

# NRC INSPECTION MANUAL

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## INSPECTION PROCEDURE 71111 ATTACHMENT 21N

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### DESIGN BASES ASSURANCE INSPECTION (PROGRAMS)

Effective Date: **February 5, 2019**

INSPECTABLE AREA:	Design Bases Assurance (DBA) Inspection
CORNERSTONES:	Barrier Integrity Mitigating Systems
INSPECTION BASES:	Licensees are required to establish and implement various programs to provide control over activities affecting the quality of the identified structures, systems, and components, to an extent consistent with their importance to safety. This inspection is intended to assess the effectiveness of one of the many licensee programs in the engineering area (e.g., environmental qualification) using the appropriate attachment to this inspection procedure.
LEVEL OF EFFORT:	Review one engineering program. Note that IP Attachment 71111.21M provides direction on conducting a 2-week Design Bases Assurance inspection.

#### 71111.21N-01 INSPECTION OBJECTIVE

To gain reasonable assurance that structures, systems, and components (SSCs) can adequately perform their design basis function. This includes reasonable assurance that equipment important-to-safety can perform its safety functions(s) without experiencing common cause failures before, during and after applicable design basis events.

The inspection attachment is intended to assess the effectiveness of one engineering program by sampling a limited number of components. In the course of evaluating specific components, important attributes of the selected program, processes, and procedures are also examined to provide a reasonable level of assurance that SSCs throughout the plant will function as designed during design basis events and that common-mode failures of components are prevented.

#### 71111.21N-02 INSPECTION REQUIREMENTS AND GUIDANCE

See attachment 1.

#### 71111.21N-03 DOCUMENTATION

The results of this inspection may be documented in either the resident inspector's integrated quarterly inspection report or in a stand-alone inspection report. The inspection report shall contain 1) number of samples inspected; 2) criteria to which the samples were inspected against; 3) the results of the inspection (e.g., no inspection findings were identified or describe the finding identified); 4) all corrective action documents (include corrective action document identifier) written to address issues identified during the inspection.

#### 71111.21N-04 RESOURCE ESTIMATE

Completion of this attachment to the DBA inspection procedure is expected to take, on the average, 172 to 212 hours of direct inspection effort at the site, regardless of the number of units, every triennial cycle. This attachment should nominally take three inspectors two weeks to complete and should be performed by engineering specialists trained in the engineering program being inspected.

#### 71111.21N-05 PROCEDURE COMPLETION

Inspection in the sample range specified in the attachment for a license program inspected will constitute completion of this procedure in the RPS.

Satisfactory completion of inspection procedures 71111.21M and 71111.21N satisfy the requirement to complete IP 71111.21 every triennial cycle.

#### 71111.21N-06 REFERENCE

[10 CFR 50.49, "Environmental Qualification of Electric Equipment Important to Safety for Nuclear Power Plants"](#)

[Bulletin 78-02, "Terminal Block Qualification," Issued on January 30, 1978](#)

[Bulletin 78-04, "Environmental Qualification of Certain Stem Mounted Limit Switches Inside Reactor Containment," Issued on February 21, 1978](#)

[Bulletin 79-01, "Environmental Qualification of Class IE Equipment," issued on 02/08/1979, revision 1 dated 02/27/1979; BL-79-01a dated June 6, 1979; BL-79-01b dated January 14, 1980; Supplement No. 2 to Bulletin 79-01B dated September 30, 1980; and Bulletin No. 79-01B Supplement No. 3 dated October 24, 1980](#)

[Division of Operating Guidelines \(DOR\) \(ML032541214\)](#)

[IE Circular No. 78-08, "Environmental Qualification of Safety-Related Electrical Equipment at Nuclear Power Plants," issued on May 31, 1978](#)

[IEEE Std. 323-1974, "IEEE Standard for Qualifying Class 1E Equipment for Nuclear Power Generating Stations](#)

[NUREG-0588, "Interim Staff Position on Environmental Qualification of Safety-Related Equipment", Revision 1, July 1981](#)

[Regulatory Guide 1.89, "Environmental Qualification of Certain Electric Equipment Important to Safety for Nuclear Power Plants", Revision 1, June 1984](#)

[Regulatory Guide 1.97, "Instrumentation for Light-Water-Cooled Nuclear Power Plants to Assess Plant and Environs Conditions During and Following an Accident," Revision 3, May 1983.](#)

[Regulatory Guide 1.97, "Criteria for Accident Monitoring Instrumentation for Nuclear Power Plants", Revision 4, June 2006](#)

[SECY-05-0197, "Review of Operational Programs in a Combined License Application and Generic Emergency Planning Inspections, Tests, Analyses, and Acceptance Criteria", dated 10/28/2005](#)

[Temporary Instruction 2515/76, "Evaluation of Licensee's Program for Qualification of Electrical Equipment Located in Harsh Environments", issued 03/27/1986" \(ML090980422\)](#)

[Staff Requirements – SECY-14-0016 – Ongoing Staff Activities to Assess Regulatory Considerations for Power Reactor Subsequent License Renewal dated August 29, 2014](#)

Statement of Consideration for 10 CFR 50.49

END

Attachment 1 - Environmental Qualification (EQ) under 10 CFR 50.49 Programs, Processes, and Procedures

Attachment 2 - Select Topics Regarding the Environmental Qualification Process

Appendix A – Checklist for Review of Licensee EQ Documentation Files

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## Attachment 1 - Environmental Qualification (EQ) under 10 CFR 50.49 Programs, Processes, and Procedures

### Background:

It is essential that important-to-safety equipment located in harsh environments be qualified to demonstrate that it can perform its safety function during and after a design basis accident under the environmental service conditions in which it will be required to function for the length of time its function is required. Additionally, non-safety related equipment should be able to withstand environmental stresses under which its failure could prevent the satisfactory function of safety-related equipment.

Formal qualification requirements for electrical equipment located in harsh areas are stated within 10 CFR Part 50.49, "Environmental Qualification of Electric Equipment Important to Safety for Nuclear Power Plants." Furthermore, EQ principles are embodied in General Design Criteria 1, 2, and 4 of Appendix A, "General Design Criteria for Nuclear Power Plants," to 10 CFR Part 50 and in Criterion III, "Design Control," Criterion XI, "Test Control," and Criterion XVII, "Quality Assurance Records," of Appendix B, "Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants," to 10 CFR Part 50.

Plants are committed to differing NRC EQ requirements based on the date of the plant's construction permit Safety Evaluation Report (SER). Plants are licensed to one of the following requirements:

- Division of Operating Reactor Guidelines for Evaluating Environmental Qualification of Class 1E Electrical Equipment in Operating Reactors (DOR)
- NUREG-0588 Category I Requirements
- NUREG-0588 Category II Requirements
- 10 CFR 50.49 (RG 1.89, Rev. 1) Requirements

This inspection is intended to assess the effectiveness of the licensee's EQ program by sampling a limited number of components. In the course of inspecting specific components, important attributes of the EQ program, processes, and procedures are also examined to provide a reasonable level of assurance that components and systems throughout the plant will function as designed during design basis events and that common-mode failures of components are prevented. This attachment is applicable to equipment located in areas with harsh environments (as defined in 10 CFR 50.49) both inside and outside primary containment. Licensees are required to maintain a record of qualification in auditable form (10 CFR 50.49(j)) for the entire period during which each covered item installed in the nuclear power plant or is stored for future use.

Additionally, 10 CFR 50.49(e) states that electric equipment qualification programs must include and be based on temperature, pressure, humidity, chemical effects, radiation, aging, submergence, and synergistic effects. The requirements of 10 CFR 50.49(e) also include the application of the margins to account for unquantified uncertainties, including production variations and inaccuracies in test instruments. These margins are in addition to any conservatism applied during the derivation of local environmental conditions of the equipment unless these conservatisms can be quantified and shown to contain the appropriate margins.

Aging provisions contained in 10 CFR 50.49(e)(5) require provisions for preconditioning equipment to its end-of-installed life condition that requires, in part, consideration of all significant types of aging degradation (e.g., thermal, radiation, vibration, plant specific operational aging, and cyclic aging) that can affect the function of electrical equipment. For equipment preconditioned to less than an end-of-installed life condition (i.e., designated life) 10 CFR 50.49(e)(5) requires the equipment to be replaced or refurbished at the end of its designated life unless additional life is established through reanalysis or on-going qualification.

The time interval between performance of this attachment and the 2-week team Design Bases Assurance Inspection (IP 71111.21M) should be at least 12 months.

## 71111.21N-01 INSPECTION OBJECTIVES

The purpose of this inspection procedure is to review the licensee's implementation of the electrical equipment environmental qualification program, as required by their license, to verify that the licensee is maintaining the qualified status of equipment during the life of the plant. Additionally, this inspection procedure will review the equipment qualification documentation files to verify that electric equipment important-to-safety and located in harsh environment meets the requirements of 10 CFR 50.49(j).

## 71111.21N-02 INSPECTION REQUIREMENTS

02.01 Select Sample Components to Review. Select 6 to 10 components to review and assess regarding the implementation of the licensee's EQ program.

02.02 The team leader (TL) shall make a site visit/bagman trip.

02.03 The onsite inspection will consist of the following tasks:

- a. Obtain the EQ file associated with the component selected for inspection and verify that the recommended EQ preventive maintenance is being performed. Preventive maintenance includes replacement of elastomers (e.g., O-rings), inspection as well as replacement of components at a defined periodicity.
- b. For plants that are operating in the period of extended operation (40-60 years), based on sampling, the inspectors shall confirm that licensees have updated their EQ analyses and qualification reports to ensure that the sampled EQ components are either qualified for 60 years or replaced prior to qualified life expires ( $\leq 60$  years). Verify that the licensee has technically justified Arrhenius extrapolations for components that are beyond their initially qualified service life.
- c. Verify that the licensee's EQ records are auditable.
- d. Verify that the correct maximum accident and maximum normal operating temperature values are used to determine the qualified life of EQ components.

- e. Verify that the licensee has applied the correct regulatory requirement to components which have been replaced. For example, EQ Category II components should be replaced with EQ Category I component classification.
- f. Sample any modifications made to selected components or replacements and verify that the EQML has been appropriately updated (power uprates and alternative source term amendments may require updates to the EQML).
- g. Verify that the replaced components meet the EQ specifications described in the EQ file.
- h. Verify that the licensee has provided adequate justification for any components removed from the EQ program during the previous 20 years.
- i. Perform a general walkdown of the area in which the component is located.
- j. Determine if the equipment surrounding the component being inspected may fail in a manner that could prevent the device from performing its safety function. Any condition that could adversely affect the safety function of equipment being inspected shall be noted for discussion with the licensee.
- k. Verify that the components are installed in their tested configuration. For example, Rosemount transmitters are not to be installed with plastic shipping plugs and Limitorque valve actuators must be installed in a qualified configuration.
- l. Verify that there are no high energy break locations (verify using review of licensing basis) located in areas determined to be a mild environment.
- m. Verify that the licensee accounts for warehouse storage time and environmental conditions, where applicable, in the service life of components approved as EQ replacement parts in plant systems.
- n. For a sample of selected problems documented in the corrective action program, verify that the corrective actions and resolutions are appropriate and adequate. See Inspection Procedure 71152, "Problem Identification and Resolution," for additional guidance.

#### 71111.21N-03 Inspection Guidance

##### General Guidance:

Appendix A, "Checklist for Review of Licensee EQ Documentation Files" is used to verify that these file packages contain the information needed to qualify the component to the requirements of 10 CFR 50.49(j). Appendix B, "Physical Inspection Checklist" contains the checklists which are to be used to record the component information in the field.

### Specific Guidance:

03.01 Because there may be multiple EQ files associated with one component, review of one EQ file associated with the component selected is sufficient to satisfy the sample requirements. The focus should be equipment that is subjected to the effects of pipe breaks, radiation, high temperatures, or other harsh environments and is required to mitigate the consequences of a design basis accident or bring the plant to safe shutdown. At least one of the components shall be located within primary containment.

The components should be in different plant systems and shall cover a variety of equipment types (e.g., pressure and flow transmitters, solenoid-operated valves (only if energized), air operated valves, motor-operated valves, cables (low and medium voltage and also sensitive instrumentation and control cables), electrical splices, limit switches, motors (only if the motor was replaced), terminal blocks, containment penetrations (only if the penetration was modified or replaced), and post-accident monitoring equipment). No more than one equipment type shall be chosen (i.e., one pressure and flow transmitter; one solenoid-operated valve (only if energized); one MOV; one motor (only if the motor was replaced)). The selection process may consider the safety significance of the equipment items informed by Probabilistic Risk Assessment (PRA) ranking of the licensee's design or component which was modified or component for which there was an NRC Information Notice issued or if is a component which was added to the licensee's EQML.

03.02 Pre-Inspection Tasks Prior to the On-Site Inspection. The following tasks should be completed:

On-site preparation/sample selection (commonly referred to as the "bagman trip")

Schedule permitting, the team leader should make a site visit/bagman about a month before the start of the EQ program inspection. Site visit is beneficial because it allows the team leader to become familiar with the licensee's EQ program and personnel associated with the program. This visit should facilitate a more effective and efficient identification of inspection samples and improved ability to identify appropriate licensee procedures and documents needed during the EQ inspection. During the bagman trip, the team leader (TL) should ensure that the licensee's EQ records are organized in an auditable format (see section 8 of IEEE 323-1974 for the type of information which is needed to audit the licensee's EQ program). The TL shall obtain a listing of components in the licensee's EQ program; obtain copy of test reports for selected samples; expected temperature profile during harsh-environmental conditions for the areas in which the components are located, and list of preventive maintenance schedule (PMS) for components selected. The TL should consider making requests to the licensee on obtaining access to component internals (i.e., for the purpose of inspecting MOV wiring connections) so that the licensee can have adequate time to plan and schedule these inspection activities, or alternately, request to accompany work on EQ components scheduled during the inspection week. Another alternative to obtaining access to component internals is to consider use of plant photographs of selected component, if the photographs captures the component internals in sufficient detail and these photographs were recently taken (i.e., photographs of component internals are no more than several refueling outages old and no major modifications have been performed on the component which could have affected the component internals). The following is a listing of some of the documents or information which could be useful during the EQ inspection:

- Licensee's word-searchable UFSAR. If not available in a single file per unit format, ensure a collective table of contents is provided. Specifically identify which UFSAR sections address environmental (including seismic) qualification.
- NRC's Safety Evaluation Report(s) associated with the licensee's environmental qualification.
- Licensee's commitments to various EQ standards (including year, edition, or revision).
- Identify whether a plant(s) has entered its period of extended operation (i.e., operation past the original 40 year license period).
- Equipment Qualification Master List (EQML).

Selected (not all) Equipment qualification documentation files for a sample of electrical equipment listed on the EQML (e.g., transmitter, limit switch, motor, MOV actuator, cable, solenoid) (paper copy). Note any deviations/justifications discussed in the qualification report. Confirm that auditable records are available onsite to establish qualification of each EQ component. Identify the most limiting temperature/pressure profile for the design bases accidents applicable to the components selected for inspection.

- Plant drawings which indicate areas affected by high energy line breaks.
- Licensee documents which show the maximum accident and maximum normal operating temperatures expected for areas in which components selected for inspection are located. List or drawings of plant areas that are subjected to EQ, identifying design (limiting) temperature, both normal and accident, high energy line break, radiation levels, etc. that the associated equipment will have to be qualified to meet EQ. If unit has obtained a power uprate (greater than 5 percent) provide same information pre-uprate (earliest available if multiple uprates).
- Procedures for material storage and shelf life controls.
- List of commercial grade dedication (CGD) evaluations performed, for which the dedicated parts have been issued for installation (approximately previous 5 years) on EQ applications in the plant. Include CGD evaluation number, name of part, component ID number or description of the component the part was issued to repair, work order, and date issued or installed.
- List of corrective action documents related to the EQ program or components (both electrical and mechanical) for previous 5 years.
- List of modifications, repairs, or replacement of EQML components completed for the previous 5 years, including date completed. Also, list of modification, repairs or replacements made to containment penetrations since initial plant operation.
- List of components removed from the EQ program during the previous 20 years.



- Any self-assessments or Quality Assurance (QA) assessments of the EQ program (performed during the previous 5 years).
- List of systems, system numbers/designators and corresponding names.

03.03.a No specific guidance.

03.03.b No specific guidance.

03.03.c No specific guidance.

03.03.d The inspector should verify that qualification of electrical equipment as documented in the qualification report reflects the plant as-built configuration. Any deviation from the qualified configuration must have adequate technical basis. Site (and corporate if applicable) procedures associated with the 10 CFR 50.49 EQ Program for electrical components.

03.03.e No specific guidance.

03.03.f No specific guidance.

03.03.g No specific guidance.

03.03.h No specific guidance.

03.03.i Walkdown of the area for components located in containment is not required while the plant is at power. Field walkdowns shall be coordinated with other EQ inspection activities in order to maximize inspection efficiency. Visually inspect the component selected for inspection and note any material condition deficiencies. If the component selected is not available for inspection internally, note any material condition deficiencies, if any, associated with the component selected and discuss the deficiencies with the licensee. Use the equipment checklists contained in Appendix B to determine if the installed equipment is the same as that described in the licensee's documentation and that the equipment is properly installed. Verify proper mounting, direction, and interfaces for position and limit switches.

03.03.j No specific guidance.

03.03.k No specific guidance.

03.03.l No specific guidance.

03.03.m No specific guidance.

03.03.n No specific guidance.

END

## Attachment 2

### Select Topics Regarding the Environmental Qualification Process

#### Arrhenius Methodology

Thermal aging is a temperature-dependent chemical process which can lead to changes in the properties of organic materials over a period of time. Since real-time aging is not practical over the long periods of time over which electrical equipment must be qualified for nuclear power plants, accelerated processes have been developed to simulate a defined life over a much shorter period of time. The Arrhenius methodology was developed to simulate accelerated aging.

The Arrhenius methodology has been addressed in a number of regulatory documents and various venues. The NRC Staff has concurred in the use of the Arrhenius methodology for thermal aging. The licensing proceeding for *Carolina Power & Light Co. and North Carolina Eastern Municipal Power Agency*, Shearon Harris Nuclear Power<sup>1</sup>, included the following NRC staff views of the Arrhenius methodology:

The Arrhenius methodology has been developed to simulate accelerated aging. This methodology is based on the premise that deterioration of materials in service is due to chemical reaction. These occur internally, sometimes between components of the material, and sometimes with compounds in the environment such as oxygen or water vapor. Chemical reactions occur more rapidly at higher temperatures. Arrhenius showed that temperature dependence of chemical reactions follows an exponential equation. He postulated a consistent correlation between the amount of physical change and chemical reaction so that the time to reach a selected amount of physical change will vary according to an equation. The rate of thermal aging is the slope of the graph using the Arrhenius equation. It is Applicants' conclusion that other than testing of the material or system for the predicted years of service, this is the most logical scientific way of predicting whether a material or system will be reliable. Type tests for thermal aging are made from 1 to 2 years. After the linearity of the Arrhenius graph for a particular material is confirmed, then short-time, more accelerated tests are acceptable to evaluate small changes in materials or application conditions. Generally, the experience has been excellent in confirming the predictions.

The NRC Staff has concurred in the use of the Arrhenius methodology for thermal aging.

The Staff is aware of the inadequacies in the Arrhenius methodology. However, it is the best approach currently available to address accelerated thermal aging and has been used in Equipment Qualification Programs of every nuclear power plant in the country. The Staff does not allow reliance exclusively on the Arrhenius methodology of accelerated aging to address the requirements for establishing a qualified life for equipment. Applicants must have a surveillance and maintenance program to account for unanticipated degradation which is not reflected in the results of the accelerated aging process. Combined with the

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<sup>1</sup> Carolina Power & Light Co. and North Carolina Eastern Municipal Power Agency, Shearon Harris Nuclear Power Plant, LBP 85-28, 22 NRC 232, 275-78 (1985) (addressing a contention concerning thermal aging of resistance temperature detectors (RTDs)), aff'd ALAB-856, 24 NRC 802

surveillance program, the Arrhenius methodology is considered acceptable for aging to establish a qualified life.

Furthermore, a February 24, 2000, Memorandum from Ashok C. Thadani, Director of the Office of Nuclear Regulatory Research to Samuel J. Collins, Director of the Office of Nuclear Reactor Regulation (ADAMS Accession No. ML003701987), "User Need Request on the Acceptability of the Arrhenius Methodology for Environmental Qualification (EQ) for LOCA and Post-LOCA Environments", included the following conclusion about the Arrhenius methodology:

Based on the overall Phase 1 research effort, the following conclusions are drawn:

1. The Arrhenius methodology has been studied extensively over the past few decades and has been shown to be a valid means of modeling temperature effects and for evaluating thermal degradation of polymers, with some limitations. These limitations include: (i) Arrhenius methodology is applicable only if the thermal degradation of the polymer involved is dominated by a single reaction within the temperature range of interest; Arrhenius extrapolation between different transition regions should be avoided; (ii) there may be significant uncertainties in the activation energy used (i.e., activation energies measured in air are used to model accident environments, and these may be different from those in steam environment); (iii) oxygen diffusion limitations are not accounted for in the Arrhenius model; and (iv) moisture effects are not accounted for in the Arrhenius model.
2. Arrhenius methodology can be used to evaluate the effects of varying temperature conditions provided that it is based on the principle of cumulative damage to the polymers involved.
3. There is a general agreement that an adequate technical basis exists to justify the application of the Arrhenius methodology for integrated time-temperature equivalent analysis as used in recent licensee submittals. In spite of its limitations, the Arrhenius methodology is applicable for analyzing the effects of small deviations in time temperature profiles to meet EQ requirements for LOCA and post-LOCA environments.

While there is no specific regulatory guidance for how to *apply* the Arrhenius Methodology for determining the qualified life of components, 10 CFR 50.49(e)(5), and the DOR Guidelines, NUREG 0588, Revision 1, Regulatory Guide 1.89, Revision 1, IEEE Std. 323-1974, IEEE Std. 101-1987, "IEEE Guide for the Statistical Analysis of Thermal Life Test Data," NUREG 1800, and NUREG-1801 include requirements and guidance for addressing *thermal aging* using the Arrhenius Methodology to qualify electric equipment.

In July of 1984, the NRC issued Regulatory Guide (RG) 1.89, Rev. 1, "Environmental Qualification of Certain Electric Equipment Important to Safety for Nuclear Power Plants," dated July 1984. It endorses, with certain exceptions identified in Section C, 'Regulatory Position', IEEE Std. 323-1974, "IEEE Standard for Qualifying Class 1E Equipment for Nuclear Power Generating Stations," and describes a method acceptable to the NRC Staff for complying with 10 CFR 50.49, "Environmental Qualification of Electric Equipment Important to Safety for Nuclear Power Plants."

Section C.5 of RG 1.89 states in part:

“Section 6.3.3, “Aging” of IEEE Std. 323-1974; and paragraph 10 CFR 50.49(e)(5) should be supplemented with the following:

...

b. The expected operating temperature of the equipment under service conditions should be accounted for in thermal aging. The Arrhenius methodology is considered an acceptable method of addressing accelerated thermal aging within the limitation of state-of-the-art technology. Other aging methods will be evaluated on a case-by-case basis.

c. The aging acceleration rate and activation energies used during qualification testing and the basis upon which the rate and activation energy were established should be defined, justified, and documented.”

In section B of RG 1.89, the NRC discussed preconditioning, stating in part:

For the purposes of this guide, "qualification" is a verification of design limited to demonstrating that the electric equipment is capable of performing its safety function under significant environmental stresses resulting from design basis accidents in order to avoid common-cause failures. Paragraph 50.49(e)(5) calls for equipment qualified by test to be preconditioned by natural or artificial (accelerated) aging to its end-of-installed-life condition and further specifies that consideration must be given to all significant types of degradation that can have an effect on the functional capability of the equipment. There are considerable uncertainties regarding the processes and environmental factors that could result in such degradation. Oxygen diffusion, humidity, and accumulation of deposits are examples of such effects. Because of these uncertainties, state-of-the-art preconditioning techniques are not capable of simulating all significant types of degradation, and natural pre-aging is difficult and costly. As the state of the art advances and uncertainties are resolved, preconditioning techniques may become more effective. Experience suggests that consideration should be given, for example, to a combination of (1) preconditioning of test samples employing the Arrhenius theory and (2) surveillance, testing, and maintenance of selected equipment specifically directed toward detecting those degradation processes that, based on experience, are not amenable to preconditioning and that could result in common-cause functional failure of the equipment during design basis accidents.

Section 6.3.3 of IEEE Std. 323-1974 notes that IEEE Std. 101-1972, “Guide to Statistical Analysis of Thermal Life Test Data,” may be used as a basis for selecting aging time and temperature.

According to the Guidelines for Evaluating Qualification of Class 1E Electrical Equipment in Operating Reactors (commonly referred to as DOR [Division of Operating Reactor] Guidelines, ML032541214), aging was to be evaluated as follows:

Tests which were successful using test specimens which had not been pre-aged may be considered acceptable provided the component does not contain materials which are known to be susceptible to significant degradation due to thermal and radiation aging (See Section 7.0). If the component contains such materials, a qualified life for the component must be established on a case by case basis. Arrhenius techniques are generally considered acceptable for thermal aging” (DOR Guidelines, Section 5.2.4).

As described in NUREG-0588, "Interim Staff Position on Environmental Qualification of Safety-Related Electrical Equipment," Rev. 1, page 2:

As part of the staff reviews of operating license applications, a number of positions have been developed on the methods and procedures used to environmentally qualify safety-related electrical equipment. These positions, which are described in the following sections of this report, supplement the requirements found in the 1971 and the 1974 version of IEEE Standard 323\*. While alternatives to these positions may be proposed, the positions will be used, together with the standards, as the basis for reviewing all license applications. The positions are divided into two categories. Category I positions apply to equipment qualified in compliance with IEEE Std. 323-1974 and Category II positions apply to equipment qualified in compliance with IEEE Std. 323-1971.

The positions are divided into two categories. Category I positions apply to equipment qualified in compliance with IEEE Std. 323-1974 and Category II positions apply to equipment qualified in compliance with IEEE Std. 323-1971.

Section 1 of the [ ] table [in NUREG-0588] contains positions related to the establishment of the service conditions for areas inside and outside containment to which equipment should be qualified. It includes guidance for calculating the pressure and temperature conditions that result from a high energy line break (LOCA and/or MSLB), and also provides guidance for determining the chemical spray and the radiation environments expected to occur during a design basis event condition. Section 2 provides guidance on the selection of qualification methods (that is, testing, analysis, etc.) to be used for equipment located inside and outside containment. Sections 3, 4, and 5 provide guidance on the selection of margins, aging and the preparation of qualification documentation. The appendices supplement the positions and identify specific codes, sample calculations, and procedures that should be used when qualifying equipment. The term "equipment" referred to in the following sections applies to safety-related electrical equipment required for accident mitigation, post-incident monitoring, and safe shutdown.

NUREG 0588, Rev. 1, Section 4, paragraph 2 (page 15) states for Category II equipment for aging that:

For other equipment, the qualification programs should address aging only to the extent that equipment that is composed, in part, of materials' susceptible to aging effects should be identified, and a schedule for periodically replacing the equipment and/or materials should be established. During individual case reviews, the staff will require that the effects of aging be accounted for on selected equipment if operating experience or testing indicates that the equipment may exhibit deleterious aging mechanisms. Thus, Arrhenius methodology can be used in Cat II.

EQ component reanalysis attributes are described in Section X.E1 "Environmental Qualification (EQ) of Electric Components," of NUREG-1801, "Generic Aging Lessons Learned (GALL) Report - Final Report," Rev. 2, which states:

The reanalysis of an aging evaluation is normally performed to extend the qualification by reducing excess conservatism incorporated in the prior evaluation. Reanalysis of an aging evaluation to extend the qualification of a component is performed on a routine basis pursuant to 10 CFR 50.49(e) as part of an EQ program. While a component life

limiting condition may be due to thermal, radiation, or cyclical aging, the vast majority of component aging limits are based on thermal conditions. Conservatism may exist in aging evaluation parameters, such as the assumed ambient temperature of the component, an unrealistically low activation energy, or in the application of a component (de-energized versus energized). The reanalysis of an aging evaluation is documented according to the station's quality assurance program requirements, which requires the verification of assumptions and conclusions.

Furthermore, NUREG-1800, "Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants," Rev. 2, Section 4.4, "Environmental Qualification of Electric Equipment," discusses equipment qualification in relation to license renewal.

#### Validation of Information in EQ Reports (e.g., Activation Energy)

Equipment qualification is governed by 10 CFR Part 50, Appendix B; and the regulation for environmental qualification of electrical equipment important to safety is 10 CFR 50.49.

Beyond ensuring that vendor programs satisfy the 10 CFR Part 50, Appendix B, requirements and confirming that EQ equipment is received as procured, licensees are not required to validate information (e.g., activation energy) contained in the EQ reports provided by Appendix B vendors.

Issues associated with the validity/justification of an activation energy provided by an Appendix B vendor may not necessarily be a licensee performance deficiency. In such cases, a compliance issue may still exist that would have to be addressed by the licensee.

Per the 2016 NRC Enforcement Policy (ML16271A446):

When inspectors determine that violations of NRC requirements (e.g., 10 CFR Part 50, Appendix B) have occurred that could adversely affect the quality of a safety-significant product or service, the NRC will typically take enforcement action. NOVs and civil penalties will be used, as appropriate, for licensee failures to ensure that their contractors have programs that meet applicable requirements. The NRC may also issue NOVs to contractors and vendors who violate 10 CFR Part 21 and may also issue NOVs for other violations such as those resulting from deliberate misconduct. Civil penalties may be imposed against individual directors or responsible officers of a contractor organization who deliberately fail to provide the notice required by 10 CFR 21.21(d)(1). The NRC may issue NOVs or orders to non-licensees who are subject to the specific requirements of 10 CFR Part 71 and 10 CFR Part 72, "Licensing Requirements for the Independent Storage of Spent Nuclear Fuel, High-Level Radioactive Waste, and Reactor-Related Greater than Class C Waste." Notices of Nonconformance will be used for contractors who fail to meet commitments related to NRC activities but are not in violation of specific requirements.

As used in 10 CFR Part 21, "Dedication", is defined in 10 CFR 21.3 as:

(1) When applied to nuclear power plants licensed pursuant to 10 CFR part 50, dedication is an acceptance process undertaken to provide reasonable assurance that a commercial grade item to be used as a basic component will perform its intended safety function and, in this respect, is deemed equivalent to an item designed and manufactured under a 10 CFR part 50, appendix B, quality assurance program.

This assurance is achieved by identifying the critical characteristics of the item and verifying their acceptability by inspections, tests, or analyses performed by the purchaser or third-party dedicating entity after delivery, supplemented as necessary by one or more of the following: commercial grade surveys; product inspections or witness at hold points at the manufacturer's facility, and analysis of historical records for acceptable performance. In all cases, the dedication process must be conducted in accordance with the applicable provisions of 10 CFR part 50, appendix B. The process is considered complete when the item is designated for use as a basic component.

RG 1.164, "Dedication of Commercial Grade Items for use in Nuclear Power Plants," Section B, "Discussion," Rev. 0, states that:

...equipment qualification is a part of the design process covered under 10 CFR Part 50, Appendix B, Criterion III, which demonstrates that an item exhibits design characteristics that allow it to function or survive a set of environmental conditions and/or seismic spectra. The purpose of the commercial grade dedication acceptance process is to provide reasonable assurance that the commercial item intended to be used as a basic component will perform its intended safety function. Therefore, equipment qualification requirements become an important input to the commercial-grade acceptance process when the selection of critical characteristics is performed.

RG 1.164 further states that:

...attempting to use one process to accomplish the objectives of both qualification and commercial-grade dedication is inappropriate because it could result in inadequately qualified equipment or specification of unnecessary acceptance requirements.

While commercial grade dedication can be utilized to establish similarity to previously qualified equipment it does not provide the methods for establishing environmental qualification. The licensee or the supplier performing the dedication under 10 CFR 50, Appendix B, would need to demonstrate similarity to the originally tested and qualified parts. This could include performing tests and/or analyses to provide an appropriate level of confidence that the replacement part will perform in a similar manner as the part originally qualified and tested, both during assumed accident conditions as well as in normal operation.

10 CFR 50, Appendix B, Criterion III, "Design Control," requires that licensees verify or check the adequacy of the design. Commercial grade items could be environmentally qualified, provided that there is a documented and acceptable material verification to ensure the replacement items are similar to those originally qualified items and the original qualification tests and analysis remain valid. Qualification of replacement components should be established based on qualification methods specified in 10 CFR 50.49(f) (e.g. environmental qualification via analysis with partial type test data or similarity to gain confidence that the component can perform its function in the required harsh environment). Per 10 CFR 50.49(f), each item of electrical equipment important to safety must be qualified by testing, analyses and/or experience. Per 10 CFR 50.49(k), "Applicants for and holders of operating licenses are not required to requalify electric equipment important to safety in accordance with the provisions of this section if the Commission has previously required qualification of that equipment in accordance with 'Guidelines for Evaluating Environmental Qualification of Class 1E Electrical Equipment in Operating Reactors,' November 1979 (DOR Guidelines), or NUREG-0588 (For Comment version), 'Interim Staff Position on Environmental Qualification of Safety-Related Electrical Equipment.'"



Further guidance was provided in Regulatory Guide 1.89, Rev. 1, issued in June 1984. Per RG 1.89, Rev. 1, Section C.5.:

Section 6.3.3, ['] Aging, ['] of IEEE Std. 323-1974 and paragraph 50.49(e)(5) should be supplemented with the following: Section (c) which states, "The aging acceleration rate and activation energies used during qualification testing and the basis upon which the rate and activation energy were established should be defined, justified, and documented."

While there is no regulatory requirement that establishes the level of technical basis needed for demonstrating an acceptable activation energy, changes made by licensees to materials or manufacturing processes between the original and the replacement parts should be evaluated for their impact on qualification. This could include how such changes might impact the activation energies used in the thermal aging analyses. Licensees and vendors may rely on industry consensus standards and quality databases to obtain a new activation energy value for a specific material; the selected value must be supported by auditable background information. The licensee's (or vendor's) justification should include an appropriate analysis showing that the selected activation energy is suitable and/or applicable to replace the existing value (e.g., same material, use of testing to demonstrate similar failure parameter or degradation mechanism, similar temperature range, same chemical reaction, etc.).

NRR should be consulted in cases where inspectors cannot reach a reasonable conclusion on the qualified status of the EQ components. If the NRC staff currently has concerns with existing specific methodologies or values for EQ, but the information was previously approved by the NRC, then the staff should generally not cite a violation. Instead, the staff should consider a backfit assessment for addressing the issue, commensurate with the safety and/or risk significance.

#### Replacement EQ Equipment and Upgrade Requirements

When developing 10 CFR 50.49, the NRC noted that the existing specific qualification methods contained in national standards, regulatory guides, and certain NRC publications for equipment qualification were subject to different interpretations and lacked a legally enforceable regulation. Recognizing this, the Commission noted that the 1982 proposed rule (47 Fed. Reg. 2876 (Jan 20, 1982)) would codify environmental qualification methods and clarify the Commission's requirements in this area.

The NRC has used a variety of methods to ensure that these general requirements are met for electric equipment important to safety. Prior to 1971, qualification was based on the fact that the electric components were of high industrial quality. For nuclear plants licensed to operate after 1971, qualification was judged on the basis of IEEE 323-1971. For plants whose Safety Evaluation Reports were issued since July 1, 1974, the Commission has used Regulatory Guide 1.89, "Qualification of Class 1E Equipment for Light-Water-Cooled Nuclear Power Plants," which endorses IEEE 323-1974, ['] "IEEE Standard for Qualifying Class 1E Equipment for Nuclear Power Generating Stations," subject to supplementary provisions.



Currently, the Commission has underway a program to reevaluate the qualification of electric equipment important to safety in all operating nuclear power plants. As a part of this program, more definitive criteria for environmental qualification of electric equipment have been developed by the NRC. A document entitled "Guidelines for Evaluating Environmental Qualification of Class 1E Electrical Equipment in Operating Reactors" (DOR Guidelines) was issued in November 1979. In addition, the NRC has issued NUREG-0588, "Interim Staff Position on Environmental Qualification of Safety-Related Electrical Equipment," which contains two sets of criteria: the first for plants originally reviewed in accordance with IEEE 323-1971 and the second for plants reviewed in accordance with IEEE 323-1974.

The Commission finalized the environmental qualification rule on January 31, 1983 (48 Fed. Reg. 2729) and later revised the rule on September 8, 1997 (62 Fed. Reg. 47268) to correct a discrepancy with the definition of safety-related structures, systems, and components. Concerning guidance, when publishing the final rule, the Commission stated:

Included in the final rule are specific technical requirements pertaining to (a) qualification parameters, (b) qualification methods, and (c) documentation. Qualification parameters include temperature, pressure, humidity, radiation, chemicals, and submergence. Qualification methods include (a) testing as the principal means of qualification and (b) analysis in combination with partial type test data or operating experience. The final rule requires that the qualification program include synergistic effects, radiation, environmental conditions and margin considerations. Also, a record of qualification must be maintained. Proposed Revision 1 to Regulatory Guide 1.89, which has been issued for public comment, describes methods acceptable to the NRC for meeting the provisions of this rule and includes a list of typical equipment covered by it. Revision 1 to Regulatory Guide 1.89 will be issued after resolution of public comments.

There are no requirements that explicitly specify what must be done if the DOR Guidelines do not address a particular area of EQ. However, 10 CFR 50, Appendix B, Criterion III, "Design Control," may address aspects not covered by the DOR Guidelines. Additionally, the NRC staff provided the following clarification under the 'Aging' Section for Category II equipment in NUREG 0588, Rev. 1, in response to comments received on the For Comment version of NUREG 0588:

For other equipment, the qualification programs should address aging only to the extent that equipment that is composed, in part, of materials' susceptible to aging effects should be identified, and a schedule for periodically replacing the equipment and/or materials should be established. During individual case reviews, the staff will require that the effects of aging be accounted for on selected equipment if operating experience or testing indicates that the equipment may exhibit deleterious aging mechanisms

Furthermore, NUREG-0588, Rev. 1, pages ix and x states:

All reactors with Operating Licenses as of May 23, 1980 will be evaluated by the staff against the DOR guidelines (Division of Operating Reactors – ‘Guidelines for Evaluating Environmental Qualification of Class IE Electrical Equipment in Operating Reactors,’ dated November 13, 1979). In cases where the DOR guidelines do not provide sufficient detail but NUREG-0588 Category II does, NUREG-0588 will be used.

It should be noted that the expectations identified above would only be applicable for licensees that have licensing commitments to conform to the guidance in NUREG 0588, Rev. 1.

With regard to replacing EQ components, 10 CFR 50.49(l) states:

Replacement equipment must be qualified in accordance with the provisions of this section unless there are sound reasons to the contrary.

Section 6 of RG 1.89, Rev. 1, states:

Replacement electric equipment installed subsequent to February 22, 1983, must be qualified in accordance with the provisions of § 50.49 unless there are sound reasons to the contrary. The NRC staff considers the following to be sound reasons for the use of replacement equipment previously qualified in accordance with the DOR Guidelines or NUREG-0588 in lieu of upgrading:

- a. The item of equipment to be replaced is a component of equipment that is routinely replaced as part of normal equipment maintenance, e.g., gaskets, o-rings, coils; these may be replaced with identical components.
- b. The item to be replaced is a component that is part of an item of equipment qualified as an assembly; these may be replaced with identical components.
- c. Identical equipment to be used as a replacement was on hand as a part of the utility's stock prior to February 22, 1983.
- d. Replacement equipment qualified in accordance with the provisions of § 50.49 does not exist.
- e. Replacement equipment qualified in accordance with the provisions of § 50.49 is not available to meet installation and operation schedules. However, in such case, the replacement equipment may be used only until upgraded equipment can be obtained and an outage of sufficient duration is available for replacement.
- f. Replacement equipment qualified in accordance with § 50.49 would require significant plant modifications to accommodate its use.
- g. The use of replacement equipment qualified in accordance with § 50.49 has a significant probability of creating human factor problems that would negatively affect plant safety and performance, for example:

- (1) Knowledge, skills, and ability of existing plant staff would require significant upgrading to operate or maintain the specific replacement equipment;
- (2) The use of the replacement equipment would create a one-of-a-kind application; or
- (3) Maintenance, surveillance, or calibration activities would be unnecessarily complex.

Therefore, licensees that were originally licensed to meet the DOR Guidelines or NUREG-0588 CAT II criteria for EQ are only required to 'upgrade' the qualification of EQ components to the CAT I criteria of NUREG-0588, Rev. 1, if they cannot satisfy the sound reasons to the contrary provision in 10 CFR 50.49(l) when replacing EQ components.

### EQ Files

EQ files are required by 10 CFR 50.49(d) and (j). 10 CFR 50.49(d) and (j), respectively, require, in part:

(d) The applicant or licensee shall prepare a list of electric equipment important to safety covered by this section. In addition, the applicant or licensee shall include the information in paragraphs (d)(1), (2), and (3) of this section for this electric equipment important to safety in a qualification file. The applicant or licensee shall keep the list and information in the file current and retain the file in auditable form for the entire period during which the covered item is installed in the nuclear power plant or is stored for future use to permit verification that each item of electric equipment is important to safely meet the requirements of paragraph (j) of this section.

(j) A record of the qualification, including documentation in paragraph (d) of this section, must be maintained in an auditable form for the entire period during which the covered item is installed in the nuclear power plant or is stored for future use to permit verification that each item of electric equipment important to safety covered by this section:

(1) Is qualified for its application; and

(2) Meets its specified performance requirements when it is subjected to the conditions predicted to be present when it must perform its safety function up to the end of its qualified life.

The applicable requirements for qualifying electrical equipment are dependent on the issuance date of a nuclear power facility's Construction Permit, and other regulatory commitments.

EQ files are considered supporting documents relied upon for demonstrating compliance with 10 CFR 50.49. The EQ files contain specific information such as equipment data, operating parameters, accident profile, procurement information, test parameters, a detailed explanation of test procedures, etc.

In the 80's, the NRC contracted Franklin Research to review each licensee's EQ program including the EQ files. The resultant Technical Evaluation Reports (TERs) and Safety Evaluation Reports (SERs) may contain staff positions and state what the NRC has accepted as part of each licensee's EQ program. In line with this, 10 CFR 50.49(k) acknowledges the work that was performed by licensees prior to the issuance of the final EQ rule to satisfy the DOR Guidelines and NUREG-0588.

END

## APPENDIX A

### CHECKLIST FOR REVIEW OF LICENSEE EQ DOCUMENTATION FILES

The checklist provided in Appendix B is for use in performing evaluations of the adequacy of a qualification documentation package for a piece of equipment qualified to the requirements of 10 CFR 50.49(j).

Such reviews by the inspector(s) will determine the adequacy of the EQ program for the device and will verify the adequacy of the licensee's review and approval process for the equipment. For other files, items not reviewed should be marked "N/A" in the "Comments Column."

Plant/Docket No.: \_\_\_\_\_ Reviewer: \_\_\_\_\_

Component(s): \_\_\_\_\_

Equipment Documentation File: \_\_\_\_\_

A general list of attributes to consider in reviewing EQ documentation include:

- Definitive documentation provided by the licensee that the equipment is qualified for its application (summary assessment)
- Technical description and function of the equipment
- If qualification sample is not identical to the installed devices, a documented engineering analysis has been provided
- Required mounting methods and orientations
- Delineated Interfaces – conduit, housing, seal(s), etc.
- A documented qualified life has been established based on accelerated aging – thermal, radiation, vibration, seismic, cyclic, as appropriate
- All type tests performed on the same test specimen for CAT-1
- Performance/acceptance criteria (operating time, transmitter accuracy, etc., as applicable to component)
- Documented test sequence conforms to IEEE 323-1974, or justification for deviation has been provided
- Radiation levels (total dose) and exposure times, cover accident, and normal service
  - ☐ Design Bases Event (DBE) exposure simulation meets plant requirements:
    - o Steam Exposure/chemical spray
    - o Temperature o Pressure Humidity
    - o Seismic
- Chemical or water spray testing performed, when required
- Suggested margins according to IEEE Std. 323 was retained
- Submergence test (If required)
- Test anomalies properly documented and resolved
- Applicable installation issues, etc., resolved
- EQ Maintenance/surveillance requirement and criteria are met, and qualified life is defined
- References clearly identified and attached or retrievable (including the component name and designator of the plant equipment)

## APPENDIX B

### PHYSICAL INSPECTION CHECKLISTS

This Appendix contains checklists for use in physical inspections of environmentally qualified equipment. Prior to the physical inspection, checklists should be prepared for each device that is to be inspected. The blank spaces in the “Documented Information” section of the checklist should be completed from the information in the licensee’s documentation files, relating to the device. Alternatively, system component evaluation worksheets (SCEW) may be used in lieu of completing some of the check sheet spaces. During the physical inspection, the “as-installed condition” should be compared with the “as-documented information.” Agreement between the “as-installed condition” and “as-documented information” should be marked in the “Yes” column. A disagreement should be marked with a “No”, and a description of the nature of the disagreement should be placed in the “Comments” column.

Checklists are provided for the following equipment on the licensee’s EQML:

- Pressure transmitters (also to be used for level and flow transmitters)
- Motor Operated Valves
- Limit Switches
- Solenoid Operated Valves
- Electric Motors
- Cables

A general form (EQUIPMENT DESCRIPTION) is provided for other devices such as:

- Switchgear
- Motor Control Centers
- Logic Equipment
- Diesel Generator Control Equipment
- Sensors (pressure, pressure differential, temperature, and neutron)
- Limit Switches
- Heaters
- Fans
- Control Boards
- Instrument Racks and Panels
- Electrical Penetrations
- Connectors
- Terminal Blocks
- EQ Splices: taped and Raychem

# PRESSURE TRANSMITTER PHYSICAL INSPECTION CHECKLIST

Component ID No. \_\_\_\_\_ Review: \_\_\_\_\_

<u>Documented Information</u>	<u>Installed Condition Agrees with Documented Information</u>		
	<u>Yes</u>	<u>No</u>	<u>Comments</u>
<b>1. <u>Location</u></b>  Bldg. _____ Room _____ Elevation _____			
<b>2. Manufacturer</b>  Model No. _____ Serial No. _____ Range/Type/Code _____			
<b>3. Mounting Description</b>			
<b>4. Orientation</b>			
<b>5. Process Connection Type</b>			
<b>6. Electrical Connection Type</b>			
<b>7. Housing seal(s) in good condition, covers, in place</b>			
<b>8. Does the installed device, experience a significant temperature rise from process or accident conditions?</b> (If yes, review documentation to determine whether considered)			
<b>9. Environmental conditions (including temperature, pressure, humidity, and others, as applicable)</b>  Ambient normal expected temperature range: _____ (If ambient temperature exceeds normal expected range, verify that licensee has considered the elevated temperature in the qualified life evaluation)			

# MOTORIZED VALVE ACTUATOR PHYSICAL INSPECTION CHECKLIST

Component ID: \_\_\_\_\_ Reviewer \_\_\_\_\_

<u>Documented Information</u>	<u>Installed Condition Agrees with Documented Information</u>		
	<u>Yes</u>	<u>No</u>	<u>Comments</u>
<b>1. <u>Location</u></b>  Bldg. _____ Room _____ Elevation _____			
<b>2. Manufacturer</b>  Model No. _____ Serial No. _____ Range/Type/Code _____			
<b>3. Mounting Description</b>			
<b>4. Orientation</b>			
<b>5. Housing seal(s) in good condition, covers, in-place</b>			
<b>6. Housing and motor drains. MOVs in radiation only fields do not require Tdrains</b>			
<b>7. Does the installed device have a brake? (If yes, verify status qualification)</b>			
<b>8. Conduit seal(s)</b>			
<b>9. Environmental conditions (including temperature, pressure, humidity, and others, as applicable)</b>  Ambient normal expected temperature range _____  (If ambient temperature exceeds normal expected conditions, verify, that the licensee has considered the elevated temperature in the qualified life evaluation)			

# LIMIT SWITCH PHYSICAL INSPECTION CHECKLIST

Component ID: \_\_\_\_\_ Reviewer: \_\_\_\_\_

<u>Documented Information</u>	<u>Installed Condition Agrees with Documented Information</u>		
	<u>Yes</u>	<u>No</u>	<u>Comments</u>
<b>1. Location</b>  Bldg _____ Room _____ Elevation _____			
<b>2. Manufacturer</b>  _____ Model No. _____ Serial No. _____			
<b>3. Mounting Description</b>			
<b>4. Orientation</b>			
<b>5. Electrical Connection Type</b>			
<b>6. Housing seal(s) in good condition</b>			
<b>7. Environmental conditions (including temperature, pressure, humidity, and others, as applicable)</b>  Ambient Normal Expected Temperature Range _____ (If ambient temperature exceeds normal expected conditions, verify, that the licensee has considered the elevated temperature in the qualified life evaluation)			



# SOLENOID OPERATED VALVE PHYSICAL INSPECTION CHECKLIST

Component ID: \_\_\_\_\_ Reviewer: \_\_\_\_\_

<u>Documented Information</u>	<u>Installed Condition Agrees with Documented Information</u>		
	<u>Yes</u>	<u>No</u>	<u>Comments</u>
1. Location Bldg: _____ Room _____ Elevation _____			
2. Manufacturer 3.  Model No. _____ Serial No. _____ Voltage _____ Configuration _____			
4. Mounting Description			
5. Orientation			
6. Process Connection Type			
7. Electrical Connection Type			
8. Housing seal(s) in good condition			
9. Does installed device, experience a significant temperature rise from process? (If yes, documentation must be reviewed to determine if the temperature was considered.)			
10. Environmental conditions (including temperature, pressure, humidity, and others, as applicable)  Ambient normal expected temperature range _____ (If ambient temperature exceeds normal expected conditions, verify that the licensee has considered the elevated temperature in the qualified life evaluation.)			

## ELECTRIC MOTOR PHYSICAL INSPECTON CHECKLIST

Component ID No. \_\_\_\_\_ Reviewer: \_\_\_\_\_

<u>Documented Information</u>	<u>Installed Condition Agrees with Documented Information</u>		
	<u>Yes</u>	<u>No</u>	<u>Comments</u>
1. Location Bldg. _____ Room _____ Elevation _____			
2. Manufacturer _____ Model No. _____ Serial No. _____ Batch No. _____			
3. Insulation Type _____ Jacket Type _____ No. of Conductors _____ Conductor Size _____ Shield Configuration _____			
4. Voltage Rating			
5. Environmental conditions (including temperature, pressure, humidity, and others, as applicable) _____  Ambient Normal Expected Temperature Range _____			
6. General Condition of Installed Cable			

# CABLE PHYSICAL INSPECTION CHECKLIST

Component ID: \_\_\_\_\_

Reviewer: \_\_\_\_\_

<u>Documented Information</u>	<u>Installed Condition Agrees with Documented Information</u>		
	<u>Yes</u>	<u>No</u>	<u>Comments</u>
<p>1. <u>Location</u></p> <p>Bldg. _____</p> <p>Room _____</p> <p>Elevation _____</p>			
<p>2. Manufacturer</p> <p>Model No. _____</p> <p>Serial No. _____</p> <p>Batch No. _____</p>			
<p>3. Insulation Type</p>			
<p>4. Jacket Type</p>			
<p>5. No. of Conductors</p>			
<p>6. Conductor Size</p>			
<p>2. Shield Configuration</p>			
<p>3. Voltage Rating</p>			
<p>4. Environmental conditions (including temperature, pressure, humidity, and others, as applicable)</p> <p>Ambient Normal Expected Temperature Range _____</p>			
<p>5. General Condition of Installed Cable</p>			

## EQUIPMENT DESCRIPTION

Component ID: \_\_\_\_\_ Reviewer: \_\_\_\_\_

<u>Documented Information</u>	<u>Installed Condition Agrees with Documented Information</u>		
	<u>Yes</u>	<u>No</u>	<u>Comments</u>
1. Location Bldg. _____ Room _____ Elevation _____			
2. Manufacturer Model No. _____ Serial No. _____			
3. Mounting Description			
4. Orientation			
5. Process Connection Type			
6. Electrical Connection Type			
7. Housing seal(s) in good condition, Covers in-place			
8. Does the installed device experience a significant temperature rise _____? (If yes, documentation must be reviewed to determine if the temperature rise was considered)			
9. Environmental conditions (including temperature, pressure, humidity, and others, as applicable) Ambient normal expected temperature range _____ (If ambient temperature exceeds normal expected conditions, verify that the licensee has considered the elevated temperature in the qualified life evaluation)			
10. Does the licensee account for warehouse storage time, where applicable, in the service life of components approved as replacement parts in plant systems (e.g. elastomer compounds such as O-rings, airoperated valve diaphragms, etc.)			

Attachment 3  
Revision History for IP 71111.21N

Commitment Tracking Number	Accession Number Issue Date Change Notice	Description of Change	Description of Training Required and Completion Date	Comment and Feedback Resolution Accession Number (Pre-Decisional, Non-Public Information)
N/A	ML15302A009 02/17/16 CN 16-006	Initial Issuance of the pilot inspection procedure. Researched commitments for four years and found none.	Oct and Dec 2015	ML15197A214
N/A	ML16237A126 DRAFT CN 16-XXX	Revised inspection procedure to include lessons learned from the pilot EQ inspections and FF - 19652120  Made draft version public prior to final version being issued to allow viewing of potential inspections starting CY 2017.	No	ML16239A104 71111.21-1965 ML16342C264 71111.21-2120 ML16342C352
N/A	ML16340B001 12/08/16 CN 16-032	Changes associated with ML16237A126.  A new ADAMS Accession Number was created to address a non-concurrence on the changes proposed by version of the IP associated with ML16237A126. Completed non-concurrence package can be found in ML16341C689. No additional changes were made to this IP.	No	ML16239A104 71111.21-1965 ML16342C264 71111.21-2120 ML16342C352  See non-concurrence package ML16341C689.
	ML19036A556 02/05/19 CN 19-005	Editorial revision to add Attachment 2, "Select Topics Regarding the Environmental Qualification Process"		n/a