January 28, 2002

APPLICANT: Exelon Generation Company, LLC (Exelon)

FACILITIES: Peach Bottom Atomic Power Station, Units 2 and 3

SUBJECT: TELECOMMUNICATION WITH EXELON GENERATING COMPANY TO DISCUSS INFORMATION IN THEIR LICENSE RENEWAL APPLICATION ON SECTION 3.5, AGING MANAGEMENT OF CONTAINMENT, STRUCTURES, AND COMPONENT SUPPORTS

On January 16, 2002, after the NRC staff reviewed information provided in Section 3.5 of the license renewal application (LRA), a conference call was conducted between the staff and representatives of Exelon Generating Company to clarify information presented in the application pertaining to the aging management of containment, structures, and component supports. The information discussed, the applicant's responses, and the follow-up actions are in Attachment 1. A list of participants is included in Attachment 2.

A draft of this telephone conversation summary was provided to the applicant to allow them the opportunity to comment on the contents of its input prior to the summary being issued.

/***RA***/

Raj K. Anand, Project Manager
License Renewal and Environmental Impacts Program
Division of Regulatory Improvement Programs
Office of Nuclear Reactor Regulation

Docket Nos. 50-277 and 50-278

Attachments: As stated

cc w/attachments: See next page

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SUMMARY OF TELECOMMUNICATION WITH
EXELON GENERATING COMPANY
PEACH BOTTOM UNITS 2 AND 3

3.5.1 Containment Structure

Table 3.5-1 has a column for "Environment." Please provide information regarding the operating temperature (range), humidity, cumulative radiation (neutron, gamma) and medium (nitrogen, water, etc) for all the components in this Table.

Response to 3.5.1-1: The applicant stated that the two environments listed in Table 3.5-1 are "Sheltered" and "Torus Water". Sheltered environment applies to components in the drywell and pressure suppression chamber air space. Torus water environment applies only to the submerged components inside the suppression chamber. Operating conditions for each environment are:
Drywell sheltered environment is described in LRA page 3-5. The environment is inerted with nitrogen to maintain oxygen content at less than 4%. The normal operating temperature range is 65^{O} F - 145^{O} F (150^{O} F in the LRA for the drywell is in error. The Technical Specification limit is 145^{O} F.) and the relative humidity range is 10% - 90%. The suppression chamber air space sheltered environment operating temperature ranges from 65^{O} F - 135^{O} F and relative humidity range is 10% -90%.
Cumulative radiation limits inside the primary containment are location specific. The projected cumulative neutron fluence radiation for 60 years inside primary containment drywell, just outside the sacrificial shield wall, is 1.16×10^{15} n/cm^2. The bounding gamma radiation dose for 60 years is estimated to be 8.0×10^{9} Rads. Components in Table 3.5-1 were evaluated for these values.
Torus water environment is described in LRA page 3-5 under the heading of Torus Grade Water. Quality of this water is monitored periodically and maintained in accordance with station procedures that include recommendations from EPRI TR-103515, "BWR Water Chemistry Guidelines." Average normal water temperature is equal to or less than 95^{O} F.

Discussion: The staff indicated that the response is adequate. However, Table 3.5-1 should reflect the response in the "environment column." The staff will issue a formal RAI.

3.5.1-2 The reactor pedestal, foundation and floor slab are supporting the reactor vessel, interior floors, equipment and piping in the drywell. These components are also subjected to high temperatures, radiation, and borated water spills. Please provide justification as to how their intended functions will be maintained without some type of aging management program during the period of extended operation.

Response to 3.5.1-2: The applicant stated that the normal operating temperature range for the primary containment drywell is 65ºF to 145 ºF. The cumulative gamma radiation level is 8.0×10^{9} Rads and neutron fluence limit is 1.16×10^{15} n/cm^2. The temperature range and irradiation limits do not exceed the level specified in NUREG-1557, "Summary of Technical Information and Agreement from Nuclear Management and Resources Council Industry Reports Addressing License Renewal." Thus the impact of temperature and irradiation on the reactor pedestal, foundation, and floor slab are non-significant and require no aging management during the period of extended operation.

For PBAPS borated water is a solution of sodium pentaborate and is limited to the Standby Liquid Control (SBLC) system. Portions of the SBLC system, which penetrate the containment, are empty during normal plant operation. Therefore borated water spills are not applicable.

DISCUSSION: The staff indicated that the NUREG-1557 values for temperature and radiation are established as guideline values beyond which the concrete properties could be affected. These values do not guarantee that there will not be any cracking or other concrete degradation if these limits are met. Concrete cracks and deteriorates even at air temperature of between 50°F and 100°F, and it keep on deteriorating if not properly maintained. Thus, an argument that the environment is below the threshold limits established in NUREG-1557 does not alleviate a need for a credible aging management program to ensure the integrity of reactor pedestal, foundation and floor slabs during the extended period of operation. The staff stated that a aging management program to ensure the integrity of reactor pedestal, foundation and floor slabs during the extended period of operation is needed. The staff will issue a formal RAI .

3.5.1-3 The sacrificial shield wall performs the function of providing shielding as well as provides supports for earthquake ties required to stabilize the drywell during the postulated earthquakes. The internal and external carbon steel plates are subjected to varying temperatures (expansion and contraction), vibratory loads during SRV discharges (steam environment), and significant radiation. Please provide justification as to how their intended functions will be maintained without some type of aging management program during the period of extended operation.

Response to 3.5.1-3: The applicant stated that the design basis of the sacrificial shield wall is described in Updated Final Safety Analysis Report (UFSAR) Section C.4.6. The wall is composed of concrete and embedded structural steel columns continuously tied with ¼ " thick plate. The concrete, which is encased in the ¼" plate, is designed primarily for shielding. The steel columns and the ¼" thick plate are designed to transfer seismic and service loads to the supporting reactor pedestal. The sacrificial shield wall is not subject to SRV loads or steam environment during normal plant operation. Each SRV discharge is piped through its own discharge line to a point below the minimum water level in the primary containment suppression chamber (torus). The primary containment drywell and the suppression chamber are separate structures thus the SRV vibratory loads are not applicable to the sacrificial shield wall. (UFSAR Section 4.4, Appendix M.3.2.3)

Aging management reviews for the wall considered both concrete and carbon steel components of the wall. For carbon steel components the aging management reviews identified loss of material due to corrosion, loss of strength and modulus due to elevated temperature, and loss of fracture toughness and ductility due to irradiation as potential aging effects. For concrete components the reviews identified change in material properties, due to elevated temperature and irradiation as a potential aging effect. The reviews concluded the aging effects for both carbon steel and concrete components are non-significant and will not impact the intended function of the wall; thus require no management. Justification for the conclusion is as follows:

Loss of material due to corrosion was generalally evaluated for carbon steel structures and components located in sheltered environment. The rationale for this conclusion is provided in more detail in our response to RAI 3.5.2-5.

Loss of strength and modulus due to elevated temperature for carbon steel is non-significant if the temperature is less than 700°F. The drywell temperature is maintained at 145°F or less. Thus the aging effect is non-significant and requires no aging management. (NUREG-1557)

According to NUREG-1557, loss of fracture toughness and ductility due to irradiation of carbon steel is non-significant if neutron fluence levels do not exceed 2×10^{17} n/cm^2. EPRI TR-103842, "Class I Structures License Renewal Industry Report; Revision 1", states that currently available data indicate that the effect of irradiation on mechanical properties of steel are measurable at 1×10^{18} n/cm^2. The estimated maximum neutron fluence, just outside the sacrificial shield wall is 1.16×10^{15} n/cm^2 for 60 years. Thus the aging effect is non-significant and requires no aging management.

For concrete elements of the wall, aging management reviews identified change in material properties, due to elevated temperature and irradiation as a potential aging effect, which could impact its intended function. The reviews however concluded that the effect of temperature is non-significant since containment general air temperature is maintained below 150°F, and there are no known areas of localized air temperatures greater than 200°F. Similarly, irradiation effects are ruled non-significant since the neutron fluence and gamma radiation are below the threshold limits specified in NUREG-1557 (5×10^{19} n/cm^2 and 1×10^{10} rads).

Discussion: The staff's prior inspection of a BWR Mark I sacrificial shield has indicated that the steel plates corrode at the seismic tie connections and at seam welds of the plates. Moreover, the interior steel plates which are subjected higher temperature and radiation than the exterior plates for which you may have estimates of actual temperature and radiation levels, are not inspectable. The staff believes that there has to be a nominal inspection of the visible portions of the sacrificial shield walls as part of an aging management program to maintain the overall integrity of the walls during the extended period of operation. The staff will issue a formal RAI .

3.5.1-4 The columns, saddle supports, and seismic restraints associated with the pressure suppression chamber are affected by the expansion and contraction of the major diameter of the torus induced by SRV discharges and temperature transients. In one case, the staff has seen pullout of the anchor-bolts of the column supports due to such movements. Please provide justification as to how their intended functions will be maintained without some type of aging management program during the period of extended operation.

Response to 3.5.1-4: The applicant stated that the columns, saddle supports, and seismic restraints associated with PBAPS suppression chambers are designed with lubrite plates. The design allows for free horizontal movement of the suppression chambers and for release of horizontal loads due to temperature transients and SRV discharges. The supports transmit downward vertical load to the foundation without relying on anchor bolts. The anchor bolts are provided to prevent gross vertical uplift of the suppression chambers, if any, during a seismic event.
Suppression chamber supports and restraints were reviewed for aging effects, which could impact their intended function. Loss of material for carbon steel components due to corrosion and loss of material due to wear of the lubrite plates (caused by thermal, SRV and seismic load cycles) were identified as potential aging effects. The reviews concluded that loss of material due to corrosion in a sheltered environment is non-significant and requires no aging management (see Question 3.5.2-5). Loss of material, due to wear is also non-significant and requires no management since the load cycles occur infrequently. On this basis the aging

effects in Table 3.5-1 are indicated as “none” and the aging management activity is indicated as “Not Applicable”.

Discussion: The staff stated that Appendix A of NUREG-1522 shows corrosion of steel structures in sheltered but humid environment in all the six plant visited by the staff. At Brunswick, Quad Cities and Dresden, the steel corrosion in sheltered area (in the Reactor Buildings) was pervasive enough to affect their scheduled plant outages. Though small amount of rusting or corrosion of steel members could be acceptable, but periodic assessment has to be made to ensure the integrity of these Category 1 structures. Based on the industry experience, the staff cannot accept the “non-significant” finding of the applicant. The staff is reviewing the applicant’s response. The staff will issue a formal RAI .

3.5.2 Reactor Building Structure

3.5.2.1 In your evaluation of technical basis of the fuel pool chemistry activities you have indicated that no credit will be taken for detecting aging effects, because these activities will mitigate the onset and propagation of loss of materials and cracking effects. However, crevice and pitting corrosion may occur at locations of stagnant flow conditions with no possibility to control water chemistry. What provision will be provided in your program for verifying that no significant degradation has occurred to the components in these locations?

Response to 3.5.2-1: The applicant stated that the fuel pool water is continuously recirculated through the pool to maintain design basis temperature and water clarity. The recirculation, coupled with natural circulation, which occurs in the pool as a result of heat transfer, provide adequate mixing to prevent stagnant flow for extended period of time. Fuel pool chemistry is maintained in accordance with the recommendations of EPRI TR-103515. Concentration of chlorides, sulfates, and dissolved oxygen are monitored and kept below the recommended levels to mitigate crevice corrosion and pitting. PBAPS fuel pool chemistry activities are consistent with NUREG-1801, GALL program XI.M2, Water Chemistry. As indicated in NUREG- 1801, Chapter III, Item A5.2-b the program is adequate for managing loss of material for the spent fuel pool liner without further evaluation.

Discussion: The staff found the applicant response acceptable. No further action is needed.

3.5.2-2 The foundation of the Reactor Building Structure is in contact with soils and water (ground water and/or rain water). You state in Table 3.5-2 that there is no aging effect for the concrete foundation and that the aging management activity is not applicable. Provide soil properties and water chemistry that surround the concrete foundation and the reasons that the concrete foundation would have no aging effects.

Response to 3.5.2-2: The applicant stated that the concrete foundation slab is founded on bedrock. Backfill material that surrounds the foundation consists of imported sand and gravel or crushed rock. The density and grading of the backfill material meets the requirements of American Association of State Highway Officials (AASHO) Specification. Ground water around the structure has a pH of 7.2, sulfates of 38 ppm and chlorides of 24 ppm. These conditions are non-aggressive for concrete foundation. Thus its aging effect is non-significant as is discussed in detail in response to 3.5.2-3.

Discussion: The staff will issue a general RAI for concrete components.

3.5.2-3 You state in Table 3.5-2 that there is no aging effect for concrete components, such as walls, slabs, columns, and beams of the Reactor Building Structure, and that the aging management activity is not applicable. The staff does not agree with the result of your aging management review. The staff found concrete deterioration at nuclear power plant structures from time to time during its inspection. Without inspection, concrete structure deterioration will go undetected, and may progress to a point to render the structure non-serviceable. Provide justification as to how the intended function will be maintained without an aging management program during the period of extended operation.

Response to 3.5.2-3: The applicant stated that PBAPS concrete meets the requirements of American Concrete Institute (ACI) Standards 318-63, and constructed to specifications that are based on ACI guidance. Concrete components in buried, outdoor, and sheltered environments were reviewed for loss of material, cracking, and change in material properties. Each aging effect and causal mechanism was evaluated considering concrete materials of construction, soil properties and ground water chemistry, temperature, and irradiation limits. The evaluation concluded that concrete aging effects at PBAPS are non-significant and require no aging management; except for change in material properties, due to leaching of calcium hydroxide, on the walls of the emergency cooling tower and reservoir structure. The applicant provided the technical basis for the conclusion is in a table. The conclusion is supported by PBAPS operating experience, the results of industry and national laboratory investigations (EPRI TR-103842, NUREG/CR-4652, NUREG-1557), and is consistent with GALL evaluation.

Discussion: The staff will issue a general RAI for concrete components.

3.5.2-4 You state in Table 3.5-2 that there is no aging effect for Masonry block walls, and that the aging management activity is not applicable. The staff does not agree with the result of your aging management review. The staff found masonry block wall deterioration at nuclear power plant structures from time to time during its inspection. The deterioration includes masonry cracking and steel angle corrosion. Without inspection, masonry block wall deterioration will go undetected, and may progress to a point to render the block wall non-serviceable. Provide justification as to how the intended function will be maintained without an aging management program during the period of extended operation.

Response to 3.5.2-4: The applicant stated that masonry block walls at PBAPS are located in sheltered environment. They're constructed of concrete block, mortar, and grout or concrete. Concrete block conforms to ASTM C-90 grade U-I. Mortar is in accordance with ASTM C-270, Type N. Concrete and grout are proportioned to develop a minimum compressive strength of 2000 psi at 28 days in accordance with ASTM C-31 and C-39. The walls are reinforced with rebar, which is in accordance with ASTM C-615.

Applicant's aging management reviews determined that these materials in the sheltered, non-aggressive environment are potentially susceptible to loss of material, cracking, and change in material properties. However the aging effects were determined to be non-significant and require no aging management during the period of extended operation. The applicant provided the technical basis for the conclusion is in a table.

In addition, PBAPS operating experience has not identified masonry block wall degradations, which could impact their intended functions. Engineering inspections performed in response to IE Bulletin 80-11, and NRC follow-up inspections identified few issues with the block walls. However the issues are related to the design process, control of attachment loads to the block

walls, and verification that anchors are installed as required by design drawings. None of the issues was age degradation related. The issues were resolved with and closed by NRC. The applicant stated that the response above pertains to masonry block walls. Corrosion of the steel angles, which support the walls, is considered as a "component support" and evaluated in Section 3.5.13.

Discussion: The staff will issue a general RAI for concrete components.

3.5.2-5 You state in Table 3.5-2 that there is no aging effect for structural steel made from carbon steel, and that the aging management activity is not applicable. You list the structural steel as structural steel for supports, reinforced concrete embedments, pipe whip restrains, missile barrier, blowout panels in sheltered environment, and roof deck. The staff does not agree with the result of your aging management review. The staff found corrosion and paint peeling in structural steel at nuclear power plant structures from time to time during its inspection. Without inspection, corrosion and paint peeling in structural steel will go undetected, and may progress to a point to render the steel structure non-serviceable. Provide justification as to how the intended function will be maintained without an aging management program during the period of extended operation.

Response to 3.5.2-5: The applicant stated that the experience with carbon steel materials shows that loss of material, due to corrosion, depends on site-specific environment conditions. Variables, which influence corrosion and corrosion rate, include temperature, humidity, atmospheric chemistry, alternate wetting and drying, and time. Tests conducted in outdoor environments show that initially, the exposed steel surface reacts with available oxygen and moisture in the air to form an oxide film or rust. Once this oxide film has been established and is not disturbed by erosion or alternating wetting and drying, oxidation rate diminishes rapidly with time. For example, Technical industry report (Ref. 1), Figure 4.1-1 provides carbon steel atmospheric corrosion rate obtained from 55 individual tests at six different locations and environments. The figure shows 0.926 mils per year thickness loss during the first 1½ year, decreasing geometrically to 0.21 mils per years after 15 ½ years. The decreasing atmospheric corrosion rates have been confirmed via EPRI testing in outside atmosphere at four nuclear facilities located in Michigan and Washington (Ref. 1, Figure 4.1-2). From these results EPRI concluded that the integrated atmospheric corrosion is less that 0.5 mils per year or less than 1/32 inch (30 mils) for a 60-year exposure. Similar results are documented in corrosion handbooks and steel design manuals (reference 2 & 3). For example reference 2, Figure – 1, shows time-corrosion curves for steels in industrial atmosphere based on tests conducted at Kearny, New Jersey. Using corrosion rate from the curves, the predicted loss of material for 60 years is less than 9 mils. Reference 3, Figure –16, shows corrosion rate results for carbon steel in semi-industrial outdoor environment. The computed loss of material from this reference is less than 18 mils for a 60-year exposure. Structural steel in the PBAPS sheltered environment is exposed to air temperature range of 65°F - 150°F with a relative humidity from 10% - 90%. The environment does not contain aggressive chemicals and protects structural steel from alternate wetting and drying. Our review of industry literature did not identify corrosion tests for sheltered environments. However, the expected loss of material for 60-year exposure to this environment should be less than outdoor environments reviewed above. Assuming outdoor corrosion rates from tests conducted at Kearny, NJ, are conservatively applied to structural steel in PBAPS sheltered environment, then the projected loss of material for 60 years is less than 9 mils. Similarly the use of more conservative corrosion rates provided in references 1 & 3 result in a projected total loss of material of less than 30 mils and 18 mils respectively. However the Kearny, NJ tests should be more representative of PBAPS outdoor

environment because of its geographical proximity. Even the Kearny test corrosion rates are too conservative since PBAPS is located in a rural area where atmospheric pollutants are at lower levels.

PBAPS operating experience revealed no loss of structural steel material due to corrosion in the sheltered environment. Occasional localized rust is observed in highly humid area outside the primary containment. However engineering evaluation of these areas determined that the rust is limited to the surface of the affected members (e.g. discoloration) and has no impact on the structural integrity of the member. Nuclear industry experience as summarized in NUREG-1522 (Ref. 4), and NUREG/CR-6679 (Ref. 5) shows that general degradation of steel structures due to corrosion, other than the containment/liner, is non-significant in nature and occurs infrequently. Based on this analysis and engineering judgment, we concluded that carbon steel exposed to sheltered environment would be subjected to non-significant loss of material due to atmospheric corrosion. The reduction in material thickness will not significantly degrade the load bearing capacity of structural members. This conclusion is supported by PBAPS operating experience and industry experience documented in NUREG-1522. Consequently aging management of loss of material for structural steel exposed to sheltered environment is not required.

References:

1. EPRI TR-103840, BWR Containments License Renewal Industry Report; Revision 1.
2. Design Manual for High Strength Steels, H.M. Priest and J.A. Gilligan, U.S Steel Corp., 1954
3. Metals Handbook, Ninth Edition, Vol. 13, Corrosion, ASM International, 1987.
4. NUREG-1522, “Assessment of Inservice Conditions of Safety-Related Nuclear Plant Structures.”
5. NUREG/CR-6679, “Assessment of Age-Related Degradation of Structures and Passive Components for U.S. Nuclear Power Plants.”

Discussion: The staff will issue a general RAI for structural steel components.

3.5.2-6 Do your concrete embedments include steel anchor bolts both in cast-in-concrete types and in expansion type anchors? If not, how does the intended function of these bolts will be maintained during the period of extended operation?

Response to 3.5.2-6: Anchors are considered subcomponent of the component supports. Thus their aging effects were reviewed with the component supports as listed in Table 3.5-13. The embedded portion of the anchors is considered as an embedment for the purpose of evaluating concrete cracking due to corrosion of embedded steel.

Discussion: The applicant’s response is acceptable to staff. No further action is needed.

3.5.3 Radwaste Building and Reactor Auxiliary Bay

3.5.3-1 The foundation of the Radwaste Building and Reactor Auxiliary Bay Structure is in contact with soils and water (ground water and/or rain water). You state in Table 3.5-3 that there is no aging effect for the concrete foundation and that the aging management activity is not applicable. Provide soil properties and water chemistry that surround the concrete foundation, and the reasons that the concrete foundation would have no aging effects.

Response to 3.5.3-1:See response to 3.5.2-2

Discussion: The staff will issue a general RAI for concrete components.

3.5.3-2 You state in Table 3.5-3 that there is no aging effect for concrete components, such as walls, slabs, columns, and beams of the Radwaste Building and Reactor Auxiliary Bay, and that the aging management activity is not applicable. The staff does not agree with the result of your aging management review. The staff found concrete deterioration at nuclear power plant structures from time to time during its inspection. Without inspection, concrete structure deterioration will go undetected, and may progress to a point to render the structure non-serviceable. Provide justification as to how the intended function will be maintained without an aging management program during the period of extended operation.

Response to 3.5.3-2: See response to 3.5.2-3

Discussion: The staff will issue a general RAI concerning concrete components.

3.5.3- 3 You state in Table 3.5-3 that there is no aging effect for Masonry block walls, and that the aging management activity is not applicable. The staff does not agree with the result of your aging management review. The staff found masonry block wall deterioration at nuclear power plant structures from time to time during its inspection. The deterioration include masonry cracking and steel angle corrosion. Without inspection, masonry block wall deterioration will go undetected, and may progress to a point to render the block wall non-serviceable. Provide justification as to how the intended function will be maintained without an aging management program during the period of extended operation.

Response to 3.5.3-3: See Response to 3.5.2-4

Discussion: he staff will issue a general RAI for concrete steel components.

3.5.3-4 You state in Table 3.5-3 that there is no aging effect for structural steel made from carbon steel, and that the aging management activity is not applicable. You list the structural steel as structural steel for supports, reinforced concrete embedments, jet impingement shields, and missile barrier. The staff does not agree with the result of your aging management review. The staff found corrosion and paint peeling in structural steel at nuclear power plant structures from time to time during its inspection. Without inspection, corrosion and paint peeling in structural steel will go undetected, and may progress to a point to render the steel structure non-serviceable. Provide justification as to how the intended function will be maintained without an aging management program during the period of extended operation.

Response to 3.5.3-4: See Response to 3.5.2-5.

Discussion: The staff will issue a general RAI for concrete components.

3.5.3-5 Do your concrete embedments include steel anchor bolts both in cast-in-concrete types and in expansion type anchors? If not, how does the intended function of these bolts will be maintained during the period of extended operation?

Response to 3.5.3-5: See Response to 3.5.2-6.

3.5.8 Stack

3.5.8-1 The foundation of the stack is in contact with soils and water (ground water and/or rain water). You state in Table 3.5-8 that there is no aging effect for the concrete foundation and that the aging management activity is not applicable. Provide soil properties and water chemistry that surround the concrete foundation of the stack, and the reasons that the concrete foundation would have no aging effect.

Response to 3.5.8-1: See response to 3.5.2-2.

Discussion: Discussion: The staff will issue a general RAI for concrete components.

3.5.8-2 You state in Table 3.5-8 that there is no aging effect for the concrete stack, and that the aging management activity is not applicable. The staff does not agree with the result of your aging management review. The staff found concrete deterioration at nuclear power plant structures from time to time during its inspection. Without inspection, concrete structure deterioration will go undetected, and may progress to a point to render the structure non-serviceable. Provide justification as to how the intended function will be maintained without an aging management program during the period of extended operation.

Response to 3.5.8-2: The applicant stated that the stack is designed and constructed to meet the requirements of ACI 307-69, Specification for the design and Construction of Reinforced Concrete Chimneys. Concrete materials and mix design are consistent with those discussed in response to RAI 3.5.2-3. Thus, the response to Question 3.5.2-3 applies to this Question.

Discussion: Discussion: The staff will issue a general RAI for concrete components.

3.5.10 Diesel Generator Building

3.5.10-1 The foundation of the Diesel Generator Building is in contact with soils and water (ground water and/or rain water). You state in Table 3.5-10 that there is no aging effect for concrete foundation and that the aging management activity is not applicable. Provide soil properties and water chemistry that surround the concrete foundation of the stack, and the reasons that the concrete foundation would have no aging effect.

Response to 3.5.10-1: See response to 3.5.2-2.

Discussion: Discussion: The staff will issue a general RAI for concrete components.

3.5.10-2 You state in Table 3.5-10 that there is no aging effect for concrete components, such as walls, slabs, columns, and beams of the Diesel Generator Building, and that the aging management activity is not applicable. The staff does not agree with the result of your aging management review. The staff found concrete deterioration at nuclear power plant structures from time to time during its inspection. Without inspection, concrete structure deterioration will go undetected, and may progress to a point to render the structure non-serviceable. Provide justification as to how the intended function will be maintained without an aging management program during the period of extended operation.

Response to 3.5.10-2: See response to 3.5.2-3

Discussion: The staff will issue a general RAI for concrete components.

3.5.10-3 You state in Table 3.5-10 that there is no aging effect for structural steel made from carbon steel, and that the aging management activity is not applicable. You list the structural steel as structural steel for supports and reinforced concrete embedments. The staff does not agree with the result of your aging management review. The staff found corrosion and paint peeling in structural steel at nuclear power plant structures from time to time during its inspection. Without inspection, corrosion and paint peeling in structural steel will go undetected, and may progress to a point to render the steel structure non-serviceable. Provide justification as to how the intended function will be maintained without an aging management program during the period of extended operation.

Response to 3.5.10-3: See response to 3.5.2-5

Discussion: Discussion: The staff will issue a general RAI for structural steel components.

3.5.10-4 You state in Table 3.5-10 that there is no aging effect for steel foundation piles made from carbon steel, and that the aging management activity is not applicable because NUREG-1557 indicated that steel piles driven in undisturbed soils have been unaffected by corrosion. Nevertheless, you did not state that your piles were driven in undisturbed soils. State whether your piles were driven in undisturbed soils.

Response to 3.5.10-4: The applicant stated that piles for the emergency diesel generator building foundation were driven into the reclaimed area of Conowingo Pond or in the backfilled areas where the rock was excavated during plant construction. The note on Table 3.5-10 is incomplete and should have stated, "Steel piles driven in undisturbed soils have been unaffected by corrosion and those driven in disturbed soil experience minor to moderate corrosion to a small area of the metal." Therefore, according to NUREG-1557, the aging effect is non-significant and will not impact the intended function of piles.

Discussion: The staff will issue a general RAI for structural steel components.

3.5.10-5 Do your concrete embedments include steel anchor bolts both in cast-in-concrete types and in expansion type anchors? If not, how does the intended function of these bolts will be maintained during the period of extended operation?

Response to 3.5.10-5: See response to 3.5.2-6

3.5.12 Recombiner Building

3.5.12-1 The foundation of the Recombiner Building is in contact with soils and water (ground water and/or rain water). You state in Table 3.5-12 that there is no aging effect for concrete foundation and that the aging management activity is not applicable. Provide soil properties and water chemistry that surround the concrete foundation of the stack, and the reasons that the concrete foundation would have no aging effect.

Response to 3.5.12-1: See Response to 3.5.2-2

Discussion: The staff will issue a general RAI for concrete components.

3.5.12-2 You state in Table 3.5-12 that there is no aging effect for concrete components, such as walls, slabs, columns, and beams of the Recombiner Building, and that the aging management activity is not applicable. The staff does not agree with the result of your aging management review. The staff found concrete deterioration at nuclear power plant structures from time to time during its inspection. Without inspection, concrete structure deterioration will go undetected, and may progress to a point to render the structure non-serviceable. Provide justification as to how the intended function will be maintained without an aging management program during the period of extended operation.

Response to 3.5.12-2: See response to 3.5.2-3

Discussion: The staff will issue a general RAI for concrete components.

3.5.12-3 You state in Table 3.5-12 that there is no aging effect for structural steel made from carbon steel, and that the aging management activity is not applicable. The staff does not agree with the result of your aging management review. The staff found corrosion and paint peeling in structural steel at nuclear power plant structures from time to time during its inspection. Without inspection, corrosion and paint peeling in structural steel will go undetected, and may progress to a point to render the steel structure non-serviceable. Provide justification as to how the intended function will be maintained without an aging management program during the period of extended operation.

Response to 3.5.12-3: See response to 3.5.2-5

Discussion: The staff will issue a general RAI for structural steel components.

3.5.4 Turbine Building and Main Control Room Complex

3.5.4-1 LRA Section 3.5.4 and Table 3.5.4-1 indicate that aging management is not required for reinforced concrete structural members (walls, slabs, columns, beams and foundation) and reinforced concrete masonry block walls. However, there has been sufficient industry operating experience that demonstrates the need for aging management of concrete nuclear structures. ACI 349.3R was specifically developed to provide guidance for inspection of concrete nuclear structures other than containment. Implementation of Structures Monitoring under the Maintenance Rule (10 CFR 50.65) includes inspection of concrete for age-related degradation. This is a current licensing basis requirement that can be credited for aging management of concrete for the period of extended operation. Based on the above discussion, the staff requests the applicant to provide the technical basis why current licensing basis programs for inspection of concrete are not credited as AMPs for license renewal.

Response: The applicant stated that PBAPS aging management reviews concluded that reinforced concrete and reinforced concrete masonry wall aging effects are non-significant and require no aging management. Technical basis for this determination is provided in response to RAI 3.5.2-3 and RAI 3.5.2-4.

Discussion: The staff will issue a general RAI for concrete components.

3.5.4-2 LRA Section 3.5.4 and Table 3.5.4-1 indicate that aging management is not required for structural steel members (structural steel, reinforced concrete embedments and missile barrier). No basis for this conclusion is provided in the LRA. The staff requests the applicant to

provide a technical justification for this conclusion and to specifically address the potential effect of humidity on degradation of the structural steel members.

Response: See response to 3.5.2-5.

Discussion: The staff will issue a general RAI for structural steel components.

3.5.5 Emergency Cooling Tower and Reservoir

3.5.5-1 Provide justification for concluding that there are no aging effects for concrete components for each of the three possible environments (buried, outdoor, sheltered).

Response: See Response to 3.5.2-3

Discussion: The staff will issue a general RAI for concrete components.

3.5.5-2 Provide justification for concluding that there are no aging effects for the reinforced concrete block walls.

Response: See Response to 3.5.2-4

Discussion: The staff will issue a general RAI for concrete components.

3.5.5-3 Provide justification for concluding that there are no aging effects for the sheltered carbon steel components.

Response: See Response to 3.5.2-5

Discussion: The staff will issue a general RAI for structural steel components.

3.5.6 Station Blackout Structure and Foundation

3.5.6-1 LRA Section 3.5.6 and Table 3.5.6-1 indicate that aging management is not required for reinforced concrete foundation. The staff understands that implementation of Structures Monitoring under the Maintenance Rule (10 CFR 50.65) includes inspection of concrete for age-related degradation. The staff requests the applicant to provide the technical basis why current licensing basis programs for inspection of concrete are not credited as AMPs for license renewal.

Response: The applicant stated that the scope of PBAPS Maintenance Rule Structures Monitoring Program includes concrete structures. The program however is not credited for managing concrete aging effects during the extended period of operation because our AMRs concluded that concrete aging effects do not require management. Technical basis for this conclusion is provided in response to 3.5.2-2.

Discussion: The staff will issue a general RAI for concrete components.

3.5.6-2 LRA Section 3.5.6 and Table 3.5.6-1 indicate that aging management is not required for structural steel members (structural steel and reinforced concrete embedments). No basis

for this conclusion is provided in the LRA. The staff requests the applicant to provide a technical justification for this conclusion.

Response: See response to 3.5.2-5

Discussion: The staff will issue a general RAI for structural steel components.

3.5.7 Yard Structures

3.5.7-1 Provide justification for concluding that there are no aging effects for concrete components for each of the two possible environments (buried, outdoor).

Response: See response to 3.5.2-3

Discussion: The staff will issue a general RAI for concrete components.

3.5.7-2 Provide justification for concluding that there are no aging effects for the sheltered carbon steel components.

Response: See response to 3.5.2-5

Discussion: The staff will issue a general RAI for structural steel components.

3.5.9 Nitrogen Storage Building

3.5.9-1 LRA Section 3.5.9 and Table 3.5.9-1 indicate that aging management is not required for reinforced concrete structural members (walls, slabs and foundation). The staff understands that implementation of Structures Monitoring under the Maintenance Rule (10 CFR 50.65) includes inspection of concrete for age-related degradation. The staff requests the applicant to provide the technical basis why current licensing basis programs for inspection of concrete are not credited as AMPs for license renewal.

Response: See response to 3.5.6-1

Discussion: The staff will issue a general RAI for concrete components.

3.5.11 Circulating Water Pump Structure

3.5.11-1 LRA Section 3.5.11 and Table 3.5.11-1 indicate that aging management is not required for reinforced concrete structural members (walls, slabs, columns, beams and foundation) and reinforced concrete masonry block walls. However, there has been sufficient industry operating experience that demonstrates the need for aging management of concrete nuclear structures. The staff understands that implementation of Structures Monitoring under the Maintenance Rule (10 CFR 50.65) includes inspection of concrete for age-related degradation. This is a current licensing basis requirement that can be credited for aging management of concrete for the period of extended operation. The staff requests the applicant to provide the technical basis why current licensing basis programs for inspection of concrete are not credited as AMPs for license renewal.

Response: See response to 3.5.6-1

Discussion: The staff will issue a general RAI for concrete components.

3.5.11-2 LRA Section 3.5.11 and Table 3.5.11-1 indicate that aging management is not required for structural steel members (structural steel, reinforced concrete embedments and sluice gates). No basis for this conclusion is provided in the LRA. The staff requests the applicant to provide a technical justification for this conclusion and to specifically address the potential effect of humidity on degradation of the structural steel members.

Response: See response to 3.5.2-5

Discussion: The staff will issue a general RAI for structural steel components.

3.5.13 Component Supports

3.5.13-1 LRA Section 3.5.13 and Table 3.5.13 indicate that aging management is not required for anchors support members (carbon steel and alloy steel materials only). No basis for this conclusion is provided in the LRA. The staff requests the applicant to provide a technical justification for this conclusion and to specifically address the potential effect of humidity on degradation of these materials.

Response: See response to 3.5.2-5

Discussion: The staff will issue a general RAI for structural steel components.

3.5.15 Miscellaneous Steel

3.5.15-1 Provide justification for concluding that there are no aging effects for steel components for each of the two possible environments (sheltered, outdoor).

Response: The applicant stated that:
1. Carbon steel components in sheltered environment.
   See response to RAI 3.5.2-5.

2. As indicated in Table 3.5-15, the only steel components exposed to outdoor environment are manhole covers. The covers are, heavy-duty type ferrous castings, manufactured by NEENAH Foundry Co. to ASTM, AASHTO, and Federal standards. The higher silicon content and the presence of graphite flakes contained in the ferrous materials for these castings provide natural corrosion resistance. The covers are widely used by utilities and highway departments for manhole covers in extreme/severe outdoor environment. Experience has shown that loss of material due to corrosion is non-significant and will not impact the intended function of the covers.

Discussion: The staff will issue a general RAI for structural steel components.

3.5.16 Electrical and Instrumentation Enclosures and Raceways

3.5.16-1 Provide justification for concluding that there are no aging effects for steel components for each of the two possible environments (sheltered, outdoor).

Response: The applicant stated that:

1. Carbon steel components in sheltered environment.
   See response to 3.5.2-5.

2. Steel components in outdoor environment.
   The only steel components in Table 3.5.16-1, which are located in the outdoor environment, are 2-2 ½ inch diameter electrical conduits and fittings. The conduits provide protection against outdoor elements (rain, snow, wind) and structural support to cables credited for fire protection. Material for the conduits and fittings are hot dip galvanized and resistant to atmospheric corrosion. Therefore loss of material for the 13/64-inch thick conduits is expected to non-significant and will not impact their intended function.

Discussion: The staff will issue a general RAI for structural steel components.

3.5.17 Insulation

3.5.17-1 Provide the following information concerning isolation jacketing:

List the components which have isolation jacketing and are included in your aging management program

How often isolation jacketing on these components are inspected?

What is the operating experience for this type of isolation jacketing?

Response: The applicant stated that the piping associated with the water supply from the condensate storage tank (CST) to the HPCI, RCIC and Core Spray systems, and piping associated with CST level monitoring, is located outdoors and is insulated with jacketed insulation. This is the jacketed insulation that is included in the aging management program identified in Table 3.5.17, "Outdoor, Buried and Submerged Component Inspection Activities" (LRA Appendix B.2.5).

The outdoor piping insulation jacketing is inspected annually.

Various pipe system insulation inspections have revealed no corrosion degradation of the jacketing itself; rather the jacketing has been damaged as a result of other outdoor work processes. Corrective maintenance work orders have been written as necessary to repair or replace any insulation or jacketing damage. Outdoor piping insulation jacketing has required repairs due to work process damage - not by corrosion degradation.

Discussion: The applicant response is acceptable to the staff. However, the staff will issue the formal RAI.

TELECOMMUNICATION PARTICIPANTS

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Attachment 2