Equipment and Operator Terminology for Risk-Informed Programs

2020 Configuration Risk Management Forum Research Task

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ABSTRACT

This report examines terminology that is used in risk-informed applications that depend on probabilistic risk assessment (PRA). The definitions associated with the terms *available*, *dedicated operator*, *designated operator*, and *PRA functional* differ from plant to plant and within industry guidance documents. This report proposes standardized, industry consensus definitions for these terms.

The terms having relevance to risk-informed programs have been defined in several documents. The relevant terms and source documents are as follows:

- *Operable* is defined in Nuclear Regulatory Commission Regulation (NUREG) 1431 and Nuclear Energy Institute (NEI) 18-03.
- *Unavailability* is defined in NEI 99-02 and Nuclear Management and Resources Council (NUMARC) 93-01.
- *Dedicated operator* is defined in NUMARC 93-01, NEI 99-02, and NRC Inspection Manual Chapter (IMC) 0308.
- *Designated operator* is defined in NUMARC 93-01.
- *PRA functionality* is defined in NEI 06-09. However, the concept of PRA function or PRA functionality is also discussed or implied by several of the other documents listed previously.

The definitions and implications of these definitions from industry guidance are not exhaustive, and there is room for interpretation. Different interpretations have led to questions by the U.S. Nuclear Regulatory Commission, particularly relating to available equipment and/or PRA functional equipment. Varied approaches regarding employing a dedicated operator have also been observed in the industry, which has sometimes led to regulatory concerns. The concept of PRA functional structures, systems, and components requires judgment concerning the treatment of degraded conditions. At present, there is no industry document that provides a standardized approach to these terms.

Current industry guidance and plant practices were reviewed in support of this research effort. As a result, definitions have been proposed to establish greater consistency, while providing flexibility to account for plant design and operational practices.

Keywords
Availability/unavailability
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EXECUTIVE SUMMARY

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PRIMARY AUDIENCE: Plant probabilistic risk assessment (PRA) staff

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KEY RESEARCH QUESTION

The terms *availability*, *unavailability*, *dedicated operator*, and *designated operator* are defined at a high level in the industry documents concerning risk-informed programs. This has allowed for varied interpretations among plants and has led to questions by the regulator regarding appropriate decisions, such as those relating to available equipment. Increased standardization of these terms would lead to better industry consensus and a common understanding among all stakeholders.

RESEARCH OVERVIEW

Current definitions in industry source documents were reviewed, and specific examples of the application of definitions were discussed with plant personnel. Gaps in current industry guidance concerning these terms were evaluated in the context of actual plant scenarios, and proposed definitions were developed. The intent of the definition development was to capture the essence of current guidance but also to allow for differences in plant design and operational practices. The proposed definitions are presented in this report for trial use and industry comment.

KEY FINDINGS

- As described in Section 2, current definitions in the industry guidance documents are open to interpretation. This has caused confusion about whether plant equipment is available under particular circumstances.
- Case studies are presented that illustrate challenges in the use of the current guidance and how the proposed definitions would apply in actual plant scenarios to provide improved clarity.

WHY THIS MATTERS

Risk-informed programs, such as the Maintenance Rule, Mitigating System Performance Index, and Risk-Managed Technical Specifications, have become increasingly important regulatory metrics. This report establishes the existing common ground regarding the key definitions that are important to plant equipment and operational decision making and makes the linkage to the PRA success criteria explicit.

HOW TO APPLY RESULTS

Plants can apply the proposed definitions presented in this report in their own processes to support determinations of the availability of structures, systems, and components, using PRA information as an input. In addition, plants can establish new protocols, or validate existing protocols, for the use of a dedicated operator based on the guidance in this report.

LEARNING AND ENGAGEMENT OPPORTUNITIES

The annual Electric Power Research Institute Risk Technology Meeting, typically scheduled in January of each calendar year, provides an opportunity to explore configuration risk management and PRA software issues. This event includes meetings of the Configuration Risk Management Forum, the Integrated Risk Technology Users Group, and the Human Reliability Analysis Calculator Users Group. The Maintenance Rule User Group (MRUG) meets twice annually, addressing issues involving the maintenance rule (10CFR50.65) and supporting industry guidance, including practices related to the assessment and management of proposed maintenance activities.

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CONTENTS

LIST OF TABLES

1 INTRODUCTION

As a result of the ongoing development and introduction of new risk-informed processes into the nuclear power industry since the 1990s, the terminology to address the functionality of plant equipment to perform its safety functions has been subjected to various interpretations. The purpose of this report is to define and clarify several of these terms that are commonly used in plant configuration risk management (CRM). The terms to be discussed are "*operability*", "*availability*", "*dedicated operator*", "*designated operator*" and *"PRA functionality"*. These terms are specifically relevant to the CRM requirements of the Maintenance Rule (10CFR50.65) [1]. However, the use of these terms can also apply to other plant processes and programs, including the Mitigating System Performance Index (MSPI) [5] and Risk Managed Technical Specifications [8].

The lack of consistent definitions for these terms has led to confusion and in some cases has resulted in regulator concerns about the application of the terminology to implementation of the Maintenance Rule and other risk-informed programs at various plants. In many cases, these similar terms come from different regulatory and industry guidance documents. This issue has been a discussion topic during several recent meetings of the EPRI Configuration Risk Management Forum (CRMF), leading to the development of this research effort. This report presents consensus definitions for these terms to help promote standardization throughout the industry. This report does not recommend or identify the methodology used to determine the duration of inoperable or unavailable equipment. The duration of the equipment *inoperability* and/or *unavailability* will be determined using the methodology of the specific program (for example, the Maintenance Rule or MSPI).

2
SOURCES AND ORIGINS OF TERMINOLOGY

This section discusses the development of the current industry terminology, current industry guidance concerning the terminology, as well as issues that have been encountered when using the terminology in day-to-day plant applications.

2.1 Operable

"*Operable*" is defined in the Standard Technical Specifications [2] as:

> A system, subsystem, train, component, or device shall be OPERABLE or have OPERABILITY when it is capable of performing its specified safety function(s) and when all necessary attendant instrumentation, controls, normal or emergency electrical power, cooling and seal water, lubrication, and other auxiliary equipment that are required for the system, subsystem, train, component, or device to perform its specified safety function(s) are also capable of performing their related support function(s).

Operator actions to manually actuate SSCs are generally not credited in determining operability unless such manual actions are explicitly considered in the licensing basis. Operability can sometimes credit the use of a designated operator as compensatory actions if defined in the Technical Specifications Bases or other licensing documents. Section 3.1 presents an example of a situation in which a standby component would be operable despite requiring manual actuation.

Prior to the introduction of the Maintenance Rule [1] and other risk-informed applications, "*operability*" was the typical measure used by Operations, other plant staff, and the NRC inspectors to assess the functionality of plant structures, systems, and components (SSCs).

NEI 18-03 [9] affirms the definition of *operability* based on Technical Specification guidance. In addition, Section A.4 pertains to the consideration of probability and risk in making operability determinations:

> The definition of operability (that the SSC must be capable of performing its specified safety functions) is based on the inherent assumption that the event occurs. Therefore, the use of probability of occurrence of accidents or external events is not acceptable for making operability decisions. In other words, the likelihood that an SSC will not be needed is not an appropriate consideration when determining if it is capable of functioning as intended.
>
> Probabilistic risk assessment involves the consideration of both the probability of occurrence and the consequences of an event and can be a valuable tool for determining the safety significance of SSC. The safety significance, whether determined by PRA or other analyses, may be considered when making decisions about the timeliness and technical rigor of operability determinations.

2.2 Available

The term *available* is defined and used in various industry documents. The context for each is discussed in the subsections below.

2.2.1 NUMARC 91-06 (Shutdown Risk Management)

NUMARC 91-06 [3, Section 2.0] defines the term *available* as follows:

> AVAILABLE (AVAILABILITY): The status of a system, structure, or component that is in service or can be placed in service in a FUNCTIONAL or OPERABLE state by immediate manual or automatic actuation.
>
> This definition relies on two defined terms, also defined in NUMARC 91-06, provided below.
>
> FUNCTIONAL (FUNCTIONALITY): The ability of a system or component to perform its intended service with considerations that applicable technical specification requirements or licensing/design basis assumptions may not be maintained.
>
> OPERABLE: The ability of a system to perform its specified function with all applicable technical specifications requirements satisfied.

This definition of available (availability) is a general statement of the requirements for considering an SSC to be *available* and comports with the general notion of SSC *availability*; that is, the time period during which an SSC is operating or would successfully operate immediately when demanded. However, with respect to including an allowance for immediate manual actuation, the definition is not specific in that there is no requirement for procedures, or timeframe for the manual actions. It should be noted that the timeframe for actions can often differ depending on whether design basis or PRA success criteria are used. Operations personnel may typically rely on design basis requirements unless PRA success criteria have been defined and made available to the Operations staff.

Further, the definition introduces the concept of functionality, which allows for SSC credit even when it is not operable. The definition is more suited to be used by plant operations personnel who are trained to make such qualitative judgments than by a PRA analyst who is trying estimate a specific period of SSC unavailability.

2.2.2 NUMARC 93-01 (Maintenance Rule Guidance)

An alternative definition of *availability* in more mathematical terms is provided in NUMARC 93-01 [4, Appendix B].

> **Availability**:
>
> The time that a SSC is capable of performing its intended function as a fraction of the total time that the intended function may be demanded. The numerical complement of unavailability.

This definition is consistent with the previous one, but its focus is more quantitative as the *availability* of an SSC was of particular importance for the assessment of the risk impacts of maintenance required to comply with paragraph a(2) of the Maintenance Rule [1]. This was then augmented by the *unavailable* definition provided in NUMARC 93-01 [4, Appendix B]. NUMARC 93-01 provides a definition for numerically calculating *unavailability* (quoted below) but only states that *availability* is the complement of *unavailability* (as shown above) and that the definition is primarily intended for use in calculating performance criteria. It does not provide a specific definition of the term *available*. Also, the NUMARC 93-01 approach to defining *unavailability* is to provide examples of when an SSC is not functional.

> Unavailability, SSC (for purposes of availability or reliability calculation):
>
> Note: This definition of unavailability is not intended for direct applicability to the configuration assessment required by 10 CFR 50.65(a)(4).
>
> Unavailability is defined as follows:
>
> $$\frac{\text{planned unavailable hours} + \text{unplanned unavailable hours}}{\text{required operational hours*}}$$
>
> Unavailability is considered in two cases:
>
> 1. Maintenance activities
>
>   Equipment out of service (for example, tagged out) for corrective or preventive maintenance is considered unavailable. Support system unavailability may be counted against either the support system, or the front line systems served by the support system. The treatment of support system unavailability for the maintenance rule should be consistent with its treatment in the plant PSA. Performance criteria should be established consistent with whichever treatment is chosen.
>
> 2. 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 of this paragraph is to allow licensees to take credit for restoration actions that are virtually certain to be successful (that is, probability nearly equal to 1) during accident conditions.
>
>   * Required operational hours are the number of hours that the SSC serves a safety function. The safety function (and the need to count required hours), may be necessary at all times, or may be dependent on reactor mode, criticality, fuel in the reactor vessel, or other factors. The degree of redundancy for SSCs performing a safety function may vary based on factors as described above, and the determination of required operational hours may take this into account. However, 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.

It should be noted that while restoration during testing can be credited, NUMARC 93-01 does not include provisions for crediting recovery during maintenance activities when calculating availability per paragraph a(2) of the Maintenance Rule. Also, in the use of local operators, regulatory personnel have emphasized the need for adequate communication between the control room staff and the locally-assigned operator to ensure that actions can be properly executed.

2.2.3 NEI 99-02 (MSPI Guidance)

The terms *unavailable* and *unavailability* are defined in very specific contexts and terms in the MSPI guidance document. The definitions from NEI 99-02 [5, Appendix F.1.2.1] are provided below. As with NUMARC 93-01, the approach to defining *unavailability* in NEI 99-02 focuses on when an SSC is not capable of performing its monitored function(s):

> <u>Train/segment unavailability</u>: Train/Segment unavailability is the ratio of the hours the train/segment was unavailable to perform its monitored functions due to planned or unplanned maintenance or test during the previous 12 quarters while critical to the number of critical hours during the previous 12 quarters.
>
> <u>Train/segment unavailable hours</u>: The hours the train/segment was not able to perform its monitored function while critical. Fault exposure hours are not included; unavailable hours are counted only for the time required to recover the train's/segment's monitored functions. In all cases, a train/segment that is considered to be OPERABLE is also considered to be available. Trains/segments that are not OPERABLE must be returned to service in order to be considered available. Unavailability must be by train/segment; do not use average unavailability for each train/segment because trains/segments may have unequal risk weights.
>
> <u>Return to service</u>: Return to service is the transition from unavailable to available. A train/segment is "returned to service" when the following conditions are met: clearance tags have been removed, the train/segment has been aligned and prepared for operation, (for example, valve line-up complete, system filled and vented), further adjustment of associated equipment is not required or expected as the result of the unavailability period, and operators concur that the train/segment is able to perform its expected functions. For standby equipment, automatic functions are aligned or can be promptly restored by an operator consistent with the requirements for crediting operator recovery stated later in this section.
>
> <u>Planned unavailable hours</u>: These hours include time a train or segment is removed from service for a reason other than equipment failure or human error. Examples of activities included in planned unavailable hours are preventive maintenance, testing, equipment modification, or any other time equipment is electively removed from service to correct a degraded condition that had not resulted in loss of function. When used in the calculation of UAI, if the planned unavailable hours are less than the baseline planned unavailable hours, the planned unavailable hours will be set equal to the baseline value.

Unplanned unavailable hours: These hours include elapsed time between the discovery and the restoration to service of an equipment failure or human error (such as a misalignment) that makes the train/segment unavailable. Time of discovery of a failed monitored component is when the licensee determines that a failure has occurred or when an evaluation determines that the train would not have been able to perform its monitored function(s). In any case where a monitored component has been declared inoperable due to a degraded condition, if the component is considered available, there must be a documented basis for that determination, otherwise a failure will be assumed and unplanned unavailability would accrue. If the component is degraded but considered operable, timeliness of completing additional evaluations would be addressed through the inspection process. Unavailable hours to correct discovered conditions that render a monitored train/segment incapable of performing its monitored function are counted as unplanned unavailable hours. An example of this is a condition discovered by an operator on rounds, such as an obvious oil leak, that was determined to have resulted in the equipment being non-functional even though no demand or failure actually occurred. Unavailability due to mis-positioning of components that renders a train incapable of performing its monitored functions is included in unplanned unavailability for the time required to recover the monitored function.

2.2.4 ASME RA-Sb-2013 (ASME/ANS PRA Standard)

The ASME/ANS PRA Standard [6] definitions for *availability* and *unavailability* are discussed below. The definition for *availability* is stated in straightforward mathematical terms, while the definition for *unavailability* is stated in terms of when an SSC is not capable of performing its supporting function.

- *Availability* is defined as the complement of unavailability.
- *Unavailability* is defined as the probability that a system or component is not capable of supporting its function. This includes, but is not limited to, the time it is disabled due to test or maintenance.

Since *available* is defined in terms of *functionality*, and *functionality* is not specifically defined, there is room for interpretation as to the *availability* of an SSC when it is degraded. Similarly, determinations of *unavailability* for the Maintenance Rule [1] and MSPI [5] based on the definitions provided above, are complicated by the lack of a precise *functionality* definition, in each case.

2.2.5 INPO 19-002 (IRIS Reporting Requirements)

Guidance was also reviewed from Section 4.3 of INPO 19-002 [10], "General Guidance for Safety System Unavailability-WANO". This section provides guidance for data reporting for performance indicators to track unavailable hours, monitored at the train level, summed for all trains and reported at the system level. It does not provide definitions for availability or unavailability. The system scope is narrower than what would be considered in a PRA – High pressure injection systems, BWR residual heat removal (RHR), PWR auxiliary feedwater (AFW), and emergency AC Power.

Reported data elements include:

- Planned unavailable hours – The sum of planned unavailable hours for all system trains, including unavailable time due to maintenance, surveillance testing, modifications, and any other elective activity planned in advance.
- Unplanned unavailable hours – The sum of the unplanned unavailable hours for all system trains. Causes for unplanned unavailable hours include, but are not limited to human errors, corrective maintenance, and unplanned support system unavailability.
- Fault exposure hours – This is defined as the sum of the fault exposure hours for all system trains, comprised of the hours that each train is in an undetected failed condition. This section includes the case when only the time of discovery of a failure is known and thus the actual unavailable hours are not known with certainty. In this case, the unavailable hours are estimated as half of the time since the last successful operation or test.

Note that these reporting requirements have distinctions associated with performance indicators that do not apply to risk applications. As an example, if the unavailability of a support system causes a monitored system to be unavailable, then the hours that the support system were unavailable are counted against the train as either planned or unplanned unavailable hours.
For a PRA, typically the support system unavailability would be explicitly modeled. Also, in a shutdown PRA or shutdown Defense-in-Depth (DID) model, one emergency generator that is unavailable during shutdown conditions would be treated as unavailable for the purpose of the risk assessment. However, the INPO/WANO document does not require reporting the unavailable time, provided that at least one emergency generator is available to supply emergency loads.

To summarize, Table 2-1 below summarizes the differences between operable and available as presently defined in the documents reviewed:

Table 2-1
Comparison of Operable and Available

Operable	Available
Defined by Plant Technical Specifications.	Minimum requirements for functionality are defined by PRA Success Criteria. Success criteria may differ for specific hazards and initiating events.
Operator action credited for specific limited purposes as defined in the licensing basis.	SSC may be out of service for testing but still be *available* with operator actions.
Inoperable if a support system is inoperable.	SSC may be *available* even if a support system is not available, but the primary component can still perform its safety function.
Not tracked by site programs.	*Unavailability* is tracked as part of the requirements for Maintenance Rule and MSPI.
May require reporting the inoperability of the SSC to the NRC (LER).	*Unavailability* is not generally reportable to the NRC.

2.3 Designated Operator

NUMARC 93-01 [4] originally included the term *designated operator.* This term applied to situations where a long period of time was available for an operator to perform the restoration actions and allowed the operator flexibility in his location and duties. This term, *designated operator*, has since been removed from NUMARC 93-01.

NEI 99-02 [5] retains the term *designated operator* in its discussion of how operator actions may be credited for restoration of monitored functions. NEI 99-02 provides the following guidance in this regard:

> <u>Credit for Operator Recovery Actions to Restore the Monitored Functions</u>
>
> 1. During testing, operational alignment or return to service:
>
>   Unavailability of a monitored function during testing, operational alignment or return to service need not be included if the test or operational alignment 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 designated operator[1] stationed locally for that purpose. Restoration actions must be contained in a written procedure[2], must be uncomplicated (a single action or a few actions), must be capable of being restored in time to satisfy PRA success criteria, and must not require diagnosis or repair. Credit for a designated local operator can be taken only if the operator is positioned at the proper location throughout the duration of the test or operational alignment for the purpose of restoration of the train should a valid demand occur. The intent of this paragraph is to allow licensees to take credit for restoration actions that are virtually certain to be successful (that is, probability nearly equal to 1) during accident conditions.
>
>   The individual performing the restoration function can be the person conducting the test or operational alignment and must be in communication with the control room. Credit can also be taken for an operator in the main control room provided the operator is in close proximity to restore the equipment when needed. Normal staffing for the test or operational alignment may satisfy the requirement for a designated operator, depending on work assignments. The designated operator cannot be re-tasked, even for a short period of time (such as reading an unrelated instrument). In all cases, the staffing must be considered in advance and an operator identified to perform the restoration actions independent of other control room actions that may be required.
>
>   Under stressful, chaotic conditions, otherwise simple multiple actions may not be accomplished with the virtual certainty called for by the guidance (for example, lifting test leads and landing wires; or clearing tags). In addition, some manual operations of systems designed to operate automatically, such as manually controlling high pressure coolant injection (HPCI) turbine to establish and control injection flow, are not virtually certain to be successful. These situations should be resolved on a case-by-case basis through the FAQ process.

2. During maintenance

   Unavailability of a monitored function during maintenance need not be included if the monitored function can be promptly restored either by an operator in the control room or by a designated operator (see footnote 1 below) stationed locally for that purpose. Restoration actions must be contained in an approved procedure, must be uncomplicated (a single action or a few actions), must be capable of being restored in time to satisfy PRA success criteria and must not require diagnosis or repair. Credit for a designated local operator can be taken only if the operator is positioned at a proper location throughout the duration of the maintenance activity for the purpose of restoration of the train should a valid demand occur. The intent of this paragraph is to allow licensees to take credit for restoration of monitored functions that are virtually certain to be successful (that is, probability nearly equal to 1).

   The individual performing the restoration function can be the person performing the maintenance and must be in communication with the control room. Credit can also be taken for an operator in the main control room provided the operator is in close proximity to restore the equipment when needed. Normal staffing for the maintenance activity may satisfy the requirement for a designated[1] operator, depending on work assignments. In all cases, the staffing must be considered in advance and an operator identified to perform the restoration actions independent of other control room actions that may be required.

   Under stressful chaotic conditions otherwise simple multiple actions may not be accomplished with the virtual certainty called for by the guidance (for example, lifting test leads and landing wires, or clearing tags). These situations should be resolved on a case-by-case basis through the FAQ process.

3. During degraded conditions

   In accordance with current regulatory guidance, licensees may credit limited operator actions to determine that degraded equipment remains operable in accordance with Technical Specifications. If a train/segment is determined to be operable, then it is also available. Beyond this, no credit is allowed for operator actions during degraded conditions that render the train/segment unavailable to perform its monitored functions.

   1. “Operator” in this circumstance refers to any plant personnel qualified and designated to perform the restoration function.
   2. Including restoration steps in an approved test procedure.

The key attributes regarding a designated operator specified in the above excerpt from NEI 99-02 are:

- The designated operator is any plant personnel qualified and designated to perform the restoration function.
- The designated operator is identified in advance to perform the restoration actions for the SSC following a valid actuation signal independent of other control room actions that may be required.

- The designated operator is stationed locally[1] throughout the duration of the test, maintenance, or operational alignment and is in communication with the control room or is a control room operator who will always be within close proximity to the requisite manual controls.
- Restoration actions are included in an approved, written procedure.
- Restoration actions are uncomplicated (that is, a single or a few actions) that can be completed in time that PRA success criteria are satisfied.
- Restoration actions must not require diagnosis or repair.
- Must be referred to the MSPI FAQ process if the actions are to be performed under stressful, chaotic conditions, or involve manual control of a system designed to operate automatically.

The amount of time the designated operator has to perform the required restoration action(s) is determined by the plant PRA staff or other knowledgeable groups. The actual time to execute the action is determined by the Operations group. This requires input from all the involved groups and can be somewhat subjective in certain instances. The inputs from these groups determine if the designated operator can perform the restoration actions within the required timeframe.

As noted in Section 2.1, designated operators can sometimes be credited in operability determinations if specifically noted in the Technical Specifications Bases or other licensing documents.

It should be noted that as described above in NEI 99-02, the use of the term designated operator is subject to interpretation.

- For example, the operator has to be at a "proper location." The words "proper location" allow for interpretation as to where the operator can be stationed. An interpretation used by one plant was that the operator must be stationed at the equipment that has to be operated, although that is not explicitly stated in the description above.
- The description also refers to normal staffing satisfying the requirement for a designated operator, depending on work assignments, in reference to a test or operational alignment and for a maintenance activity. The wording "normal staffing" and "work assignments" leaves room for interpretation of each of these terms.

2.4 Dedicated Operator

The term *dedicated operator* is also used by industry for operator actions to allow SSCs to be considered *available*. A *dedicated operator* is described within the *unavailability* definition provided in NUMARC 93-01 [4], and this description is contained almost verbatim in IMC-0308, Attachment 3, Appendix K [7]. These documents describe the dedicated operator as follows (note that the following excerpt is also provided above in Section 2.2 as part of the Reference 4 unavailability definition):

> 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,

[1] The local operator may be located immediately outside of the area where the equipment to be manipulated is located if conditions in the vicinity of the component pose a personnel safety risk.

> 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 of this paragraph is to allow licensees to take credit for restoration actions that are virtually certain to be successful (that is, probability nearly equal to 1) during accident conditions.

IMC-0308, Attachment 3, Appendix K [7] also notes the following with respect to the timing of the credited action(s):

> If the restoration actions are virtually certain to be successful due to emergent conditions, the risk assessment may consider the time necessary for restoration of the SSC's function, with respect to the time at which performance of the function would be needed.

The amount of time the operator has to perform the required restoration action(s) is determined by the plant PRA staff or other knowledgeable groups. The actual time to execute the action is determined by the Operations group. This requires input from all the involved groups and can be somewhat subjective in certain instances. The inputs from these groups determine if the operator can perform the restoration actions within the required timeframe.

NUMARC 93-01 [4] also includes the following text in Section 11.3.2.7, which discusses implementation of paragraph a(4) of the Maintenance Rule, concerning consideration of the use of prompt operator action to restore equipment in the a(4) risk assessments:

> The assessment may take into account whether the out-of-service SSCs could be promptly restored to service if the need arose due to emergent conditions. This would apply to surveillance testing, or to the situation where the maintenance activity has been planned in such a manner to allow for prompt restoration. In these cases, the assessment may consider the time necessary for restoration of the SSC's function, with respect to the time at which performance of the function would be needed.

This definition is compatible with the other previously discussed definitions for *dedicated operators* and *designated operators*.

2.5 Functional

The initial formal definition of SSC functionality is stated in NUMARC 91-06 [3] in support of the availability definition:

> FUNCTIONAL (FUNCTIONALITY): The ability of a system or component to perform its intended service with considerations that applicable technical specification requirements or licensing/design basis assumptions may not be maintained.

This definition of functional (functionality) is a general statement of the requirements for considering an SSC to be *functional* and comports with the general notion of SSC *functionality*; that is, the capability for the SSC to achieve minimal performance even though some aspect of its operation is not consistent with its design intent (for example, no room cooling). This definition is best suited to be used by plant operations personnel who are trained to make such qualitative judgments.

NUMARC 93-01 [4] provides more specific, contextual guidance for determining SSC functionality in support of the Maintenance Rule. With respect to Maintenance Rule scoping, *function* is defined as follows:

> **Function**:
>
> As used in this guideline the scoped function is that attribute (for example, safety related, mitigates accidents, causes a scram, and so on) that included the SSC within the scope of the maintenance rule. For example, some units scope the condenser vacuum system under the maintenance rule because its total failure caused a scram and not the design function of pulling a vacuum on the condenser.

This definition is sufficient for establishing the bases for including SSCs within the scope of the Maintenance Rule. These Maintenance Rule functions are then used to identify what constitutes a Maintenance Rule failure:

> **Maintenance Preventable Functional Failure (MPFF)- Initial and Repetitive**
>
> An MPFF is the failure of an SSC (structure, system, train, or component) within the scope of the Maintenance Rule to perform its intended function (that is, the function performed by the SSC that required its inclusion within the scope of the rule), where the cause of the failure of the SSC is attributable to a maintenance-related activity. The maintenance-related activity is intended in the broad sense of maintenance as defined above. The loss of function can be either direct, that is, the SSC that performs the function fails to perform its intended function or indirect, that is, the SSC fails to perform its intended function as a result of the failure of another SSC (either safety related or nonsafety related). [Additional detail regarding “Initial MPFFs” and “Repetitive MPFFs” is not quoted because it is not germane to this discussion.]

This definition of functional failure provides the important insight that the cause of the loss of function is either the result of a failure of the SSC itself or due to a failure involving another SSC. These causes of loss of function are consistent with PRA modeling techniques and may involve a set of SSCs since a Maintenance Rule function may be stated broadly and involve multiple trains. However, this definition of functional failure is limited in its focus to causes of loss of function that are ultimately the result of a maintenance process at a nuclear plant. This implies that the PRA model may include a larger set of causes for an SSC’s loss of function.

As the Maintenance Rule program implementation across the nuclear industry matured, the NRC issued its Reactor Oversight Process (ROP) which included the Significance Determination Process (SDP). This framework includes probabilistic risk assessment as an integral component. The technical basis document for the maintenance risk assessment and management SDP, IMC 0308, Attachment 3, Appendix K [7] defines loss of function as follows:

> <u>Loss of Function</u>. This is the condition in which an SSC becomes incapable of performing its intended purpose. This can mean a complete functional failure or impaired or degraded performance or condition such that the affected SSC is incapable of meeting its functional success criteria. Functional success criteria include having the required trains, adequate speed, flow, pressure, load, startup time, mission time, and so on. These are defined or assumed in the design and/or licensing bases (that is, updated final safety

evaluation report, license conditions, or technical specifications and/or their bases). For the purposes of determining risk/safety significance, the functional success criteria of particular interest would be those assumed in the plant's PRA and/or the licensee's risk assessment tool.

This definition of loss of function identifies the spectrum of possible failures in terms of an SSC being unable to achieve its success criteria for fulfilling a function. It also identifies that the success criteria are defined by a variety of source documents, including design and/or licensing bases, as well as the PRA model or a stand-alone risk assessment tool.

The term *PRA functional* is used by industry to denote a level of SSC functionality that meets the performance criteria required to support the PRA model. If an SSC is PRA functional, then it can be credited as *available* in the PRA model. This term, PRA functional, is also defined in NEI 06-09 [8] and applies to Risk-Informed Completion Time (RICT) calculations.

11.1 If a component is declared inoperable due to degraded performance parameters, but the affected parameter does not and will not impact the success criteria of the PRA model, then the component may be considered PRA functional for the purposes of the RICT calculation. For the provisions of this section to apply, the following must occur:

11.1.1 The degraded condition must be identified and its associated impact to equipment functionality known.

11.1.2 Further additional degradation that could impact *PRA functionality* is not expected during the RICT.

11.2 If the functional impact of the condition causing the inoperability is capable of being assessed by the PRA model, then the remaining unaffected functions of the component may be considered PRA functional in the RICT calculation.

11.3 If the function(s) affected by the condition causing a component to be inoperable is not modeled in the PRA, and the function has been evaluated and documented as having no risk impact, then the RICT may be calculated assuming *availability* of the inoperable component and its associated system, subsystem or train. If there is no documented basis for exclusion, or if the condition was screened as low probability, then the inoperable component must be considered not functional.

This definition allows for the determination of *availability* based on *PRA functionality*. The above definition allows interpretation as to whether the degraded equipment impacts the PRA model. The method used to determine *PRA functionality* is not explicitly stated, allowing interpretation of how to determine this.

Note that an SSC may be considered *PRA functional* for one PRA model hazard but not for another PRA model hazard. For example, if there was a situation in which a PRA-modeled cooling water system had a common discharge header that was supported by a degraded snubber, it could be possible for the entire system to be unavailable for certain seismic events in the Seismic PRA model, yet unaffected and available for the full-power internal events PRA model.

3
PROPOSED DEFINITIONS

As can be seen from the examples of the previous section, the terms used by the industry for *operability*, *availability*, *dedicated operator* and *PRA functionality* can lead to confusion and potential misapplication. To provide consistency across the industry, these terms should be better defined so that they can be uniformly applied at all plants. Below are recommended definitions which should help to minimize interpretations and allow all plants to use these terms in a consistent and defensible manner.

The term *operable* is defined in the plant's Technical Specifications. This definition may differ somewhat from plant to plant. Since the Technical Specifications definition exists in an NRC-accepted document, it will not be defined here.

The terms *available* and *unavailable* should be defined based on specific characteristics that allow a determination of the applicability of each term and in a manner consistent with their mathematical relationship. These definitions should include enough detail as to minimize the need for interpretation yet allow their use at plants of varying designs. This will make the requirements more consistent throughout the industry. The definition of *available* should also align more closely with *PRA functional* as used in Risk Managed Technical Specifications applications.

The term *designated operator* should be defined consistently with the term "dedicated operator" so these terms may be used interchangeably. This will prevent misuse of the terms *designated* or *dedicated operator* since the terms will have identical meanings. To do so, requires that the *dedicated operator* should have a more detailed definition. The detailed requirements in the definition will remove the need for interpretation and lead to more consistent usage of this term in the industry.

It should be noted that the calculation of *unavailability* for maintenance rule and MSPI was not addressed here. The methodology of those calculations should remain unchanged by these new definitions.

The following sections contain summaries of proposed changes to the definitions of existing terms.

3.1 Operable

Operability is defined in the plant's Technical Specifications. This definition may differ somewhat from plant to plant. Since the Technical Specifications are part of the licensing basis for a given plant, they provide the authoritative definition. For illustrative purposes, the Standard Technical Specifications [2] definition of an operable SSC is shown below.

> A system, subsystem, train, component, or device shall be OPERABLE or have OPERABILITY when it is capable of performing its specified safety function(s) and when all necessary attendant instrumentation, controls, normal or emergency electrical power, cooling and seal water, lubrication, and other auxiliary equipment that are required for the system, subsystem, train, component, or device to perform its specified safety function(s) are also capable of performing their related support function(s).

It should be noted that there may be specific exceptions to the above definition. The scenarios where this definition may not apply could involve plant alignments that have been analyzed for operator action, analyzed for the time requirements to perform those actions, and the operator actions have been included in plant operating procedures. An example would be the breakers in the power supply for the hydrogen igniters at ice condenser plants. The normal configuration is to have the hydrogen igniter breakers open. When the hydrogen igniters need to function, an operator needs to close the breakers. The component is *operable* (when the breaker is open) because the action needed to allow use of the component has been incorporated into the relevant procedures. In some other cases, a designated or dedicated operator may be credited for operability if permitted by the Technical Specification Bases or other licensing documents.

The inputs to operability determination evaluations are typically deterministic in nature and do not require PRA input.

If an SSC is inoperable <u>it may or may not be</u> *available*. If an SSC is operable, it <u>is</u> *available*.

3.2 Available and PRA Functional

Proposed definitions of *available* and *PRA functional* are provided below. These definitions are closely related, so they are presented together.

3.2.1 Available

A system, subsystem, train, component, or device is available when it is capable of performing its specified function(s) within the timeframe required by the PRA or other success criteria. These capabilities and required timing are the success criteria for the function(s) and may involve *PRA model-supporting* documentation for a PRA function, or *design basis/licensing basis*-supporting documentation for a non-PRA function. The SSC PRA success criteria, if any, may differ from the deterministic criteria because more realistic estimates of SSC capabilities are used in place of the licensing or bounding criteria. SSC PRA success criteria may also differ for specific hazards and initiating events. SSC availability may be influenced by power requirements, support systems, operator actions, plant alignments, or other factors. It is likely that the PRA availability requirements may be less restrictive than the design criteria availability requirements, including credit for certain operator actions.

The following criteria should be used when determining availability given a degraded SSC performance condition:

- If the affected parameter of the SSC does not and will not impact satisfaction of all the SSC's functional success criteria, then the SSC remains *available.* The degraded condition must be identified and its associated impact to equipment functionality known.
- If the degraded condition does impact one or more of the SSC's functional success criteria, the degradation must be identified and its associated impact to equipment functionality known. If the performance degradation impacts SSC response to only a subset of hazards or initiating events modeled in the PRA and the risk impacts on the affected hazards/initiators

can be demonstrated to be negligibly small (for example, an impact resulting in less than 1% change in the total risk assuming that the SSC is unavailable for the affected hazards/initiators[2]), then the SSC can be considered to be available based on the limited impact of those hazards/initiators.

- Further additional degradation that could impact the SSC's functionality is not expected prior to the time of repair or the time that the SSC is no longer required to function (for example, due to a change in plant operating mode)

If an SSC is *available*, <u>it may or may not</u> be *operable*.

This definition is compatible with NUMARC 93-01, NEI 99-02 (MSPI guidance), IMC-0308 (NRC Inspection Manual for Maintenance Rule Risk Assessment SDP), and NEI 06-09 (Risk-Managed Technical Specification guidance).

As identified in the discussion on operability, there are exceptions to the above definition. The scenarios where this definition may not apply could involve plant alignments that have been analyzed for operator action, analyzed for the time requirements to perform those actions, and the operator actions have been included in plant operating procedures. The example of hydrogen igniters in Section 3.1 also applies here.

3.2.2 PRA Functional

In general, the proposed definition of PRA functional or PRA functionality is equivalent to the proposed definition of *available or availability.* However, there are additional considerations that apply for plants that have implemented the Risk Managed Technical Specifications (RMTS) PRA application. These considerations are described below.

- Quantitative credit for recovery of inoperable equipment is not permitted, per NEI 06-09 [8]. In addition, the following additional considerations would apply when determining if an SSC remains *PRA functional* for RMTS purposes when a performance degradation affects functionality for only a subset of the SSC's functions:
- If the functional impact of the condition causing the inoperability is capable of being assessed by the PRA model, then the remaining unaffected functions of the component may be considered PRA functional for RMTS purposes. This condition could result in a component being *PRA functional* if some of the PRA-modeled functions are unaffected. However, the overall SSC would not be considered *available* per the definition presented in Section 3.2.
- If the function(s) affected by the condition causing a component to be inoperable is not modeled in the PRA, and the function has been evaluated and documented as having no risk impact, then *availability* of the inoperable component and its associated system, subsystem or train can be assumed for RMTS purposes. If there is no documented basis for exclusion, or if the condition was screened as low probability, then the inoperable component must be considered not functional.

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[2] A 1% change is consistent with other PRA screening criteria in use. For example, the ASME/ANS PRA Standard [6] uses 1% or "at least two orders of magnitude" as criteria for not modeling certain component failures or failure modes. A "significant accident sequence" is one that comprises at least 1% of the total CDF or LERF.

It should be recognized that *PRA functionality* can vary for specific hazards and initiating events considered within the PRA. As an example, one plant had an actuation timing issue for the Auxiliary Feedwater (AFW) system. As a result, the AFW system could be considered *PRA functional* and *available* for all initiating events except for ATWS scenarios. In the case of components such as snubbers, their active function to attenuate SSC movement is generally of concern for seismic events but would not impact PRA functionality of supported SSCs for non-seismic events. Case studies are presented below which apply the definitions of availability and PRA functionality.

3.2.3 Case Studies Concerning Availability Definition

The following examples illustrate situations that have occurred in the industry where the concept of SSCs that are PRA functional was applied to determine availability as well as other case studies in which there was confusion about this concept. Where appropriate, how the updated guidance presented here can help to reduce the opportunities for improper application is presented. These examples were obtained through discussions with knowledgeable industry personnel.

These first two examples correctly illustrate how *availability* decisions should reflect the ability of plant equipment to meet PRA success criteria:

> At a plant, the Auxiliary Feed Water (AFW) pumps were required to provide a flowrate of 200 gpm at 1000 psig (45.4 m^3/hour at 6900 kPa) to the Steam Generators in order to meet success criteria in the PRA model for depressurization and cooldown. One of the AFW pumps was in maintenance and the other was in a degraded but stable condition. It was determined that the degraded pump could still supply 200 gpm at 1000 psig to the Steam Generators, and all the necessary support systems were *available*. Therefore, the pump was able to meet its PRA function and was considered *available*.

> At another plant, the CVCS pump was required to provide a flowrate of 400 gpm at 2300 psig (90.8 m^3/hour at 15850 kPa) in order to meet the success criteria in the PRA model for High Pressure Safety Injection. The pump was in a degraded condition and it was determined that the pump could not deliver the required flowrate at 2300 psig. Therefore, the pump was not able to meet its PRA function and was considered *unavailable*.

Through the use of the *availability* concept, credit could be taken for functionality of some equipment in risk-informed maintenance situations. However, the perception remains that if an SSC is not "*operable"* then it is "*unavailable",* and in some cases, these terms are used interchangeably. However, this may or may not be true. While all cases cannot be anticipated, it is beneficial for plant personnel to understand the PRA success criteria and other relevant criteria (if applicable) for the equipment in order to properly assess availability. This may require efforts by the PRA organization and the Operations staff to identify and understand the PRA success criteria for the various key safety functions.

The following illustrate some examples that have occurred in the industry in which confusion or misunderstanding of the term *available* have resulted in undesirable situations. These examples were obtained through discussions with knowledgeable industry personnel.

> At a plant, the operators were asked by the NRC Resident Inspector why a Chemical Volume and Control System (CVCS) pump was considered *available* even though it was in a degraded condition. The answer was that the pump would operate and supply water to the required SSCs (that is, the RCS pump seals and the RCS itself). The inspector then

questioned the operator if he had documentation of the criteria that the pump needed to meet. The operator did not have the required documentation and could not provide a source for the pump flow criteria. The operator then asked the plant PRA staff to discuss the matter with the inspector. The lack of a definition for *available* based on specific criteria led to the questioning of the operator's knowledge and raised concerns about the configuration risk management program at the plant. T**his case study illustrates the benefits of a clear definition of *availability* based on the success criteria, the basis for such determinations, and communication of the information between Operations and PRA staff.**

As another illustration of the need to define availability in terms of the SSC success criteria, system engineers at a plant provided *availability* data on SSCs in their systems for use in calculating performance indicators. The data that was provided considered an SSC *unavailable* if it was inoperable. This led to several SSCs being close to or exceeding their allotted Maintenance Rule and MSPI *unavailability* limits. The site PRA group reviewed the data and revised it based on the SSC success criteria which provided more margin for the performance indicators.

At another plant during an outage, the room cooling for a Residual Heat Removal (RHR) pump was taken out of service. Since this support system was considered to be out of service, the pump was declared *inoperable*. The work week manager brought this to the plant management's attention and plans were being made to extend the outage since the DID shutdown risk assessment was showing unacceptable results due to the RHR pump being considered *unavailable*. The onsite PRA group produced a room heat up calculation to demonstrate that the *inoperable* pump was still *available* to perform its safety function. **This situation could have led to an extended outage and unnecessary and significant costs. However, determination of pump *availability* was appropriately based on the ability to perform its functions in accordance with its success criteria.**

Plant systems may also have differing success criteria associated with the response to various plant transients and accident conditions. For example, different response times or flow rates may be required for different scenarios. This can result in situations in which a system or train could be considered *available* to respond to some plant conditions while being *unavailable* to respond to other types of events. Such situations can also lead to different interpretations as to whether the system or train is overall *available.* A couple of examples are noted below:

During RHR quarterly isolation valve testing at a PWR plant, the suction valve from the Refueling Water Storage Tank (RWST) to an RHR pump is closed. The RHR pump itself is placed in "pull-to-lock" for equipment protection since its suction is isolated. In the event of a need for RCS injection flow following a plant initiating event, two minutes is required to re-open the valve (and the pump must be manually started after suction flow is established). In the event of a large LOCA, RCS injection is required to begin within seconds, which means that the affected RHR train is unavailable to respond to events of this type. However, for most other plant transients and accidents, RHR flow could be manually restored using a dedicated operator. In the past, some control room operators had assumed that the valve can be reopened manually in time to support all functions, hence the train was considered to be *available*. **The proposed definition of *available* presented in this section includes guidance for assessing conditions in which a component may not be able to respond to a small subset of initiating events, but**

able to successfully respond to most other events. In this case, if the evaluation of the risk impacts of the affected initiating event (Large LOCA) was negligibly small (for example, less than 1% of the total change in risk), the RHR train could be considered *available*.

The Service Water (SW) header at a PWR plant supports both safety-related (including the emergency diesel generators) and non-safety-related loads. The supply line to the non-safety loads has an MOV which closes upon a Safety Injection (SI) signal coincident with sustained low SW header pressure. During MOV testing as well as testing of the low header pressure switch that actuates valve closure, the MOV was open with control power removed. This condition rendered the header *inoperable*. The EDG auto-start functions were not disabled in any way during this test (it would start and respond normally). For isolation to be required, the non-safety header would need to suffer a significant break at the time of the SI signal. If SW pressure began to drop for reasons other than a large pipe break, several additional SW pumps (safety and non-safety) would auto-start to compensate for the pressure loss before the low pressure setpoint would be reached. Finally, during this test, the motor and valve were intact such that the MOV could be manipulated if necessary. Since the MOV would only need to isolate during a significant pressure loss, multiple pumps are available to counteract such a pressure loss, and there was the ability to manually close the MOV, plant operators determined the SW header and its supported EDG to be *available*. **Similar to the RHR train case above, the guidance in the proposed definition of *available* can be used to determine whether the Service Water train is *available* based on the very low risk impact due to a coincident non-safety piping break.**

There can also be situations in which a system may be operated in configurations that are not explicitly modeled in the PRA. This can make it difficult to determine if the PRA success criteria are being fulfilled. An example was noted at a PWR plant in which modifications were being made to the normal reactor coolant letdown flow path in the CVCS system while the plant was at power. The plant's excess letdown flow path provided equivalent flow and was used as an alternate path, with the system's containment isolation functions maintained during the evolution. However, the PRA-based risk monitor used for CRM evaluations did not explicitly model the excess letdown (alternate) flow path. If the normal letdown flow path was taken out-of-service in the risk monitor, the result would calculate elevated risk and would have been inaccurate. In this case, the PRA group was able to assist in evaluating the alternate flow path to demonstrate that the letdown functions were able to remain fulfilled. A system or train may still be *available* during atypical system alignments, but such alignments may not be able to be directly evaluated using the normal CRM model. Such situations can also be confusing to plant operators and could result in difficulty in assessing possible risk impacts from non-modeled alignments. **In this case, since the alternate flow path was qualitatively evaluated to be equivalent to the normal flow path, the system success criteria was met, even though the alternate path was not explicitly modeled in the risk monitor. Therefore, the system was considered to be *available*.**

3.3 Unavailable

The following is the proposed definition of an SSC that is *unavailable* for risk-informed applications:

> A system, subsystem, train, component, or device shall be *unavailable* when it is not capable of performing its specified function(s) within the required timeframe required by the PRA or other success criteria. The PRA function(s) of an SSC is defined by the success criteria for the SSC as described in the PRA model supporting documentation. Non-PRA functions of an SSC are defined by design basis or other licensing criteria. The SSC PRA success criteria may differ from the design basis criteria because more realistic estimates of SSC capabilities are used in in place of the licensing or bounding criteria. SSC PRA success criteria may also differ for specific hazards and initiating events. SSC unavailability may also be influenced by power requirements, other support systems, operator actions, plant alignments, and other factors.

This definition is compatible with NEI 99-02 (MSPI guidance), IMC-0308 (NRC Inspection Manual for Maintenance Rule Risk Assessment SDP), and NEI 06-09 (Risk-Managed Technical Specifications guidance). It should be noted that NUMARC 93-01 defines "unavailability" in terms of the fraction of unavailable time. The definition set forth above does not change the need to track unavailable time and should provide greater clarity.

3.4 Dedicated Operator

The proposed definition of a *dedicated operator,* consists of the following requirements:

1. The *dedicated operator* shall be explicitly assigned, and his/her duties identified in the pre-job brief, prior to the start of the test or maintenance task that could render an SSC otherwise unavailable. The duties of the *dedicated operator* shall include items 2 through 11.
2. The *dedicated operator* shall be a control room operator, or an operator stationed locally, in close proximity to the SSC or its controls that may require restoration actions.
3. The control room-based *dedicated operator* must be able to perform the restoration actions independent of other control room actions that may be required.
4. A locally-stationed operator must be positioned at a proper location to allow timely restoration. The local operator may be located immediately outside of the area where the equipment to be manipulated is located if conditions in the vicinity of the component pose a personnel safety issue. The travel path to get to the equipment must remain accessible during any event that requires the operation of that equipment.
5. The *dedicated operator* will remain in the required location as long as that individual is the *dedicated operator*. Any replacement for the *dedicated operator* shall meet the same requirements as the original operator.
6. The *dedicated operator* will be in communication with the control room. The communication must be adequate to allow for clear and timely discussion concerning actions taken to initiate and confirm restoration actions.
7. The locally-stationed *dedicated operator* shall have only restoration duties unless (s)he is part of the test crew. If the operator is part of the test crew, (s)he shall be able to stop his/her test functions immediately and begin restoration actions.
8. The *dedicated operator* must have detailed written guidance for restoration. This can be a plant procedure or part of the document used to perform the work (that is, work order, standing order, and so on).

9. The restoration steps must be only a few steps (for example, less than 5) and they must be simple to perform.
10. The restoration steps must be of the type that would ensure a high degree of confidence that the actions can be completed within the time frame specified by the PRA success criteria.
11. The action(s) cannot require diagnosis or repair.

Note that regulatory requirements for specific programs and processes may impose additional limitations on the use of dedicated operators. For instance, calculation of availability for paragraph a(2) of the Maintenance Rule allows credit for a dedicated operator to restore equipment undergoing testing, but not for maintenance activities.

3.4.1 Case Studies Concerning Dedicated Operator Definition

As with *availability*, there have been misunderstandings in the use of the term the *dedicated operator* in the industry. The guidance documents presented in Section 2 require the dedicated operator to be at a "proper location". This does not provide specific guidance for where the operator should be stationed and is open to interpretation. The guidance presented in Section 2 also allows the use of normal staff for test or operational alignment as the *dedicated operator*, depending on the "work assignments", requiring interpretation of this terminology. An interpretation at one plant was that the operator could be taking data while he was the *dedicated operator,* but this is not stated in any current industry definitions as described in Section 2.

The following illustrate some examples that have occurred in the industry in which confusion or misunderstanding of the *dedicated operator* has resulted in undesirable situations and how the proposed definition improves clarity. These examples were obtained through discussions with knowledgeable industry personnel.

> The Auxiliary Building Operator (AO) was used as the *dedicated operator*. The AO was performing his scheduled rounds while he was the *dedicated operator*. The NRC Resident Inspector questioned the use of an operator who was performing another task while being appointed the *dedicated operator*. The utility was given a non-cited violation for the use of a *dedicated operator* who was performing rounds. **The proposed definition for a *dedicated operator* includes the provision that a locally-stationed operator must be positioned at a proper location to allow timely restoration, and the travel path to get to the equipment must remain accessible during any event that requires the operation of that equipment.**
>
> At another plant, the control room reactor operator (RO) was used as the *dedicated operator* during maintenance on the feedwater regulator valve. The NRC Resident Inspector questioned whether the operator could attend to the feedwater regulator valve while performing his normal control room duties. This led to lengthy discussions and a change in the plant approach to *dedicated operator* responsibilities for this type of work. Many plant procedures were revised, and the operators were retrained on the term

dedicated operator. **The proposed definition for dedicated operator includes provisions that a *dedicated operator* in the control room is to be in close proximity to controls that require restoration actions and that he or she must be able to perform restoration actions independent of other control room actions that may be required.**

At a third plant, a diesel was being tested and the operator running the test was the *dedicated operator*. The test involved performing the diesel water roll to ensure there is no water in the engine cylinders. This prevents damage to the diesel when it is started. This required that eight (8) valves be opened and the diesel local operations switch to be in the maintenance position. In this case, the regulator determined that the utility did not meet the requirement of a few simple steps when applying the *designated operator* status and this resulted in a non-cited violation. **The proposed guidance includes the provision that restoration steps must only be a few steps (for example, less than 5) and there must be a high degree of confidence that the actions can be completed within the time frame specified by the PRA success criteria.**

3.5 Designated Operator

The term *designated operator* is explicitly defined to mean exactly the same role as the term *dedicated operator*. This term may be used interchangeably with the term *dedicated operator.* This should allow utilities that have previously used one of these terms to meet the requirements defined here while maintaining the plant's existing terminology.

The requirements for a *designated operator* are provided above under the term *dedicated operator*.

4
CONCLUSIONS

This report proposes definitions for the terms *available*, *unavailable, dedicated operator, designated operator* and *PRA functionality*. The proposed definitions and their requirements are of sufficient detail to address previously identified concerns with consistency, varied interpretations and confusion that has arisen in the past. These definitions are compatible with the current industry documents: NUMARC 93-01 [4], MSPI guidance - NEI 99-02 [5], the NRC Inspection Manual for Maintenance Rule Risk Assessments - IMC-0308 [7] and the Risk-Managed Technical Specification guidance in NEI 06-09 [8]. The use of these definitions should lead to a more consistent use of these terms across the industry.

Industry and regulator feedback concerning these definitions and experience gained from trial application of these definitions is encouraged. The feedback can be used to revise and improve the definitions. The industry is encouraged to consider additional actions to apply these definitions in published guidance to further advance the consistency of the usage of these terms.

It is recommended that utilities consider incorporating the definitions in internal guidance and procedures to ensure consistent applications by Operations, PRA, Maintenance, Engineering and other affected staff.

5
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