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SUBJECT: Responds to Generic Ltr 88-05, "Boric Acid Corrosion of Carbon Steel Reactor Pressure Boundary Components in...."

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Donald C. Cook Nuclear Plant Units 1 and 2
Docket Nos. 50-315 and 50-316
License Nos. DPR-58 and DPR-74
NRC GENERIC LETTER 88-05: BORIC ACID CORROSION OF CARBON STEEL
REACTOR PRESSURE BOUNDARY COMPONENTS IN PWR PLANTS

U.S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, D.C. 20555

Attn: T. E. Murley

June 7, 1988

Dear Dr. Murley:

This letter and its attachment respond to NRC Generic Letter 88-05, "Boric Acid Corrosion of Carbon Steel Reactor Pressure Boundary Components in PWR Plants," dated March 17, 1988. The program to monitor, evaluate and perform maintenance on primary coolant leaks at Cook Nuclear Plant is described in the attachment to this letter.

Sincerely,

M. P. Alexich
Vice President

MPA/eh

Attachment

cc: D. H. Williams, Jr.
W. G. Smith, Jr. - Bridgman
R. C. Callen
G. Bruchmann
G. Charnoff
NRC Resident Inspector - Bridgman
A. B. Davis - Region III

A001
1/1

STATE OF OHIO)
COUNTY OF FRANKLIN)

Milton P. Alexich, being duly sworn, deposes and says that he is the Vice President of licensee Indiana Michigan Power Company, that he has read the foregoing response to Generic Letter 88-05, "Boric Acid Corrosion of Carbon Steel Reactor Pressure Boundary Components in PWR Plants," and knows the contents thereof; and that said contents are true to the best of his knowledge and belief.

Subscribed and sworn to before me this 7th

day of June, 1988.

NOTARY PUBLIC

Commission expires 3-9-91

DONALD C. COOK NUCLEAR PLANT

BACKGROUND

The following is the Indiana Michigan Power Company's response to the NRC Generic Letter 88-05 as it applies to Donald C. Cook Nuclear Plant. The GL was prompted by incidents in PWRs where leaking reactor coolant caused significant corrosion problems for carbon steel and low alloy components in the reactor coolant pressure boundary (RCPB). Accordingly, GL 88-05 requests that licensees implement a program that includes "measures to ensure that boric acid corrosion does not lead to degradation of the assurance that the RCPB will have an extremely low probability of abnormal leakage, rapidly propagating failure, or gross rupture."

The issue of degradation of the RCPB has received significant attention for Cook Units 1 and 2. This issue has been previously reviewed as part of our response to NRC IE Bulletin 82-02 and IE Information Notices 80-27, 82-06 and 86-108, and during the review of numerous industry events as reported by INPO and others.

GL 88-05 outlines a program with four features to address the issue of boric acid corrosion of the RCPB. These four features and the corresponding programs that are presently in place for Cook Nuclear Plant are described below. Our review of this issue has indicated that additional measures can be taken to strengthen our programs. These additional measures are identified with schedules for implementation.

Requirement No. 1:

A determination of the principal locations where leaks that are smaller than the allowable technical specification limit can cause degradation of the primary pressure boundary by boric acid corrosion. Particular consideration should be given to identifying those locations where conditions exist that could cause high concentration of boric acid on pressure boundary surfaces.

Response:

Reviews of RCPB components susceptible to boric acid corrosion have been undertaken previously in response to industry experience.

For example, in our response to IEB 82-02 (AEP:NRC:0703) we summarized leakage experience and corrective actions related to bolted closures in the RCPB. During our review of IEN 86-108, we considered the relevance of the events that occurred at Arkansas Nuclear One (valve packing leakage leading to wastage of a carbon steel high pressure injection nozzle). We considered the

applicability of responses to these and other notices to Cook Nuclear Plant and initiated corrective actions when warranted (see response to Requirement No. 4).

It should be noted that in some aspects, the design of the Cook Nuclear Plant reactor coolant system (and other systems containing borated water) affords increased resistance to boric acid corrosion over designs employed by some other plants. Contrary to the design of plants such as Arkansas Nuclear One which employ clad carbon steel piping, Cook Nuclear Plant systems containing borated water utilize various grades of stainless steel piping in these services. These materials offer improved resistance to boric acid corrosion over carbon and low alloy steels.

In addition to our previous efforts, in accordance with GL 88-05, we undertook another review to identify pressure retaining components within the RCPB that have a relatively high risk of boric acid induced corrosion (components containing low alloy or carbon steels) and also to identify the likely sources of leakage that could impact these susceptible areas. A list of pressure retaining components in the RCPB that contain low alloy or carbon steel was developed based on review of pipe and equipment specifications and manufacturer's information. We then compiled both Cook Nuclear Plant and industry leakage and RCPB corrosion experience which we used to identify potential leakage sources and to determine conditions and configurations in which material wastage is likely to occur. This was accomplished through:

- a review of Cook Plant Job Orders,
- a review of past NRC transmittals on this topic,
- review of past INPO SOERs and SERs,
- queries of INPO's NPRDS failure data base,
- a review of other pertinent information such as manufacturer's bulletins and reports generated by industry groups such as NUMARC and AIF.

Using this information we developed a list of components susceptible to boric acid corrosion and principal sources of leakage from the reactor coolant system (RCS) and other systems containing borated water which could impact these susceptible areas. We plan to verify this component list through field walks which will be completed prior to the end of the current Unit 2 steam generator repair outage (January 1989) and during the next Unit 1 refueling outage (presently scheduled to begin in April 1989).

Requirement No. 2:

Procedures for locating small coolant leaks (i.e., leakage rates at less than technical specification limits). It is important to establish the potential path of the leaking coolant and the reactor pressure boundary components it is likely to contact. This information is important in determining the interaction between the leaking coolant and the reactor coolant pressure boundary materials.

Response:

Current plant Technical Specifications require the performance of a reactor coolant system water inventory balance at least once per 72 hours. Normal practice is to perform an RCS leakage calculation once per day as part of the daily operator duties. Additionally, RCS leakage is evaluated and trended regularly by monitoring parameters such as containment humidity, air particulate activity, sump inventory and discharge which may be indicative of reactor coolant system leakage. Plant procedures contain administrative Notification Limits of 0.8 gpm applicable to reactor coolant system leak rate, which alert of encroachment on the Technical Specification limit of 1.0 gpm unidentified leakage.

In addition to procedures to monitor RCS leakage, procedures are also in place to perform inspections of the containment prior to plant heatup from cold shutdown. These inspections check for RCS leakage and areas of boric acid encrustation. If problems are found job orders are written to determine and effect corrective actions. After the unit approaches normal operating temperature and pressure, an additional inspection for RCS leakage is performed. Following a unit trip or shutdown, it is standard practice to perform containment inspections to identify any RCS leakage or boron encrustation problems.

We plan to enhance these existing measures by augmenting routine operator tours by a more formal search for leaks on accessible components when administrative Notification Limits (0.8 gpm) on RCS leakage are reached. Procedures will be developed to search for signs of leakage on components identified in response to Requirement No. 1 that are accessible at power. These procedures will include a checklist of the potential leakage sources and susceptible components and guidelines for evaluation and documentation of the inspection findings.

We also plan to develop detailed post-shutdown and pre-startup inspection procedures to search for signs of leakage on components identified in response to Requirement No. 1 above that are not accessible at power. These procedures will include a checklist of the potential leakage sources and susceptible components and provide guidelines for evaluation and documentation of the inspection findings.

We plan to have these two sets of procedures in place prior to the end of the next refueling outage for Unit 1 (presently scheduled to begin in April 1989) and prior to the end of the current Steam Generator Repair outage for Unit 2 (January 1989), respectively.

Requirement No. 3:

Methods for conducting examinations and performing engineering evaluations to establish the impact on the reactor coolant pressure boundary when leakage is located. This should include procedures to promptly gather the necessary information for an engineering evaluation before the removal of evidence of leakage, such as boric acid crystal buildup.

Response:

As stated in response to Requirement No. 2, existing plant procedures require that leakage discovered during containment closeout inspection tours be documented via completion of a job order to determine the source of the leakage, required corrective actions, and the possible degree of corrosion and subsequent need for replacement of carbon steel components. In order to enhance these measures, the inspection procedures referenced in response to Requirement No. 2 will reference examination and evaluation procedures which will be developed to require such activities as:

- identifying the source of the leak and its nature (gross, weep, startup leak, self resolved, etc.),
- identifying all impacted components,
- collecting appropriate data prior to cleanup (leakage flow at time of discovery, RCS conditions, quantifying measurements, sketches, pictures, as appropriate),
- performing NDE,
- performing evaluations and justifications for continued operation, if required,
- developing action plans following cleanup (repair of leakage, repair of corroded components, initiation of reviews to determine if long term corrective actions are appropriate), and
- maintaining accurate historical records of leakage locations, inspections, wastage measurements, repairs, and other corrective actions taken.

These examination and evaluation procedures will be in place by January 1, 1989.

Requirement No. 4:

Corrective actions to prevent recurrences of this type of corrosion. This should include any modifications to be introduced in the present design or operating procedures of the plant that (a) reduce the probability of primary coolant leaks at the locations where they may cause corrosion damage and (b) entail the use of suitable corrosion resistant materials or the application of protective coatings or claddings.

Response:

As stated previously, the issue of boric acid corrosion of the RCPB has been reviewed on several occasions for Cook Nuclear Plant.

Prior to our receipt of IEB 82-02, Cook Nuclear Plant had experienced boric acid corrosion of body-to-bonnet studs on several valves in each unit's reactor coolant system. Further review identified 42 valves on each unit that were supplied with carbon steel body-to-bonnet studs. In 1981 we instituted a design change to replace these fasteners with materials offering improved resistance to boric acid corrosion as each valve was opened to repair leakage, or for routine maintenance (on a contingency basis). Following receipt of Bulletin 82-02, we expanded the scope of the body-to-bonnet stud replacement to include valves in systems outside the RCPB which contact boric acid solutions. Following receipt of IE Notice 86-108, we expedited this effort by instituting a planned change-out of the body-to-bonnet studs for critical valves within the RCPB. This program has been essentially completed on Unit 1 and is planned to be completed on Unit 2 during the current Steam Generator Repair outage.

More recently, we have reviewed incidents of corrosion of valve packing follow studs for relevance to Cook Nuclear Plant. As part of these reviews, we are gathering information to develop a program for replacement of carbon steel packing follow studs on valves within the RCPB. We plan to issue a design change outlining planned modifications by January 1, 1989.

In order to investigate the potential to reduce valve packing leakage, we have recently completed a program to evaluate the usefulness of live-load valve packing. Due to perceived benefits, we are considering to install live-load packing on troublesome valves in borated water service. We are also evaluating potential uses of this hardware on other key valves.

As stated in response to Requirement No. 3, a key facet of our examination and evaluation procedures will be the initiation of further reviews to determine if long term corrective actions are warranted for leaking or corroded components. This will ensure that recurrences of corrosion and leakage are minimized to the extent practicable. As part of the corrective action, proper consideration will be given to (a) reduce the probability of primary coolant leaks at the locations where they may cause corrosion damage and (b) entail the use of suitable corrosion resistant materials or the application of protective coatings/claddings.

Finally, we are undertaking a review of our training programs and procedures to ensure they contain adequate guidance on issues relevant to RCPB leakage and corrosion concerns. For example, we plan to review our training programs and procedures governing restoration and assembly of pressure boundary bolted closures to ensure they stress points such as cleanliness of seating surfaces, the importance of proper gasket and fastener materials and proper torquing practices. This review of our training programs and procedures will be completed, with identified enhancements incorporated, by August 29, 1988.