

POLICY ISSUE NOTATION VOTE

April 20, 2001

SECY-01-0067

FOR: The Commissioners

FROM: William D. Travers
Executive Director for Operations

SUBJECT: REPORT ON SUPPORT TO THE AMERICAN NUCLEAR SOCIETY FOR
THE DEVELOPMENT OF STANDARD ON PROBABILISTIC RISK
ASSESSMENT FOR LOW POWER AND SHUTDOWN

PURPOSE:

To report the status of the staff's activities in support of the American Nuclear Society (ANS) efforts to develop a probabilistic risk assessment (PRA) standard for low power and shutdown (LPSD) operations and request Commission approval on additional work needed to support this effort.

BACKGROUND:

In SECY-00-0007 (January 12, 2000), the staff proposed a plan for work on LPSD risk to support risk-informed regulatory decision-making. The purpose of this work was to support the development by ANS of a standard on LPSD PRA quality and to assess in a more realistic fashion the risk associated with LPSD operations. The Commission, in its staff requirements memorandum (SRM) of March 31, 2000, approved the staff's plan to support ANS in developing standards for a LPSD PRA. Specifically, the Commission directed the staff to (1) identify those plant operating states (POSS) which need to be included in the scope of the standard for consistency in the treatment of shutdown risk and associated risk management decision-making and (2) identify specific shutdown events which are important to risk and need to be considered in the standard. The Commission also directed the staff to report its progress and propose additional work if needed.

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DISCUSSION:

Since the Commission's SRM of March 31, 2000, work has proceeded in the following areas:

- ANS activities regarding development of a LPSD PRA
- Staff activities regarding identification of POSs and initiating events important to LPSD risk.

A summary of the work in each of these areas follows.

ANS Activities:

ANS is developing a LPSD PRA standard. This standard fits with the PRA standard being developed by the American Society of Mechanical Engineers (ASME). That is, ASME is developing a standard for a Level 1 and Level 2 PRA for internal events (excluding fire) at full power operation. ANS is developing a complementary standard for internal events (excluding fire) at LPSD conditions and is building upon the ASME effort.

In developing the LPSD PRA standard, ANS has divided the standard into three major areas:

1. Criteria for identifying and screening the POSs not important to risk.
2. Criteria for identifying and screening plant configurations not important to risk.
3. Criteria for estimating the core damage frequency (CDF) and large early release frequency (LERF) for the risk important POSs and associated configurations.

POS Identification and Screening:

A plant transitions through different states as it shuts down from full power or as it restarts to full power. The risk associated with some POSs does not contribute substantially to the total plant risk. For these POSs, development of a quantitative model is not necessarily warranted. The ANS standard will provide a set of criteria for identifying the potentially risk important operating states while screening the unimportant. ANS plans to base these criteria on available analyses (information) indicating what POSs have been found to be risk significant along with any unique or specific characteristics. A major input will be the work currently being pursued by the staff (discussed later in this paper).

Plant Configuration Identification and Screening:

As with the POS, not every plant configuration is risk significant. Consequently, the ANS standard will also contain criteria for identifying the significant configurations and screening the unimportant configurations. ANS plans to build upon industry's Configuration Management program that would compare configurations against a "benchmark" to determine if it is risk significant relative to full

power. The Electric Power Research Institute (EPRI) is funding the necessary research to develop this benchmark. It is ANS's intention to use the results of EPRI's effort to develop the necessary criteria to identify the risk significant configurations associated with the risk significant POSs.

Quantification of CDF and LERF for LPSD:

ANS is developing criteria to estimate CDF and LERF for the risk significant POSs and associated configurations for LPSD conditions. The techniques used in the major tasks of a PRA are applicable to both full power and LPSD (e.g., developing a fault tree). Therefore, the technical criteria developed by ASME for full power will be adopted by ANS to develop a LPSD standard. Consequently, the ANS standard will provide the criteria for modifying a full-power model for application at LPSD. For example,

- Initiating Events – There are many events in the full-power model which cannot occur at LPSD and therefore should be deleted. Similarly, there are events unique to LPSD conditions that are not included in the full-power model. Criteria for identifying these LPSD events are needed. A major input will be the work currently being pursued by the staff (discussed later in this report).
- Success criteria – at LPSD conditions, the success criteria (e.g., amount of coolant inventory needed to prevent core damage) is different than at full-power. Therefore, the event trees and fault trees, for example, will need to be modified to account for the different accident progression and different logic.
- Level 2 – The ASME Level 2 PRA standard at full-power is only for the estimation of LERF and relies heavily on the approach described in NUREG/CR-6595, "An approach for Estimating the Frequencies of Various Containment Failure Modes". This guideline does not fully cover LPSD conditions. For ANS to adopt this approach, work is needed to expand this method to address LPSD.

For the areas where information is needed for LPSD, the ANS project team writing the standard is obtaining this information from technical studies, where available. For example, the ANS project team is relying on staff work regarding risk significant LPSD events, and EPRI work on risk significant LPSD configurations. However, with regard to Level 2 PRA analyses, the ANS project team believes there is insufficient information to write the Level 2 part of the LPSD standard and additional work is needed (as discussed above). At present, there are no efforts underway in this area. The ANS project team is looking for support in this area. Without support, ANS will either reduce the scope of the standard to just Level 1 (with a LPSD Level 2 PRA standard potentially at some future date) or delay the schedule until ANS (through its project team members) can perform the necessary work. This delay would be substantial since this work (via the members) would be voluntary.

Although the Commission in its SRM of March 31, 2000, had not approved the staff's plan to perform Level 2 LPSD work, the staff recommends some limited Level 2 work to support the ANS LPSD PRA standard effort. Specifically, the staff proposes to revise NUREG/CR-6595 to fully account for LPSD conditions. The staff support to ANS in this area will help ensure that ANS meets its proposed schedule.

Staff Activities:

The staff is actively supporting the ANS LPSD standard development; the staff activities include:

- Provided funding to ANS through a grant to support their LPSD PRA standard development. This grant assists in the administrative costs and in recruiting LPSD PRA technical experts.
- Being active members in: (a) the ANS Risk Committee responsible for setting policy and providing technical oversight and (b) the Project Team which has the responsibility to write the standard.
- Performing technical studies in the areas of important POSs and important initiating events. This work is being performed through NRC's participation in the LPSD Working Group of the International Cooperative PRA (COOPRA) Research Program, which is discussed below.

COOPRA LPSD Working Group Activities:

The International COOPRA Research Program is a program organized and administered by RES and consists of risk analysts from 22 different countries. The purpose of COOPRA is to provide a forum for technical exchange of information on PRA methods, data, and results. COOPRA has undertaken several initiatives, including LPSD risk, each of which is supported by a working group which sets specific objectives to be pursued in the identified area.

The NRC representative chairs the LPSD COOPRA working group. The objectives established by the working group are to share information specific to LPSD, identify areas of common interest, and identify and pursue cooperative research programs on LPSD risk.

Many areas of common interest (i.e., information needed to support the activities of participant organizations) have been identified by the LPSD working group including, but not limited to:

- Initiating event frequencies (includes controlled shutdowns)
- Fire
- Screening and splits in POSs
- Thermal-hydraulic analyses
- Boron dilution
- Human reliability analysis (including instrumentation)/recovery
- Common cause failures
- Instantaneous versus average risk
- Repair of equipment/recovery
- Mission time
- Cold overpressurization

Of these, the LPSD working group identified the areas of initiating events and POSs as the highest priority to pursue and is currently working on technical reports. The reports will include insights regarding the significance of LPSD risk for POSs and initiating events, respectively. These insights will be derived from LPSD PRAs and operational experience provided from each member country. From these reports, ANS will have the benefit of international knowledge to develop the LPSD standard and not just limited to U.S. experience.

SCHEDULE:

The staff efforts (including COOPRA LPSD working group) have been scheduled to support the ANS LPSD PRA activities. The major milestones (for COOPRA, NRC, and ANS) are as follows:

Milestone	Dates	Responsible Organization
POS and IE final technical reports	9/01	NRC/COOPRA
POS screening criteria	12/01	ANS
Benchmark technical analysis	12/01	EPRI
Level 2 (revise NUREG/CR-6595)	12/02	NRC
Configuration screening criteria	3/02	ANS
Quantitative LPSD criteria	3/02	ANS
Integrated LPSD draft standard	12/02	ANS
Published LPSD final standard	6/03	ANS

RESOURCES:

RES resources needed for supporting the ANS effort to develop LPSD PRA standard, including the new proposed work, are included in the current RES budget for FY 2001 and in the proposed FY 2002 and 2003 budgets. Specifically, the resources for the new proposed work for which the staff is requesting approval are about 0.1 FTEs and \$50k total (for FYs 2001, 2002, and 2003).

COORDINATION:

The Office of the Chief Financial Officer has reviewed this paper for resource implications and has no objections.

RECOMMENDATION

The staff recommends that the Commission approve:

- support to ANS for revising NUREG/CR-6595 to address LPSD conditions

The staff support to ANS in this area will help ensure that ANS meets its proposed schedule.

In the interim, the staff will continue to support ANS in developing a LPSD standard and continue to work with the COOPRA LPSD working group in producing technical reports on POSs and initiating events to support the ANS effort.

/RA/

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