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

April 17, 1991
ST-HL-AE-3745
File No.: G02
10CFR50.73
10CFR21

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

South Texas Project Electric Generating Station
Unit 1
Docket No. STN 50-498
Licensee Event Report 91-009 and Special Report
Regarding Diesel Generator #12 and #13 Valid
Failures due to Cracked Fuel Injector Nozzle Tips

Pursuant to the South Texas Project Electric Generating Station Technical Specifications 4.8.1.1.3 and 6.9.2 and 10CFR50.73, Houston Lighting & Power submits the attached Licensee Event Report (LER) 91-009 and Special Report regarding diesel generator #12 and #13 valid failures due to cracked fuel injector nozzle tips.

A more detailed analysis of these failures is underway. A supplemental report regarding the results and additional corrective actions, if necessary, will be submitted when the results become available. We have been informed by Cooper-Bessemer that they have reported these problems pursuant to 10CFR21 by telephone to Mr. Walter Haass of the Nuclear Regulatory Commission.

On April 10, 1991 Mr. W. Jones of NRC Region IV was contacted by Mr. C. A. Ayala of our staff to request an extension on the due date of this report. An extension to April 17, 1991 was granted at that time.

If you should have any questions on this matter, please contact Mr. C. A. Ayala at (512) 972-8628 or myself at (512) 972-7205.

William J. Jump
Manager,
Nuclear Licensing

CAA/sgs

Attachment: South Texas, Unit 1 LER 91-009

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cc:

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L4/NRC/

NRC Form 366
(9-83)

U.S. NUCLEAR REGULATORY COMMISSION
APPROVED OMB NO. 3150-0104
EXPIRES: 8/31/88

LICENSEE EVENT REPORT (LER)

FACILITY NAME (1): South Texas, Unit 1

DOCKET NUMBER (2): 0 5 0 0 0 4 9 8

PAGE (3): 1 OF 0 8

TITLE (4): Diesel Generator #12 and #13 Valid Failures Due to Cracked Fuel Injector Nozzle Tips

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 NAMES	DOCKET NUMBER(S)
0 3	1 1	9 1	9 1	0 0 9	0 0	0 4	1 7	9 1	South Texas Unit 2	0 5 0 0 0 4 9 9
										0 5 0 0 0

OPERATING MODE (9)	5	THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more of the following) (11)			
POWER LEVEL (10)	0 0 0	20.402(b)	20.405(c)	50.73(a)(2)(iv)	73.71(b)
		20.405(a)(1)(i)	50.36(c)(1)	X 50.73(a)(2)(v)	73.71(c)
		20.405(a)(1)(ii)	50.36(c)(2)	X 50.73(a)(2)(vii)	X OTHER (Specify in Abstract below and in Text, NRC Form 366A) Special Report 10CFR21 Report
		20.405(a)(1)(iii)	50.73(a)(2)(i)	50.73(a)(2)(viii)(A)	
		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)	

LICENSEE CONTACT FOR THIS LER (12)

NAME	TELEPHONE NUMBER
Charles Ayala - Supervising Licensing Engineer	AREA CODE 5 1 2 9 7 2 - 8 6 2 8

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	
B	E K	N Z L	C 6 3 4	Y							

SUPPLEMENTAL REPORT EXPECTED (14)		EXPECTED SUBMISSION DATE (15)	MONTH	DAY	YEAR
X YES (If yes, complete EXPECTED SUBMISSION DATE)	NO		0 7	3 0	9 1

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

On March 10, 1991 Unit 1 was in a refueling outage in mode 5 and Unit 2 was operating at full power. Following a maintenance test run of Standby Diesel Generator (SDG) #12 in Unit 1 a cracked fuel injector nozzle tip was discovered. Subsequently, a March 13th run of SDG #13 led to discovery of a leaking fuel injector nozzle. On March 20th, a nondestructive test of the SDG #13 injector nozzle tip identified another cracked nozzle tip. Nondestructive examinations of 151 injector nozzle tips from these and other SDGs as well as from spares identified several additional cracked nozzle tips. The cracking failure mode appears to be high-cycle fatigue related to a specific lot of nozzle tips, however, additional detailed analysis is ongoing.

Cooper-Bessemer, the manufacturer of the six South Texas SDGs, has notified the NRC, as well as affected customers, of this issue pursuant to 10CFR21. Action was taken to replace nozzle tips from two lots which were considered suspect from each of the Unit 1 and Unit 2 SDGs. HL&P has sent the cracked nozzle tip from SDG #12 to an offsite laboratory for analysis. HL&P has also requested that the Cooper-Bessemer Owners Group initiate a generic evaluation of the cracking. Once these activities are complete a supplemental report will be provided.

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

DESCRIPTION OF EVENT:

On March 10, 1991 South Texas Unit 1 was in a refueling outage in mode 5 and Unit 2 was operating at full power in mode 1. During an engine balance run on Unit 1 Standby Diesel Generator (SDG) 12 (train B), cylinders 4L and 6R were found out of balance. The engine balance test was performed again on March 11 to focus on these two cylinders. The subject cylinder valve covers were removed and when SDG 12 was loaded, fuel oil was noticed leaking out from around injector 4L. The fuel oil was draining toward the rocker arm assembly and would have eventually drained into the engine lube oil sump which is common to all 20 engine cylinders. SDG 12 was out of service in support of refueling outage maintenance at the time of the finding.

Fuel injectors 4L and 6R were removed and tested at the onsite machine shop. Fuel injector 4L was found to have cracks on both the nozzle tip (spray head) and the assembly tip nut (refer to Figure 1). The 4L nozzle tip was installed during the first Unit 1 refueling outage in the fall of 1989. A standard pressure test of the 6R injector was performed to establish its opening pressure. The injector leaked below the required opening pressure and was rejected, however, no cracking was noticed.

Houston Lighting & Power was aware of previous findings of bad fuel injector lots from the diesel engine manufacturer Cooper-Bessemer. Prior to licensing in 1987, South Texas identified lot 001124 with twenty cracked nozzle tips. In 1988, Cooper-Bessemer notified South Texas of a bad lot (150008) identified by Commonwealth Edison. Both lots were purged from the site.

The lot number of the SDG 12 4L injector nozzle tip was identified as 150010. Three other nozzle tips from this lot were identified in SDG 12 and these injectors were also removed from the engine. Each of the corresponding engine cylinders were inspected with the aid of a boroscope and no evidence of damage was found. An inspection of the valve train on cylinder 4L also found no apparent damage. A lube oil sample analysis identified no significant decrease in lube oil viscosity. Following replacement of the injector nozzle tips from lot 150010, an engine balance run was performed on March 12th and SDG 12 tested satisfactory.

On March 13, 1991 during a performance run of SDG 13 (train C, Unit 1) a low combustion pressure was identified at cylinder 4L. The valve cover was removed and a fuel leak was observed on injector 4L. The run was terminated and SDG 13 was declared inoperable at 1419 hours.

The SDG 13 4L injector was removed and tested at the shop. The fuel injector would not pop open at the pre-determined design pressure of 3600 psi. A liquid penetrant examination on March 20th indicated a crack along the axis of the nozzle tip. (Refer to Figure 2.) This fuel injector was installed in SDG

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

DESCRIPTION OF EVENT: (cont'd)

13 prior to the fall of 1989, at which time HL&P initiated detailed record-keeping for individual installed nozzles.

The SDG 13 4L nozzle tip was identified as being from lot 150006. Lube oil samples and analysis resulted in identification of viscosity at the minimum allowed by the lube oil specification. The remaining nineteen fuel injectors from SDG 13 were removed, operability tested at the shop, and liquid penetrant examination of the tips was performed. All of the remaining nozzles were found satisfactory by both tests.

On March 21st, offsite laboratory personnel from Southwest Research Institute were brought onsite to perform eddy current testing of fuel injector nozzle tips. This testing was performed on 151 nozzle tips from SDGs 11, 12, 13, 21 and 23 as well as maintenance impound areas and the warehouse with findings as follows:

Lot No.	# Tested	# Found Cracked
001110	3	0
150003	2	0
150004	12	*0
150006	26	23
150009	5	0
150010	23	*0
D87001	2	*0
LC001091	29	0
LCH1	10	0
LCH19	39	0
TOTALS	151	23

* - one indication was found, which was not indicative of failure, in each of these lots.

The 23 additional cracked nozzle tips from lot 150006 had seen some amount of service time. No cracks were found in any unused, new nozzle tips, several of which were included in the 151 which were tested.

On March 22nd, all twenty fuel injector nozzle tips were replaced in SDG 13 and the lube oil was changed. A post maintenance surveillance test was performed successfully. SDG 13 was declared operable on March 24, 1991 at approximately 1525 hours.

CAUSE OF EVENT:

The specific cause(s) for the cracked fuel injector nozzle tips is (are) not known, however, the most probable cause(s) are manufacturing related and appear to be lot specific. The failure mode appears to be high-cycle fatigue related. Additional actions are planned to evaluate the cause(s) of the cracking.

ANALYSIS OF EVENT:

In both cases fuel oil was leaking toward the rocker arm assembly and eventually would have drained into the lube oil sump which is common to each engine cylinder. The potential dilution of the lube oil could have adversely affected the mechanical functioning of the engines and, therefore, the capability of the diesel generators to respond in emergency duty. As such these events have both been classified as valid failures per Regulatory Guide 1.108.

Since cracked nozzle tips were found in more than one SDG and others were found in the maintenance impound area, cracked fuel injector nozzle tips could have adversely affected the ability to provide emergency power and as such are reportable pursuant to 10CFR50.73(a)(2)(v) and (vii). Cooper-Bessemer has informed HL&P that they have notified the NRC and affected users pursuant to 10CFR21 of these nozzle tip failures.

As noted below, immediate actions have resulted in replacement of all nozzle tips from lots 150006 and 150010 in all six STPEGS SDGs. However, as a conservative measure, since the cause(s) of the cracking is (are) not yet known, a safety evaluation of the SDGs with the remaining nozzle tips was performed. High confidence exists that a generic concern for poor quality of nozzle tips is limited to STPEGS lots 150006 and 150010 based on the testing data and operating experience.

CORRECTIVE ACTIONS:

Actions being taken for these events are as follows:

1. For the March 10th SDG 12 event, fuel injector nozzle tips with lot 150010 were replaced and lube oil analysis was completed. Subsequently, an engine balance run on March 12th provided a satisfactory result.

2. Following the March 13th SDG 13 event, all twenty of the SDG's fuel injector nozzle tips were removed and replaced. Following lube oil analysis the lube oil was changed. A post maintenance test was completed and SDG 13 was declared operable on March 24th.

CORRECTIVE ACTIONS: (cont'd)

3. As a result of the findings from SDG 12 and 13 and the eddy current testing of 151 nozzle tips, all nozzle tips from lots 150006 and 150010 were removed from the SDGs. All six SDGs now contain lot numbers not considered suspect.

4. The nozzle tips from the suspect lots have been segregated and placed on hold. STPEGS procedures currently require a pressure test of each fuel injector nozzle which verifies that the nozzle will open at a predetermined pressure and that no leakage occurs. If either criterion is not satisfied the nozzle tip is replaced or set aside for refurbishment. This test will detect any leakage from a cracked nozzle tip. Any replacement nozzle tips will have been pressure tested before use.

5. STPEGS has requested the Cooper-Bessemer Owners Group to investigate and advise STPEGS if any other user has had fuel injector nozzle tips crack or leak. As a result of this request, no other users have identified cracked fuel injector nozzle tips since Commonwealth Edison identified problems in 1988 with a bad lot as noted above.

6. The cracked fuel injector nozzle tip from SDG 12 was sent to an HL&P offsite laboratory for chemical, metallurgical and dimensional analysis. HL&P is also requesting that the Cooper-Bessemer Owners Group initiate a more generic evaluation of nozzle tip cracking. Additional evaluation of fuel injector manufacturing and maintenance is being initiated. These actions will contribute to a more detailed analysis of the cause(s) of the nozzle tip cracking and will assist in establishment of recurrence controls. HL&P anticipates completion of this more detailed analysis prior to June 28, 1991. A supplemental report will be provided following evaluation of the further analysis.

7. As a conservative measure, a written safety evaluation of the STPEGS SDGs with the remaining nozzle tips in place has been performed. The very low probability of future cracks is apparent due to test results and operating experience.

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

ADDITIONAL INFORMATION:

The fuel injector nozzle tip is Cooper-Bessemer part number 2-50F-003-023.

Including the events above, there has been one valid failure in the last 20 valid tests for SDG 12 and the number of valid failures in the last 100 valid tests is less than four. Therefore, per STPEGS Technical Specification 3.8.1.1, the testing frequency for SDG 12 remains once per 31 days.

Similarly for SDG 13 there has been one valid failure in the last 20 valid tests and the number of valid failures in the last 100 valid tests is less than four, therefore, the testing frequency for SDG 13 remains once per 31 days.

Previous similar events concerning SDG fuel injectors were discussed in the Description section above.

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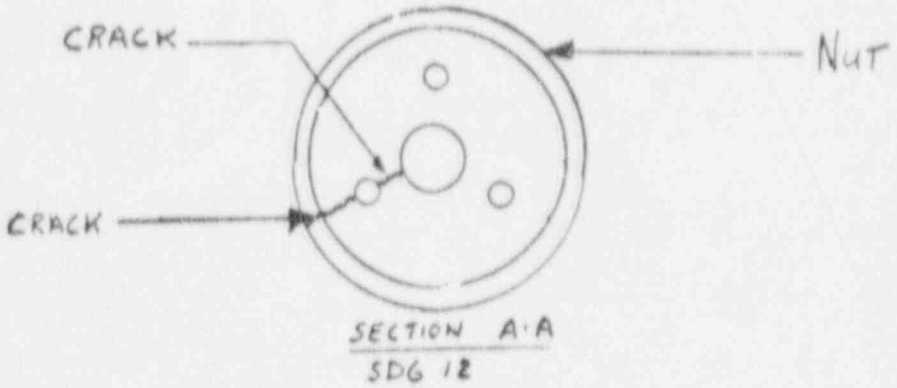
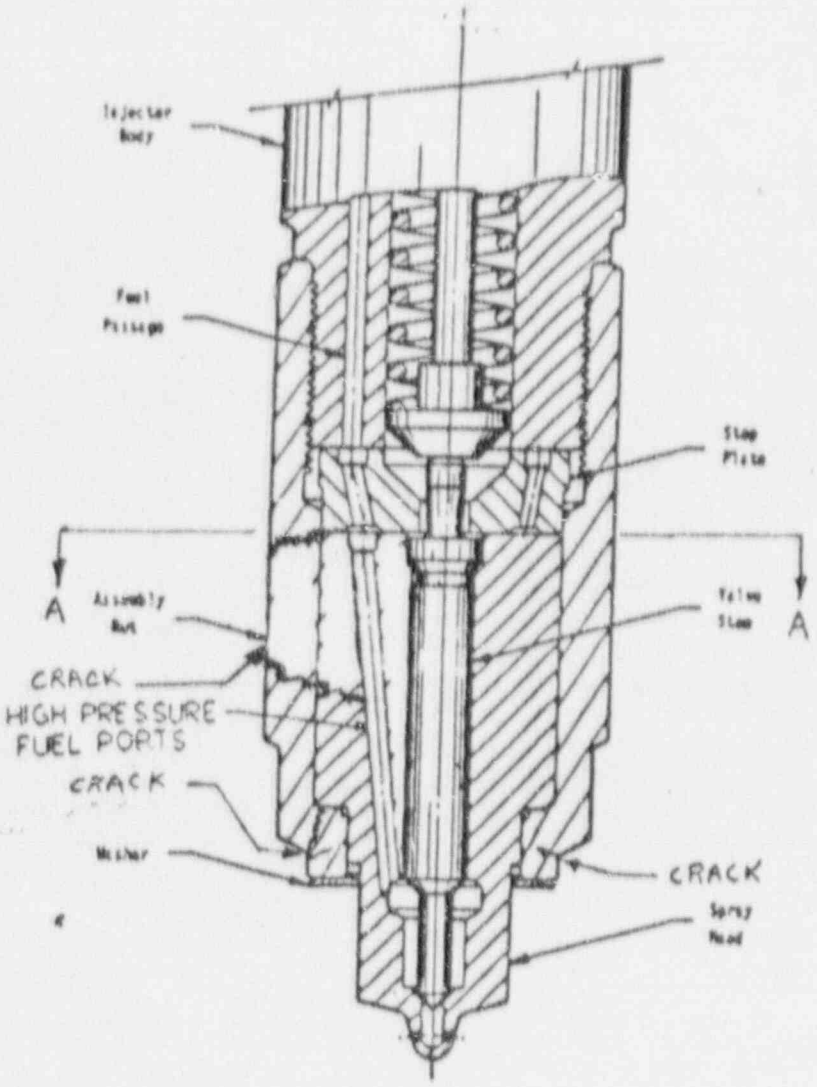
TEXT (If more space is required, use additional NRC Form 366A's) (17)

Figure 1
SDG 12 Fuel Injector Nozzle Crack



SECTION A-A
SDG 12



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ASSEMBLY DRAWING - LOWER END OF INJECTOR

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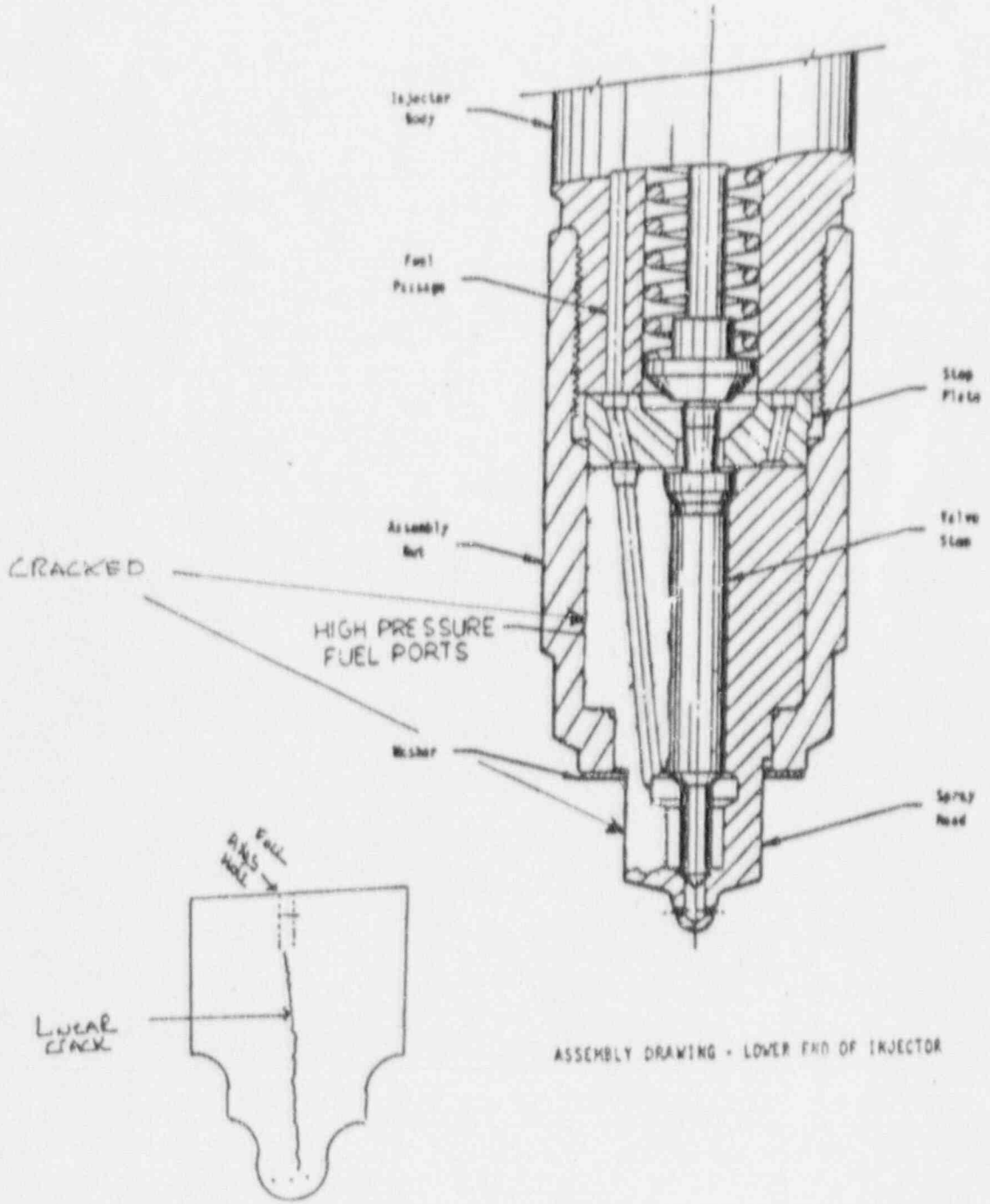
TEXT (If more space is required, use additional NRC Form 366A's) (17)

Figure 2
SDG 13 Fuel Injector Nozzle Crack



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