

## NUCLEAR REGULATORY COMMISSION

### Proposed Interim Staff Guidance (ISG)-17 on; Periodic Inspection of Bus Ducts for License Renewal Solicitation of Public Comment

**AGENCY:** Nuclear Regulatory Commission (NRC).

**ACTION:** Solicitation of public comment.

**SUMMARY:** The NRC is soliciting public comment on its proposed interim staff guidance (ISG) for license renewal. This ISG proposes an acceptable aging management program (AMP), "Periodic Inspection of Bus Ducts," to manage the effects of aging on bus ducts during the period of extended operation. The NRC staff issues ISGs to facilitate timely implementation of the license renewal rule and to review activities associated with a license renewal application. Upon receiving public comments, the NRC staff will evaluate the comments and make a determination to incorporate the comments, as appropriate. Once the NRC staff completes the ISG, it will issue the ISG for NRC and industry use. The NRC staff will also incorporate the approved ISG into the next revision of the license renewal guidance documents.

**DATES:** Comments may be submitted by February 22, 2005. Comments received after this date will be considered, if it is practical to do so, but the Commission is able to ensure consideration only for comments received on or before this date.

**ADDRESSES:** Comments may be submitted to: Chief Rules and Directives Branch, Office of Administration, U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001.

Comments should be delivered to: 11545 Rockville Pike, Rockville, Maryland, Room T-6D59, between 7:30 a.m. and 4:15 p.m. on Federal workdays. Persons may also provide comments via e-mail at [NRCREP@NRC.GOV](mailto:NRCREP@NRC.GOV). The NRC maintains an Agencywide Documents Access and Management System (ADAMS), which provides text and image files of NRC's public documents. These documents may be accessed through the NRC's Public Electronic Reading Room on the Internet at <http://www.nrc.gov/reading-rm/adams.html>. Persons who do not have access to ADAMS or who encounter problems in accessing the documents located in ADAMS should contact the NRC Public Document Room (PDR) reference staff at 1-800-397-4209, (301) 415-4737, or by e-mail at [pdr@nrc.gov](mailto:pdr@nrc.gov).

**FOR FURTHER INFORMATION CONTACT:** Mr. Mark Lintz, License Renewal Project

Manager, Office of Nuclear Reactor Regulation, U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001; telephone (301) 415-4051 or e-mail [mp12@nrc.gov](mailto:mp12@nrc.gov).

#### SUPPLEMENTARY INFORMATION:

Attachment 1 to this **Federal Register** notice, entitled Staff Position and Rationale for the Interim Staff Guidance (ISG)-17: Proposed Aging Management Program (AMP) XI.E4, "Periodic Inspection of Bus Ducts" contains the NRC staff's rationale for publishing ISG-17. Attachment 2 to this **Federal Register** notice, entitled Proposed Aging Management Program: Periodic Inspection of Bus Ducts, contains the proposed AMP required to implement ISG-17.

NRC Information Notice 89-64, entitled "Electrical Bus Bar Failures," and NRC Information Notice 98-36, entitled "Inadequate or Poorly Controlled, Non-Safety-Related Maintenance Activities Unnecessarily Challenged Safety Systems," provide examples that illustrate the importance of periodic inspection of bus ducts and the potential problems that can arise from age-related bus duct failures. Instances of the loosening of the bus bar connecting bolts at several plants due to thermal cycling have been reported in Sandia National Laboratory Report entitled Aging Management Guideline for Commercial Nuclear Power Plants (Sandia 96-0344; September 1996) and in NRC Information Notice 2000-14, entitled "Non-Vital Bus Fault Leads to Fire and Loss of Offsite Power." The last report identified torque relaxation of splice plate connecting bolts as one potential cause of a bus duct failure.

Operating experience has shown that electrical buses in bus ducts have failed due to cracked insulation in the presence of moisture, debris buildup, and loosening of bus connecting bolts. These failures could lead to loss of power to electrical loads connected to the buses and could cause unnecessary challenges to plant safety systems. To prevent such failures, NRC has developed ISG-17 to ensure that:

(1) Internal portions of bus duct assemblies are free of corrosion, debris, excessive dust buildup, and moisture intrusion;

(2) Electrical buses and their supports are free of insulation cracking; and

(3) Bolted connections of the buses are secure.

Additionally, the external portions of bus ducts and structural supports will also be inspected in accordance with a plant-specific structural monitoring program.

Dated at Rockville, Maryland, this 16th day of December 2004.

For the Nuclear Regulatory Commission.

**Pao-Tsin Kuo,**

*Program Director, License Renewal and Environmental Impacts Program, Division of Regulatory Improvement Programs, Office of Nuclear Reactor Regulation.*

### Attachment 1: Staff Position and Rationale for the Interim Staff Guidance (ISG)-17: Proposed Aging Management Program (AMP) XI.E4, "Periodic Inspection of Bus Ducts"

#### Staff Position

Consistent with the requirements specified in 10 CFR 54.4(a), bus ducts (non-segregated phase bus and isolated phase buses) support safety-related and non-safety-related functions in that the failure of the bus ducts precludes a safety function from being accomplished [10 CFR 54.4(a)(1) and (a)(2)].

Thermal cycling of bus ducts can result in torque relaxation of connecting bolts, causing loose connections that lead to arcing, overheating, and explosive damage. Bus insulation material may experience a significant temperature rise during operation that may cause age-related degradation during the period of extended operation. Insulation failure, along with the presence of moisture or debris, may provide phase-to-phase or phase-to-ground electrical tracking paths that eventually result in catastrophic failure of the bus ducts. These bus ducts, therefore, need to be inspected periodically during the period of extended operation to preclude their failure.

In order to prevent such occurrences, the staff has developed an aging management program for periodic inspection of bus ducts for license renewal to ensure that:

(1) Internal portions of bus duct assemblies are free of corrosion, debris, excessive dust buildup, and moisture intrusion; and

(2) Electrical buses and their supports are free of insulation cracking; and

(3) Bolted connections of the buses are secure.

Additionally, the external portions of bus ducts and structural supports will also be inspected in accordance with a plant-specific structural monitoring program.

#### Rationale

An electrical bus is an assembly of bus conductors with the associated connections, joints, and insulating supports. Bus ducts are electrical buses installed on electrically insulated supports and are constructed with all

phase conductors enclosed in either a separate metal enclosure or a common metal enclosure. The conductors are separated and insulated from each other and from the ground by insulating bus supports. Also, the conductors in the non-segregated bus are insulated throughout to reduce corona and electrical tracking. The bus ducts are used in power systems that connect various elements of electric power circuits, such as switchgears, transformers, main generators, and diesel generators.

Industry operating experience indicates that the failure of bus ducts is caused by the cracking of bus bar insulation (bus sleeving) combined with the accumulation of moisture or debris. Cracked insulation results from high ambient temperatures and contamination from bus bar joint compound. Cracked insulation in the presence of moisture or debris provides phase-to-phase or phase-to-ground electrical tracking paths, which results in catastrophic failure of the buses. Bus failure leads to loss of power to electrical loads connected to the buses, causes subsequent reactor trips, and initiates unnecessary challenges to plant safety systems.

Bus ducts exposed to appreciable ohmic heating during operation may experience loosening of bolted connections because of the repeated cycling of connected loads. This phenomenon can occur in heavily loaded circuits, *i.e.*, those exposed to appreciable ohmic heating. A Sandia National Laboratory Report entitled, *Aging Management Guideline for Commercial Nuclear Power Plants* (Sandia 96-0344; September 1996) documents instances of bolted connection loosening at several plants due to thermal cycling. NRC Information Notice 2000-14, entitled *Non-Vital Bus Fault Leads to Fire and Loss of Offsite Power*, identified torque relaxation of splice plate connecting bolts as one potential cause of a bus duct fault.

In addition to NRC Information Notice 2004-14, NRC Information Notice 89-64, entitled *Electrical Bus Bar Failures*, and NRC Information Notice 98-36, entitled *Inadequate or Poorly Controlled, Non-Safety-Related Maintenance Activities Unnecessary Challenged Safety Systems*, also provide examples that underscore the safety significance of bus ducts and the potential problems that can arise from age-related bus duct failures.

## **Attachment 2: Proposed Aging Management Program: Periodic Inspection of Bus Ducts**

### **XI.E4 Periodic Inspection of Bus Ducts**

#### *Program Description*

An electrical bus is an assembly of bus conductors with the associated connections, joints, and insulating supports. Bus ducts are electrical buses installed on electrically insulated supports and are constructed with all phase conductors enclosed in either a separate metal enclosure or a common metal enclosure. The conductors are separated and insulated from each other and from the ground by insulating supports. Also, the conductors in the non-segregated bus are insulated throughout to reduce corona and electrical tracking. The bus ducts are used in power systems that connect various elements of electric power circuits, such as switchgears, transformers, main generators, and diesel generators.

Industry operating experience indicates that the failure of bus ducts is caused by the cracking of bus bar insulation (bus sleeving) combined with the accumulation of moisture or debris. Cracked insulation results from high ambient temperatures and contamination from bus bar joint compound. Cracked insulation in the presence of moisture or debris provides phase-to-phase or phase-to-ground electrical tracking paths, which results in catastrophic failure of the buses. Bus failure leads to loss of power to electrical loads connected to the buses, causes subsequent reactor trips, and initiates unnecessary challenges to plant systems.

Bus ducts exposed to appreciable ohmic heating during operation may experience loosening of bolted connections because of the repeated cycling of connected loads. This phenomenon can occur in heavily loaded circuits, *i.e.*, those exposed to appreciable ohmic heating. Sandia 96-0344 identified instances of bolted connection loosening at several plants due to thermal cycling. NRC Information Notice 2000-14 identified torque relaxation of splice plate connecting bolts as one potential cause of a bus duct fault.

One objective of the aging management program is to provide an inspection of bus ducts. In managing this aspect of the aging management program, bolted connections at sample sections of the buses in the bus ducts will be checked for proper torque, or the bolted joints will be checked for low resistance. This activity will include

visual inspection of interior portions of bus ducts to identify aging degradation of insulating and metallic components and water/debris intrusion. The external portions of bus ducts and structural supports will be inspected in accordance with a plant-specific structural monitoring program.

#### *Evaluation and Technical Basis*

1. *Scope of Program:* This program applies to all bus ducts within the scope of license renewal.

2. *Preventive Actions:* This is an inspection program and no actions are taken as part of this program to prevent or mitigate aging degradation.

3. *Parameters Monitored/Inspected:* A sample of accessible bolted connections (bus joints and ending devices) will be checked for proper torque, or the resistance of bolted joints will be checked using a micro-ohm meter of sufficient current capacity that is suitable for checking bus bar connections. This program will also inspect the internal portions of accessible bus ducts for cracks, corrosion, foreign debris, dust buildup, and moisture intrusion. The bus insulating system will be inspected for signs of embrittlement, cracking, melting, swelling, or discoloration, which may indicate overheating or aging degradation. The bus supports will be inspected for structural integrity and cracking.

4. *Detection of Aging Effects:* Visual inspection of internal portions of bus ducts detects cracks, corrosion, debris, dust and moisture. Visual inspection of the bus insulating system detects embrittlement, cracking, melting, swelling and discoloration. Visual inspection of bus supports detects cracking and lack of structural integrity. Internal portions of bus ducts, the bus insulating system, and the bus supports are visually inspected at least once every 10 years.

A torque test or a resistance test of a sample of accessible bolted connections is performed at least once every 10 years. This program will be completed before the end of the initial 40-year license term and every 10 years thereafter. This is an adequate period to identify failures of the bus ducts since experience has shown that aging degradation is a slow process. A 10-year inspection frequency will provide two data points during a 20-year period, which can be used to characterize the degradation rate.

5. *Monitoring and Trending:* Trending actions are not included as part of this program because the ability to trend inspection results is limited. Although not a requirement, trending would

provide additional information on the rate of degradation.

6. *Acceptance Criteria:* Bolted connections must meet the manufacturer's minimum torque specifications, or the resistance of bolted joints must meet required specifications. Bus ducts are to be free from any surface anomalies that suggest that conductor insulation degradation exists. An additional acceptance criterion includes no indication of unacceptable corrosion, cracking, foreign debris, dust buildup, or moisture intrusion. Any condition or situation that, if not corrected, could lead to a loss of intended function is considered unacceptable.

7. *Corrective Actions:* Further investigation and evaluation is performed when the acceptance criterion is not met. Corrective actions may include but are not limited to sample expansion, increased inspection frequency, and replacement or repair of the affected bus duct insulation components. When an unacceptable or situation is identified, a determination shall be made as to whether the same condition or situation is applicable to other areas, and sample expansion shall include those areas. As discussed in the appendix to this report, the staff finds the requirements of 10 CFR part 50, appendix B, acceptable to address corrective actions.

8. *Confirmation Process:* As discussed in the appendix to this report, the staff finds the requirements of 10 CFR part 50, appendix B, acceptable to address the confirmation process.

9. *Administrative Controls:* As discussed in the appendix to this report, the staff finds the requirements of 10 CFR part 50, appendix B, acceptable to address administrative controls.

10. *Operating experience:* Industry operating experience has demonstrated that the failures of bus ducts are caused by cracked insulation of the bus combined with moisture or debris buildup internal to the bus ducts. It has also been shown that bus duct internals exposed to appreciable ohmic heating during operation may experience loosening of bolted connections related to repeated cycling of connected loads.

#### References

1. IEEE Std. P1205-2000, IEEE Guide for Assessing, Monitoring and Mitigating Aging Effects on Class 1E Equipment Used in Nuclear Power Generating Stations.
2. SAND 96-0344, Aging Management Guideline for Commercial Nuclear Power Plants—Electrical Cable and Terminations, prepared by Sandia National Laboratories for the U.S. Department of Energy, September 1996.

3. EPRI TR-109619, Guideline for the Management of Adverse Localized Equipment Environments, Electric Power Research Institute, Palo Alto, CA, June 1999.

4. EPRI TR-104213, Bolted Joint Maintenance & Application Guide, Electric Power Research Institute, Palo Alto, CA, December 1995.

5. NRC Information Notice 89-64, "Electrical Bus Bar Failures."

6. NRC Information Notice 98-36, "Inadequate or Poorly Controlled, Non-Safety-Related Maintenance Activities Unnecessary Challenged Safety Systems."

7. NRC Information Notice 2000-14, "Non-Vital Bus Fault Leads to Fire and Loss of Offsite Power."

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### PENSION BENEFIT GUARANTY CORPORATION

#### Submission of Information Collection for OMB Review; Comment Request; Liability for Termination of Single-Employer Plans

**AGENCY:** Pension Benefit Guaranty Corporation.

**ACTION:** Notice of request for extension of OMB approval.

**SUMMARY:** The Pension Benefit Guaranty Corporation ("PBGC") is requesting that the Office of Management and Budget ("OMB") extend approval, under the Paperwork Reduction Act, of a collection of information in its regulation on Liability for Termination of Single-Employer Plans, 29 CFR Part 4062 (OMB control number 1212-0017; expires January 31, 2005). This notice informs the public of the PBGC's request and solicits public comment on the collection of information.

**DATES:** Comments should be submitted by January 24, 2005.

**ADDRESSES:** Comments should be mailed to the Office of Information and Regulatory Affairs of the Office of Management and Budget, Attention: Desk Officer for Pension Benefit Guaranty Corporation, Washington, DC 20503. Copies of the request for extension (including the collection of information) may be obtained without charge by writing to or visiting the PBGC's Communications and Public Affairs Department, suite 240, 1200 K Street, NW., Washington, DC 20005-4026, or calling (202) 326-4040. (TTY and TDD users may call (800) 877-8339 and request connection to (202) 326-4040). The regulation on Employer Liability can be accessed on the PBGC's Web site at <http://www.pbgc.gov>.

**FOR FURTHER INFORMATION CONTACT:** Thomas H. Gabriel, Attorney, Office of

the General Counsel, Pension Benefit Guaranty Corporation, 1200 K Street, NW., Washington, DC 20005-4026, (202) 326-4024. (For TTY and TDD, call (800) 877-8339 and request connection to (202) 326-4024).

**SUPPLEMENTARY INFORMATION:** Section 4062 of the Employee Retirement Income Security Act of 1974 provides that the contributing sponsor of a single-employer pension plan and members of the sponsor's controlled group ("the employer") incur liability ("employer liability") if the plan terminates with assets insufficient to pay benefit liabilities under the plan. The PBGC's statutory lien for employer liability and the payment terms for employer liability are affected by whether and to what extent employer liability exceeds 30 percent of the employer's net worth.

Section 4062.6 of the PBGC's employer liability regulation (29 CFR 4062.6) requires a contributing sponsor or member of the contributing sponsor's controlled group who believes employer liability upon plan termination exceeds 30 percent of the employer's net worth to so notify the PBGC and to submit net worth information. This information is necessary to enable the PBGC to determine whether and to what extent employer liability exceeds 30 percent of the employer's net worth.

The collection of information under the regulation has been approved by OMB under control number 1212-0017 (expires January 31, 2005). The PBGC is requesting that OMB extend its approval for three years. An agency may not conduct or sponsor, and a person is not required to respond to, a collection of information unless it displays a currently valid OMB control number.

The PBGC estimates that an average of 5 contributing sponsors or controlled group members per year will respond to this collection of information. The PBGC further estimates that the average annual burden of this collection of information will be 12 hours and \$3,300 per respondent, with an average total annual burden of 60 hours and \$16,500.

Issued in Washington, DC, this 20th day of December, 2004.

**Stuart A. Sirkin,**

*Director, Corporate Policy and Research Department, Pension Benefit Guaranty Corporation.*

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