

The Light company

Houston Lighting & Power South Texas Project Electric Generating Station P. O. Box 289 Wadsworth, Texas 77483

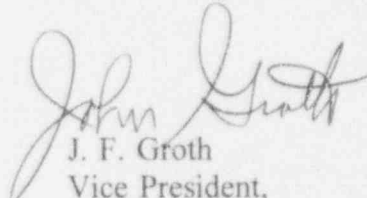
June 22, 1994
ST-HL-AE-4826
File No.: G26
10CFR50.73

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

South Texas Project
Unit 2
Docket No. STN 50-499
Voluntary Licensee Event Report 94-002
Standby Diesel Generator 22 Piston Failure

Houston Lighting & Power (HL&P) submits the attached Voluntary Unit 2 Licensee Event Report 94-002 regarding Standby Diesel Generator 22 Piston Failure. This voluntary report is provided to inform the NRC and the industry of characteristics of this unique failure. This event did not have an adverse effect on the health and safety of the public.

If you should have any questions on this matter, please contact Mr. J. M. Pinzon at (512) 972-8027 or me at (512) 972-8664.


J. F. Groth
Vice President,
Nuclear Generation

JMP/esh

Attachment: Voluntary LER 94-002 (South Texas, Unit 2)

270054
9406290052 940622
PDR ADDCK 05000499
S PDR
LER-94\194002RO.U2 Project Manager on Behalf of the Participants in the South Texas Project 06/21/94 (1:00pm)

JE22

Houston Lighting & Power Company
South Texas Project Electric Generating Station

ST-HL-AE-4826
File No.: G26
Page: 2

C:

Leonard J. Callan
Regional Administrator, Region IV
U. S. Nuclear Regulatory Commission
611 Ryan Plaza Drive, Suite 400
Arlington, TX 76011

Lawrence E. Kokajko
Project Manager
U. S. Nuclear Regulatory Commission
Washington, DC 20555-0001 13H15

David P. Loveless
Sr. Resident Inspector
c/o U. S. Nuclear Regulatory Comm.
P. O. Box 910
Bay City, TX 77404-910

J. R. Newman, Esquire
Newman, Bouknight & Edgar, P.C.
STE 1000, 1615 L Street, N.W.
Washington, DC 20036

K. J. Fiedler/M. T. Hardt
City Public Service
P. O. Box 1771
San Antonio, TX 78296

J. C. Lanier/M. B. Lee
City of Austin
Electric Utility Department
721 Barton Springs Road
Austin, TX 78704

G. E. Vaughn/C. A. Johnson
Central Power and Light Company
P. O. Box 2121
Corpus Christi, TX 78403

Rufus S. Scott
Associate General Counsel
Houston Lighting & Power Company
P. O. Box 61067
Houston, TX 77208

Institute of Nuclear Power
Operations - Records Center
700 Galleria Parkway
Atlanta, GA 30339-5957

Dr. Joseph M. Hendrie
50 Bellport Lane
Bellport, NY 11713

Richard A. Ratliff
Bureau of Radiation Control
Texas Department of Health
1100 West 49th Street
Austin, TX 78756-3189

U. S. Nuclear Regulatory Comm.
Attn: Document Control Desk
Washington, D. C. 20555-0001

J. R. Egan, Esquire
Egan & Associates, P.C.
2300 N Street, N.W.
Washington, D.C. 20037

NRC FORM 366 (5-92)		U.S. NUCLEAR REGULATORY COMMISSION			APPROVED BY OMB NO. 3150-0104 EXPIRES 5/31/95					
LICENSEE EVENT REPORT (LER)							ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS INFORMATION COLLECTION REQUEST: 50.0 HRS. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE INFORMATION AND RECORDS MANAGEMENT BRANCH (MNBB 7714), 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.			
(See reverse for required number of digits/characters for each block)										
FACILITY NAME (1) <div style="text-align: center;">South Texas Unit 2</div>					DOCKET NUMBER (2) <div style="text-align: center;">05000 499</div>		PAGE (3) <div style="text-align: center;">1 OF 4</div>			
TITLE (4) <div style="text-align: center;">Standby Diesel Generator 22 Piston Failure</div>										
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	02	94	94	-- 002 --	00	06	22	94	FACILITY NAME	DOCKET NUMBER 05000
OPERATING MODE (9)		N/A		THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more) (11)						
POWER LEVEL (10)		0		20.402(b)		20.405(c)		50.73(a)(2)(iv)		73.71(b)
				20.405(a)(1)(i)		50.36(c)(1)		50.73(a)(2)(v)		73.71(c)
				20.405(a)(1)(ii)		50.36(c)(2)		50.73(a)(2)(vii)		<input checked="" type="checkbox"/> OTHER
				20.405(a)(1)(iii)		50.73(a)(2)(i)		50.73(a)(2)(viii)(A)		(Specify in Abstract below and in Text, NRC Form 366A)
				20.405(a)(1)(iv)		50.73(a)(2)(ii)		50.73(a)(2)(viii)(B)		
				20.405(a)(1)(v)		50.73(a)(2)(iii)		50.73(a)(2)(x)		Voluntary
LICENSEE CONTACT FOR THIS LER (12)										
NAME <div style="text-align: center;">Jairo Pinzon - Staff Engineer</div>								TELEPHONE NUMBER (Include Area Code) <div style="text-align: center;">(512) 972-8027</div>		
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	DG	C634	Yes						
SUPPLEMENTAL REPORT EXPECTED (14)						EXPECTED SUBMISSION DATE (15)		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)										
<p>On March 2, 1994 Unit 2 was defueled in a refueling outage. Standby Diesel Generator 22 was classified as inoperable due to an ongoing 18 month surveillance inspection. Piston 4R was discovered to be damaged during this inspection. As a result an additional comprehensive inspection plan of each piston and cylinder liner was implemented and reviews of previous inspection videotapes for the other Standby Diesel Generators was conducted. These reviews determined that the conditions that existed in Standby Diesel Generator 22 were not present in the other Diesels. Extensive investigations, utilizing the Vendor (Cooper-Bessemer) and other consultants and metallurgical laboratories, determined the probable cause of the damaged piston was the introduction of foreign material into the cylinder. This introduction of foreign material caused increased friction and a loss of lubrication, increasing the dynamic stresses within the piston structure that resulted in the cracking. The engine was reassembled and an extended testing plan was successfully completed.</p>										

LICENSEE EVENT REPORT (LER)
TEXT CONTINUATION

ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS INFORMATION COLLECTION REQUEST: 50.0 HRS. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE INFORMATION AND RECORDS MANAGEMENT BRANCH (MNBB 7714), 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.

FACILITY NAME (1)	DOCKET NUMBER (2)	LER NUMBER (6)			PAGE (3)
South Texas, Unit 2	05000 499	YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	2 OF 4
		94	-- 002 --	00	

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

Description of Event

On March 2, 1994 Unit 2 was defueled while in a refueling outage. Standby Diesel Generator 22 was inoperable due to an 18 month surveillance inspection. Piston 4R was discovered damaged during this inspection. A section was broken on the lower piston skirt and another section was fractured (but still in place) between the number 6 and 7 oil rings below the wristpin. This fracture was approximately 6" to 10" peripherally and had cracked into three separate pieces.

An investigative team consisting of representatives of Cooper-Bessemer (the engine manufacturer), MPR Associates (the Cooper-Bessemer Owners Group Engineering contractor) and selected project personnel was assembled. Determination of the root cause for the piston failure was the objective of the investigation. The potential failure mechanisms analyzed were:

- Pre-existing condition(s)
 - Physical and Chemical properties
 - Casting wall thickness
 - Physical damage (e.g. resulting in a crack)
- Introduction of foreign material
- Geometric disturbance
- Engine component misalignment
- Engine imbalance

The piston and cylinder liner were analyzed by a metallurgical laboratory for failure. The analysis report concluded that there were no metallography, macrofractography, chemical, dimensional, hardness, or tensile deficiencies. The metallurgical report stated that the piston surface reached 1300°F in certain locations. No evidence of pre-existing (i.e., handling or installation) damage was identified.

Physical dimensions were taken at strategic locations inside the engine block and on various internal engine components and compared to those originally specified by the manufacturer. No discrepancies were noted which could have been contributing factors to the failure. Reviews of previous engine performance history revealed no abnormalities or indications of potential failure.

To resolve potential generic concerns video tapes of previous boroscopic examinations of all Standby Diesel Generators were reviewed and no conditions were identified which indicated the onset of excessive wear or potential failure.

LICENSEE EVENT REPORT (LER)
TEXT CONTINUATION

ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS INFORMATION COLLECTION REQUEST: 50.0 HRS. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE INFORMATION AND RECORDS MANAGEMENT BRANCH (MNBB 7714), 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.

FACILITY NAME (1)		DOCKET NUMBER (2)		LER NUMBER (6)			PAGE (3)
South Texas, Unit 2		05000 499		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	3 OF 4
				94	-- 002 --	00	

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

Cause of Event

After carefully analyzing each failure scenario, no conclusive failure mechanism could be identified. The most probable cause of piston failure was the introduction of foreign material or trapped wear particles between the piston and the liner. This created a scuffing condition of the piston skirt against the lower liner thrust-side which led to a degrading condition of localized heating, tin transfer, and ultimately, loss of lubrication. The heat generated from the loss of lubrication led to the fracture of the piston by exceedance of material strength from thermal and dynamic stresses within the piston structure. The unusual part of this failure was that the piston fractured prior to reaching the point of seizure.

Analysis of Event

The Standby Diesel Generators are part of the Class 1E 4.16 KV AC Power System. The Class 1E 4.16 KV AC Power System at STP is composed of three trains designed to provide a reliable source of power to safety-related equipment essential to all modes of plant operation including emergency shutdown following any design basis event. Upon a loss of offsite power, each of the three Standby Diesel Generators starts automatically to supply back-up power to its associated 4.16 KV bus to support plant cooldown. In addition the SDG can supply power to mitigate the consequences of postulated accidents.

The piston degradation resulted in Standby Diesel Generator 22 remaining in an inoperable status pending completion of corrective actions and testing. Standby Diesel Generator 21 was also inoperable. Standby Diesel Generator 23 was operable. There were no adverse radiological or safety consequences resulting from this event. Had the failure progressed to piston seizure, while the engine was at power, the probable result could have been internal engine damage to the crankshaft and/or connecting rod(s). However, plant shutdown (in the event of loss of offsite power) would have been successfully accomplished utilizing the remaining Technical Specification required Standby Diesel Generators.

LICENSEE EVENT REPORT (LER)
TEXT CONTINUATION

ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS INFORMATION COLLECTION REQUEST: 50.0 HRS. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE INFORMATION AND RECORDS MANAGEMENT BRANCH (MNB 7714), 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.

FACILITY NAME (1)	DOCKET NUMBER (2)	LER NUMBER (6)			PAGE (3)
South Texas, Unit 2	05000 499	YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	4 OF 4
		94	-- 002 --	00	

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

Corrective Actions

The following corrective actions have been taken as a result of this event:

1. Piston and Cylinder Liner for cylinder 4R were replaced.
2. Each of the Twenty (20) pistons and liners in Standby Diesel Generator 22 were inspected for degraded conditions. As a prudent management decision, other parts were replaced in order to preclude a possible future forced outage.
3. All lower oil rings and piston pin end caps on Standby Diesel Generator 22 were removed per recommendation from the engine manufacturer. This will facilitate increased lubricant flow and create a "flushing" effect as lubricant is expelled between the piston and cylinder liner.
4. A comprehensive testing plan was successfully performed for Standby Diesel Generator 22. This test included a run of 168 hours, followed by a "lower end" visual inspection of all cylinders.
5. An additional "lower end" inspection will be performed on Standby Diesel Generator 22 at each 6 month LCO during the next fuel cycle.
6. An information notice was forwarded to the other Nuclear Plants using the same model engines on March 4, 1994.
7. Previous Unit 1 and 2 boroscopic inspection videotapes were reviewed by the investigative team to verify that no indication of potential failure (i.e., scuffing, tin smear or heat transfer) was present that would preclude reliable operation.

In addition to the actions outlined above, a number of future actions, to increase confidence that the root cause was identified and that appropriate additional corrective actions to preclude recurrence are implemented, are planned.

Additional Information

Standby Diesel Generator 22 is a model KSV-20 manufactured by Cooper-Bessemer.

A Unit 2 Special Report documented a thrown connecting rod on Standby Diesel Generator 22 on November 28, 1989.