NRC FORM 366 (4-95)

U.S. NUCLEAR REGULATORY COMMISSION

APPROVED OMD NO. 3150-0104
EXPIRES: 04/30/98
ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS INFORMATION COLLECTION REQUEST: 50.0 HRS. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE INFORMATION AND RECORDS MANAGEMENT BRANCH (MNBB 7714), U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, DC 20555-0001, AND TO THE PAPERWORK REDUCTION PROJECT (3150-0104), OFFICE OF MANAGEMENT AND BUDGET, WASHINGTON, DC 20503.

LICENSEE EVENT REPORT (LER)

FACILITY NAME (1)	DOCKET NUMBER (2)	PAGE (3)
Oconee Nuclear Station, Unit 1	05000269	1 of 10

TITLE (4)
Test Method Does Not Meet Technical Specification Requirement Due To Inadequate Wording Of Licensing Submittal

EVENT DATE (5)			LER NUMBER (6)				REPORT DATE (7)			OTHER FACILITIES INVOLVED (8)	
MONTH	DAY	YEAR	YEAR		SEQUENTIAL NUMBER	REVISION NUMBER	MONTH	DAY	YEAR	FACILITY NAME	DOCKET NUMBER(S)
										Unit 2	05000270
07	06	98	98	-	10	- 0	8	05	98	Unit 3	05000287

OPERATING MODE (9)	N	THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR (Check one or more of the following) (11)					
POWER LEVEL (10)	100	20.402(b)	20.405(c)	50.73(a)(2)(iv)	73.71(b)		
		20.405(a)(1)(i)	50.36(c)(1)	50.73(a)(2)(v)	73.71(c)		
		20.405(a)(1)(ii)	50.36(c)(2)	50.73(a)(2)(vii)	OTHER (Specify in		
		20.405(a)(1)(iii)	X 50.73(a)(2)(i)(B)	50.73(a)(2)(viii)(A)	Abstract below and		
		20.405(a)(1)(iv)	50.73(a)(2)(ii)	50.73(a)(2)(viii)(B)	in Text, NRC Form		
		20.405(a)(1)(v)	50.73(a)(2)(iii)	50.73(a)(2)(x)	366A)		

LICENSEE CONTACT FOR THIS LER (12)

NAME	TELEPHONE NUMBER
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COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT (13)

CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPRDS		CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPRDS	

SUPPLEMENTAL REPORT EXPECTED (14)			EXPECTED SUBMISSION DATE (15)	MONTH	DAY	YEAR
	YES (If yes, complete EXPECTED SUBMISSION DATE)	X NO				

ABSTRACT (Limit to 1400 spaces, i.e. approximately fifteen single-space typewritten lines) (16)

During a Safety System Engineering Inspection at Oconee Nuclear Station, the NRC concluded that Technical Specifications (TS) required use of a pitot tube traverse to measure Penetration Room Ventilation System (PRVS) fan flow rates. The procedure used installed orifice meters. The NRC issued a violation, which Duke Energy Corporation (Duke) denied. On July 6, 1998, the NRC rejected Duke's denial. As a result, Duke concluded that the PRVS TS surveillance was not satisfied and declared both PRVS trains on all three Oconee units technically inoperable. TS 3.0 was entered at 1330 hours, with all three Oconee units at 100% power. A Notice of Enforcement Discretion was verbally granted at 1735 hours. The root cause of the event is Deficient Written Documentation, specifically inadequate wording of the licensing submittal which requested the TS in 1976. Corrective actions include modification and testing of the PRVS using pitot tube traverses.

EVALUATION:

BACKGROUND:

The Penetration Rooms of each Oconee unit are those areas of the Auxiliary Building where most of the mechanical and electrical systems pass through the Reactor Building containment structure. The UFSAR assumes that 50% of leakage from the Reactor Building after an accident (LOCA) will be into the Penetration Rooms. The Penetration Room Ventilation System (PRVS) [EIIS:VC] is an Engineered Safety Feature System which is intended to filter this post accident leakage to limit any releases to the public. The PRVS is designed to maintain a slight negative pressure in the Penetration Rooms relative to surrounding areas to limit outleakage and to filter particulates and gases (specifically radioactive iodine) prior to release through the ventilation stack. The PRVS for each Oconee Unit includes two independent trains of prefilters, HEPA filters, activated carbon adsorbers, fans, and associated piping. The design flow rate is 1000 cfm per train. The PRVS design includes a flow orifice permanently installed in the piping, with a flow meter and throttle valve controls located at a remote control station to permit operators to set and monitor system flow rates after a LOCA. The system design did not include test ports to allow pitot tube traverses.

ANSI N510-1975, "Testing of Nuclear Air-Cleaning Systems," (N510) was the first approved edition of the industry standard for field testing of high efficiency air cleaning systems for nuclear power plant applications.

Section 4 and Table 1 of N510 classify tests as either acceptance or surveillance, and gives the recommended test frequency. Table 1 and Section 8.1 indicate the airflow capacity test is "made only during acceptance testing following original installation, modification, or major repair of the air cleaning system."

Section 8.3.1 of N510, the Airflow Capacity Test detailed procedure, specifies that "a pitot tube traverse" be made and air flow calculated "in accordance with Section 9 of ACGIH *Industrial Ventilation*". "One of the other methods" described in *Industrial Ventilation* may be used "if there is no place where airflow is greater than 1000 fpm."

Section 9 of *Industrial Ventilation*, 16th edition, issued by the American Conference of Government Industrial Hygienists (ACGIH), states: "The use of the orifice... as permanent measuring stations is well accepted in engineering practice." "These meters are very infrequently applied to industrial exhaust systems but... can be used as fixed metering devices for calibration of instruments, fan testing and experimental work."

Technical Specification (TS) 4.5.4.1.a requires the PRVS to be operated monthly for at least 15 minutes at design flow +/- 10%.

TS 4.5.4.1.b.1 requires that every 18 months the Penetration Room Ventilation System (PRVS) fans shall be demonstrated to "operate at design flow (+/- 10%) when tested in accordance with ANSI N510-1975."

DESCRIPTION OF EVENT:

During the Safety System Engineering Inspection at Oconee for the Control Room Ventilation System (CRVS) and Penetration Room Ventilation System (PRVS), the NRC identified a potential violation because the PRVS fan flow rates were measured using installed orifice meters. The NRC violation states: "Technical Specification (TS) 4.5.4.1.b.1 states that during each refueling outage, it shall be demonstrated that the Penetration Room Ventilation System (PRVS) fans operate at design flow (+/- 10 percent) when tested in accordance with ANSI N510-1975. The ANSI N510-1975 specified test method for air flow capacity testing is with a pitot traverse tube which measures air-flow-velocity pressure and converts this to flow rate."

Oconee initiated Problem Investigation Process (PIP) report 0-O98-3420 on March 11, 1998, to address this issue. As part of PIP 0-O98-3420, an operability evaluation concluded that the orifice meters were acceptable under provisions of N510 for use of alternative methods and verified operability of the system.

The NRC notified Duke Energy Corporation (Duke) of the violation in a letter dated May 4, 1998.

In a letter dated June 4, 1998, Duke denied the violation due to statements within ANSI N510-1975 (N510) and "*Industrial Ventilation*" which recognize limitations in the accuracy of pitot tube measurements at low flow rates

and where system geometry produces poor flow distributions within the pipe or duct. In such cases, alternative methods discussed in "*Industrial Ventilation*" are allowed by N510. The Duke position was that the flow velocities at a hypothetical test location would fall into the range where N510 allows alternate test instruments, and that the orifice would yield more accurate results than a pitot tube traverse.

In early June 1998, Duke obtained flow measurements using a 12 point pitot array in a test rig, which was temporarily installed over the intake openings of the PRVS in the Penetration Room ceilings. However, due to obstructions and poor access, the test rig was awkward to use and gave unstable readings with poor repeatability. The data obtained using the test rig did indicate higher flow rates than the installed orifice meter on both trains of all three units.

Design data sheets for the orifice plates used in the flow meters could not be located in order to document the accuracy of the meter calibrations.

In a letter dated July 6, 1998, the NRC notified Duke that Duke's denial of the violation was not acceptable and that the violation would not be rescinded. In their letter, the NRC stated that "there was no justification, by analysis or testing to demonstrate equivalency or acceptability of this method."

As a result, Duke acted on the staff's position that the TS surveillance requirement for the PRVS had not been satisfied and declared both PRVS trains on all three Oconee units technically inoperable. Technical Specification 3.0 was entered at 1330 hours on July 6, 1998.

Duke requested enforcement discretion, which was verbally granted at 1735 hours on July 6, 1998. A Notice of Enforcement Discretion was issued by letter dated July 8, 1998. Subsequently, a license amendment was requested to permit continued operation of all three Oconee units in non-compliance with TS 4.5.4.1.b.1 until August 30, 1998, to allow modifications to be completed which would permit pitot tube traverses to be performed. This license amendment is still pending NRC approval.

The modifications have been completed on all three units and testing is currently in progress. After testing three trains, preliminary results

using data uncompensated for temperature effects, indicate the pitot traverse and the orifice readings agree within expected instrument accuracy.

An investigation into the root cause of this event was initiated.

Oconee was designed and built in the mid-60's and early 70's. The PRVS design included a permanently installed orifice flow meter and throttle valve controls, located at a remote control station to permit operators to set and monitor system flow rates after an accident (LOCA). The system design did not include test ports to allow pitot tube traverses.

The PRVS initial acceptance testing was performed at flow rates set and measured using the orifices. Acceptance testing was completed on August 19, 1974, for Unit 3, the last unit, prior to its initial criticality in December 1974.

The original version of N510 was issued in 1975. Technical Specifications were revised, at the NRC's request, to refer to N510 in August, 1976. Since the Oconee acceptance testing had been performed prior to publication and adoption of N510, Engineer A, the site lead for ventilation system testing at that time, understood that no additional acceptance testing was required to be performed.

Section 10 and 12 of N510, In-place Testing of HEPA Filter Banks and Carbon Adsorbers, respectively, both require testing per Section 8 as a pre-requisite. However, Sections 10 and 12 are listed as both acceptance and surveillance tests, and Section 8.1 and Table 1 specifically stated that Section 8 of N510 was an initial acceptance test. Therefore, it appeared to Engineer A that the authors of N510 did not intend to require Section 8 as a prequisite during surveillance tests. Engineer A recalls that his interpretation was that Section 8 of N510 would only apply to Oconee if the system was modified or repaired to an extent that the periodic surveillance testing would not be adequate.

Due to the fact that N509, issued after N510, required installed flow instrumentation for Engineered Safety Feature (ESF) systems, it appeared to Engineer A that the authors did not have any objection to use of an installed orifice meter for testing. Engineer A concluded that the authors

just did not expect installed flow meters to be available on all systems being tested.

As a result of all of these factors, Engineer A and his management concluded that Section 8 of N510 did not apply to surveillance testing.

Vendors continued to perform in-place filter tests for several years after the initial system tests. Two specific individuals who performed many of the surveillance tests at Oconee were owners of their testing services companies and also served as members of the subcommittees that authored ANSI N509-1976 and ANSI N510-1975 and the 1980 revisions to those standards. One of these individuals was the chairman of the "Ad Hoc Working Group" that authored ANSI N510-1975. In 1982, these individuals were contracted to assist Duke General Office personnel in the development of a training program for Duke engineering and test personnel who would perform tests per N510. These two vendors taught the three day training classes, which included both classroom and laboratory sessions. As part of this training, a portable filter/fan unit was assembled for use in the laboratory sessions. It was equipped with an installed flow orifice. The training package specifically used the orifice flow measurement for the segment on flow capacity testing.

Over the intervening years there have been several accountable filter test engineers and a relatively stable core of qualified filter test technicians.

A review was conducted for other filtered ventilation systems at Oconee subject to testing in accordance with N510 to determine if other TS filter testing requirements were affected by this interpretation. TS 4.12 applies to the Control Room Pressurization and Filtering System, but does not specifically reference ANSI N510-1975. The Control Room outside air booster fans do not have installed flow instruments, and pitot tube traverses are used to measure flow. TS 4.14 applies to the Unit 2 and 3 filters shared by the Reactor Building Purge and the Spent Fuel Pool Filtered Ventilation systems. It also requires the systems to "operate at design flow (+/- 10%) when tested in accordance with ANSI N510-1975." The SFP Filtered Ventilation systems have installed pitot arrays as the flow measuring devices rather than orifices. Duke's current position is that

pitot arrays are equivalent to pitot tube traverses and, therefore, are acceptable for use in accordance with N510 and *Industrial Ventilation.*

CONCLUSIONS:

The root cause of this event is Deficient Written Documentation, specifically inadequate wording of the licensing submittal that incorporated ANSI N510. It did not clearly delineate which section of the standard applied to the flow measurement surveillance. This led to a different interpretation of the standard than was intended by the NRC.

It is apparent that accountable Duke personnel over a number of years did not interpret ANSI N510 to require use of pitot tube traverses on those systems where installed instruments existed. The use of a similar orifice during training laboratory sessions indicates that the interpretation that installed flow instruments could be used was not just one individual's error.

Engineer A and his contemporaries who reviewed the 1976 TS change made assumptions and interpretations as to which sections applied. They did not adequately recognize that their interpretations were not documented in the TS submittal, and, therefore, were not officially approved (or rejected) by the NRC. They did not see a need to request official clarification or interpretation. A more questioning attitude with respect to the meaning of the TS reference to N510 could have led to a more timely identification and resolution of this issue. A contributing factor is a mis-understanding among some personnel related to the need for regulatory approval of technically acceptable alternatives which deviate from exact compliance to requirements.

A review of previous events was conducted to determine if this event was considered recurring. LER 269/96-06 addressed filter test surveillances that were conducted to a newer revision of ANSI N510. That event was a literal compliance issue in that a more conservative test was used, but Duke personnel interpreted that a TS change was not necessary. The corrective action from that event was to submit a TS change. LER 269/98-03 addressed surveillances that were performed at times other than refueling outages. That event was a literal compliance issue in that Duke personnel

interpreted that refueling outage frequency surveillances could be performed at other times. The corrective action from that event was also to submit a TS change. Because this event is also a surveillance not performed in accordance with current NRC interpretation of a TS requirement, this event is considered to be recurring. However, the error in this event goes back to 1976, therefore no corrective actions from the other events could have prevented this event.

There were no injuries, radioactive releases, overexposures, or reportable equipment failures associated with this event.

CORRECTIVE ACTION:

Immediate:

1. Upon notification of the NRC rejection of Duke's denial of violation, Duke entered Technical Specification (TS) 3.0 on all three units.

2. Duke requested and received a Notice of Enforcement Discretion.

Subsequent:

1. Duke submitted a license amendment to permit continued operation without compliance with TS 4.5.4.1.b.1 pending completion of modifications to allow use of pitot tubes to measure flow.

2. Duke designed and implemented a modification to add test ports to allow flow measurements by pitot traverses.

3. Duke prepared extensive test procedures (TT/*/A/010/19 and TT/*/A/010/20) and obtained an expert vendor service to conduct the initial pitot traverse flow measurements.

Planned:

1. Duke will complete the initial pitot traverse flow measurements on all three units (six PRVS trains), analyze the resulting data, and take

appropriate action to come into complete compliance with TS 4.5.4 by August 30, 1998.

2. Duke will prepare a training package on the relationship between operability and surveillance requirements and provide training to appropriate personnel.

3. Following completion of item 2 above, Oconee will perform a review of TS for references to industry ventilation and filtration standards, then review the programs and procedures that implement those standards to assure that all requirements are met and any compliance issues with surveillance items are identified and resolved. The Oconee Improved TS (ITS) have been submitted and conversion from the current TS to ITS is expected to occur in the first quarter of 1999. Therefore, this review will be performed against ITS.

Planned Corrective Actions 1, 2, and 3 are NRC commitments. They are the only NRC commitments contained in this report.

SAFETY ANALYSIS:

The Penetration Room Ventilation System (PRVS) function is to help reduce radioactive releases to the public following a Loss of Coolant Accident (LOCA). The Oconee UFSAR assumes that 50% of post-accident leakage from containment is released into the Penetration Room, where it will be filtered by the PRVS prior to release. Credit is taken for the efficiency of the HEPA filters and the charcoal adsorbers. The PRVS flow rate potentially affects this analysis in two ways.

First, if PRVS flow is too low, the flow rate may not be adequate to establish and maintain a slight negative pressure with respect to surrounding areas. This negative pressure must exist to assure that leakage into the PRVS from containment is controlled and directed into the filters, rather than escaping to other portions of the Auxiliary Building or to the environment. Although the Oconee Technical Specifications do not require measurement or monitoring of the PRVS ability to achieve a negative pressure, existing test procedures periodically verify that the flow rate is adequate to maintain a negative pressure. This testing has been

conducted at 1000 cfm as indicated by the orifice meter. Even if the flow meter is inaccurate, the existing flow is adequate because it creates an adequate negative pressure.

Second, if PRVS flow is too high, carbon adsorber efficiency can be reduced. The carbon adsorbers operate by passing the air over carbon particles. Given a fixed depth of the carbon adsorber bed, the in-place filter efficiency is a function of the amount of time the air is in contact with the carbon material. If the air passes through too fast, it does not have enough "residence time" to interact with the carbon, and efficiency is reduced. Oconee has performed a calculation of the maximum flow rate that would be necessary to reduce in-place efficiency below the 90% efficiency assumed in the UFSAR, based on the actual carbon capacity indicated by past laboratory testing of samples taken from the PRVS. This corresponds to a flow rate of 1650 cfm or greater. Therefore, if the orifice were inaccurate, it would have to be reading low by 650 cfm (-39%) for actual flow to reduce residence time and filter efficiency below assumed limits. Pending the results of testing in progress, this percentage error and this flow rate are not considered credible.

The PRVS system must be considered past inoperable due to the inappropriate use during past surveillances of a flow measurement method that was unauthorized in this specific application. However, the flow measurement method is adequate to assure that the system has been capable of performing its intended safety function. Therefore, the health and safety of the public have not been affected by this event.