APPENDIX

U. S. NUCLEAR REGULATORY COMMISSION
REGION IV

NRC Inspection Report: 50-445/84-17

Docket: 50-445 Category A2

Licensee: Texas Utilities Electric Company (TUEC)
Skyway Tower
400 North Clive Street
Lock Box 81
Dallas, Texas, 75201

Facility Name: Comanche Peak Steam Electric Station (CPSES), Unit 1

Inspection at: Glen Rose, Texas

Inspection Conducted: February 20, 1984 - May 25, 1984

Inspector: for D M Hunnicutt 6/13/84
W. F. Smith, Resident Inspector (RRI) Date

Approved: D M Hunnicutt 6/13/84
D. M. Hunnicutt, Team Leader, Comanche Peak Task Force Date

Inspection Summary

Inspection Conducted February 20 - May 25, 1984 (Report 50-445/84-17)

Areas Inspected: Special, announced inspection of work and documentation associated with the CPSES site portion of the recertification program implemented on Unit 1 Train A Emergency Diesel Generator, Serial Number 76001, manufactured by Transamerica Delaval, Incorporated (TDI). The inspection involved 204 inspector-hours onsite by one NRC inspector.

Results: No violations or deviations were identified. NRC Resident Inspection Report 50-445/84-15 has previously reported one deviation and one unresolved item related to the Emergency Diesel Generator recertification program. They are discussed in detail in NRC Inspection Report 84-15 and briefly in this report.

DETAILS

1. Persons Contacted

Principle Licensee Employees

*B. R. Clements, Vice President, Nuclear Operations
*J. C. Kuykendall, Manager, Nuclear Operations
*R. A. Jones, Manager, Plant Operations
*D. E. Diviney, Operations Quality Assurance Supervisor
*R. E. Camp, Startup Manager
*Jim Smith, Operations QA
*H. A. Lancaster, Startup QA
*J. T. Merritt, Asst. Project General Manager
*J. A. Roberts, Const. Startup Turnover Supervisor
*T. L. Gosdin, Support Services Supervisor
D. A. London, Electrical Startup Group Leader
John Maxwell, Operations Quality Control Supervisor
C. W. Smith, Mechanical Maintenance Supervisor
Dean Lystad, Maintenance Supervisor
Billy Snellgrove, Quality Control Inspector, Level III
M. R. Blevins, Maintenance Superintendent
G. E. Jergins, Mechanical Maintenance Engineer
Duerk Reimer, Maintenance Engineer

Others

V. Lyndstrom, Transamerica Delaval, Inc., Technical Representative

The NRC inspector also interviewed other licensee employees during this inspection period.

*Denotes those present during the exit interview.

2. Emergency Diesel Generator Inspection (General Comments)

The emergency diesel generators (EDGs) at CPSES were supplied by Transamerica DeLaval, Incorporated (TDI). There are four machines; two per unit. TDI has provided 53 other emergency diesel generators for 14 other nuclear power plant sites in the United States. On August 12, 1983, the main crankshaft on one of the three EDG's at Shoreham Nuclear Power Station broke into two pieces during a load test. There have been several 10 CFR Part 21 reports issued by TDI reflecting a variety of minor and major defects; i.e., cracks in piston skirts, push rod cracks, governor drive coupling failures, potential failures in fuel lines, and dimensional problems with component fasteners and dowel pins. These

defects are generic in nature, even though there are some design differences between EDGs at CPSES and those at other plants. During the course of the evaluation of the Shoreham failure and the repairs of the Shoreham EDGs, information related to the operating history of TDI engines and a QA program of the manufacturer has been identified which calls into question the reliability of all TDI diesels. As a result of the foregoing and the generic implication involved, an "Owners Group" consisting of representatives from affected nuclear power plants was formed for the purpose of investigating all aspects of quality and reliability of the EDG's supplied by TDI.

In anticipation of comprehensive internal inspections and tests, and to facilitate correction of already known defects, the licensee commenced teardown of the first machine (EDG Serial 76001) on February 20, 1984. NRC inspection efforts include (but are not limited to) observation of the work in progress, review of procedures used and compliance thereto, and tracking the work to ensure the plan is followed and adequately documented.

This project is being accomplished by Texas Utilities Generating Company (TUGCO) Maintenance Department Personnel, rather than site construction (Brown & Root) personnel. This provided TUGCO with a unique opportunity to gain valuable experience in the maintenance aspects of the EDG and an opportunity to exercise the written instructions that had been prepared for future maintenance outages.

The overall performance and attitude of persons associated directly with the project were excellent. The work was accomplished in a professional, controlled manner as would be expected for safety-related equipment. Care was taken to segregate and properly identify components as they were removed from the EDG. Upon reinstallation emphasis, was placed upon cleanliness, foreign material exclusion, and protection of vulnerable surfaces.

Procedures required changes, mainly in the sequence of events. The changes were incorporated into the procedures such that work on the next EDG will be performed more efficiently. Documentation of findings, with few exceptions as described below, were complete and legible.

At the onset of the project there was some disarray, as TUGCO experienced difficulty in reaching a clear understanding of what the Owners' Group needed inspected and to what acceptance criteria. By the end of this inspection period, the project was well defined in the form of 60 inspection plans.

3. Chronology of Events

Due to the length of this inspection period, a weekly summary of events is provided below. The RRI inspected work in progress on a daily basis, most of the time.

February 20 - 26:

The NRC inspector reviewed the initial work authorizing documents and procedures to be used for the EDG teardown. All appeared to be in order except that the licensee is using "Mechanical Maintenance Instructions" which are not approved by the Safety Operations Review Committee (SORC). The licensee contends that a document which specifies or describes detailed work activities which are unique to a particular department or section, and does not have significant impact on other departments or sections, does not require SORC approval. The RRIs consider this a deviation from commitments made in the FSAR, and as such have addressed this in NRC Inspection Report 50-445/84-15 as Deviation 8415-01.

The RRI witnessed removal of selected cylinder head subcovers, push rods, and cylinder heads. Good work practices were used with emphasis on foreign material exclusion.

February 27 - March 4:

By the end of this week all heads, push rods, pistons and connecting rods were removed. The RRI witnessed removal of pistons and connecting rods and noted that care was being taken not to score the cylinder liner walls. Each piston and connecting rod assembly was carefully wrapped and immediately shipped to the shop for inspection and evaluation. The TDI service representative was present and indicated that he will be on hand full time to support the disassembly and reassembly process.

March 5 - 11

The RRI observed cleaning of the block-to-head surfaces and removal of the two turbochargers. This work was completed by the end of the week. Also, the RRI witnessed measurement of crankshaft deflection. Results were satisfactory, confirming that the crankshaft has the proper cold "sag," a cold preliminary indication that the engine block is properly mounted. The final check will be performed while the engine is at normal operating temperature after reassembly and operation.

In the maintenance shop the RRI witnessed attempts to determine cylinder head valve guide clearances. The procedure required a "rocking" technique with a dial indicator as specified in the TDI manual. The mechanics had difficulty obtaining consistent results, consulted with Maintenance Engineering, obtained appropriate procedure changes, and resumed with another method using inside and outside micrometers to get accurate results. This method proved successful, and satisfactory results were achieved.

March 12 - 18:

The NRC inspector observed Failure Analysis Associates (FaAA) personnel taking measurements of the rotor and journals for the turbochargers. The FaAA representative indicated that they were experiencing difficulty in obtaining design drawings with the precise dimensions needed for the stress analyses FaAA intended to perform. FaAA was also observed conducting Eddy Current tests on the crankshaft. The NRC inspector checked the calibration labels and noted that the equipment being used was in current calibration.

March 19 - 25:

During this week the licensee removed all of the cylinder liners in accordance with the appropriate work instructions. The RRI witnessed the removal of one liner, and noted no deficiencies. In the shop, the cylinder head fire decks and valve seats were being liquid penetrant and magnaflux tested. Four of four heads checked had cracks in the fire deck and indications on the valve seats. The licensee opted to replace all of the heads and inspect the remaining 12 heads later.

During the inspection of the fire decks, the licensee found that liquid penetrant testing was difficult because of the surface roughness and subsurface cracks were not revealed. Accordingly, magnetic particle testing techniques were utilized with better results, i.e., one subsurface crack was found where the head apparently had been repair welded by TDI.

March 26 - April 1:

The RRI witnessed liquid penetrant testing of the cylinder liner lands on the engine block where the cylinder liners seat. Three significant linear indications were found in the area of 4R, 5R and 6L cylinders. The licensee considers, after subsequent thorough investigation and measurement, that the indications are casting defects of no significance rather than stress-induced failures. This will be confirmed or denied by later inspection after some hours of operation are put on the EDG.

At this point in the inspection the RRI reviewed the documentation of findings being generated by the licensee. Each inspection plan (IP) identified by the Owners' Group has its own package. Each package contains a copy of the work authorizing document, the inspection plan, an inspection report detailing what to look for and a place to record the results, non-conformance reports, photos, and any other pertinent data. Each package is being retained by Quality Control, and when ready for

Owners' Group review, a copy of the package is submitted. As of this week, about 40 of 60 inspection plans have been identified to the licensee by the Owners' Group. This apparent slow influx of information is causing the licensee minor planning problems, and as such has had an adverse effect on projected work schedules.

Also during this week, the RRI witnessed liquid penetrant inspections of the engine base main bearing mating surfaces. No significant findings were identified by this inspection. The mechanics experienced difficulty in removing No. 1 bearing cap because the engine block casting interfered with the hydraulic torque tool. With the assistance of the TDI representative, the tool was modified to accomplish the task.

The RRI observed nondestructive testing of the aluminum crank bearing inserts. These inserts had a multitude of liquid penetrant indications, and an apparent sponginess or porosity which was readily visible after acid etching the inserts. Radiographs confirmed the porosity and showed some minor voids. Eleven out of sixteen insert sets were rejected and therefore replaced.

April 2-8:

During this week, some of the new cylinder heads arrived. There was some controversy between the licensee and TDI, over the liquid penetrant inspection acceptance criteria, when the licensee performed source inspection of the new head fire decks and valve seats. This was later resolved and an acceptable set of heads became available.

During dimensional inspection of the cylinder liners, the licensee noted that the thickness of the upper liner lip caused the liner-to-head contact surface to protrude out of the block from 0.003" to 0.011". The significance of this is that when the head rests on the liner, the engine block land that the liner seats on is exposed to stresses from head bolt torque that could cause the land to be overstressed. TDI directed 0.000" to 0.003" protrusion by revision of the drawing, thus, the licensee machined the liners to obtain a proper fit.

The RRI observed removal of the mounting plate associated with the overspeed governor and engine-mounted fuel booster pump. The licensee had difficulty removing this part because the dowel pins were rusty and TDI did not provide jacking screws in the plate. Pry bars and wedges were used along with a mechanic tapping on the plate from inside the engine with a brass bar. These efforts damaged some adjacent tubing which was subsequently replaced.

April 9 - 15

While inspecting the engine internals via the overspeed governor mounting plate opening, the RRI noted that one of the four capscrews (inside the engine) that hold the power take-off pinion for the overspeed trip and fuel booster pump was not properly locked. This could lead to a fastener dropping into the timing gears or the overspeed coupling not holding its alignment. This deficiency was brought to the attention of the QC supervisor. The defect was identified on a nonconformance report and subsequently corrected prior to reassembly. The licensee is evaluating the reportability of this defect.

All of the cylinder head inspections were completed this week. Fourteen of the sixteen heads removed from the engine had rejectable liner defects. As mentioned previously in this report, all heads are being replaced. Disassembly, cleaning, and inspection of the air start distributors was accomplished this week.

April 16 - 22

Fourteen of 60 inspection plans were complete by this point in the sequence and signed off. During this week the licensee measured timing and power takeoff gear backlash. The results were satisfactory. The RRI noted that a few pieces of tape, wooden splinters and bits of paper towel were beginning to collect in the bottom of the crankcase. Even though the licensee intended to do a thorough cleaning before final closure, the RRI pointed out the wisdom of keeping such debris out on a continuing basis. The licensee responded favorably by exercising greater care in this area. The RRI informed the licensee that there will be a NRC inspection of the crankcase just prior to final closure and that the RRI was to be called whenever this was to occur.

Inspection and machining of the cylinder liners was completed this week. One liner was rejected and donated to the Owner's Group for destructive testing.

April 23 - 29

All cylinder liners, machined as required to obtain proper interface with the heads, were installed. The RRI witnessed installation of the last liner in 4R. Great care was being exercised by QC to ensure the liners were clean, free of nicks and burrs, and that the cylinder block water passages were clear of foreign material before releasing the liners for insertion.

In preparation for installation of pistons and connecting rods, the licensee thoroughly cleaned and inspected the crankcase.

During this week, the RRI inspected 18 inspection plan (IP) packages that were reported by the licensee as completed and copies forwarded to the Owners' Group. The packages were:

I.P. 8 Front Gear Case Gasket & Bolts

I.P. 10 Fuel Tappet Assembly

I.P. 16 Intake & Exhaust Tappet Assembly

I.P. 17 Cylinder Block Studs

I.P. 18 Governor Assembly Heat Exchanger

I.P. 22 Camshaft Assembly

I.P. 23 Governor Drive Gear Shaft

I.P. 30 Valve Springs

I.P. 35 Intercooler Piping Coupling (Dresser Couplings)

I.P. 37 Crankcase Covers

I.P. 46 Cylinder Block Covers

I.P. 47 Exhaust Rocker Shaft Assembly

I.P. 48 Long Push Rods

I.P. 49 Push Rod Connector

I.P. 50 Rocker Arms and Pushrod Fasteners

I.P. 51 Governor Drive Coupling

There were no significant deficiencies found in any of the IP packages except for IP 17. Seven other IP packages prompted minor questions from the NRC inspector, all of which were answered or corrected upon review of the inspection results with Maintenance Engineering and Quality Control Supervision. The problem related to IP 17 involved the certification records on the individual who performed the alloy separation examination on cylinder block studs. The technician was required by Long Island Lighting Company. (LILCO) Procedure QCI FS1-F11.1-080 to be qualified to the test equipment technical manual and LILCO Procedure QAD-2.5. Documentation in the package IP 17 shows the individual to be qualified to LILCO Procedure QAI-11.2.6. This disparity is reflected in NRC Inspection Report 50-445/84-15 as Unresolved Item 50-445/8415-01.

April 30 - May 6

During this week, all of the new pistons were assembled to the connecting rod assemblies, transported to the EDG room and installed in the engine. All heads are installed. The RRI witnessed the entire process of reassembly and installation of the piston 7L and head 8L. The licensee's mechanics, under the surveillance of QC, properly installed the components in accordance with procedures and exercised great care to protect the components from damage and maintain cleanliness of mating parts.

On May 3, 1984, the dismantling of Train B EDG (Serial No. 76002) commenced. The lessons learned on Train A EDG (Serial No. 76001) will be utilized in the methods used. Procedures have been revised in some cases to ensure a smoother process. The licensee has scheduled a 30-day time span for disassembly, cleaning and inspection, and reassembly. The NRC inspection of this activity will be documented by separate NRC Inspection Report 50-445/84-20.

May 7 - 13

By the end of this week the EDG was completely assembled with exception of the overspeed governor and engine driven fuel booster pump. As the cylinder head subcovers were being installed, the RRI noted that housekeeping and signoffs of on-the-spot procedure changes were relaxing. QC and maintenance supervision were alerted by the RRI to take action to restore the high level of quality that has been followed thus far. QC issued a written directive reminding all personnel of the importance of rigid controls. This action yielded satisfactory results.

May 14 - 20

All assembly work was completed on the train A EDG on May 15, 1984. The balance of the week was spent cleaning the diesel generator room and making preparations for the first retest. On May 19, 1984, the retest of EDG auxiliary system control and interlock functions was performed with satisfactory results.

May 21 - 25

On May 23, 1984, the NRC inspector conducted a detailed review of 14 additional IP packages to verify proper identification documentation and followup on defects found on the train A EDG.

The following IP packages were reviewed:

Inspection Plan	Subject
I.P. - 15	Turbocharger Butterfly Valve Assembly
I.P. - 19	Turbocharger Bracket Bolting
I.P. - 20	Rocker Arm and Push Rod Assembly
I.P. - 21	Cylinder Block
I.P. - 24	Cylinder Liners
I.P. - 25	Starting Air Distributor
I.P. - 27	Pistons & Piston Pin Assembly
I.P. - 28	Governor Linkage
I.P. - 29	Control Panel Cleanliness
I.P. - 31	Exhaust Manifold Bolting & Gaskets
I.P. - 32	Cylinder Block Liner & Manifold Nuts
I.P. - 33	Turbocharger
I.P. - 34	Crankcase Assembly
I.P. - 36	Base and Bearing Caps

Of the 14 IP packages sampled, it was noted by the RRI that eight had nonconformance reports (NCR) that were not closed. At this point in time, the engine was being prepared for starting and break-in of the new piston rings. The RRI expressed concern to the licensee's Quality Assurance Supervisor that running the equipment with unresolved deficiencies will violate procedures and is not in the best interest of quality. The response was that all NCR's written against the engine would be cleared or conditionally released before the engine is operated. "Conditional release" means in broad terms that an engineering evaluation has been conducted and quality of the equipment will not be compromised if the equipment is operated. This concept is frequently needed in order to conduct in-process equipment checkouts prior to final restoration to service.

After the engine had been run, the RRI noted that some of the NCR's were still open, and not conditionally released. For example: NCR 84-0097 rejects all of the pistons pins for wear, and the IP - 27 package has no documentation showing this to be an acceptable, "use as-is" condition. Upon questioning the licensee's Quality Control supervisor, it was revealed that the "hold tags" that would have prevented premature

engine operation were removed from the engine without proper authority, however, there was documentation showing that the engine could be operated "as is." The QC supervisor stated that this is a violation of the administrative procedure controlling NCRs and immediately placed the equipment back in a "hold" status. A Deviation Report was initiated which documented the procedure violation. NCR 84-0082 (pushrod cup defects) was handled in a similar manner.

The package for IP - 33 (turbocharger) had notations stating that dimensions specified could not be taken because the needed measuring equipment was not available. The inspector inserted "N/A" for the attribute on the inspection report and the Level III inspector approved the inspection report for closure. The inspection report and the inspection plan had not been revised. The licensee issued a Deviation Report to document and provide for corrective action.

The above failures to follow administrative procedure, among others not related to the TDI Recertification Program constitute an apparent violation which will be addressed in NRC Inspection Report 50-445/84-18 (to be issued).

The RRI noted a few instances where the quality control inspector indicated "satisfactory" on inspection reports when unsatisfactory or indeterminate conditions existed. The licensee's representative explained that there was some confusion as to whether the inspector is comparing conditions with stated or implied acceptance criteria or just simply reporting his observations. Procedure QPM-004 (inspection reports) states that acceptance criteria shall be included in the instructions to the inspector that are entered on the inspection report. It has become evident that there will be times when a condition report is needed for subsequent engineering evaluation. There may be no acceptance criteria. The licensee is considering procedure changes to accommodate such situations in the future.

In the IP - 32 package, the RRI noted that the IP was revised over the signature of the previous revision, lending confusion to what acceptance criteria was used in evaluating defects on cylinder block nuts. The inspection report was closed out with a satisfactory reinspection, yet the related NDE report still showed the rejection. No NCR was written. The "paper trail" in this IP package was inadequate. The QC supervisor indicated that he would make the proper corrections. This problem will be addressed in NRC inspection report 50-445/84-18 as Unresolved Item 50-445/8418-01.

4. Exit Interview

An exit interview was conducted on June 1, 1984, with licensee representatives (identified in paragraph 1). During this interview, the RRI reviewed the scope of this inspection and discussed the inspection findings. Due to the length and special nature of this inspection, action items such as violations, deviations, open and unresolved items have been documented and tracked in the routine periodic resident inspection program report.