

EDO Principal Correspondence Control

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FINAL REPLY:

David Lochbaum
Union of Concerned Scientists

TO:

Borchardt, EDO

FOR SIGNATURE OF : ** GRN ** CRC NO:

Leeds, NRR

DESC:

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2.206 - Seismic Qualification Issues at DC Cook
Unit 1 (EDATS: OEDO-2008-0949)

Borchardt
Virgilio
Mallett
Ash
Ordaz
Cyr/Burns
Caldwell, RIII
Trocine, OEDO

DATE: 12/24/08

ASSIGNED TO: CONTACT:

NRR

Leeds

SPECIAL INSTRUCTIONS OR REMARKS:

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Originator Name: David Lochbaum

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Addressee: R. William Borchardt, EDO

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Union of Concerned Scientists

Citizens and Scientists for Environmental Solutions

December 16, 2008

R. William Borchardt
Executive Director for Operations
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

**SUBJECT: PETITION PURSUANT TO §2.206 – SEISMIC QUALIFICATION
ISSUES AT DC COOK UNIT 1 – DOCKET 50-315**

Dear Mr. Borchardt:

On behalf of the Union of Concerned Scientists (UCS), I submit this petition under 10 CFR 2.206 requesting that the Nuclear Regulatory Commission (NRC) take enforcement action against the licensee for the Donald C. Cook Unit 1 nuclear power reactor. Specifically, UCS petitions the NRC to issue a Demand for Information (DFI) requiring this licensee to docket the following information at least 30 days prior to restarting the reactor from the current outage:

1. The vibration levels* experienced in the control room, turbine building, and other structures during the September 20, 2008, event.
2. The vibration levels assumed in these locations during the safe shutdown earthquake (SSE).
3. In locations where the vibration levels during the September 2008 event exceeded the vibration levels assumed for SSE, the extent of piping, pipe supports, etc. replaced/repared due to potential stress damage and the bases for not replacing other structures, systems, and components exposed to greater than SSE loading.
4. In locations where the vibration levels during the September 2008 event did not exceed the vibration levels assumed for SSE, the extent of measure taken to protect against spurious equipment operation and the bases for concluding the as-left configuration will not pose a public health hazard in event of a SSE.

UCS requests a public meeting before the NRC's Petition Review Board to highlight our concerns and answer any questions the PRB members have regarding the DFI we seek.

* "Vibration levels" is used in this petition for the less user friendly term "response spectrum" as defined in Appendix A to 10 CFR Part 100 (available online at <http://www.nrc.gov/reading-rm/doc-collections/cfr/part100/full-text.html>)

BASES FOR REQUESTED INFORMATION

The Unit 1 nuclear power reactor at the Donald C. Cook nuclear plant in Michigan experienced significant vibrations during an event on September 20, 2008. For example:

- “On September 20, 2008, at 2055 hours, Donald C. Cook Nuclear Plant (CNP) Unit 1 operators initiated a manual reactor trip from 100% power when all main turbine bearing vibration monitors [IV] indicated high-high vibration.” Weber, page 2, paragraph 1.
- “...the control room operators could feel vibration and hear loud rumbling coming from the area of the main turbine. Control room operators noted that all vibration points on the main turbine supervisory panel indicated high-high vibration.” Weber, page 2, paragraph 3.
- “This delayed response was due to the Unit 2 operating crew responding to a secondary plant transient caused by the simultaneous start of several standby condensate [SD] pumps [P] and performing the required notifications of the UE. Vibration actuation of the condensate pump auto start pressure switches [PS] is the suspected cause of the unexpected pump auto starts of the standby pumps.” Weber, page 3, paragraph 3.
- “Fire Protection personnel reported that the North Fire Water Storage Tank [KP] [TK] was empty. ... Subsequent reports noted a breach in the buried fire header, outside on the west side of the turbine building. ... The breach was subsequently determined to have been caused by a separated Victaulic coupling [CPLG]. Follow-up investigation identified that the East Diesel Driven Fire Pump [P] was was {sic} damaged due to running with no flow.” Weber, page 3, paragraph 6.

The licensee informed the NRC that abnormally high vibration levels were detected in the turbine building and felt in the control room, that the vibration levels likely caused the unexpected and undesired start of standby equipment, and the fire header experienced a breach that resulted in loss of fire protection water inventory and damage to a fire pump.

The **first set of information** sought by this petition deals with the magnitude of the vibration levels experienced during the September 2008 event. Like an earthquake, the damaged turbine caused the structures to shake, producing vibrations felt and sounds heard in the control room. The first set of information will establish the magnitudes of vibration levels throughout the plant. Because vibrations were detected in the turbine building and felt in the control room, the magnitudes of those motions should be ascertained. And since the turbine building and control room are physically attached to other structures, motions in these connected structures should be quantified as well.

The **second set of information** seeks to put the first set of information in proper design and licensing bases context by documenting the magnitude of vibration levels assumed for the safe shutdown earthquake (SSE). By NRC definition:

The Safe Shutdown Earthquake is that earthquake which is based upon an evaluation of the maximum earthquake potential considering the regional and local geology and seismology and specific characteristics of local subsurface material. It is that earthquake which produces the maximum vibratory ground motion for which certain structures, systems, and components are designed to remain functional.[†]

The Cook nuclear plant was designed assuming that systems, structures, and components could experience movement caused by ground acceleration during a postulated SSE. Whereas the first set of information will establish what actually happened during the September 2008 event, the second set of

[†] See <http://www.nrc.gov/reading-rm/doc-collections/cfr/part100/full-text.html>

information will provide the necessary framework to determine whether the magnitude of that event was bounded by Cook's design and licensing bases.

The **third set of information** is conditional upon the first and second sets of information identifying one or more locations where actual vibration levels during the September 2008 event exceeded the vibration levels assumed in the SSE. If no such locations are identified, the third set of information will be an empty set. If one or more locations are identified, the third set of information will document how those locations were dispositioned. Systems, structures, and components within these identified locations could have been damaged by exposure to vibration levels above those assumed in design analyses and procurement specifications. The third set of information will chronicle how these identified structures, systems, and components were either replaced/repared or evaluated such that the as-left configuration provides reasonable assurance that this equipment can perform all required safety functions during/after all design and licensing bases events.

The **fourth set of information** is conditional upon the first and second sets of information identifying one or more locations where actual vibration levels during the September 2008 event were less than or equal to the vibration levels assumed in the SSE. If no such locations are identified, the fourth set of information will be an empty set. If one or more locations are identified, the fourth set of information will document how those locations were dispositioned. The vibration levels during the September 2008 event likely caused some equipment to operate spuriously; if those actual vibration levels were less than the vibration levels during a SSE event, the consequences and implications could be significantly during the higher vibration levels associated with a SSE event. The fourth set of information will document protective measures (either hardware or procedural) applied against spurious equipment operation and/or the evaluations concluding that spurious equipment operation has no adverse safety implications.

The risk significance of spurious equipment operation is abundantly obvious by NRC efforts such as those attempting to resolve the fire-induced circuit failures issue:

- "This informs the Commission of the U.S. Nuclear Regulatory Commission (NRC) staff approach to resolving issues concerning fire-induced circuit failures and multiple spurious actuations." Borchardt, page 1, paragraph 1.

The safety implications from spurious equipment actuations are essentially identical regardless of whether those unwanted, unplanned actuations result from cable damage in a fire or from vibrations during a seismic event. Because the risks are equivalent, equivalent protections must be provided.

The safety implications from spurious equipment actuations during a seismic event were the focus of an evaluation commissioned by the NRC two decades ago. The evaluation team examined the issue for one representative pressurized water reactor (Zion Unit 1) and one representative boiling water reactor (LaSalle Unit 2). The team conducting the evaluation reported:

- "For both Zion-1 and LaSalle-2, assuming that loss of offsite power (LOSP) occurs after a large earthquake and that there are no operator recovery actions, the analysis finds very many combinations (Boolean minimal cut sets) involving chatter of three or four relays and/or pressure switch contacts. The analysis finds that the number of min-cut-set combinations is so large that there is a very high likelihood (of the order of unity) that at least one combination will occur after earthquake-caused LOSP." Budnitz, abstract.
- "For the pump-seal-LOCA sequence group, the analysis finds over 27,000 min cut sets of order 5 (LOSP, swing diesel alignment to other unit, 3 relay chatters) and over 17,000 of order 6 (LOSP, swing diesel, 4 relay chatters) [emphasis in original]." Budnitz, page 6-3, paragraph 2.

- “For the transient group involving failures of service water pumps, over 150,000 min cut sets of order 6 are identified (LOSP, swing diesel, 4 relay chatters) [emphasis in original].” Budnitz, page 6-3, paragraph 3.
- “The number of min cut sets [at Zion] is so large that, given an earthquake strong enough to cause LOSP, the probability that at least one of these cut sets will occur is close to 100% ...”. Budnitz, page 6-3, paragraph 4.
- “The number of min cut sets found at LaSalle-2 is so large that, given an earthquake strong enough to cause LOSP, the probability that at least one of these cut sets will occur is very high. For the peak-response case (see Section 4.5), this probability is essential 100% ...”. Budnitz, page 6-5, paragraph 5.
- “This means, if true, that in the absence of operator recovery the frequency of a core-damage accident would be within small factors of the frequency of an earthquake large enough to cause LOSP.” Budnitz, page 6-7, paragraph 2.
- “Operator recovery from the chatter sequences we have examined requires resetting circuit breakers either in the control room or at their local cabinets. **Our assumption of no operator recovery is surely pessimistic, but we cannot judge what would be a better analytical approach without performing a detailed task analysis for the recovery tasks.** [emphasis added]” Budnitz, page 6-9, paragraph 6.

Thus, the team reported that when an earthquake is severe enough to cause a nuclear power plant to experience loss of offsite power (like the situation experienced last year at the Kashiwazaki-Kariwa nuclear plant in Japan), the postulated sequences leading to reactor core damage are so numerous that the chance that one of them happens approaches 100 percent.

The evaluation team assumed that the operators would take no steps to mitigate or compensate for the spurious equipment actuations caused by the seismic event. As they clearly noted, such an assumption is pessimistic. This pessimism partially explains why the July 2007 earthquake did not lead to the meltdown of any nuclear reactor operating at Kashiwazaki-Kariwa. But as the evaluation team also clearly noted, no informed judgment can be made until after a detailed task analysis of the steps that operators must take.

The evaluation team’s conclusion is consistent with recent NRC positions on operator actions in response to terrorist actions (i.e., the 5.b.5 measures) and to fires. Credit cannot be given for vague, unspecified, ad hoc operator manual actions, but credit can be given for defined operator manual actions supported by timelines and studies showing that those steps can be taken in time to produce the desired outcomes.

The fourth set of information, then, seeks to treat spurious equipment actuations, and any associated manual actions, consistent with their treatment in comparable regulatory space. Simply put, a SSE event at Cook Unit 1 could subject systems, structures, and components to vibration levels higher than experienced during the September 2008 event. As a direct result, there could be even more spurious equipment actuations and damage to systems, structures, and components. The fourth set of information explains how the plant will endure vibration levels associated with a SSE event without undue risk to public health and safety.

CONCLUSION

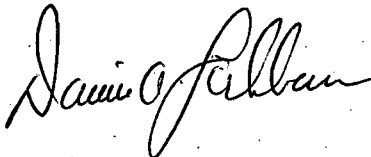
On September 20, 2008, turbine damage caused significant vibration levels at the Unit 1 reactor at the Donald C. Cook nuclear plant. Those vibration levels apparently caused the spurious operation of standby equipment and may have contributed to a breach that seriously impaired the fire protection system. The sets of information sought in this petition (1) quantify the vibration levels experienced during that event, (2) establish the design bases vibration levels for the reactor unit, (3) define how systems, structures, and components subjected to vibration levels higher than design bases levels have been dispositioned, and (4) define how systems, structures, and components subjected to design bases vibration levels are protected against spurious operation and/or analyzed for no adverse safety implications from spurious actuations. Collectively, these sets of information are needed to apply the proper lessons from the September 2008 event to future operation of the reactor. Absent this information, the NRC cannot be assured, and the public is therefore not adequately protected, from a SSE at Cook Unit 1 that causes spurious actuation of equipment with significant adverse safety implications.

This petition seeks to have the licensee provide the requested information on the docket at least 30 days before the Unit 1 restart. Given published reports that the repairs may extend into late 2009 or even 2010, this response time seems doable. By placing this information on the docket in advance of restart, the public and other interested stakeholders can gain confidence not only that the specific widgets broken during this event have been repaired, but also lessons have been learned and implemented so as to lessen the likelihood and severity of future events.

ACKNOWLEDGEMENT

Arnold Gundersen of Burlington, Vermont was the catalyst behind this effort. Arnie reviewed my comments on the licensee event report submitted to the NRC on the September 20, 2008, event and asked the right questions, as usual, about resolving the concerns. I greatly appreciate Arnie's invaluable counsel and solid advice.

Sincerely,



David Lochbaum
Director, Nuclear Safety Project

CITED REFERENCES

1. Borchardt, R. W., 2008. Resolution of issues related to fire-induced circuit failures. SECY-08-0093. Borchardt is executive director for operations at the Nuclear Regulatory Commission. June 30. Available online at <http://www.nrc.gov/reading-rm/doc-collections/commission/secys/2008/secy2008-0093/2008-0093scy.pdf>
2. Budnitz, R. J., Lambert, H. E., and Hill, E. E., 1987. Relay chatter and operator response after a large earthquake. NUREG/CR-4910. Budnitz, Lambert, and Hill work for Future Resources Associates, Inc. of Berkeley. August.
3. Weber, Lawrence J., 2008. Licensee event report 315/2008-006-00 manual reactor trip due to main turbine high vibration. Weber is site vice president for the Indiana Michigan Power Company. November 13. Available online in NRC ADAMS under accession no. ML083370197