Issue 47: The Loss of Offsite Power

DESCRIPTION

Historical Background

On April 7, 1980, Arkansas Nuclear One (ANO) Units 1 and 2 experienced a significant event resulting from a loss of offsite power. Although both units were safely shut down, the analysis and evaluation of the event identified some design and procedural deficiencies. As a result of their investigation of this (event, AEOD published a report[1] which included a set of recommendations based on their findings.

Safety Significance

The offsite power system of a nuclear power plant provides the preferred source of electrical power to all the station auxiliaries. Loss of the offsite source results in a plant upset condition (usually a reactor trip) and the start of the backup power sources. Correct plant response would not result in risk to the public; however, there is a large amount of equipment which must function to mitigate such an event. Overall plant response to such an event may indicate plant specific and/or generic problems that could lead to core melt.

Possible Solution

AEOD investigated the ANO plant response and noted some problems. Based on their review and findings, they made the following recommendations:

(1) The design arrangement and operation of the bus tie autotransformer should be considered and reviewed by the licensee and NRC to determine possible failure modes and minimize the probability of losing offsite power. A single failure (loss of bus tie autotransformer) in the offsite power supply system should not result in a two unit upset and a need for the onsite emergency power system. In this regard, the implementation of GDC-17 should be reevaluated. In the past, GDC-17 has not been implemented to require the offsite power source to meet the single failure criterion.

(2) An IE Information Notice has been issued concerning the loss of the emergency feedwater system due to simultaneous alignment to the Startup and Blowdown Demineralizer System and the condensate storage tank. Although not included in this notice, each licensee should be requested to describe the modes of operation of the emergency feedwater system and other safety-related systems for non-emergency conditions, including operation at low reactor power and refueling. The acceptability of simultaneous alignment below some specified power level for these systems (e.g., 5% full power) should be evaluated by NRR.

(3) The safety implications of overfeeding and overcooling the pressurizer with the HPI for B&W plants should be evaluated. Sustained operation of the HPI results in limited pressure control and possible loss of the pressurizer steam bubble. There is also an increased probability of a stuck open relief valve. In addition, the system is subjected to an additional thermal stress cycle. The licensees should be advised against sustained operation of the HPI system after the steam pressure has been recovered and adequate subcooling exists.

(4) Licensees should be advised of the failure of the high pressure injection system isolation valve due to a stuck handwheel engage lever, particularly if this problem has been experienced elsewhere. It should be emphasized that all safety-related valves should be tested from the control room after the valves have been manually operated (e.g., during maintenance).

(5) Action should be initiated to develop recordkeeping requirements or perhaps a Regulatory Guide

[1] AEOD/C003, "Report on Loss of Offsite Power Event at Arkansas Nuclear One, Units 1 and 2, on April 7, 1980," Office for Analysis and Evaluation of Operational Data, U.S. Nuclear Regulatory Commission, October 15, 1980. [8011170099]

to address the need for adequate and accurate operator log entries during normal and transient operation, especially when the process computer is unavailable. This information is required for post-event analysis.

(6) Licensees should be advised of the need to ensure that plant response data and information developed immediately prior to and during a transient is appropriately retained. The licensee should ensure that any selector or mode switch, if provided for the process or trend computers, is always in the position which ensures that the computer is available during a loss-of-offsite power event.

(7) There have been repeated problems with the ANO Unit 2 turbine-driven emergency feedwater train which have rendered it inoperable.[2] These resulted in only one full-capacity, motor-driven emergency feedwater train available to provide the safety function of providing emergency feedwater to both steam generators. It is important to ensure the reliability of the motor-driven emergency feedwater train until the problems with the turbine-driven train are resolved. Resolution of the problems with the turbine-driven train should be expedited and, until full resolution has been achieved, interim licensee actions should be implemented to ensure high reliability of the motor-driven emergency feedwater train.

(8) Prompt and careful consideration should be given by NRR to the development of suitable criteria to be used by reactor operators to determine and thereby claim that natural circulation has been achieved. This is a potentially serious area for misinterpretation or misunderstanding during an event wherein it may be important to quickly communicate the plant status to the NRC in unambiguous terms. Operator academic instructions and training progrms should specifically address these criteria and assure that the operators have a complete understanding regarding how natural circulation can be determined.

NRC addressed[3] all of the AEOD recommendations specifically as follows:

(1) PBS concluded that no further action is required on this recommendation since related requirements are presently being implemented on all operating plants through MPAs B-48 and B-23 and case work reviews through SRP Section 8.2, Revision 2 review procedures and BTP PSB-1. Furthermore, the overall issue of loss of electric power (both offsite and onsite) is being addressed by USI A-44.

(2) OIE issued Information Notice 80-23 and NRR is pursuing this under resolution of TMI Action Plan Item II.E.1.1, "Auxiliary Feedwater System Evaluation," which is being implemented as part of NUREG-0737.[4]

(3) NRR addressed this as three separate recommendations:

(a) Safety Implications of Overfeeding the Pressurizer with High Pressure Injection

NRR concluded (although from an operational standpoint this is not desired) that there are no direct safety implications of overfeeding and overcooling the pressurizer with HPI.

(B) Advise Licensee Against Sustained HPI Operation After System Pressure Recovery and Existence of Adequate Subcooling.

NRR concluded that sufficient guidance has been provided to all licensees by Inspection and Enforcement Bulletin No. 79-06A and by vendor-supplied operator guidelines.

(c) Need for HPI to Recover System Pressure and Pressurizer Level in a B&W NSSS After Reactor Trip

The actions presently in place to address this recommendation are documented in TMI Action Plan Item II.E.5 "Design Sensitivity of B&W Reactors."

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[2] AEOD/C003, "Report on Loss of Offsite Power Event at Arkansas Nuclear One, Units 1 and 2, on April 7, 1980," Office for Analysis and Evaluation of Operational Data, U.S. Nuclear Regulatory Commission, October 15, 1980. [8011170099]

[3] Memorandum for C. Michelson from H. Denton, "NRR Responses to AEOD Recommendations on the Arkansas Loss of Offsite Power Event of April 7, 1980," February 13, 1981. [8102270127]

[4] NUREG-0737, "Clarification of TMI Action Plan Requirements," U.S. Nuclear Regulatory Commission, November 1980, (Supplement 1) January 1983.

(4) Regarding the stuck handwheel engage-lever problem, NRR concluded that this is not a generic problem and further action is not warranted at this time. Regarding the testing of valves, NRR concluded that this recommendation is already incorporated as TMI Action Plan Item I.C.6, "Procedures for Verification of Correct

Performance of Operating Activities" which is mandated by NUREG-0737.[5]

(5) NRR concluded that the Technical Support Center (and its data acquisition system) requirements[6] will also provide the desired result; i.e., information for post-event analysis. Furthermore, NRR stated that the proposed revision to Regulatory Guide 1.33, "Quality Assurance Program Requirements," will address the aspect of upgraded log-keeping. As a result, they concluded that this concern was sufficiently addressed.

(6) Similar to the above recommendation 5, NRR concluded that the Technical Support Center data acquisition system[7] addresses this concern.

(7) This recommendation is not generic and applies only to ANO. NRR concluded that the experience to date demonstrates sufficient availability of the ANO turbine-driven EFW pump and that additional interim licensee actions by ANO to ensure high reliability of the motor-driven EFW pump were unwarranted.

(8) NRR concluded that this recommendation is adequately addressed by other actions (TMI Action Plan Item I.C.1, "Short-Term, Accident Analysis and Procedures Revision," and plant operating procedures which address inadequate core cooling) and that additional requirements beyond the indicated actions are unnecessary.

CONCLUSION

Based on the NRR report,[8] we conclude that the AEOD recommendations are included in other issues or are RESOLVED.

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[5] NUREG-0737, "Clarification of TMI Action Plan Requirements," U.S. Nuclear Regulatory Commission, November 1980, (Supplement 1) January 1983.

[6] Letter to All Licensees of Operating Reactors, Applicants for Operating Licenses, and Holders of Construction Permits from U.S. Nuclear Regulatory Commission, "Supplement 1 to NUREG-0737, Requirements for Emergency Response Capability (Generic Letter No. 82-33)," December 17, 1982. [ML031080548]

[7] Letter to All Licensees of Operating Reactors, Applicants for Operating Licenses, and Holders of Construction Permits from U.S. Nuclear Regulatory Commission, "Supplement 1 to NUREG-0737, Requirements for Emergency Response Capability (Generic Letter No. 82-33)," December 17, 1982. [ML031080548]

[8] Memorandum for C. Michelson from H. Denton, "NRR Responses to AEOD Recommendations on the Arkansas Loss of Offsite Power Event of April 7, 1980," February 13, 1981. [8102270127]