December 12, 2001

LICENSEE : Duke Energy Corporation

FACILITIES: McGuire, Units 1 and 2, and Catawba, Units 1 and 2

SUBJECT: TELECOMMUNICATION WITH DUKE ENERGY CORPORATION TO DISCUSS INFORMATION IN THEIR LICENSE RENEWAL APPLICATION ON AGING MANAGEMENT PROGRAMS FOR MECHANICAL SYSTEMS AND COMPONENTS

On October 25, 2001, after the NRC (the staff) reviewed information provided in Appendix B of the license renewal application (LRA), a conference call was conducted between the staff and Duke Energy Corporation (the applicant) to clarify information presented in the application pertaining to aging management programs for mechanical systems and components. Participants in the conference call are provided in an attachment.

The questions asked by the staff, as well as the responses provided by the applicant, are as follows:

B.3.4 Borated Water Systems Stainless Steel Inspection

1. The LRA proposes that one of twelve possible inspection locations at each site will be inspected volumetrically as part of the Borated Water Systems Stainless Steel Inspection program (monitoring & trending). Stainless steel (SS) has demonstrated susceptibility to intergranular stress corrosion cracking (IGSCC) in low-temperature borated water systems in pressurized water reactors, particularly in stagnant lines, at weld heat-affected zones (HAZs), involving weld procedures that resulted in sensitization of the stainless steel in the HAZs. Since IGSCC has a wide range of induction and propagation rates, depending on degree of sensitization, local stresses, and specific impurities at a given location, justify why only a one-time inspection is sufficient. Also, since not all welds, stress patterns, and impurity levels and species are necessarily similar, justify why inspection of only one of twelve locations adequately represents the durability of material at the other eleven locations and explain the process for inspection population expansion should aging effects be identified.

   The applicant indicated that the containment spray piping is essentially the same (material and environment) at each site, such that one spray pipe is representative of all twelve at that site. As such, if no parameters are known that would distinguish certain locations at each site as being more susceptible to loss of material or cracking, one location will be chosen based upon radiological conditions and accessibility. The applicant also indicated that the staff previously found this aging management program acceptable, as documented in the safety evaluation report for the staff's review of the Oconee LRA. The staff will consider the information provided in the applicant's response, but may request additional information to complete its review of this item.

2. The LRA proposes that a one-time inspection be performed and that no actions are to be taken to trend inspection results (monitoring & trending). The LRA also states that if an engineering evaluation determines that the aging effects, identified during the one-time inspection, will not result in a loss of the component's intended function(s) during the period of extended operation, then no further action will be required. Industry operating experience has shown that, under this environment, stress-corrosion cracking tends to result in leaks that are somewhat localized. In this light, explain the basis for not performing future inspections at those locations in which aging effects have been identified in order to ensure that degradation predictions made in the engineering evaluations remain valid (detection of aging effects and monitoring & trending).

   The applicant indicated that engineering judgment would be applied to determine if corrective actions are warranted based upon the results of the one-time inspection. Provisions for programmatic oversight would be established at the time the results of the inspection are obtained, and the inspection results, as well as corrective actions taken by the applicant (licensee), would be subject to NRC inspection at the appropriate time in the future. The staff will consider this information but may request additional information to determine the appropriateness of not performing future inspections at those locations in which aging effects have been identified in order to ensure that degradation predictions made in the engineering evaluations remain valid (detection of aging effects and monitoring & trending). In addition, the staff may request that the applicant describe the criteria for (1) assessing the severity of the observed degradation, and (2) determining whether or not corrective action is necessary.

3. The LRA states that the parameters inspected by the borated water systems stainless steel inspection program are pipe wall thickness, as a measure of loss of material, and evidence of cracking (parameters monitored or inspected). Will the inspections also reveal evidence of pitting? If so, discuss the inspection technique(s) that will be used to reliably identify the presence of pits (monitoring & trending).

   The applicant indicated that the volumetric technique (ultrasonic testing) would reveal loss of material from pitting. The staff is satisfied with this response but may request this information formally.

<u>B.3.14 Flow Accelerated Corrosion Program</u>

1. The LRA states that the inspection frequency for each location will vary and depend on previous inspection results, calculated rate of material loss, analytical model review, changes in operating or chemistry conditions, pertinent industry events, and plant operating experience (monitoring and trending). Identify the predictive model(s) that will be used to predict component degradation in the systems conducive to flow accelerated corrosion and the inspection schedules necessary to provide reasonable assurance that the structural integrity will be maintained between inspections. Also discuss how these models have been benchmarked.

   The applicant indicated that the predictive model to be used is CHECWORKs, and that the inspection schedules would be determined in accordance with Electrical Power Research Institute (EPRI) document NSAC-202L based upon inspection results and wear rate, as documented in the LRA under Section B.3.14, Flow Accelerated Corrosion

Program. The staff is satisfied with this response and has no additional questions on this issue.

2. Describe the basis for location sampling and the provisions for expanding the inspection scope (i.e., additional examinations) in the event that degradation is detected that exceeds the acceptance criteria (monitoring and trending).

   The applicant indicated that the basis for location sampling and the provisions for expanding the inspection scope is provided in the EPRI document, which is referenced in the Flow-Accelerated Corrosion program documented on page XI M-58 of the Generic Aging Lessons Learned (GALL) report. The staff is satisfied with this response and has no additional questions on this issue.

B.3.15 Fluid Leak Management Program

1. The program is stated to focus on carbon and low alloy steels (scope). There are several cases of failure of stainless steels in borated water systems, for example, spent fuel pool piping. Why is stainless steel not indicated as a relevant material?

   The applicant indicated that boric acid corrosion of stainless steel is not a plausible aging effect. The staff is satisfied with this answer and has no additional questions on this issue.

2. There is no mention of strategies that address leak management for component segments that are not accessible to visual inspection (monitoring and trending). Indicate whether there are provisions in the fluid leak management program for leak management in inaccessible locations.

   The applicant indicated that the condition of material in accessible areas is considered indicative of material in inaccessible areas. The staff will consider this information, but may request additional information to understand the applicant's response to Generic Letter 88-05, which may contain provisions for inspecting potentially vulnerable locations for boric acid corrosion.

B.3.16 Galvanic Susceptibility Inspection

1. The LRA states that the galvanic susceptibility inspection will inspect a select set of carbon steel/stainless steel couples at each site (monitoring and trending). Since the galvanic susceptibility inspections are one-time inspections of a given sample that are intended to provide objective evidence that the applicable aging effects are being adequately managed, explain how the sample size will be selected in order to ensure that the inspection population is representative for all systems listed in the galvanic susceptibility inspection program scope.
   The applicant indicated that a bounding approach will be used for the one-time inspection such that the worst-case combination of materials and environments will be inspected. Material and environment combinations that are less susceptible to galvanic corrosion will be inspected if the worst-case combinations reveal degradation. The staff will consider this information, but may request additional information to complete its review of this item.

2. In the LRA, provisions for sample size expansion and subsequent inspections, in the event that the initial inspection detects degradation, are not included (monitoring and trending). Provide justification for their exclusion. Otherwise, discuss the criteria that will be used and the procedure that will be implemented for expanding the sample size when degradation is detected in initial/subsequent inspections.

   The applicant indicated that the provisions for sample size expansion and subsequent inspections, in the event that the initial inspection detects degradation, are included in the discussion of corrective actions and confirmation process associated with the Galvanic Susceptibility Inspection. The staff is satisfied with this response and has no additional questions on this issue.

3. The LRA describes the acceptance criterion for the galvanic susceptibility inspections as "no unacceptable loss of material that could result in a loss of the component intended function(s) as determined by engineering evaluation." Describe the criteria that will be used to define "unacceptable loss of material" and how the acceptance criteria will ensure that the component functions are maintained under all current licensing basis design loading conditions during the period of extended operation. Also, describe the analysis methodology that will be used to evaluate the inspection results against the acceptance criteria.

   The applicant indicated that the criteria are not defined for this one-time inspection and that engineering judgment will be applied. The applicant also indicated that it is difficult to establish prescriptive acceptance criteria that will take into account all factors that should be considered in light of the inspection results to determine if a loss of intended function could result. In addition, since the inspection may not reveal any degradation, prescribing acceptance criteria would not be necessary. The staff will consider the information provided in the applicant's response, but may request additional information to complete its review of this item.

4. The LRA states that "programmatic oversight" will be defined in the event that engineering evaluations determine that continuation of the aging effects could cause a loss of component intended function(s) under current licensing basis design conditions for the period of extended operation (corrective action and confirmation). Explain what programmatic oversights will need to be defined in order to implement corrective actions. Clarify if these activities are related to the corrective actions program described in B.3.2.2 of the LRA.

   The applicant indicated that the programmatic oversight will be defined at an appropriate time in the future when the results of the inspection can be considered to develop that oversight. The applicant also indicated that the corrective action process would be used to document the inspection results as well as the planned and completed actions (including programmatic oversight) taken to correct the degradation. The staff is satisfied with this response and has no additional questions on this issue.

5. The scope of the galvanic susceptibility inspection program is indicated to include all galvanic couples exposed to gas, unmonitored treated water, and raw water environments in the McGuire and Catawba systems listed (scope). However, the proposed implementation involves only measurements on carbon steel/stainless steel couples (parameters monitored or inspected), based on an assumption that this couple

represents a worst-case combination, based on expectations from the galvanic series (monitoring and trending). First, note that the relative position in the series can shift, depending on specific environments. Second, note that the position of stainless steel in the series depends on whether the material is active or passive. Third, as an example, copper alloys are listed as relevant materials. Could the carbon steel/stainless steel couple measurements provide favorable results that fail to address the galvanic phenomena that may be degrading other materials?

The list of systems includes nuclear service water, which is large, complex, usually with multiple materials, subject to a variety of environments, that may change over time, including flowing and stagnant water, microbiological species, etc. The mechanisms include localized (e.g., pitting) and uniform corrosion. Given these complexities, justify that limiting the proposed inspections to carbon-stainless steel couples provides sufficient evidence in regards to the potential aging degradation of all galvanic couples in nuclear service water and other systems.

The applicant indicated that raw water is the worst case, bounding environment for galvanic corrosion. The staff will consider this information, but may request additional information to complete its review of this item as well as Question 1 under B.3.16, Galvanic Susceptibility Inspection. Any future request for additional information on this issue will address both of these questions, if appropriate.

6. The LRA states that the parameter inspected by the galvanic susceptibility inspection program is pipe wall thickness (parameters monitored or inspected) and inspections will be performed using a volumetric examination technique. As an alternative, visual examination will be used should access to internal surfaces become available (monitoring and trending). Is it the intent to substitute the volumetric examination (wall thickness) with a visual examination for those components where access to the internal surfaces is available? If so, describe how section thickness will be determined.

   The applicant indicated that their intent was not to substitute a volumetric test with a visual inspection. The applicant acknowledged that a visual inspection does not provide the same level of confidence that a volumetric examination provides. The staff is satisfied with this response. However, since the LRA states that a visual inspection could be used as an alternative to volumetric testing, the staff will request this clarification formally from the applicant.

B.3.17 Heat Exchanger Activities

1. The approaches for heat exchanger performance testing at Catawba and McGuire involve flow monitoring using differential pressure tests (parameters monitored and inspected). Do the tests include converting mass flow to linear flow velocity to assure that flow regimes that promote flow-assisted corrosion are avoided? This is particularly important in systems involving admiralty brass, which has shown susceptibility to flow-induced corrosion in heat exchangers in power systems.

   The applicant requested the staff to review the aging management review tables in the LRA to determine if the Heat Exchanger Activities aging management program was credited for any heat exchangers with admiralty brass components. The staff will review the tables as requested to determine if a request for additional information is needed to complete its review of this issue.

2. The pressure differential test, while an indicator of fouling, does not directly address assurance of satisfactory heat transfer coefficients. It seems possible that relatively thin films may have poor heat transfer characteristics. Describe the monitoring and trending method or technique that will be used to ensure that the heat exchangers are capable of adequate heat transfer required to meet system and accident load demands.

   The applicant requested the staff to share with them the operating experience that involves the phenomenon of thin films that have poor heat transfer characteristics so they can review the information for applicability to Catawba and McGuire. The staff will either provide industry operating experience to the applicant for their review and determination of applicability, or the staff will reconsider its need for additional information to complete its review of this item.

3. The LRA states that the performance testing will monitor flow capacity by measuring the pressure drop through the component cooling heat exchanger tubes to identify the presence of fouling (parameters monitored or inspected). Will the monitoring and testing program for the component cooling heat exchangers also consider performance parameters on the shell side? If so, explain what parameters will be monitored. Describe how the parameters being monitored will indicate degraded heat transfer capabilities.

   The applicant indicated that treated water flows through the component cooling water heat exchanger shell and requested the staff to indicate if, perhaps, this question applies to other heat exchangers for which raw water flows through the shell. The staff will identify heat exchangers that are exposed (shell-side) to raw water and will review LRA Section B.3.29, Service Water Piping Corrosion Program, to verify that aging management of the heat exchanger interior shell is addressed.

B.3.22 Liquid Waste System Inspection

1. In section B.3.22 of the LRA, under monitoring and trending, the applicant stated that the selection of the specific areas for inspection for the system material/environment combinations will be the responsibility of the system engineer. Discuss the selection criteria that will be used by the system engineer for the inspection of the specific areas.

   The applicant suggested that the staff issue a request for additional information so that they can provide the selection criteria to the staff in their response.

2. The acceptance criterion for the liquid waste system inspection program is "no unacceptable loss of material and cracking of stainless steel components and loss of material of carbon steel and cast iron components that could result in a loss of the component intended function(s) as determined by engineering evaluation." Describe the criteria for (1) assessing the severity of the observed degradation, and (2) determining whether or not corrective action is necessary.

   The applicant indicated that the criteria are not defined for this one-time inspection and that engineering judgment will be applied. The applicant also indicated that it is difficult to establish prescriptive acceptance criteria that will take into account all factors that should be considered in light of the inspection results to determine if a loss of intended function could result. In addition, since the inspection may not reveal any degradation, prescribing acceptance criteria would not be necessary. The staff will consider this information, but may request additional information to complete its review of this issue.

B.3.32 Sump Pump Inspection

1. The acceptance criterion for the sump pump inspection program is "no unacceptable loss of material that could result in the loss of the component intended function(s), as determined by engineering evaluation." Describe the criteria for (1) assessing the severity of the observed degradation, and (2) determining whether or not corrective action is necessary.

   The applicant indicated that the criteria are not defined for this one-time inspection and that engineering judgment will be applied. The applicant also indicated that it is difficult to establish prescriptive acceptance criteria that will take into account all factors that should be considered in light of the inspection results to determine if a loss of intended function could result. In addition, since the inspection may not reveal any degradation, prescribing acceptance criteria would not be necessary. The staff will consider this information, but may request additional information to complete its review of this issue.

A draft of this telecommunication summary was provided to the applicant to allow them the opportunity to comment prior to the summary being issued.

/***RA***/

Rani L. Franovich, Project Manager
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Office of Nuclear Reactor Regulation

Docket Nos. 50-369, 50-370, 50-413, and 50-414

Attachment: As stated

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