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OFFICE OF SECRETARY
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**Union of Concerned Scientists' Comments on the Advance Notice of Proposed Rulemaking
for the Amended Station Blackout Rule (SBO ANPR)**

The Union of Concerned Scientists (UCS) is pleased to have the opportunity to provide our comments on the framework for this critically important rulemaking effort.

The station blackout (SBO) Advance Notice of Proposed Rulemaking (ANPR) requests comment on many questions, some of which contain significant overlap. Rather than answer every question individually, UCS would like to present two alternative frameworks for development of the proposed rule. It is our expectation that these either of these frameworks could provide a unified, efficient and systematic approach to resolving the many individual technical issues that need to be addressed in this complex rulemaking. One possibility is that licensees could have the option to choose one or the other.

1. Framework

- (a) Framework 1: Treat a prolonged SBO as a design-basis accident.

The simplest and most straightforward approach to addressing the risk of a prolonged SBO is to define it as a design-basis accident. This would provide ready resolution of many of the issues on which the ANPR seeks comment, such as the requirements for design, inspection, testing, quality assurance and corrective action that should be applied to structures, systems and components (SSCs) credited for SBO mitigation (Question D.1); regulatory treatment of the procedures for SBO mitigation and relationship to emergency operating procedures (EOPs) (Question C.4); and change control requirements for SBO mitigation SSCs, procedures and programs (Question D.5).

- (b) Framework 2: Treat a prolonged SBO as an "extended" design-basis accident.

A prolonged SBO could also be treated as an "extended design basis" accident along the lines of the concept introduced by the Fukushima Near Term Task Force. The key to implementing this option is a requirement that multiple "success paths" for mitigating the extended SBO be specified in detailed procedures and demonstrated with a high level of assurance through analysis, tabletops and performance exercises.

2. Baseline assumptions for the prolonged SBO

In order to address the lessons learned from the Fukushima Daiichi accident as fully as possible, UCS believes that the following assumptions should apply to the prolonged SBO event that licensees will be required to mitigate. These assumptions should apply within either framework.

- (a) The analysis should assume the initial loss of all ac electrical power, dc electrical power, and electrical distribution systems.

At Fukushima Daiichi, the severity of the event was not due only to the loss of off-site and on-site ac power sources, but also to dc power sources (batteries) and extensive damage to electrical distribution systems. According to the December 2011 TEPCO Interim Report,

“At Units 1 to 5, due to the tsunami, all high-voltage power panels for both ordinary and emergency systems were damaged by water due to the tsunami. Therefore, electric power could not have been supplied to the necessary equipment even if off-site power and EDG had been functioning.

“Most of the power centers were also damaged by water, leaving few places where high-voltage power supply cars could be connected.”

In addition, dc power panels at Units 1, 2 and 4 were also damaged by water.

The loss of dc power rendered inoperable the installed systems needed to monitor plant status from the main control rooms, control alternate water injection systems such as the Unit 2 Reactor Core Isolation Cooling System (RCIC), and operate safety relief valves needed to depressurize the reactor vessels to permit the use of portable, low-pressure injection systems. The damage to high-voltage distribution panels greatly complicated the ability to use portable power supplies. Although it is not clear if the outcome would have been different had dc power and high-voltage electrical distribution systems been available, these factors certainly increased the difficulty of mitigating the accident.

Consequently, power reactor licensees should be required to demonstrate that they can cope for a specified period of time not only with the loss of all ac sources but also the loss of dc power sources and electrical distribution systems, unless it can be shown that no credible hazard – including all potential associated consequences (such as seismically induced fires or floods) – can disable both ac and dc sources. Otherwise, one of the main safety vulnerabilities revealed by Fukushima will not be addressed.

- (b) Common-cause SBOs at multiple units at a site.

Another obvious lesson from Fukushima Daiichi is that strategies for mitigating SBOs at multiple unit sites need to address accidents affecting more than one unit. The simplest approach would be to assume as a baseline that the SBO affects the entire site and is a common-cause challenge to all units at that site. Coping strategies based on the assumption that only a single

unit would be affected would lack important considerations such as the unavailability of power supplies or equipment from neighboring units, the proper sizing of stores of emergency equipment and supplies to accommodate multiple unit events, and the interactions between units that could impede strategy implementation. Exceptions might be permissible if it can be shown that a site's configuration is such that all units will not be affected by the same initiator. If real differences could be shown to make a legitimate difference in unit response to the common threat (e.g., tsunami, earthquake, rainfall, hurricane, tornado, grid failure, etc.), then justification may exist for not treating the SBO as a site-wide event. But narrowing the SBO threat down to a single unit at a multiple unit site by unverified, unsupported assumption must not be an option.

(c) Mitigation strategies should be employable both before and after core damage occurs.

Although the primary goal of an prolonged SBO mitigation rule should be prevention of core and spent fuel damage, defense-in-depth considerations require that licensees maintain the capability to mitigate the consequences in the event that an extended SBO results in core or spent fuel damage at one or more units at a site. At Fukushima Daiichi, manually implemented emergency measures were required for prolonged periods of time after core damage began to limit the extent of the radiological release from the site. As a result, SBO mitigation procedures must be designed to be usable even under the harsh environmental conditions that could be present after damage to fuel, reactor vessels, containment buildings and spent fuel pools.

3. Coping requirements for an extended SBO

To address question C.3, UCS supports the conceptual approach originally outlined in the Near Term Task Force (NTTF) report regarding the establishment of nominal requirements for a three-phase SBO coping period. However, we do not believe the timelines proposed by the NTTF are sufficiently conservative. UCS proposes that licensees be able to cope with the extended SBO for a period of 24 hours using permanently installed equipment and highly reliable operator actions, followed by a period of 7 days using emergency mitigation procedures.

We understand that this is a very stringent requirement, especially coupled with the assumption that there is no dc power. For instance, it could require hardening of equipment and procedures needed for RCIC blackstart and blackrun to beyond design-basis standards. But in the face of what actually happened at Fukushima Daiichi, the risk of not having such capabilities available is unacceptable.

We chose these time periods for the following reasons. At Fukushima Daiichi Unit 1, for various reasons, operators were unable to establish alternate water injection using a fire truck until more than 14 hours after the SBO was initiated. Core damage was well underway at that point. We believe that 24 hours is a reasonable upper bound for assuming the lack of availability of emergency means of water injection.

The 7-day period for requiring on-site emergency mitigation is based on the current requirement that operators maintain a 7-day supply of fuel for emergency diesel generators in the event of a loss of offsite power. It would not make sense for the NRC to require a shorter period of licensee self-reliance now than what was in place before the Fukushima accident.

4. Success paths for a mitigating a prolonged SBO

Key to a performance-based rule for prolonged SBO mitigation is a requirement for a consistent procedure for demonstrating “success paths.” The NRC should avoid repeating the mistakes of the process for implementing the B.5.b orders, in which the NRC ultimately allowed licensees to propose various “strategies” without also requiring a comprehensive evaluation of whether the strategies would be workable under the actual conditions that would be experienced in the aftermath of an aircraft attack. As a result, NRC inspections subsequently found problems with the implementation of the B.5.b strategies, and their overall effectiveness remains unclear.

In contrast, a meaningful demonstration of a success path would begin with the development of a set of scenarios leading to a prolonged SBO, based on site-specific factors. For each scenario, one would formulate the initial conditions – for instance, a concurrent natural disaster and SBO – and then evaluate all the resulting implications for equipment availability, personnel availability, accessibility and habitability of critical areas, and other relevant factors. This analysis should include an assessment of the full SBO mitigation timeline, including off-site response. All activities needed for completion of the success path would then be evaluated, using realistic assumptions. This is essentially the concept of a “stress test.” In response to the “stress” – prolonged SBO conditions – the plant response would be assessed to see if the success path is adequate.

One possible approach would be to require two independent success paths for each scenario. For instance, assurance of survivability of emergency equipment following a natural disaster-caused SBO may be attempted in two distinct ways. One is the U.S. nuclear industry’s FLEX approach, which would try to ensure a success path through diversity of equipment storage locations, but would not require that individual pieces of equipment be designed or stored in a manner that could survive all potential external hazards. Another approach is the French “hard core,” in which each plant would be required to have one set of emergency equipment that would be required to survive a full range of external hazards, including those of a severity beyond the design basis of the plant itself.

These two approaches represent different ways of achieving additional safety margin for events beyond the current design basis. We conclude, based on defense-in-depth considerations, that both should be required for compliance with an “extended design basis” SBO rule. Thus at least one set of emergency equipment to be deployed should be hardened well beyond the plant’s design basis to help ensure its usability as a last resort.

5. Applicability to new reactor licensees

In reply to the questions in section E of the ANPR, we agree that the rule should apply in a consistent fashion to both currently operating and new reactors. We note that the mitigating strategies order issued on March 12, 2012 gave AP1000 combined operating license holders favorable treatment by exempting them from the requirements for near-term mitigation of beyond-design-basis external events. The SBO rule should not repeat that mistake, which has no technical justification. The 72-hour SBO coping capability of the AP1000 is qualified to function only under design-basis conditions, not under beyond-design-basis conditions.

We appreciate your consideration of our comments as the draft SBO rule is developed.

Sincerely,

**Edwin Lyman
Senior Scientist
Global Security Program**

**Dave Lochbaum
Director
Nuclear Safety Project**

Rulemaking Comments

From: Edwin Lyman [ELyman@ucsusa.org]
Sent: Friday, May 04, 2012 7:15 PM
To: Rulemaking Comments
Cc: Dave Lochbaum
Subject: UCS Comments on the SBO ANPR, NRC-2011-0299
Attachments: ucs comments sbo anpr 5 4 12.pdf

Please find attached comments of the Union of Concerned Scientists on the Advance Notice of Proposed Rulemaking for Station Blackout, NRC-2011-0299.

Sincerely,

Edwin Lyman
Union of Concerned Scientists