March 17, 2005

MEMORANDUM TO: Charles E. Ader, Director
Division of Risk Analysis and Applications
Office of Nuclear Regulatory Research

FROM: Farouk Eltawila, Director ***/RA/***
Division of Systems Analysis and Regulatory Effectiveness
Office of Nuclear Regulatory Research

SUBJECT: REQUEST FOR REVIEW OF "STATION BLACKOUT RISK EVALUATION FOR NUCLEAR POWER PLANTS (DRAFT)"

In your memorandum of January 14, 2005 you requested our review and comments on the subject report. We are pleased to be given the opportunity to provide the comments that follow:

1. The report summarizes the history of EDG reliability trends from 1970 to the present based on NRC reports. The current report should also use the results of the EDG reliability studies performed by the Idaho National Laboratory (INL, previously INEL and INEEL) dated 1996 and 1999.

   INEL-95/0035 Emergency Diesel Generator Power System Reliability 1987-1993, dated February 1996 presents an evaluation of EDG train performance at nuclear power plants. INEEL/Ext-99-01312, Reliability Study Update: Emergency Diesel Generator Power System Reliability 1987-1998, December 1999 updated INEL-95/0035 to include five more years of experience that has not been issued by the NRC. These reports are based on data from tests and unplanned demands that simulate and are as stressful as real demands under low voltage conditions. INL found that the monthly surveillance tests did not simulate EDG safety system performance and excluded them from the calculation of EDG reliability. In addition, the failure criteria in the current study differs from the past INL EDG reliability calculations that included manual failures to start under actual LOOP conditions with the reactor at power. These reports show EDG unreliabilities range from 0.044 to 0.031 (0.956 and 0.969 reliability, respectively) for an 8-hour mission time for the selected data groupings and this is significantly more than the current study. Specific comments are:

   Table 4-2 of the report, "Data 1998-2002" shows EDG failures and demands (or hours) from the EPIX database for different EDG failure modes. The demands (or hours) range from 23983 to 61070 for the different EDG failure modes. Section 4.2 of the report discusses the EDG performance and indicates that the EPIX data includes monthly and cyclic (refueling outage) tests. The EPIX demand data should be adjusted to exclude the monthly tests for the reasons explained in INEL-95/0035.

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In addition, Table 4-2 under “Unplanned Demand Data” shows shutdown experience that should be excluded since it does not simulate the loading for a LOOP when the reactor is at power. When the reactor is shutdown, and a LOOP is experienced, some of the largest pump motors that stress the EDG do not start and run. In addition, some of the motors are lightly loaded when shutdown such that the EDG running load is typically less than 50 percent of the design loading.

In addition, the EDG performance is monitored by the licensees to ensure that the EDG train reliability is maintained above 0.95. We suggest a sensitivity analysis to show an impact of allowing 0.95 EDG train reliability.

Also there is experience with the gas turbine generators (GTGs) following LOOPs with a reactor trip that could be entered under “Unplanned Demand Data” in Table 4-2 and analyzed. The LERs with LOOPs and a reactor trip indicate there have been seven starts with one failure due to a power dependency, and six load runs with two failures. One load run failure occurred when the GTG was stopped to remove ice from its air intake (and then it was successfully restarted), and the other was a conditional failure due to a power dependency after 8 hours (had there been an SBO with a mission time of 24 hours as postulated in the analyses it would have failed to run).

Other EPIX failure data used in the analyses should be verified to be representative of the equipment and system performance for a safety mission.

2. The report provides a historical summary of the SBO CDF based on an annual averages. Historically the LOOPs with the reactor at power occurred more or less randomly throughout the year and the SBO CDF is best represented by the annual average. However, most LOOPs since occurred in the summer period May–September and SBO CDF is best represented by the results of sensitivity studies provided in the report for the May–September and the other months. These sensitivity studies should be shown as the basis of comparison to the historical SBO CDFs.

3. DSARE provided other comments to the draft report, “Evaluation of Loss of Offsite Power Events at Nuclear Power Plants 1986–2003" (ML050250124). The collective effect of these comments, and those in this memorandum, may impact data, analyses, results, and conclusions in the subject report.

4. The executive summary and conclusions should be revised to highlight the central assumptions and the resulting equipment and operator performance that the current baseline SBO CDF relies upon in the areas of EDG reliability (e.g. the 98.8 percent EDG reliability, and 99.9 and 99.8 percent EPS reliability for a 8 hour and 24 hour mission times, respectively); LOOP frequency and duration; and SBO coping capabilities.

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