NRC Form 366
(9-83)

U.S. NUCLEAR REGULATORY COMMISSION
APPROVED OMB NO. 3150-0104
EXPIRES: 8/31/85

LICENSEE EVENT REPORT (LER)

FACILITY NAME (1)	DOCKET NUMBER (2)	PAGE (3)
North Anna Power Station Units 1 and 2	0 5 0 0 0 3 3 8	1 OF 0 7

TITLE (4)
Application of Unqualified Protective Coatings on Containment Ventilation Ductwork

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 NAMES	DOCKET NUMBER(S)
										0 5 0 0 0 3 3 9
0 8	0 1	8 4	8 4	- 0 0 6	- 0 0	0 8	3 0	8 4		0 5 0 0 0

OPERATING MODE (9)	5	THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more of the following) (11)			
POWER LEVEL (10)	0 0 0	20.402(b)	20.405(c)	50.73(a)(2)(iv)	73.71(b)
		20.405(a)(1)(i)	50.36(c)(1)	X 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 Abstract below and in Text, NRC Form 366A)
		20.405(a)(1)(iii)	50.73(a)(2)(i)	50.73(a)(2)(viii)(A)	
		20.405(a)(1)(iv)	50.73(a)(2)(ii)	50.73(a)(2)(viii)(B)	
		20.405(a)(1)(v)	50.73(a)(2)(iii)	50.73(a)(2)(x)	

LICENSEE CONTACT FOR THIS LER (12)

NAME	TELEPHONE NUMBER
	AREA CODE
E. Wayne Harrell	7 0 3 8 9 4 - 5 1 5 1

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

CAUSE	SYSTEM	COMPONENT	MANUFAC-TURER	REPORTABLE TO NPRDS		CAUSE	SYSTEM	COMPONENT	MANUFAC-TURER	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)

ABSTRACT

The Air Cooling and Purging System galvanized ductwork and supports in the lower level of Unit No. 1 and Unit No. 2 Containments have been coated to mitigate corrosion. Review of Station Records indicated that the coating materials selected were not known to be qualified for application within the Containment when applied over a galvanized substrate. Subsequent DBA and adhesion tests were performed on test panels removed from the ductwork which verified that the coating did not meet the required performance criteria. The cause of the event was determined to be primarily due to inadequate classification of the work and secondarily to a failure of personnel to follow site procedures controlling application of coatings within the Containment. The corrective action taken was to install a Type 304 stainless steel wire mesh screen over the coated surfaces of the ductwork and supports. The wire screen will retain the coating material which may disbond from the ductwork following a LOCA and therefore ensure that there will be no impact on the operation of safety related equipment. Site procedures have been strengthened in order to prevent recurrence and training has been provided.

1. Description of the Event

The Air Cooling and Purging System (EIIS system identifier VD) ductwork (EIIS identifier DUCT) and supports (EIIS identifier SPT) in the lower level of Unit 1 and Unit 2 Containments have been coated to mitigate corrosion in areas where borated water could leak on galvanized surfaces of the duct. The application of the coating was completed in Unit No. 1 and Unit No. 2 Containments in January, 1983 and May, 1983, respectively. Following a recent report that the coating system utilized in Unit No. 1 may not have been qualified, an investigation was initiated to determine the suitability of the coatings applied.

Section 3.8.2.7.6 of the UFSAR states the general requirements for protective coatings within the containment liner boundary. It is necessary that protective coatings remain intact if subjected to the environment associated with a postulated LOCA. This section of the UFSAR also states the the coating systems used during initial construction were qualified by DBA testing. A description of qualified coatings that were specified for containment interior painting is given in Table 3.8-10 of the UFSAR. The extent to which unqualified coatings were used in the Containment is given in UFSAR Table 3.8-11. The UFSAR states that coatings applied after initial construction will be acceptable if they meet the technical performance requirements for simulated DBA testing set forth in ANSI N101.2-72, "Protective Coatings (Paints) for Light Water Nuclear Reactor Containment Facilities."

Review of the Station Records indicated that the following coating materials were applied to the galvanized ductwork and supports:

Unit No. 1 Containment

Primer - Mobile Chromox Red Primer, No. 13-R-50

Topcoat - Dupont Corlar Dual Build Epoxy Enamel,
No. 823-Y-67632 with Activator No. VG-Y-8339

Unit No. 2 Containment

Primer - Keeler and Long White Epoxy Primer 6548

Topcoat - Keeler and Long White Epoxy Finish

It should be noted that the Protective Coatings Preparation Records indicated that the primer selected for application on Unit 1 was Mobil Chromox Red Primer No. 13-R-50. However, a further review of Station purchasing and the batch mixing records implies that a similar alkyd, Dereka 505 manufactured by Cheeseman - Debevoise Company, was used for the primer on Unit No. 1.

The Alkyd primer which the records indicated was applied in Unit No. 1 is not nuclear qualified. The Dupont epoxy is nuclear qualified, but neither the primer or topcoat is approved for use over galvanized surfaces. Since the coating system used in Unit 1 was not known to be qualified, a Deviation Report was written on Unit 1 on 08-01-84. The deviation was determined to be reportable under the requirements of 10 CFR50.73 (a) (2) (v) (D) since failure of the coating following a postulated LOCA could have potentially prevented the fulfillment of the safety function of systems required to mitigate the consequences of the accident. Specifically, if the paint came off the ductwork during a LOCA, a concern existed that a portion could be carried to the containment sump. If a sufficient amount of paint particles enter the sump and they are larger than the smallest restriction in the fine mesh sump screens (EIIS identifier SCN), then there may be some blockage of the screens. At the time the deviation was reported, Unit No. 1 was in a refueling outage.

Further evaluation indicated that the Keeler and Long epoxy coating system applied in Unit No. 2 is nuclear qualified, but was not known to be qualified over a galvanized substrate. Therefore, the Unit No. 2 reactor was shutdown on 08-03-84 pending further evaluation and implementation of any necessary corrective action.

A field walkdown was conducted to verify the surfaces of the ductwork and supports to which the coatings had been applied. It was determined that the total surface area coated in Unit No. 1 was approximately 8000 square feet. A slightly lower total surface area had been coated in Unit No. 2.

2. Cause of the Event

The work was performed under the Station Maintenance Program and documented in a Maintenance Report. The work performed did not have sufficient controls. This resulted because, at the time, the painting of the ductwork was inappropriately designated to be non-safety related and it was considered to be a routine maintenance item rather than a permanent modification to the plant. Further, the requirement that application of any protective coating materials be conducted in accordance with Specification NAS-1016 was not adhered to.

3. Evaluation of Coatings Applied

Following the initial evaluation, KTA-Tator, Inc. was retained to evaluate the suitability of the coatings applied to the Unit 1 and 2 Containment Air Cooling and Purging System ductwork. The initial coating evaluation program conducted by KTA consisted of three phases as described below:

Phase I - Field inspection of the coating applied to the Unit No. 1 ductwork to establish the coating thickness and identify locations which bracket those conditions for subsequent sample removal and Design Basis Accident (DBA) Testing.

Phase II - Determination of acceptability of the coating systems through irradiation/DBA testing at Oak Ridge National Laboratory*, adhesion testing, and evaluation of results. The samples tested included those removed from Unit No. 1 as selected by KTA, and samples removed from Unit No. 2 in similar locations as selected by Vepco.

Phase III - Determination of the generic type of coating applied to the Unit 1 and Unit 2 ductwork.

A brief summary of KTA's findings for each phase of their evaluation is as follows:

Phase I - The coating applied to the Unit No. 1 ductwork is comprised of two coats (red primer, white finish) which possesses poor adhesion to the galvanized substrate. The coating thickness ranges are: primer - 1.0 to 2.5 mils; finish - 2.0 to 5.0 mils.

Phase II - Eight sample locations were selected from both the Unit 1 and Unit 2 ductwork for evaluation. Four 2" X 4" test panels were removed from each sample location resulting in a total of 64 samples. Two panels from each location were preirradiated prior to DBA testing with the remaining samples DBA tested only. After irradiation, neither the Unit 1 or Unit 2 samples showed any defects with the exception of discoloration. The irradiation also appeared to have no effect on the DBA results.

*Irradiation/DBA testing performed in accordance with ANSI Standards.

FACILITY NAME (1)	DOCKET NUMBER (2)	LER NUMBER (6)			PAGE (3)
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	
North Anna Power Station Units 1 and 2	0 5 0 0 0 3 3 8	8 4	— 0 0 6	— 0 0	0 5 OF 0 7

TEXT (If more space is required, use additional NRC Form 366A's) (17)

Phase II - (Con't)

After the DBA test, all the Unit 1 samples (32 total) failed to meet the ANSI N101.2 criteria (no delamination and a maximum blister size/frequency of #4 Few). The test results ranged from #2 Medium Dense to large blisters and delamination. Upon receipt of the panels at KTA (two days after the completion of testing), the coating could be easily detached as a complete film on 31 of the 32 panel surfaces.

Of the 32 Unit 2 panels tested, 25 failed to meet the ANSI criteria with results ranging from #2 Few to large blisters and delamination. The seven passing panels ranged from no defects to #6 Few and #4 Few blisters. Upon receipt of the panels at KTA (two days after testing) the coating on the face of 24 panels could be easily detached as complete or near complete films. Two of these panels had previously received passing grades at Oak Ridge. Of the remaining eight, three contained blisters outside of the ANSI criteria. Thus, upon receipt at KTA the number of failures increased from 25 to 27.

In addition to the Oak Ridge results, laboratory adhesion tests of the Unit 2 samples showed the coating to disbond completely from the galvanized substrate at values less than the 200 psi required by ANSI N5.12. Based on the above, the coating on the Unit 1 and 2 ductwork is considered to be unqualified.

PHASE III - The coating systems were evaluated for generic type using infrared spectroscopy. The results are:

Unit 1 Primer - Alkyd
Unit 1 Finish - Epoxy

Unit 2 Primer - Epoxy
Unit 2 Finish - Epoxy

4. Corrective Action

The immediate corrective action taken was to discontinue power operation of both units until the problem could be corrected. Subsequently, all site painting was stopped until an evaluation of site procedures controlling the painting process could be made and any necessary revisions made. Finally, a review of Station Records was initiated to determine whether any other inappropriate coatings had been applied elsewhere within the plant.

Since the coating systems applied over the galvanized ductwork and supports in Unit 1 and 2 were determined to be unqualified, action will be taken to correct this problem prior to startup of Unit 1 and 2. Several solutions to the problem were evaluated including removal of the coating, removal and replacement of the ductwork, and installation of a covering system over the ductwork and supports to mitigate the consequences of failure of the coating during a postulated LOCA. Based on the investigation of various solutions, the corrective action selected is to install a stainless steel wire mesh screen over the painted surfaces of the ductwork and supports prior to start up of each unit. The wire screen is fabricated from Type 304 stainless steel with 8 X 8 mesh per linear inch. The wire diameter is a 0.028 inch and the width of the opening is 0.097 inch. The wire mesh screen will encapsulate essentially all (> 99%) of the affected portions of the ductwork and supports. This fix is considered temporary pending further evaluation. A general visual inspection from the sump level of the containment will be made of the screen whenever containment vacuum is broken until a permanent fix is determined.

Based on the results of the DBA testing performed, it has been shown that if the paint disbonds during a LOCA, it will separate from the ductwork in relatively large sheets rather than small chips. These sheets are large enough to be entrapped within the wire mesh screen. Based on tests performed by KTA-Tator, Inc. and onsite tests (simulating actual containment spray flow rate conditions) performed by Vepco, it has been shown that an insignificant amount of the paint particles actually break off and pass through the screen during the course of the accident. The testing has also shown that any paint particles which may escape the screen will rapidly settle out (specific gravity $\sim$ 1.5). Therefore, the major portion of any small particles escaping the mesh will not carry to the containment sump, since most of the ductwork is not in the vicinity of the sump and water on the floor in these areas flows to the sump at a low velocity. Since the width of the opening in the wire mesh screen around the ductwork (.097 inch) is smaller than the width of the opening in the fine mesh screen at the containment sump (.120 inch), it is expected that any small paint particles which may enter the sump will pass through the screens on the pump suction and be circulated through the system. Therefore, there will be no impact on the operation of safety related equipment.

4. Corrective Action (Con't)

An evaluation has been performed to ensure that installation of the wire mesh screen around the ductwork and supports will not create an unreviewed safety question as defined in 10 CFR 50.59. Since the ductwork and supports have been designed to meet OBE/DBE seismic criteria, a seismic analysis is also being performed to determine the impact of adding the additional weight to the ductwork. An initial assessment indicated that no major impact on the existing seismic analysis would result from the addition of the mesh screen to the ductwork. The final assessment will ensure that all supports have been analyzed to ensure that the seismic design criteria is met. Any required modifications to the supports will be installed prior to unit startup. Since the modified system will meet the original design criteria, it is concluded that an unreviewed safety question will not be created as a result of this modification. The UFSAR will be updated to reflect the additional unqualified painting associated with the Air Cooling and Purging System.

5. Action Taken to Prevent Recurrence

Adequate procedures do exist for application of coatings at North Anna. However, to prevent recurrence, positive steps have been taken to clarify these procedures. To ensure that the requirements of Specification NAS-1016 are adhered to, a Site Operating Procedure (Construction Department) and Quality Assurance Department Instruction (Quality Assurance Department) have been developed to specify how coatings may be applied at North Anna. The Site Operating Procedure addresses control of materials, control of tools, control of applications, qualification of applicators, training requirements, and control of documents. The revised Quality Assurance Department Instruction addresses the inspection requirements and compliments the Site Operating Procedure. In addition, a training program on the requirements specified in Specification NAS-1016 and the revised procedures controlling the coatings process has been developed.

Other actions being undertaken are to 1) review Specification NAS-1016 and update as required, 2) augment the Station Administrative Procedures to further ensure that no plant modification work can be performed under the Maintenance Program, and 3) complete the painting documentation review. Also, a consultant has been retained to independently evaluate the adequacy of the existing controls over the painting and maintenance program process.

This report will be revised if any significant new information becomes available.

Vepco

VIRGINIA ELECTRIC AND POWER COMPANY
NORTH ANNA POWER STATION
P. O. BOX 402
MINERAL, VIRGINIA 23117

August 30, 1984

U. S. Nuclear Regulatory Commission
Document Control Desk
016 Phillips Building
Washington, D.C. 20555

Serial No. N-84-014
NO/RCS: nih
Docket No. 50-338
50-339
License No. NPF-4
NPF-7

Dear Sirs:

The Virginia Electric and Power Company hereby submits the following License Event Report applicable to North Anna Unit No. 1 and 2.

Report No. LER 84-006

This report has been reviewed by the Station Nuclear Safety and Operating Committee and will be forwarded to Safety Evaluation and Control for their review.

Very Truly Yours,

for E. Wayne Harrell
Station Manager

Enclosures (3 copies)

cc: Mr. James P. O'Reilly, Regional Administrator
U. S. Nuclear Regulatory Commission
Region II
101 Marietta Street, Suite 2900
Atlanta, Georgia 30303

IE22
1/1