



South Texas Project Electric Generating Station P.O. Box 289 Wadsworth, Texas 77483

July 5, 2022
NOC-AE-22003867
10 CFR 50.73
STI: 35276504

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

South Texas Project
Unit 2
Docket No. STN 50-499
Licensee Event Report 2021-002-01
Supplement to Condition Prohibited by Technical Specifications Due to
Inoperable Train of Essential Core Cooling System and Containment Spray System

Reference: Letter from M. Schaefer, STPNOC; to NRC Document Control Desk; "Licensee Event Report 2021-002-01 Condition Prohibited by Technical Specifications Due to Inoperable Train of Essential Core Cooling System and Containment Spray System;" December 21, 2021; (ML21355A278) (NOC-AE-21003862)

On December 21, 2021, STP Nuclear Operating Company (STPNOC) submitted the referenced Licensee Event Report. This letter is a supplement to the report to provide the updated corrective actions after review of industry operating experience and inspection of similar hand switches. The updated information is denoted by revision bars located in the right-hand margin. This report is submitted in accordance with the requirements of 10 CFR 50.73.

The event did not have an adverse effect on the health and safety of the public.

There are no commitments in this letter.

If you should have any questions on this submittal, please contact Zachary Dibbern at (361) 972-4336 or me at (361) 972-7888.

A handwritten signature in black ink, appearing to read "Michael A. Schaefer".

Michael A. Schaefer
Site Vice President

Attachment: STP Unit 2 LER 2021-002-01, Condition Prohibited by Technical Specifications Due to Inoperable Train of Essential Core Cooling System and Containment Spray System

cc:

Regional Administrator, Region IV
U.S. Nuclear Regulatory Commission
1600 E. Lamar Boulevard
Arlington, TX 76011-4511

Attachment

**STP Unit 2 LER 2021-002-01, Condition Prohibited by Technical Specifications Due to
Inoperable Train of Essential Core Cooling System and Containment Spray System**



LICENSEE EVENT REPORT (LER)

(See Page 3 for required number of digits/characters for each block)

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1. Facility Name South Texas Project, Unit 2	2. Docket Number 05000499	3. Page 1 OF 8
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4. Title
Condition Prohibited by Technical Specifications due to Inoperable Train of Essential Core Cooling System and Containment Spray System

5. Event Date			6. LER Number			7. Report Date			8. Other Facilities Involved	
Month	Day	Year	Year	Sequential Number	Rev No.	Month	Day	Year	Facility Name	Docket Number
10	15	2021	2021	- 002 -	01	07	05	2022	Facility Name	Docket Number

9. Operating Mode 1	10. Power Level 100
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11. This Report is Submitted Pursuant to the Requirements of 10 CFR §: (Check all that apply)

<input type="checkbox"/> 10 CFR Part 20	<input type="checkbox"/> 20.2203(a)(2)(vi)	<input type="checkbox"/> 50.36(c)(2)	<input type="checkbox"/> 50.73(a)(2)(iv)(A)	<input type="checkbox"/> 50.73(a)(2)(x)
<input type="checkbox"/> 20.2201(b)	<input type="checkbox"/> 20.2203(a)(3)(i)	<input type="checkbox"/> 50.46(a)(3)(ii)	<input type="checkbox"/> 50.73(a)(2)(v)(A)	10 CFR Part 73
<input type="checkbox"/> 20.2201(d)	<input type="checkbox"/> 20.2203(a)(3)(ii)	<input type="checkbox"/> 50.69(g)	<input type="checkbox"/> 50.73(a)(2)(v)(B)	<input type="checkbox"/> 73.71(a)(4)
<input type="checkbox"/> 20.2203(a)(1)	<input type="checkbox"/> 20.2203(a)(4)	<input type="checkbox"/> 50.73(a)(2)(i)(A)	<input type="checkbox"/> 50.73(a)(2)(v)(C)	<input type="checkbox"/> 73.71(a)(5)
<input type="checkbox"/> 20.2203(a)(2)(i)	10 CFR Part 21	<input checked="" type="checkbox"/> 50.73(a)(2)(i)(B)	<input type="checkbox"/> 50.73(a)(2)(v)(D)	<input type="checkbox"/> 73.77(a)(1)(i)
<input type="checkbox"/> 20.2203(a)(2)(ii)	<input type="checkbox"/> 21.2(c)	<input type="checkbox"/> 50.73(a)(2)(i)(C)	<input type="checkbox"/> 50.73(a)(2)(vii)	<input type="checkbox"/> 73.77(a)(2)(i)
<input type="checkbox"/> 20.2203(a)(2)(iii)	10 CFR Part 50	<input type="checkbox"/> 50.73(a)(2)(ii)(A)	<input type="checkbox"/> 50.73(a)(2)(viii)(A)	<input type="checkbox"/> 73.77(a)(2)(ii)
<input type="checkbox"/> 20.2203(a)(2)(iv)	<input type="checkbox"/> 50.36(c)(1)(i)(A)	<input type="checkbox"/> 50.73(a)(2)(ii)(B)	<input type="checkbox"/> 50.73(a)(2)(viii)(B)	
<input type="checkbox"/> 20.2203(a)(2)(v)	<input type="checkbox"/> 50.36(c)(1)(ii)(A)	<input type="checkbox"/> 50.73(a)(2)(iii)	<input type="checkbox"/> 50.73(a)(2)(ix)(A)	

☐ Other (Specify here, in Abstract, or in NRC 366A).

12. Licensee Contact for this LER

Licensee Contact Zachary Dibbern, Licensing Engineer	Phone Number (Include Area Code) 361-972-4336
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13. Complete One Line for each Component Failure Described in this Report

Cause	System	Component	Manufacturer	Reportable To IRIS	Cause	System	Component	Manufacturer	Reportable To IRIS
E	VG	HS	GE	Y					

14. Supplemental Report Expected

15. Expected Submission Date

<input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes (If yes, complete 15. Expected Submission Date)	Month	Day	Year

16. Abstract (Limit to 1560 spaces, i.e., approximately 15 single-spaced typewritten lines)

On October 15, 2021, at 0133 hours, the South Texas Project Nuclear Operating Company (STPNOC) started High Head Safety Injection (HHSI) Pump 2B for SI Accumulator 2B fill. Neither the HHSI pump room fans nor the containment sump isolation valve cubicle fans auto started as expected. The B-Train Emergency Core Cooling System (ECCS) and Containment Spray were declared inoperable. On October 15, 2021, at 1319 hours, troubleshooting commenced and determined the cause for the failure was the B-Train hand switch (B2HFHS9527) was sticking and needed to be replaced. On October 15, 2021, at 2318 hours, Operations declared B-Train ECCS and Containment Spray operable following completion of corrective maintenance.

On October 27, 2021, at 2058 hours the event was determined to be reportable by Operations as a condition prohibited by Technical Specifications because the required action statements for Technical Specifications 3.5.2 and 3.6.2.1 were not met.

A planned corrective action resulting from this event is to improve the process of requiring retention of defective components. Completed corrective actions resulting from this event include the replacement of the B train hand switch, evaluation of operating experience against the risk of de-termining and re-termining the hand switch given its proximity to other switches, and inspection of four other hand switches to determine effectiveness of current PMs.

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CONTINUATION SHEET**

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		YEAR	SEQUENTIAL NUMBER	REV NO.
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NARRATIVE**I. Description of Reportable Event****A. Reportable event classification**

This event is reportable pursuant to 10 CFR 50.73(a)(2)(i)(B) because the South Texas Project (STP) Technical Specification 3.5.2 required action statements for an inoperable Essential Core Cooling System (ECCS) and Technical Specification 3.6.2.1 required action statements for an inoperable Containment Spray System were not met.

B. Plant operating conditions prior to event

Prior to the event, STP Unit 2 was at 100% power in Mode 1.

C. Status of structures, systems, and components that were inoperable at the start of the event and that contributed to the event

No other structures, systems, or components were inoperable at the start of this event that contributed to this event.

D. Background Information

Unit 2 Control Room hand switch (B2HFHS9527), hereafter referred to as the B-Train hand switch, can be operated to turn on the fans that provide cooling for the B-Train Safety Injection (SI) Pump and Containment Spray (CS) Pump cubicles. The B-Train hand switch failed which prevented the cooling fans in air handling units VAH-005 and VAH-013 from starting automatically as designed when High Head Safety Injection (HHSI) Pump 2B was started for testing.

The B-Train hand switch is a General Electric SBM rotary control hand switch, which are used widely throughout industry and at South Texas Project Electric Generating Station (STPEGS). This B-Train hand switch is designed with a manual start position which can start the SI pump valve room VAH-005 fan from the control room, a STOP position to secure the fan, a pull-to-lock position to completely deenergize power to the fans for personal safety and for maintenance, and an AUTO position that allows the cooling fans to start automatically when HHSI Pump 2B is started. Once the fan motors are started, they continue to run until an operator manually stops the fans with the B-Train hand switch. The status of the fans (on/off) can be confirmed in the Control Room by computer point readout.

The function of the VAH-005 and VAH-013 supplemental cooler units is to provide cooling in Fuel Handling Building (FHB) Room 005 and FHB Room 008 which contain the B-Train SI pumps and the Containment Spray Pump. Elevated temperatures in these rooms are detected by thermostats and the VAH-005 and VAH-013 fans are designed to start automatically on high temperature. The fan startup circuits are also interlocked with the startup and running of any one of the pumps in the room.

The FHB Heating, Ventilation, and Air Conditioning (HVAC) System maintains the normal environmental conditions required to ensure the operability of the system components that are located inside the Fuel Handling Building. During normal operation, the supply air subsystem provides the building with a filtered source of outside air at the proper temperature. Cooling coils supplied by the



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non-safety Mechanical Auxiliary Building chilled water subsystem provide adequate cooling capacity to maintain the building within design ambient temperatures. Similarly, electric heating coils provide adequate heating capacity to temper outside supply air during winter conditions. Upon an engineered safety features (ESF) actuation for safety injection, high radiation, or loss of offsite power, the supply air subsystem is shut down. Emergency air relief dampers are opened to continue to permit outside air into the building. During the ESF mode of operation, the safety-related exhaust air subsystem continues to draw outside air into the building through the relief dampers. The exhaust air subsystem pulls air through return air registers in the cubicles and exhaust ventilation ducts to exit through the plant main vent stack.

FHB HVAC is a required support system for the Emergency Core Cooling System (ECCS) and the containment spray system.

E. Narrative summary of the event

Note: all times are approximate and are listed in Central Daylight Time

October 5, 2021, 03:44 hours: Operations started HHSI Pump 2B for Accumulator fill. ESF Pump Room and Valve Room Ventilation fans (VAH-005 and VAH-013) started as expected.

October 5, 2021, 03:46 hours: Operations secured HHSI Pump 2B following accumulator fill.

October 5, 2021, 03:48 hours: B-Train SI/CS Pump Room Air Handling Unit 21B fan VAH-005 was stopped by Operations in the Control Room.

October 5, 2021, 03:49 hours: B-Train SI/CS Valve Room Air Handling Unit 21B fan VAH-013 was stopped by Operations in the Control Room.

October 15, 2021, 01:33 hours: Operations started HHSI Pump 2B for Accumulator 2B fill. When HHSI pump 2B was started, the B-Train SI/CS Pump Room Air Handling Unit (AHU) 21B and Valve Room AHU 21B failed to start (VAH-005 and VAH-013 fans). B-Train ECCS and Containment Spray declared inoperable due to failure of room AHU to start on pump start.

October 15, 2021, 01:34 hours: Operations secured HHSI Pump 2B following accumulator fill and placed it in automatic.

October 15, 2021, 13:19 hours: Troubleshooting commenced to determine the cause for the supplemental cooler fans failing to start as expected. Results of troubleshooting concluded that the B-Train hand switch (B2HFHS9527) was sticking and needed to be replaced.

October 15, 2021, 20:04 hours: Operations started HHSI Pump 2B for post maintenance testing after replacement of the B-Train hand switch. Fans for both VAH-005 and VAH-013 started with the HHSI Pump 2B start.

October 15, 2021, 20:05 hours: Secured HHSI Pump 2B following satisfactory post-maintenance test.

October 15, 2021, 23:18 hours: Operations declared B-Train ECCS and Containment Spray operable following completion of corrective maintenance to replace the B-Train hand switch and successful completion of post-maintenance testing.



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October 27, 2021, 20:58 hours: Event was determined to be reportable by Operations as a condition prohibited by Technical Specifications.

F. Method of discovery

The event was self-revealed when the VAH-005 and VAH-013 fans failed to start when HHSI pump 2B was started for testing.

Engineering evaluation concluded there was firm evidence that the B-Train hand switch failure occurred on October 5, 2021 when the switch was manipulated to stop the VAH-005 fans. The failure of the B-Train hand switch prevented cooling fans VAH-005 and VAH-013 from performing their safety function of heat removal from October 5, 2021 to October 15, 2021, resulting in conditions prohibited by Technical Specifications for exceeding the seven-day allowed outage times for ECCS Technical Specifications 3.5.2 Limiting Condition for Operation Action (a) and the Containment Spray System Technical Specification 3.6.2.1 Limiting Condition for Operation Action (a).

II. Component failures

A. Failure Mode, mechanism, and effects of failed component

The failed component in this event was B-Train hand switch (B2HFHS9527). This hand switch is a General Electric rotary SBM control switch located in the Control Room. This model of hand switches is a rugged design with proven reliability, but they can develop high contact resistance that in rare instances can prevent relay actuations.

Troubleshooting determined that the B-Train hand switch was sticking, as reported by Maintenance personnel during switch replacement. Prior to replacement of the switch, Operations manipulated the switch to the start position and the fans came on at that time, indicating a potential intermittent failure of the switch. The most likely cause of the switch was sticking of the switch and/or high resistance contacts inside the switch.

The failure of the B-Train hand switch resulted in the cooling fans VAH-005 and VAH-013 not automatically starting to provide heat load removal for the B-Train HHSI pump, Low Head Safety Injection (LHSI) pump, and Containment Spray Pump should these pumps be called upon to perform their safety functions during the time window from October 5, 2021 to October 15, 2021. This time frame exceeds the seven-day allowed outage time of the ECCS Technical Specification 3.5.2 Limiting Condition for Operations Action (a) and the seven-day allowed outage time of the Containment Spray System Technical Specification 3.6.2.1 Limiting Condition for Operations Action (a).

B. Cause of component or system failure or personnel error

The direct cause of this event was the failure of B-Train hand switch B2HFHS9527 which resulted in cooling fans VAH-005 and VAH-013 failing to start automatically to provide supplemental heat load removal in the rooms containing the B-Train HHSI pump, LHSI pump, and Containment Spray Pump.

The failure of the hand switch was due to a sticking hand switch or due to a high resistance contact in the switch. The failed switch was not retained for more detailed failure analysis, but the personnel who



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performed the replacement activity reported it was sticking when operating. Additionally, prior to replacement of the B-Train hand switch, Operations manipulated the switch to the start position and the fans started, indicating a potential intermittent failure of the switch.

Engineering evaluation concluded that there is firm evidence that the B-Train hand switch failed when Operations used it to stop the VAH-005 fans, in accordance with procedure. Although the fans are started automatically, to stop the VAH-005 fans after a start due to any cause other than high room temperature, the operator must take the hand switch from the AUTO position to the STOP position. The hand switch should have spring-returned to center, which is the AUTO position. The switch contact would not be expected to go from being closed to open without some external event occurring, therefore South Texas Project Nuclear Operating Company (STPNOC) concluded the component failure occurred when the spring returned to center when VAH-005 was stopped on October 5, 2021.

C. Systems or secondary functions that were affected by the failure of components with multiple functions

This event involved a failure in the B-Train supplemental coolers portion of the Fuel Handling Building HVAC system, resulting in the B-Train Safety Injection System and the B-Train Containment Spray System being declared inoperable. The dependency of B-Train Safety Injection and B-Train Containment Spray on FHB HVAC supplemental coolers is an expected consequence of the approved STPEGS design. No other systems were directly affected.

D. Failed component information

The B-Train hand switch was a General Electric SBM control switch model Q16SBMC4A42S1F1P1. This model control switch is a four-position, three-stage, with spring return to the central position, Pull-to-Lock capability, and a pistol hand grip. General Electric SBM rotary switches are used widely in the industry and at STPEGS in many applications; most of these are in the Control Board of the Control Room and in Switchgear of the Power Distribution System. They are a rugged design with proven reliability, but they can develop high contact resistance that in rare instances can prevent relay actuations.

III. Analysis of the event

A. Safety system responses that occurred

No safety system responses occurred due to this event.

B. Duration of safety system inoperability

The Unit 2 B-Train LHSI, HHSI, and Containment Spray systems were inoperable from October 5, 2021 at 0348 hours until October 15, 2021 at 2318 hours.

C. Safety consequences and implications

Supplemental cooler VAH-005 provides cooling for continued operation of the LHSI Pump 2B, HHSI Pump 2B, and Containment Spray Pump 2B motors, so it is considered required auxiliary equipment to support the B-Train of the ECCS and Containment Spray System. These systems were declared inoperable from October 5, 2021 through October 15, 2021 due to the inability to provide sufficient

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HVAC heat removal.

This ten-day period exceeds the seven-day allowed outage time of the ECCS Technical Specification 3.5.2 Limiting Condition for Operations Action (a) and the seven-day allowed outage time of the Containment Spray System Technical Specification 3.6.2.1 Limiting Condition for Operations Action (a).

The period of inoperability for ECCS B-Train and Containment Spray B-Train is based on the supplemental cooler VAH-005 not providing cooling for continued operation of the LHSI Pump 2B, HHSI Pump 2B, and Containment Spray Pump 2B motors. These pumps were available to start automatically with an ESF signal and would have started successfully and provided their design flow rates. During the ESF mode of operation, the safety-related Fuel Handling Building exhaust air subsystem continues to draw outside air into the building through the relief dampers. The exhaust air subsystem pulls air through return air registers in the cubicles and exhaust ventilation ducts to exit through the plant main vent stack. The exhaust air fans will draw air from the lower elevations of the Fuel Handling Building, and eventually outside air, to the B-Train Safety Injection and Containment Spray pump room. This air flow will be available for some heat removal from the pump room.

Due to the condition with the B-Train hand switch, the VAH-005 and VAH-013 fans would not have started with an ESF actuation through the breaker closed contacts for the LHSI Pump 2B, HHSI Pump 2B, or Containment Spray Pump 2B. VAH-005 would also not have started on high room temperature. The valve room supplemental cooler VAH-013 would have started automatically if high room temperature was sensed by the thermostat in the valve room (FHB Room 008) and would have provided its design capacity for heat removal with essential chilled water. The high temperature start of VAH-013 is independent of the control circuit VAH-005.

Considering the size of the B-Train Safety Injection and Containment Spray pump room, the cooling provided air drawn to the exhaust air subsystem, and the availability of supplemental cooler VAH-013 to start on valve room high temperature, engineering judgement indicates the LHSI Pump 2B, HHSI Pump 2B, and Containment Spray Pump 2B motors could have continued to operate successfully if called upon. The failure of the B-Train hand switch (B2HFHS9527) did not significantly compromise plant safety.

IV. Cause of the event

The most-likely cause of the event was due to a sticking hand switch or due to a high resistance contact in the switch. The failed switch was not retained for more detailed failure analysis.

V. Corrective actions

As a corrective action, the sticking B-Train hand switch was replaced, and a post-maintenance test was successfully performed on October 15, 2021.

STPNOC plans to improve the process of requiring retention of components for further analysis after they are removed following an unexpected failure. This corrective action is being tracked in the CR database and is due to be complete August 31, 2022.



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STPNOC evaluated industry operating experience and determined that the best solution would be to follow the industry recommendation for cycling the hand switches to verify operability. STPNOC concluded that the other industry recommendation for de-terming and re-terming the hand switches to inspect them for developing issues presented too high of a plant status control risk due to the proximity of other switches on the control board.

STPNOC inspected four other SBM hand switches at the station to determine the material conditions and evaluate if the preventative maintenance strategies need to be revised. All four switches were found to have no discrepancies, clean contacts, and operated smoothly without sticking. The results were evaluated and STPNOC determined that the current preventative maintenance frequency and scope are sufficient. Therefore, the corrective action to increase the frequency of the preventative maintenance from 468 weeks to 234 weeks was canceled. As an alternate solution, system engineers will continue to monitor the condition of the hand switches, and if a trend is identified will generate corrective actions.

VI. Previous similar events

General Electric SBM rotary switches are used widely in the industry and at STPEGS in many applications; most of these are in the Control Board of the Control Room and in the Switchgear of the Power Distribution System. They are a rugged design with proven reliability, but STP experience shows they can develop high contact resistance that in rare instances can prevent relay actuations.

Since the SI and Containment Spray pumps are rarely energized, GE SBM series control room hand switches are not exercised frequently. This can lead to contamination buildup on the contacts or binding in the switch mechanism and develop high contact resistance that in rare instances can prevent relay actuations.

A similar event occurred at STPEGS in 2007. In this similar event, the Unit 1 A-Train fans VAH-004 and VAH-012 failed to start following a start of LHSI Pump. This failure was attributed to high contact resistance of the associated A-Train hand switch (A1HFHS9517). As a corrective action for this event, STPNOC created preventive maintenance activities to cycle the hand switches to remove contact oxidation and exercise the switch. These actions have proved effective in preventing additional similar events since 2007.

Additionally, there is also industry experience with defective internal cam followers and worn, dirty, or broken contacts that can prevent switch actuation found in a report prepared by Power Technical Associates, Inc., "Generic Qualification of Rotary Hand Switches," May 1983. The defective cam followers were the result of some of the cam followers being exposed to hydrocarbons during manufacturing. The hydrocarbons would cause the cam followers to degrade as they were made of polycarbonate. As a result, maintenance procedures were revised to prohibit the use of hydrocarbons as a cleaner. Industry operating experience has also found multiple instances of failed actuation being caused by tarnished, dirty, or loose contacts.

Additional recent industry guidance can be found in a special inspection report, ML21321A365, that describes a General Electric type SBM control switch that failed to actuate. When examined the switch was found to have fouling on the contacts that prevented the current flow necessary to actuate the

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CONTINUATION SHEET**

(See NUREG-1022, R.3 for instruction and guidance for completing this form
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Estimated burden per response to comply with this mandatory collection request: 80 hours. Reported lessons learned are incorporated into the licensing process and fed back to industry. Send comments regarding burden estimate to the FOIA, Library, and Information Collections Branch (T-6 A10M), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by e-mail to Infocollects.Resource@nrc.gov, and the OMB reviewer at: OMB Office of Information and Regulatory Affairs, (3150-0104), Attn: Desk ail: oir_submission@omb.eop.gov. The NRC may not conduct or sponsor, and a person is not required to respond to, a collection of information unless the document requesting or requiring the collection displays a currently valid OMB control number.

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system. After further investigation the fouling was determined to be caused by no preventive maintenance activities being performed.