May 7, 1999

Mr. Steve Haberman
Field Director
Seacoast Anti-Pollution League
P.O. Box 1136
Portsmouth, NH 03802

SUBJECT: Response to Letter Dated April 9, 1999, Discussing Seabrook Daily Event Report, Dated April 1, 1999

Dear Mr. Haberman:

I am responding to your letter to me dated April 9, 1999, regarding your concerns about an event notification from North Atlantic Energy Service Company (NAESCO) indicating that one of Seabrook's two emergency diesel generators (EDG) may have been inoperable since June 1997. We also have concerns regarding this event. Our inspection of the problem described in the event report is not yet completed. The results of our inspection will be discussed in NRC Inspection Report 50-443/99-02, a copy of which will be provided to you. In the meantime, I'd like to address some of your concerns.

NAESCO reported that the "B" EDG may have been inoperable during the last operating cycle, and that the "A" EDG was unavailable for short durations during the same time period for maintenance and testing, for a total of about 7.5 days. The EDGs are not the only sources of power in response to accident conditions at Seabrook. Two off-site power sources are also available for response to accident conditions at the site. The EDGs are necessary to respond to events involving a total loss of off-site power.

It is important to note that while the "B" EDG may have been inoperable for an extended period of time because, after starting, it may not have automatically powered required equipment, this equipment could have been manually connected to the EDG as specified by station emergency procedures. So, while the "B" EDG was functional but inoperable, it remained available for use by the operators had a total loss of off-site power occurred.

The licensee has completed its investigation into the root causes for the relay problems and identified corrective actions to minimize recurrence as described in the enclosed Licensee Event Report (LER) 50-443/99-001. The LER discussed a combination of two factors which led to the relay failures including: improper relay calibration settings and a high relay contact impedance caused by the build-up of corrosion products. As part of the corrective actions for this event, the licensee has replaced all similar relay internals used in safety-related applications with new components. The licensee also confirmed that the relays were properly calibrated prior to installation. In addition, the licensee has revised the procedure for testing the relays in the future to incorporate the lessons learned from this event and to visually inspect the relays for signs of corrosion.

As discussed above, while the relay failure caused the 'B' EDG to be inoperable for an indeterminate period of time during the last operating cycle, plant operators still would have had the ability to power the associated equipment on the 'B' vital bus using the 'B' EDG. The relay failure affected the automatic loading of the equipment on the bus, resulting in the reported condition. In LER 99-001 the company addressed a number of hypothetical accident scenarios associated with the relay failures and concluded that these failures would not have compromised the integrity of the fuel or the containment building and therefore, would not have increased the radiological consequences of an accident.

In conclusion, we have reviewed the licensee's actions to correct this condition and prevent recurrence and found them acceptable. The degraded relays identified by the test have been replaced and tested prior to restart. We will inform you of the results of our inspection, including any possible enforcement action resulting from this matter when the inspection has been completed.

Sincerely,

Original Signed by:
Richard V. Crlenjak for

A. Randolph Blough, Director
Division of Reactor Projects

Docket No. 50-443

Enclosure: Seabrook Station LER 99-001-00

cc w/encl:
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B. D. Kenyon, President - Nuclear Group
J. S. Streeter, Recovery Officer - Nuclear Oversight
W. A. DiProfio, Station Director - Seabrook Station
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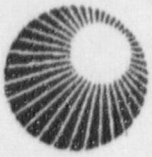

North Atlantic

North Atlantic Energy Service Corporation
P.O. Box 300
Seabrook, NH 03874
(603) 474-9521

The Northeast Utilities System

April 28, 1999

Docket No. 50-443

NYN-99047

AR#99004956
ACR 99-1158
ACR 99-1159

United States Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, DC 20555

Seabrook Station
Licensee Event Report (LER) 99-001-00
Emergency Diesel Generator Inoperability Due to Westinghouse AR Relay Failures

Enclosure 1 is Licensee Event Report (LER) 99-001-00 for an event that occurred at Seabrook Station on March 29, 1999. This event is being reported pursuant to 10 CFR 50.73(a)(2)(i) and 10 CFR 50.73(a)(2)(v). Enclosure 2 is a list of North Atlantic Energy Service Corporation (North Atlantic) commitments made in response to this LER.

Should you require further information regarding this matter, please contact Mr. James M. Peschel, Regulatory Compliance Manager at (603) 773-7194.

Very truly yours,

NORTH ATLANTIC ENERGY SERVICE CORP.

for Ted C. Feigenbaum
Executive Vice President and
Chief Nuclear Officer

cc: H. J. Miller, NRC Regional Administrator
J. T. Harrison, NRC Project Manager, Project Directorate 1-2
R. K. Lorson, NRC Senior Resident Inspector

9905040238 4pp.

ENCLOSURE 2 TO NYN-99047

North Atlantic Commitments Contained in NYN-99047

	Description of Commitment
AR#99004956-02	The AR relay internals and covers in both the Train A and Train B EDG EPS's will be replaced with new units prior to startup from the current refueling outage. The existing relay cases will be cleaned to remove any corrosion residue.
AR#99004956-03	The replacement AR relay internals for the Train A and Train B EDG EPS will be confirmed to be properly calibrated before installation.
AR#99004956-04	The 46 non-safety AR relays associated with the electrical distribution system will be periodically visually inspected for corrosion and gasket degradation, their contacts will be burnished and the relay cover gaskets will be replaced.

ENCLOSURE 1 TO NYN-99047

NRC FORM 366 (4-95) U.S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB NO. 3150-0104
EXPIRES 04/30/98
ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS MANDATORY INFORMATION COLLECTION REQUEST: 50.0 HRS. REPORTED LESSONS LEARNED ARE INCORPORATED INTO THE LICENSING PROCESS AND FED BACK TO INDUSTRY. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE INFORMATION AND RECORDS MANAGEMENT BRANCH (T-6 F33), 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)

(See reverse for required number of digits/characters for each block)

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TITLE (4)

Emergency Diesel Generator Inoperability Due to Westinghouse AR Relay Failures

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
03	29	99	99	001	00	04	28	99	FACILITY NAME	DOCKET NUMBER

OPERATING MODE (9)	5	THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more) (11)			
POWER LEVEL (10)	0	20.2201(b)	20.2203(a)(2)(v)	[X] 50.73(a)(2)(i)	50.73(a)(2)(viii)
		20.2203(a)(1)	20.2203(a)(3)(i)	50.73(a)(2)(ii)	50.73(a)(2)(x)
		20.2203(a)(2)(i)	20.2203(a)(3)(ii)	50.73(a)(2)(iii)	73.71
		20.2203(a)(2)(ii)	20.2203(a)(4)	50.73(a)(2)(iv)	OTHER
		20.2203(a)(2)(iii)	50.36(c)(1)	[X] 50.73(a)(2)(v)	Specify in Abstract below or in NRC Form 366A
		20.2203(a)(2)(iv)	50.36(c)(2)	50.73(a)(2)(vii)	

LICENSEE CONTACT FOR THIS LER (12)

NAME	TELEPHONE NUMBER (Include Area Code)
James M. Peschel, Regulatory Compliance Manager	(603) 773-7194

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
X	EK	RLY	W120	Y					

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

ABSTRACT (Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines) (16)

On March 31, 1999 at 1100, during the sixth refueling outage, North Atlantic Energy Service Corporation (North Atlantic) determined that the Train B Emergency Diesel Generator (EDG) may not have been operable during portions of the previous operating cycle. Specifically, during 18 month EDG testing on March 29, 1999, it was determined that an AR relay associated with the Train B EDG Emergency Power Sequencer (EPS) was incapable of opening the breaker to the Unit Auxiliary Transformer (UAT). This could have prevented the Train B EDG from powering the emergency bus if called upon to do so. Additional testing on March 30, 1999, revealed that another AR relay associated with the Train B EDG EPS was incapable of starting a Containment Building Spray (CBS) pump. This would have prevented the Train B CBS pump from automatically starting if called upon to do so.

This event was caused by a combination of two factors; formation of corrosion products on the relay contacts and other surfaces resulting from age related degradation of the relays' molded neoprene cover gaskets and improper relay calibration settings. The AR relay internals and covers in both trains of the EDG EPS will be replaced with new units prior to startup from the current refueling outage. The procedure utilized for testing the AR relays has been revised to clarify techniques and acceptance criteria. The AR relays in the EDG EPS will be periodically inspected for signs of corrosion and gasket degradation.

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TEXT *(If more space is required, use additional copies of NRC Form 366A)* (17)

I. Description of Event

On March 29, 1999, at 1254 EST, during the sixth refueling outage, the Train B Emergency Diesel Generator [EK] failed its 18 month loss of power test conducted in accordance with Technical Specification (TS) 4.8.1.1.2.f.4. The test failure occurred when an Emergency Power Sequencer (EPS) [EK] Westinghouse Type AR high speed auxiliary relay failed to function properly. The subject relay's (K85) function is to open the 4160 volt circuit breaker connecting the Unit Auxiliary Transformer (UAT)[EA] to the E6 emergency bus [EB]. As a result, the Train B EDG started but its output breaker did not close. This prevented the EDG from powering the emergency bus during the testing.

After relay K85 was replaced, the Train B EDG loss of power test was again conducted on March 30, 1999 at 0834 EST, and another EPS Westinghouse type AR output relay failed to function properly. The subject relay (K77) starts the Train B Containment Building Spray (CBS)[BE] pump (CBS-P-9B). While the emergency bus was successfully powered, the K77 relay failure prevented the Train B CBS pump from automatically starting. Although the CBS pump would not normally start on a loss of power, the test simulated a containment spray signal to verify the sequencing for the CBS pump start.

On March 31, 1999, at 1100 EST, North Atlantic Energy Service Corporation (North Atlantic) determined that the Train B EDG may not have been operable during portions of the previous operating cycle (June 1997 - March 1999). This conclusion was reached when information became available that the aforementioned relay failures most likely occurred sometime before the loss of power test was conducted. Since it is possible that the Train B EDG had been inoperable at times when the Train A EDG was also inoperable for maintenance or testing as allowed by the TS, it was concluded that this represented a condition that alone could have prevented the fulfillment of the safety function of structures, systems, or components that are needed to mitigate the consequences of an accident. North Atlantic reported this condition to the NRC on March 31, 1999 at 1307 EST, pursuant to 10 CFR 50.72(b)(2)(iii).

The potential inoperability of the Train B EDG for periods longer that the TS allowed outage time (72 hours) and possibly concurrent with the TS allowed inoperability of the Train A EDG as a result of maintenance or testing constitutes a condition prohibited by the TS and is also reportable pursuant to 10 CFR 50.73(a)(2)(i).

II. Cause of Event

North Atlantic has determined that this condition was caused by a combination of two factors: formation of corrosion products on the relay contacts and other surfaces and improper relay calibration settings.

Some of the AR relays in the EPS, including K85 and K77, exhibited higher than normal resistance across their silver contacts as a result of a silver sulfide film. The silver sulfide film was caused by the release of compounds from the age-related degradation of the relays' molded neoprene cover gasket. Over time, the

gaskets released compounds such as sulfuric acid, hydrochloric acid, and other sulfur bearing compounds. These compounds attacked the relays' silver contacts and caused the formation of a silver sulfide film. These compounds also caused corrosion on other metallic relay parts. For the K85 relay, the silver sulfide film in conjunction with low contact pressure caused the relay to fail. For the K77 relay, it is believed that the contacts would not open due to foreign debris and the relay not being calibrated properly.

In most cases, the electrical resistance of the silver sulfide film was overcome by either the voltage applied across the contacts or sufficient contact pressure and the relays performed properly. However, if the relay was not optimally calibrated such that it exhibited more than minimal deviation from the relay setup acceptance criteria, then it was possible that this, in conjunction with the sulfide film, created a condition where the relay may not function properly.

As stated above, some of the relays were not optimally calibrated. This was caused by inadequate calibration by the relay manufacturer. A contributing cause was the lack of adequate acceptance testing to verify all critical characteristics by Automation Industries, Inc., Vitro Laboratories Division, the manufacturer of the EPS who qualified the relays and North Atlantic upon receipt of the EPS. Notwithstanding, the AR relays in the Train B EDG EPS which were replaced during the previous refueling outage were verified to be operable following maintenance testing via successful EDG testing during that outage. Hence, improper relay calibration alone did not adversely affect relay operability.

III. Analysis of Event

The AR relay failures did not result in any adverse safety consequences since offsite power was always available during the last operating cycle and the Train B EDG was not called upon to respond to an actual loss of offsite power. However, this condition has safety significance since the Train B EDG may not have been operable during portions of the previous operating cycle for periods of time longer than the TS allowed outage time and during periods when the Train A EDG may have been removed from service for maintenance or testing.

North Atlantic has been unable to conclusively determine when during the last operating cycle the two AR relays became inoperable. The thirteen AR relays in the Train B EDG EPS were replaced with available spares just prior to the last operating cycle during the fifth refueling outage which was completed in June 1997. These spares were the same age as those originally installed in the EDG EPS and they had been in storage since plant construction. The relay contacts were inspected and cleaned if necessary, prior to installation. The operability of the relays was verified during surveillance testing conducted during the fifth refueling outage. North Atlantic believes that sulfide deposition on the contacts occurred over time.

During the last operating cycle the Train A EDG was inoperable for maintenance and testing for a total of approximately 7.5 days. Independent of this, the Train A emergency bus E5 was inoperable for

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TEXT *(If more space is required, use additional copies of NRC Form 366A)* (17)

approximately 0.54 day. Similarly, the Train A CBS pump was inoperable for a total of approximately 6.25 days during the last cycle. Based on this, both trains of EDGs and both trains of CBS would have been inoperable concurrently for only a relatively short period of time during the last cycle.

North Atlantic believes that the AR relay failures would not have caused any adverse safety consequences during a loss of offsite power event while at power operation even if the Train A EDG was unavailable. In this scenario, the Train B EDG would have automatically started but the K85 AR relay failure would have prevented it from automatically powering the emergency bus in response to the loss of offsite power. This would have resulted in a loss of power to the Station. However, proceduralized operator action would have directed prompt restoration of power to the emergency bus. When in Modes 1 - 4, Step 3 of Emergency Procedure E-0, "Reactor Trip or Safety Injection," verifies power to the emergency busses and restores power if necessary. At this point in E-0, it is likely that, based on information available on the main control board in the Control Room, operators would recognize that the UAT breaker was closed and open it from the Control Room. Based upon observations of operating crews during simulator training scenarios regarding how long it takes to complete steps in the emergency procedures, it is estimated that the UAT breaker would be opened in this scenario within approximately 30 seconds.

Continuing with this scenario, if power was not restored by step 3 of E-0, then the operators would transition to procedure ECA-0.0, "Loss of All AC Power." Step 5.a of ECA-0.0 requires the operators to verify that the UAT and Reserve Auxiliary Transformer (RAT) [EA] supply breakers are open and if necessary, to open them. Following this, operators verify that the EDG is running and that the EPS automatically actuates and the EDG loads properly, which results in the restoration of power to the emergency bus. It is estimated based on this sequence of steps that the UAT breaker could have been opened within approximately one minute forty-five seconds of event initiation which would have allowed loads to be automatically sequenced onto the emergency bus at five second intervals over the next two minutes based on a preestablished priority.

This estimated period of time to restore power is insignificant since Seabrook Station is a four-hour coping plant to satisfy the Station Blackout requirements of 10 CFR 50.63. During the four-hour coping period, the plant relies only on the Station batteries [EJ] as a source of electrical power and no adverse safety consequences would be experienced.

The most limiting hypothetical accident scenario (beyond design basis) for the relay failures involves power operation with a simultaneous large break loss of coolant accident (LOCA) with a resultant high pressure in the containment building [NH] requiring the initiation of CBS and a loss of offsite power at a time when the Train A EDG was inoperable. This is a very unlikely event with a probability of 2.9 E-09. Similar to the loss of power scenario without the LOCA, the Train B EDG would have automatically started but the K85 AR relay failure would have prevented it from automatically powering the emergency bus in response to the loss of offsite power. This would result in a loss of power to the Station and a loss of emergency core cooling and CBS until power is restored. However, when the bus was manually powered from the Train B EDG by the operators, the K77 relay failure would have prevented the Train B CBS pump from sequencing onto the bus and automatically starting. Irrespective of this, it is reasonable to expect that operator action would have started a CBS pump.

Had the operators stayed in E-0, step 14 would direct them to manually actuate CBS from the main control board in the Control Room. If the operators had previously transitioned to ECA 0.0, the operators would transition to procedure FR-Z.1 "Response to High Containment Pressure," upon restoring power to the emergency bus. Step 3.b of FR-Z.1 directs operators to manually start the CBS pumps if they are not already running. It is estimated based on this sequence of steps for either staying in E-0, or transitioning to ECA 0.0, that the operators would have attempted starting the CBS pump CBS-P-9B within less than approximately five minutes from initiation of the accident.

However, it is also possible that the operators would not have been successful at starting the CBS pump since in this scenario, the circuit design would require the pump's control switch to be placed in either "stop" or "pull-to-lock" before the pump could be successfully started when the control switch is placed in run. If the pump was not started at this time, operators would likely dispatch an electrician to check the pump's circuit breaker, before which the pump's control switch would likely have been placed in "pull-to-lock." For the purpose of this scenario, it is estimated that the troubleshooting would be completed such that the pump could have been successfully started within approximately 10-15 minutes from the initiation of the event.

North Atlantic evaluated the most limiting accident scenario described above by running sensitivity cases with a semi-best estimate Seabrook Station specific non 10 CFR 50 Appendix K ECCS model. Consistent with the above estimated operator response times, this modeling considered power restoration to the emergency core cooling pumps such that pumps would be running and up to speed within an estimated two minutes three seconds. This would result in an increase in the peak cladding temperature (PCT) by approximately 5 to 200 degrees Fahrenheit depending on whether operators opened the UAT breaker at 30 seconds or one minute forty-five seconds. In either case, the PCT remains below 2200 degrees Fahrenheit. Hence, under the hypothetical scenario and assumed manual actions described above, this condition would not adversely affect fuel integrity nor increase the radiological consequences of an accident.

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If the CBS pump was successfully started within five minutes of initation of the event, then containment building pressures would remain less than the design basis value of 52 psig. However, the lack of CBS for a total of approximately ten minutes from the initiation of the accident would have allowed containment building internal pressure to increase to approximately 53 psig. If it took longer to establish CBS, such as 15 minutes from initation of the event, then containment pressure could reach approximately 55 psig. Both of these values are above 52 psig but below the point where the containment building would be expected to fail. Hence, under the hypothetical scenario and assumed manual actions described above, North Atlantic believes that containment building integrity would not have been compromised as a result of this condition.

It should also be noted that some events that result in a loss of power also result in a direct trip of the UAT circuit breaker by protective relays. Examples include a 345kV bus fault or a UAT or Generator Step-up Transformer (GSU) [EL] failure. For these events, the K85 relay function to trip the UAT would not be needed and hence, would not have prevented the EDG from automatically supplying power to the emergency bus.

While not the most limiting hypothetical accident scenario, North Atlantic also evaluated the potential affect of the AR relay failures during the shutdown modes. The K85 relay failure would have prevented shutdown cooling systems from removing heat from the Reactor Coolant System (RCS)[AB] if a loss of power event occurred while in Modes 5 and 6 when the Train A EDG was also inoperable. In response, operators would implement procedure OS1246.01 "Loss of Offsite Power - Plant Shutdown." The first step of this procedure directs operators to restore power to any emergency bus by verifying that the UAT and RAT supply breakers are open and if necessary, to open them. Following this, operators verify that the EDG is running and that the EPS actuates and the EDG loads properly, which results in the restoration of power to the emergency bus. These actions would be completed in less than approximately two minutes such that shutdown cooling would be restored well before the onset of any adverse consequences.

In conclusion, North Atlantic believes that for the hypothetical accident scenarios described above, the AR relay failures would not have compromised the integrity of the fuel nor the containment building and therefore would not have increased the radiological consequences of an accident.

IV. Corrective Action

As an interim corrective action, the thirteen AR relays in the Train A EPS and four AR relays in the Train B EPS were replaced with available spares and EDG testing was satisfactorily completed. The contacts for the remaining nine AR relays in the Train B EPS were inspected and cleaned as necessary. The relays that had been in place in the Train A EDG EPS were inspected and while some showed evidence of higher

than normal contact resistance and the presence of some corrosion products, it was concluded that they would have functioned properly.

As corrective actions to prevent recurrence, the AR relay internals and covers in both the Train A and Train B EDG EPS's will be replaced with new units prior to startup from the current refueling outage. The existing relay cases will be utilized, but they will be cleaned to remove any corrosion residue. The replacement relays were manufactured by ABB in April 1999 specifically for Seabrook Station. The new relays utilize a cover gasket made of extruded neoprene, as opposed to molded neoprene, which was used in the original relays that failed. Additionally, these relays will be confirmed to be properly calibrated by the vendor before installation.

North Atlantic has also revised the procedure utilized for testing the AR relays to clarify techniques and acceptance criteria to incorporate the lessons learned from this event and to visually inspect the AR relays in the EDG EPS for signs of corrosion and gasket degradation. This inspection will supplement the Technical Specification required EDG surveillance testing.

Forty-six similar type AR relays are utilized at Seabrook Station for non-safety related electric distribution system protective relaying. Some of these relays have also exhibited signs of corrosion although this has not prevented them from functioning properly. These relays are functionally tested on a periodic basis and for the most part, are backed up by redundant relays, or relays of a different type. North Atlantic will also periodically visually inspect these type AR relays for corrosion and gasket degradation, burnish their contacts and replace their cover gaskets over a period of time.

V. Additional Information

The phenomenon of silver sulfide film growth on stored satellite electrical components was researched and documented in a report developed for NASA on March 25, 1988, "Sulfide Corrosion of Silver Contacts During Satellite Storage," R. Bauer, Chemistry and Physics Laboratory, The Aerospace Corporation, Report Number AD-A196217. This research addressed sulfide film growth on silver, growth mechanisms, electrical properties, and techniques for reducing the potential for sulfide growth.

Similar Events

This is the first event at Seabrook Station involving the inoperability of an EDG as a result of Westinghouse AR relay failures.

NRC FORM 366A (4-95) U.S. NUCLEAR REGULATORY COMMISSION

LICENSEE EVENT REPORT (LER)

TEXT CONTINUATION

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Manufacturer Data

AR Relays: Westinghouse-four pole auxiliary type Direct Current (DC) AR relays designed for high speed circuit breaker control. The following two styles of AR relays were used in the EDG EPS: 606B017A09A and 606B017A15A. These relays were manufactured between 1979 and 1982. The AR relays are currently being manufactured by Asea Brown Boveri (ABB) in Coral Springs, FL.

The AR relays that were in the EDG EPS were originally supplied by Westinghouse as commercial relays to Automation Industries, Inc. Vitro Laboratories Division, who qualified them and installed them in the EPS.