



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

April 15, 2021
NOC-AE-21003797
10CFR50.73
STI: 35154210

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

South Texas Project
Unit 1

Docket No. STN 50-498

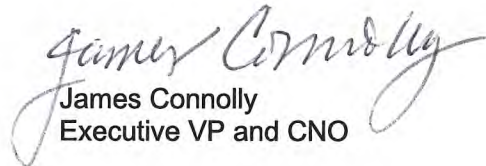
Licensee Event Report 2021-001-00 Frozen Common Sensing Line Results in Loss of Two
Main Feedwater Pumps Leading to Automatic Reactor Protection and Auxiliary Feedwater
Systems Actuations due to Low Steam Generator Level

Pursuant to 10CFR50.73(a)(2)(iv)(A), STP Nuclear Operating Company submits South Texas
Project (STP) Unit 1 Licensee Event Report 2021-001-00 for actuations of the reactor protection
system and the auxiliary feedwater system.

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 N. Boehmisch
at (361) 972-8172 or me at (361) 972-7344.


James Connolly
Executive VP and CNO

NB

Attachment: STP Unit 1 LER 2021-001-00, Frozen Common Sensing Line Results in Loss of
Two Main Feedwater Pumps Leading to Automatic Reactor Protection and
Auxiliary Feedwater Systems Actuations due to Low Steam Generator Level

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

Attachment

STP Unit 1 LER 2021-001-00, Frozen Common Sensing Line Results in Loss of Two Main
Feedwater Pumps Leading to Automatic Reactor Protection and Auxiliary Feedwater Systems
Actuations due to Low Steam Generator Level



LICENSEE EVENT REPORT (LER)

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

(See NUREG-1022, R.3 for instruction and guidance for completing this form

<http://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr1022/r3/>)

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 Infocollections.Resource@nrc.gov, and the OMB reviewer at: OMB Office of Information and Regulatory Affairs, (3150-0104), Attn: Desk all: 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.

1. Facility Name South Texas Project, Unit 1	2. Docket Number 05000 00498	3. Page 1 OF 5
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4. Title
Frozen Common Sensing Line Results in Loss of Two Main Feedwater Pumps Leading to Automatic Reactor Protection and Auxiliary Feedwater Systems Actuations due to Low Steam Generator Level.

5. Event Date			6. LER Number			7. Report Date			8. Other Facilities Involved	
Month	Day	Year	Year	Sequential Number	Revision No.	Month	Day	Year	Facility Name	Docket Number
02	15	2021	2021	- 001 -	00	04	15	2021	Facility Name	05000
									Facility Name	Docket Number
										05000

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 checked="" type="checkbox"/> 10 CFR Part 20	<input type="checkbox"/> 20.2203(a)(2)(vi)	<input type="checkbox"/> 50.36(c)(2)	<input checked="" 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)	<input checked="" type="checkbox"/> 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)	<input checked="" type="checkbox"/> 10 CFR Part 21	<input 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)	<input checked="" type="checkbox"/> 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)	
<input type="checkbox"/> OTHER (Specify here, in abstract, or NRC 366A).				

12. Licensee Contact for this LER

Licensee Contact Nic Boehmisch, Licensing Engineer	Phone Number (Include area code) (361) 972-8172
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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
B	JK	TBG	n/a	Y					

14. Supplemental Report Expected

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

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

On February 14, 2021, at 1516 hours the South Texas Project Electric Generating Station entered a period of abnormally cold weather. The temperatures on site reached 16 degrees Fahrenheit at the time of the event. A section of exposed common sensing line that fed pump protection switches for the Unit 1 steam generator feedwater pumps (SGFP) was not insulated or heat traced. The common line froze resulting in two out of three SGFPs tripping off-line. The Unit 1 reactor tripped on low steam generator level two minutes later. The startup feedwater pump tripped a short time afterwards from the same cause. An organizational and programmatic root cause evaluation identified that station personnel implemented a freezing weather plan that was fragmented and lacked engagement, sufficient direction, verification of readiness, and designated ownership to ensure the station was prepared for abnormally cold weather. This event is reportable as an event that resulted in the automatic actuation of the Unit 1 reactor protection system and auxiliary feedwater system. Planned corrective actions include streamlining and revision of the freeze protection program and installing additional insulation and heat trace. The event did not result in any offsite release of radioactivity or increase of offsite dose rates and there were no personnel injuries or damage to any safety-related equipment associated with this event. Additionally, all Engineered Safety Feature (ESF) equipment operated as designed. Therefore, there was no adverse effect on the health and safety of the public.

**LICENSEE EVENT REPORT (LER)
CONTINUATION SHEET**

(See NUREG-1022, R.3 for instruction and guidance for completing this form
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1. FACILITY NAME

South Texas Unit 1

2. DOCKET NUMBER

05000- 00498

3. LER NUMBER

YEAR	SEQUENTIAL NUMBER	REV NO.
2021	- 001	- 00

NARRATIVE**I. Description of Reportable Event****A. Reportable event classification**

This event is reportable pursuant to 10 CFR 50.73(a)(2)(iv)(A) as an event that resulted in the automatic actuation of reactor protection system (RPS) (10 CFR 50.73(a)(2)(iv)(B)(1)), and Auxiliary Feedwater System (AFWS) (BA) (10 CFR 50.73(a)(2)(iv)(B)(6)).

B. Plant operating conditions prior to event

Prior to the event both Unit 1 and Unit 2 were at full 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

The feedwater system (SJ) is composed of three nominal 40-percent-capacity (normally operating at 33-1/3-percent-capacity), turbine-driven, single-stage feedwater pumps (P) connected in parallel to supply feedwater to the four steam generators (SG). During normal operation all the pumps are running to supply the required flow of feedwater to the four steam generators. In addition to the three turbine-driven (main) steam generator feedwater pumps (SGFPs), one motor-driven startup steam generator feedwater pump (SUFP) (P) is provided (20-percent-capacity). The SUFP has the dual purpose of supplying feedwater during fill-up and low-load conditions when steam is not available to drive the main feed pump turbines and to allow plant operation at full power with one main SGFP out of service.

Unit 1 has a common sensing line that feeds the low-pressure side of the net positive suction head (NPSH) differential pressure trip switches (PDS) for all SGFPs. The common sensing line utilizes a tee connection to split to both the SGFPs and SUFP with separate heat trace protection circuits (EHTR). The common sensing line is composed of stationary (no flow) quarter inch inner diameter stainless-steel tubing (TBG). A short segment (roughly five feet in length) of the common sensing line (that was uninsulated and without heat trace) runs into the turbine generator building (TGB) to six low-NPSH switches located inside the TGB for the SGFPs. Another branch of the common sensing line (that had heat trace and insulation) runs to two low-NPSH switches for the SUFP.

The AFWS is designed to back up the main feedwater system during plant hot shutdown (or hot standby) in the event the main feedwater system and/or the SUFP is unavailable. The AFWS can be used as a means of continuous feedwater supply even if this condition is maintained for extended periods. The AFWS feedwater supply is the auxiliary feedwater storage tank (AFST) (TK).

E. Narrative summary of the event

On February 14, 2021, at 15:16 the South Texas Project Electric Generating Station entered a period of abnormally cold weather for the station. The temperatures dropped to 32 degrees Fahrenheit and continued to drop throughout the rest of the afternoon and night. Shortly after midnight, ice began to form in sensing lines on the Deaerator Structure (DEA). The first symptom was Deaerator pressure "slowly failing high." This was consistent with formation of ice. Over the next two hours, Deaerator Storage Tank #2 level indication failed low, and Deaerator inlet flow displayed "bad data" and then failed high. The Deaerator level control was transferred from automatic to manual control at 02:41 on February 15, 2021.

On February 15, 2021, at 05:24, the Unit 1 SGFPs 11 & 13 tripped off-line due to an invalid low Net Positive Suction Head (NPSH) trip input. The invalid trip signal resulted from ice that formed in the common sensing line of the low-pressure side of the NPSH switches. The ice formation increased the pressure on the low-pressure side and reduced the differential pressure to below the trip setpoint.

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NARRATIVE

The near simultaneous trip of two SGFPs led to a significant reduction of feedwater flow to the steam generators. Each of three SGFPs, rated for 40% of system capacity, normally produce 1/3 of feedwater system flow. The loss of a single pump could have been overcome with the automatic start of the startup feedwater pump (SUFP), rated at 20% of feedwater flow, with no reduction in power and no reduction in the Unit 1 electrical output. By design, the automatic start of the SUFP plus the remaining operating SGFP 12 could maintain the plant online at 60% power. However, as experienced during the event and subsequently confirmed in the plant simulator, it was not possible to reduce power quickly enough to overcome the near simultaneous loss of two SGFPs which resulted in a low water level condition in steam generator 'C.' At 05:26, the reactor protection system automatically tripped Unit 1 on low steam generator water level and the AFWS pumps automatically started. The outside ambient temperature at the time, as measured at the STP Meteorological (MET) Tower, was 16 degrees Fahrenheit. SGFP 12 was manually secured per procedure, as it did not trip with SGFPs 11 and 13. The SUFP was secured per procedure. The AFST was declared inoperable for having less than the required volume. The normal AFST makeup valve was open but not allowing water flow. Operators assumed the pipe was frozen and used the makeup bypass valve to makeup to the AFST. At 05:47 the SUFP was restarted to begin refilling the steam generators. Approximately 25 minutes later the SUFP tripped, due to the same condition that tripped SGFPs 11 and 13. The AFW pumps were secured one minute after the SUFP trip and were restarted five minutes later. At 14:03 the AFST normal makeup valve was opened and able to begin increasing AFST volume. The AFST was declared operable at 17:45 after reaching the required volume. At 18:33 the SUFP was started to commence filling the steam generators.

The following is a summary timeline of relevant events (note: all times are Central Daylight Time):

- 1988 – A short segment of common sensing line was installed without heat trace or insulation
- 02/02/2020 14:30 – Heat trace circuit on the common sensing line upstream of the tee was deenergized.
- 02/14/2021 15:16 – Site temperature reading was 32°F and dropping
- 02/15/2021 05:24 – SGFP 11 and 13 tripped
- 02/15/2021 05:26 – Unit 1 reactor automatically tripped due to low steam generator levels, AFWS pumps start
- 02/15/2021 05:28 – SUFP 14 secured per procedure
- 02/15/2021 05:31 – AFST declared inoperable due to volume going below 485,000 gallons
- 02/15/2021 05:47 – SUFP 14 was manually started
- 02/15/2021 06:14 – SUFP 14 tripped
- 02/15/2021 06:15 – AFWS pumps 11, 12, 13, and 14, secured
- 02/15/2021 06:19 – AFWS pump 14 started to commence feeding steam generators
- 02/15/2021 06:20 – AFWS pumps 11, 12, and 13 were started to feed steam generators
- 02/15/2021 14:03 – AFST makeup valve thawed to allow water flow
- 02/15/2021 17:45 – AFST declared operable, greater than 485,000 gallons
- 02/15/2021 18:33 – SUFP 14 started following maintenance

F. Method of discovery

This event was self-revealed when SGFP 11 and 13 tripped off-line due to low NPSH, resulting in a reactor trip due to low steam generator level two minutes later.

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NARRATIVE**II. Component failures****A. Failure Mode, mechanism, and effects of failed component**

The failed component in this event was the common sensing line tubing. A portion of the quarter inch inside diameter stainless steel tubing developed an ice seal during freezing weather resulting in increased pressure on the low-pressure side of the low-NPSH trip switches. The switches actuated in response to the perceived loss of NPSH and tripped the SGFPs.

B. Cause of component or system failure or personnel error

The cause of this event was the lack of insulation and heat trace on the exposed common sensing line tubing, as well as deenergized heat tracing on a portion of the common sensing line upstream of the tee.

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

There are no secondary systems or functions for this component.

D. Failed component information

Feedwater system instrumentation tubing
Stainless steel tubing
Size: 1/4 inch inside diameter, 3/8 inch outside diameter

III. Analysis of the event**A. Safety system responses that occurred**

The RPS and AFWS actuated in response to low steam generator levels after the SGFPs tripped offline.

B. Duration of safety system inoperability

The AFST was inoperable from 05:31 until 17:45, a period of approximately twelve hours and fifteen minutes.

C. Safety consequences and implications

The failure in this event occurred in a non-safety related system. The event resulted in the actuation of the RPS and AFWS. The initiating event was caused by a severe weather external event. This event did not result in any offsite release of radioactivity or increase of offsite dose rates, and there were no personnel injuries or damage to any safety-related equipment associated with this event. Therefore, there was no adverse effect on the health and safety of the public.

IV. Cause of the event

The root cause for this event was determined to be:

Station personnel implemented a freezing weather plan that was fragmented and lacked engagement, sufficient direction, verification of readiness, and designated ownership to ensure the station was prepared for Winter Storm Uri.

The contributing causes for this event was determined to be:

1. In 1988, heat trace and insulation were not installed as designed per Modification.
2. Opportunities to improve the station's cold weather program were either not identified or not fully implemented.
3. In some cases, station personnel did not implement procedure guidance as written; therefore, barriers that would have reduced the likelihood of the event were ineffective.

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NARRATIVE**V. Corrective actions**

Planned corrective actions are as follows:

1. Institute a freeze protection program that is: not fragmented, engages staff, provides sufficient direction, establish a single program owner with overall responsibility for the freeze protection program.
2. Install permanent heat trace and insulation for the 5-foot section of common sensing line.
3. Evaluate and address single point vulnerabilities including passive failures affecting the SGFPs.
4. Present a case study, on proactively identifying similar problems, at a leadership team alignment meeting.
5. Implement a schedule for strategic engineering supervisors and manager to perform and document observed system walkdowns.

VI. Previous similar events

A review of internal events identified numerous conditions relating to frozen lines. Aspects that were related to these events include extreme cold, malfunctioning heat trace, and missing insulation. Most conditions were closed with tool pouch maintenance with no extent of condition and no analysis to determine if insulation or heat trace should be considered to prevent the same freeze in the future.

A 2010 condition identified seal water differential pressure lines on all six SGFPs in both units that were not heat traced. This condition could have led to a greater analysis of extent of condition that might have identified the lack of insulation and heat trace on the sensing line which caused this event. This was a missed opportunity to identify the sensing line which caused the event.

There were no events related to the specific line that froze during this event.