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SERIAL: BSEP 03-0023 10 CFR 50.73

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

BRUNSWICK STEAM ELECTRIC PLANT, UNIT NO. 2
DOCKET NO. 50-324/LICENSE NO. DPR-62
LICENSEE EVENT REPORT 2-02-002

Ladies and Gentlemen:

In accordance with the Code of Federal Regulations, Title 10, Part 50.73, Progress Energy Carolinas, Inc. submits the enclosed Licensee Event Report. This report fulfills the requirement for a written report within sixty (60) days of a reportable occurrence.

Please refer any questions regarding this submittal to Mr. Edward T. O'Neil, Manager – Support Services, at (910) 457-3512.

Sincerely,

W. G. Noll
Plant General Manager
Brunswick Steam Electric Plant

SFT/sft

Enclosure: Licensee Event Report

IE22

Brunswick Nuclear Plant
PO Box 10429
Southport, NC 28461

cc (with enclosure):

U. S. Nuclear Regulatory Commission, Region II
ATTN: Mr. Luis A. Reyes, Regional Administrator
Sam Nunn Atlanta Federal Center
61 Forsyth Street, SW, Suite 23T85
Atlanta, GA 30303-8931

U. S. Nuclear Regulatory Commission
ATTN: Mr. Theodore A. Easlick, NRC Senior Resident Inspector
8470 River Road
Southport, NC 28461-8869

U. S. Nuclear Regulatory Commission
ATTN: Ms. Brenda L. Mozafari (Mail Stop OWFN 8G9) **(Electronic Copy Only)**
11555 Rockville Pike
Rockville, MD 20852-2738

Ms. Jo A. Sanford
Chair - North Carolina Utilities Commission
P.O. Box 29510
Raleigh, NC 27626-051

NRC FORM 366 (7-2001) U.S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB NO. 3150-0104 EXPIRES 7-31-2004

Estimated burden per response to comply with this mandatory information collection request 50 hrs. Reported lessons learned are incorporated into the licensing process and fed back to industry. Send comments regarding burden estimate to the Records Management Branch (T-6 E6), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by internet e-mail to bjs1@nrc.gov, and to the Desk Officer, Office of Information and Regulatory Affairs, NEOB-10202 (3150-0104), Office of Management and Budget, Washington, DC 20503. If a means used to impose information collection does not display a currently valid OMB control number, the NRC may not conduct or sponsor, and a person is not required to respond to the information collection.

# LICENSEE EVENT REPORT (LER)

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

| 1. FACILITY NAME | 2. DOCKET NUMBER | 3. PAGE |
|---|---|---|
| Brunswick Steam Electric Plant (BSEP), Unit 2 | 05000324 | 1 OF 4 |

**4. TITLE**

Remote Shutdown Panel Power Supply Inverter Design Deficiency

| 5. EVENT DATE | | | 6. LER NUMBER | | | 7. REPORT DATE | | | 8. OTHER FACILITIES INVOLVED | |
|---|---|---|---|---|---|---|---|---|---|---|
| MO | DAY | YEAR | YEAR | SEQUENTIAL NUMBER | REV NO | MO | DAY | YEAR | FACILITY NAME | DOCKET NUMBER |
| | | | | | | | | | | 05000 |
| 12 | 19 | 02 | 2002 | -- 02 -- | 00 | 02 | 14 | 2003 | FACILITY NAME | DOCKET NUMBER 05000 |

| 9. OPERATING MODE | 1 |
|---|---|
| 10. POWER LEVEL | 100 |

**11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more)**

| | | | | | |
|---|---|---|---|---|---|
| | 20.2201(b) | | 20.2203(a)(3)(ii) | X | 50.73(a)(2)(ii)(B) | | 50.73(a)(2)(ix)(A) |
| | 20.2201(d) | | 20.2203(a)(4) | | 50.73(a)(2)(iii) | | 50.73(a)(2)(x) |
| | 20.2203(a)(1) | | 50.36(c)(1)(i)(A) | | 50.73(a)(2)(iv)(A) | | 73.71(a)(4) |
| | 20.2203(a)(2)(i) | | 50.36(c)(1)(ii)(A) | | 50.73(a)(2)(v)(A) | | 73.71(a)(5) |
| | 20.2203(a)(2)(ii) | | 50.36(c)(2) | | 50.73(a)(2)(v)(B) | | OTHER Specify in Abstract below or in NRC Form 366A |
| | 20.2203(a)(2)(iii) | | 50.46(a)(3)(ii) | | 50.73(a)(2)(v)(C) | | |
| | 20.2203(a)(2)(iv) | | 50.73(a)(2)(i)(A) | | 50.73(a)(2)(v)(D) | | |
| | 20.2203(a)(2)(v) | | 50.73(a)(2)(i)(B) | | 50.73(a)(2)(vii) | | |
| | 20.2203(a)(2)(vi) | | 50.73(a)(2)(i)(C) | | 50.73(a)(2)(viii)(A) | | |
| | 20.2203(a)(3)(i) | | 50.73(a)(2)(ii)(A) | | 50.73(a)(2)(viii)(B) | | |

**12. LICENSEE CONTACT FOR THIS LER**

| NAME | TELEPHONE NUMBER (Include Area Code) |
|---|---|
| Steve Tabor – Lead Engineer Technical Support Specialist | (910) 457-2178 |

**13. COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT**

| CAUSE | SYSTEM | COMPONENT | MANU-FACTURER | REPORTABLE TO EPIX | CAUSE | SYSTEM | COMPONENT | MANU-FACTURER | REPORTABLE TO EPIX |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | |

| 14. SUPPLEMENTAL REPORT EXPECTED | | | | 15. EXPECTED SUBMISSION DATE | MO | DAY | YEAR |
|---|---|---|---|---|---|---|---|
| | YES (If yes, complete EXPECTED SUBMISSION DATE). | X | NO | | | | |

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

During a review of the impact of electrical faults on the systems required to safely shutdown the facility in the event of a control room fire, it was determined that an existing inverter design is incompatible with the center tap design of the ungrounded DC electrical system. Specifically, a postulated fire that results in an electrical short of the Unit 2 Division 2 125/250 VDC distribution system to ground can potentially result in the loss of automatic or manual control of the Reactor Core Isolation Cooling (RCIC) turbine at the Remote Shutdown Panel (RSDP). The current fire safe shutdown analysis credits the RCIC system for post-fire inventory control during a worst-case main control room fire. The postulated loss of the RSDP RCIC control capability is considered an unanalyzed condition.

The cause of the condition is attributed to the failure to recognize and incorporate critical design characteristics into the design specification. The affected inverter has been modified to eliminate the potential for inverter failure as a result of hard grounds on the 125/250 VDC distribution system. Other installed inverters with susceptible surge suppression will be modified in accordance with the work management process. Additional corrective actions include training and communication of the issue with appropriate individuals and applicable procedure and process enhancements. The actual and potential safety significance of this condition is considered minimal.

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

Energy Industry Identification System (EIIS) codes are identified in the text as [XX].

## EVENT DESCRIPTION

On November 2, 2002, a DC electrical system ground caused the failure of the Unit 1 Reactor Protection System (RPS) [JC] Channel A2 power supply inverter 1-C71-NVT-1-A2 [INVT] and an isolated fire in the main control room instrumentation panel XU-66. As part of the corrective actions associated with this event, a review was performed to determine the impact of electrical faults on the ability of systems and associated power supply inverters to safely shutdown the plant in the event of a main control room fire.

On December 19, 2002, while Unit 2 was in Mode 1, operating at 100 percent of rated thermal power, it was determined that a postulated fire that results in an electrical short of the Unit 2 Division 2 125/250 VDC distribution system [EJ] to ground could result in a potential across the Remote Shutdown Panel (RSDP) instrument power supply inverter's (i.e., 2-B21-ES-5508) surge suppression device [SPP] (i.e., metal oxide varistor (MOV)) in excess of the MOV design rating. This condition can cause either an inverter surge suppression failure or the associated voltage supply fuses to fail. Consequently, no power supply would be available for automatic or manual control of the Reactor Core Isolation Cooling (RCIC) system [BN] turbine at the RSDP. The same inverter failure would result in the loss of reactor, drywell, and suppression pool monitoring instruments at the RSDP. The comparable Unit 1 RSDP power supply inverter design is not susceptible to the same failure mechanism as addressed above and, therefore, this condition was only applicable to Unit 2.

The current fire safe shutdown analysis credits the RCIC system for post-fire reactor coolant inventory control during a worst-case main control room fire. The postulated loss of the RSDP RCIC control capability involves an unanalyzed condition that potentially degrades plant safety. Upon identification of the condition, the Unit 2 RSDP was declared inoperable but remained available. In addition, an alternate safe shutdown (ASSD) system impairment was initiated in accordance with applicable fire protection program procedures. An eight hour ENS notification (i.e., Event Number 39463) was made on December 19, 2002, at 1430 EST in accordance with the requirements of 10 CFR 50.72(b)(3)(ii)(B). This condition is being reported in accordance with 10 CFR 50.73(a)(2)(ii)(B) since an unanalyzed condition existed which degraded plant safety.

## EVENT CAUSE

The cause of this event is inadequate design control due to a deficiency in the original design specification for the Topaz power supply Model 5352-13 inverters.

The 125/250 VDC distribution system consists of two separate divisions. Each division contains two 125 VDC batteries wired in a series/parallel ungrounded common tap arrangement thus allowing for 125 or 250 VDC loading. Inverters are powered from one side of the 250 VDC division power or subdivision. A ground introduced on the opposite side of the 125 VDC portion of the system can result in a potential voltage across the inverter's MOVs as high as 280 VDC.

The existing inverter was installed in November 1996. Engineering Service Request (ESR) 96-00700 evaluated the acceptability of replacing an obsolete Topaz power supply Model 5352-13 inverter with a Nuclear Logistics, Inc. (NLI) Model NLI-INV-1000-125-117-S inverter. This evaluation relied, in part, on the critical design characteristics of the original design specification for the Topaz inverters. However, the original design specification did not specify a maximum design voltage rating of 280 VDC as a critical design characteristic for ground loop components. As a result, ESR 96-00700 inappropriately concluded that the NLI inverter, which had a 170 VDC MOV maximum voltage rating,

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

was an acceptable replacement. Had a maximum design voltage rating been specified, it is likely that the existence of the 170 VDC MOV maximum voltage rating would have been recognized when ESR 96-00700 was developed.

In addition, engineering reviews, performed in support of ESR 96-00700, failed to identify information related to the potential for 280 volts across individual components connected to ground, which was contained within the DC electrical system design basis document.

## CORRECTIVE ACTIONS

1. To eliminate the potential for inverter failure as a result of grounds occurring on the 125/250 VDC system, Engineering Change (EC) 51090 was generated to remove the surge suppressor protection from the NLI inverters installed on the DC voltage system. On December 21, 2002, the RSDP inverter 2-B21-ES-5508 was rendered inoperable from 1510 to 1630 EST during modification of the inverter in accordance with EC 51090. Following completion of the modification, the associated ASSD impairment was canceled and the RSDP restored to an operable status on December 21, 2002, at 1630 EST.

   NLI inverters currently installed in Units 1 and 2 which provide electrical power to other systems, including RPS, Primary Containment Isolation, and Emergency Core Cooling systems will also be modified in accordance with EC 51090. Due to the redundancy of the DC electrical system design, the loss of these system functions is not credible since an inverter failure would require multiple hard grounds, one ground on each division of the DC bus. Therefore, considering the level of risk and the measures established as identified in actions 2 and 3 below, implementation of EC 51090 for other installed NLI inverters in accordance with the work management process schedule is acceptable.

2. Actions have been taken to heighten the sensitivity of applicable Operations and Work Control individuals who work on DC circuits and the potential impacts of grounds on NLI inverters until the NLI inverters are modified.

3. Appropriate annunciator procedures have been revised to address the potential affect of DC grounds on NLI inverters.

4. ESR 96-00700 has been re-evaluated to ensure other design inputs were appropriately considered. No other deficiencies were identified.

5. The lessons learned from this issue have been communicated to the engineering organization.

6. Formal engineering training on DC system ground loop voltages and associated effects will be provided to electrical and instrumentation and control modification reviewers.

7. A review of appropriate plant processes and procedures will be performed to determine enhancements which may be needed to prevent recurrence of a similar issue and identified enhancements completed.

## SAFETY ASSESSMENT

The actual safety significance of this condition is considered minimal because there have been no control room fires severe enough to require control room evacuation and use of the RSDP RCIC function. The potential safety significance of this condition is also considered minimal. Control room fires that result in control room evacuation are considered highly unlikely events for the following reasons:

Industry data, from records since 1986, indicates that no control room evacuation events or events which have generated a heavy density of smoke in a control room have occurred. Additionally, such a fire would also have to result in a hard ground condition on the specific DC bus of concern.

The combustible loading in an electrical cabinet in the control room or in the back panel areas of the 49 foot elevation of the control building is not expected to generate enough smoke to require control room evacuation.

Events involving smoke or fire in the BSEP control room have, historically, been isolated to a component within a single panel; the fire or related problem detected at the onset of the event either by the fire detection system, personnel in the area, or associated panel power supply monitoring instrumentation, and the smoke or fire extinguished in a timely manner due to continuous manning of the 49 foot elevation of the control building.

Procedures for smoke removal may be invoked as needed to eliminate smoke in the control room.

## PREVIOUS SIMILAR EVENTS

A review of reportable events for the past three years did not identify any previous similar events. Failure analysis of the 1-C71-NVT-1-A2 inverter that failed on November 2, 2002, confirmed that the MOVs had failed. Similar grounding problems involving the failure or degradation of the MOVs on the RPS inverter, 1-C71-NVT-1-B1, occurred on two separate occasions in March of 2002. This inverter was also manufactured by NLI. In each of these cases, MOV degradation or failure had occurred and the affected MOVs were replaced prior to returning the inverters to service.

## COMMITMENTS

Those actions committed to by Progress Energy Carolinas, Inc. in this document are identified below. Any other actions discussed in this submittal represent intended or planned actions by Progress Energy Carolinas, Inc. They are described for the NRC's information and are not regulatory commitments. Please notify the Manager - Support Services at BSEP of any questions regarding this document or any associated regulatory commitments.

1. A review of appropriate plant processes and procedures will be performed to determine enhancements which may be needed to prevent recurrence of a similar issue. Identified enhancements will be completed by July 31, 2003.
2. Formal engineering training on DC system ground loop voltages and associated effects will be provided to electrical and instrumentation and control modification reviewers by June 30, 2003.