance.

Depending on the circumstances, the cause of the first failure could have been attributed to a design inadequacy. Leads should not have to be lifted to perform surveillance testing. Mitigative actions taken, expected to prevent recurrence, did not prevent recurrence. The subsequent events are MPFFs. If all practical maintenance related mitigative actions taken are not expected to prevent recurrence or an immediate design change is not justified, the events are not Maintenance Preventable.

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The Following are Repetitive Events

Event	Component Type	Direct Cause	Basic Cause
Loss of System Function	Terminal Strip Screws	The pump fails on demand due to a loose control circuit wire, caused by over torquing terminal screws during surveillance testing.	The basic cause is "Inadequate Procedure". A design inadequacy is recognized, but it is expected that a mitigative action of better procedural guidance would prevent over torquing.
Loss of System Function (Within 24 months or previous event)	Terminal Strip Screws	The pump fails on demand due to a loose control circuit wire, caused by over torquing terminal screws during surveillance testing.	The basic cause is "Inadequate Procedure". The procedure was not corrected after the first event.

Subsequent Event that is not Repetitive

Loss of System Function (Within 24 months of previous event)	Terminal Strip Screw	The pump fails on demand due to a loose control circuit wire, caused by over torquing terminal screws during surveillance testing.	The basic cause is "Procedure Not Followed Correctly". Because of the previous events, a procedure is now provided but was not followed.

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4.3 A system functional failure is caused by the failure of an MOV to stroke, caused by the spring pack being installed improperly due to a procedure error. The direct cause is improper installation. The basic cause is "Inadequate Procedure". The event is an MPFF.

Within 24 months, a subsequent failure occurs in another MOV due to improper installation of a spring pack. The direct cause is improper installation of the spring pack by the worker. The basic cause is "Personnel Error". The event is an MPFF, but is not repetitive. The direct cause is the same but the basic cause is different.

Within 24 months, a subsequent failure occurs in another MOV due to improper installation of the spring pack. The direct cause is improper installation of the spring pack by the worker. The basic cause is "Personnel Error". The event is an MPFF and is repetitive; the basic cause and direct cause are the same. Repetitive personnel errors require additional evaluation to ensure that the true cause of the events are found. It is likely that there is a deeper cause of repetitive events than "Personnel Error".

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The Following Events are not Repetitive

Event	Component Type	Direct Cause	Basic Cause
Loss of System Function	MOV	An MOV failed to stroke due to spring pack being installed improperly by the worker, caused by an error in the procedure.	The basic cause is "Inadequate Procedure".
Loss of System Function (Within 24 months of previous event)	MOV	An MOV failed to stroke due to the spring pack being installed improperly, caused by inattention by the worker.	The basic cause is "Personnel Error". After the first event, the MOV procedure was revised to correct the error.

Subsequent Event that is Repetitive

Loss of System Function (Within 24 months of previous event)	MOV	An MOV failed to stroke due to the spring pack being installed improperly, caused by inattention by the worker.	The basic cause is "Personnel Error". This event requires additional investigation. The root cause is more likely to be other than personnel error if the same event has occurred three times within two years.

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4.4 A system functional failure is caused by a seized gland on a pump due to too many rings of packing being installed. The direct cause is too many rings of packing being installed. The basic cause is "Inadequate Vendor Supplied Documents". This is not an MPFF. Because of this event, the vendor manual is corrected and the industry informed of the error through a Significant Operating Event Report (SOER) (or other recognized industry wide operating experience distribution documents). If the same direct cause results in another functional failure, after the vendor manual is corrected and SOER is distributed to the industry, it is an MPFF, but not repetitive. The basic cause is "Inadequate Implementation of Industry Operating Experience". Consideration should be given to ensure industry operating experience is implemented in a timely manner. This consideration should include the importance and potential risk associated with the industry experience received.

The Following Event is not an MPFF

Event	Component Type	Direct Cause	Basic Cause
Loss of System Function	Pump	A pump seized due to too many rings of packing being installed, caused by an error in the vendor's manual.	This basic cause is an "Error in Vendor Supplied Documents".

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The Following Event is an MPFF Event that is not Repetitive

Loss of System Function (Within 24 months of previous event)	Pump (Same design and vendor manual as above)	A pump seized due to too many rings of packing being installed, caused by an error in the vendor's manual.	The basic cause is "Inadequate Implementation of Industry Operating Experience". Previously identified error in the vendor's manual forwarded to the industry, as in an SOER, was not incorporated by the utility.

4.5 A system functional failure occurred when a pump fails on demand due to lack of design flow caused by the impeller being installed backward during an overhaul. The basic cause is "Personnel Error". Adequate guidance was provided by the procedure. Within 24 months another pump in a different system failed on demand due to a seized packing gland caused by over tightening. The basic cause is "Personnel Error". Adequate guidance was provided by the procedure. The direct causes are different and the basic causes are the same. The second event is not repetitive because it is not reasonable to expect that corrective action taken with the first event could have prevented the second. Though outside the scope of the Rule, CPNPP has a program in place to identify these programmatic issues, e.g., personnel error, that do not meet the Maintenance Rule requirement for being repetitive.

FUNCTIONAL FAILURE GUIDE

The Following MPFFs are not Repetitive

Event	Component Type	Direct Cause	Basic Cause
Loss of System Function	Pump	A pump fails on demand due to lack of design flow, caused by the impeller being installed backward.	The basic cause is "Personnel Error". Adequate guidance was provided by the procedure. The cause may have been an "Inadequate Post Maintenance Test" if it should have found the error.
Loss of System Function (Within 24 months of previous event)	Pump	A pump failed on demand due to a seized packing gland caused by over tightening.	The basic cause is "Personnel Error". Adequate guidance was provided by the procedure. This event is not repetitive because it is not reasonable to expect that action taken to correct the first event would have prevented the second event.

4.6 A system functional failure occurred when a solenoid valve coil failed on demand due to the wrong model coil being installed, caused by incorrect model identification by the vendor. The model number on the coil was incorrect. The supplied coil has a shorter expected service life. This is not an MPFF and the basic cause is "Error in Manufacture". Maintenance activities are not expected to find this error. Contact with the vendor found that other coils may have been installed in the plant with this same identification error. An evaluation concluded that the other coils should be replaced during the next refueling outage.

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Within 24 months and before the next refueling outage another functional failure occurred due to another improperly marked solenoid valve coil from this same vendor, caused by lack of timely corrective action. This is an MPFF and the basic cause is "Lack of Timely Response to a Known Problem". This is not a Repetitive MPFF; the direct and basic causes are different. When evaluating the need for corrective action, consideration should be given to the risk associated with the problem recurring <u>and</u> cost associated with implementation of the corrective action.

The Following MPFFs are not Repetitive

Event	Component Type	Direct Cause	Basic Cause
Loss of System Function	Solenoid Valve	Solenoid valve fails due to the wrong model coil being installed.	The basic cause is “Error in Manufacture.” Maintenance activities are not expected to find this error. As such this is not an MPFF
Loss of System Function	Solenoid Valve	Solenoid valve fails due to the wrong model coil being installed.	The basic cause is “Lack of Timely Response to a Known Problem.” This should be considered an MPFF, but was not repetitive.

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GOAL SETTING AND MONITORING

1.0 PURPOSE

The purpose of this guide is to provide guidance for goal setting and monitoring for systems, structures and components that require improved performance.

2.0 INTRODUCTION

An important purpose of establishing specific goals is to focus management attention on those areas that require improved performance. Goals and associated monitoring determine the effectiveness of actions taken to improve performance of SSCs subject to 10 CFR 50.65 paragraph (a)(1). Goals should be established to effectively and accurately monitor the SSC performance and address the cause of unsatisfactory performance. PSA assumptions, industry indicators, industry codes and standards, failure rates and performance related data should be considered when establishing goals.

3.0 GOALS

"Goals are established to bring about necessary improvements in performance", (NUMARC 93-01). Improvements in performance are determined to be necessary by comparison of performance to established performance criteria. When performance criteria are exceeded, or when an unacceptable performance trend has been experienced, or any other time it is considered to be appropriate, corrective action(so need to be implemented.

A goal is required to provide a standard by which the effectiveness of corrective action(s) in the restoration of acceptable performance can be monitored. The margin between the performance criteria and the goal should be such that achievement of the goal will assure qualified performance.

GOAL SETTING AND MONITORING

3.1 Goal Setting

NUMARC 93-01 states:

"If any of the following conditions exist, a goal should be established at the appropriate level (i.e., structure, system, train, or component):

- A maintenance preventable functional failure (MPFF) caused an overall plant performance criteria to be exceeded; or
- A MPFF caused a risk significant or non-risk significant SSC performance criteria not to be met; or
- A second MPFF (same cause) occurs following the initial MPFF and implementation of corrective action". (NUMARC 93-01)

CPNPP has further stated (see Section 6.4 of STA-744):

- System Engineering should establish performance goals on SmartForm Evaluations (EVALs) that address conditions which exceed established Maintenance Rule criterion.
- Goals should be approved by the Maintenance Rule Review panel
- See STA-744, Section 6.4.2 if the need for a goal is identified but later determined to be not applicable.

The above conditions from NUMARC 93-01 and STA-744 should be monitored and followed in setting goals as well as the use of industry operating experience (Reference "Goal Setting Template" in Section 3.3).

GOAL SETTING AND MONITORING

3.1.1 Timeliness of Goal Setting

The system engineer should ensure SmartForm Evaluations (EVALs) used for goal setting are assigned a required completion date in compliance with the Corrective Action Program (STA-422). Completing the goal setting and monitoring evaluation and obtaining MRRP approval must be timely and generally should be completed within 90 days from the designation of (a)(1) status.

3.2 System/Train/Component/Structures/Program Level Goals

The general philosophy of goal setting is to set the goal as near the source of the problem as possible. If a system is not monitored by train and there are several problems that add up to the system not meeting its performance criteria, then the goal should be set a level such that corrective actions for the several problems are included in the scope of the goal.

Redundancy should be considered when setting goals on systems with performance criteria set on redundant trains or components. Example: If a system that requires goal setting has the problems distributed over more than one train, its goal should be set with consideration of the redundance. A trained system that is exceeding its performance criteria and has the problems unique to one train could have only the one train considered when setting the goal.

When component level goals are determined to be necessary, they should be established based upon the component's contribution to a system/train not meeting it's performance criteria or a system/train level goal. Candidates for component goals could include classes of components with unacceptable performance, components which have caused trips or are directly associated with the causes of challenges to safety systems, and those components which have failed and caused the performance criteria, or goal, at the system or train level to be missed. Careful review and analysis should be performed prior to establishing component goals to ensure that the number of component goals is manageable and not overly complex.

GOAL SETTING AND MONITORING

Failure to meet plant level performance criteria should result in an evaluation of the contributions to unsatisfactory performance. Goals should be established to monitor effectiveness of the corrective actions for SSCs identified as significant contributors. This may result in multiple SSCs being placed in (a)(1).

It is expected that most structures will be addressed as required through condition monitoring. In those cases where it is determined that a structure requires a goal to be established, the goal could be based on, for example, limits for cracking, corrosion, erosion, settlement, deflection, or other condition criteria.

3.3 Goal Setting Template

Goals are to be set using a Maintenance Rule goal setting template that addresses the items below:

> NOTE: A similar electronic template is available for use in the SmartForm Evaluation (EVAL) application.

3.3.1. Performance Criteria exceeded

Describe the problem as documented on the related SMF. State the Maintenance Rule function of concern along with the applicable performance criteria. Include relevant discussion of performance history.

3.3.2. Cause

Describe cause determination results. Specifically address programmatic weaknesses or lack of timeliness in implementing previous corrective actions , especially for MPFF or repeat MPFFs.

GOAL SETTING AND MONITORING

3.3.3. Corrective Actions Taken

Describe corrective action taken AND plan to improve performance and return the function to (a)(2) status. Ensure that actions to be taken are being tracked via SmartForm ACTNs.

3.3.4. Goals

Goals are established to bring about necessary improvements in performance. List the recommended goals including success criteria and any supporting reasoning.

3.3.5. Monitoring Duration

Determine the appropriate monitoring period per the Goal Setting guide. Explain how this duration is appropriate for the goal. Refer to Section 3.4 for details. The basis for the monitoring duration should be fully explained and documented.

3.3.6. Monitoring Frequency

List the method and frequency to be used in monitoring the corrective actions for effectiveness. Refer to Section 3.4 for details.

3.3.7. Commensurate with Safety

Describe how the goal is commensurate with safety per the PRA risk significance, use of the existing performance criteria, etc.

GOAL SETTING AND MONITORING

3.3.8. Industry Operating Experience

Describe in detail the operating experience used to develop the goals. Include data sources (EPIX, Nuclear network, Operating Experience, IEEE 500, user groups, vendor info, etc.). This section should describe what was searched, the results and your analysis, including how or why the OE was or was not used for development of the goals

3.3.9. Estimated Date to (a)(2)

Provide an estimated date that the function will return to (a)(2) status.

3.3.10. Long Term Actions Planned or In-progress

List long term actions, including related activity numbers here and as reference documents.

3.4 Goal Monitoring & Duration

"Monitoring should consist of periodically gathering, trending, and evaluating information pertinent to the performance, and/or availability of the SSC's and comparing the results with established goals and performance criteria to verify that the goals are being met. Results of monitoring (including (a)(1) and (a)(2) activities) should be analyzed in a timely manner to assure that appropriate action is taken." (NUMARC 93-01)

Regarding the timeliness of such monitoring activities, it is considered sufficient if these activities are performed on a monthly basis. However, the monitoring philosophy should be documented in the goalsetting and monitoring evaluation.

GOAL SETTING AND MONITORING

The duration of goal monitoring must be long enough to verify that the corrective action taken was effective. Minimum examples follow:

Quoted from NUMARC 93-01, "A goal may be determined to have been met, and monitoring of SSC performance against goals may be discontinued if any of the following criteria are satisfied:

- Performance is acceptable for three surveillance periods where the surveillance periodicity is equal to or less than a six month interval;
- Performance is acceptable for two successive surveillances where the surveillance periodicity is greater than six months but no greater than two fuel cycles: or
- An approved and documented technical assessment assures the cause is known and corrected and thus monitoring against goals is unnecessary."

To the above three criteria for the discontinuance of goals from NUMARC 93-01, CPNPP has added (STA-744):

- Performance meets acceptance criteria specified when the goal was originally created.

If a goal is set on unavailability or functional failures over 24 months, the duration of the goal has to be long enough to yield statistically significant results. If the goal is set on the component level or monitors the number of cycles, the duration may be much shorter, especially if using accelerated testing. The basis for the goal setting and duration should be documented in the goal setting SmartForm Evaluation (EVAL).

GOAL SETTING AND MONITORING

If an SSC without historical performance data is placed in (a)(1), then the SSC should remain in (a)(1) until 24 months of data is evaluated to verify satisfactory performance, unless otherwise justified.

Monitoring SSCs against specific established goals should be conducted in a way that provides a means of recognizing performance trends. Where failures or not meeting performance criteria could result in the loss of an intended safety function, monitoring should be predictive, when appropriate, to provide timely warning. Monitoring should also provide a means for determining the effectiveness of previous corrective actions.

Monitoring should appropriately consider the following factors:

- Existing plant specific or industry performance monitoring such as technical specification surveillances, plant walkdowns, ISI/IST and Appendix J test programs, inspections and tests;

- Establishing a practical monitoring process that is capable of detecting changes in SSC performance; and

- Establishing a baseline, to which goal monitoring data can be compared.

The monitoring frequency to meet established goals can vary, but may be initially established consistent with existing Technical Specification surveillance requirements, or other surveillance type monitoring currently being performed or engineering judgement. Frequency of monitoring is also dependent upon the goal established and the availability of plant-specific or industry data. It may be either time directed, or based on performance. The frequency of monitoring should be adjusted, if necessary, to allow for early detection and timely correction of negative trends.

GOAL SETTING AND MONITORING

Data could be collected from existing sources (e.g., surveillances, Appendix J requirements, ISI/IST, work order tracking) that are relevant to the goal being monitored. Avoid creating the need for new data if existing data is adequate to support the required goal monitoring. The type and quality of the data being collected and trended is very important in that it will ultimately determine if goals are being met. Analysis and evaluation of the collected data should be timely so that, where necessary, corrective action can be taken.

If the existing Preventive Maintenance (PM) program is used to support the demonstration that SSC performance is being effectively controlled through PM and performance monitoring later indicates that performance is unacceptable then the cause determination should correct any PM program deficiency.

Goals which are then set to monitor the effectiveness of changes in the PM program should include the results of the affected PM program where applicable.

Goals are considered to be met based upon the criteria in STA-744, Section 6.4. Historical performance data (functional failures, unavailability, etc.) should not be altered or reset once goals are met. This results in the need to return system performance to within the normal performance criteria before placing the system back into (a)(2).

Failure to meet plant level performance criteria will involve an evaluation to identify the SSCs that contributed most to the performance problem. This may result in multiple systems in (a)(1) with goals at the appropriate level (system, train, component, or structure).

GOAL SETTING AND MONITORING

3.4.1 Monitoring System Level Goals

The object of monitoring at the system level is to evaluate the performance of the system against established goals to proceed from the present status of not meeting a performance criterion toward a level of acceptable performance. Some examples of parameters monitored at the system level include availability, reliability, and failure rate. Systems could be monitored utilizing existing surveillance procedures if the data collected using these procedures addresses the specific system goal(s).

3.4.2 Monitoring Train Level Goals

Monitoring train level performance against established goals should consist of gathering availability or failure data and evaluating the results. The review and analysis of this data will provide a basis on where improvements are needed and confirm when corrective actions have been effective. Individual train performance should be compared with each other or against the average train performance.

3.4.3 Monitoring Component Level Goals

Should it be determined that a component requires goal setting, component monitoring could include performance characteristic data (e.g., flow, pressure, pump head, temperatures, vibration, current, hysteresis) that can be used to determine performance of the component. Monitoring could also be done using nondestructive examination analysis (e.g., oil or grease, vibration, ultrasonic, infrared, thermographic, eddy current, acoustics, and electric continuity). Information could include surveillance test results that the utility already performs, and industry failure rate data.

GOAL SETTING AND MONITORING

3.4.4 Monitoring Structure Level Goals

Should it be determined that a structure requires goal setting, that goal should be monitored to assure that the goal is being met or will be met. Such structures might include the reactor containment, foundations for important components such as turbines, pumps and heat exchangers, and structures whose degradation or failure could significantly compromise the function of other SSCs covered by the Maintenance Rule. Examples of monitoring include nondestructive examination, visual inspection, vibration, deflection, thickness, corrosion, or other monitoring methods as appropriate.

3.5 Documentation SmartForms

SmartForm Evaluations (EVALs) will be used to document the rationale for the goals and goal monitoring durations.

The Maintenance Rule database computer software will normally contain the data necessary to monitor Maintenance Rule goals. Other data sources may also be used if needed provided the data is retrievable in the future.

PERFORMANCE CRITERIA GUIDE

1.0 PURPOSE

The purpose of this desktop guide is to provide guidance in establishing system performance and action level criteria for use in monitoring maintenance effectiveness at Comanche Peak Nuclear Power Plant.

2.0 DETERMINING PERFORMANCE CRITERIA LEVEL

Performance criteria should be established to effectively monitor performance of system functions within the scope of the Maintenance Rule. Monitoring at the highest level possible, consistent with the ability to effectively monitor performance is usually the most efficient approach. The level of monitoring needed for a system function is dependent upon the mode of operation (standby or normally operating) and contribution to risk.

- Plant level performance criteria are used to monitor most functions in the scope of the Maintenance Rule. Plant performance criteria are normally adequate for the monitoring of non-risk significant, non-standby functions.

- If plant performance criteria (and repetitive MPFF monitoring) do not adequately monitor a non-risk significant, non-standby function in the scope of the Maintenance Rule, then system / train level criteria should be established.

- System / train level performance criteria should be used for risk significant and non-risk significant standby system functions in the scope of the Maintenance Rule.

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- Considerations of the redundancy designed into the system must be made. Adequate monitoring may require a lower level of criteria assignment to prevent a good performing redundant train/component from shadowing a poor performing train/component.

- Additional or "supplemental" unavailability Performance Criteria may be established to monitor the effectiveness of one time or rarely occurring maintenance activities. These criteria should be established in advance of the activity.

  In such cases supplemental performance criteria may be established. This is accomplished by initiating a SmartForm to document the supplemental criteria. Additionally, an evaluation outlining the specific 'unusual' work activities and its schedule shall be initiated and submitted to the Maintenance Rule Review Panel for review and approval prior to performing the maintenance activity.

  The evaluation should document the supplemental performance criteria for the work activity. The System Engineer shall be responsible for monitoring the maintenance activity against the supplemental performance criteria. If the supplemental criteria are exceeded goal setting and Maintenance Rule Monitoring status change should be considered per the normal process.

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NOTE: Supplementing the normal performance criteria for unavailability should be an infrequent situation and is not intended to permit exceeding the established unavailability performance criteria.

Example: The unavailability performance criteria for a switchyard function were established based on normal maintenance activities. A switchyard outage to modify and replace aging equipment is planned. The maintenance activities and outage duration are beyond the scope accommodated for in the existing "normal maintenance" performance criteria. Even if the maintenance unavailability is well executed per the outage schedule and is effective at increasing reliability, the existing performance criteria will be exceeded. This example could be considered for supplemental unavailability performance criteria.

2.1 Plant Level Criteria Parameters

Plant level criteria are broad based, with parameters monitoring many SSC functions that are either safety or non-safety related. Since equipment performance is a major contributor to meeting plant level performance criteria, these criteria can be useful in determining overall maintenance program effectiveness.

Plant level performance criteria examples include:

- Forced loss rate (FLR)
- Unit unplanned capability loss factor (UCLF)
- Unit unplanned safety systems actuation
- Unit unplanned automatic scrams per 7000 hours critical
- Manual and automatic trips
- Unplanned entry into higher ORAM risk categories during refueling outages
- Flow accelerated corrosion monitoring of large bore piping (FAC)

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2.2 System / Train Level Criteria Parameters

System level parameters should be selected based upon system / train mode of operation (standby or normally operating), data sources, and the ability to effectively monitor system functions.

Parameter	Considered for use as a parameter for:	Data Source
Unavailability	Recommended for risk significant and/or standby functions or other functions as necessary for effective monitoring	Electronic LCO time, station logs, clearance data, etc.
Reliability	Recommended for risk significant and/or standby functions or other functions as necessary for effective monitoring	Functional failure / MPFF data in the Maintenance Rule database event reviews SmartForms, TSP-503, Emergency DG reliability program, etc.
Condition Monitoring	Recommended when plant, system, train or other monitoring is ineffective	Operating logs, Predictive Maintenance Program, plant computer, walkdowns, etc.

Other considerations when selecting parameters include:

- • Care should be taken when grouping several functions under one performance parameter. Masking of poor performance, or unnecessarily exceeding performance criteria may result if unrelated functions with different levels of safety significance are grouped together. If related functions are not grouped, then one failure may affect multiple performance parameters causing monitoring results to be distorted.

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- Consideration should be taken for why the system is in the scope of the maintenance rule. For example, if system level performance criteria are being established for a function because it is a trip initiator, then reliability may be the most effective monitoring parameter if unreliability / failure produces trips.

- Highly redundant systems, by design, are unlikely to fail at the highest system function level thus, performance criteria may need to be established at the train or lower level. If the FSAR or IPE take credit for redundancy in a train or system, then each redundant "sub-train" should be considered for monitoring by using unavailability and reliability.

- Some system / train functions may need performance monitoring during plant outages (mode 5 & 6) that require parameters that are different from those at power.

3.0 DETERMINING PERFORMANCE CRITERIA PARAMETER VALUES

3.1 When establishing performance values, consider the following:

- Every performance criterion should have an operating margin built in to guard against statistical variations that can be expected to perturb the indicator frequently in a way that would otherwise cause unwarranted corrective actions to be taken.

- Avoid establishing a baseline on poor performance. Past performance may have been unsatisfactory. Input such as industry data, IPE assumptions, unit / train comparisons, statistical analysis of history data and engineering judgement should be used to reveal this unsatisfactory performance.

- Action level criteria that would identify the need for actions to prevent exceeding performance criteria should be considered. This consideration should include historical performance, IPE issues, engineering judgement, etc.

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3.2 Plant Level Performance Criteria Values

The determination of quantitative values for the plant parameters will be influenced by different factors, including such things as design, operating history, age of the plant, and previous plant performance. Input should be considered and a value established or adopted which can be used to identify unsatisfactory performance. These criteria values should be approved by the Maintenance Rule Review Panel (Ref. Attachment 8.F).

3.3 System / Train Level Performance Criteria Values

3.3.1 If unavailability is used as a performance parameter for system functions, then establish an appropriate unavailability performance criterion value using a form similar to STA-744-1.

> Note: IPE unavailability assumptions are based upon an estimated mean unavailability. Actual data will normally fall above or below the mean resulting in the need for an operating margin.

3.3.1.1 Determine if PRA assumptions are associated with the function(s) and consider establishing a preliminary 24 month running average criterion value at 2 times the assumption. This guidance may not be appropriate for CCW, 6.9KV, Turbine driven AFW, and is not appropriate for EDG and SSW. The CCW, 6.9KV, and TDAFW should have historical unavailability evaluated and taken into account before using the 2 times IPE assumptions. For EDG and SSW systems the criteria should be set lower than 2 times mean value. Historical performance should be used as a guide to establish the Performance criteria. (Reference letter CPSES-9601266 Maintenance Rule System Performance Criteria - Test and Maintenance Unavailability Sensitivity Study.)

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3.3.1.2 If PRA assumptions do not exist, then appropriate unavailability criteria should be established based upon plant/system historical data and engineering judgement.

Note: The IPE utilizes industry data which may not reflect actual performance at CPNPP.

3.3.1.3 Evaluate actual unavailability time, core damage frequency sensitivity to unavailability changes and applicable industry information / studies and equipment history, to determine if the criterion is appropriate.

Note 1: Statistical analysis techniques are available which can be useful when analyzing historical data.

Note 2: Analysis of the core damage frequency sensitivity to unavailability can be especially useful when setting performance criteria for functions with lower safety significance. Contact Risk and Reliability for assistance.

Note 3: The PRA utilizes 8760 hours required availability per year. Actual required availability (considering plant outages etc.) should be considered when comparing PRA assumed unavailability to actual unavailability.

3.3.1.4 If the criterion is not appropriate, then develop justification for adjustment to the criteria. Making adjustments or changes may be appropriate such as increasing or decreasing allowable unavailability for the monitoring period.

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3.3.2 If reliability is used as a performance criterion, then establish an appropriate performance criterion value using a form similar to STA-744-1 and the guidance in Section 4.0, "Developing Reliability Criteria".

3.3.2.1 Obtain PRA liability assumptions from Risk and Reliability. Other sources of reliability information or engineering judgement can be used if PRA assumptions do not exist. Less than 2 MPFFs over 24 months can be used for operating non-risk significant functions.

> Note: An action level is not applicable if the performance criteria is less than one.

3.3.2.2 If applicable, establish an action level using engineering judgement.

3.3.2.3 Evaluate actual FF and MPFF history, core damage frequency sensitivity or reliability changes, and applicable industry information / studies to determine if the performance and action reliability criteria are appropriate.

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NOTE: Analysis of the core damage frequency sensitivity to reliability can be especially useful when setting performance criteria for functions with lower safety significance. Contact Risk and Reliability for assistance.

3.3.2.4 If the criterion is not appropriate, then develop justification for adjusting or changing the criterion. The following adjustments or changes may be appropriate:

- increasing the number of allowable FFs
- increasing or decreasing the monitoring period
- use of demand failure trending rather than functional failures
- use of other established reliability monitoring criteria programs (e.g., NUMARC 87-00 Rev. 1 Diesel Generator reliability triggers)

3.3.3 If condition monitoring is utilized as a performance criterion then establish an appropriate performance criterion value.

3.3.3.1 Identify required performance levels such as ISI / IST and Appendix J limits and obtain available CPNPP / industry performance history for the parameter.

3.3.3.2 Evaluate performance requirements and history input, then establish a criterion value that can be used to identify unsatisfactory performance.

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3.4 Guidance for Accepting or Challenging Performance Criteria Changes Prompted by PRA updates.

3.4.1 Periodic PRA updates may produce recommended changes to performance criteria. The system engineer will be provided with information on the current criteria, the proposed criteria and the actual performance data from the Maintenance Rule software.

3.4.2 If the proposed PC are Not Acceptable:

3.4.2.1 Review the PC Worksheet and the "Performance Criteria Review" section of the PRA Input Sheet. Consider the following:

- Is the current performance acceptable as opposed to "normal"?
- Do the PRA assumptions account for all planned maintenance activities for the function?
- Does the PRA count the UA or FF against the same function as the Maintenance Rule?
- Check assumptions for Unavailability and Functional Failures
- Ensure that the PRA model accounts for all planned maintenance being done
- Ensure that unavailability assumptions are being made against the right function.

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3.4.2.2 Justify why the PC you want to use are acceptable by considering if:

- Actual performance is acceptable
- Availability is properly balanced with reliability
- PRA model doesn't account for everything

3.4.2.3 Arrange for MRRP review of the challenge, and document the challenge in a SmartForm evaluation.

3.5 Performance Criteria Approval of Documentation

3.5.1 Present proposed performance criteria or changes to the Maintenance Rule Review Panel for review and approval. Unavailability and reliability criteria assumptions and calculations should be submitted for review using a form similar to STA-744-1.

3.5.2 A SmartForm is used to track scoping and performance criteria changes and documenting entering the data into the Maintenance Rule database. The following steps should be accounted for:

A. Review and approve scoping change request per STA-744, section 6.6.2.
B. Enter changed function data directly into the Maintenance Rule database.
C. Enter draft performance criteria data via the Maintenance Rule database.
D. Update system health software
E. Update EPIX database
F. Update PM Basis database criticality data if MR functions or risk significance changed.
G. Communicate changes to users.

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4.0 DEVELOPING RELIABILITY CRITERIA

4.1 Purpose

This section is used to develop reliability criteria for risk significant and standby safety systems and assures that the criteria are appropriately tied to the CPNPP PRA. The approach is based in part on EPRI Technical Bulletins 96-11-01 and 97-3-01, “Monitoring Reliability for the Maintenance Rule”, “Failures to Start and Failures to Run”, respectively. However, rather than using these bulletins to define generic reliability criteria for all systems, the method adopted by CPNPP applies the EPRI methodology to systems individually, taking into account specific system reliability, system demands and system operating hours, as appropriate to set system specific criteria. This approach is consistent with the “memorandum of understanding” between NRC and NEI (NRC letter F.J. Miraglia to R.E. Beedle, NEI dated October 22, 1996) and has been accepted by NRC in certain of its baseline Maintenance Rule inspections at other plants.

4.2 Requirements

CPNPP has chosen to follow the guidance of NUMARC 93-01 in implementing the Maintenance Rule. Section 9.3.2 of that document states:

> “The actual performance criteria used should be SSC availability, reliability, or condition”;
>
> “The performance criteria for a standby system can be qualitatively stated as ‘initiates upon demand and performs its intended function’. The reliability of a standby system to satisfy both criteria can be quantitatively established as calculated in PRA methodology;”

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> "Specific risk significant SSC performance criteria should consider plant specific performance and, where practical, industry wide operating experience. Performance criteria for risk significant SSCs should be established to assure that reliability and availability assumptions used in plant-specific PRA, IPE, IPEEE, or other risk determining analysis are maintained or adjusted when determined necessary by the utility".

This guidance provides for establishing a link between the plant-specific PRA and performance criteria for risk significant and standby SSCs. Although reliance on the PRA is not mandated by the Maintenance Rule guidance, CPNPP has used the PRA extensively in determining the risk significance of SSCs and in evaluating the impact of removing SSCs from service. Such a link to the PRA is an appropriate method of ensuring that applicable performance criteria and/or goals are established commensurate with safety.

For reliability performance criteria, the NRC interprets these requirements as follows (based on the NRC letter dated October 22, 1996 discussed in 4.1 above):

> "The maintenance rule is a risk-informed, performance based regulation that requires licensees to provide reasonable assurance that SSCs remain capable of performing their intended functions. The NRC does not expect licensees to perform highly sophisticated, rigorous analyses to demonstrate that reliability performance criteria are mathematically equivalent to the values used in PRA's. Rather, the expectation is that licensees provide a reasonable and appropriate technical basis for selecting performance criteria to meet the regulation. However, it is expected that such approaches would incorporate some consideration of demands for standby systems and service time for normally operating systems."

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"Acceptable approaches exist for linking performance levels to safety (risk). During the nine pilot site visits performed to review early implementation of the maintenance rule, reviews of the licensees' goal and performance criteria-setting processes were performed. As stated above, the inspectors found that licensees did understand the issues related to developing performance standards for reliability that were linked to safety. Several of those licensee programs described in significant detail the link to safety (risk) and justified the use of functional failures in the measure of SSC reliability. Therefore, the issue was not raised in the trip reports or meetings with NEI, since none existed."

"In short, the NRC's position has been, and is, that performance standards -- goals and performance criteria -- must be demonstrably linked to safety, and our enforcement decisions will continue to be made based on licensee compliance with 10CFR50.65."

In this letter, the NRC noted that NEI would provide additional guidance to the industry regarding this issue. That guidance was provided by NEI and is discussed in Section 5.0 below.

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5.0 INDUSTRY RESOLUTION

The proposed industry resolution of this issue was provided in EPRI Technical Bulletins 96-11-01 and 97-3-01, "Monitoring Reliability for the Maintenance Rule", November 1996, and March 1997, respectively. The EPRI approach was intended to provide a generic basis for selecting reliability criteria for systems. For standby systems, the EPRI approach uses the Binomial Equation to compute the probability of exactly 0,1,2,3 etc. failures given a IPE-based system/train unreliability and the number of demands on the system over the operating cycle or monitoring interval. For normally operating systems, the Poisson distribution is used to calculate the probability of experiencing exactly 0,1,2,3 etc. failures given the number of run hours and the IPE hourly failure rates for each system/train. Then, depending on these probabilities, a criteria value is selected.

This approach was criticized by NRC in certain baseline inspections because it was generic and not system specific Therefore, rather than using EPRI approach outright, CPNPP uses the EPRI methodology but applies it at the individual system level, taking into account specific system reliability, system demands and system operating hours, as appropriate to set system specific criteria. This approach is consistent with the "memorandum of understanding" between NRC and NEI discussed above (NRC letter F.J. Miraglia to R.E. Beedle, NEI dated October 22, 1996) and has been accepted by NRC in certain of its baseline maintenance rule inspections at other plants.

The application of this methodology is described in Section 5.1.

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5.1 Application of the Methodology to CPNPP

This section describes how the methodology is applied at CPNPP. This assures that the performance criteria are appropriately tied to the failure probabilities used in CPNPP IPE/PSA and that consideration is given to the number of demands for standby systems and to the operating hours for a normally operating system.

5.1.1 Establishing the Criteria for Standby Systems

For standby systems, (e.g., Auxiliary Feedwater) a spreadsheet was developed using a range system/train failure probability unreliability from the CPNPP IPE/PSA and a range of expected numbers of demands for the operating cycle or monitoring interval (at CPNPP the monitoring interval has been set at 24 months) as inputs to the Binomial Equation. The spreadsheet was developed with the following inputs:

Demands:	5	10	15	20	
Probability:	.1	.05	.01	.005	.001

The resulting matrix is shown in Tables 1 thru 5. These tables show the probabilities of exactly 0,1,2,3 and 4 or more failures, respectively.

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The Binomial Equation is written as:

$$Pn(r) = \frac{n!}{r!(n-r)!} P^r(1-P)^{(n-r)}$$

where r = # of failures

n = # of demands

P = System/Train unreliability (failure probability)

Thus,

Probability of 0 failure in n demands is:

$$Pn(0) = (1-P)^n$$

Similarly for 1,2,3 failures in n demands

$$Pn\ (1) = nP(1-P)^{n-1}$$

$$Pn\ (2) = \frac{n(n-1)P^2(1-P)^{n-2}}{2}$$

$$Pn\ (3) = \frac{n(n-1)(n-2)\ P^3(1-P)^{n-3}}{2x3}$$

Finally the probability of 4 or more failures is

$$Pn(>4) = 1-Pn(0)-Pn(1)-Pn(2)-Pn(3)$$

These equations were used to calculate the entries in the matrix.

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TABLES 1-5

Table 1

Demands/Unreliability Matrix for Zero Failures	0.1	0.05	0.01	0.005	0.001
5	59%	77%	95%	98%	100%
10	35%	60%	90%	95%	99%
15	21%	46%	86%	93%	99%
20	12%	36%	82%	90%	98%

Table 2

Demands/Unreliability Matrix for One Failure	0.1	0.05	0.01	0.005	0.001
5	33%	20%	5%	2%	0%
10	39%	32%	9%	5%	1%
15	34%	37%	13%	7%	1%
20	27%	38%	17%	9%	2%

Table 3

Demands/Unreliability Matrix for Two Failures	0.1	0.05	0.01	0.005	0.001
5	7.290%	2.143%	0.097%	0.025%	0.001%
10	19.371%	7.463%	0.415%	0.108%	0.004%
15	26.690%	13.475%	0.921%	0.246%	0.010%
20	28.518%	18.868%	1.586%	0.434%	0.019%

Table 4

Demands/Unreliability Matrix for Three Failures	0.1	0.05	0.01	0.005	0.001
5	0.810%	0.113%	0.001%	0.000%	0.000%
10	5.740%	1.048%	0.011%	0.001%	0.000%
15	12.851%	3.073%	0.040%	0.005%	0.000%
20	19.012%	5.958%	0.096%	0.013%	0.000%

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Table 5

Demands/Unreliability Matrix for Four or More Failures	0.1	0.05	0.01	0.005	0.001
5	0.046%	0.003%	0.000%	0.000%	0.000%
10	1.280%	0.103%	0.000%	0.000%	0.000%
15	5.556%	0.547%	0.001%	0.000%	0.000%
20	13.295%	1.590%	0.004%	0.000%	0.000%

These tables are based on the Binomial Equation

These tables show that the probability of experiencing a given number of failures varies significantly with system reliability. For a very reliable system (failure probability ~ .005), there is a very high probability of experiencing zero failures even for a large number of demands. For a much less reliable system (failure probability ~ 0.1) there is a significant probability of experiencing as many as three failures.

By knowing the system/train unreliability and the number of demands on the system during the monitoring interval, an appropriate reliability criteria can be chosen for the system/train. In setting the criteria, a 10 percent probability of experiencing a random failure has been chosen as the cutoff. This is shown in the example below.

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5.1.2 Example for setting Criteria for a Standby System:

Assume a system/train has an unreliability of • 0.05 as determined by the PSA/IPE. Assume that the number of demands on the system/train via the monitoring interval is • 20 based on an estimate from historical data. Using the tables, it can be seen that there is a significant probability (• 19%) of experiencing exactly two failures. The probability of experiencing exactly three failures is • 6%. Therefore, a criteria of <3 failures for the system/train would be appropriate.
That is, a reasonable criteria for this system would be <u>less than 3 failures during the monitoring interval</u>.

It should be noted that there is almost a 10% probability of experiencing three or more failures. One might argue that less than 4 failures is not unreasonable as a criteria. However, using the 10% value as a cut off, less than 3 failures is correct here.

<u>Applying the Spreadsheet or Matrix</u>

A. Determine the system/train unreliability using input from the IPE/PSA.

B. Determine the estimated number of demands on the system/train during the monitoring interval. Use the master test and surveillance schedule or operating history to do the estimate. Record the information on form STA-744-1.

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C. Locate the intersection of unreliability and demands on Tables 1-4 for which the probability is less than 10% (starting on Table 1 and moving to Table 4) or use the spreadsheet to compute a new column in the table using the values from 4.b above. If another table is required, use the Binomial Equation to calculate it.

D. Set the proposed system criteria based on the results of the calculation, using the appropriate table. All proposed criteria should be discussed with the Maintenance Rule Coordinator.

5.2 Establishing Criteria for Normally Operating Systems

For normally operating systems such as the Component Cooling Water System and the Safety Chilled Water System, a spreadsheet was developed using the Poisson Equation to determine appropriate reliability criteria for these systems. The spreadsheet uses as inputs system/train failure probabilities and estimated operating hours during the interval. From this spreadsheet, Tables 6-10 were developed which can be used to select appropriate criteria..

The Poisson Equation is written as:

$$P(n,T) = \frac{\bullet\bullet^{\bullet}(\bullet T)^{n}}{n!}$$

where • •is the system failure rate - per hour.
where T is the operating interval in hours and,
where n is the exact number of failure events occurring on the interval.

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Thus,

$$P(0,T) = e^{-\lambda T}$$

$$P(1,T) = (\lambda T)e^{-\lambda T}$$

$$P(2,T) = \frac{(\lambda T)^2 e^{-\lambda T}}{2}$$

$$P(3,T) = \frac{(\lambda T)^3 e^{-\lambda T}}{2x3}$$

$$P(4,T) = \frac{(\lambda T)^4 e^{-\lambda T}}{2x3x4}$$

Tables 6,7,8,9 and 10 were prepared using these equations. These tables, like the Binomial Tables, show the probability of experiencing exactly n failure given a failure rate and an operating interval. This can be used to develop system/train criteria similar to that for standby systems. In setting the criteria, a 10 percent probability of experiencing a random failure has been chosen as the cutoff. This is shown in the example below.

Example of setting Criteria for a Normally Operating System

Assume a system has an hourly failure rate of (2.5 x 10^{-3}/24 hours) ≈ 1x10^{-4}/hour as determined from the IPE. Assume the system operates on a biweekly rotating basis or about ½ the monitoring interval, a monitoring interval of 24 months, and a plant capacity factor of 85% for the period. Given these, the operating hours @ power are 24 × ½ × .85= 12 × .85= 10.2 months. 10.2 × 730=7446 hours. Enter the tables using 7500 hours and 1x10^{-4}/hr. This shows the following:

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With these system values, the likelihood of experiencing zero failures is • 47%; one failure is 35.4%, two failures is • 13%; three failures is • 3%. Therefore, using • 10% as the cut off, it would be appropriate to set the criteria for this system/train at <3 failures in a two year period.

5.3 Applying the Spreadsheet or Tables (Tables 6 thru 10)

5.3.1. Determine the system/train hourly failure rate using the PSA/IPE where practicable.

5.3.2. Determine the system/train operating hours using the following considerations (Record the information on Form STA-744-1):

- 24 month operating interval
- Fraction of time system/train operates during the interval
- Plant capacity factor (Note that if the system is normally in operation during shutdown and the criteria is intended to apply for shutdown modes as well, then use 100%.)
- Compute the operating hours as 24 months x 730 hrs/mo x operating time x capacity factor

5.3.3. Enter the tables using operating hours and hourly failure rate or use the spreadsheet to calculate a new column in the tables. Locate the intersection of these two values where the probability is less than 10%. Note that because the shape of these curves, the probabilities may first increase, then decrease. Therefore, locate a point less than 10% with the probability decreasing.

5.3.4. Set the proposed system criteria based on the results of the calculation, using the appropriate table.

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5.4 Documentation

Form STA-744-1 shows a worksheet that should be prepared for each risk significant and standby safety system/function that requires reliability criteria to be established. The proposed criteria should be discussed with the Maintenance Rule Coordinator and approved by the Maintenance Rule Review Panel.

Run Hours versus Hourly Failure Rate Tables

Poisson Equation

Table 6

Run Hours/ Hourly Failure Rate -- Zero Failures	0.01	0.001	0.0005	0.0001	0.00005	0.00001
2500	0.0%	8.2%	28.7%	77.9%	88.2%	97.5%
5000	0.0%	0.7%	8.2%	60.7%	77.9%	95.1%
7500	0.0%	0.1%	2.4%	47.2%	68.7%	92.8%
10000	0.0%	0.0%	0.7%	36.8%	60.7%	90.5%
15000	0.0%	0.0%	0.1%	22.3%	47.2%	86.1%
17500	0.0%	0.0%	0.0%	17.4%	41.7%	83.9%
20000	0.0%	0.0%	0.0%	13.5%	36.8%	81.9%

Table 7

Run Hours/ Hourly Failure Rate -- One Failure	0.01	0.001	0.0005	0.0001	0.00005	0.00001
2500	0.0%	20.5%	35.8%	19.5%	11.0%	2.4%
5000	0.0%	3.4%	20.5%	30.3%	19.5%	4.8%
7500	0.0%	0.4%	8.8%	35.4%	25.8%	7.0%
10000	0.0%	0.0%	3.4%	36.8%	30.3%	9.0%
15000	0.0%	0.0%	0.4%	33.5%	35.4%	12.9%
17500	0.0%	0.0%	0.1%	30.4%	36.5%	14.7%
20000	0.0%	0.0%	0.0%	27.1%	36.8%	16.4%

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Table 8

Run Hours/ Hourly Failure Rate -- Two Failures	0.01	0.001	0.0005	0.0001	0.00005	0.00001
2500	0.0%	25.7%	22.4%	2.4%	0.7%	0.0%
5000	0.0%	8.4%	25.7%	7.6%	2.4%	0.1%
7500	0.0%	1.6%	16.5%	13.3%	4.8%	0.3%
10000	0.0%	0.2%	8.4%	18.4%	7.6%	0.5%
15000	0.0%	0.0%	1.6%	25.1%	13.3%	1.0%
17500	0.0%	0.0%	0.6%	26.6%	16.0%	1.3%
20000	0.0%	0.0%	0.2%	27.1%	18.4%	1.6%

Table 9

Run Hours/ Hourly Failure Rate -- Three Failures	0.01	0.001	0.0005	0.0001	0.00005	0.00001
2500	0.0%	21.4%	9.3%	0.2%	0.0%	0.0%
5000	0.0%	14.0%	21.4%	1.3%	0.2%	0.0%
7500	0.0%	3.9%	20.7%	3.3%	0.6%	0.0%
10000	0.0%	0.8%	14.0%	6.1%	1.3%	0.0%
15000	0.0%	0.0%	3.9%	12.6%	3.3%	0.0%
17500	0.0%	0.0%	1.8%	15.5%	4.7%	0.1%
20000	0.0%	0.0%	0.8%	18.0%	6.1%	0.1%

Table 10

Run Hours/ Hourly Failure Rate -- Four Failures	0.01	0.001	0.0005	0.0001	0.00005	0.00001
2500	0.0%	13.4%	2.9%	0.0%	0.0%	0.0%
5000	0.0%	17.5%	13.4%	0.2%	0.0%	0.0%
7500	0.0%	7.3%	19.4%	0.6%	0.1%	0.0%
10000	0.0%	1.9%	17.5%	1.5%	0.2%	0.0%
15000	0.0%	0.1%	7.3%	4.7%	0.6%	0.0%
17500	0.0%	0.0%	3.9%	6.8%	1.0%	0.0%
20000	0.0%	0.0%	1.9%	9.0%	1.5%	0.0%

These tables are based on the Poisson Equation

MAINTENANCE RULE REVIEW PANEL

1.0 PURPOSE AND SCOPE

The purpose of this guidance document is to provide guidance to the Maintenance Rule Review Panel for performing Maintenance Rule:

- scoping review and approval
- performance criteria review and approval
- risk significance determinations
- goal review and approval
- periodic assessment review

2.0 MEMBERSHIP

The members of the MRRP are selected based on their nuclear power plant experience in areas such as systems engineering, design engineering, risk analysis, operations, maintenance and maintenance engineering. Guidance for the facilitation of the MRRP is found in Section 6.6 of STA-744, NUMARC 93-01, NUMARC 93-02, NUREG/CR-5424, NUREG/CR-4962, and NUREG/CR-5695. The MRRP should consist of five to eight members which will include a qualified Chair. The MRRP Chair should have technical experience as well as project management skills in order to facilitate the discussion and obtain end results.

The desired education and experience requirements for panel membership are a B.S. in an engineering discipline (or a USNRC Senior Reactor Operator License) and eight years in nuclear power. However, non-degreed personnel with extensive nuclear power experience may also qualify as MRRP candidates. At least one representative should hold a current USNRC Senior Reactor Operator License. Alternate individuals should be presented to the MRRP for consideration. The Site Engineering Director will provide final approval of changes in membership and alternates.

MAINTENANCE RULE REVIEW PANEL

3.0 SCOPING REVIEW AND APPROVAL

The results of Maintenance Rule system function scoping and any changes should be reviewed and approved by the MRRP. The panel should determine if scoping information in the MRule Manager database is correct by reviewing function descriptions and the five Maintenance Rule scope criteria for system functions that have been determined to be both in scope and out of scope. The panel should also review operating status (standby / operating) and applicable plant modes for system functions determined to be in scope. Comments and approvals should be documented in MRRP meeting minutes.

The MRRP should review changes to Maintenance Rule scoping including function descriptions, answers to the five scope criteria, operating status and applicable plant modes. Corrections of typographical errors and clarifications that do not change intent do not require review and approval.

MAINTENANCE RULE REVIEW PANEL

4.0 DETERMINING RISK SIGNIFICANCE

The Maintenance Rule Review Panel (MRRP) should confirm or adjust the risk importance measures developed using the individual plant examination (IPE) results and insights and provide a qualitative assessment based upon engineering judgement. This qualitative assessment compensates for limitations of the IPE Study, including those cases where adequate quantitative risk information is not available.

As prescribed in Section 9.3.1 of NUMARC 93-01, risk significant criteria may be developed using any of the following methods:

- Individual Plant Examination
- Plant-specific Probabilistic Risk Assessment (PRA)
- Critical Safety Functions (CSF) system performance review, or,
- Other processes, provided they are systematic and documented.

One of the "other processes" methods is use of an "Expert Panel". The CPNPP MRRP was formed to be this type of expert panel and, as such, the panel chose to use the results of all three of the other methods above as an aid in the original assessment of the risk significance of each SSC in the scope of the rule at CPNPP.

The MRRP should assess the changes potentially impacting system and function risk significance determinations. Changes may be prompted by design changes, system engineer requests, Industry Operating Experience, PRA results, etc. (reference STA-744, Section 6.6.4).

The MRRP used the DELPHI methodology and the IPE for the original risk significance determinations. Future adjustments to risk significance can be accomplished using an appropriate decision method. Comments and approvals should be documented in MRRP meeting minutes.

MAINTENANCE RULE REVIEW PANEL

5.0 PERFORMANCE CRITERIA REVIEW AND APPROVAL

Performance criteria for system functions in the scope of the Maintenance Rule should be reviewed and approved by the MRRP. The panel should ensure performance criteria established are effective and consistent with the "Performance Criteria Guide", (Attachment 8.E). Comments and approvals should be documented in MRRP meeting minutes.

The MRRP should review changes to Maintenance Rule performance criteria. Corrections of typographical errors and clarifications that do not change intent do not require review and approval.

6.0 REVIEW AND APPROVAL OF GOALS

Goals established to monitor the effectiveness of corrective action taken to address unsatisfactory performance under the Maintenance Rule should be reviewed and approved by the MRRP. The panel should ensure goals will be effective and consistent with the "Goal Setting and Monitoring", (Attachment 8.D). Comments and approvals should be documented in MRRP meeting minutes.

7.0 PERIODIC ASSESSMENT REVIEW AND APPROVAL

The MRRP should review Maintenance Rule Periodic Assessments as an agenda item. The panel should ensure periodic assessments adequately address the requirements of 10 CFR 50.65, NUMARC 93-01, and STA-744. The review should be documented in MRRP meeting minutes.

MAINTENANCE RULE REVIEW PANEL

8.0 DUTIES OF MEMBERS

The members should meet as determined by the panel chairperson or Maintenance Rule Coordinator. MRRP meetings should be scheduled to allow for timely review and oversight of Maintenance Rule issues. Issues should be identified and resolved as described in this guidance document. The proceedings of the meeting should be documented in a 'minutes of the meeting' by a member designated by the chairperson.

Since the MRRP needs to be generally familiar with the IPE model as an engineering tool, each member of the panel should have some familiarity with the CPNPP IPE study and its application to ranking. For example, the members should be familiar with the importance measures, specifically FV, IPE, PRA and RAW (reference NUMARC 93-01, section 9.3.1), including what each importance measure indicates and how it is used in the risk-ranking process for the CPNPP program.

Members and alternates should be familiar with Maintenance Rule procedures and guides.

9.0 QUORUM

The quorum necessary for the MRRP to conduct business is four (4) members, or their alternates, consisting of one representative that holds a current USNRC Senior Reactor Operator License, one from Probabilistic Risk Assessment, one degreed engineer from engineering, and one person from either Engineering or Maintenance.

10.0 MEMBERS

A list of approved panel members and alternates should be maintained by the Maintenance Rule Review Panel Chairman.

ATTACHMENT 8.F
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MAINTENANCE RULE REVIEW PANEL

11.0 VOTING

Approval of any item normally requires a unanimous decision by the members present. The System Engineering Director can authorize approval on a case by case basis where one or more of the members present do not agree with the majority.

12.0 MINUTES OF MEETINGS

The MRRP chair will ensure the minutes of MRRP meetings are prepared. The minutes should include status of open items and decisions needed to document required panel activities. Panel meeting minutes should use a number derived from the meeting date (e.g. meeting # 97-0708 would be the meeting held on July 7, 1997) and meeting minutes should be prepared separately for each day of a meeting. Meeting minutes should be issued by letter signed by the chairman or his designee. Meeting minutes for more than one day can be issued with a single letter. The panel should review and approve meeting minutes prior to issue.

Minutes should be stored as Adobe Acrobat .pdf files with a searchable index.

PERIODIC A3 MAINTENANCE EFFECTIVENESS ASSESSMENT GUIDE

1.0 PURPOSE

The purpose of this instruction is to provide information, guidance and instructions in the compilation of the necessary records, information and data required to evaluate maintenance effectiveness and to assess the effect of the maintenance activities performed over a period of time that is at least as long as one refueling cycle but not to exceed 24 months. This assessment is performed to meet the requirements of 10 CFR 50.65, paragraph (a)(3).

2.0 APPLICABILITY

This instruction is applicable to the Maintenance Rule Coordinator, the responsible system engineers and other site personnel who share responsibility for the periodic maintenance effectiveness assessment.

3.0 RESPONSIBILITIES

3.1 Maintenance Rule Coordinator

Responsible for:

- Scheduling the assessment within the required time period.
- Selecting and identifying the system(s) to be assessed to the responsible system engineer and system engineering management.
- Coordinating and assigning or delegating responsibility to system engineers and others who will provide graphs, data, reports or any other information required for the assessment.

ATTACHMENT 8.G
PAGE 2 OF 7

PERIODIC A3 MAINTENANCE EFFECTIVENESS ASSESSMENT GUIDE

(3.1 continued)

- Assuring that the activities identified in section 4.2 are included, as required, for each system assessed.
- Assuring that the Composite Assessment Report is reviewed by the maintenance Rule Review Panel (MRRP) prior to final approval.
- Assuring the composite assessment report is completed and submitted to the Site Engineering Director for final approval.

3.2 System Engineer

Responsible for:

- Providing the required graph, data, reports or any other information for a system selected for assessment to the Maintenance Rule Coordinator on time and in the format required.
- Assuring the applicable activities of section 4.2 are complied with for all systems scoped within the rule that are assigned to the system engineer, whether or not the system is selected for assessment.

3.3 Site Engineering Director

Responsible for:

- Performing a final review and approval of the Periodic (a)(3) Maintenance Effectiveness Assessment.

PERIODIC A3 MAINTENANCE EFFECTIVENESS ASSESSMENT GUIDE

4.0 INSTRUCTIONS AND INFORMATION

4.1 Assessment Scheduling

The need for assessment of each scope system will be determined by the Maintenance Rule Coordinator. His judgement in system selection should include a review of the LEADING Program observations and coordination with the System Engineering Manager and the System Engineering Smart Team Managers and Supervisors.

The Maintenance Rule Coordinator should coordinate the periodic assessment, but normally should not be an assessor on the assessment team. The MR Coordinator may however, perform assessments of the MR Program that the assessment team can use in the Periodic Assessment. The Maintenance Rule Coordinator should team with each system engineer that has responsibility for a system/train scoped within the rule and identified as a system to be assessed, when performing the assessment.

Requirements for performing the periodic assessment can be satisfied through the use of ongoing assessments combined with a higher level summary assessment performed at least once per refueling cycle not to exceed 24 months between evaluations (reference NUMARC 93-01, Section 12.0). The system Maintenance Rule reports and the Quarterly System Health Reports will provide ongoing assessments over the maintenance effectiveness assessment period.

Note: The Maintenance Rule Program Health Report tracks the time since the last (a)(3) Assessment. This tracking should provide the awareness necessary to maintain compliance with the scheduling requirements.

PERIODIC A3 MAINTENANCE EFFECTIVENESS ASSESSMENT GUIDE

4.2 Periodic Assessment Activities (reference NUMCARC 93-01 & STA-744, sec 6.5)

The assessment consists of several activities to assure an effective maintenance program and to identify necessary adjustments that should be made to the MEMP. These activities include the assessment of; goal setting and corrective actions, performance criteria monitoring, use of ongoing industry operating experience and optimizing system availability and reliability.

4.2.1 Effectiveness of Goal Setting and Corrective Actions (CA's)

Goals are established to monitor the effectiveness of CA's taken when a SSC has been placed in (a)(1) status. The effectiveness of the CA's should be assessed by the system engineer by trending the performance of his/her (a)(1) system(s)/train(s) in a manner that provides documentation and a means of recognizing performance trends so progress toward satisfactory performance resulting from CA's can be tracked.

Note: A negative trend is deemed to exist when the monitoring and assessments indicate corrective actions established have been ineffective in achieving the goal.

The ongoing assessments provide the Maintenance Rule trend unavailability graphs a means of recognizing performance trends.

When positive performance is consistent the system engineer should assess the qualification for goal removal and restoration to standard (a)(2) performance by the criteria provided in STA-744 section 6.4.

The Maintenance Rule Coordinator should assess the overall effectiveness of CA's in restoring positive performance to (a)(1) systems.

PERIODIC A3 MAINTENANCE EFFECTIVENESS ASSESSMENT GUIDE

4.2.2 Performance Criteria Monitoring (ref. STA-744, Section 6.3 & NUMARC 93-01, section 12.2.2)

The evaluation of the performance of an SSC that is subject to performance criteria only (an (a)(2) system/train) is required to identify the need for adjustments or improvements to SSC performance and performance criteria and to evaluate the effectiveness of any CA's taken for MPFF's or adverse performance trends.

The system engineer should recognize the need for CA during the assessment period by performing an ongoing assessment provided by the unavailability graphs provided from the Maintenance Rule database.

When CA has not reversed negative trending, the system engineer should provide a CA Evaluation. The evaluation should include, where appropriate, recommendations for design change, request for assistance, industry operating experience, and a review of the performance criteria to redisposition the SSC from (a)(2) to (a)(1) status (refs. STA-744, Attachment 8.D, "Goal Setting and Monitoring").

The Maintenance Rule Coordinator should assess the overall performance of (a)(2) SSC's during the assessment period and include in the periodic assessment actions taken to improve performance and negative trends.

PERIODIC A3 MAINTENANCE EFFECTIVENESS ASSESSMENT GUIDE

4.2.3 Use of ongoing Industry Operating Experience (ref. STA-744, sec. 6.5 & NUMCARC 93-01, sec. 12.1)

The responsible system engineer and the Maintenance Rule Coordinator should perform an assessment and report:

- Improved performance which has resulted from the use of industry operating experience.

- Those occurrences where a failure to monitor industry operating experience or a failure to; implement a corrective action, change or add preventive maintenance, recommend a design change to avoid loss in availability or reduced reliability, resulted in a functional failure when similar occurences in the industry were known in time to avoid the failure.

As a part of the assessment for (a)(2) system(s)/train(s) the system engineer should, where appropriate, assess Industry Operating Experience to identify the need for performance criteria changes. Sources of industry information that could be used include NPRDS, EPIX and INPO safety system performance indicator summary data for the industry.

The Maintenance Rule Coordinator should, as part of the assessment, assess Industry Operating Experience with respect to the plant performance criteria to identify needed changes. Sources of information include INPO plant performance summary for the industry.

PERIODIC A3 MAINTENANCE EFFECTIVENESS ASSESSMENT GUIDE

4.2.4 Optimizing Availability and Reliability (ref. STA-744 section 6.5 & NUMARC 93-01 section 12.2.4)

One of the assessment activities involves the optimization of availability and reliability for scope SSC's which requires proper managing of the occurrence of SSC's being out of service for preventive maintenance to assure acceptable availability and reliability. The Maintenance Rule Coordinator and the responsible system engineer should coordinate with planning and scheduling supervision to maintain a balance between the two.

The Maintenance Rule Coordinator should assess and report how effective the plant has been in balancing availability vs. reliability. This assessment should address whether decisions made for taking equipment out of service for maintenance were appropriate. Optimum balance is achieved when:

- Equipment is out of service for maintenance to improve reliability when the risks associated with unavailability are less than reliability risks or,
- Equipment is not taken out of service for reliability improvement when the risks associated with unavailability are more than the reliability risks.

5.3 Composite report

The Maintenance Rule Coordinator should ensure a composite report that provides the necessary assessment of maintenance effectiveness is submitted for review to the MRRP and to the System Engineering Director each assessment period for final review and approval.

STRUCTURAL MONITORING INSPECTION GUIDE

1.0 PURPOSE

This document provides a detailed plan for performing inspections, and monitoring of buildings and structures within the scope of the Maintenance Rule.

Other plant programs, procedures, and work activities, listed in the references, contain provisions that either augment or in some cases perform some of the inspections for the Structural Monitoring Program.

This document is in compliance with the guidance provided in NUMARC 93-01, "Industry Guideline for Monitoring the Effectiveness of Maintenance at Nuclear Power Plants," and is intended to meet the requirements of 10 CFR 54, "The License Renewal Rule".

2.0 APPLICABILITY

Requirements of periodic inspections and monitoring specified in this document are applicable, at a minimum, to all buildings and structures within the scope of the Maintenance Rule.

3.0 REFERENCES

3.1 STA-692 Maintenance Coatings Program

3.2 STA-708 Seismic and Environmental Qualification

3.3 STA-722 Fire Protection Program

3.4 STA-723 Fire Protection Systems/Equipment Requirements

STRUCTURAL MONITORING INSPECTION GUIDE

3.5 STA-730 Corrosion Monitoring Program

3.6 STA-737 Boric Acid Corrosion Detection and Evaluation

3.7 EME-3.21-15 Engineering Support - Protective Coatings Program

3.8 CHM-108 Corrosion Monitoring Program

3.9 FIR-302 Fire Door Tests and Inspections

3.10 FIR-310 Penetration Seal Inspection

3.11 FIR-311 Fire Rated Assembly Visual Inspection

3.12 INC-3020 Maintenance and Rework of Plant Doors

3.13 ACI 201.1R-92: Guide for Making a Condition Survey of Concrete in Service.

3.14 ACI SP-2(99): ACI Manual of Concrete Inspection.

3.15 ACI 349.3R-02: Evaluation of Existing Nuclear Safety-Related Concrete Structures.

3.16 NUREG-1522: Assessment of In-service Conditions of Safety-Related Concrete Structures.

3.17 NEI 96-03: Guidelines for Monitoring the Condition of Structures at Nuclear Power Plants.

STRUCTURAL MONITORING INSPECTION GUIDE

4.0 DEFINITIONS

4.1 Cracks - A complete or incomplete separation of either concrete or masonry into two or more parts produced by breaking or fracturing.

4.1.1 Checking - Development of shallow cracks at closely spaced but irregular intervals on the surface of plaster, cement paste, mortar or concrete.

4.1.2 Craze Cracks - Fine random cracks or fissures in a surface of plaster, cement paste, mortar or concrete.

4.1.3 D-Cracking - A series of cracks in concrete near and roughly parallel to joints, edges, and structural cracks.

4.1.4 Diagonal Crack - In a flexural member, an inclined crack caused by shear stress, usually at about 45 deg to the axis; of a crack in a slab, not parallel to either the lateral or longitudinal directions.

4.1.5 Hairline Cracks - Cracks in an exposed concrete surface having widths so small as to be barely perceptible.

4.1.6 Pattern Cracking - Fine openings on concrete surfaces in the form of a pattern; resulting from a decrease in volume of the material near the surface, or an increase in volume of the material below the surface, or both.

4.1.7 Shrinkage cracking - Cracking of a structure or member due to failure in tension caused by external or internal restraints as reduction in moisture content develops, or as carbonation occurs, or both.

STRUCTURAL MONITORING INSPECTION GUIDE

4.1.8 Temperature Cracking - Cracking due to tensile failure, caused by temperature gradient in members subjected to external restraints or by temperature differential in members subjected to internal restraints.

4.1.9 Transverse Cracks - Cracks that develop at right angles to the long direction of the member.

4.2 Deterioration

1) Physical manifestation of failure of a material (e.g., cracking, delamination, flaking, pitting, scaling, spalling, straining) caused by environmental or internal autogenous influences on hardened concrete as well as other materials;

2) Decomposition of material during either testing or exposure to service.

Disintegration - Reduction into small fragments and subsequently into particles.

1) Abrasion Damage - Wearing away of a surface by rubbing and friction.

2) Blistering - The irregular raising of a thin layer, frequently 25 to 300 mm in diameter, at the surface of placed mortar or concrete during or soon after completion of the finishing operation; blistering is usually attributed to early closing of the surface and may be aggravated by cool temperatures. Blisters also occur in pipe after spinning or in a finish plastic coat in plastering as it separates and draws away from the base coat.

3) Chalking - Formation of a loose powder resulting from the disintegration of the surface of concrete or of applied coating, such as cement paint.

4) Corrosion - Destruction of metal by chemical, electrochemical, or electrolytic reaction with its environment.

STRUCTURAL MONITORING INSPECTION GUIDE

(4.2) 5) Deflection - Movement of a point on a structure or structural element, usually measures as a linear displacement transverse to a reference line or axis.

6) Deformation - A change in dimension or shape.

7) Efflorescence - A deposit of salts, usually white, formed on a surface, the substance having emerged in solution from within either concrete or masonry and subsequently been precipitated by evaporation.

8) Erosion - Progressive disintegration of a solid by the abrasive or cavitation action of gases, fluids, or solids in motion.

9) Pitting - Development of relatively small cavities in a surface; in concrete, localized disintegration, such as a popout; in steel, localized corrosion evident as minute cavities on the surface.

10) Peeling - A process in which thin flakes of mortar are broken away from a concrete surface, such as by deterioration or be adherence of surface mortar to forms as forms are removed.

11) Papeete - The breaking away of small portions of a concrete surface due to localized internal pressure which leaves a shallow, typical conical, depression.

12) Sealing - Local flaking or peeling away of the near-surface portion of hardened concrete or mortar; also of a layer from metal.

13) Scaling, light - Loss of surface mortar without exposure of coarse aggregate.

14) Scaling, medium - Loss of surface mortar 5 to 10 mm in depth and exposure of coarse aggregate.

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(4.2) 15) Scaling, severe - Loss of surface mortar 5 to 10 mm in depth with some loss of mortar surrounding aggregate particles 10 to 20 mm in depth.

16) Scaling, Very Severe - loss of coarse aggregate particles as well as mortar, generally to a depth greater than 20 mm.

17) Spall - A fragment, usually in the shape of a flake, detached from a larger mass by a blow, by the action of weather, by pressure, or by expansion within the large mass.

18) Small Spall - A roughly circular depression not greater than 20 mm in depth nor 50 mm in any dimension.

19) Large Spall - May be roughly circular or oval or, in some cases elongated, more than 20 mm in depth and 150 mm in dimension.

20) Warping - A deviation of a slab or wall surface from its original shape, usually caused by either temperature or moisture differentials or both within the slab or wall.

4.3 Textural features and phenomena relative to their development.

1) Air Void - A space in cement paste, mortar, or concrete filled with air; an entrapped air void is characteristically 1 mm or more in size and irregular in shape; an entrained air void is typically between 10 up and 1 mm in diameter and spherical or nearly so.

2) Bleeding - The autogenous flow of mixing water within, or its emergence form, newly placed concrete or mortar; caused by the settlement of the solid materials within the mass; also called water gain.

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(4.3) 3) Bungholes - Small regular or irregular cavities, usually not exceeding 25 mm in diameter, resulting from entrapment of air bubbles in the surface of formed concrete during placement and consolidation.

4) Discoloration - Departure of color from that which is normal or desired.

5) Honeycomb - Voids left in concrete due to failure of the mortar to effectively fill the spaces among coarse aggregate particles.

6) Joint - A physical separation in concrete, whether precast or cast-in-place, including cracks if intentionally made to occur at specified locations; also the region where structural members intersect such as a beam-column joint.

7) Latence - A layer of weak and nondurable material containing cement and fines from aggregates, brought by bleeding water to the top of over wet concrete; the amount is generally increased by overworking or over-manipulating concrete at the surface by improper finishing or by job traffic.

8) Stalactite - A downward-pointing deposit formed as an accretion of mineral matter produced by evaporation of dripping water from the surface of concrete, commonly shaped like an icicle.

9) Stalagmite - An upward-pointing deposit formed as a accretion of mineral matter produced by evaporation of dripping water, projecting from the surface of concrete, commonly conical in shape.

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(4.3) 10) Stratification - The separation of overwet or over vibrated concrete into horizontal layers with increasingly lighter material toward the top; water, laitance, mortar, and coarse aggregate tend to occupy successively lower positions, in that order, a layered structure in concrete resulting from occurrence in aggregate stockpiles of layers of differing grading or composition; a layered structure in a rock foundation.

11) Water Void - Void along the underside of an aggregate particle or reinforcing steel which formed during the bleeding period; initially filled with bleed water.

5.0 RESPONSIBILITIES

5.1 System Engineering, Manager

Has overall responsibility for maintaining this guide, and providing technical directions contained in this guide.

5.2 System Engineering Smart Team Manager

Has responsibility for ensuring that inspection of buildings and structures according to the provisions of this guide are performed in a satisfactory and timely manner.

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5.3 Buildings and Structures System Engineer

Responsible for:

- Performing inspections of buildings and structures according to the provisions of this guide. Assistance may be obtained from other qualified plant personnel for performing such inspections.
- Evaluation of identified conditions and implementing corrective actions, as necessary.
- Maintaining documentation of inspections performed according to the provisions of this guide.

6.0 <u>INSTRUCTIONS</u>

6.1 General

All structures identified in Section 7.0 will be included within the scope of the Structural Monitoring Program. However, structures and structural components that are monitored using other plant programs will continue to be monitored by those programs, and only references to those programs will be made here.

Inspection of structures will be performed using the examination guidelines provided in Section 8.0.

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6.2 Inspection Plan

All buildings and structures within the scope of this monitoring guide have been divided into several areas to facilitate the inspection process, and an inspection frequency established for each area. The inspection frequency for each area was based, in general, on recommendations made in Section 7.0, except for roofs of safety-related structures, where an inspection frequency of two years was adopted based on experience. These inspection frequencies may be modified based on observed conditions and performance.

Inspection of each area will include all structural components within the area except for components that are addressed by other inspection programs. Section 7.0 provides a listing of the various inspection areas along with their corresponding inspection frequencies and inspection start dates.

Inspection of buildings and structures under this guide began with the inspection of Unit 2 Containment during 2RF07 in October, 2003. Beginning of inspection of all other areas will be staggered as noted in Section 7.0. New inspection areas may be added to the list in Section 7.0 as and when necessary.

Room and area layout drawings to be used for inspection are also provided in Section 7.0 for reference. Inspection Checklist STA-744-3 through -6 may be utilized to help identify inspection attributes for various structural components. However, these checklists need not be maintained as records for future reference.

All inspections will be performed by personnel having the required qualifications as stated in Section 13.0.

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6.3 Special Monitoring Inspection

Special monitoring inspections will be performed for structures and components, as determined by the Buildings and Structures System Engineer, based on condition of such structures and components. Such inspections will, in general, be performed to monitor identified conditions of interest. Buildings and Structures System Engineer will maintain completed "Area Inspection Form" STA-744-2.

6.4 Documentation and Evaluation of Results of Inspection

All inspection results will be documented on Area Inspection Form STA-744-2 by the Building and Structures System Engineer or his/her qualified designee. Structures and structural components in good acceptable condition need not be reported. All conditions considered by the inspector to be non-conforming, or degraded, or requiring attention or action, should be reported with sufficient details such that the location and condition of identified area or component are easily understandable. Explanatory notes, marked-up sketches, photographs, etc., may be added to the Area Inspection Forms, as deemed necessary, to identify degraded conditions. The next due date for inspection should be noted on the Area Inspection Forms. All area inspections not performed by the Building and Structures System Engineer should have their STA-744-2 forms independently reviewed by the Building and Structures System Engineer.

The Buildings and Structures System Engineer or his designee shall review all reported conditions, and initiate appropriate actions, e.g., perform evaluation, initiate corrective action, adopt plans for more frequent monitoring, present to System Health meetings for direction, initiate Smart Form, etc., as necessary. References to such actions should be included in the Walkdown Area Reports for all reported conditions.

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6.5 Missed Inspections

Inspection of Reactor Building Internal Structure rooms are to be conducted every other outage. If all rooms cannot be inspected because of availability of rooms, or any other reasons, the remaining areas may be slated for inspection during the following outage of the respective unit.

If any scheduled inspection, other than inspection of RB Internal Structure rooms, is missed for any reason, the missed inspection should be performed within the following three months. All inspections not performed within three months of the scheduled date should be documented on a corrective action document.

6.6 Structures and Components Included in Other Plant Programs

The following structures and components are included within the scope of the Maintenance Rule, and are monitored by other plant programs. Inspection and monitoring of these structures and components are not included in this Structural Monitoring Guide.

Containment Shell and Liner - IWE and IWL programs. (STA-703)
Plant Fire Doors - FIR 302
Plant Doors - INC-3020
Penetration Seals - FIR 310
Fire Rated Assembly Visual Inspection - FIR 311
Engineering Support-Protective Coatings Program - EPG 5.01
Safe Shutdown Impoundment Dam - Surveillance 500682, PPT-SX-7517
Squaw Creek Dam - PM 305356, ENV 314
ASME Class 1, 2 and 3 Component Supports - ISI Program (STA-703)

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7.0 INSPECTION AREAS & FREQUENCIES

Inspection Area Designation

Inspection Area Number	Inspection Area Coverage	Inspection Frequency	Monitoring Inspection Start Date	Ref. Area Map Dwg. No.	Remarks
1	Unit 1 RB Internal Structure-All Rooms	Every other outage	1RF10	A1-0413, Sh.01 ~06	Locked high radiation areas to be inspected based on available access. Interval not exceed more than 2 outages
2	Unit 2 RB Internal Structure-All Rooms	Every other outage	2RF07	A1-0413, Sh.01 ~06	Locked high radiation areas to be inspected based on available access. Interval not exceed more than 2 outages
3	Unit 1 Safeguards Building- El. 790'-6" and below	Every 5 years	Jan, 2004	A1-0413, Sh.01	Including portion of pipe tunnel at El.796'-6"& 810'-6"
4	Unit 1 Safeguards Bldg. El. 810'-6"	Every 5 years	Feb, 2004	A1-0413, Sh.02	Including rooms at El.800'-0"&821'-0"
5	Unit 1 Safeguards Bldg. El. 831'-6" & 841'-6"	Every 5 years	Apr, 2004	A1-0413, Sh.03	
6	Unit 1 Safeguards Bldg. El.852'-6"	Every 5 years	Jun, 2004	A1-0413, Sh.04	

ATTACHMENT 8.H
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7.0 INSPECTION AREAS & FREQUENCIES

Inspection Area Designation

Inspection Area Number	Inspection Area Coverage	Inspection Frequency	Monitoring Inspection Start Date	Ref. Area Map Dwg. No.	Remarks
7	Unit 1 Safeguards Bldg. El.873'-0" and above	Every 5 years	Jul, 2004	A1-0413, Sh.05 and 06	
8	Unit 2 Safeguards Building- El. 790'-6" and below	Every 5 years	Jan, 2004	A1-0413, Sh.01	Including portion of pipe tunnel at El.796'-6"& 810'-6"
9	Unit 2 Safeguards Bldg. El. 810'-6"	Every 5 years	Feb, 2004	A1-0413, Sh.02	Including rooms at El.800'-0"&821'-0"
10	Unit 2 Safeguards Bldg. El. 831'-6" & 841'-6"	Every 5 years	Apr, 2004	A1-0413, Sh.03	
11	Unit 2 Safeguards Bldg. El.852'-6"	Every 5 years	Jun, 2004	A1-0413, Sh.04	
12	Unit 2 Safeguards Bldg. El.873'-0" and above	Every 5 years	Jul, 2004	A1-0413, Sh.05 and 06	
13	Fuel Building El.825'-2" & below	Every 5 years	Nov, 2004	A1-0413, Sh.01 & 02	Including Service Water Pipe Tunnel
14	Fuel Building El. 830'-6" & above	Every 5 years	Nov, 2004	A1-0413, Sh.03, 04,05 & 06	
15	Auxiliary Building El. 790'-6"	Every 5 years	Jan, 2005	A1-0413, Sh.01	

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7.0 INSPECTION AREAS & FREQUENCIES

Inspection Area Designation

Inspection Area Number	Inspection Area Coverage	Inspection Frequency	Monitoring Inspection Start Date	Ref. Area Map Dwg. No.	Remarks
16	Auxiliary Building El.810'-6"&822'-0"	Every 5 years	Jan, 2005	A1-0413, Sh.02	
17	Auxiliary Building El.831'-6"&841'-0"	Every 5 years	Feb, 2005	A1-0413, Sh.03	
18	Auxiliary Building El.842'-0",852'-6"&862'-6"	Every 5 years	Feb, 2005	A1-0413, Sh.04	
19	Auxiliary Building El. 873'-0"	Every 5 years	Apr, 2005	A1-0413, Sh.05	
20	Electrical & Control Building E.778'-0"&792'-0"	Every 5 years	Apr, 2005	A1-0413, Sh.01	
21	Electrical & Control Building El. 807'-0"	Every 5 years	Jun, 2005	A1-0413, Sh.02	
22	Electrical & Control Building El.830'-0"&840'-6"	Every 5 years	Jun, 2005	A1-0413, Sh.03	
23	Electrical & Control Building El.854'-4"& above	Every 5 years	Jul, 2005	A1-0413, Sh.04 & 05	

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7.0 INSPECTION AREAS & FREQUENCIES

Inspection Area Designation

Inspection Area Number	Inspection Area Coverage	Inspection Frequency	Monitoring Inspection Start Date	Ref. Area Map Dwg. No.	Remarks
24	Unit 1 Turbine Building El.758'-3" & below	Every 5 years	Jul, 2005	A1-0413, Sh.01	
25	Unit 1 Turbine Building El.778'-0"	Every 5 years	Aug, 2005	A1-0413, Sh.01	
26	Unit 1 Turbine Building El. 803'-0"	Every 5 years	Nov, 2005	A1-0413, Sh.02	
27	Unit 1Turbine Building E.821'-8"&830'-0"	Every 5 years	Nov, 2005	A1-0413, Sh.03	
28	Unit 2 Turbine Building El.758'-3" & below	Every 5 years	Jan, 2006	A1-0413, Sh.01	
29	Unit 2 Turbine Building El.778'-0"	Every 5 years	Jan, 2006	A1-0413, Sh.01	
30	Unit 2 Turbine Building El. 803'-0"	Every 5 years	Feb, 2006	A1-0413, Sh.02	
31	Unit 2 Turbine Building E.821'-8"&830'-0"	Every 5 years	Feb, 2006	A1-0413, Sh.03	

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7.0 INSPECTION AREAS & FREQUENCIES

Inspection Area Designation

Inspection Area Number	Inspection Area Coverage	Inspection Frequency	Monitoring Inspection Start Date	Ref. Area Map Dwg. No.	Remarks
32	Unit 1 Switchgear Building El. 810'-6"	Every 5 years	Apr, 2006	A1-0413, Sh.02	
33	Unit 2 Switchgear Building El. 810'-6"	Every 5 years	Apr, 2006	A1-0413, Sh.02	
34	Service Water Intake Structure El.810'-6"&796'-0"	Every 5 years	May, 2006	A1-0413, Sh.08	
35	Service Water Intake Structure Below El.796'-0"	Every 2 years	Sep, 2004	A1-0413, Sh.08	
36	Circulating Water Intake Structure	Every 2 years	Sep, 2005	A1-0413, Sh.07 & A-1104	Including Chlorination Building
37	Circulating Water Discharge Structure	Every 5 years	May, 2006	S-1106	Accessible areas only
38	Service Water Discharge Structure	Every 5 years	May, 2006	S-1117 & S-1118	Accessible areas only
39	Reactor Make-up Water Storage Tanks	Every 2 years	Sep, 2004	A1-0413, Sh.02	External Tank Structures only
40	Condensate Water Storage Tanks	Every 2 years	Sep, 2004	A1-0413, Sh.02	External Tank Structures only

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7.0 INSPECTION AREAS & FREQUENCIES

Inspection Area Designation

Inspection Area Number	Inspection Area Coverage	Inspection Frequency	Monitoring Inspection Start Date	Ref. Area Map Dwg. No.	Remarks
41	Refueling Water Storage Tanks	Every 2 years	Sep, 2005	A1-0413, Sh.02	External Tank Structures only
42	Plant Effluent Tanks	Every 2 years	Sep, 2005	DCN 3703	External Tank Structures only
43	Fire Water Pump House	Every 5 years	Jun, 2006		
44	138 KV Switch Yard	Every 5 years	Jun, 2006		
45	345 KV Switch Yard	Every 5 years	Jun, 2006		
46	Unit 1 & 2 Main Transformer Foundation	Every 5 years	Jul, 2006		
47	Unit 1 & 2 Start-Up Transformer Foundation	Every 5 years	Jul, 2006		
48	Unit 1 & 2 Auxiliary Transformer Foundation	Every 5 years	Jul, 2006		
49	Demineralized Water Storage Tank Foundation & Appurtenances	Every 5 years	Jul, 2006		
50	Foundations for Fire Water Tanks	Every 5 years	Nov, 2003		

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7.0 INSPECTION AREAS & FREQUENCIES

Inspection Area Designation

Inspection Area Number	Inspection Area Coverage	Inspection Frequency	Monitoring Inspection Start Date	Ref. Area Map Dwg. No.	Remarks
51	Block wall enclosures for the Fire Water Deluge Valves for the transformers	Every 5 years	Nov, 2003		
52	Supporting Structures, Foundations and metal enclosure for the Meteorological and Back-up Towers	Every 5 years	Nov, 2003		
53	Roofs of Safety Related Structures (SWIS, SG1, SG2, AUX, EC, FB)	Every 2 years	May, 2005		
54	Roofs of Non-Safety Related Structures (TB1, TB2, Switchgear)	Every 2 years	May, 2005		
55	Structural Isolation Gaps Category I Structures	Every 2 years	Aug, 2004	DBD-CS-015, Attachment 1	

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7.0 INSPECTION AREAS & FREQUENCIES

Inspection Area Designation

Inspection Area Number	Inspection Area Coverage	Inspection Frequency	Monitoring Inspection Start Date	Ref. Area Map Dwg. No.	Remarks
56	Settlement of Category I Structures	Every 10 years	Aug, 2005		

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8.0 INSPECTIONS

8.1 INSPECTIONS PURPOSE

The purpose of this Section is to provide guidance for performing inspections of SSCs which are part of the Maintenance Rule Civil/Structural scope. These inspections will document the plant conditions at a certain time; ensure the timely identification, assessment, and repair of any identified, degraded parameters, and will define and confirm the periodic inspection intervals of SSCs for CPNPP.

8.2 SCOPE

The scope of this program includes safety related and non-safety related SSCs that are within the scope of the Maintenance Rule. Other SSCs may be included because of the Company's financial investment in those SSCs.

8.3 STRUCTURES IDENTIFICATION

8.3.1 Identification of Structures

A structure is defined as something, like a building, that is designed and constructed to sustain a load.

A list of plant structures, given below, has been developed for the Structural Monitoring Program. The structures identified within the scope of the Maintenance Rule support or protect equipment or components defined in 10CFR 50.65, paragraph (b)(1) and (b)(2).

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8.3.1.1 Unit 1 and 2 structures are:

- Concrete Containments
- Reactor Building Internal Concrete Structures
- Safeguard Buildings
- Turbine Buildings
- Reactor Make-up Water Storage Tanks
- Condensate Water Storage Tanks
- Refueling Water Storage Tanks

8.3.1.2 Common structures are:

- Fuel Building
- Service Water Discharge Structure
- Auxiliary Building
- Circulating Water Discharge Structure
- Electrical and Control Building
- 138 Kv Switchyard
- Service Water Intake Structure
- 345 Kv Switchyard
- Circulating Water Intake Structure
- Firewater Pump House

8.3.1.3 Other structures/equipment foundations are:

- Unit 1 and Unit 2 Main Transformers Foundations
- Unit 1 and Unit 2 Start-up Transformers Foundations
- Unit 1 and Unit 2 Auxiliary Transformers foundations
- Demineralized Water Storage Tanks Foundations and Appurtenances
- Foundations for the Fire Water Tanks
- Block wall enclosures for the Fire Water Deluge Valves for the transformers
- Supporting structures, foundations and metal enclosure for the meteorological and back-up towers

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8.3.2 IDENTIFICATION OF STRUCTURAL COMPONENTS

Examples of structural components are beams, columns, slabs, walls and roofs that when connected with other structural components make up the structure. Since most structures are arranged on a grid system corresponding to building columns, with each building floor slab identified by its elevation, the following methods are used to identify components.

8.3.2.1 Concrete

- Beams - beam number (if applicable) or elevation and coordinates
- Floor or Roof slab - elevation and area
- Columns - coordinates and elevation
- Walls - elevation and column coordinates

8.3.2.2 Steel

- Beams - beam number (if applicable) or elevation and coordinates
- Columns - coordinates and elevation

8.3.2.3 Masonry Walls

Block wall number or building, elevation, and coordinates

8.3.2.4 Roofing

Building designation, elevation, or area defined by column coordinates.

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8.3.3 Identification of other Structural Elements

The components annotated under this listing predominantly refer to structural items that are parts of the overall mechanical and electrical systems or are considered as architectural designed features. These items are predominantly identified by the equipment they are associated with.

8.3.3.1 Equipment Foundation

Equipment tag numbers

8.3.3.2 Component supports

Support numbers are shown on drawings for:

1) Pipe supports
2) Cable tray supports
3) Conduit and junction box supports
4) HVAC supports

A certain number of supports will be selected, which will be representative of the supports throughout the plant. This sample will remain constant, unless it is expanded based on identified, degraded conditions. Sample sizes for each component support will be as follows:

Pipe Supports	50
Cable Tray Supports	25
Conduit Supports	25
HVAC Supports	25

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8.3.3.3 Structural Isolation Gaps

Building interface, elevation, boundary coordinates

8.3.3.4 Doors

Tag numbers, building, room number, location, elevation

Twenty-five (25) doors will be selected and will be representatives of the doors used in the plant. This sample will remain constant, unless it is expanded based on identified, degraded conditions.

8.4 FUNCTIONAL DESCRIPTION OF BUILDINGS

8.4.1 Containment Building Dome, Shell and Basemat

The Containment Building is a reinforced concrete pressure vessel, which houses the reactor coolant system as well as portions of reactor auxiliary systems and other engineered safeguards systems. It is designed to sustain, without loss of essential functions, the environmental effects of natural phenomena in addition to the effects of normal operating and postulated accident conditions. The Containment Building ensures that leakage of radioactive material to the environment, following a postulated accident, will not exceed the requirements of 10 CFR 100, "Reactor Site Criteria" and to preclude normal operating doses from exceeding 10 CFR 20 limits.

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8.4.2 Reactor Building Internal Structures

The Reactor Building Internal Structures are primarily comprised of reinforced concrete and consist of major elements such as the primary shield wall, primary loop compartment walls, operating floor, refueling cavity, and an interior base slab.

The primary shield wall, a heavily reinforced concrete cylinder, is situated at the approximate center of the Containment Building, and extends up from the interior base slab to surround the reactor vessel. This reactor cavity structure provides support for the reactor vessel. During normal operation, the primary shield wall provides biological shielding for maintenance inspections. Under seismic loading, this structure provides seismic shear resistance and stiffens the Containment Internal Structure.

The primary loop compartments are formed by the secondary shielding walls on the exterior and by the reactor and refueling canal walls on the interior. These walls extend from the interior base slab up to the operating floor. Each compartment houses the steam generator, reactor coolant pumps, and the reactor coolant loops. The compartment walls provide radiation shielding, isolation of the reactor coolant system, and lateral restraint for the steam generator, pump and pressurizer.

The operating floor is supported by the primary loop compartment walls and concrete columns adjacent to the containment shell, which extend down to the interior base slab. The operating floor provides a working and access floor during refueling, maintenance, and repair operations. Vent areas are provided where required.

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(8.4.2) The refueling cavity provides shielded access for transport of spent fuel and new fuel between the reactor vessel and fuel transfer penetration. It also provides shielding storage space for the reactor vessel internals during refueling or maintenance. The cavity is lined with stainless steel.

The interior base slab is placed on top of the foundation mat liner plate. This slab provides lateral and flexural restraint at the base of the primary loop compartment walls and the primary shield wall. The slab ties the primary loop compartment walls to the primary shield walls and provides a diaphragm for seismic shear distribution at the bottom of the internal structure. It also protects the foundation mat liner from any missiles generated in the primary loop compartment and from the effects of accident temperatures.

8.4.3 Fuel Building

The principal function of the Fuel Building is to house the new fuel storage area and the two spent fuel pools. The Fuel Building is designed to Seismic Category I requirements. The Fuel Building is also designed to resist the effects of design basis tornado.

8.4.4 Safeguard Building

The Safeguard Building for each unit houses the safety injection pumps, RHR pumps and coolers, containment spray pumps and coolers, auxiliary feedwater pumps, diesel generators, electrical switchgear, motor control centers, and control rod drives. The Safeguard Building is a Seismic Category I structure and is designed to resist the effects of the design basis tornado.

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8.4.5 Auxiliary and Control Building

The Auxiliary and Control Building house the control room, battery rooms, ventilation equipment, waste treatment equipment, and other fluid auxiliary systems. They are Seismic Category I structures and are designed to resist the effects of the design basis tornado.

8.4.6 Seismic Category I Tanks and Pipe Tunnels

All Seismic Category I Tanks contain fluid feeding, safety-related piping systems such as auxiliary feedwater system and safety injection system. These Tanks are circular in shape, with stainless steel liners to provide leak tightness. For the Refueling Water Storage Tank, the liner also prevents absorption of radioactive material by the concrete structure. Seismic Category I tanks are also designed to resist the effects of the design basis tornado.

The Seismic Category I pipe tunnel structures protect safety-related piping systems against damage from environmental effects, including the effects of design basis tornado.

8.4.7 Service Water Intake Structure

The Seismic Category I Service Water Intake Structure houses the service water pumps and fire pump, and is equipped with trash racks, traveling screens, stop gates, and screen wash pumps. The safety-related service water traveling screens provide long-term protection from accumulation of debris. This service water system draws water from the Safe Shutdown Impoundment (SSI) and supplies all safety-related cooling systems. The Service Water Intake Structure is designed to resist the effects of the design basis tornado.

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8.4.8 Other Structures

8.4.8.1 Turbine Building

The only non-Category I structures which are adjacent to any Seismic Category I structure are the Turbine Building and the Switchgear Buildings. These structures do not share a common mat with the adjacent Seismic Category I structure, with all structures founded on firm rock. Therefore, there is no possible interaction of non-Category I structures with Seismic Category I structures resulting from seismic motion. Sufficient space is provided between Turbine Building and the adjacent Seismic Category I structures so as to prevent contact because of deformations occurring in the structures during a seismic event.

8.4.8.2 Turbine-Generator Pedestals

The turbine is a tandem-compound, four-flow, 1800-rpm machine installed on the Turbine Building operating deck (elevation 803') and is supported by the turbine pedestal.

The possibility of structural failure during a seismic event is considered for the Turbine Building. Structural failure in the direction of the adjacent Seismic Category I structure is prevented by the bearing of the mezzanine and operating floor slabs on the concrete turbine generator pedestal.

8.4.8.3 Circulating Water Intake Structure

The Circulating Water Intake Structure is a non-Seismic Category I structure. The Circulating Water Intake Structure houses the circulating water pumps and is equipped with trash racks, traveling screens, stop gates, and screen wash pumps. The traveling screens provide long-term protection from accumulation of debris. This circulating water system draws water from the Squaw Creek reservoir and supplies the turbine condenser cooling systems.

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8.5 EXAMINATION GUIDELINES

This section provides recommended guidelines for the examination of structures and components addressed in this program. These guidelines focus on "common" conditions that might occur and are not meant to be all-inclusive.

All examinations shall be visual to assess the condition of the structures and components. Previous examinations or structural issues recently identified may be used to assess the present conditions.

8.5.1 Concrete:

8.5.1.1 Cracks

Cracks should be classified by direction, width, and depth using the following terms: longitudinal, transverse, vertical, diagonal, and random. Three width ranges should be used for the purposes of description: fine - less than 1 mm, medium - between 1 and 2 mm, and wide - greater than 2 mm. Cracking can also be classified by different types. Pattern cracking consists of fine openings on the concrete surface that are in the form of a pattern. Checking is the development of shallow cracks at close, irregular intervals on the concrete surface. Hairline cracking is fine cracks in a random pattern on the surface of the concrete. D-cracking is the progressive formation on the surface consisting of a series of fine cracks at close intervals typically found near edges and joints.

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8.5.1.2 Scaling

Scaling is defined as the local flaking or peeling away of the near surface of concrete. ACI 201 describes five grades of scaling. Peeling occurs when thin flakes of mortar are broken away from the surface. Light scaling is the loss of surface mortar without the exposure of course aggregate. Medium scaling is the loss of surface mortar to a depth of 5 to 10 mm and exposure of coarse aggregate. Severe scaling is also the loss of surface mortar 5 to 10 mm in depth, but with some loss of mortar surrounding the coarse aggregate particles. Very severe scaling is the loss of surface mortar and coarse aggregate particles.

8.5.1.3 Spalling (Popouts)

Concrete spalling occurs when a fragment is detached from the surface by a blow, weather, pressure, or by thermal expansion. ACI 201 describes three types of concrete spalling. A small spall is a surface depression not greater than 20 mm in depth nor greater than 150 mm in diameter. A large spall is defined as a surface depression greater than 20 mm in depth or greater than 150 mm in diameter. A joint spall is a elongated cavity adjacent to a joint.

8.5.1.4 Pitting

This type of concrete deficiency is commonly referred to a honey combs. It occurs when voids are left in the concrete when the mortar does not completely fill the spaces among the coarse aggregate particles.

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8.5.1.5 Other types of degradation:

- Ground or surface water in-leakage
- Surface discoloration
- Chemical leaching
- Exposed reinforcing steel
- Conditions where previously patched

8.5.1.6 Lined Concrete Surfaces

Lined surfaces should be examined, if possible, for the presence of the following:

1) Without Active Leak Detection System

    - Bulges or depressions in the liner plate
    - Corrosion or damage to the liner
    - Cracking or deterioration of base and weld metal
    - Exterior leakage if the outside is accessible and water is returned

2) With Active Leak Detection System

    - Detectable leakage observed in the leak detection system
    - Bulges or depressions in the liner plate

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8.5.1.7 Areas Around Embedment

- Surface conditions as mentioned above
- Corrosion of the exposed metal surfaces and around the embedded metal
- Detached embedment or loose bolts
- Indications of degradation caused by vibratory components

8.5.1.8 Joints, Coatings, and Non-structural Components

- Signs of separation, environmental degradation, or water in-leakage present in the joint or joint material
- Loss of degraded areas of coatings
- Any other waterproofing component or membrane protecting below grade concrete surfaces not serving their intended function.

8.5.2 MASONRY

This section provides guidance for the visual inspection of masonry. Inspectors should consider:

8.5.2.1 Signs of efflorescence caused by the movement of water through the exterior facing of masonry walls depositing "white substances" on the surface.

8.5.2.2 Cracks around commodities such as piping and raceway systems that penetrate masonry walls. When noted, a sketch should be initiated noting the location, length and width of the crack.

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8.5.2.3 Steel members laterally support the masonry walls. These connections between the masonry and the support members should be examined, looking at:

- Exposed welds for signs of cracks
- Secured bolts with nuts

8.5.2.4 Missing or broken masonry blocks

8.5.3 STRUCTURAL STEEL

This section includes steel beams, columns, braces, column base plates, column anchor bolts, floor plates, grating, and their associated connections. Visual inspections should be performed noting such conditions as:

8.5.3.1 Excessive deflection or misalignment

8.5.3.2 Significant corrosion of steel members

8.5.3.3 Cracks, tears, and laminations in steel members

8.5.3.4 Connections:

- Loose or missing bolts for bolted connections
- Cracks in welded connections

8.5.3.5 Spalling or cracking of fireproof coatings

8.5.3.6 Peeling, blistering, cracking, and other paint/coating failures

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8.5.3.7 Column bases:

- Broken or missing anchor bolts at base plates
- Loose or missing nuts or washers
- Missing or degraded grout under base plates

8.5.4 EQUIPMENT FOUNDATIONS:

This section covers foundations and anchorages for pumps, heat exchangers, horizontal tanks, fans, HVAC equipment, electrical equipment, instrument racks, battery racks, transformers, engine/motor generators, and compressors. Visual inspection should cover items such as:

8.5.4.1 Corrosion appearing on anchor bolts

8.5.4.2 Corrosion of embedded plates and spalling of the concrete near the embedment

8.5.4.3 Cracks or corrosion on the attachment welds

8.5.4.4 Corrosion and load path carrying capacity for the shim plates

8.5.4.5 Degradation of the grout or concrete showing signs of cracking, spalling, or separation from the floor for equipment resting on pads

8.5.4.6 Sign of corrosion, coating degradations, distortion of structural members, and cracked welds at equipment located on structural skids

8.5.4.7 Degradation of coatings as they apply to equipment foundations

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8.5.5 ROOFING:

This section provides guidance relative to inspections for single and multiple ply membrane roofing systems installed with or without ballast material.

A visual inspection of the roof surface should be made to assess the overall condition of the roof including the perimeter parapets, flashing, drains, etc. Drawings should be marked up indicating the areas of concern.

8.5.5.1 General Appearance

- Presence of debris, vegetation, and other signs of physical damage
- Areas where changes have been made by adding new equipment, penetrations, etc.

8.5.5.2 Ballasted Roofing Systems

The ballast material should be examined for signs of damage or distress as indicated by:

- Displaced or cracked ballast pavers
- Un-adhered ballast pavers
- Scoured ballast material

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8.5.5.3 Unballasted Roofing Systems

The exposed roofing membrane surface should be examined for the presence of

- Blistering or bubbling of the surface
- Open laps or seams
- Wrinkling or ridging of the membrane material
- Physical damage or perforations

8.5.5.4 Flashing

- Splits or cracks
- Open laps
- Fasteners present and properly engaged
- Punctures or damage

8.5.5.5 Drainage Systems

- Signs of ponding caused by low spots on the surface
- Unrestricted flow for the drains
- Debris in the gutters, which would restrict flow

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8.5.6 COMPONENT SUPPORTS:

This examination covers guidelines for piping, HVAC ductwork, cable trays, and conduits supports including the steel members between the supported component and the concrete slab/beam or structural steel framing. Not included for inspections are standard components such as snubbers, struts and spring cans.

A general inspection of the area will be made with selections made randomly based on representative types and/or certain supports exhibiting some type of structural or material degradation.

8.5.6.1 Structural members

- Excessive deflection
- Cross section distortion
- Misalignment

8.5.6.2 Material degradation

- Significant corrosion resulting in loss of cross section
- Cracks, tears, or laminations of members

8.5.6.3 Connections

- Loose or missing bolts for bolted connections
- Cracks in welded connections
- Corrosion and positive contact for anchor bolts

8.5.6.4 Painting/Coating

- Cracking, peeling, blistering, or other coating failures

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8.5.7 VERTICAL TANKS:

This examination addresses the structural integrity of vertical, atmospheric tanks constructed of steel or concrete with a steel liner.

8.5.7.1 General Appearance

- Obvious distortions caused by settling and overpressurization
- Evidence of corrosion
- Coating degradation
- Cracks, spalling, popouts, efflorescence or evidence of reinforcing steel corrosion in concrete tanks

8.5.7.2 Leakage

- Staining, efflorescence, or corrosion evident on the exterior surface
- Contents on the floor or on the ground near the base of the tank

8.5.7.3 Penetrations

- Potential leakage paths at piping penetrations
- Cracked welds

8.5.7.4 Anchorage

- Corrosion, deformation, or cracked attachment welds for chairs
- Corrosion, loose, or missing anchor bolts
- Positive connections for the load path

8.5.7.5 Foundations

- Cracks in the grout pads for tanks located inside of buildings

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8.5.8 DOORS

The scope of these visual examinations includes watertight, fire, negative pressure, tornado and EQ type doors.

8.5.8.1 Identify any distortion of the door/frame

8.5.8.2 Misalignment between the door and frame

8.5.8.3 Significant corrosion in the door hardware

8.5.8.4 Examine structural members for cracks, tears, or laminations

8.5.8.5 Connections

- Loose or missing bolts for bolted connections
- Cracks for welded connections
- Any signs of corrosion and load carry capacity of anchor bolts

8.5.8.6 Deterioration of the door seals are evidenced by cracking, shrinking, or other visible signs

8.5.8.7 Cracking, peeling, blistering or other coating failures for the door

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8.5.9 SETTLEMENT

8.5.9.1 Structures

Overall and differential settlement of structures, which would be evidenced by cracking or warping of structures and structural components is not a problem at CPNPP since the plant structures, constructed in the mid 1970's, are founded on rock.

Settlement markers, located on exterior walls of various buildings, will have measurements taken and compared to previous readings.

The locations of the markers are as follows:

-	Fuel Building	2 markers	DCA 75149
-	U1 Containment Building	2 markers	DCA 75150
-	U2 Containment Building	2 markers	DCA 75151
-	U1 Safeguard Building	2 markers	DCA 75152
-	U1 Diesel Generator	1 marker	DCA 75152
-	U2 Safeguard Building	2 markers	DCA 75153
-	U2 Diesel Generator	1 marker	DCA 75153
-	U1 Refueling Water Storage Tank	1 marker	DCA 75154
-	Condensate Storage Tank	1 marker	DCA 75154
-	U1 Reactor Makeup Water Storage Tank	1 marker	DCA 75154
-	U2 Refueling Water Storage Tank	1 marker	DCA 75155
-	U2 Condensate Storage Tank	1 marker	DCA 75155

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(8.5.9.1)

- U2 Reactor Makeup Water Storage Tank	1 marker	DCA 75155
- Service Water Intake Structure	2 markers	DCA 75156

8.5.9.2 Dams

The Safe Shutdown Impoundment is inspected yearly under surveillance 500682-AA and procedure PPT-SX-7617. The inspection attributes include erosion settlement, slope stability, integrity of rip rap, sedimentation, piezometers, alignment, and drainage.

The Squaw Creek dam is inspected under the PM 305356 and procedure ENV 314 for erosion, settlement, alignment, integrity of rip rap, piezometer, and drainage. The inclinometers in the dam are read at least once a year. The dam is inspected by Environmental Services (Dallas) every two years using the state guidelines. For the above reasons, no specific inspections are required per this Program.

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8.5.10 Structural Isolation Gaps

Structural Isolation Gaps provide air gaps between structures and structural components for isolating one from the other, thereby preventing load transfer across the gaps. Some gaps are intentionally left open and unfilled such as gaps between main walls and secondary walls in the plant and between the containment internal structure (e.g., floor) and the containment exterior wall. Other gaps, known as seismic gaps, are elastomeric-filled and provide the necessary isolation between structures during an earthquake.

A technical issue regarding the maintenance of air gaps between structures was identified and resolved in the late 1980's, prior to licensing Unit 1. Calculations were performed that documented the required displacements that were validated against the structural and secondary wall gap requirements. In particular, the gaps between the concrete structures were inspected and then resealed with elastomers. DBD-CS-019 was generated and provided building and secondary wall displacements. The design drawings were then revised to incorporate the gap design criteria specified in the DBD.

Procedures are established emphasizing the controls required when specific work activities involve opening the elastomeric-filled gaps, noting the importance of keeping material from falling into the gaps.

Based on the reasons above, the visual inspections of the isolation gaps will then be limited to identifying any noticeable damage/degradation to the elastomeric gap covers.

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9.0 EVALUATION OF RESULTS

This section addresses the evaluation and disposition of the inspections resulting from the structural walkdowns. The Reviewer is responsible for determining the acceptability of a degraded component in conjunction with relevant codes, standards, design drawings, specifications, industry guidelines, engineering experience, analysis, or more detailed walkdowns.

Based upon the evaluations, the condition of the structure and components will be made as follows:

9.1 Acceptable

Acceptable structures and components are capable of performing their structural functions, including the protection and support of safety related systems or components. Acceptable structural components are free of deficiencies or degradations which could lead to a possible failure.

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9.2 Acceptable with Deficiencies

Structures and components which are acceptable with deficiencies are those which are capable of performing their structural functions, including the protection or support of safety related systems or components, but are degraded or have deficiencies which could deteriorate to an unacceptable condition. Consideration for initiating corrective action document per STA-422 should be made for this condition.

Deficient conditions can be further defined by the action necessary to ensure that the component will perform its structural function. These conditions should be categorized by the following:

Acceptable with Deficiencies - No Specific Actions Required: Identified conditions where specific or further action is <u>not</u> required to prevent further degradation or to restore design margin. In some cases, a commitment may be made to perform some form of continuous monitoring to ensure the condition does not worsen.

Acceptable with Deficiencies - Actions Required: Identified condition where actions, normally in terms of repair, are required to prevent further degradation or to restore design margin.

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9.3 Unacceptable

Unacceptable structures and components are those which are damaged or degraded such that they are not capable of performing their structural functions, including the protection or support of safety related systems or components. An unacceptable structure or component should be classified as a functional failure in accordance with this Program and the Maintenance Rule. A correction action document must be initiated for all structures and structural components classified as such.

Because of the robust design and construction methods employed in nuclear power plants, it would take extreme environmental conditions or many years of neglect for this state to appear. Early detection, review and repair of deficient conditions can preclude reaching this failure state.

10.0 <u>CORRECTIVE ACTIONS</u>

10.1 Damage, deficiencies, and/or degraded conditions should be documented and corrected in accordance with applicable CPNPP project procedures. Implementation of any specific corrective action will be tracked and monitored to ensure the structures and structural components meet their intended design functions.

10.2 As part of the corrective action, cause determinations should be made for structures which are unacceptable or which could deteriorate to an unacceptable condition. The results of the cause determination may result in corrective actions, including goal setting, as appropriate.

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11.0 FUNCTIONAL FAILURES

The following list provides guidance for defining functional failures as they apply to structures and components.

11.1 Concrete

Functional failure of concrete contributes to cases where the concrete, as evidenced by degradations such as pitting, popouts, scaling, spalling, cracking, leaching, ground water in leakage and a deterioration of protective coatings or reinforcing bars, is not capable of meeting the plant's current design basis. The degradations are such that no margin or safety factor exists to support the structural function.

11.2 Structural Steel

Functional failure of structural steel is evidenced by a loss of cross-sectional area caused by corrosion, cracks, in the welds or base metal, or loose, missing, or broken bolts rendering the steel from carrying its design load and performing its design basis function.

11.3 Masonry

Functional failure of masonry occurs when degradations caused by defects such as cracking, popouts, spalling, mortar deterioration, or efflorescence render the wall incapable of meeting its design basis. Degradation of the wall's structural supports would entail missing or loose bolts or cracks. The degradation of the masonry or components must be significant enough that an evaluation would show no margin or safety factor to support the structural function.

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11.4 Equipment Foundations

Functional failure of an equipment foundation involves the degraded condition where a piece of equipment is declared inoperable for its design basis loads. Degradation may include loss of bearing capacity or anchor capacity resulting possibly in vibration problems. Degradations in the concrete would most often be visible or detectable.

11.5 Roofing

A functional failure of a roofing system would be defined as degradation to the roofing membrane where leakage becomes uncontrollable or may exist in an area that may prevent safety related or selected non safety related systems from performing their required safety functions. This also includes degradation of the roofing system where the membrane degrades enough that the structural members/connections are not capable of performing their intended design functions up to the point of failure.

11.6 Component Support

A functional failure of a component support is defined by a loss of cross-sectional area caused by corrosion, cracks in the weld or base metal, or loose, missing, or broken bolts rendering the support from carrying its design basis loads.

11.7 Vertical Tanks

A functional failure for a vertical tank is defined as a degraded condition in which the tank would not be able to withstand its design basis loads. In addition, another functional failure would involve any significant leakage which cannot be controlled, resulting in unavailability of its contents to other vital equipment and flooding of undesired areas in the plant.

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11.8 Buried Piping

A functional failure for a buried pipe results in its inability to sustain design basis loads or perform its required design basis functions caused by reductions in cross section or in leak tightness. Failure may be characterized by a loss of pipe wall thickness caused by material degradation, resulting in loss of section properties which are not adequate for design loads or by leaks in the pressure retaining portions that cause failure to convey liquids or gases at a design pressure or flow rate. For a failure to exist, the leaks must be significant enough resulting in insufficient pressure/flow rate at the outlet to meet the design or the leakage must be significant in the soil to prevent washout of the soil embedment for the pipe. Leaks may result from material degradation such as cracking, erosion/corrosion caused by inadequate coatings, or by flow-induced erosion/corrosion.

11.9 Structural Isolation Gaps

A functional failure of a structural isolation gap occurs when the elastomers have degraded to the extent that they can no longer perform their intended function, which is to isolate and to prevent load transfer between adjacent structures. Functionality is compromised if the elastomer is cracked, torn, brittle, not bonded to the adjoining media, or exhibits signs of in-leakage. Also, the elastomeric gap would be considered degraded if the gap is occupied by a foreign material, which was not previously there or accounted for, or if the as-found gap dimension is less than that specified in the design.

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11.10 Doors - Watertight, Fire, Negative Pressure, Tornado and EQ

A functional failure for a door of this type is defined when:

- Leakage of a watertight door exceeds its design basis limits for the required flooding level.
- Inability of a door to be opened and/or closed to the extent that the door would not perform its intended (safety) function (i.e., to open during a tornado, to close during a fire, to close for isolating equipment inside for temperature, pressure, and humidity changes for EQ).
- Failure of a door to maintain its structural integrity for other design basis loads (seismic, ...etc.)

12.0 <u>FREQUENCY, TRENDING AND INDUSTRIAL DATA:</u>

12.1 The frequency for performing and documenting further examinations for structures and structural components will generally follow a five year interval, which will be further defined and substantiated upon completion of the baseline and subsequent inspections.

Major modifications may necessitate reperforming the baseline inspections for certain areas based on structural changes to the plant.

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12.2 Exceptions to the 5 year inspection intervals for structures and structural components are identified in the schedule listed in Section 7.0 "Inspecting Areas and Frequencies" or as noted below:

- Containment - 1 every two outages
- Roofs of Safety Related Structures - 1 every two years
- Roofs of Non-Safety Related Structures - 1 every two years
- Component Supports (Sampled) - 1 every ten years

12.3 The frequencies for further examinations follows current industry guidelines and sound engineering practices. These examination frequencies may be revised by the Building and Structures System Engineer with concurrence from the Maintenance Rule Review Panel based on changes in plant environments or observed degradations. Some examples that may dictate increased inspection frequencies are:

- Concrete sections which have been inspected and have active cracks or leaks.
- Chemical environments which have shown to actively attack concrete or structural steel.
- Vibrating loads increasing for equipment which may lead to structural degradations.

12.4 When previously inaccessible inspection areas or components become accessible, inspections of these areas and components should be scheduled and implemented, as appropriate.

12.5 The inspection programs take into account through CPNPP project procedures and through the Maintenance Rule Coordinator any industry data, including Information Notices, which may have structural degradation issues.

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12.6 Additional inspections and evaluations will be made for the structures and structural components if the plant should experience a significant event, such as a tornado, earthquake, fire, flooding, high winds, ...etc.

13.0 <u>PERSONNEL QUALIFICATIONS</u>

13.1 Inspector:

A person performing the inspection of structures and components and is knowledgeable in the Civil Structural area and/or is trained to perform this activity. (This requirement is waived for a speciality item, such a roof, that may be inspected by a manufacturer's representative or a suitably trained consultant in this speciality field.)

A person possessing a Level I or II Concrete Inspector certification from the plant owner, using internal methods, ACT, or other authorized testing organization for conducting qualification testing.

13.2 Reviewer:

A person evaluating the results of the inspections and is knowledgeable in the design, evaluation, and performance requirements of structures. He/she is a degreed, Civil/Structural Engineer with a minimum of 5 years experience in structural design, analysis, and field experience and is a registered Professional Engineer.

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14.0 REFERENCES

14.1 ACI 201.1R-92, "Guide for Making a Condition Survey of Concrete in Service."

14.2 ACI 311, "ACI Manual of Concrete Inspection."

14.3 ACI 349.3R-95, "Evaluation of Existing Nuclear Safety-Related Structures."

14.4 10CFR50.65, "Requirements for Monitoring the Effectiveness of Maintenance at Nuclear Power Plants."

14.5 Regulatory Guide 1.160, "Monitoring the Effectiveness of Maintenance at Nuclear Power Plants."

14.6 NUREG-1522, "Assessment of Inservice Conditions of Safety-Related Concrete Structures."

14.7 NUREG-1526, "Lessons Learned from Early Implementation of the Maintenance Rule at Nine Nuclear Power Plants - U.S. Nuclear Regulatory Commission, June, 1995."

14.8 NUMARC 93-01, "Industry Guideline for Monitoring the Effectiveness of Maintenance at Nuclear Power Plants."

14.9 NEI 96-03, "Guidelines for Monitoring the Condition of Structures at Nuclear Power Plants."

14.10 "Aging Assessment Field Guide", Life Cycle Management - Westinghouse Owners Group (WOG).

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14.11 WCAP-14580, "Aging Management Evaluation for Seismic Category I Structures", Westinghouse Owners Group (WOG) and Life Cycle Management/Licensing Removal (LCM/LR) Program, Rev. 0, February, 1997.

14.12 WCAP-14576, "Aging Management Evaluation for Pressurized Water Reactor Containment Structure", Westinghouse Owners Group (WOG) and Life Cycle Management/License Renewal (LCM/LR) Program, Rev. 0, December, 1996.

14.13 Administrative Procedure 0.27.1, "Periodic Structural Inspections of Structures", Cooper Nuclear Station's Operation's Manual, Rev. 0 C1, 8-15-96.

14.14 NEP-17-03, "Structures Monitoring", Commonwealth Edison Company, Rev. 0, 12-31-96.

14.15 Maintenance Rule Program Module 6, "Monitoring of Structures", Duane Arnold Electric Center, Rev. 0, 12-16-96.

14.16 DBD-CS-073, "Concrete Containment Structure", Rev. 4, 7/18/87.

14.17 DBD-CS-083, "Containment Concrete Internals", Rev. 3, 1/13/94.

14.18 DBD-CS-084, "Other Seismic Category I Concrete Structures", Rev. 4, 3/25/94.