



UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION II
101 MARIETTA ST., N.W.
ATLANTA, GEORGIA 30323

Report Nos.: 50-269/89-07, 50-270/89-07, and 50-287/89-07

Licensee: Duke Power Company
422 South Church Street
Charlotte, NC 28242

Docket Nos.: 50-269, 50-270,
and 50-287

License Nos.: DPR-38, DPR-47, and
DPR-55

Facility Name: Oconee 1, 2, and 3

Inspection Conducted: February 13-17, 1989

Inspector: Paul J. Fillion 3/9/89
P. J. Fillion Date Signed

Team Members: M. Miller
C. Paulk

Approved by: T. Conlon 3/10/89
T. Conlon, Chief Date Signed
Plant Systems Section
Engineering Branch
Division of Reactor Safety

SUMMARY

Scope: This routine, announced inspection was conducted in the area of the licensee's conformance to Regulatory Guide (RG) 1.97, Instrumentation for Light-Water-Cooled Nuclear Power Plants to Assess Plant and Environs Conditions During and Following an Accident. Open items related to environmental qualification were addressed.

Results: As discussed in paragraph 2, the licensee deviated from RG 1.97 with respect to the qualification criteria for several key variables. Since this represents a deviation from the licensee's commitment to comply with RG 1.97, a Notice of Deviation has been issued.

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REPORT DETAILS

1. Persons Contacted

Licensee Employees

- *M. Tuckman, Station, Manager
- *B. McAlister, I&E Maintenance Engineer
 - T. Harbinson, Design Electrical Engineer
- *G. Sanders, On-site Design Engineer
 - T. Ledford, Design Electrical Engineer
- *C. Boyd, On-site Design Engineer
 - T. Brooks, Production Specialist - Planning Section
- *T. Glenn, I&E Maintenance Engineer
- *E. LeGette, Shift Supervisor and Regulatory Compliance
 - R. Smith, Control Operator
 - M. Haynes, Computer Coordinator, Computer Services Group

Other licensee employees contacted during this inspection included craftsmen, engineers, operators, security force members, technicians, and administrative personnel.

NRC Resident Inspectors

- *L. Wert
- *P. Skinner

*Attended exit interview

2. Inspection of licensee's Implementation of Multiplant Action A-17: Instrumentation for Nuclear Power Plants to Assess Plant and Environs Conditions During and Following an Accident (Regulatory Guide 1.97) (25587).

Criterion 13, "Instrumentation and Control", of Appendix A to 10 CFR Part 50 includes a requirement that instrumentation be provided to monitor variables and systems over their anticipated ranges for accident conditions as appropriate to ensure adequate safety. Regulatory Guide 1.97 (RG 1.97) describes a method acceptable to the NRC staff for complying with the Commission's regulations to provide instrumentation to monitor plant variables and systems during and following an accident.

The purpose of this inspection was to verify that the licensee has an instrumentation system for assessing variables and systems during and following an accident, as discussed in Regulatory Guide (RG) 1.97. Under accident conditions it is necessary that the operating personnel have (1) information that permits the operator to take preplanned actions to

accomplish a safe plant shutdown; (2) determine whether the reactor trip, Engineered Safety-Feature Systems (ESFS), and that other manually initiated safety systems important to safety are performing their intended functions; and (3) provide information to the operators that will enable them to determine the potential for causing a gross breach of the barriers to radioactivity release and to determine if a gross breach of barrier has occurred. For this reason multiple instruments with overlapping ranges may be necessary, the required instrumentation must be capable of surviving the accident environment for the length of time its operability is required. It is desirable that components continue to function following seismic events.

As a result, five types of variables have been specified that serve as guides in defining criteria and the selection of accident-monitoring instrumentation. The types are: Type A - Those variables that provide information needed to permit the control room operating personnel to take specified manual actions for which no automatic control is provided and that are required for safety systems to accomplish their functions for design basis accident events; Type B - Those variable that provide information to indicate whether plant safety functions are being accomplished; Type C - Those variables that provide information to indicate the potential for barriers being breached or the actual breach of barriers to fission product release; Type D - Those variables that provide information to indicate operation of individual safety systems and other systems important to safety; Type E - Those variable to be monitored in determining the magnitude of the release of radioactive materials and for continuously assessing such release.

The design and qualification criteria are separated into three separate categories that provide a graded approach to requirements depending on the importance to safety of the measurement of a specific variable, Category 1 provides the most stringent requirements and is intended for key variables. Category 2 provides less stringent requirements and generally applies to instrumentation designated for indicating systems operating status. Category 3 is intended to provide requirements that will ensure that high-quality off-the-shelf instrumentation is obtained and applies to backup and diagnostic instrumentation. A key variable is that single accomplishment of a safety function (Types B and C), or the operation of a safety system (Type D), or radioactive material release (Type E). Type A variables are plant specific and depends on the operations that the designer chooses for planned manual actions. Inspection of Categories 1 and 2 equipment was performed as described below.

a. Category 1 Instrumentation

The instrumentation listed in the Category 1 Table, of this section, was examined to verify that the design and qualification criteria of RG 1.97 had been satisfied. The instrumentation was inspected by reviewing drawings, procedures, data sheets, other documentation, and performing walkdowns for visual observation of the installed equipment, The following areas were inspected:

- (1) Equipment Qualification - The EQ Master Equipment List and the Q-List were reviewed for confirmation that the licensee had addressed environmental qualification requirements for class 1E equipment.
- (2) Redundancy - Walkdowns were performed to verify by visual observation the specified instruments were installed and separation requirements were met. In addition, drawings were reviewed to verify redundancy and channel separation.
- (3) Power Sources - Drawings were reviewed to verify the instrumentation is energized from a safety-related power source.
- (4) Display and Recording - Walkdowns were performed to verify by visual observation that the specified display and recording instruments were installed. Drawings were reviewed to verify there was at least one recorder in a redundant channel and two indicators, one per division (channel) for each measured variable.
- (5) Range - Walkdowns were performed to verify the actual range of the indicator/recorders was as specified in RG 1.97 or the SER. Review of calibration procedures verified sensitivity and overlapping requirements of RG 1.97 for instruments measuring the same variable.
- (6) Interfaces - The drawings and Q-List were reviewed to verify that safety-related isolation devices were used when required to isolate the circuits from non-safety systems.
- (7) Direct Measurement - Drawings were reviewed to verify that the parameters are directly measured by the sensors.
- (8) Service, Testing, and Calibration - The maintenance program for performing calibrations and surveillances was reviewed and discussed with the licensee. Calibration and surveillance procedures and the latest data sheets for each instrument were reviewed to verify the instruments have a valid calibration.

CATEGORY 1 TABLE

<u>Variable</u>	<u>Type</u>	<u>Instrument Number (Channel or Train)</u>		<u>Unit 1 Drawings</u>
Containment Hydrogen Concentration	A	MT-80	A	OEE-131-45
		P-300		0-711-F
		CR-45		0-711-K
				0-711-L
		MT-81	B	0-714-D
		P-301		0-714-F

CATEGORY 1 TABLE (Cont'd)

<u>Variable</u>	<u>Type</u>	<u>Instrument Number (Channel or Train)</u>		<u>Unit 1 Drawings</u>
Steam Generator Level	A	LT-80	A	OM-201L-0001 O-705 O-778 O-785-F
		P-270		
		LT-81	A	
		P-273		
		LT-82	B	
		P-272		
		IT-83	B	
Upper Surge Tank Level	A	LT-15	A	OEE-155-10 O-422K-6 O-713-C O-794-E
		CP-81		
		LT-36	B	
		CP-343		
		CR-18		
Emergency Feedwater Flow	D	FT-129	B	O-705 O-711B O-711C O-711D O-779-A
		P-277		
		FT-130	B	
		P-278		
		FT-153	C	
		P-275		
		FT-154	C	
Containment Pressure (Reactor Building)	B	PT-230	A	OEE-158-20 O-702 O-704-E
		P-265		
		CR-85		
		PT-231	B	
		P-266		
Reactor Building Level	B	LT-90	A	OEE-158-21 O-711-F O-711-K O-711-L O-714-D O-714-F
		P-304		
		CR-45		
		LT-91	B	
		P-305		
Reactor Coolant System Pressure (RVLIS)	A	PT-244	A	Technical Manual ICCM-86 System OM.311.B-0030
		PT-245	B	
		CR-420		
Reactor Vessel Head Level	A	LT-125	A	O-794-A O-794-B
		CR-420		
and Hot Leg Level	A	LT-126	B	O-794-C O-794-E O-794-F
		CR-420		
(RVLIS)		LT-123	A	O-714-I O-714-M
		LT-124	B	

CATEGORY 1 TABLE (Cont'd)

<u>Variable</u>	<u>Type</u>	<u>Instrument Number (Channel or Train)</u>		<u>Unit 1 Drawings</u>
Reactor Coolant System Hot Leg Temperature (RVLIS)	A	RD-84B	A	
		RD-85B	B	
Degrees of Subcooling (RVLIS)	A	(Part of RVLIS)		
Core Exit Temperature	A			

b. Category 2 Instrumentation

The instrumentation listed in the Category 2 Table, of this section, was examined to verify that the design and qualification criteria of RG 1.97 had been satisfied. The instrumentation was inspected by reviewing drawings, procedures, data sheets, other documentation, and performing walkdowns for visual observation of the installed equipment. The following areas were inspected:

- (1) Equipment Qualification - The EQ Master Equipment List and the Q-List were reviewed for confirmation that the licensee had addressed environmental qualification requirements for Class 1E equipment.
- (2) Power Sources - Drawings were reviewed to verify the instrumentation is energized from a high quality or safety-related power source.
- (3) Display and Recording - Walkdowns were performed to verify by visual observation that the specific display and recording instruments were installed. Drawings were reviewed to verify there was at least one recorder, where required by RG 1.97, in a redundant channel and two indicators, one per division (channel) for each measured variable.
- (4) Range - Walkdowns were performed to verify the actual range of the indicators/recorders was as specified in RG 1.97 or the SER. Also calibration procedures were reviewed to verify sensitivity and overlapping requirements of RG 1.97 for instruments measuring the same variable.

- (5) Interfaces - The drawings and Q-list were reviewed to verify that safety-related isolation devices are used when required to isolate the circuits from computer systems (not safety-related).
- (6) Direct Measurements - Drawings were reviewed to verify that the parameters are directly measured by the sensors.
- (7) Service, Testing, and Calibration - The maintenance program for performing calibrations and surveillances was reviewed and discussed with the licensee. Calibration and surveillance procedures and the latest data sheets for each instrument were reviewed to verify the instruments have a valid calibration.

CATEGORY 2 TABLE

<u>Variable</u>	<u>Type</u>	<u>Instrument Number (Channel or Train)</u>		<u>Unit 1 Drawings</u>
Emergency	B	LT-3P	A	OEE-158-23
Sump Level	C	P-325		OEE-158-25
		CR-195		
		LT-112	B	
		P-326		
Volume Control	D			
Tank Level				
KEOWE Voltage	D			
Battery Voltage	D			
Inverter Voltage	D			
Containment Heat	D			
Removal System				
Motor Amperes				
Inlet Coolant Flow				
Outlet Coolant Flow				
Inlet Air Temperature				
Outlet Air Temperature				

c. Discussion

RG 1.97 Revision 2 states that the instruments designated as Types A, B, and C and Categories 1 and 2 should be specifically identified on the control panels so that the operator can easily discern that they are intended for use under accident conditions. Examples of acceptable methods for accomplishing this requirement are identification labels having a different background color than other labels or instrument bezels color coded to indicate RG 1.97 instruments. The

licensee, in a letter dated September 28, 1984, repeated the words of the RG, and committed to comply with this requirement. However, the Types A, B, and C, Categories 1 and 2 instruments were not specifically identified on the control panels during the inspection for any of the three Units.

At the Unit 1 main control panel several recorders did not have any identification label. Just prior to the inspection, Unit 1 had been in a refueling outage. A modification performed during the outage had been to replace a group of Foxboro type recorders with Leeds and Northrup type recorders, but the corresponding identification labels were not installed before the Unit was returned to power. The recorders that did not have labels were for the following variables:

- (1) RCS pressure
- (2) Reactor vessel level
- (3) Hot leg level
- (4) Hydrogen concentration
- (5) Containment sump water level

The licensee promptly installed proper labels on these instruments during the inspection period.

While verifying the sample of RG 1.17 instruments on the control panels, the inspector noticed that each variable on one three-pin indicating recorder on Unit 1 had improper indications. The three-pin L&N indicating recorder was being used for RCS pressure, reactor vessel level and hot leg level (same instrument as mentioned in the previous paragraph). Later it was determined that the cause of the improper indications was incorrect wiring, i.e. each set of wires was connected to the wrong recorder pin. The wiring was corrected during the inspection. A contributing cause to the incorrect wiring not being identified by the licensee's maintenance personnel was that the calibration procedure called for a separate recorder check rather than a string (loop) check. The licensee stated that the calibration procedure for the recorder in question would be revised to a string check type procedure. All other calibration procedures reviewed during the inspection called for string type checks, which is considered a plus for the licensee's program. The design and qualification criteria for Category 1 variables requires that recording of instrumentation readout information should be provided. Where direct and immediate trend or transient information is essential for operator information or action, the recording should be continuously available on dedicated recorders. Otherwise, it [recording information] may be continuously updated, stored in computer memory, and displayed on demand. Intermittent displays such as scanning

recorders may be used in some cases. The licensee's submittal for Regulatory Guide 1.97, dated September 28, 1984, indicated use of a computer for the recording of four Category 1 variables:

- (1) RCS hot leg water temperature
- (2) Auxiliary feedwater flow
- (3) Steam generator level
- (4) Degrees of subcooling

The submittal implies that, for these four variables, direct and immediate trend or transient information is not essential for operator information or action at Oconee, and therefore the trend or transient information would be stored in computer memory for display on demand. During the inspection, the inspector asked the Unit 2 Controls Operator on duty to display the trend information for each of these four variables, but the operator was not able to do so. It was later determined that the computer was not programmed to store trend information for these variables. Except for the auxiliary feedwater flow (discussed later), the computer could display the current reading. The Computer Coordinator stated that the computer had the capability to trend up to 40 variables with a scan rate of 5 to 60 seconds (selectable at 5 second increments). A maximum of 240 points per variable could be displayed. Use of a computer of this limited capability may or may not meet the intent of the RG, and therefore application to particular variables should be carefully reviewed and justified. At the time of the inspection, the computer was trending 40 variables that the operators had chosen. Other trending capability in the control room was provided by four strip chart recorders that operate in conjunction with the computer. An operator may select any variable input to the computer for trending on one of the four strip chart recorders.

Wiring diagrams for the RG 1.97 auxiliary feedwater flow loops did not indicate any input to the computer. Therefore, until proven otherwise, it is assumed that the two auxiliary feedwater flow indications at the computer (each unit) are from non RG 1.97 loops.

The calibration program for each of the variables in the inspection sample was reviewed. Actual calibration data sheets for most of the Unit 1 variables were reviewed. The maintenance tracking system was utilized to ensure that Units 2 and 3 variables were being calibrated. Based on this review, it was concluded that the RG 1.97 instruments were covered by the calibration program. One exception to this was that the voltmeters for the inverter output had not been calibrated since original construction time. The inverter output voltmeters would be classified as Type D, Category 2.

At Units 1, 2 and 3 main control panels, the identification labels for the RG 1.97 containment pressure recorders indicated the variable being measured and the range. The NRC inspector noted that the indicated range on these labels was 0 to 175 psig rather than -5 to 175 psig as required. It was determined that the instrumentation actually measured -5 to 175 psig, and the licensee stated that the label would be corrected to read the proper range. Chart paper scaling must also be checked. The Units 1 and 3 recorders, were setup such that the pens would be on scale for the full range (-5 to 175). The Unit 2 recorder, which was a different model than the Units 1 and 3 model, was set up such that -5 to 0 psig would be off scale.

As part of the inspection effort to verify redundancy, isolation and proper wiring, wiring diagrams were reviewed. As the wiring of components for each variable was checked on drawings, the calibration sheets were also checked. During this review, the NRC inspector noted that particular components, such as indicators or recorders, had different unique identifications on different documents. For example, the hydrogen analyzer recorder was identified as CR-45 on drawings, but was identified as CR-85 in the calibration procedure. This was a discrepancy since the same unique identification should appear on all related documents for a particular component. The licensee stated that he had previously identified this discrepancy as a possible source of confusion. The licensee was in the process of standardizing identification on all working documents.

The licensee's compliance with Regulatory Guide 1.97 may be summarized as follows:

- (1) The Safety Evaluation Report approved the licensee's RG 1.97 submittal except for the Accumulator Tank Level and Pressure variable. The licensee has requested an exemption from the RG for this variable, and the NRC will issue a supplementary SER.
- (2) Plant modifications to bring the plant equipment into compliance with the RG will be ongoing until June 1993 according to the agreed upon schedule.
- (3) The licensee has deviated from his commitment to comply with the RG in three areas:
 - (a) Instruments on the control board were not specifically identified.
 - (b) Four Category 1 variables were not recorded.
 - (c) The inverter output voltmeters were not covered by any calibration program.

This matter will be identified as Deviation 269,270,287/89-07-01, Deviation from Regulatory Guide 1.97.

- (4) The importance of RG 1.97 was underemphasized by plant management in that the control room operators were not fully cognizant of RG 1.97.

3. Corrective Action Program

One conclusion based on findings of the inspection was that the licensee had deviated from the RG in three respects. Obviously, the licensee realized that he did not meet the criteria for specific identification of control room indicators and recorders. The licensee stated that he intended to provide special RG 1.97 labels (or equivalent) at some unspecified date in the future. Failure to provide recording for 4 Category 1 variables may have been the result of an erroneous interpretation of the RG. The fact that the inverter output voltmeters were not covered by a calibration program was attributed to personnel error and inattention to detail.

4. Action on Previous Inspection Items (92701)

- a. (Closed) VIO 50-269, 270, 287/88-03-01, Inadequate Maintenance Procedures.

During a previous inspection, maintenance procedures were found to be inadequate in the area of environmental qualification (EQ) requirements. Three procedures were identified that did not include all the EQ requirements. The licensee admitted this violation in the original response to the NOV dated September 26, 1988. The licensee stated in the response that the Environmental Qualification Reference Index (EQRI) for each of the identified deficiencies would be revised and the procedures would be updated to include the appropriate information. This was to be accomplished by October 15, 1988. The inspector verified the corrective action had been accomplished as stated by the licensee. The procedure for the Genis level transmitters was revised on October 15, 1988; the procedure for the Limitorque motor operators was revised on September 30, 1988; and the EQRI for Westinghouse motors was updated by October 15, 1988. Based on the corrective actions taken, this item is closed.

- b. (Closed) URI 50-269, 270, 287/88-03-02, Operability Evaluation Concerning Problem Investigation Report (PIR) 87-0231.

During a previous inspection, an inspector questioned the evaluation that was performed under PIR 1-087-0231. The PIR evaluated the RCS wide range pressure transmitters being installed without graphoil tape on the threaded pipe connections to the transmitter. The actual hardware deficiency, which was found by the licensee, was corrected on October 24, 1987, prior to the first round EQ inspection. The

evaluation did not address the possibility of film formation. The licensee performed a supplemental evaluation and testing to show that the concern of moisture intrusion, in this case, was not actually a concern. The licensee documented the supplemental evaluation on March 8, 1988. During this inspection the inspector reviewed the supplemental evaluation and found it to be acceptable. Based on the above, this item is closed.

- c. (Closed) VIO 50-269, 270/88-03-03, Reactor Building Level Transmitters Oil Level Not at Top of Instrument Termination Junction Box.

During a previous inspection the silicon oil that was required to be above the terminal block in the termination junction box was found to be below the terminal block. The licensee admitted the violation and stated that the oil levels would be corrected. The licensee had filled all affected level transmitters by September 1, 1988, and has revised the procedure as discussed above on October 15, 1988. Based on the above, this item is closed.

- d. (Closed) VIO 50-269, 270, 287/88-03-04, Similarity Analysis for Installed Cable to Tested Vendor Specimens Not Established in EO Files.

This item was closed by the letter that transmitted the enforcement conference summary, dated July 1, 1988. It will be administratively removed from the NRC records by this report.

- e. (Closed) VIO 50-269, 270, 287/88-03-05, Similarity Analysis for Qualification of Installed Configuration for High Range Radiation Monitors Not Established in EQ File.

During a previous inspection the EQ file for the Victoreen High Range Radiation Monitor was found not to have a similarity analysis to show that the installed configuration was qualified. The licensee contacted the vendor and presented the vendor with the installation design. The vendor responded that the design and method of sealing would achieve the same sealing as described in the test report. Based on this, the similarity analysis has been incorporated into the EQ file. Based on the above, this item is closed.

5. Exit Interview

The inspection scope and results were summarized on February 17, 1989, with those persons indicated in paragraph 1. The inspector described the areas inspected and discussed in detail the inspection results listed below. Proprietary information is not contained in this report.

269,270,287/89-07-01 Deviation - Deviation from Regulatory Guide 1.97.

Licensee management was informed that the five open items discussed in paragraph 4 were closed.

The Station Manager stated that special RG 1.97 labels (or equivalent) would be installed by April 1, 1989. He stated that failure to provide recording for 4 category 1 variables was due to Duke Power Company's interpretation of the RG. The inspector offered that they make a supplementary submittal explaining their position. In a phone conversation on February 21, 1989, the licensee stated he did not intend to do so. The Station Manager stated that RG 1.97 would be appropriately emphasized with the operators.

6. Acronyms and Initialisms

CR	-	Chart recorder
FT	-	Flow Transmitter
LT	-	Level Transmitter
MT	-	Monitor (hydrogen) Transmitter
P	-	Indicator
PT	-	Pressure Transmitter
RCS	-	Reactor Coolant System
RD	-	Resistance Detector (Temperature)
RG	-	Regulatory Guide
RVLIS	-	Reactor Vessel Level Indication System
SER	-	Safety Evaluation Report