FAQ Number 10-0059 **FAQ Revision** 5

FAQ Title NFPA 805 Monitoring

Plant: Harris Nuclear Plant **Date:** February 10, 2012

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Purpose of FAQ:

The purpose of this FAQ is to clarify the following for the NFPA 805 monitoring program:

- Screening criteria
- Action levels
- Definition of fire compartments in the fire PRA

Is this Interpretation of guidance? Yes

Proposed new guidance not in NEI 04-02? Yes

Details:

NEI 04-02 guidance needing interpretation (include section, paragraph, and line numbers as applicable):

Some clarification is required to help the user implement the monitoring program for NFPA 805. The clarification stems from lessons learned while developing the monitoring program for the pilot plants.

There are three key points of clarification:

1. Analysis Unit - The monitoring analysis unit used to select high safety significant NFPA 805 fire protection Structures, Systems, and Components (SSCs) should be a fire area. Fire compartments smaller than fire areas may be used instead of fire areas provided the compartments are independent (i.e., share no fire protection SSCs). Selections of nuclear safety capability equipment (NSCA) SSCs that are relied on to meet the nuclear safety performance criteria are done at the plant level using the fire PRA. For the purposes of the FAQ, NSCA equipment is intended to include Nuclear Safety Equipment List, Fire PRA equipment, and NPO equipment. The difference in selection scope arises because fire protection SSCs generally respond to fires within the local areas, whereas NSCA SSCs generally respond to fires in many different areas.

2. Screening – Screening can be used to identify the population of SSCs that need not be monitored. The screening of fire protection SSCs may be based on multiple compartments up to and including fire areas. The screening of NSCA SSCs may be based on maintenance rule guidelines used to identify high safety significant SSCs.

3. Action level threshold – When establishing the action level threshold for reliability and availability, the action level should be no lower than the fire PRA assumptions. When applicable, a sensitivity study should be performed to determine the margin below the action level that still provides acceptable fire PRA results to help prioritize corrective actions if the action level is reached.

Circumstances requiring guidance interpretation or new guidance:

Lessons learned.

Detail contentious points if licensee and NRC have not reached consensus on the facts and circumstances:

None

Potentially relevant existing FAQ numbers:

None

Response Section:

Proposed resolution of FAQ and the basis for the proposal:

See specific revisions listed below.

If appropriate, provide proposed rewording of guidance for inclusion in the next

Revision:

See revisions to NEI 04-02 Section 5.2.1, Section 5.2.3, and Appendix E below.

5.2 Monitoring

Section 2.6 of NFPA 805 discusses monitoring requirements associated with a risk-informed, performance-based fire protection program. The following are the requirements from Section 2.6:

> "***2-6* Monitoring.*** *A monitoring program shall be established to ensure that the availability and reliability of the fire protection systems and features are maintained and to assess the performance of the fire protection program in meeting the performance criteria. Monitoring shall ensure that the assumptions in the engineering analysis remain valid.*
>
> ***2-6.1 Availability, Reliability, and Performance Levels.*** *Acceptable levels of availability, reliability, and performance shall be established.*
>
> ***2-6.2 Monitoring Availability, Reliability, and Performance.*** *Methods to monitor availability, reliability, and performance shall be established. The methods shall consider the plant operating experience and industry operating experience.*
>
> ***2-6.3 Corrective Action.*** *If the established levels of availability, reliability, or performance are not met, appropriate corrective actions to return to the established levels shall be implemented. Monitoring shall be continued to ensure that the corrective actions are effective.*"

Section 2.3 of NFPA 805 provides additional requirements related to assumptions used in performing engineering analyses to support a risk-informed, performance-based fire protection program. The following requirements are included:

> *"**2.3 Assumptions.** The following assumptions are provided to perform a deterministic analysis of ensuring the nuclear safety performance criteria are met. [Performance-based information (i.e., equipment out of service, equipment failure unrelated to the fire, concurrent design basis events) are integral parts of a PSA and shall be considered when performance-based approaches are utilized.]*

Section 2.4.2.1 of NFPA 805 discusses systems and equipment utilized to meet the nuclear safety performance criteria. One requirement cited for those systems and equipment relates to availability and reliability:

> "***2.4.2.1 Nuclear Safety Capability Systems and Equipment Selection****…Availability and reliability of equipment selected shall be evaluated."*
>
> *Section 2.4.3.3 of NFPA 805 discusses PSA analyses performed to support fire risk evaluations:*
>
> *"**2.4.3.3*** The PSA approach, methods, and data shall be acceptable to the AHJ. They shall be appropriate for the nature and scope of the change being evaluated, be based on the as-built and as-operated and maintained plant, and reflect the operating experience at the plant."*

As part of the transition review, the adequacy of the inspection and testing program to address fire protection systems and equipment within plant inspection and the compensatory measures programs should be reviewed. In addition, the adequacy of the plant corrective action program in determining the causes of equipment and programmatic failures and minimizing their recurrence should also be reviewed as part of the transition to a risk-informed, performance-based licensing basis.

5.2.1 Existing Guidance and Programs

The Maintenance Rule (10 CFR 50.65) and Regulatory Guide 1.174 are provided as examples in NFPA 805 Section A.2.6 of acceptable monitoring programs. However, the appendices of NFPA-805 are not part of the 50.48(c) rule and flexibility is provided to allow plant-specific processes to be established for performance monitoring.

NEI Document NUMARC 93-01, *Industry Guideline for Monitoring the Effectiveness of Maintenance at Nuclear Power Plants*, provides an acceptable approach to meet the Maintenance Rule. It includes methods for selecting equipment, establishing and applying risk significance criteria and performance criteria, goal setting and monitoring, assessing and managing risk, performing periodic assessment of performance, and necessary documentation. Although not required, NUMARC 93-01 may be consulted for ideas in developing/updating a monitoring program for fire protection and NSCA SSCs. Due to the efforts expended in complying with the maintenance rule for plant safety systems, a plant may determine that the incremental effort associated with adding selected NSCA SSCs and fire protection program systems and features to previously established programs may be less than establishing a new process or effort. NUMARC 93-01 is very flexible in recognizing the utilization of existing plant programs.

Plant/owner-operator specific initiatives have been undertaken to optimize fire protection surveillance and testing practices and frequencies for fire protection SSCs. This is allowed under traditional regulatory framework using a fire protection standard license condition. Therefore, there are established programs that could be used, enhanced, or modified in an effort to meet the monitoring requirements for fire protection SSCs as discussed in NFPA 805. If a licensee plans to utilize these initiatives post-transition, a discussion should be included in the monitoring section of the LAR and NEI 04-02 Table B-1 Transition of Fundamental Fire Protection Program and Design sections of the LAR. Other entities such as the Department of Defense and Department of Energy have participated in performance-based fire protection inspection and testing efforts. Therefore, there are a number of resources available to establish and maintain a risk-informed, performance-based program.

Acceptable levels of availability, reliability, and performance must be established for both fire protection SSCs and NSCA SSCs. This does not imply or require detailed statistical analysis of all fire protection and NSCA systems, features, components, and sub-components. Instead, determining acceptable levels of availability, reliability, and performance should be commensurate with their risk significance and may be established at the structure, system, or component level, or aggregates of these, where appropriate. It is up to individual plants to establish goals and criteria for acceptable levels of availability and reliability.

5.2.2 Monitoring Program Development

It is expected that a monitoring program for a risk-informed, performance-based fire protection program would be established in phases, with elements added as more of the program relies upon risk-informed, performance-based techniques. It is important to identify parts of the program that may require additional attention during the transition and change evaluation process. Likely candidates would include monitoring of NSCA equipment or other plant equipment that is not part of the traditional 10 CFR 50, Appendix R post-fire safe shutdown analysis and whose availability is an important component of limiting fire risk. Other attributes may include features that are integral to successful fire modeling in an area, but may not have been considered important in a deterministic approach.

It is expected that a more refined monitoring program (availability, reliability, and performance goals) would be established for the parts of the program where these techniques have been employed. For

example, as risk-informed, performance-based techniques are used as part of the change process (i.e., fire modeling in a fire area, change in equipment in PRA model, change in equipment relied upon to achieve the nuclear safety performance criteria, change in surveillance frequencies of fire protection equipment), the scope and depth of the monitoring program would need to be adjusted accordingly.

See Appendix E of this document for additional guidance on establishing a monitoring program. This guidance is provided on the four major phases of program development:

- Phase 1 – Scoping (fire protection, radioactive release, and NSCA SSCs and programmatic elements)
- Phase 2 – Screening Using Risk Criteria
- Phase 3 – Risk Target Value Determination
- Phase 4 – Monitoring Implementation

5.2.3 Monitoring Considerations

Monitoring programs for fire protection systems and features are not a new concept being introduced as part of a risk-informed, performance-based fire protection program. Surveillance, testing, inspection, and maintenance testing of fire protection systems and features have always been part of a sound program. In addition, the system engineer functions at nuclear power plants have stressed system and equipment health, reliability, and availability.

Risk-informed, performance-based reactor oversight has also increased attention on plant systems and features (including fire protection) with the greatest contribution to risk. Adoption of a risk-informed fire protection licensing basis, however, may introduce some different considerations that may not have been present in a traditional fire protection program.

- Calculations and analyses such as fire modeling, particularly a maximum expected and limiting fire scenario, rely on key assumptions that help form the basis for acceptability of configurations and changes to those configurations. These assumptions and input conditions may be different in content and form than previously analyzed.

  For example, a fire scenario in a traditional program may have assessed fire hazards by monitoring the combustible loading represented by a BTU/square foot value in an area, which would be monitored by a plant combustible control program. Under a risk-informed, performance-based program, fire modeling, using more advanced and accurate predictions of fire behavior may rely on a certain quantity of oil spill from a pump motor or containment of spilled oil by a retaining berm. The factors that influence results of fire scenarios should be included within an administrative or design control/monitoring program.
- Suppression systems, relied upon specifically in a calculation for core damage frequency, have reliability and availability values that will have been used in the calculations. Systems that are integral to prevention of risk-significant fire scenarios may require monitoring to meet numerical availability numbers in order to satisfy risk acceptance criteria.
- Traditional safe shutdown analyses have relied upon safe shutdown equipment (e.g., NSCA SSCs) being in service at the start of a fire. A risk-informed, performance-based approach, particularly in a risk model that calculates core damage frequency, considers both NSCA SSCs and fire protection SSCs reliability and unavailability.
- The majority of NSCA SSCs relied upon to ensure post-fire nuclear safety performance criteria is met is equipment that is important for plant risk and mitigation of the consequences of design

basis accidents. Therefore, most NSCA equipment important to fire risk will be subjected to inspection, testing, and performance monitoring as part of the Maintenance Rule process and subjected to a variety of plant controls and processes. However, all NSCA equipment important to fire risk may not be part of an existing monitoring program. For example, there may be dominant fire risk contributors that are insignificant contributors to internal events risk. SSCs relied upon to recover from the event may, or may not, be safety significant for the Maintenance Rule. Outliers must be identified and incorporated as necessary into a monitoring program.

- Most of the fire protection features and systems are already being included in the existing fire protection inspection and test program and system/program health programs. The existing program is adequate for routine monitoring of the fire protection systems and features required by the fundamental program of Chapter 3 of NFPA 805 or of low safety significance for Chapter 4 of NFPA 805. The process outlined in Appendix E of this document determines those high safety significant fire protection systems and features, NSCA equipment and programmatic elements that may require additional monitoring beyond normal inspection, testing and surveillance activities.
- Due to different success criteria that are evaluated in a risk-informed, performance-based program, other fire protection systems and features may require monitoring. For example, a fire barrier previously not credited for 10 CFR 50, Appendix R compliance may be important to preventing fire from causing a fire-induced loss of offsite power or plant trip, which may prove to be risk significant. Another example is a fire barrier installed prior to efforts for compliance with 10 CFR 50, Appendix R that was abandoned in place without any credit taken for fire protection. This barrier may prove valuable in protecting risk significant circuitry against a credible fire (as determined by fire modeling).
- To demonstrate compliance with NFPA 805, action levels should be established for the monitored SSCs, which may be grouped together functionally in ‘pseudo-systems’ or ‘performance monitoring groups’(PMG) to “ensure that the assumptions in the engineering analysis remain valid.”
- Screening compartments and fire areas should also include considerations for design/operation/maintenance limitations. For instance, fire detection should not subdivide systems beyond the system/train/channel level used in normal operation/maintenance.

REPLACE ALL OF APPENDIX E WITH THE FOLLOWING:

E. MONITORING

The monitoring process consists of four major phases:

- Phase 1 – Scoping
- Phase 2 – Screening Using Risk Criteria
- Phase 3 – Risk Target Value Determination
- Phase 4 – Monitoring Implementation

A documented evaluation is used to:

- Determine the scope of fire protection, radioactive release, and NSCA SSCs and programmatic elements to monitor.
- Establish initial levels of availability, reliability, or other criteria for those elements that require monitoring.

A suggested methodology is outlined below. Figure E-1 provides an overview of the Monitoring Process, while Figure E-2 provides detail on a process for Phases 1 and 2.

Phase 1 – Scoping

In order to meet the NFPA 805 requirements for monitoring, the following categories of SSCs and programmatic elements should be included in the NFPA 805 monitoring program:

- Structures, Systems, and Components required to comply with NFPA 805, specifically:
  - Fire protection systems and features
    - Required by the Nuclear Safety Capability Assessment
    - Modeled in the Fire PRA
    - Required by Chapter 3 of NFPA 805
  - Nuclear Safety Capability Assessment equipment*
    - Nuclear safety equipment
    - Fire PRA equipment
    - NPO equipment
  - SSCs relied upon to meet radioactive release criteria
- Fire Protection Programmatic Elements

*For the purposes of the NFPA 805 Monitoring, “NSCA equipment” is intended to include Nuclear Safety Equipment, Fire PRA equipment, and NPO equipment.

Phase 2 – Screening Using Risk Criteria

The equipment from Phase 1 scoping will be screened to determine the appropriate level of NFPA 805 monitoring. As a minimum, the SSCs identified in Phase 1 should be part of an inspection and test program and system/program health program. If not in the current program, the SSCs should be added in order to assure that the criteria can be met reliably.

The following screening process is suggested to determine those SSCs that may require additional monitoring beyond normal surveillance activities.

1. Fire Protection Systems and Features

Those fire protection systems and features identified in Phase 1 would be candidates for additional monitoring in the NFPA 805 program commensurate with risk significance.

Risk significance may be accomplished at the component, programmatic element, and/or functional level. Since risk is evaluated at the compartment level or fire area level, criteria must be developed to determine those analysis units for which the fire protection SSCs contained within the area are considered risk significant. Screening compartments and fire areas should also include considerations for design/operation/maintenance limitations. For instance, fire detection should not subdivide systems beyond the system/train/channel level used in normal operation/maintenance.

The Fire PRA is the primary tool used to establish the risk significance criteria and performance bounding guidelines. Screening thresholds used to determine risk significant analysis units are those that meet the following criteria:

Risk Achievement Worth (RAW) of the monitored parameter ≥ 2.0

(AND) either

Core Damage Frequency (CDF) x (RAW) $\geq$ 1.0E-7 per year

(OR)

Large Early Release Frequency (LERF) x (RAW) $\geq$ 1.0E-8 per year

CDF, LERF, and $RAW_{(monitored\ parameter)}$ are calculated for each fire area. The 'monitored parameter' will be established by licensee at a level commensurate with the amenability of the parameter to risk measurement (e.g., a fire barrier may be more conducive to risk measurement than an individual barrier penetration). If compartments are used that are smaller than fire areas, sufficient basis should be documented.

The monitoring program will include the appropriate fire protection program SSCs based on the criteria above. The licensee may also screen in additional fire protection program SSCs based on plant-specific considerations. Additionally, licensees may submit criteria that are different than above for review and approval in the NFPA 805 LAR.

2. Nuclear Safety Capability Assessment Equipment*

NSCA equipment may already be appropriately monitored by the Maintenance Rule. A comparison of NSCA equipment to the SSCs that are monitored in the Maintenance Rule program should be performed to determine what equipment may require additional NFPA 805 Monitoring. For NSCAs SSCs not monitored by the Maintenance Rule, the basis for inclusion or exclusion of the SSCs in the NFPA 805 monitoring program should be documented.

The fire PRA should be used to identify high-safety-significant (HSS) NSCA SSCs that require monitoring. The Maintenance Rule guidelines differentiating HSS from low-safety-significant (LSS) SSCs should be used. HSS NSCA SSCs not currently monitored in Maintenance Rule should be included in either the Maintenance Rule or the NFPA 805 monitoring program. If the Fire PRA and Maintenance Rule are not used to identify HSS NSCA SSCs that require

monitoring, the licensee should fully describe the process used. All NSCA SSCs that are not HSS should be considered LSS and need not be included in the monitoring program.

For fires originating during non-power operational modes, the qualitative use of fire prevention to manage fire risk during Higher Risk Evolutions does not lend itself to quantitative risk measurement. Therefore, fire risk management effectiveness is monitored programmatically similar to combustible material controls and other fire prevention programs. Additional monitoring beyond inspection and test programs and system/program health programs is not considered necessary.

3. SSCs Relied upon for Radioactive Release Criteria

The evaluations performed to meet the radioactive release performance criteria are qualitative in nature. The SSCs relied upon to meet the radioactive release performance criteria are not amenable to quantitative risk measurement. Additionally, since 10 CFR Part 20 limits (which are lower than releases due to core damage and containment breach) for radiological effluents are not being exceeded, equipment relied upon to meet the radioactive release performance criteria is considered inherently low risk. Therefore, additional monitoring beyond inspection and test programs and system/program health programs is not considered necessary.

4. Monitoring of Fire Protection Programmatic Elements

Monitoring of programmatic elements is required in order to "assess the performance of the fire protection program in meeting the performance criteria". Programmatic aspects include:

- Transient Combustible Control; Transient Exclusion Zones
- Hot Work Control; Administrative Controls
- Fire Watch Programs; Program compliance and effectiveness
- Fire Brigade Effectiveness

Fire protection health reports, self-assessments, regulator and insurance company reports provide inputs to the monitoring program. The monitoring of programmatic elements and program effectiveness may be performed as part of the management of engineering programs. This monitoring is more qualitative in nature since the programs do not lend themselves to the numerical methods of reliability and availability. These programs form the bases for many of the analytical assumptions used to evaluate compliance with NFPA 805 requirements

Phase 3 – Risk Target Value Determination

Phase 3 consists of using the Fire PRA, or other processes as appropriate, to determine target values of reliability and availability for the HSS fire protection/NSCA SSCs and programmatic elements established in Phase 2 as requiring additional monitoring beyond inspection and test programs and system/program health programs.

Failure criteria are established by an expert panel or evaluation based on the required fire protection and nuclear safety capability SSCs and programmatic elements assumed level of performance in the supporting analyses. Action levels are established for the SSCs at the component level, program level, or functionally through the use of the pseudo system or 'performance monitoring group' concept. Action level should be developed for the NSCA SSCs that are included in a monitoring program.

If HSS SSCs have been identified using the Maintenance Rule guidelines, the associated SSC specific performance criteria may be established as in the Maintenance Rule, provided the criteria are consistent with Fire PRA assumptions. The actual action level is determined based on the number of component, program or functional failures within a sufficiently bounding time period (~2-3 operating cycles). Adverse trends and unacceptable levels of availability, reliability, and performance will be reviewed against established action levels. The Monitoring Program failure criteria and action level targets should be documented.

Phase 4 – Monitoring Implementation

Phase 4 is the implementation of the monitoring program, once the monitoring scope and criteria are established. Monitoring should consist of periodically gathering, trending, and evaluating information pertinent to the performance, and/or availability of the SSCs and comparing the results with the established goals and performance criteria to verify that the goals are being met. Results of monitoring activities should be analyzed in timely manner to assure that appropriate action is taken. The corrective action process will be used to address performance of fire protection and nuclear safety SSCs that do not meet performance criteria.

For fire protection and NSCA SSCs that are monitored, unacceptable levels of availability, reliability, and performance will be reviewed against the established action levels. If an action level is triggered, corrective action should be initiated to identify the negative trend. A corrective action plan will then be developed using the appropriate licensee process. Once the plan has been implemented, improved performance should return the SSC back to below the established action level.

A periodic assessment should be performed (e.g., at a frequency of approximately every two to three operating cycles), taking into account, where practical, industry wide operating experience. This may be conducted as part of other established assessment activities. Issues that should be addressed include:

- Review systems with performance criteria. Do performance criteria still effectively monitor the functions of the system? Do the criteria still monitor the effectiveness of the fire protection and nuclear safety capability assessment systems?
- Have the supporting analyses been revised such that the performance criteria are no longer applicable or new fire protection and nuclear safety capability assessment SSCs, programmatic elements and/ or functions need to be in scope?
- Based on the performance during the assessment period, are there any trends in system performance that should be addressed that are not being addressed?

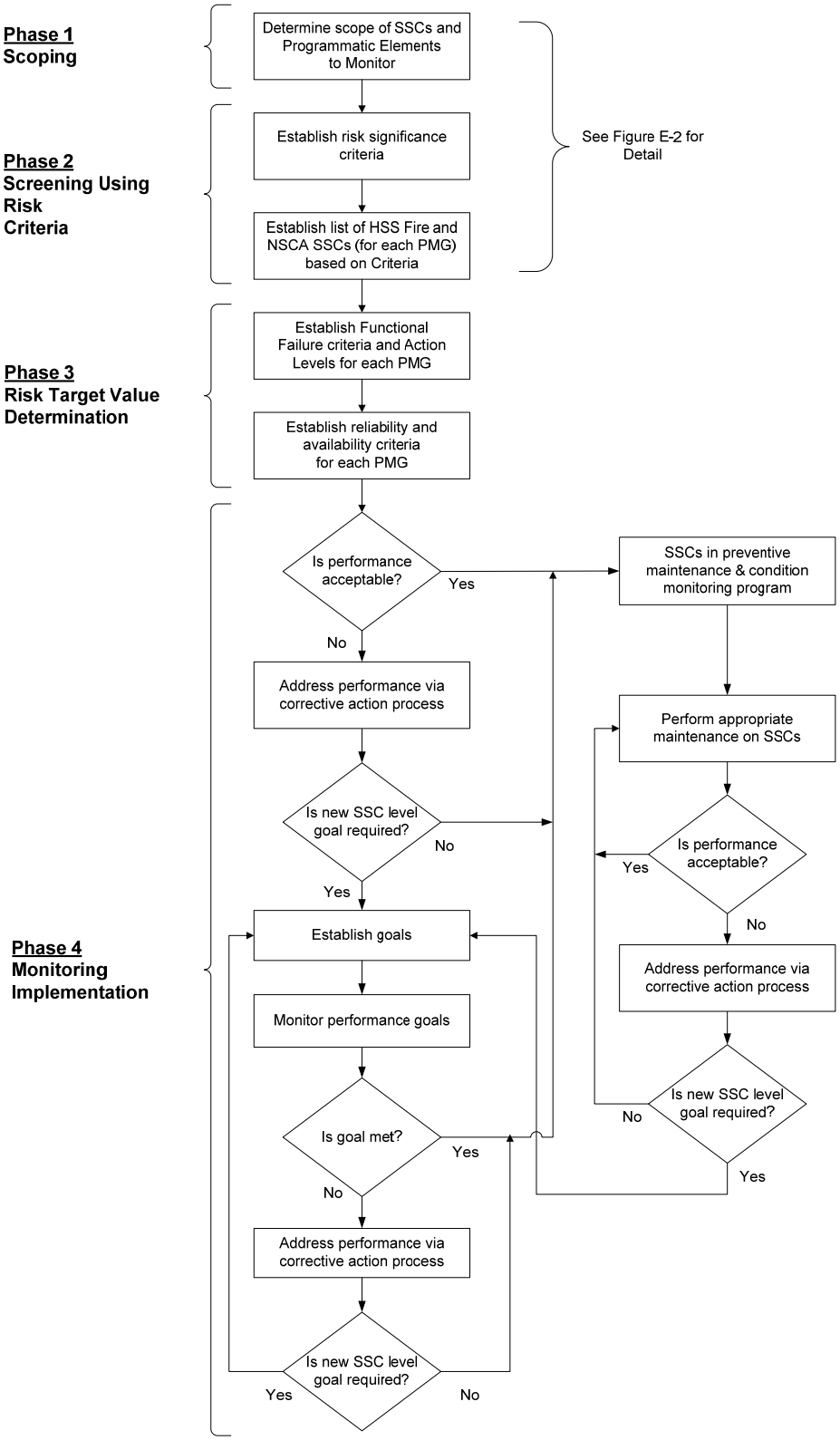

Figure E-1 – NFPA 805 Monitoring Process

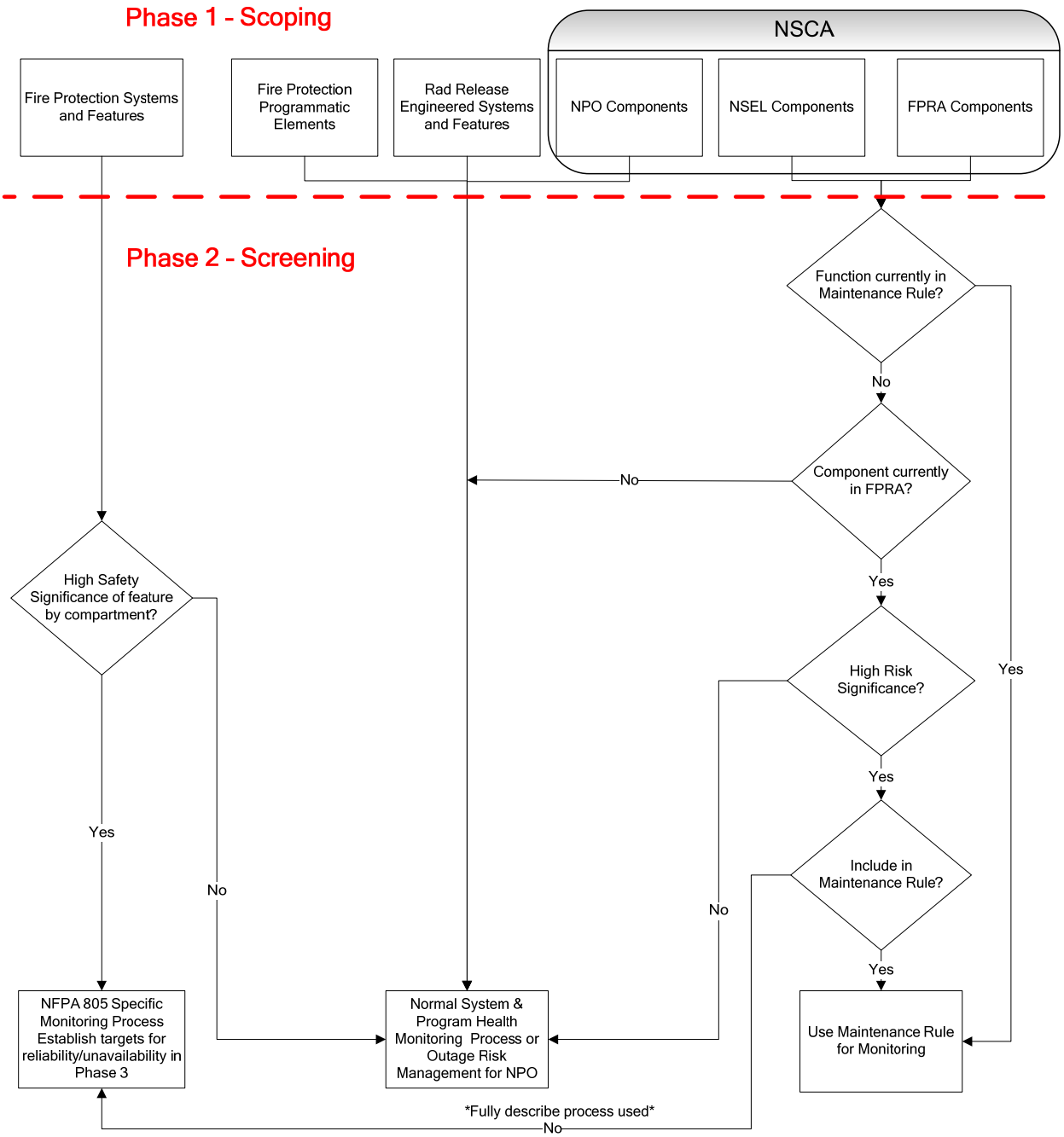

Figure E-2 – NFPA 805 Monitoring – Scoping and Screening