

UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
OFFICE OF NUCLEAR REACTOR REGULATION  
OFFICE OF NEW REACTORS  
WASHINGTON, DC 20555-0001

January 28, 2010

NRC INFORMATION NOTICE 2010-02: CONSTRUCTION-RELATED EXPERIENCE WITH  
CABLES, CONNECTORS, AND JUNCTION  
BOXES

**ADDRESSEES**

All current holders of and applicants for an early site permit, combined operating license, or standard design certification for a nuclear power plant under the provisions of Title 10 of the *Code of Federal Regulations* (10 CFR) Part 52, "Licenses, Certifications, and Approvals for Nuclear Power Plants."

All holders of operating licenses or construction permits for nuclear power reactors under the provisions of 10 CFR Part 50, "Domestic Licensing of Production and Utilization Facilities," except those that have permanently ceased operations and have certified that fuel has been permanently removed from the reactor.

**PURPOSE**

The U.S. Nuclear Regulatory Commission (NRC) is issuing this information notice (IN) to alert addressees of construction-related operating experience at domestic and international facilities associated with the rating, installation, and qualification of cables and junction boxes. Recipients are expected to review the information for applicability to their planned activities and consider actions to avoid similar problems. The suggestions contained in this IN are not NRC requirements, and no specific action or written response is required.

**DESCRIPTION OF CIRCUMSTANCES**

Penly Unit 2 in France—Improper Installation of Shrink-Fit Sheathing

On September 23, 2003, at Penly Unit 2 in France, an isolation fault was detected in the junction boxes of two containment isolation valves for the nuclear sampling system. Electrical cables in those junction boxes failed because of "cable insulation cuts" and "improperly shrunk thermal shrink-fit sheathing", which resulted in exposed copper conductors that accessed external ground paths. Further inspections found similar damage to the safety-qualified electrical cables in 57 out of 122 junction boxes inspected at Penly. Électricité de France expanded the inspections of cables and junction boxes to its other nuclear plants in France and found similar problems at Flamanville Unit 2, Gravelines Unit 3, Dampierre Unit 4, and Tricastin Unit 1. The primary cause of this event is not currently known. Improper installation practices are suspected, but it is not clear why the post-installation inspection did not detect the bare copper conductors. The most likely cause is expected to be improper installation practices

**ML090290185**

combined with a degradation of the insulating sheaths over time, which caused the cables to have exposed bare copper conductors.

#### Cattenom Unit 2 in France—Fire in Electrical Cable Penetration

On May 16, 2004, at Cattenom Unit 2 in France, a cable fire occurred in a fire-resistant, electrical penetration carrying 6.6-kilovolt (kV) electrical cables (to the circulating water pumps) and other safety-related cables between the electrical building and the turbine hall. The fire was detected by alarms indicating an insulation fault on the 6.6-kV electrical switchboards, followed by a fire alarm.

The primary cause of the fire was attributed to undersized cables for the circulating water pumps. A contributing factor to this event was the closure of the cable penetration at both ends, which allowed a buildup of heat causing carbonization of the cable insulation.

Modifications were made in the four units of Cattenom by (1) using two cables per phase to increase the allowed amperage per phase and (2) by opening one end of the cable penetration to eliminate the oven effect on the cables.

#### Palisades— Electrical Cables Degraded by Hot Nearby Piping

On February 17, 2007, an auxiliary operator at Palisades Nuclear Plant discovered that cables in a cable tray that are primarily associated with components of the cooling water and service water system had sustained damage to their cable jackets from the radiant heat effects of an uninsulated hot pipe that was in proximity to the cable tray. These cables, which were rated for 194 degrees Fahrenheit (90 degrees Celsius), were close to the steam generator blowdown pipe, which had a surface temperature of 480 degrees Fahrenheit (248 degrees Celsius). The licensee subsequently determined that all of the cables in the cable tray that were potentially affected by the radiant heat damage were inoperable because of loss of qualification life and the potential for cable-to-cable interaction from degradation of the cable. Licensee corrective actions included replacing the damaged cable sections and insulating the steam generator blowdown line. Additional information is available in Palisades Licensee Event Report 50-255/2007-003, dated April 25, 2007 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML071230123).

## **BACKGROUND**

### Related NRC Communications

- Generic Letter 2007-01, “Inaccessible or Underground Power Cable Failures That Disable Accident Mitigation Systems or Cause Plant Transients” (ADAMS Accession No. ML070360665), dated February 7, 2007, and Summary Report (ADAMS Accession No. ML082760385), dated November 12, 2008.
- IN 1986-53, “Improper Installation of Heat Shrinkable Tubing” (ADAMS Accession No. ML031220693), dated June 26, 1986, discusses problems involving improper installation of heat shrinkable tubing over electrical splices and terminations.

- NUREG-1055, "Improving Quality and the Assurance of Quality in the Design and Construction of Nuclear Power Plants" (ADAMS Accession No. ML063000293), dated May 31, 1984, documents the lessons learned from plant construction.

## DISCUSSION

The operating experience discussed in this IN involves deficiencies with the rating, installation, and qualification of cables and junction boxes that originated during construction. Improper electrical cable installation techniques can result in conditions that, over time, manifest themselves in degraded insulation/sheathing which can lead to electrical shorts and grounds that can render technical specification required equipment inoperable. Licensees are required by 10 CFR Part 50, Appendix B, Criterion V, "Instructions, Procedures, and Drawings Activities," to establish and implement adequate instructions and procedures for activities affecting quality which includes electrical cable installation. NRC regulations in 10 CFR Part 50, Appendix B, "Design Control," includes consideration of cable material qualification (for both fire retardancy and installation stresses), qualification of thermal shrink-fit sheathing, and proper cable installation processes (to ensure that insulation/sheathing is not damaged during installation).

## CONTACT

This information notice requires no specific action or written response. Please direct any questions about this matter to the technical contacts listed below.

**/RA/**

Timothy McGinty, Director  
Division of Policy and Rulemaking  
Office of Nuclear Reactor Regulation

**/RA/**

Glenn Tracy, Director  
Division of Construction Inspection and  
Operational Programs  
Office of New Reactors

Technical Contacts: Omid Tabatabai, NRO/DCIP  
(301) 415-6616  
[omid.tabatabai@nrc.gov](mailto:omid.tabatabai@nrc.gov)

Edmund Kleeh, NRO/DCIP  
(301) 415-2964  
[edmund.kleeh@nrc.gov](mailto:edmund.kleeh@nrc.gov)

Note: NRC generic communications may be found on the NRC public Web site, <http://www.nrc.gov>, under Electronic Reading Room/Document Collections.

- NUREG-1055, "Improving Quality and the Assurance of Quality in the Design and Construction of Nuclear Power Plants" (ADAMS Accession No. ML063000293), dated May 31, 1984, documents the lessons learned from plant construction.

**DISCUSSION**

The operating experience discussed in this IN involves deficiencies with the rating, installation, and qualification of cables and junction boxes that originated during construction. Improper electrical cable installation techniques can result in conditions that, over time, manifest themselves in degraded insulation/sheathing which can lead to electrical shorts and grounds that can render technical specification required equipment inoperable. Licensees are required by 10 CFR Part 50, Appendix B, Criterion V, "Instructions, Procedures, and Drawings Activities," to establish and implement adequate instructions and procedures for activities affecting quality which includes electrical cable installation. NRC regulations in 10 CFR Part 50, Appendix B, "Design Control," includes consideration of cable material qualification (for both fire retardancy and installation stresses), qualification of thermal shrink-fit sheathing, and proper cable installation processes (to ensure that insulation/sheathing is not damaged during installation).

**CONTACT**

This information notice requires no specific action or written response. Please direct any questions about this matter to the technical contacts listed below.

**/RA/**

Timothy McGinty, Director  
Division of Policy and Rulemaking  
Office of Nuclear Reactor Regulation

**/RA/**

Glenn Tracy, Director  
Division of Construction Inspection and  
Operational Programs  
Office of New Reactors

Technical Contacts: Omid Tabatabai, NRO/DCIP  
(301) 415-6616  
[omid.tabatabai@nrc.gov](mailto:omid.tabatabai@nrc.gov)

Edmund Kleeh, NRO/DCIP  
(301) 415-2964  
[edmund.kleeh@nrc.gov](mailto:edmund.kleeh@nrc.gov)

Note: NRC generic communications may be found on the NRC public Web site, <http://www.nrc.gov>, under Electronic Reading Room/Document Collections.

ADAMS Accession Number: ML090290185

TAC ME0471

OFFICE	CCIB:NRO	TECH EDITOR	TL:CCIB:NRO	BC:CCIB:NRO	BC:EEB:NRO	BC:EEEB:NRR
NAME	EKleeh	KAzariah-Kribbs	OTabatabai	JStarefos	RJenkins	GWilson
DATE	02/04/09	03/16/09 e-mail	02/04/09	02/06/09	02/09/09	02/26/09
OFFICE	BC:OIP	PGCB:NRR	PGCB:NRR	BC:PGCB:NRR	D:DPR:NRR	D:DCIP:NRO
NAME	CAbrams	DBeaulieu	CHawes	MMurphy	TMcGinty	GTracy
DATE	4/15/09	07/23/09	1/11/10	1/19/10	1/28/10	1/22/10

**OFFICIAL RECORD COPY**