Union of Concerned Scientists

Citizens and Scientists for Environmental Solutions

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Mr. Christopher I. Grimes, Chief
License Renewal and Standardization Branch
Division of Regulatory Improvement Programs
Office of Nuclear Reactor Regulation
United States Nuclear Regulatory Commission
Washington, DC 20555-0001

SUBJECT: STATION BLACKOUT ISSUE

Dear Mr. Grimes:

On behalf of the Union of Concerned Scientists, I reviewed the February 5, 2002, memo written by Mr. Peter J. Kang of your staff regarding the January 15, 2002, meeting between the NRC and the industry regarding the inclusion of offsite power components within the license renewal scope in order to demonstrate compliance with the station blackout rule (10 CFRF 50.63). I also attended the follow-up meeting between the NRC and the industry held on January 14, 2002. Following that meeting, I went to the NRC Public Document Room to review the Updated Final Safety Analysis Reports (UFSARs) for a few plants to review offsite power design basis requirements. But I was denied access to these fundamental design and licensing documents and therefore could not perform that confirmatory research. Nevertheless, I agree with the NRC staff position as articulated in the February 5th memo and reiterated frequently during the February 14th meeting that "the offsite power system components should be in the scope of LR [license renewal]." The primary justification for inclusion of offsite power components within the license renewal scope is, as many NRC staffers described during the February 14th meeting, that the probability of restoring offsite power along with the probability of restoring onsite emergency AC power determines the station blackout coping duration.

During the February 14th meeting, industry representatives offered several arguments supporting their contention that offsite power components should not be included within the license renewal scope. I considered these arguments, but rejected each and every one for the following reasons:

- NEI Slide 4: "These questions [of whether offsite power components were relied upon to demonstrate compliance with 10 CFR 50.63] can not be answered generically and must be addressed on a plant-specific basis."

  UCS Position: It is indeed possible to generically ascertain whether offsite power components are relied upon for 10 CFR 50.63 compliance. As the NRC reminded the industry less than one year ago, "GDC 17 and Plant Technical Specifications require the offsite power source to be capable of powering safety equipment after an event." [1] General Design Criterion 17 of Appendix A to 10

[1] Ronaldo V. Jenkins, Nuclear Regulatory Commission, Presentation titled "NRC Perspectives," at NEI/INPO Workshop on Grid Reliability, April 3, 2001.

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CFR 50 and plant operating licenses require at least one offsite power source connection at all times, even with the reactor in cold shutdown. The Standard Technical Specifications incorporate this legal requirement. For example, Section 3.8.1 of the Standard Technical Specification for Westinghouse plants requires at least two qualified circuits between the offsite electrical grid and the onsite 1E electrical distribution system to be OPERABLE[2] in Modes 1, 2, 3, and 4. Section 3.8.2 of the Westinghouse Standard Technical Specifications requires at least one qualified circuit between the offsite electrical grid and the onsite 1E electrical distribution system to be OPERABLE in Modes 5 and 6. Entry into a station blackout event does not suspend applicability of the operating license and GDC 17 requirements.

Moreover, offsite power source configuration and reliability were an implicit factor used by plant owners and the NRC staff in determining the station blackout coping duration. Consider the Palisades nuclear plant for example:

> "The licensee has calculated a minimum acceptable station blackout (SBO) duration of four hours based on a plant AC power design characteristic group P1, an emergency AC (EAC) power configuration Group C, and a target Emergency Diesel Generator (EDG) reliability of 0.95. ... The P1 grouping is based on an independence of off-site power classification of Group I 1/2, a severe weather (SW) classification of Group 2, and an extremely severe weather (ESW) classification of Group 1." [3]

Thus, offsite power sources were explicitly considered in deriving an important element of each plant's station blackout compliance scheme; namely, the coping duration. The offsite power source configuration and its vulnerability to severe weather was a vital factor because experience had shown that offsite power outages were generally short, except when caused by severe weather. Thus, station blackout coping duration was directly established on the recognition that offsite power source would, in all likelihood, be available to terminate the loss of AC power.

In addition, there is reliance on offsite power systems in terms of reducing the probability of entering into a station blackout event. The industry focused exclusively on the role of offsite power systems in terminating a station blackout event. Obviously, the reliability of these systems is a factor in the initiating event frequency for SBO events. That is a generic observation applicable to all US nuclear power plants.

According to an NRC compilation of industry station blackout information,[4] station blackout events represent about 20 percent of the overall core damage frequency at the average nuclear power plant. In addition, the NRC staff reported:

> "Licensees reporting low SBO CDFs attributed the low values to their plants having highly redundant and independent emergency diesel generator configurations, **having a low LOOP initiating event frequency**, having a battery depletion time of eight hours ot more, having operator action to manually control auxiliary feedwater flow following

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[2] Section 1.1 of the Westinghouse Standard Technical Specifications defines OPERABLE such that it includes all required support systems, structures, and components.

[3] Brian Holian, Project Manager, Nuclear Regulatory Commission, to Gerald B. Slade, Plant General Manager, Consumers Power Company, "Palisades Plant Station Blackout Analysis: Safety Evaluation (TAC No. 68578)," May 20, 1991.

[4] Nuclear Regulatory Commission, "Individual Plant Examination Program: Perspectives on Reactor Safety and Plant Performance," NUREG-1560 Vol. 1, Part 1, October 1996.

battery depletion, and having a low likelihood of reactor coolant pump (RCP) seal LOCAs [emphasis added]." ibid, page 7-8

"For BWRs, a simple regression of the SBO CDFs indicates that the variation in SBO CDFs is caused by several factors. These factors include the **LOOP initiating event frequency**, battery lifetime, diesel generator configuration, emergency AC power configuration, site weather characteristics, and the **independence of offsite power systems** [emphasis added]." ibid, page 7-8

It is abundantly clear that reliable offsite power source are not only an explicit condition of nuclear plant operating licenses, they play an important rule in reducing risk to the public.

- NEI Slide 5: "The use of these factors [generic industry data on the frequency of loss of offsite power and the probable time needed to recover offsite power] does not constitute a reliance on any plant-specific elements or components of the offsite power system."

  UCS Position: Each plant owner's response to the SBO rule, and the NRC's subsequent safety evaluation for and acceptance of the plant owner's SBO compliance measures, constituted reliance on the offsite power system elements and components for that plant. The use of generic industry data should not muddy the water in this application as it does not in the many license amendment requests submitted by plant owners seeking to extend inspection/testing intervals based on generic industry data such as mean-time-between-failures.

- NEI Slide 6: "The SBO rule does not exclusively direct or rely on restoration of offsite power as the means to recover from a station blackout."

  UCS Position: For this NEI assertion to be valid, the SBO rule must solely rely on restoration/recovery of onsite emergency AC power to terminate a station blackout event. But as NRC staffer Mr. James Lazevnick observed during the February 14th meeting, the industry has not provided data demonstrating that onsite emergency AC power sources can be repaired with high confidence within the specific coping duration. Thus, it is obvious that the coping duration was implicitly founded on the probability of restoring either offsite power or onsite emergency AC power. The SBO rule does not exclusively rely on restoration of offsite power. The SBO rule does not exclusively rely on restoration of onsite emergency AC power. The SBO rule does rely on restoration of at least one of these two sources within the coping duration. Thus, the SBO rule does indeed rely in part on restoration of offsite power.

  But for 10 CFR 50.63, the role and function of offsite power systems would be like that of the normal feedwater systems. Plant procedures allow, even encourage, operators to use the offsite power systems and normal feedwater systems during transients and accidents, but no credit is taken for their performance in safety analyses. 10 CFR 50.63 imposed a new licensing condition for each plant by requiring it to cope with the loss of the offsite power systems and the onsite emergency power systems. The coping duration is established such that the probability of restoring neither offsite power nor onsite emergency AC power within that time period is so small as to be incredible. Removal of any credit, or reliance, on offsite power restoration in SBO space would necessarily entail a longer coping duration, as NRC staffer Mr. Jose Calvo repeatedly pointed out during the February 14th meeting.

- NEI Slide 6: "Incorporation of steps necessary to restore offsite power in plant procedures does not constitute a plant-specific reliance on restoration of offsite power."

UCS Position: For this NEI statement to be relevant, it must be possible to remove the subject steps from the plant procedures. But while it may be possible to write a 50.59 safety evaluation for their removal, it would not be possible to sign or approve that safety evaluation because NRC pre-approval must be obtained for the associated reduction in safety margins. Restoration of offsite power is one of two methods of terminating a station blackout event. Unless a plant owner relied exclusively on restoration of onsite emergency AC power and provided the NRC staff with data demonstrating high confidence that the needed repairs would be completed within the SBO coping duration, restoration of offsite power is clearly within the current licensing basis for compliance with 10 CFR 50.63.

- NEI Slide 8: "The CLBs for most, if not all, plants do not rely on offsite power systems to demonstrate compliance with the SBO rule."

  UCS Position: NEI is just plain wrong. Consider that investigators from the Oak Ridge National Laboratory concluded after visiting several nuclear power plants sites examining electrical grid reliability:

  > "A key factor in providing the required offsite power quality is a determination of the offsite power design basis requirements for the nuclear plant. Some of the utilities which were visited do not appear to be addressing this important analysis in a thorough manner." [5]

  Thus, Oak Ridge scientists—hardly having a reputation for liberal views—think that some plant owners have not done a good job determining offsite power design basis requirements. The Oak Ridge finding parallels that of the NRC Independent Safety Assessment Team (ISAT) dispatched to Maine Yankee during the summer of 1996. The ISAT concluded this facility was not in compliance with GDC 17 and its design/licensing bases requirements for offsite power sources.

None of the arguments put forth by the industry during the February 14th meeting justifies excluding offsite power systems from the scope of license renewal. And the paucity of risk information on loss of offsite power event frequency does not allow a suitable surrogate. A flurry of recent events at least suggests that the reliability of offsite power systems may be decreasing. For example, EPRI reported "Seeing more LOOP [loss of offsite power] and partial LOOP events related to refueling outages." [6] In addition, an abridged listing of offsite power system related events includes the following:

- On May 22, 2001, the Salem Unit 1 nuclear plant automatically shut down from 100 percent power after a fault on the main generator. "Extensive troubleshooting determined that there was a degraded termination associated with the field wiring to the 'A' phase main generator neutral current transformer." [7]

- On March 28, 2001, the Hatch Unit 1 nuclear plant automatically shut down from 100 percent power when an internal fault in unit auxiliary transformer 1B resulted in a direct turbine trip signal. This was the third failure of this nature for unit auxiliary transformer 1B. "The high side windings of this phase [phase 3] also failed a routine doble test in March 1999 after almost fifteen

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[5] B. J. Kirby, J. D. Kureck, and A. B. Poole, Oak Ridge National Laboratory, "Evaluation of the Reliability of the Offsite Power Supply as a Contributor to Risk of Nuclear Plants," ORNL/NRC/LTR-98/12, August 1998.
[6] Frank Rahn, EPRI, Presentation titled, "Losses of Off-Site Power at Nuclear Units," at NEI/INPO Workshop on Grid Reliability, April 2-4, 2001.
[7] D. F. Garchow, Vice President - Operations, PSEG Nuclear LLC, to Nuclear Regulatory Commission, "LER 272/2001-006-00 Salem Generating Station Unit 1," June 20, 2001.

years of service; this problem was discovered before the windings had deteriorated to the point of causing an internal transformer fault." [8]

- On February 3, 2001, the San Onofre Unit 3 nuclear plant automatically shut down from 39 percent power when electrical "breaker 3A0712 faulted, and started a fire within the breaker cubicle. Ionized gases and smoke diffused through cable passages between adjacent cubicles and entered the Reserve Aux Transformer (RAT) feeder breaker 3A0714 cubicle and caused a ground fault with the 3A0714 cubicle, which resulted in the RAT trip and loss of non-safety-related offsite AC power to Unit 3." [9]

- On May 15, 2000, Diablo Canyon Unit 1 automatically shut down from 100 percent power following an electrical fault on the 12 kV bus bars from the Unit Auxiliary Transformer. "The licensee had included the 12 kV system under the Maintenance Rule. Selected parts of the 12 kV system had specific performance criteria; however, the 12 kV bus bars that failed were monitored using plant level criteria because the licensee had concluded that the only risk from bus failure was a reactor trip. In addition, the 12 kV busing was not considered risk significant by the expert panel. The inspectors founds that the licensee did not have any preventative maintenance requirements for the bus bars." [10]

- On 07:34am on February 13, 2000, the Callaway nuclear plant automatically shut down from 100 percent power when a reactor coolant pump tripped during an electrical grid disturbance caused by "a transmission line breaker failing to operate due to a defective electrical connection within the neighboring electric cooperative's protective relaying scheme. This resulted in an eight-minute system disturbance." [11] [12]

- "Low switchyard voltage [at the Callaway nuclear plant] on August 11 and 12, 1999 ... Reduced grid voltages increase the potential for INOPERABLE offsite power sources" [13]

The majority of these events caused the associated nuclear reactor to shut down. Unplanned power reductions and reactor scrams are among the performance indicators (PIs) supplied to the NRC by plant owners under the Reactor Oversight Program. But the submission of this PI data is currently voluntary and therefore cannot be relied upon to flag increasing unreliability of offsite power systems. Likewise, many plant owners maintain "living" plant safety assessments and update them periodically to incorporate actual plant-specific initiating event frequencies. But few if any of these plant safety assessments have

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[8] Lewis Sumner, Vice President - Hatch Project Support, Southern Nuclear Operating Company, to Nuclear Regulatory Commission, "Licensee Event Report Component Failure Causes Turbine Trip and Reactor Scram," May 21, 2001.

[9] R. W. Krieger, Vice President - Nuclear Generation, Southern California Edison, to Nuclear Regulatory Commission, "Licensee Event Report No. 2001-001 San Onofre Nuclear Generating Station, Unit 3," April 2, 2001.

[10] Ken E. Brockman, Director - Division of Reactor Projects, Nuclear Regulatory Commission, to Gregory M. Rueger, Senior Vice President and General Manager, Pacific Gas and Electric Company, "Diablo Canyon Inspection Report No. 50-275/00-09; 50-323/00-09," July 31, 2000.

[11] R. D. Affolter, Manager - Callaway Plant, to Nuclear Regulatory Commission, "Licensee Event Report 2000-002-00 Automatic Reactor Trip Initiated by Reactor Coolant Pump Trip Caused by Motor Current Imbalance Due to Transmission System Disturbance," March 13, 2000.

[12] R. D. Affolter, Manager - Callaway Plant, to Nuclear Regulatory Commission, "Licensee Event Report 2000-002-01 Automatic Reactor Trip Initiated by Reactor Coolant Pump Trip Caused by Motor Current Imbalance Due to Transmission System Disturbance," May 1, 2000.

[13] Arthur T. Howell III, Director - Division of Reactor Safety, Nuclear Regulatory Commission, to Garry L. Randolph, Vice President and Chief Nuclear Officer, Union Electric Company, "Meeting to Discuss the August 11-12, 1999, Degraded Switchyard Voltage Event," March 14, 2000.

been docketed. Thus, they cannot be relied upon to flag increasing unreliability of offsite power systems. Absent reliable "flags," NRC review of aging management programs for offsite power systems appears to be the only way to assure the public that safety margins are not be reduced by license renewal.

Conclusion

The station blackout issue as it relates to license renewal is a classic "good news/bad news" situation. On one hand, it was encouraging to see that the NRC staff does indeed wield a two-edged sword that can both add and remove things. Having heard so often about the other edge, it was refreshing to actually have seen it. UCS agrees wholeheartedly with the NRC staff that offsite power systems must be included within the license renewal scope.

On the other hand, the license renewal appeal process affords the industry at least two more appeals—to the EDO and to the Commission. Based on past practice, it is almost certain that either the EDO or the Commission will buckle to industry pressure and rule that the offsite power systems are excluded from the license renewal scope. UCS knows from personal experience how frustrating it is to be on solid technical and legal ground and still be over-ruled. UCS commiserates with the NRC staff in advance of its ultimate defeat. The NRC staff's frustration will likely exceed ours because we weren't sold out by our own management.

Sincerely,

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Nuclear Safety Engineer

cc: Mary Olson, NIRS-SE