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Calvert Cliffs Nuclear Power Plant
1650 Calvert Cliffs Parkway
Lusby, Maryland 20657
410 495-4455

BGE

July 30, 1997

U. S. Nuclear Regulatory Commission
Washington, DC 20555

ATTENTION: Document Control Desk

SUBJECT: Calvert Cliffs Nuclear Power Plant
Unit Nos. 1 & 2; Docket Nos. 50-317 & 50-318
Request for Review and Approval of Commodity Report on Environmentally Qualified Equipment for License Renewal

REFERENCES:

(a) Letter from Mr. R. E. Denton (BGE) to NRC Document Control Desk, dated August 18, 1995, Integrated Plant Assessment Methodology

(b) Letter from Mr. D. M. Crutchfield (NRC) to Mr. C. H. Cruse (BGE), dated, April 8, 1996, Final Safety Evaluation (FSE) Concerning The Baltimore Gas and Electric Company Report entitled, Integrated Plant Assessment Methodology

(c) Letter from Mr. S. C. Flanders (NRC), dated March 4, 1997, "Summary of Meeting with Baltimore Gas and Electric Company (BGE) on BGE License Renewal Activities"

This letter forwards the attached Integrated Plant Assessment (IPA) Commodity Report on Environmentally Qualified Equipment for review and approval in accordance with 10 CFR Part 54, the License Renewal Rule. Should we apply for License Renewal, we will reference IPA System and Commodity Reports as meeting the requirements of 10 CFR 54.21(a), "Contents of application-technical information," and the demonstration required by 10 CFR 54.29(a)(1), "Standards for issuance of a renewed license."

This report documents Baltimore Gas and Electric Company's (BGE's) evaluation of the Calvert Cliffs Nuclear Power Plant's environmentally-qualified equipment and its Environmental Qualification (EQ) Program with regard to license renewal. Calvert Cliffs is a Division of Operating Reactors Guidelines plant. This report does not change Calvert Cliffs' current licensing basis relative to EQ. Baltimore Gas and Electric Company has Division of Operating Reactors Guideline, NUREG-0588, and 10 CFR 50.49

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qualified equipment. Calvert Cliffs will continue to function in the period of extended operation as it does today relative to EQ, except as required by changes to regulatory requirements. Equipment that must be replaced due to the approaching end of its qualified life will be replaced in accordance with regulatory constraints associated with 10 CFR 50.49.

This is consistent with the contents of the November 15, 1996 Report to the NRC on Status of the EQ Task Action Plan (WITS 9300107). This report stated that the staff recognized that there were differences in the methodology and requirements that had been imposed on each licensee according to the original licensing requirements of each individual plant. It further stated that based on actions taken by the NRC since the EQ rule and the margins inherent to the qualification process itself, an acceptable level of safety is assured independent of which qualification requirements were implemented. To quote that report, "The staff concluded that the differences between older and newer EQ requirements do not constitute a significant safety issue, and that adequate margin exists in the qualification process for both older and newer plants to ensure public health and safety."

On another issue, to quote the report further, "The staff believes, however, that because of uncertainties in predicting age-related degradation, condition monitoring (i.e., an inservice inspection program) provides the simplest and most effective approach to assuring environmental qualification for the license renewal term. . . . The staff is currently sponsoring research to investigate whether certain condition monitoring techniques can be used successfully to predict the condition of nuclear power plant cables that are within the scope of 10 CFR 50.49."

Baltimore Gas and Electric Company takes these NRC positions as affirmations of the Calvert Cliffs approach to EQ during the period of extended operation upon license renewal, as documented in the attached report. Baltimore Gas and Electric Company will continue to monitor research in the area of condition monitoring through Electric Power Research Institute and Nuclear Energy Institute, and will respond to any new regulatory requirements arising from the resolution of this aspect of Generic Safety Issue 168. To the extent that regulatory acceptance and economic and technical considerations support it, we will consider using condition monitoring when extended life margins warrant reinforcement of analytical results.

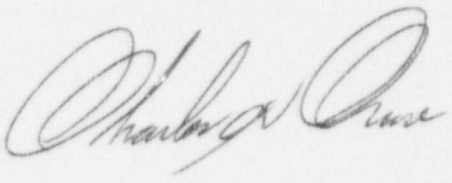
The information in this report is accurate as of the dates of the references listed therein. Per 10 CFR 54.21(b), an amendment or amendments will be submitted that identify any changes to the current licensing basis that materially affect the content of the license renewal application.

In Reference (a), BGE submitted the IPA Methodology for review and approval. In Reference (b), the NRC concluded that the IPA Methodology is acceptable for meeting 10 CFR 54.21(a)(2) of the license renewal rule, and if implemented, provides reasonable assurance that all structures and components subject to an aging management review pursuant to 10 CFR 54.21(a)(1) will be identified. Additionally, the NRC concluded that the methodology provides processes for demonstrating that the effects of aging will be adequately managed pursuant to 10 CFR 54.21(a)(3) that are conceptually sound and consistent with the intent of the license renewal rule.

In Reference (c), the NRC stated that if the format and content of these reports met the requirements of the template developed by BGE, the NRC could begin its technical review. This report has been produced and forwarded in accordance with these guidance documents.

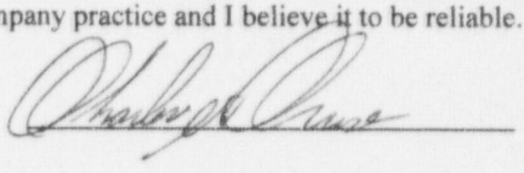
Should you have questions regarding this matter, we will be pleased to discuss them with you.

Very truly yours,



STATE OF MARYLAND :
: **TO WIT:**
COUNTY OF CALVERT :

I, Charles H. Cruse, being duly sworn, state that I am Vice President, Nuclear Energy Division, Baltimore Gas and Electric Company (BGE), and that I am duly authorized to execute and file this response on behalf of BGE. To the best of my knowledge and belief, the statements contained in this document are true and correct. To the extent that these statements are not based on my personal knowledge, they are based upon information provided by other BGE employees and/or consultants. Such information has been reviewed in accordance with company practice and I believe it to be reliable.



Subscribed and sworn before me, a Notary Public in and for the State of Maryland and County of Calvert, this 30 day of July, 1997.

WITNESS my Hand and Notarial Seal:

Michelle D Hall
Notary Public

My Commission Expires:

February 2, 1998
Date

CHC/SJR/dlm

Attachment (1): Appendix A - Technical Information; 6.3 - Environmentally Qualified Equipment

cc: R. S. Fleishman, Esquire
J. E. Silberg, Esquire
Director, Project Directorate I-1, NRC
A. W. Dromerick, NRC
S. C. Flanders, NRC
H. J. Miller, NRC
Resident Inspector, NRC
R. I. McLean, DNR
J. H. Walter, PSC

ATTACHMENT (1)

APPENDIX A - TECHNICAL INFORMATION

6.3 - ENVIRONMENTALLY QUALIFIED EQUIPMENT

Baltimore Gas and Electric Company
Calvert Cliffs Nuclear Power Plant
July 30, 1997

6.3 Environmentally Qualified Equipment

This is a section of the Baltimore Gas and Electric Company (BGE) License Renewal Application (LRA), addressing the Environmentally Qualified (EQ) Equipment. The EQ Equipment has been evaluated in accordance with the Calvert Cliffs Nuclear Power Plant (CCNPP) Integrated Plant Assessment (IPA) Methodology described in Section 2.0 of the BGE LRA. The results are presented below. These sections are prepared independently and will, collectively, comprise the entire BGE LRA.

Because this section of the BGE LRA provides justification for the aging management afforded by a plant program, the Environmental Qualification (also used as EQ) Program, instead of the techniques utilized for the aging management of a plant system, its approach will differ from the template employed to generate the other BGE LRA sections. It provides three things: (1) a discussion of the program, and the devices included in the program, that indicates how the program provides effective aging management of those passive, long-lived EQ devices that require aging management review (AMR) for license renewal; (2) a discussion of the program and its function as a Time Limited Aging Analysis (TLAA) for license renewal for all long-lived EQ devices; and (3) a discussion of the program with regard to accelerated aging issues in Generic Safety Issue (GSI) 168, "Environmental Qualification of Electrical Equipment." This section of the BGE LRA is provided to specifically address the EQ provision (10 CFR 50.49) of 10 CFR 54.4(a)(3).

6.3.1 Scoping

Title 10 CFR 50.49 requires that the aging of EQ equipment be addressed such that required Design Basis Event (DBE) functionality is ensured if the equipment is exposed to postulated harsh environmental conditions at any time up to and including the end of the equipment's qualified life. The CCNPP EQ Program addresses the effects of aging to ensure that the required electrical equipment EQ functionality is maintained, as required, by analytically determining the qualified life of the program equipment and determining the maintenance required to maintain qualification. The program is also referred to as the CCNPP 50.49 Program. [Reference 1, Section 1.3]

The License Renewal Rule (10 CFR Part 54) requires that the effects of aging of passive, long-lived equipment be managed. During the component level scoping process, described in Section 4.0 of the CCNPP IPA Methodology, the performance of safety-related functions under harsh environmental accident conditions was identified and associated with EQ components designated as SR-5049 on the Calvert Cliffs Quality List (Q-List). During the scoping process to determine structures and components subject to AMR, any structures or components (including those designated as SR-5049) that are replaced at intervals shorter than 40 years, are excluded from further AMR. Those EQ devices with qualified lives greater than or equal to 40 years were included on the list of structures or components subject to AMR, in accordance with 10 CFR 54.4(a)(3), and have been designated for evaluation under this section of the BGE LRA. [Reference 1, Section 1.3]

In this regard, an EQ device may have intended functions in the scope of license renewal that are not managed by the EQ Program. For example, a normally open solenoid valve (SV) may have an EQ function of closure under DBE conditions, and a pressure-retaining license renewal function. The functionality of the operator portion of the valve would be ensured by the EQ Program. Any plausible aging, which could affect the pressure-retaining function, could be managed by the EQ Program (e.g., if the entire SV is replaced at 40 years), or it could be managed by means other than the EQ Program. This

section of the BGE LRA addresses the effects of aging on passive, long-lived EQ equipment, whether managed by the CCNPP 50.49 Program or some other means. Where addressed by other means, those means are identified. [Reference 1, Section 1.3]

6.3.1.1 System Level Scoping

Since the EQ Program is not specific to any particular system and applies, in fact, to many systems, the system level scoping considerations normally addressed are not applicable in this case. [Reference 1, Section 2.0]

6.3.1.2 Component Level Scoping

The equipment which satisfies 10 CFR 50.49(b)(1) and (b)(2) is classified as safety-related and further designated as Class 1E on the Calvert Cliffs Q-List. The equipment which satisfies 10 CFR 50.49(b)(3) was identified in the CCNPP response to NRC Inspection and Enforcement Bulletin (IEB) 79-01B. This equipment is classified as safety-related and further designated as PAM1 or PAM2 on the CCNPP Q-List. Electrical equipment which is required to perform a safety-related function, after being subjected to, or while exposed to, harsh environmental conditions induced by DBEs, is further designated as 5049 on the Q-List. [Reference 1, Section 1.2.2]

Device Types Subject to AMR

Table 6.3-1 contains a summary of those EQ device types that are within the scope of license renewal and includes the applicable abbreviation of each device type. [Reference 1, Table 2-1]

TABLE 6.3-1
SUMMARY OF EQ DEVICE TYPES WITHIN SCOPE OF LICENSING RENEWAL

Cables (CBL)	Core Exit Thermocouple System (RI)
Current/Pneumatic Transducer (I/P)	Seal (SEAL)
Junction Box (WRNMS)	Solenoid Valve (SV)
Level Transmitter (LT)	Terminal Block (TB)
Motors (M, MA, MB)	Temperature Element (TE)
Valve Motor Operator (MOVOP)	Reactor Vessel Level Monitoring System In-Core
Neutron Flux Monitoring Instrument Assembly (NE)	Assembly (TP)
Containment Penetration Assembly (PEN)	Temperature Switch (TS)
Pressure Transmitter (PT)	Vibration Element (VE)
Hydrogen Recombiner (RCMB)	Vibration Signal Transmitter (VT)
Flow Transmitter (FT)	Pressure Switch (PS)
Radiation Element (RE)	Position Switch (ZS)

As seen from this table, EQ equipment includes motor-operated valve operators; however, the associated valve bodies are given their own unique equipment identifiers and are not identified as EQ equipment. In those cases, evaluation of aging mechanisms applicable to the valve body, disc, and seat is under the appropriate equipment group containing these valves and included in the applicable system section of the BGE LRA. When the valve and the operator are a single unit (SVs), and the unique equipment identifier is designated as EQ, then aging of the valve body, internals, and operator are addressed in this section of the BGE LRA. [Reference 1, Section 4.2.2]

After identification of long-lived, passive components, consideration must be given to the aging of these components in their normal service environment. Plausible aging mechanisms are identified from a list of potential age-related degradation mechanisms (ARDMs) based on operating environmental conditions and the presence of material in the component, which is known to be susceptible to the effects of one or more of the potential aging mechanisms. [Reference 1, Section 4.1]

6.3.2 The Aging Management Function of the EQ Program

Section 6.3.2.1 presents the evaluation of the ARDMs for the various EQ device types. Section 6.3.2.2 discusses the CCNPP 50.49 Program that manages these ARDMs. Section 6.3.2.3 provides the operating history and design basis of the program. Section 6.3.2.4 discusses the methods utilized to effectively manage the effects of aging. Section 6.3.2.5 provides a conclusion regarding the effectiveness of aging management of EQ device types at CCNPP.

6.3.2.1 ARDM Evaluation

Of the EQ device types listed in Table 6.3-1, only eight were determined to be subject to AMR. The remaining device types were determined to be active either in the individual system pre-evaluation tasks or in the Instrument Lines Commodity Evaluation. These eight device types subject to AMR are presented in Table 6.3-2 with the ARDMs that could potentially affect them. ARDMs that were evaluated for a device type but were determined to be not plausible have been marked as not plausible using the symbol (×) in the device type's column. Age-related degradation mechanisms that have been determined to be plausible for a device type have been marked with a check mark (✓) in the device type's column. These ARDMs are based on aging from exposure to normal service. [Reference 1, Table 4-1, Section 4.2.3]

TABLE 6.3-2
POTENTIAL AND PLAUSIBLE ARDMS FOR EQ DEVICE TYPES

	EQ DEVICE TYPES SUBJECT TO AMR							
POTENTIAL ARDMs	CBL	PEN	SEAL	SV	TB	TP	RI	WRNMS
Cavitation Erosion				×				
Corrosion Fatigue				×				
Crevice Corrosion		×		✓		✓	✓	
Erosion Corrosion				×				
Fatigue		×		×				
Fouling				×				
Galvanic Corrosion				×				
General Corrosion		✓		×	×			
Hydrogen Damage		×		×				
Intergranular Attack		×		×				
Kapton Unique Aging				✓				
Microbiologically-Induced Corrosion		×		×				
Oxidation		×		×				
Particulate Wear Erosion				×				
Pitting		×		✓		✓	✓	
Radiation Damage	✓	✓	✓	✓	✓	✓	✓	✓
Rubber Degradation				×				
Selective Leaching				×				
Stress Corrosion Cracking		×		×				
Stress Relaxation		×		×				
Thermal Damage	✓	✓	✓	✓	✓	✓	✓	✓
Thermal Embrittlement		×		×				
Wear				×				

Passive Intended Functions

For the eight EQ device types having plausible ARDMs, Table 6.3-3 identifies their intended functions. Active device types and short-lived device types (requiring periodic replacement of device or device wear parts) are not subject to AMR. The intended functions for each of the device types subject to AMR are included in Table 6.3-3. Active functions are included for information. The passive functions are identified as EQ and non-EQ. [Reference 1, Sections 3.0, 4.0]

TABLE 6.3-3
INTENDED FUNCTIONS FOR DEVICE TYPES REQUIRING AMR

DEVICE TYPE	INTENDED FUNCTION
CBL	Provide electrical continuity for the execution of safety-related functions under harsh environmental conditions associated with a DBE occurring at the end of the plant's licensed life (Passive-EQ).
WRNMS	(1) Provide indication of reactor core neutron flux levels (Active). (2) Provide electrical continuity for the execution of safety-related functions under harsh environmental conditions associated with a DBE occurring at the end of the plant's licensed life (Passive-EQ).
PEN (EPA)	(1) Provide electrical continuity for the execution of safety-related functions under harsh environmental conditions associated with a DBE occurring at the end of the plant's licensed life (Passive-EQ). (2) Provide a containment pressure boundary function to prevent the release of fission products in the event of a DBE occurring at the end of the plant's licensed life (Passive-non-EQ).
RI (CETX)	(1) Provide indication of reactor core exit temperatures (Active). (2) Provide pressure seal at the reactor vessel (Passive-non-EQ). (3) Provide electrical continuity for the execution of safety-related functions under harsh environmental conditions associated with a DBE occurring at the end of the plant's licensed life (Passive-EQ).
SEAL	Prevent moisture intrusion into splices, terminations, conduits, and equipment housings, under accident conditions, to protect cables and equipment relied upon to execute safety-related functions, under harsh environmental conditions, associated with a DBE occurring at the end of the plant's licensed life (Passive-EQ).
SV	(1) Open/close control of venting, sampling, and instrument air (IA) flow paths to support the execution of safety-related functions (Active). (2) Maintain system pressure boundary to support safety-related functions (Passive-non-EQ).
TB	Provide electrical continuity for the execution of safety-related functions under harsh environmental conditions associated with a DBE occurring at the end of the plant's licensed life (Passive-EQ).
TP (RVLMS)	(1) Provide indication of water level in the reactor vessel (Active). (2) Provide pressure seal at reactor vessel (Passive-non-EQ). (3) Provide electrical continuity for the execution of safety-related functions under harsh environmental conditions associated with a DBE occurring at the end of the plant's licensed life (Passive-EQ).

For each of the device types in Table 6.3-3, the following discussions describe the aging management programs in place for each of the plausible ARDMs. Each EQ device type is analyzed in detail in the CCNPP 50.49 Program EQ Files (EQFs). The EQFs for each device type requiring AMR are identified in the following discussions.

Cables (CBL)

The cables subject to AMR (EQFs CBL001, 003, 008, 009, 010, 011, 013, 018, 019, 024, 027, 031, 035, 037, 038, 039, 041, 043, 045, and 046) are susceptible only to radiation and thermal damage. These aging mechanisms affect organic material and are addressed by the CCNPP 50.49 Program to ensure electrical safety-related functionality throughout the component's qualified life. [Reference 1, Tables 4-1 and 4-3]

WRNMS

The Wide Range Nuclear Monitoring System (WRNMS) is susceptible only to radiation and thermal damage, and these ARDMs are managed by the CCNPP 50.49 Program. [Reference 1, Table 4-10]

Penetrations (PEN)

Penetrations are deemed to be susceptible to radiation, thermal damage, and general corrosion, as indicated in Table 6.3-4, for the various penetration types that are subject to AMR. The aging management programs, other than the CCNPP 50.49 Program, and ARDMs indicated in this table by an (*), are addressed in Section 3.3, Structures (under Containment Systems), of the BGE LRA within the discussions for non-EQ and mechanical penetrations. The ARDMs and their managing programs are equivalent. [Reference 1, Table 4-4]

TABLE 6.3-4
AGING MANAGEMENT PROGRAMS FOR PLAUSIBLE PENETRATION (PEN) ARDMS

APPLICABLE EQFS	AGING MECHANISMS	PLAUSIBLE	AGING MECHANISM PROGRAM
EPA004 - Types 2A, 2B, 2C, 2D, 3A, 3C, & 3E	Radiation Damage	No	N/A
	Thermal Damage	No	
	General Corrosion*	Yes	PEG-7*, MN-3-100*, QL-2-100*
EPA004 - Type 3D	Radiation Damage	Yes	CCNPP 50.49 Program
	Thermal Damage	Yes	
	General Corrosion*	Yes	PEG-7*, MN-3-100*, QL-2-100*
EPA010 - Types 2A, 2B, 4A, 4B	Radiation Damage	Yes	CCNPP 50.49 Program
	Thermal Damage	Yes	
	General Corrosion*	Yes	PEG-7*, MN-3-100*, QL-2-100*

Seals (SEAL)

The seals subject to AMR (SEAL01, 02, 04, 06, 08, 09, 10, 11, 12, 13, 14, 15, and 16) are susceptible only to radiation and thermal damage, and these ARDMs are managed by the CCNPP 50.49 Program. [Reference 1, Table 4-5]

Solenoid Valves (SV)

Solenoid valves are susceptible to radiation and thermal damage, crevice corrosion, pitting, and Kapton unique aging (Kapton undergoes accelerated aging when under sufficient mechanical stress in a hot and wet environment), as indicated in Table 6.3-5, for the various SV types that are subject to AMR. The aging management programs and ARDMs indicated in this table by an (*), are addressed in Section 5.13, NSSS Sampling, of the BGE LRA for equivalent SVs. [Reference 1, Table 4-7]

TABLE 6.3-5
AGING MANAGEMENT PROGRAMS FOR PLAUSIBLE SV ARDMS

APPLICABLE EQFS	AGING MECHANISMS	PLAUSIBLE	AGING MECHANISM PROGRAM
SV0026 Target Rock 79 UU-001-1 Reactor Coolant System Vent Service	Radiation Damage	Yes	CCNPP 50.49 Program
	Thermal Damage	Yes	
	Crevice Corrosion, Pitting	No, corrosion of 316SS prevented by low oxygen content of Reactor Coolant System	N/A
SV0029 Valcor V526-5295-xxx Post-Accident Monitoring Service	Radiation Damage	Yes	CCNPP 50.49 Program
	Thermal Damage	Yes	
	Crevice Corrosion*, Pitting*	Yes	Chemistry Control Program* (wetted valves only); Age-Related Degradation Inspection*
	Kapton unique aging	Yes	CCNPP 50.49 Program
SV0034 ASCO NP(L) 8316 A65E IA Service	Radiation Damage	Yes	CCNPP 50.49 Program
	Thermal Damage	Yes	
	Crevice Corrosion, Pitting	No	N/A
SV0038 ASCO NP(L) 8320 IA Service	Radiation Damage	Yes	CCNPP 50.49 Program
	Thermal Damage	Yes	
	Crevice Corrosion, Pitting	No	N/A
SV0038 ASCO (L) 206-381 IA Service	Radiation Damage	Yes	CCNPP 50.49 Program
	Thermal Damage	Yes	
	Crevice Corrosion, Pitting	No	N/A

Terminal Blocks (TB)

The terminal blocks subject to AMR (EQFs TB0001, 0003, 0004, 0005, and 0008) are susceptible only to radiation and thermal damage and these ARDMs are managed by the CCNPP 50.49 Program. The general corrosion ARDM is not plausible since all terminal blocks inside containment are installed in a gasketed junction box with a weephole, and the normal Auxiliary Building environment (temperature and humidity controlled) does not promote corrosion of termination hardware. [Reference 1, Table 4-6]

Reactor Vessel Level Monitoring System Thermocouple Probes (TP)

The Reactor Vessel Level Monitoring system (EQF RVLMSX) is susceptible to four ARDMs as shown in Table 6.3-2. Radiation and thermal damage are managed by the CCNPP 50.49 Program. The crevice corrosion and pitting ARDMs are addressed by Section 4.2, Reactor Pressure Vessels and Control Element Drive Mechanisms/Electrical System of the BGE LRA. [Reference 1, Table 4-9]

Core Exit Thermocouple System (RI)

The Core Exit Thermocouple System (EQF CETX01) is susceptible to four ARDMs as shown in Table 6.3-2. Radiation and thermal damage are managed by the CCNPP 50.49 Program. The crevice corrosion and pitting ARDMs are addressed by Section 4.2, Reactor Pressure Vessels and Control Element Drive Mechanisms/Electrical System of the BGE LRA. [Reference 1, Table 4-11]

6.3.2.2 CCNPP 50.49 Program Overview

The control of EQ equipment at Calvert Cliffs is administered under a program designated as the Calvert Cliffs 50.49 Program. The equipment encompassed by this program is all electrical equipment, which satisfies the criteria specified in 10 CFR 50.49(b), and must function while exposed to potentially harsh environmental conditions associated with DBEs. All such equipment is referred to as being EQ. The program manages the following: [Reference 1, Sections 1.1, 1.2.1]

- Qualification of all EQ equipment; and
- Aging of organic subparts to provide reasonable assurance that all EQ equipment will function when subjected to postulated harsh environmental conditions during its qualified life.

Engineering procedures are in place to ensure the program is administered in accordance with 10 CFR 50.49 requirements and BGE quality assurance procedures. As required by 10 CFR 50.49, the aging of EQ equipment is addressed to ensure that, when exposed to harsh environmental conditions, the equipment will perform its intended function as required. The EQ Program at CCNPP is based on the following regulatory requirements: [Reference 1, Section 1.2.1]

- Division of Operating Reactors (DOR) Guidelines as transmitted by NRC IEB 79-01B
- NUREG-0588, Interim Staff Position on Environmental Qualification of Safety-Related Electrical Equipment
- 10 CFR 50.49, Environmental Qualification of Electric Equipment Important to Safety for Nuclear Power Plants

The CCNPP 50.49 Program has the following elements: [Reference 1, Section 1.2.1]

- Identification of the equipment that is required to be EQ per 10 CFR 50.49(b);
- Establishment of documentation that substantiates EQ equipment is EQ;
- Establishment of a maintenance and surveillance program to ensure that qualification is maintained on a continuing basis; and
- Establishment of procedures to describe the requirements and process for development and control of the EQ Program documentation.

Each of these elements is discussed further below.

Identification of Equipment within the Scope of the EQ Program

The equipment which satisfies 10 CFR 50.49(b)(1) and (b)(2) is classified as safety-related and further designated as Class 1E on the Calvert Cliffs Q-List. The equipment which satisfies 10 CFR 50.49(b)(3) was identified in the CCNPP response to NRC IEB 79-01B. This equipment is classified as safety-related and further designated as PAM1 or PAM2 on the CCNPP Q-List. Electrical equipment which is required to perform a safety-related function, after being subjected to, or while exposed to, harsh environmental conditions induced by DBEs, is further designated as 5049 on the Q-List. Selection criteria are outlined in Engineering Standard ES-011, "System, Structure, and Component (SSC) Evaluation" [Reference 2]. The Q-List and classification process is controlled under EN-1-100, "Engineering Service Process Overview" [Reference 3]. [Reference 1, Section 1.2.2]

Substantiation of EQ

The CCNPP 50.49 Program considers exposure to harsh environmental conditions, i.e., temperature, pressure, humidity (steam), chemical and demineralized water sprays, radiation and submergence, imposed as a result of a DBE. The DBEs include a Loss-of-Coolant Accident (LOCA) or Main Steam Line Break inside containment, or a High Energy Line Break (HELB) outside containment as described in the Updated Final Safety Analysis Report (UFSAR). The specific parameters (limiting conditions) are based upon UFSAR Chapters 14 and 10A. Engineering Standard ES-014, "Summary of Ambient Environmental Service Conditions used at CCNPP," [Reference 4] provides the following information: [Reference 1, Section 1.2.3]

- Identification and bases for all DBEs applicable to the EQ Program;
- Identification of harsh and mild environmental areas;
- Environmental profiles for postulated accident conditions; and
- Identification of normal and accident environmental service parameters.

The equipment within the scope of the CCNPP 50.49 Program is qualified by evidence from type tests, analyses, or by any combination of these methods to substantiate that the equipment is capable of meeting, during its qualified life, the required performance as specified in the design basis. The qualification evidence and analysis for a given device type is contained in the EQF for that device type. [Reference 1, Section 1.2.3]

Each item of EQ equipment at CCNPP is qualified either to the DOR Guidelines, NUREG-0588, or 10 CFR 50.49. Note that equipment qualified to the requirements of the DOR Guidelines or NUREG-0588 will not necessarily be replaced during the period of extended operation.

Program Maintenance and Surveillance

Qualification Maintenance Requirement Sheets (QMRS) are developed by the Plant Engineering Section, based on input from the EQFs, to ensure that specific EQ-related installation and maintenance requirements are identified. The QMRS identify the following: [Reference 1, Section 1.2.4]

- Installation requirements to ensure that equipment is installed in accordance with EQ requirements, including sealing and torquing requirements;
- Requirements for EQ electrical connections; and
- Maintenance requirements and frequencies necessary to maintain the EQ of the equipment; e.g., the replacement of 'short-lived' parts such as O-rings.

Each EQ component has an associated QMRS, and NUCLEIS/NORMS, the site nuclear equipment technical database, is utilized to link EQ components to the applicable QMRS.

The "Preventive Maintenance Program," MN-1-102, [Reference 5] is utilized to ensure that the required EQ-related maintenance and replacement intervals are adhered to. Preventive maintenance tasks are created, per MN-1-102, to control these repetitive activities. The use of QMRS is integrated into the maintenance order planning process, which is controlled by MN-1-200, "Maintenance Order Planning." [Reference 6] Corrective maintenance under Rover Maintenance, as outlined in MN-1-101, "Control of Maintenance Activities" [Reference 7], also utilizes the QMRS to ensure EQ components are maintained in accordance with EQ requirements.

Administration of the Program

Calvert Cliffs Engineering Procedure EN-1-103, "Control of 10 CFR 50.49 Environmental Qualification of Electrical Equipment," [Reference 8] Engineering Standards ES-014 [Reference 4] and ES-024, "10 CFR 50.49 Environmental Qualification Program," [Reference 9] are in place to ensure that the CCNPP 50.49 Program is administered in accordance with 10 CFR 50.49 and BGE quality assurance procedures. [Reference 1, Section 1.2.5]

Integration of EQ into the design change process has been an evolving activity. Currently, EN-1-100 controls the design change process. Within the EN-1-100 process, cross-disciplinary 'specialty' design inputs are required to be considered, as outlined in Engineering Standard ES-020, "Specialty Input Screens for the Engineering Service Process." [Reference 10] As part of this specialty design input, EQ is a consideration for all changes. On changes which require EQ input, EQ documentation (EQFs) are prepared/revised by the Design Engineering Section, Electrical Engineering Unit to support the change. The preparation of this EQ documentation is controlled by EN-1-103 and ES-024. Each EQ component has an associated EQF. NUCLEIS/NORMS is utilized to link EQ components to applicable EQ Files. The temporary alteration process, MD-1-100, "Temporary Alterations," [Reference 11] also contains EQ-related specialty design input, similar to EN-1-100, to ensure continued EQ compliance, even with temporary plant changes

When EQ-related deficiencies or nonconformances are identified, an Issue Report is initiated, per QL-2-100, "Issue Reporting and Assessment." [Reference 12] The QL-2-100 process ensures that equipment operability, with the EQ deficiency or nonconformance, is evaluated and determined. The corrective actions to resolve the deficiency or nonconformance are also established and completed in accordance with QL-2-100.

6.3.2.3 Program Operating Experience and Design Basis

The design basis for the EQ Program is NRC IEB 79-01B, applicable generic letters, and 10 CFR 50.49. Calvert Cliffs UFSAR Section 7.12 [Reference 13] provides an overview of the program design basis requirements.

Design Basis

Nuclear Regulatory Commission IEB 79-01B, issued on January 14, 1980, along with Supplements 1, 2, and 3, issued on February 29, September 30, and October 24, 1980, respectively, and NRC Generic Letters 81-05, 81-15, and 82-09 are the EQ Program design basis for:

- Identifying and environmentally qualifying safety-related electrical equipment required to function, while exposed to postulated harsh environment accident conditions, to bring the plant to its licensed 'safe shutdown' condition. Applicable safety-related electrical equipment relied upon, in emergency procedures, to mitigate the postulated accidents and applicable Three Mile Island Action Plan (NUREG-0737) equipment are also to be identified. (Accident conditions were defined in IEB 79-01B as being the result LOCA/HELB inside containment, including areas outside containment where fluids are recirculated to accomplish long-term cooling following a LOCA, and HELB outside containment.)
- Establishing the normal and accident environmental conditions for identified safety-related components.
- Establishing the requirements to be met for EQ of identified safety-related components.

  Note: Nuclear Regulatory Commission IEB 79-01B, Supplement 2, specified that all operating reactors, as of May 23, 1980, must be evaluated against the DOR guidelines. In cases where the DOR guidelines did not provide sufficient detail, NUREG-0588 was to be used.

10 CFR 50.49, issued January 21, 1983 (effective date of February 22, 1983), is the EQ Program design basis for:

- Identifying and environmentally qualifying 'important to safety' electrical equipment required to function while exposed to harsh environmental conditions during and following all applicable DBEs.

  Note: 10 CFR 50.49 expanded the scope of electrical equipment to be included in the EQ Program. Previously, IEB 79-01B required only safety-related electrical equipment be considered. 10 CFR 50.49 also expanded the number of events/accidents to be considered when determining harsh environmental conditions. Previously, IEB 79-01B required only that LOCA/HELB inside containment, and HELB outside containment be considered.

- Identifying and environmentally qualifying certain post-accident monitoring equipment.

  Note: 10 CFR 50.49 provides guidance, in a footnote, on which post-accident monitoring equipment is to be considered. The footnote states, "Specific guidance concerning the types of variables to be monitored is provided in Revision 2 of Regulatory Guide 1.97."

- Establishing the requirements to be met for qualifying replacement EQ equipment installed subsequent to February 22, 1983.

  Notes: Operating reactors were not required to requalify electrical equipment important to safety in accordance with the provisions of 10 CFR 50.49 if the NRC had previously required qualification of that equipment in accordance with the requirements established in the DOR Guidelines or NUREG-0588.

  10 CFR 50.49 stipulates that replacement equipment must be qualified to the provisions of 10 CFR 50.49 unless there are 'sound reasons' to the contrary. NRC Regulatory Guide 1.89, Revision 1, provides these sound reasons. If they are met, then qualification of the replacement equipment to the DOR Guidelines, or NUREG-0588, as applicable, is acceptable. This remains unchanged by the process of license renewal.

Background

In response to IEB 79-01B, CCNPP made various submittals of EQ documentation to the NRC. This documentation was reviewed by the NRC and Safety Evaluation Reports were issued on May 28, 1981, December 16, 1982, and November 20, 1984, concluding that the CCNPP 50.49 Program complies with the requirements of IEB 79-01B and 10 CFR 50.49. These NRC Safety Evaluation Reports were supplemented by various NRC EQ inspections on June 18-20, 1980, October 27-29, 1980, October 15-19, 1984, September 9-13, 1985, March 23-27, 1987, May 11-15, 1987 and February 27-March 3, 1989. These NRC inspections were focused on the detailed implementation of the CCNPP 50.49 Program, as discussed in the various NRC Safety Evaluation Reports, to ensure compliance with IEB 79-01B and 10 CFR 50.49.

In response to 10 CFR 50.49(g), CCNPP submitted its list of electric equipment important to safety, within the scope of 10 CFR 50.49(b), that had already been qualified and had yet to be qualified in its May 10, 1983 letter to the NRC.

Note: NRC submittal requirements were imposed on CCNPP via an NRC letter to BGE dated March 25,1983. These submittal requirements were: 1) to specifically indicate whether previous submittals made in response to IEB 79-01B complied with paragraphs (a) and (b) of 10 CFR 50.49; and 2) to describe in the submittal the methods used to identify the equipment covered by paragraph (b)2 of 10 CFR 50.49, and establish any qualification programs not previously described for such equipment. Both of these submittal requirements were met in BGE's May 10, 1983 and August 24, 1983 letters to the NRC.

Additional NRC submittal requirements were imposed on CCNPP via NRC letter to BGE, dated May 31, 1984, requiring:

- BGE certification that in performing the review of the methodology to identify equipment within the scope of 10 CFR 50.49(b)(2), CCNPP had performed the 'NRC specified' steps identified in their letter.

- BGE certification that all DBEs which could potentially result in a harsh environment, including flooding outside containment, were addressed in identifying safety-related electrical equipment within the scope of 10 CFR 50.49(1).
- BGE certification that the electrical equipment within the scope of 10 CFR 50.49(b)(3) was all Regulatory Guide 1.97, Category 1 and 2 equipment, or that justification had been provided for any such equipment not included in the EQ Program.

This submittal requirement was met in BGE's July 9, 1984 letter to the NRC.

Nuclear Regulatory Commission Safety Evaluation Report, dated November 20, 1984, concluded that the various submittals made by BGE, in response to the requirements of 10 CFR 50.49(g) and associated NRC letters, were acceptable.

Operating Experience

Over the history of the program, EQ-related issues/problems have been identified by both the NRC and by BGE and its contractors as a result of audits, assessments, and day-to-day plant operation. They have been documented in Nonconformance Reports, Issue Reports, and Program Deficiency Reports as part of CCNPP's deficiency identification and corrective action program.

In each case, the appropriate corrective action was taken as required.

Since the completion of the NRC EQ audits that have been conducted, EQ equipment qualified to the requirements of the DOR guidelines has been replaced with EQ equipment qualified to 10 CFR 50.49. The Facility Change Requests and Minor Change Request that have replaced EQ equipment are as follows:

- Facility Change Request 89-0067 - Replace GE processes Model CR151 terminal blocks on main steam isolation valves (MSIVs)
- Minor Change Request 91-012-030-00 - Replace Johnson Controls Model P-7221 switches on Emergency Core Cooling System pump room temperature controls
- Facility Change Request 83-1031 - Replace Rosemount Model 104-1713-1 resistance temperature detectors on primary loops

Baltimore Gas and Electric Company is a member of the Nuclear Utility Group on Equipment Qualification (NUGEQ). This industry group is comprised of the majority of nuclear utilities in the United States as well as Canada. This group is a working group comprised of technical personnel from each utility who are responsible for the EQ Programs at their plant. This group has, since the early 1980s, provided both technical and licensing support to its members specifically related to the EQ issue as it evolved. Collectively, the group represents the largest collection of EQ experts with the most extensive industry knowledge base in the country. Industry EQ problems and issues are typically addressed by this group, with each member utility benefiting from this knowledge base.

6.3.2.4 Aging Effects Management Methodology [Reference 1, Section 4.3]

The continued functionality of passive, long-lived EQ devices is assured through the following design features, new activities, and on-going activities:

Design Features Credited in Aging Evaluation:

- Where feasible, use of materials that are insensitive to aging mechanisms;
- Location of in-containment terminal blocks above flood level;
- Enclosure of in-containment terminal blocks to prevent spray impingement; and
- Provision of weep holes in the in-containment terminal block enclosures to provide for drainage.

New Activities:

- Age-related degradation inspection of EQF SV0029 (Valcor) SVs called for in Section 5.13, NSSS Sampling System, of the BGE LRA.

On-going Activities:

- Continued administration of the CCNPP 50.49 Program in accordance with 10 CFR 50.49;
- Pressure monitoring and local leak rate testing of penetrations;
- System walkdowns per procedures PEG-7, "Plant Engineering Section System Walkdowns" [Reference 14]; and the Protective Coating Program per procedure MN-3-100, "Painting and Other Protective Coatings," [Reference 15] as applicable to penetrations;
- Keeping instrument air dry and clean to prevent the corrosion of SVs;
- The QL-2-100 Issue Reporting Program [Reference 12] to report and track the resolution of identified problems;
- The continued monitoring of NRC and industry efforts through organizations such as NUGEQ and Nuclear Energy Institute (NEI) to further investigate issues associated with EQ equipment; and
- Membership in one of the available EQ equipment databases.

The CCNPP 50.49 Program addresses the aging of EQ equipment by qualification in accordance with 10 CFR 50.49, and the execution of the required maintenance and/or condition monitoring deemed necessary to maintain the EQ of the equipment. Maintenance includes replacement before the equipment reaches the end of its qualified life. The EQF for each device contains a summary of the results of the qualification process and copies of the relevant documentation. Two of the end products of the qualification process are the determination of the qualified life for the device being evaluated and the maintenance required to maintain the device's qualification. The process is controlled by EN-1-103. [Reference 8]

Each EQF also contains the qualification criteria and criteria justification for the device covered, the identification of the qualification source (10 CFR 50.49, NUREG-0588, or the DOR Guidelines), other standards that are met in the qualification process (such as Institute of Electrical and Electronic Engineers IEEE-323-1974), the qualification methodology used, and the justification for the use of that methodology. Acceptable methodologies, include testing, analysis, or analysis, derived from partial test data. Performance characteristics are also identified and verified as part of the qualification process to ensure that

performance requirements are met. Anomalies are evaluated for impact on the qualification. The accident and normal service environmental conditions used in the qualification of equipment are documented in ES-014. [Reference 4]

The identification of materials susceptible to significant thermal and/or radiological degradation and aging ensures that the limiting subparts of the device drive the qualification process. Arrhenius accelerated pre-aging activation energies, and their source, as well as radiation thresholds, and their source, are identified for use in the qualification process. Synergistic effects are evaluated as applicable based on the best currently available information. Operational stressors are identified and incorporated into the qualification process as needed. Accident service conditions are compared to qualification conditions and margins are identified and evaluated. Note that thermal aging is not required for DOR Guideline qualified equipment.

Installation and interface requirements ensure that the equipment qualification is valid for the equipment installed in the plant. Maintenance requirements ensure that the qualification is maintained throughout the qualified life, and that replacement is performed prior to reaching the end of the equipment's qualified life. Maintenance can include a variety of activities; e.g., replacement of gaskets, or other short-lived subparts, greasing of bearings, etc. Condition monitoring requirements ensure that degradation, which could lead to premature failure if not addressed, is detected. Such degradation would be documented in an Issue Report as a condition adverse to quality/safety and addressed by QL-2-100. [Reference 12]

6.3.2.5 Conclusion for the Aging Management Function of the EQ Program

As a regulatory based and monitored program, the CCNPP 50.49 Program has regulatory approval of its implementation, management, evaluation methodologies, surveillance provisions, and documentation as discussed in Section 6.3.2.3 of the BGE LRA. Based on this and the previous discussion, BGE concludes that the CCNPP 50.49 Program adequately addresses and manages the aging (thermal, radiological, and operational stressors) of EQ devices, which could prevent them from performing their required harsh environment safety functions during their qualified lives, in such a way that the intended functions of these devices will be maintained during the period of extended operation consistent with the current licensing basis (CLB) under all design loading conditions.

6.3.3 The TLAA Function of the EQ Program [Reference 1, Section 5.1]

The CCNPP 50.49 Program is identified as a TLAA for the purposes of License Renewal. The TLAA aspect of EQ encompasses all long-lived EQ equipment whether active or passive. At CCNPP, each EQF for a long-lived component documents a TLAA.

To grant license renewal, 10 CFR 54.29 requires that the NRC find that "Actions have been identified and have or will be taken with respect to the matters identified in Paragraphs (a)(1) and (a)(2) of this section, such that there is reasonable assurance that the activities authorized by the renewed license will continue to be conducted in accordance with the CLB, and that any changes made to the plant's CLB in order to comply with this paragraph are in accord with the Act and the Commission's regulations." The matter identified in (a)(2) is "time-limited aging analyses that have been identified to require review under 10CFR54.21(c)." Whenever the Commission must find that actions "will be taken" rather than "have been taken," the NRC staff has indicated that the following information should be provided to support this finding:

- Details concerning the methodology which will be used for TLAA evaluation;

- Acceptance criteria that will be used to judge the adequacy of the component, consistent with the CLB, when the TLAA evaluation is performed;
- Corrective actions that CCNPP could perform to provide reasonable assurance that the EQ equipment will perform its intended function when called upon or will not be outside of its design basis, established by the plant's CLB; and
- Identification of when the completed TLAA evaluation will be submitted to the NRC to ensure that the necessary evaluation will be performed before any EQ components would not be able to perform their intended functions consistent with the CLB.

Each of these requirements is discussed in detail in the following sections. The information contained in these discussions supports the conclusion that the effects of aging of EQ equipment at CCNPP are being, and will continue to be, managed during the period of extended plant operation. The intent of the above NRC requirements is, therefore, being met.

Methodology for Extending Component Qualified Life [Reference 1, Section 5.2]

Environmentally qualified equipment is replaced with qualified new equipment prior to the end of its qualified life. Preventive maintenance is scheduled to initiate and execute these replacements. Qualified life re-evaluations are an ongoing activity, and consider actual normal operating conditions as compared to design maximums. Qualified lives are adjusted up or down accordingly. The following describes the steps currently taken when re-evaluation of the qualified life (in accordance with 10 CFR 50.49, ES-024 [Reference 9], and engineering oversight procedures) is considered technically viable and economically desirable:

- Review original qualified life bases including assumptions, margin/uncertainty, and margin/uncertainty sensitivity factors;
- Establish margin/uncertainty limits for qualified life;
- Review available aged specimen test data for impact on and validation of margin/uncertainty;
- Review any condition monitoring data for impact on and validation of margin/uncertainty to the degree allowed by regulations;
- Adjust qualified life based on consideration of analytical and test data, condition monitoring data, and refurbishment without violating the qualification margin/uncertainty limits established under the second bullet above; and
- Establish new replacement dates for qualified equipment and establish continuing condition monitoring requirements as appropriate in accordance with plant and 10 CFR 50.49 program procedures.

In the re-evaluation of existing EQFs to determine if the qualification will support use of the devices during the period of extended operation, required qualification margins must be maintained and aging must be analyzed in a conservative manner. Excessive conservatisms in the qualification process to support use in the extended period are available, however. For example, devices that are exposed to temperatures well below the maximum normal design value may be re-evaluated using a bounding value that envelopes the maximum temperatures experienced instead of the maximum design temperature. There is no need to maintain the excess conservatism that exists in the current qualification just because that maximum design

temperature was used as the basis for the current qualified life. This concept holds for all equipment qualification parameters, including temperature, pressure, radiation, voltage, currents, and cycling. Required margins must be maintained, so the re-evaluations will in no way change the current qualification envelope for any qualification parameter. They will just be re-evaluated using a lower maximum temperature, referring to the example, to eliminate excessive conservatism while maintaining the current parameter qualification envelopes. The end result of this approach will be an increased qualified life for the device. [Reference 16]

Baltimore Gas and Electric Company participates in and monitors industry developments and data gathering activities relative to EQ of electrical equipment. When information relative to equipment qualification comes to light as a result of these or other activities, BGE evaluates its applicability to CCNPP for incorporation into the EQ Program. The current programs and groups that BGE participates in are described below. Its participation in these programs demonstrates its commitment to quality and safety. [Reference 1, Section 5.2 and Appendix E]

- If an internal safety or quality issue arises, an Issue Report is generated. This initiates BGE's corrective action process. The report is investigated and dispositioned in accordance with plant procedures.
- If an external safety or quality issue arises, BGE will address the concern through its Industry Operating Experience Review Program or its Nuclear Regulatory Matters Unit. Baltimore Gas and Electric Company may be notified of externally generated issues by the NRC (e.g., Information Notices), by manufacturer's or users (e.g., Part 21 notifications), by Institute for Nuclear Power Operations (e.g., Bulletins), or by industry groups (NUGEQ).
- BGE is a member of the Electric Power Research Institute (EPRI), which performs research for the industry in areas of concern to maintain the viability of economical and safe power production. A program currently underway is assessing the aging and condition monitoring of cables in nuclear power plants. Programs of this type change from year to year in support of industry efforts to stay focused on the areas that will yield the maximum economic benefit to BGE.
- BGE is a member of NUGEQ, the industry group that follows industry EQ developments. They identify issues, comment on regulatory concerns, and occasionally generate position papers relative to pertinent issues.

Acceptance Criteria for Judging Adequacy of Components

Re-evaluation, as discussed above, and/or replacement at or before the end of qualified life are acceptable methods for dispositioning a TLAA that determines that a component's qualified life falls short of the end of the period of extended operation. If the re-evaluated qualified life falls short of the end of the period of extended plant operation, then the component will be scheduled for replacement at or before the end of its qualified life. These are the same actions currently taken for the short-lived EQ components under the EQ Program. [Reference 1, Section 5.3]

Note: A portion of the EQ equipment in the plant has a qualified life of 40 years. Some of this equipment has been installed within the last 6 to 16 years. Consequently, the qualified life of the equipment will exceed the current licensed life of the plant, but will not exceed the plant's licensed life with a 20-year period of extended operation. Any new EQ equipment installed today with a qualified life

of 40 years would have a qualified life which exceeded the licensed life of the plant, including a 20-year period of extended operation.

Corrective Actions if EQ Component Qualified Life Falls Short of Period of Extended Operation [Reference 1, Section 5.4]

If re-evaluation of an EQ device's qualified life to achieve an effective "plant" life of 60 years cannot be accomplished, then corrective action is required. The only corrective action currently taken by the CCNPP 50.49 Program is replacement with new equipment, qualified in accordance with 10 CFR 50.49, prior to the end of the EQ equipment's qualified life. This same corrective action will be used during the period of extended operation.

An alternative approach to replacement would be to develop reasonable assurance, through condition monitoring, that the EQ equipment's actual age is less than its established qualified life which can be conservative. 10 CFR 50.49 allows such an approach as part of "ongoing qualification;" however, such an alternative approach does not currently exist at CCNPP. In addition, such an alternative does not presently have industry consensus nor regulatory acceptance. As discussed above, CCNPP continues to follow industry and regulatory developments and will keep this option open within the context of complying with regulatory requirements.

Timing of Resolution

Calvert Cliffs typically reassesses the qualified life of EQ equipment, according to existing procedures, sufficiently in advance of the end of qualified life to determine if a revised qualified life can be established, or if equipment replacement is necessary, to maintain EQ functional continuity. This reassessment is performed now under the current EQ Program and will continue to be performed during the period of extended plant operation. [Reference 1, Section 5.5]

Conclusion of the Effectiveness of the TLAA Function of the EQ Program

During the period of extended operation, EQFs will provide the TLAAs for EQ equipment, and will be maintained and controlled under the current EQ Program in the same manner they are maintained and controlled under the CLB in accordance with 10 CFR 50.49. Adjustments will be made in accordance with any new regulatory requirements. When deemed necessary, CCNPP will make changes to the program within the bounds of the then existing regulatory requirements

6.3.4 EQ GSI

According to the BGE IPA methodology and the Statements of Consideration to the License Renewal Rule (60FR22484), there are three options available to resolve issues associated with license renewal which are also the subject of a GSI. Those three options are listed in Sections 6.3.5 and 8.3.2 of the BGE IPA methodology as follows: [Reference 1, Section 6.1]

- If the issue is resolved before BGE LRA (LRA) submittal, the applicant can incorporate the resolution into the LRA;
- An applicant can justify that the CLB will be maintained until a point when one or more reasonable options would be available to adequately manage the effects of aging; or

- An applicant could develop a plant-specific program that incorporates a resolution to the aging issue.

The following issue is identified as Issue 168 of the NRC Task Action Plan. Its description is taken directly from the plan as follows: [Reference 1, Section 6.2]

> "As discussed in SECY-93-049, the staff reviewed significant license renewal issues and found that several related to environmental qualification (EQ). A key aspect of these issues was whether the licensing bases, particularly for older plants whose licensing bases differ from newer plants, should be reassessed or enhanced in connection with license renewal or whether they should be reassessed for the current licensing term. The staff concluded that differences in EQ requirements constituted a potential generic issue which should be evaluated for backfit independent of license renewal.
>
> During the staff's development of an interoffice action plan to address upgrading EQ requirements for older plants during the current licensing term, the staff evaluated the technical adequacy of EQ requirements. As part of this evaluation, the staff reviewed tests of qualified cables performed by SNL *[Sandia National Laboratory]*, under contract with the NRC. The purpose of these tests was to determine the effects of aging on cable products used in nuclear power plants. After accelerated aging, some of the environmentally-qualified cables either failed or exhibited marginal insulation resistance during accident testing, indicating the qualification of some electric cables may have been non-conservative. Although the SNL tests may have been more severe than required by NRC regulations, the test results raised questions with respect to the EQ and accident performance capability of certain artificially-aged cables. Depending on the application, the failure of these cables during or following DBEs could affect the performance of safety functions in nuclear power plants."

As noted in the above description, the focus of this GSI is cables. The adequacy of DOR Guideline qualified equipment has been confirmed in the November 15, 1996 Report to the NRC on Status of the EQ Task Action Plan (WITS 9300107) quoted below:

> "While the staff recognizes that the methodology and requirements imposed on licensees differ according to the original licensing requirements of the plant, the staff concluded that actions taken by the Nuclear Regulatory Commission (NRC) and licensees since the implementation of the EQ rule and the margins inherent in the qualification process itself ensure an acceptable level of safety independent of which qualification requirement was implemented. . . . based on the results of the EQ-TAP *[task action plan]* to date, the staff does not believe there is a significant safety concern that requires immediate regulatory action."

This is reinforced by the following quote from the same report:

> ". . . the staff has concluded that the differences between older and newer EQ requirements do not constitute a significant safety issue, and that adequate margin exists in the qualification process for both older and newer plants to ensure public health and safety . . . "

As of this writing, the major unresolved issues may be categorized as follows: [Reference 1, Section 6.2]

- Issues associated with using accelerated aging to simulate advanced natural aging;
- Issues associated with failure mechanisms of special cables; and
- Issues associated with the efficacy of cable condition monitoring techniques.

The third of these issues (i.e., condition monitoring) addresses a staff position stated in the aforementioned report and quoted below:

> "The staff believes, however, that because of uncertainties in predicting age-related degradation, condition monitoring (i.e., an inservice inspection program) provides the simplest and most effective approach to assuring environmental qualification for the license renewal term. . . . The staff is currently sponsoring research to investigate whether certain condition monitoring techniques can be used successfully to predict the condition of nuclear power plant cables that are within the scope of 10 CFR 50.49."

These major issues are addressed in the following sections. Relative to these discussions, in accordance with the Statements of Consideration and the BGE IPA methodology, BGE will, therefore, maintain its CLB relative to EQ until such time that reasonable options are available to adequately manage the effects of aging. The resolution of this aspect of the GSI applies to the TLAA issue, as well. Environmental qualification of equipment within the scope of the CCNPP 50.49 Program will continue on the basis of the CLB until such time that reasonable options to address this aspect of the GSI are available or until the GSI is considered closed by the NRC. [Reference 1, Section 6.2.1]

Issues Associated with the Accelerated Aging Qualification Process

The principle in question is the use of accelerated aging of equipment to predict its performance when it is aged naturally. With this approach, the equipment is artificially aged by exposing it to temperatures in excess of the normal service temperature. Using Arrhenius methodology, the equipment can be quickly aged to a 40- or 60-year life condition before subjecting it to functional testing under accident conditions. The methodology assumes that thermal aging is the only significant aging mechanism. [Reference 1, Section 6.2.1]

The NRC plans additional research into the area of accelerated versus natural aging. There have been several meetings about the GSI between the NRC and the industry in which BGE has participated. There were originally 43 issues to be addressed during the performance of this research. Through these meetings, the number has been reduced to 19 and there has been a consensus that further reductions are needed to assure cost-effectiveness for the issues that are ultimately addressed. It will, however, be several years before the research is performed and a disposition can be determined. [Reference 1, Section 6.2.1]

Baltimore Gas and Electric Company will continue to meet its CLB relative to EQ, including accelerated aging at elevated temperatures. If data from current or future research activities on naturally-aged cable specimens reveals conclusively that artificially-aged specimens are not conservatively aged prior to LOCA testing, then appropriate adjustments will have to be made to the qualification of relevant cables. Baltimore Gas and Electric Company will continue to follow industry and regulatory developments

relative to the issue and will respond to any new regulatory requirements that arise from the resolution of this aspect of the GSI. [Reference 1, Section 6.2.1; Reference 17]

Issues Associated with the Failure Mechanisms of Special Cables [Reference 1, Section 6.2.2]

Explicit identification of failure modes is only needed if failure modes exist which could occur without violation of the established acceptance criteria. An acceptable criteria which is directly linked to critical cable electrical characteristics, or to a known precursor to electrical property changes, precludes the need to explicitly determine cable failure modes.

The EQ of equipment by BGE includes identification of the equipment's safety function and the acceptance criteria for meeting the intended safety function. The acceptance criteria for cables is directly linked to critical cable electrical characteristics or to a known precursor to electrical property changes. Therefore, BGE's practices under the CLB negate the need to specifically identify potential failure modes. Research in this area will continue to be monitored through EPRI and NEI. Baltimore Gas and Electric Company will respond to any new regulatory requirements that arise from the resolution of this aspect of the GSI.

Issues Associated with Condition Monitoring Techniques

The NRC plans to conduct research regarding cable condition monitoring to determine the effectiveness, reliability, and applicability of such techniques relative to the prediction of current cable condition and/or accident survivability. Condition monitoring does not currently have industry consensus or regulatory acceptance as a means of establishing cable residual life. Baltimore Gas and Electric Company will continue to monitor research in this area through EPRI and NEI and will respond to any new regulatory requirements arising from the resolution of this aspect of the GSI. To the extent that regulatory acceptance and economic and technical considerations support it, BGE will consider using condition monitoring when extended life margins warrant reinforcement of analytical results. [Reference 1, Section 6.2.3]

Conclusions of EQ GSI

With regard to this GSI, BGE is opting for the second of the approaches discussed at the beginning of this section, in that it will continue to manage the effects of aging in accordance with the CLB, modified as appropriate to address regulatory changes. The current 40-year equipment lives are, therefore, adequate until the period of extended operation because, under the CLB, EQ equipment is qualified for 40 years using the currently acceptable techniques for calculating such lives.

6.3.5 Conclusions

Calvert Cliffs is a DOR Guidelines plant. This section of the BGE LRA does not change our CLB relative to EQ. Baltimore Gas and Electric Company has DOR Guideline, NUREG-0588, and 10 CFR 50.49 qualified equipment. Calvert Cliffs will continue to function in the period of extended operation as it does today relative to EQ, except as required by changes to regulatory requirements. Equipment that must be replaced due to the approaching end of its qualified life will be replaced in accordance with regulatory constraints associated with 10 CFR 50.49

As a regulatory based and monitored program, the CCNPP 50.49 Program has regulatory approval of its implementation, management, evaluation methodologies, surveillance provisions, and documentation as discussed in Section 6.3.2.3 of the BGE LRA. Based on this and the discussion provided in the balance of Section 6.3.2, BGE concludes that the CCNPP 50.49 Program adequately addresses and manages the aging (thermal, radiological, and operational stressors) of EQ devices, which could prevent them from performing their required harsh environment safety functions during their qualified lives, in such a way that the intended functions of these devices will be maintained during the period of extended operation consistent with the CLB under all design loading conditions.

During the period of extended operation, EQFs will provide the TLAAs for EQ equipment and will be maintained and controlled under the current EQ Program in the same manner they are maintained and controlled under the CLB, in accordance with 10 CFR 50.49. Adjustments will be made in accordance with any new regulatory requirements. When deemed necessary, CCNPP will make changes to the program within the bounds of the then existing regulatory requirements.

With regard to GSI 168, BGE is opting for the provision by which it is allowed to provide justification that the CLB will be maintained until a point when one or more reasonable options will be available to adequately manage the effects of cable aging.

The program analyses/assessments, corrective actions, and confirmation/documentation process for license renewal are in accordance with QL-2, "Corrective Action Program." QL-2 is pursuant to 10 CFR Part 50, Appendix B, and covers all structures and components subject to AMR.

6.3.6 References

1. CCNPP Aging Management Review Report for the EQ System, Revision 0, November 1996
2. CCNPP Engineering Standard ES-011, "System, Structure, and Component (SSC) Evaluation, Revision 1, August 27, 1996
3. CCNPP Administrative Procedure EN-1-100, "Engineering Service Process Overview," Revision 7, March 17, 1997
4. CCNPP Engineering Standard ES-014, "Summary of Ambient Environmental Service Conditions Used at CCNPP," Revision 0, November 8, 1995
5. CCNPP Administrative Procedure MN-1-102, "Preventive Maintenance Program," Revision 5, September 27, 1996
6. CCNPP Administrative Procedure MN-1-200, "Maintenance Order Planning," Revision 13, May 9, 1997
7. CCNPP Administrative Procedure MN-1-101, "Control of Maintenance Activities," Revision 14, May 10, 1997
8. CCNPP Administrative Procedure EN-1-103, "Control of 10 CFR 50.49 Environmental Qualification of Electrical Equipment," Revision 0, March 22, 1995
9. CCNPP Engineering Standard ES-024, "10 CFR 50.49 Environmental Qualification Program," Revision 2, September 2, 1996
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