AEOD TECHNICAL REVIEW REPORT*

UNIT: North Anna, Unit 2
DOCKET No.: 50-339
LICENSEE: Virginia Electric and Power Co.
NSSS/AE: Westinghouse/Stone and Webster

TR REPORT NO. AEOD/T413
DATE: June 28, 1984
EVALUATOR/CONTACT: W. Lanning

SUBJECT: FAILURE OF FIRE DAMPER IN SAFEGUARDS VENTILATION SYSTEM

EVENT DATE: November 20, 1983

REFERENCE: Licensee Event Report 83-77

SUMMARY

A failure of a single fire damper in the safeguards ventilation system rendered the system inoperable. A fusible link inadvertently melted and the fire damper isolated the ventilation duct as designed to prevent the spread of a fire. The safeguards ventilation system is a single train system at North Anna for the safeguards building to provide cooling of safeguards equipment and to filter the atmosphere in the event of radioactive releases from the equipment during an accident.

The single failure of the fire damper that rendered the safeguards ventilation system inoperable appeared to be specific to North Anna because other ventilation designs are usually two-train systems. The licensee was unable to determine how long the system had been inoperable because the flow testing of the system had not been performed pursuant to the technical specifications. The flow testing is now performed monthly (the technical specification time interval is 18 months) to ensure the availability of the systems.

Because the failure of the fire damper could go undetected for 18 months, Region II will identify this concern as a potential generic concern to NRR for further consideration. In addition, the potential consequences of failed fire dampers on the safety functions of the ventilation system will also be identified for further study. AEOD endorsed the Region's action and will follow the activities associated with the issue.

A future article in Power Reactor Events is suggested to inform operating plants of the potential for inadvertent fire damper failures that could degrade the performance of the ventilation systems.

* This document supports AEOD and NRC activities and does not represent the position or requirements of the responsible NRC program office.

DISCUSSION:

The safeguards ventilation system is a safety system with two purposes. First, the system filters the atmosphere in the safeguards building to minimize atmospheric releases of radioactive materials leaking from emergency core cooling system (ECCS) equipment following a loss of coolant accident. Secondly, the system provides ventilation to the building to limit the ambient temperature (about 120 F) during warm weather to ensure the equipment can perform their intended functions (environmental qualification). The referenced LER reported a single failure of a fire damper in the ventilation system that rendered the system inoperable. The fire damper had failed closed, isolating the ventilation system for the safeguards building. This failure negated both design purposes for the ventilation system.

The fire damper failed closed because the fusible link had apparently melted. Thus, the fusible link had been exposed to a temperature of about 160 F. The licensee was unable to determine the cause for melting of the fusible link or the length of time the fire damper had been closed. Flow testing of the safeguards ventilation system had not been performed pursuant to technical specification requirements prior to discovery of the failed fire damper. The licensee indicated that testing of the Unit 2 exhaust fans had been omitted from procedures that were applicable to both North Anna units. The Unit 1 safeguards ventilation system had been tested.

The ventilation system for the safegards building is connected to the ventilation system for the auxiliary building which contains the filters and charcoal adsorbers. At North Anna, only a single duct is available in the safeguards building. The ventilation system in the auxiliary building is a two train system. Failure of a damper in the ventilation system that inhibits normal flow is not alarmed nor indicated in the control room. A differential pressure reading for the entire ventilation system is available that could be used to infer degraded performance. The licensee indicated that a failed fire damper can only be identified effectively during flow testing of the system. The position of a fire damper cannot usually be determined unless a cover is removed from the duct. The technical specifications require flow testing every 18 months. Thus, a failed fire damper represents an undetected failure that could exist for an entire operating cycle. The 18-month testing interval is the standard technical specification surveillance time interval for ventilation and atmospheric clean-up systems.

As the result of this event, North Anna revised its procedures to flow test the safeguards ventilation system monthly. This should minmize the unavailability of the safeguards ventilation system.

The single failure of the fire damper that rendered the safeguards ventilation system inoperable appears specific to North Anna since other designs (based on a small sample) usually employ a two-train system. The North Anna design was the only one identified that had a separate building

to house safeguards equipment (usually located in the auxiliary building at other plants). The North Anna Updated Final Safety Analysis Report inferred that the intake for the safeguards ventilation system was susceptible to a single failure and stated that there was an emergency cooling system (locally operated fan system) available. This system provides circulation cooling for equipment, but does not control the release of radioactive materials. The plant procedures require the door to the safeguards building to be opened to facilitate cooling of the equipment.

A search of the operating experience data bases revealed a small number of random failures of fire dampers in ventilation systems (two-train systems). Thus, failures of fire dampers do not appear to be significant failure mode for ventilation systems.

Fire dampers usually represent the 3-hour fire barrier between compartments pursuant to 10 CFR 50, Appendix R. Licensees generally installed new fire dampers or qualified existing fire dampers to comply with Appendix R requirements. Based on discussions with members of the Auxiliary Systems Branch and the Chemical Engineering Branch (review branch for Appendix R), the failures of fire dampers are not usually considered when evaluating the performance of the ventilation systems. When Appendix R requirements were backfitted, to include of fire dampers as barriers in ventilation systems, the systems were not re-evaluated by the Auxiliary Systems Branch to ascertain whether the fire dampers could adversely affect the design function of the safety system. Thus, fire dampers installed to prevent the spread of fires have the competing capability to degrade the safety function of ventilation systems, i.e., fail closed to prevent adequate ventilation cooling of safety-related equipment or filtering of radioactive products. For ventilation systems having two 100% capacity trains, a single fire damper failure does not represent degradation of the system to perform its safety functions.

The effects on safety equipment that are exposed to elevated ambient temperatures or the effects on offsite dose releases due to a failure of the safeguards ventilation system are not known with certainty. For example, exceeding the specified ambient temperature does not necessarily result in failures of the safeguards equipment. The qualification of equipment for mild environments (contrasted to harsh environments resulting from LOCAs and steam line breaks) is not evaluated by the NRC, but licensees have the responsibility to ensure that the equipment can perform its intended function. Thus, prudent licensees actions are necessary to ensure that the environment is maintained below specified limits.

CONCLUSIONS

The single failure of fire damper that rendered the safeguards ventilation system inoperable at North Anna appears site specific. The licensee has revised its testing procedures to flow test the ventilation system monthly,

which will significantly improve the availability of the system in comparison to the technical specification 18-month testing interval. Thus, the licensee's actions are judged acceptable and no further actions are deemed necessary.

The generic implications of the North Anna event is that the testing interval specified by the standard technical specifications may be excessive considering that a failed-closed fire damper could go undetected for 18 months. The position of a fire damper cannot usually be determined by visual inspection unless a cover is removed to reveal the fire damper. In addition, some fire dampers are not readily accessible for such inspections. Since the ventilation systems are normally operating, it would appear that a simple flow check of the exhaust and intake ventilation ducts in safeguards equipment rooms would provide an indication of a potential fire damper failure.

Inadvertent closures of fire dampers do not appear to constitute a significant safety concern. Ensuring the function of the ventilation system should be another part of licensees' overall program of good operating practices. The potential for an inadvertent failure of a fire damper that degrades the performance of the ventilation systems should be brought to the attention of licensees as part of feeding back operating information. Thus, failures of fire dampers should be the subject of a future Power Reactors Events article.

As a result of AEOD investigation into the North Anna event, Region II will identify failed fire dampers as a potential generic concern for further consideration by NRR. It is our understanding that the generic concern will address the standard technical specification time interval and the potential reduction in the performance of ventilation systems due to failed fire dampers. AEOD endorses this action and will remain cognitive of the follow-up action on the issue. The only other follow-up action required by AEOD is to address this subject in a future Power Reactors Events article.