

VIRGINIA ELECTRIC AND POWER COMPANY
RICHMOND, VIRGINIA 23261

May 31, 2000

U.S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, DC 20555-0001

Serial No.	00-181
NE/EM/DB	R0
Docket Nos.	50-338 50-339
License Nos.	NPF-4 NPF-7

Gentlemen:

VIRGINIA ELECTRIC AND POWER COMPANY
NORTH ANNA POWER STATION UNITS 1 AND 2
CLOSURE OF INDIVIDUAL PLANT EXAMINATION OF EXTERNAL EVENTS
(IPEEE)-SEISMIC, GENERIC LETTER (GL) 88-20, SUPPLEMENTS 4 AND 5

In a May 27, 1997 letter (Serial No. 97-303), Virginia Electric and Power Company transmitted the plant-specific summary report for a seismic event in response to GL 88-20, Supplement 4, "Individual Plant Examination of External Events (IPEEE) for Severe Accident Vulnerabilities." The IPEEE-Seismic evaluation was performed using the Electric Power Research Institute (EPRI) Seismic Margin Methodology in accordance with the guidelines provided in Supplement 4 and 5 of GL 88-20 (including NUREG-1407) and commitments identified in our letters Serial No. 91-410, dated December 20, 1991 and Serial No. 95-497, dated November 3, 1995. While the summary report reflected completion of the majority of the effort addressing IPEEE-Seismic, it identified a few issues that had not been resolved at that time. These unresolved issues were listed and discussed in Section 6.1 and Table 6.1-1 of the Summary Report.

In our May 27, 1997 letter, we stated that the disposition of the remaining unresolved issues was planned to be completed by the end of the North Anna Unit 1 refueling outage scheduled to commence in April 2000. The resolution of these issues is now complete and Attachment 1 contains the results, including an updated Table 6.1-1. We have determined that the high-confidence-of-low-probability-of-failure (HCLPF) capacities of the remaining systems and equipment, expressed in terms of peak ground acceleration, are greater than 0.3g. Therefore, there is no change in the previous Summary Table (Table 3.2-1) of systems, structures and components with HCLPF capacities less than 0.3g, which was provided in our summary report. We have concluded that no further cost beneficial upgrades can be performed to improve the seismic margin of the plant, based on the IPEEE-Seismic effort.

A011

If you have any questions or require further information regarding closure of the IPEEE-
Seismic issue for North Anna, please contact us.

Very truly yours,



Leslie N. Hartz
Vice President – Nuclear Engineering and Services

Attachment:

1. Disposition of Unresolved Issues - IPEEE - Seismic, North Anna Power Station
Units 1 and 2

Commitments made in this letter: None.

cc: U.S. Nuclear Regulatory Commission
Region II
Atlanta Federal Center
61 Forsyth Street, SW
Suite 23T85
Atlanta, Georgia 30303

Mr. M. J. Morgan
NRC Senior Resident Inspector
North Anna Power Station

ATTACHMENT 1

DISPOSITION OF UNRESOLVED ISSUES - INDIVIDUAL PLANT EXAMINATION OF EXTERNAL EVENTS (IPEEE) - SEISMIC

NORTH ANNA POWER STATION UNITS 1 AND 2

For the IPEEE-Seismic effort conducted at North Anna Power Station, a summary report was prepared and submitted to the NRC on May 27, 1997. A few issues required further review and/or modifications or safety enhancement, as noted in Section 6.1 of the summary report. These issues have now been resolved via area and system walkdowns, evaluations, or modifications. The issues and their resolution status (bold) are provided in the updated sections 6.1.1, 6.1.2, 6.1.3 and 6.1.4 below. Issues related to electrical and mechanical equipment in the Safe Shutdown Equipment List (SSEL) and their resolution are discussed in the Updated Table 6.1-1 below.

6.1.1 Seismic-Induced Fire Issues:

- (a) Lube Oil Heat Exchangers, 1-LO-E-1A & 2-LO-E-1A, (located at elevation 277' - Turbine Building), require anchorage check to determine if they could break loose and damage connecting piping.

Resolution:

A seismic review team consisting of Engineering Mechanics and System Engineers performed a detailed follow-up walkdown of the areas in the Turbine Building in the vicinity of the Lube Oil Heat Exchangers. It was judged that a fire initiating from a collapse of the Lube Oil Heat Exchangers and subsequent ignition of the spilled oil would not prevent operators from manually operating the feedwater control system. The area containing the Lube Oil Heat Exchangers and the reservoir has a dike and is protected with an automatic deluge system. The entire Turbine Building under the main floor is protected with an automatic wet-pipe sprinkler system. In addition, the building contains hose stations, which would be used by the fire brigade to control a potential fire. Therefore, no further evaluation of the heat exchangers or their anchorage is warranted and this issue is closed.

- (b) Hydrogen piping associated with the Generator and Turbine Lube Oil, and Seal Oil systems were all screened out, except for the piping at elevation 277', Unit 2 side of the Turbine Building. The hydrogen piping, less than 1" diameter, coming from the Turbine Lube Oil System was anchored to the Turbine pedestal at several locations. The Turbine pedestal is an independent structure from the Turbine Building. An examination of the relative seismic motion between the Turbine Building and the Turbine pedestal and its effect on the piping is required.

Resolution:

A seismic review team that included two Engineering Mechanics Engineers and a System Engineer performed a detailed follow-up walkdown of the hydrogen flat area that contains the hydrogen piping. The hydrogen piping that is less than 1" in diameter is not anchored to the Turbine pedestal at any place. Typically, U-bolts have been used to support the hydrogen piping in this area and the piping is flexible. Thus, it was judged that seismic differential motions between the Turbine pedestal and the Turbine Building would not cause any failure of the piping system or a fire. It is also noted that this area is protected by an automatic wet-pipe sprinkler system to arrest any fire-induced hazard. In addition, the Hydrogen Seal Oil Unit, Lube Oil Purifier and Lube Oil Reservoir are protected by an automatic deluge system. Therefore, this issue is closed.

- (c) The air bottles located by the roll-up door at elevation 274' (Auxiliary Building) need a set of chains at the bottom of the bottles. Supports are not bolted to concrete. A follow up evaluation and/or modification will be required. Also several hydrogen and other gas bottles located in the chemical sampling area on this elevation were not sufficiently supported and require further evaluation.

Resolution:

A seismic review team performed a follow-up walkdown and evaluation of the air bottles in the area near the roll-up door at elevation 274' of the Auxiliary Building. A lateral restraint design, using chains and anchor bolts to an adjacent concrete wall, was provided in Engineering Transmittal CEM 99-0014. This modification was implemented via Work Order No. 00318605-01 and a subsequent walkdown confirmed that the bottles are adequately supported.

The hydrogen and argon gas bottles in the chemical sampling area on this elevation were also reviewed in a follow-up walkdown. These bottles are now well restrained by chains at about mid-height. The hydrogen bottles are also restrained at the bottom.

Based on the above, this issue is closed.

6.1.2 Seismic-Induced Flood Issues:

Turbine Building:

Feedwater Heaters 1,2-FW-E-1A, 1B, 2A, 2B, 3A, 3B, 4A, and 4B are supported midway and at the base of the heater. An adequacy check of supports is required to ensure that there are no effects on surrounding equipment due to seismic interaction or flooding potential, such as pipe breaks at the nozzle.

Resolution:

A system and consequence evaluation was performed, with the assumption that the supports for the feedwater heaters may fail in a seismic event. The heaters are supported from the Turbine Building floor at elevation 254'. It was calculated that the worst case flooding from the FW heaters would cause the water level to be less than 1-foot above the Turbine Building floor. This is considerably lower than the 3-foot high flood dike that is installed at elevation 254' at the entrance to the Emergency Switchgear Room and the Auxiliary Building Tunnel. Also, components in the IPEEE success path or the safe-shutdown path located in the Turbine Building are far away from the FW heaters or on a higher elevation. Excluded are a few components associated with lake-to-lake mode of operation of the Service Water System, which is used only in extraordinary situations. High energy line breaks in the Turbine Building have been evaluated and the plant is designed to trip on the loss of main feedwater and can be maintained in hot shutdown by the use of Auxiliary Feedwater System. None of the success path components in the Turbine Building require immediate manual manipulation by operators following a seismic event and failure of feedwater heaters. Therefore, the issue regarding flooding from feedwater heaters is closed.

Tanks Located in the Yard:

Casing Cooling Tanks, located next to the Auxiliary Feedwater Pump House, appear to be well encased in concrete. However, the tank anchorage and potential interaction and flooding concerns need to be further reviewed.

Resolution:

A seismic margin calculation was performed for the Casing Cooling Tank and its anchorage. The high-confidence-of-low-probability-of-failure (HCLPF), based on the overturning capacity, was 0.39g. The fluid sloshing capacity is close to 0.3g and no significant loss of fluid is expected.

It is noted that the Casing Cooling Tanks are not encased in concrete, rather it is the Condensate Storage Tank (CST) which is encased in 2-foot thick reinforced concrete. The CST was conservatively analyzed as an unanchored tank although it is restrained at the top with an angle welded all around it. The CST was found to be seismically adequate and a discussion of its sliding, overturning, sloshing and stability analysis was provided in response to an NRC request for additional information (RAI) in our letter Serial Number 99-437 dated October 18, 1999.

Therefore, there are no interaction or flooding concerns for the Casing Cooling Tanks or the CST and this issue is closed.

6.1.3 Miscellaneous Issues:

- (a) Several lube oil reservoir sites on motor driven pumps were loose and should be tightened. Specifically, the oil reservoirs on all the SSEL pumps should be checked to prevent pump burn-up from oil leakage and subsequent lack of lubrication. A comprehensive plan will be developed to inspect all the plant pump lube oil reservoirs to resolve this issue.

Resolution:

A follow-up walkdown of several sample SSEL motor-driven horizontal pumps determined that the oil reservoir sites are not loose. It is noted that Station Electrical Maintenance Procedure No. 0-EPM-1412-01 requires a check of oil reservoir sites on pumps for oil level, cracks, leaks, tightness, and if required, further repair. Also, operators check for leaks and for adequate pump oil reservoir levels while taking operator logs. Therefore, no further inspection plan is required and this issue is closed.

- (b) A storage cabinet of air bottles near 1-HV-AC-5 (Turbine Building, elevation 279') was not anchored and could create potential missile concerns if the bottles fell and ruptured during a seismic event. The cabinet will be bolted to resolve this concern.

Resolution:

A seismic review team consisting of two Engineering Mechanics Engineers performed a follow-up walkdown of the cabinet and the air bottles. The bottles lie inside a steel cabinet in a horizontal position. The front door of the cabinet remains locked and handrails behind the cabinet protect it from falling down. There is no success path or safe-shutdown equipment in the vicinity of the cabinet. In the worst case scenario during a seismic event, if a

bottle does become a missile, the rear cover of the cabinet will provide considerable resistance. It is judged that this scenario will not produce any significant damage. Therefore, bolting of the cabinet is not required and this issue is closed.

- (c) Several mechanical and electrical penetrations were walked down and the only concern identified was that a ceramic type of material was used in the assemblies for some 4160 volt electrical penetrations in the Cable Vault area at the electrical penetrations into containment. Failure of ceramic materials has been observed in previous earthquakes. A review of this insulator structural adequacy during a seismic event will be performed.

Resolution:

The electrical penetration assemblies are manufactured by Conax Corporation and were seismically qualified to IEEE Std. 344-1975. It was concluded from the qualification results that their seismic capacity is greater than the Review Level Earthquake of NUREG-1407, anchored at 0.3g peak ground acceleration. Further, the penetration assemblies are relatively compact and are located in a caged area and seismic interaction with adjacent commodities is not a concern. Therefore, this issue is closed.

- (d) The light diffuser panels in the Control Room ceiling rest on a frame of inverted tees. Diffusers that are not tied to the frame have been known to fall through the frame during previous earthquakes. The diffuser panels need to be further evaluated and, if required, they will be tied to the frame preferably at two sides, in areas where they could injure the operators or damage sensitive equipment.

Resolution:

An Engineering Transmittal, CEM 99-0019, Rev. 1, was issued to the Station. In accordance with this Engineering Transmittal, Control Room ceiling panels were tied to the T-bars on which they rest using metal clips under Work Order 00420902-01. Therefore, this issue is closed.

- (e) Cable and Conduit Raceway Systems - Several conduit covers were missing in the cable vault and tunnel area and in the Service Building. In addition, cables in several locations were hanging loose from cable trays. Work Orders 30686, 30687, 30688, and 30689 have been issued to correct these deficiencies.

Resolution:

The Work Orders associated with cable and conduit raceway systems have been implemented and the deficiencies have been satisfactorily resolved.

Therefore, this issue is closed.

- (f) HVAC Ducting and Supports - HVAC ducting was rod hung in the Turbine Building. Supports were adequately spaced to prevent major failure; however, it is expected that the ducting will exhibit significant displacements during a seismic event. Catastrophic failure of the ducting is not thought possible, but tearing of the sheet metal, primarily at section connections, might be expected. Leakage may occur at these locations. Impact of this leakage will be evaluated.

Resolution:

This issue was further evaluated and the potential for small tears of sheet metal resulting from a seismic event were judged not to significantly affect equipment or personnel in the Turbine Building, in terms of environmental considerations (i.e., temperature). The results of small tearing of sheet metal would be a small decrease in the efficiency of the HVAC subsystems. However, the normal margins in HVAC flow and operating temperatures would be adequate to compensate for the postulated small tearing of the ducting. The functionality of the equipment and system would be maintained. Therefore, this issue is not considered a seismic vulnerability and is closed.

6.1.4 Electrical and Mechanical Equipment:

Resolution:

A description of each outstanding, unresolved issue and the current resolution status related to electrical and mechanical equipment is summarized in Updated Table 6.1-1 below. For each of these components, it was determined that the high-confidence-of-low-probability-of-failure (HCLPF) capacity is greater than 0.3g.

UPDATED TABLE 6.1-1

Resolution of Outstanding Issues - Electrical and Mechanical Equipment

ITEM NO.	DESCRIPTION OF OUTLIER/ISSUE	EQUIPMENT MARK NUMBER	PREVIOUS RESOLUTION PLAN FROM MAY 27, 1997 SUMMARY REPORT COMPLETED RESOLUTION (BOLD)
1	Housekeeping Issue: Movable CO ₂ fire extinguisher carts on wheels, unanchored tables, trash cans etc. are a few inches away from SSEL cabinets housing essential relays in the ESGR room and IRR room.	In the vicinity of several components.	<p>This issue is being resolved via an Engineering Transmittal No. CEM-97-0032 to the Station.</p> <p>A Station Administrative Procedure (VPAP-0312) addressing seismic housekeeping has been issued. Specific housekeeping issues identified during the USI A-46 walkdowns were resolved. Specific issues identified in the IPEEE-Seismic summary report have been resolved.</p> <p>This issue is therefore resolved.</p>
2	<p>(a) Some of the friction clips used in transformer cabinet anchorages have a small gap with the base channel. The coils are not laterally restrained at the top; however, the transformer has been seismically tested.</p> <p>(b) The transformer anchorage and/or load-path to the adjacent cabinets, which are bolted to the transformer cabinet, require additional review.</p> <p>(c) The nuts for the bolts connecting the transformer coils to the base channels may need to be tightened for transformers 2-EE-ST-2J and 2-EE-ST-2J1.</p>	<p>1-EE-ST-1H 1-EE-ST-1H1 1-EE-ST-1J 1-EE-ST-1J1 2-EE-ST-2H 2-EE-ST-2H1 2-EE-ST-2J 2-EE-ST-2J1</p>	<p>Further inspection and review will be performed to verify anchorage adequacy and/or load path. The gap between friction clips and base channel will be closed via modification, as needed. To tighten the nuts, a work order has been issued to the Station.</p> <p>As a result of calculation (CE-1394), and a Design Change (DC 98-002) was prepared to enhance the anchorage of the transformers. The Design Change has been implemented for all eight transformers by welding the lower toe of the existing 6" channels on which the coils are mounted, along the length, to the existing embedded steel in the floor. The nuts for bolts connecting the coils to base channel have been tightened for transformers 2-EE-ST-2J, 2J1.</p> <p>This issue is therefore resolved.</p>

ITEM NO.	DESCRIPTION OF OUTLIER/ISSUE	EQUIPMENT MARK NUMBER	PREVIOUS RESOLUTION PLAN FROM MAY 27, 1997 SUMMARY REPORT COMPLETED RESOLUTION (BOLD)
3	Cabinets contain essential relays and have the potential of side-to-side impact with adjacent cabinets	1-EI-CB-08B 2-EI-CB-08B 1-EE-EG-01C 1-EE-EG-02C 1-EE-EG-03C 1-EE-EG-04C	<p>The cabinets will be bolted with adjacent cabinets to prevent potential impact.</p> <p>For cabinets 1-EI-CB-08B and 2-EI-CB-08B, a Design Change (DC No. 99-005) was issued to the Station to connect these cabinets to the adjacent cabinets. This Design Change was implemented by bolting pieces of angle sections to these panels and to the adjacent panels at the top. This eliminates any impact loading.</p> <p>For cabinets 1-EE-EG-01C, 02C, 03C, 04C in the EDG rooms, an Engineering Transmittal (ET CEM 99-0033) was written to connect them to the adjacent motor control centers (MCCs) using Tube Steel section and threaded rods at the top. This modification has been completed under Work Orders 00420959-01/02/03/04. The cabinets and the MCCs will act as a single unit and any potential seismic interaction is eliminated.</p> <p>This issue is therefore resolved.</p>
4	A clamp support on an adjacent unistrut is close to the flow switch and has a potential for interaction	1-HV-FS-1215B	<p>Engineering Transmittal CEM-97-0012 and Work Order No. 008954 have been written to move the clamp assembly about 1" away.</p> <p>The clamp assembly has been moved about 1" by Work Order 00362829 to prevent any potential interaction.</p> <p>This issue is therefore resolved.</p>
5	A space heater is suspended on long rod hangers over the battery chargers and near the batteries in the EDG room. Swaying of the heater during a seismic event may break the connecting steam/ condensate line and spray the batteries.	1-EG-B-01A 1-EG-B-03C 2-EG-B-02B 2-EG-B-04D	<p>The requirement for the space heater in the EDG room will be reviewed, and if required the heaters will be laterally restrained to the adjacent concrete walls.</p> <p>In a subsequent walkdown performed by a seismic review team, it was determined that the space heaters have rigid pipe connections, which would prevent the heaters from swaying in a seismic event. In one location where the connected pipe is flexible, the rod-hung heater is far removed</p>

ITEM NO.	DESCRIPTION OF OUTLIER/ISSUE	EQUIPMENT MARK NUMBER	PREVIOUS RESOLUTION PLAN FROM MAY 27, 1997 SUMMARY REPORT COMPLETED RESOLUTION (BOLD)
5. (cont)			<p>from the batteries and the battery chargers. Thus, the concern of spray over the battery chargers or batteries is not considered credible.</p> <p>This issue is therefore resolved.</p>
6	<p>Potential interaction exists between valve operator limit switch support bracket and platform support beam. The valve has cast iron yoke.</p>	<p>2-FW-FCV-2479</p>	<p>Further review of the operator displacement is planned. If required, the existing support beam will be notched to clear the interference.</p> <p>An Engineering Transmittal (ET CEM 99-0017) was written to the Station to provide instructions to get adequate clearance between the limit switch bracket and the platform steel, by grinding the limit switch bracket or by other means. This task was completed and a subsequent walkdown by Seismic Capability Engineers showed that the limit switch bracket has been notched to provide sufficient clearance.</p> <p>This issue is therefore resolved.</p>

ITEM NO.	DESCRIPTION OF OUTLIER/ISSUE	EQUIPMENT MARK NUMBER	PREVIOUS RESOLUTION PLAN FROM MAY 27, 1997 SUMMARY REPORT COMPLETED RESOLUTION (BOLD)
7	Pressure gauge / regulator assembly, which is mounted to a valve operator, is approximately 5/8" away from post for adjacent handrail	2-RH-FCV-2605	<p>Further review of the operator displacement is planned. If required, the handrail will be moved away from valve operator.</p> <p>The review of the existing analysis of the valve/piping system indicated that, because of a simple modeling method used, the displacements at the valve-operator location were not available. However, for other valves in this system, which are heavier, the maximum displacement was 0.15", based on a response spectrum analysis performed with 1% damped spectra. From this review, it was judged that there is sufficient gap between the pressure gauge/regulator and the adjacent handrail to preclude a seismic interaction. Further, as stated in the report, "Use of Seismic Experience and Test Data to Show Ruggedness of Equipment in Nuclear Power Plants", prepared by the Senior Seismic Review and Advisory Panel (SSRAP), February 1991, failure of air-operated valves from impact is rare in earthquake experience and credible only when these valves are supported on very flexible piping.</p> <p>This issue is therefore resolved.</p>
8	Interaction concern of valves with adjacent commodities	1-CC-TV (SOV)-102D 1-CC-TV (SOV)-105A 1-CC-TV (SOV)-105C	<p>Further review of valve displacement is planned. If required, adjacent commodities will be relocated to eliminate the potential interaction.</p> <p>In a subsequent walkdown performed by a seismic review team, it was concluded that the interaction concerns are not credible. The actuator for valve 1-CC-TV (SOV) -102D is about 1/2" from a conduit, however the conduit is flexible. The other two valves may have a slight interaction with only the insulation of an adjacent pipe, which was judged acceptable.</p> <p>This issue is therefore resolved.</p>

ITEM NO.	DESCRIPTION OF OUTLIER/ISSUE	EQUIPMENT MARK NUMBER	PREVIOUS RESOLUTION PLAN FROM MAY 27, 1997 SUMMARY REPORT COMPLETED RESOLUTION (BOLD)
9	Valve hand-wheel is about 1/4" from an adjacent pipe	2-SI-MOV-2836	<p>Further review is planned. If required, the handwheel will be replaced or removed.</p> <p>In accordance with Engineering Transmittal No. ME 99-020, a smaller diameter hand-wheel (9" dia.) was fabricated and was installed under Work Order (WO) No. 00422833-01. This provided sufficient clearance between the valve hand-wheel and the adjacent pipe.</p> <p>This issue is therefore resolved.</p>
10	Valve operator cantilever length exceeds limits of Figure B.7-1 of the GIP	1-RC-PCV-1455C 1-RC-PCV-1456	<p>Further review of the valve/yoke is planned.</p> <p>The valves were determined to be flexible (natural frequency <10 hz). The piping analysis was revised with an updated model that reflected the natural frequency of the valves. From this analysis, the acceleration responses at the center of gravity of the extended structure of both these valves were obtained. Valve critical components were analyzed using the forces resulting from these accelerations, and the stresses were found to be within the allowable values.</p> <p>This issue is therefore resolved.</p>