

UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
OFFICE OF NUCLEAR REACTOR REGULATION  
WASHINGTON, D.C. 20555-0001

January 25, 1996

NRC INFORMATION NOTICE 96-06: DESIGN AND TESTING DEFICIENCIES OF TORNADO DAMPERS AT NUCLEAR POWER PLANTS

Addressees

All holders of operating licenses or construction permits for nuclear power reactors.

Purpose

The U.S. Nuclear Regulatory Commission (NRC) is issuing this information notice to alert addressees to the potential for inoperability of tornado dampers because of either inadequacies in damper testing or deficiencies in damper design. It is expected that recipients will review the information for applicability to their facilities and consider actions, as appropriate, to avoid similar problems. However, suggestions contained in this information notice are not NRC requirements; therefore, no specific action or written response is required.

Description of Circumstances

On March 2, 1994, the licensee for South Texas Project, Unit 1, reported a condition to the NRC that could result in the rapid depressurization of heating, ventilation and air conditioning (HVAC) systems and buildings in the event of a tornado (Licensee Event Report No. 94-003). The licensee discovered an interference between the plant exhaust vent tornado damper and a gusset (duct work structural stiffener). The gusset limited the closing travel of the damper linkage in one damper section to 40 percent of full stroke, thus preventing the damper from closing completely. The interference was discovered during stroke testing in response to an NRC inspector observation that there was no testing evidence to show that tornado dampers would actuate as required. In response to that observation, the licensee initiated changes to existing preventive maintenance work instructions for all tornado dampers (15 per unit) to include manual stroking on a periodic basis. Only one of the 30 dampers subsequently tested was found to be inoperable. The originally planned periodic maintenance of tornado dampers at 10-year intervals did not include any stroke or motion testing.

South Texas stated that rapid depressurization could result in the collapse of the HVAC duct work and could prevent cooling of safety-related equipment. The rapid depressurization could also cause unanalyzed internal pressure differential conditions that might result in damage to safety-related structures, systems, or components.

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The licensee revised the preventive maintenance program to require preventive maintenance on the tornado dampers every 2 years or at each refueling outage, depending on the specific damper function. The 2 year or refueling outage check includes inspection, cleaning, lubricating, and stroking of the damper while taking dynamometer measurements of the spring forces.

On October 22, 1993, the licensee for the River Bend Station reported a design condition to the NRC (Licensee Event Report No. 93-020) that could result in loss of ventilation to several buildings after passage of a tornado. The licensee determined through static pressure testing, that the air-exhaust dampers for several buildings would not reopen after passage of a tornado. The failure to reopen results from inadequate spring force on dampers to overcome exhaust fan shutoff pressure. This condition was applicable to the diesel generator building, the auxiliary building, the control building, the fuel building, and the standby cooling tower.

The licensee evaluation at the River Bend Station revealed that the postulated tornado event could cause loss of offsite power and could prevent the air-intake dampers for the diesel generator from reopening. Other plant areas were less susceptible to damage because of design features and/or alarms, followed by operator actions that could mitigate the consequences. The air-exhaust tornado dampers in the diesel generator building were modified by blocking them open. The licensee evaluated the equipment in the diesel generator building and concluded that it would not be affected by depressurization resulting from the tornado.

The licensee purchase specification for dampers required the dampers to be capable of automatically returning to their normal operating position (open) after the tornado passed. However, the specification did not specify the design-bases conditions on the inlet side of the exhaust tornado dampers. The static pressure that the damper counterweights would have to overcome was not specified.

### Discussion

Equipment such as tornado dampers may have been overlooked in development of surveillance testing programs as tornado dampers are not generally considered part of the HVAC system in which they are required to function. Tornado dampers are more likely to be considered part of the structure in which they are installed. Surveillance tests in the technical specifications may involve damper operations during HVAC systems testing. However, specific NRC requirements or guidelines for damper testing in general are limited and do not extend to tornado dampers. Likewise, industry standards and guidelines for testing of tornado dampers are also limited. Unlike other active safety-related dampers that are generally tested along with the HVAC system in which they function, the licensees considered tornado dampers as passive devices until they were called upon to perform their function.

When called on, certain dampers must close to prevent rapid depressurization within the structures and HVAC ductwork and then reopen after the tornado passes. In cases for which no redundancy exists, a single failure of a tornado damper to perform its safety function could result in a loss of safety system function. Therefore, absence of appropriate surveillance testing for tornado dampers could lead to multiple failures in safety systems.

This information notice requires no specific action or written response. If you have any questions about the information in this notice, please contact one of the technical contacts listed below or the appropriate Office of Nuclear Reactor Regulation (NRR) project manager.

*Dennis M. Crutchfield*  
Dennis M. Crutchfield, Director  
Division of Reactor Program Management  
Office of Nuclear Reactor Regulation

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Attachment: List of Recently Issued NRC Information Notices

*Attachment filed in Jacket*

LIST OF RECENTLY ISSUED  
 NRC INFORMATION NOTICES

| Information Notice No. | Subject   | Date of Issuance | Issued to  |
|------------------------|---|------------------|--|
| 96-05                  | Partial Bypass of Shutdown Cooling Flow from the Reactor Vessel   | 01/18/96         | All holders of OLs or CPs for boiling water reactors                 |
| 96-04                  | Incident Reporting Requirements for Radiography Licensees   | 01/10/96         | All radiography licensees and manufacturers of radiography equipment |
| 96-03                  | Main Steam Safety Valve Setpoint Variation as a Result of Thermal Effects   | 01/05/96         | All holders of OLs or CPs for nuclear power reactors                 |
| 96-02                  | Inoperability of Power-Operated Relief Valves Masked by Downstream Indications During Testing                     | 01/05/96         | All holders of OLs or CPs for PWRs                                   |
| 96-01                  | Potential for High Post-Accident Closed-Cycle Cooling Water Temperatures to Disable Equipment Important to Safety | 01/03/96         | All holders of OLs or CPs for PWRs                                   |
| 95-58                  | 10 CFR 34.20; Final Effective Date  | 12/18/95         | Industrial Radiography Licensees                                     |
| 95-57                  | Risk Impact Study Regarding Maintenance During Low-Power Operation and Shutdown                                   | 12/18/95         | All holders of OLs or CPs for nuclear power reactors.                |

OL = Operating License  
 CP = Construction Permit

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original signed by

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Tech Editor Reviewed 10/05/95

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| NAME   | WTLefave* | TKoshy*   | ACHaffee*   | DCrutchfield |         |  |
| DATE   | 10/11/95  | 01/04/96  | 01/17/96    | 01/19/96     | 01/ /96 |  |

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| NAME   | WLeFave*         |   | GHubbard *        |   | TECH ED/BCalure    |   | CMcCracken * |   |         | <i>N/A</i> |
| DATE   | 10/11/95         |   | 10/11/95          |   | 10/05/95           |   | 10/12/95     |   | 1       | 195        |
| OFFICE | PECB/DRPM        | E | SC:PECB/DOPS      | E | C/PECB:DOPS        |   | D/DRPM       |   |         |            |
| NAME   | TKoshy <i>JK</i> |   | EGoodwin <i>G</i> |   | AChaffee           |   | DCrutchfield |   |         |            |
| DATE   | 01/11/96         |   | 01/5/96           |   | 01/17/96 <i>XD</i> |   | 01/ /96      |   |         |            |

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| NAME   | TKoshy* <i>JK</i>     |   | EGoodwin* <i>3</i> |   | AChaffee        |   | DCrutchfield |   |         |     |
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Attachments:

1. Referenced Codes and Standards<sup>2</sup>
2. List of Recently Issued NRC Information Notices

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| NAME   | TKoshy* <i>TK</i> |   | EGoodwin*    |   | RKessel         |   | AChaffee     |   | DCrutchfield |     |
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<sup>2</sup> See Exhibit 24 for the format to be used when codes or standards are referenced in the information notice.

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| NAME   | TKoshy*   |   | EGoodwin*    |   | <del>RKjessel</del>  |              | AChaffee     |     | DCrutchfield |     |
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