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General Comment

See attached file(s)

Attachments

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Overview

Response to NRC, Standard Review Plan (SRP) 17.4, Reliability Assurance Programs (RAP)

Note: All comments are referenced to the SRP, and then summarized with recommendations. The terms Scheduled Maintenance (SM) Program and Preventive Maintenance (PM) Program are used interchangeably to indict a set of computer-scheduled tests, inspections, replacements and rework/overhauls done at predetermined intervals in response to a condition-directed result, or observation analyses that estimates SSC part life, including replaceable lubricants and elastomers. Monitoring activities performed by Operators on Computer Screens and Rounds are also presumed to be a part of the RAP. Systems structures and components (SSC) generically identify either all those items, or any, based on context. Most often, "SSC" refers to what we would term "components," and then secondarily, "Systems." Context for the use of SSC should be noted where the term is used.

Summary

The SRP proposed seeks to provide guidance for new plant owners to meet NRC RAP regulatory requirements. However, providing this document's RAP guidance will not assure the intent of the SECY 95-132 -- the validity of the PRA. The fundamental requirements will simply assure legacy requirements from Generation II light water reactors (LWRs) will continue to apply. It will not cover new equipment such as digital controls, combustion turbines (provided in standby electrical supply Class IE service) or other new technology. The prolific application of digital processors embedded in components like air-operated valves (AOV), motor-operated valves (MOV) and switchgear will not be covered.

With so many omissions, it's difficult to see how the SRP does more than promote obsolete methods for plants whose construction is already in progress. It does not assure that "in scope" RAP SSC will meet their service reliability and availability requirements, as intended, from the beginning of their service life. It does not provide new nuclear plants an effective RAP program for Safety Related, Safety Significant equipment plants starting out their service life. It does not provide the best possible maintenance program for new nuclear plants' reliability assurance starting out their sixty-year plus intended lifetimes. It does not clearly identify expectations for licensees to develop high-quality maintenance and monitoring programs from the start of operations. Indeed, by failing to identify a generic process to develop effective requirements, it does not assist prospective owners in obtaining the highest quality of information on SSC failure modes and mechanisms to plan for their effective servicing over the life of the pant. It sets up reactive requirements to address problems only after they occur.

Finally, by tasking the COL applicant to develop many RAP subprograms, like the SSC type failure modes (which are highly dependent on type), the SRP helps ensure that in the absence of industry individual plant programs with standard common components and system designs will develop independently,

discouraging standardization around component types (motor operated valves, air operated valves...) and suppliers (Fisher, Vulcan, Copes, etc...) and plant design types (BWR, APRW, ESBWR etc.). This is quite unfortunate, and contrary to new plant design standardization goals.

The intent of SECY 95-0132 should be met. What constitutes the RAP and how to develop it should be clear. The SRP fails to explain clearly what RAP is, in current practice terms. Because what constitutes the RAP is unclear, developing it is also unclear. "RAP" itself is a uniquely regulatory term; no other industry uses it. Unless RAP is defined clearly this creates confusion.

Tasks that fulfill the complex abstract RAP reliability goals require clear implementation steps for those who develop RAP. For reference, several simple clear standards from high-risk technical industries and the US military are available. Identifying and extracting guidance from those manuals would provide source materials to reference. This will clarify RAP, as well as interim requirements.

The SRP provides no method for age exploration on RAP SSC; for generality it must. The SRP doesn't provide a clear path using the best available nuclear and non-nuclear guidance to clear up an area of clear misunderstanding. Left as it is the SRP will not reasonably assure the RAP. Someone must develop it, so that it does, or reference standards that can.

USNRC STANDARD REVIEW PLAN page 1

17.4 RELIABILITY ASSURANCE PROGRAM page 2

I. AREAS OF REVIEW page 2

Purpose of the RAP page 2

The regulatory purpose of a RAP is to maintain the PRA. In practice, the RAP should assure that programs maintain plant equipment so that it's reliable and available to meet functional requirements specified. For in-scope RAP equipment, RAP supports safety functions and the PRA. For the balance of plant equipment, scheduled maintenance and monitoring programs assure that it maintains enough reliability and availability to support plant operating production and cost goals. (Note: The term "scheduled maintenance" is the most common English term descriptive for what is being discussed here.)

Technically, the RAP scope is limited to only safety related (SR) and safety significant (SS) SSC. Practically other RAP-like balance-of-plant (BOP) scheduled maintenance and monitoring programs support the reliability and availability of the entire nuclear plant, outside RAP regulatory scope. Past deterministic

methods are incomplete to develop the RAP for new plants; they are not performance-based. They encourage other incomplete, arbitrary or even technically unsupportable methods. Since RAP development has never been required before this rule, confusion abounds. A clear method to accomplish the objective developing RAP should be provided. Now, the current RAP method is not.

Objective of the D-RAP - page 2

An ITAAC that approves current guidance would be ineffective achieving the goal of the RAP, page 17.4-6, item 2, which cites 10CFR52.47(b)1. This ITAAC could not provide "necessary and sufficient" criteria to reasonably assure that the plant can conform to its design-certified reliability and availability, without providing additional requirements. While most licensees will attempt to establish programs that meet RAP voluntarily, the methods that they will use will vary without clear guidance, industry standards or an effective program model to follow. SRP 17.4 guidance lacks an effective program model. In the same manner, guidance for Combined Licenses would be ineffective achieving the goal of the RAP, page 17.4-6, item 3, 10CFR52.80(a).

During the DC phase - page 3

Note: this is the responsibility of the Nuclear Plant DC Licensee (formerly Nuclear Steam System Supplier, or NSSS)

SSC referred to as "in scope" need better identification. Right now, there is no consistent standard method to identify SSC, so tagging can be inconsistent. There is no specific way to identify SSC parts uniquely distinct from any other part of an SSC, for example. How to differentiate components and parts during coding comes down to experience and judgment, but on legacy plants various methods were used. Ideally, methods would be the same -- minimally, consistent. Variations in coding, or identifying the SSC, have been used within plants. Better guidance needs to be used to identify RAP SSC. Current lists of SSC for PRA and RAP are widely disparate. While there may be only several hundred PRA SSC, the RAP typically needs to address well over ten-thousand based on operating plants today. Better guidance should relate the two lists. (PRA can simply not cope directly with the total number of RAP SSC, which should say something about their risk classification. They're not safety significant.)

This leaves the dominant failure mode (DFM) identification process to the DC applicant but provides no guidance as to how DFM failure modes are used in the design and procurement stages. There should be a statistical basis for identifying DFM (e.g., so they're truly frequently observed). In the past, DFM identified were not based on failure experience, but opinion and enumeration -- creating unnecessary lengthy, non-useful or even counterproductive lists to work.

MPFFs and the DFM need both a statistical and expert opinion-based justification. DFM should be based on local failure effects, and ultimately, failure mechanisms, which includes the failure's causes. (To prevent a failure mode requires understanding its cause.)

DFMs must integrate into the operational program. Plants do not know DFM for new equipment, and only have a rough idea of new equipment aging characteristics and its failure causes. To create maintenance tasks for rare event failure modes would introduce more failures through infant mortality. Therefore DFM must be observed statistically, not developed as academic exercises. (The enumerating result listing all failure modes imaginable has occurred in past nuclear SSC DFM efforts.)

During the COL application phase page 3

"During the COL application phase, the COL applicant develops and implements those portions of the D-RAP that apply to the COL..." Unfortunately the COL applicant lacks the expertise to develop and implement these portions of the D-RAP. They do not have the new SSC knowledge from performance history to identify its DFM. Yet the RAP calls for them to do it, though it's generally not their expertise, especially for new equipment. Even if the COL applicant staff could, the supplier's experts would be better equipped to do it based on knowledge of the design and awareness of its failure experience. Details like this should be standardized across a nuclear design and its COL. Failing to do so only increases the probability of highly custom programs for what would otherwise be standard plants.

Process for integrating the RAP page 4

SRP 17. 4 should identify exactly what plant programs are, so transitional/integration work from the D-RAP to the Maintenance Rule (formerly called Operational RAP or O-RAP) can be done clearly, directly and without a lot of redevelopment of the works technical the basis.

Some legacy programs (e.g., Section ASME Section XI Inservice Inspection and Test -- ISI/IST) are essentially surveillance and/or performance measuring tools. By themselves, they do not maintain or improve reliability. They are deterministic -- not process oriented. The best they can do is identifying failure trends for root cause failure analysis (RCFA). They address legacy plants, and grandfather in Part 50 ISI and IST already.

Surveillance tools detect failure, rather than predict it, limiting their mitigation value. Surveillance monitoring only captures where failures occur. The SRP should generalize developing maintenance programs beyond preexisting Part 50 deterministic programs. It should explain how that's done (maintenance programs) and why it's beneficial. (The ASME BPV Section XI covers ISI, while the ASME OM Series Standards cover IST.)

Approximately 30% of new SR equipment SSC tags have no legacy prescriptive guidance. New components (component types like distributed controls, equipment like breakers, air operated and

motor operated vavles, local instrumentation..... with local microprocessor-based controls) will be custom developed differently without common guidance, overall less efficiently and more complex.

(3) Completing the ITAAC for the D-RAP page 4

Developing ITAAC (Right now, there will be an overall ITAAC that verifies there will be a RAP program. That should be broken down into distinct measurable RAP program development step parts. The ITAAC(s) should address the program and the specific systems covered "in scope" that will have specific RAP development steps. Development of the RAP program will be involved, regardless of the method(s) used. Once these methods are developed, proven and documented, more detailed ITAACs should be developed to document key step completion of the RAP. Ultimately, they should be included as part of a documented standard or rule.

Objective of the RAP during the operations phase page 4

The "Maintenance Rule" (MR), 50.65, developed from NUMARC 93-01, provides no guidance for developing PM programs. Meeting the Maintenance Rule performance criteria and goals is directly linked to preexisting PM programs, for Part 50 plants. This guidance does not prescribe how to develop the initial actionable RAP program for a new plant.

Preventive (Scheduled) Maintenance is an actionable, value-added tool but Maintenance Rule (NUMARC 93-01) has little or no guidance for developing PM programs. Moreover, meeting the Maintenance Rule performance criteria and goals links directly to the PM program but the guidance does not tell how to do it. NUMARC 93-01 (and the Maintenance Rule) is reactive in nature -- it relies on identify MPFFs and analyses to drive corrective actions. ANS 3.13 (draft), Reliability Assurance Programs, could be helpful identifying MPFFs during design phase providing feedback to designers and vendors. From design phase information appropriately detailed SSC PM plans can be developed for the RAP.

PRA staff responsibilities page 5

Inspections, Tests, Analyses, and Acceptance Criteria (ITAAC) page 6

Review Interfaces page 6

II. ACCEPTANCE CRITERIA

The Reliability Assurance Program (RAP) Guidance in SRP 17.4 is confusing, incomplete and ineffective. Following it does not assure developing an effective RAP, as intended. Signoff of an ITAAC for SRP 17.4, would merely document conformance to ineffective guidance in SRP 17.4. It would not assure safety

systems, structures and component reliability and availability, as intended by SECY 95-132 -- the original basis for Part 52 and this section of the SRP.

An effective RAP should

- Follow accurate technical guidance
- Categorize SSC consistently for risk, removing any arbitrary nature of SSC Classification
- Define systems/skids/trains/channels/SSC/parts for SSC hardware classification. Most legacy Part 50 plants had these subordinate SSC designed less effectively than possible, today.
- Quickly, simply evaluate risk with Out-Of-Service (OOS) or Inoperable SSC, when status change causes it to enter that mode
-
- Bring focus to high risk safety-significant or safety related SSC, including deselecting nonessential low risk embedded SSC parts
- Be complete for all applicable SSC
- Be clear
    - The intended RAP program is what is commonly termed "scheduled maintenance"
    - Develop a RAP program from first principles, not legacy requirements intended for legacy equipment forty years ago
    - Identify and include basic reliability elements - condition monitoring, testing and replacement/overhauls scheduled to occur based on phenomenological knowledge and risk
- Define RAP elements, which (in my opinion) center around traditionally-termed Scheduled Maintenance and Rounds
    - Condition Assessments
    - Tests
    - Alarm Checks (Local SSC and Distributed Controls)
    - Down select tasks considered to general nonspecific operator monitoring when no direct failure effects occur
    - No scheduled maintenance (NSM) when no effects are observed
    - Servicing (Hard Time)
    - Lubrications (Hard Time)
    - Overhauls (Hard Time)
- Provide for Operator rounds
- Provide for SSC parts "age exploration" (a program to develop part lifetimes)
- Supersede past deterministic guidance with current risk-informed, performance -based principles
- Develop an effective RAP program that meets intended SECY 95-132 RAP goals from first principles
- Be developed in computer software formats that include controlled tables and files
- Provide a way to update plant design changes
- Fix the problem of RAP -- integrally, completely and once and for all

- Identify what constitutes a "RAP"
- Provide a clear development process

SRP Acceptance Criteria

A. DESIGN CERTIFICATION APPLICATION

A.3 Methodology for Identifying Systems, Structures, and Components within the Scope of the Reliability Assurance Program

A.4 Expert Panels

A.5 Systems, Structures, and Components within the Scope of the Reliability Assurance Program

A.6 Process for Determining Dominant Failure Modes

A.8 ITAAC for Design Reliability Assurance Program

B. COMBINED LICENSE APPLICATION

B.3 Integration of Reliability Assurance Program into Operational Programs

17.4 focuses on developing the list of RAP SSCs and ensuring that the implementation controls maintain integrity between the PRA assumptions and the system design. For the operational phase, some of these programs (e.g., IST/ISI) are surveillance or performance measuring tools that by themselves they do not maintain or improve reliability.

Without a process to develop RAP you won't be able to implement design changes. Methods for update of the RAP that fall outside the scope of normal design control should be discussed. For example, age exploration programs for SSC parts, RCFA and other special program requirements.

B.4 ITAAC for Design Reliability Assurance Program

V. IMPLEMENTATION

Depending on incomplete legacy Part 50 methods, the SRP cannot address RAP for new design SSC like distributed controls, combustion turbines or components with local microprocessor controls. These are common everywhere – indeed, any non (ASME) Section XI mechanical or other modern equipment that will be used in new nuclear construction will not be covered. The only equipment covered will be legacy SSC for existing legacy Part 50 plants. That does not meet SECY 95-132 RAP goals.

VI. REFERENCES

End Matter

To go through the formal steps of developing improved guidance to support the startup of new units in three years is impractical. Still, approving an ineffective ITAAC for RAP would be self-defeating, counterproductive to long-term nuclear safety goals and set an alarming safety precedent.

Clearly identifying what RAP shall provide per the SRP will substantially improve plant guidance and lower development costs. Public Health and Safety will benefit. The existing SRP 17.4 RAP wording is circuitous, repetitive and confusing. Not providing clear guidance will lead to reinterpretation, redevelopment, rework and much higher costs for future nuclear plants, beyond its negative impact on Public Health and Safety.

Incomplete SRP guidance will allow ineffective RAP programs to develop; these will have to be corrected later, which will raise costs. RAP is a safety issue; a new nuclear plant needs a complete scheduled maintenance program to start up. To start up a new plant without resolving these key issues for safety related and safety significant SSC is contrary to SECY 95-132's fundamental goal -- that in-scope SSC have a RAP. Those details that establish clear scope and address the initial maintenance program from which the Maintenance Rule will evolve simply aren't covered. Beginning a Scheduled Maintenance Program at the Maintenance Rule with an avoidable safety event for any SR SSC doesn't demonstrate a prudent approach to nuclear safety goals.

In light of the deficiencies identified here, it's difficult to imagine how a licensee's ITAAC for RAP can more than superficially meet requirements. To provide a method to move forward while the current SRP material is under review, I suggest forming a consensus-based approach under a consensus body of professional societies with an industry-centered design user group.

The best approach would be to develop the methods performing a pilot with a new plant. Existing standards and processes could be used to develop the program, which could then be reviewed and incorporated into long-term guidance in 17.4. Such RAP methods could then demonstrate their *effectiveness meeting industry goals, be improved and -- based on positive assessment -- approved to* update SRP 17.4. Equivalently, standards could be developed to review and endorse for the same purpose.

Reviewers have no basis to sign off the ITAAC for new nuclear plants based just on what is here. New nuclear plants could end up completely highly individual and most likely incomplete RAP individually, based upon what is here.

Reference Detail

Stakeholders

Industry, NEI, EPRI, ANS, ASME and IEEE (one or all three, as SDOs) Utility Users Group

Nuclear Plant Venders, Architect Engineers, Component Supplier

New Nuclear Plant Owners

Regulatory Users/Agencies: Nuclear Regulatory Commission (NRC), Department of Energy (DOE), ...

What RAP should also do, practically

Use the best available information, based upon risk-based PRA combined with deterministic methods. Today these methods are termed, "risk-informed._

Seek nuclear component vender equipment failure information, using their profound knowledge of their equipment, with technical insights to provide a relevant Scheduled and condition-based maintenance base, with Parts replacements, inspection and servicing as due-diligence.

Develop a fundamentally invariant RAP maintenance process common to all SSC, regardless of historical precedent and historically deterministic rules.

- Identify the safety functions provided (this should be clear from the license Section Safety Analyses 15 and PRA)
- Partition SSC using analysis as needed, no more; e.g., "necessary and sufficient." (Standard 1)
- Develop actual dominant failure mechanisms using statistical insights not enumerating lists, identifying symptoms and causes
- Identify effective tasks and their initial performance intervals considering the phenomenological nature of failure and functions provided (e.g., risk of failure)

Conclusions

Three standards

Minimally, three new consensus standard(s) are needed to provide parts of an effective, actionable RAP. These include:

Standard :1 Partition—taking the plant apart

Partition -- Develop the Master Equipment List of Equipment in the Plant to provide inputs for SSC scope, and the references to its Vender Technical Literature. There is no current guidance on how to develop the detailed lists of equipment that constitute a nuclear plant and make up the RAP. Successful RAP development depends on consistent SSC lists.

Note: The American Nuclear Society (ANS) and American Society of Mechanical Engineers are developing standards that should include detailed guidance for Scoping RAP SSCs and developing RAP.

Standard 2: Actionable Program Steps

For brevity, suppose a RAP is simply a scheduled maintenance plan. After all, the goal of the RAP corresponds to the goals of doing scheduled maintenance. Developing the plan to load into the software system that implements it (e.g., like MRO "Maximo", Ventyx "Passport", SAP "mySAP"...) is a major program effort. Creating a RAP program also requires significant work. Most plants had twenty years of development, roughly, before falling under the Maintenance Rule (MR). They had moderately well-developed Scheduled Maintenance plans. Operationalizing requirements that create the initial Scheduled Maintenance plans are not clear at all. They must be for an effective RAP.

While the use of the term "RAP" may seem evident to the framers of NRC rules, actionalizing RAP means defining and /or translating it into commonly used industry terms. I believe the best, most common term for a RAP is a set of prescribed scheduled activities. These include time-based replacements, condition assessment using objective criteria, functional tests and time-based servicing or overhauls. Developing the Scheduled Maintenance Program to provide Guidance on the Specific Elements of RAP requires explaining those in commonly accepted industry terms and defining what they mean).

Standard 3: Implementation Steps

Implementation-- Standard 3

Plants don't just implement the plans they get in Vendor Technical Literature, nor should they. It still doesn't happen all by itself. The elements of the program need to be loaded into the implementation tools used, which will assure that they are performed (Okay, help assure). These include the CMMS, Digital Control Systems and other systems for design basis and work performance control.

The ANS standard should include developing implementation controls or just identifying what these are, if they are covered by other programs like Surveillance Test/ST.

Costs

Costs embedded in poor guidance are huge. Wherever guidance is unclear, licensees are at risk for redefining requirements at a later date. The RAP requirements identified here in SRP 17.4 are incomplete. RAP programs will be completed ad hoc, as legacy plants first developed legacy PM programs in the past, with whatever guidance they had. Licensees perceptive to Part 52's legacy and SRP 17.4 will add new PM programs, with new standards under development. Licensees may develop voluntary SSC PM programs piecemeal, or use NRC requirements for old SSC like EDG to model for new SSC. More probably, licensees will use all of the above.

Lowering nuclear costs requires substantially improving guidance for nuclear plant owners. There is no safety issue from improving clarity -- that has been shown to favorably improve costs. Incidentally, with fewer choices, lower error rates result and nuclear safety will benefit, too,.

How to address SRP 17.4?

Use qualified stakeholders using any of the methods suggested, or combined: pilot, standards and revision (or endorsement of equivalent methods). The NRC should encourage those knowledgeable in the industry to complete the SRP for RAP.

Who should help?

- Stakeholders
- Qualified Experts
- Technical Consulting Support

See "Follow the Jumbo Jet," J. K. August Nuclear Engineering International (NEI) Magazine pp. 18-24 May, 2010. Abstract: The US regulations that cover nuclear new-build no longer allow utilities to build plants first, and license them later. But they still do not go far enough in specifying how those plants will be maintained for trouble-free operation. Nuclear power should look to the commercial airplane industry, where such systems have been working for more than 40 years. (For a copy contact the author at jkaugust@msn.com, who owns the copyright.)