



# THE CLEVELAND ELECTRIC ILLUMINATING COMPANY

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MURRAY R. EDELMAN  
VICE PRESIDENT  
NUCLEAR

October 31, 1984  
PY-CEI/NRR-0146 L

Mr. B. J. Youngblood, Chief  
Licensing Branch No. 1  
Division of Licensing  
U. S. Nuclear Regulatory Commission  
Washington, DC 20555

Perry Nuclear Power Plant  
Docket Nos. 50-440; 50-441  
Response to NRC Delaval  
Diesel Generator Questions

Dear Mr. Youngblood:

This letter is provided in response to your letter dated December 28, 1983 requesting additional information regarding Transamerica Delaval Emergency Diesel Generators at the Perry Nuclear Power Plant. Several responses include information provided by the Owners Group effort, others provide PNPP site-specific responses.

If you have any further questions on this information, please feel free to contact us.

Very truly yours,

*A. Kaplan for M. Edelman*

Murray R. Edelman  
Vice President  
Nuclear Group

MRE:njc

Attachments

cc: Jay Silberg, Esq.  
John Stefano  
J. Grobe

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Response to NRC Questions on  
Delaval Diesel Generator Evaluation

1. Question

Provide a copy of the procurement specifications to which the standby diesel generators (DG) were ordered.

Response

The diesel generators were ordered per the requirements of specification SP-562-4549-00, entitled "Class IE Diesel Generator Units, Perry Nuclear Power Plant - Units 1 and 2." A copy of the procurement specification, along with revisions, is attached (see Attachment A).

2. Question

Provide the performance specification and inspections performed upon receiving the DGs to show that the procurement specifications were met.

Response

The performance specification is the same as the procurement specification (see Attachment A). The procurement and performance portions of the specification are verified through several methods. Receipt inspection is conducted to determine if any damage occurred during shipping, if specified packaging and shipping requirements have been maintained, and if all components have been supplied. To assure that the specification was met, the following measures were taken. CEI released the specification for bidding only to bidders CEI and Architect-Engineer Gilbert Associates, Inc. (Gilbert) considered capable of meeting the requirements of the specification. Delaval's proposal to supply the standby diesel generators was recommended only after a determination that the proposal met the specification's requirements. A Pre-Award Survey of Delaval was conducted in order to evaluate Delaval's QA program. All of CEI's QA concerns identified during the Pre-Award Survey were resolved prior to manufacture of the standby diesel generators. CEI and Gilbert then held a Pre-Award Meeting to address technical issues raised by Delaval's proposal; and all such issues were resolved prior to the award of the contract to Delaval. Prior to fabrication of the standby diesel generators, Gilbert reviewed for conformance to the specification selected Delaval documentation required by specification, such as procedures and drawings. Gilbert also established hold/witness points during the manufacture of the standby diesel generators beyond which Delaval was not permitted to proceed without Gilbert's concurrence. A number of manufacturing surveillances of Delaval were conducted during the manufacture of the standby diesel generators. (See response to Question 12.[2]). At the completion of manufacturing of the standby diesel generators, Gilbert reviewed Delaval's hardware documentation package for conformance to the specification. In addition the factory and type qualification testing programs for the standby diesel generators all helped to assure that the diesel generators conform to the specification. Documentation of these activities is maintained.



3. Question

Identify the materials used in the design of the DGs at your plant (specifically limiting components such as crankshafts, camshafts, pistons, rocker arms, bearing materials, cylinder blocks, cylinder heads, pumps, turbochargers, etc.). Discuss how you assured yourself that design materials used in the manufacture of your DGs were as stated and in accordance with materials described in the TDI proposal, purchase specifications, and conformance to industry standards.

Response

To address these questions, the TDI Diesel Generator Owners Group has issued reports covering the key diesel engine components which have had adverse operating experience and are considered to be important to engine operation. Each report assesses the adequacy of the component from a design and materials standpoint. These reports also recommend certain inspections and tests be performed on these components to either validate assumptions made in the report or to establish the as found condition of the component. CEI is presently conducting inspections of their components in accordance with the Owners Group recommendations. The results of the inspections will be forwarded to the NRC for review approximately one month following completion of the inspections. The inspections presently being conducted prior to onsite testing are anticipated to be completed by December 28, 1984. Testing and further selected inspections of diesel components identified in the Component Revalidation Checklist will be performed during the first quarter of 1985.



4. Question

Does TDI have a program where parts/components, etc., are modified (such that design margins are reduced) in order to improve operability and DG reliability. Does this apply to any DG parts at your plant. Provide a list of product improvements made by TDI on your model DG and identify and justify which of these were not incorporated on your diesels.

Response

TDI does not have a program where parts/components are modified such that design margins are reduced. TDI does have a product improvement program which is intended to improve the operability and reliability of their engines. Notification of noteworthy modifications are issued to TDI diesel engine owners by the Service Information Memo (SIM). We are not aware of any modification recommendations from TDI which decreased design margin on any DG part at the Perry Plant. A listing of the product improvements suggested to CEI through the SIM process since manufacture of the diesels is provided below:

TDI Service Information Memo's

SIM #	Subject	Incorporated at Perry	Procedure	Parts	Remarks
64 R-1	Torque Valves	yes	X		In work procedures
99	Piston Ring Replacement	yes	X		
107	Cleaning Spray Tips	yes	X		
108	Tightening Delivery Valve Holder & Assembly Nuts	yes	X		
133	L. O. Piping Fab.	yes	X		
133-A	Cleaning & preservation	yes	X		L. O. Pipe was Pickled at TDI. At Perry, pipe has been hydrolazed, dried and corrosion inhibitors applied to meet cleanliness requirements.
139	Piston Rings	yes	X		Will be used in Maintenance procedure.

TDI Service Information Memo's

SIM #	Subject	Incorporated at Perry	Procedure	Parts	Remarks
141	L. O. Flushing	yes	X		
164	Safety Wiring	yes	X		
174	Piping System Cleaning	yes	X		Same methods or equal
190	Crankshaft Rotation and Cyl. Bank Designation	yes	X		
191	Cooling Water System Treatment	yes	X		
233	Nozzle Assembly Puller	N/A		X	Maintenance Tools
240-A	Lubricating Oil	yes	X		
243	Indicator Cock	N/A		X	Maintenance Tools
249 R-2	Cyl. Head Valve Seat Repair	yes	X		TDI is inspecting and will repair heads if necessary. TDI repair will be incorporated in- to future CEI repair procedure.
283	Crankshaft Thrust Clear- ance	yes	X		
286	Hydraulic Pre-Stresser (Main Bearing Caps)	yes	X	X	Maintenance Tools
295	Exhaust Valve Guides	yes	X		Inspection Procedure
307	New Piston Ring End GAP	yes	X		
309	Valve Spring Compression Tool	N/A		X	Maintenance Tools
313	Intake Manifold Supports	yes	X	X	If necessary to eliminate oil leakage
321	Actuator Terminal Pins	yes	X	X	Governors were refur- bished and recalibrated by TDI/Woodward in 1983

TDI Service Information Memo's

SIM #	Subject	Incorporated at Perry	Procedure	Parts	Remarks
324 R-3	Two Piece Piston Modification	N/A	X		Not Applicable to Perry Pistons since we are changing to TYPE AE skirts
332	Con. Rod Bolt Washers	yes	X		
333	Liner-O-Ring Installation Tool	N/A		X	Maintenance Tool
336	Measuring Intake & Exh. Valve to Guide Clearance	yes	X		
343	Inspection & Maint. Report	yes	X		
350	Piston Crown Mod.	yes	X		
352	Cyl. Head Valve Spring or Rotator Removal	N/A	X	X	Not for use on engines with Hydraulic Lifters
355	Aux. Skid Installation Procedure	yes	X		
360	Air Start Valve Capscrews	yes	X	X	Inspection Program Performed via DAR #99
361	IE Nuclear Qualified	yes	X	X	Changed per DAR #109
364	Con Rod Wrist Pin	yes	X		
366	Field Flashing Circuit	yes	X	X	Change per DAR #203

NOTE: Maintenance Tools will either be purchased from TDI or fabricated on site. We have not committed to using TDI Tools.



5. Question

If applicable, provide responses to all NRC open items on standby DGs at your plant.

Response

SER Supplement 4 (Section 9.6.3.1) added Outstanding Issue 24 on TDI Diesel Generator Reliability. The staff concerns will be addressed through future filings, which will include PNPP-specific applications of the Owners Group analyses and recommended testing, inspection and maintenance programs. By letter dated February 23, 1984 the staff indicated that the PNPP diesel generator test program should not be considered a resolved matter. The letter noted that any changes to the program should be addressed in the next supplement to the SER.

6. Question

Identify each of your DGs by model number and rating (continuous duty and short time overload) as purchased and discuss all tests (including torsional and other design proof tests) performed on the DGs that were observed (also those not observed) by you at the manufacturer's facilities.

Response

The PNPP DGs are model DSRV-16-4, rated at 7000 KW for continuous duty and 7700 KW for short time overload. The table on page 6-2 identifies the tests performed at the manufacturers facility and the appropriate documentation of those tests. All nuclear testing performed on the PNPP DG's per Reg. Guide 1.9 and IEEE 387 was witnessed by PNPP quality assurance and engineering representatives, as was most standard factory testing.

SUMMARY OF SHOP TESTS PERFORMED AT DELAVAL

Date	Trip No.	Report No.	Witnessed	Type Test	Description of Test
2/27-3/2/78	010-08R	4173-78-7	X	Factory	4-hour shop test
3/28-31/78	010-10R	4173-78-9	X	Factory	Run @ 25%, 50%, 110% load
4/3-6/78	010-11R	4173-78-10	X	Nuclear Qualification	1) sequential loading
			X		2) load rejection test
			X		3) margin test
			X		4) load tests (short term)
			X		5) over speed control & test
			X		6) starting air system test
			X		7) starting air compressor capacity test
			X	Other tests	1) starting & loading test
			X		2) torsigraph tests
5/4-5/78	010-13	4173-78-13	X	Factory	Run thru 450 RPM (100%) load for 2 hours
5/23-25/78	010-15	4173-78-17	X	Factory	Run @100% load



7. Question

In addition to qualification tests that were performed in accordance with Regulatory Guides 1.9 and 1.108, and IEEE Std. 387, describe all other onsite tests performed on your DGs.

Response

No onsite testing has been performed on the PNPP standby diesel generators to date. Testing will be performed in accordance with TDI Owners Group recommendations and preoperational test program requirements.

8. Question

In addition to any deficiency reports already provided to the NRC, summarize and describe problems encountered and resolved during installation and preliminary operation of the DGs. During this period, were any unusual or abnormal operations observed such as excessive vibration, noise, etc., and how were these conditions corrected. Provide a detailed summary of the complete operating histories of your DGs.

Response

The PNPP standby engines have not been operated at the site to date. All significant deficiencies encountered during the installation have been reported to the NRC.

9. Question

Tabulate, compare and discuss differences in present actual DG loading to estimated loads included in the procurement specifications. Identify the magnitude of the increased load (if any) on the DGs and describe how the increased loading affects the DG capability with regard to reserve margin.

Response

The engines procured for PNPP are rated for continuous loads of 7000 KW and overloads of 7700 KW. At the time of initial procurement the maximum load was conservatively estimated at 6160 KW for a forced shutdown with loss of off-site power (LOOP). By letter dated July 25, 1984 (PY/SO-26339) from E. C. Christiansen to C. L. Ray Jr., of the TDI Owner's Group, the most detailed analysis performed to date on PNPP diesel generator loading was documented. This computer based analysis predicted that the maximum load on the DG's will be 4464 KW for simultaneous LOOP and a Loss of Coolant Accident (LOCA). The revised analysis will be reflected in a future FSAR amendment. Actual testing of the Unit 1, Divisions 1 & 2 engines will take place in early 1985 at which time the total load will be measured. Since it is expected that the actual loads will be less than the initially estimated load the reserve margin will actually be larger than originally expected.



10. Question

If DG loading has increased from that specified in the procurement specifications, has it been necessary to upgrade the standby DGs to meet the new load requirements. If DG upgrading has been performed, provide a detailed description of the upgrading accomplished on your DGs. What is the revised manufacturer's rating for each upgraded unit for normal continuous duty and short time overload conditions. Is the DG built-in design margin (after upgrading) still within the recommendations of IEEE Std. 387. What is the reserve load carrying capability (margin) of your upgraded DGs.

Response

The diesel generator loading will be less than specified in the original procurement specification (see item 9), and well within the recommendations of IEEE Std. 387.

11. Question

In light of the problems that have been identified to date with Delaval diesels, discuss your plans to perform an internal visual inspection of each standby DG with regard to potential crankshaft and/or web cracks as identified at the Shoreham Station and provide a detailed discussion of your plans to perform any non-destructive testing (NDT) such as dye penetrant testing, etc., as deemed appropriate to assure absence of cracks at these locations or at any other locations where cracks may have been observed. Discuss schedules for such testing.

Response

As a result of the failure of the Shoreham crankshaft, the TDI Diesel Generator Owners Group identified the crankshaft as a generic component for analysis in Phase I of its program.

Failure Analysis Associates (FaAA) completed its analysis of crankshafts for the DSR-48, DSRV-16-4, DSRV-12 and DSRV-20 diesel engines. These reports were forwarded to the NRC for review on 4/20/84 under letter #TDI-17, on 5/24/84 under letter # OGTP-39 and on 6/15/84 under letter OGTP-76 respectively.

The FaAA reports recommend torsiongraph testing of one crankshaft at each plant and NDE inspection of the oil holes in the main journals number 4, 6, and 8 for the DSRV-16-4 crankshafts. Both these recommendations, and NDE of all other components recommended by the Owner's Group will be performed.

The Unit 1 engines (division 1 & 2) are presently being inspected; with subsequent testing and final inspections scheduled to be completed by the end of the first quarter of 1985.

12. Question

Justify that the standby DGs at your plant are sufficiently reliable that there will be reasonable assurance that the facility can operate without undue risk to the health and safety of the public.

Your justification should include, but not be limited to the following: (1) quality assurance program conducted by you during procurement, manufacturing and receipt of your DGs, (2) your assessment of the TDI manufacturing process, inspection, and quality assurance program conducted during manufacture of your DGs, (3) your assessment of TDI responsiveness to problems that have occurred with your engines during installation and preliminary operation including assessment of TDI performance, (4) comparison of your DGs with all other TDI emergency DG models now in use or to be used in other nuclear generating stations (and other non-nuclear facilities) to show that the conditions and/or failure modes present at Shoreham will not occur at your plant and at other nuclear plants; provide any supporting information that may be obtained from non-nuclear installation, (5) independent review or verification of any TDI design calculations for critical components of your DGs, and/or other means used to assure that your DGs are designed to DEMA standards and applicable industry codes and standards, and (6) your overall assessment of the DGs at your plant with regard to TDI system design, operating experience to date, and system dependability, availability and reliability to warrant operation of your plant.

Response to 12.(1)

1). The quality assurance program conducted by PNPP during the procurement, manufacturing and receipt of the PNPP DGs was in accordance with the requirements of 10 CFR 50, Appendix B. See also response to questions 2 and 12. (2).



- 12.(2) your assessment of the TDI manufacturing process, inspection, and quality assurance program conducted during manufacture of your DGs,

Response to 12.(2)

The QA program noted in 12.(1) was applied to the manufacture of the PNPP standby diesel generators. The purpose of the program was to assess the TDI manufacturing, inspection and quality assurance program conducted during manufacture of the PNPP DG's. In September 1975 a Pre-Award Survey of Delaval was conducted. CEI and Architect-Engineer Gilbert Associates, Inc. ("Gilbert") held a Post-Award Meeting with Delaval in April 1976 in which it was verified that Delaval's responses to the findings of the Pre-Award Survey had been implemented. Also at the Post-Award Meeting CEI and Gilbert reviewed with Delaval the QA requirements of the diesel generator contract and identified the Delaval procedures which had to be reviewed and approved before Delaval would be permitted to begin fabrication of the diesel generators.

Review and approval of the necessary procedures was completed by November 1977; and on November 30, 1977 Gilbert issued a fabrication release to Delaval. Gilbert also developed a manufacturing surveillance plan for the standby diesel generators which was reviewed and approved by Applicants. To date Gilbert has conducted a total of 44 surveillances in connection with the PNPP standby diesel generators.

In addition to the manufacturing surveillance program, in May 1978 CEI and Gilbert conducted an audit of Delaval's activities in connection with the manufacture of the PNPP standby diesel generators. The audit concluded that in general Delaval's QA procedures were adequate and were being satisfactorily implemented. A July 1978 meeting with Delaval confirmed CEI's and Gilbert's confidence in Delaval's program. As a result of this favorable evaluation, CEI approved shipment from Delaval of the PNPP standby diesel generators.

A subsequent audit of Delaval was conducted by CEI and Gilbert in February 1982. A May 1982 follow-up meeting at Delaval concluded that Delaval's QA program during the manufacture of the PNPP standby diesel generators was adequate.

12.(3) your assessment of TDI responsiveness to problems that have occurred with your engines during installation and preliminary operation including assessment of TDI performance.

Response to 12. (3)

Assessment of TDI responsiveness to problems that have occurred during engine installation:

- Service engineering department response to installation concerns has always been adequate. A site TDI service representative has been assigned at PNPP since February, 1981, providing a good response to installation concerns on a day to day basis.
- Response to programmatic concerns has been supportive, but initially was not as timely as desired. Responsiveness has improved with the formation of a site task force dedicated, in part, to resolving such problems.

12.(4) comparison of your DGs with all other TDI emergency DG models now in use or to be used in other nuclear generating stations (and other non-nuclear facilities) to show that the conditions and/or failure modes present at Shoreham will not occur at your plant and at other nuclear plants; provide any supporting information that may be obtained from non-nuclear installation.

Response to 12.(4)

The TDI Diesel Generator Owners Group, of which PNPP is a member, has developed a program which will address these questions. The program provides for component by component comparison of the PNPP diesel engine with failure history developed by the Owners Group for nuclear and non-nuclear diesel engines. This process is described in the Owners Group Program Plan as the Component Selection process.



- 12.(5) independent review of verification of any TDI design calculations for critical components of your DGs, and/or other means used to assure that your DGs are designed to DEMA standards and applicable industry codes and standards.

Response to 12.(5)

The Owners Group will perform an independent Design Review and/or Quality Revalidation of each component as applicable. The results of these reviews will be forwarded to the NRC after PNPP receives its plant specific DR/QR Summary Report from the TDI Owners Group Technical Staff, which is anticipated in December 1984.

- 12.(6) your overall assessment of the DGs at your plant with regard to TDI system design, operating experience to date, and system dependability, availability and reliability to warrant operation of your plant.

Response to 12.(6)

The TDI Diesel Generator Owner's Group Program has been developed to assess the adequacy of the TDI engine design to perform its intended safety-related functions. This program will incorporate TDI diesel generator operating experience to date in its assessment. See response to Question 12.(4).

The TDI standby diesel engines at PNPP have not yet undergone onsite testing or operation. The TDI Owners Group DR/QR program for PNPP will outline the specific plans for assuring dependability, availability and reliability of the TDI diesel generators. CEI intends to implement the TDI Owners Group plans and recommendations on inspections, testing and maintenance.

13. Question

Provide a tabulation of the number of times (including each date of occurrence) voltage was lost at the emergency bus(es) requiring operation of the DG(s) including a brief description of each incident. In the above tabulation, also identify the loss of emergency bus voltage due to loss of offsite power.

Response

Since PNPP is still in the construction/testing phase and has not operated its standby diesel generators, this question is not applicable.



14. Question

Shoreham has identified connecting rod bearing materials are not in accordance with design specifications on their engines. This condition may also exist on all other TDI diesels. Provide assurance that correct bearing design and materials have been used in your engines. Should you find that improper bearings have been used in your diesels, state how and when you propose to correct this problem.

Response

The Failure Analysis Associates report on Connecting Rod Bearing Shells discusses the failure mode of the original 11-inch diameter bearings on the Shoreham engines. The report concludes that both the replacement 12" diameter bearing shells and the 13" DSRV-16-4 bearing shells similar to those used in the PNPP engines will not exhibit the same failure mode, and will function reliably in nuclear standby applications.

The FaAA report recommends radiography of the bearing shells to ensure no casting voids greater than .050 inch are present in the critical areas of the bearing shells. The FaAA report recommends that this inspection be done on a sampling basis. This inspection will be performed on the PNPP engines as recommended by the Owner's Group. Should the inspection process identify that improper bearings have been used for the PNPP DG's, they will be replaced prior to preoperational testing of the engines.

15. Question

Most of the piston skirts in the Shoreham diesels were cracked. Because of a common cylinder design for all TDI diesels, it is presumed that this condition potentially exists on all other TDI diesels. Discuss your plans, including internal inspection or other means to determine the potential or actual existence of such cracking. In your response, indicate whether the design and materials are identical to those in the Shoreham units; if not identify differences. Identify any corrective actions you have taken to date or plan to take. The staff understands that TDI has a piston design modification to correct the above problem. Are you aware of this and has TDI transmitted this service information to you?

Response

The TDI Diesel Generator Owners Group has completed an extensive review of the piston skirt originally installed in the Shoreham engines. Failure Analysis Associates reports FaAA-84-2-14 May 23, 1984 and FaAA-84-5-8, June 1984 document this review. The PNPP engines were supplied with AH type pistons which differ from those used at Shoreham. Although the AH piston skirt type has not experienced failures similar to those seen at Shoreham and elsewhere, it does lack a significant history of operations. With this in mind, PNPP has decided to replace the AH piston skirts with the AE piston skirts. NRC Board Notification 84-152 has reported that the .."AE pistons have accumulated in excess of 6000 hours without failure."

16. Question

What maintenance and/or operating practices have you developed to assure optimum reliability of your diesel generators at your plant?

Response

Since the TDI standby diesel engines at PNPP are not operational and are still in the construction/testing phase, maintenance and/or operating practices are under development. However, maintenance and surveillance procedures developed will be in accordance with the recommendations of the NRC's Board Notification 84-152 and the TDI Owners Group DR/QR program.



17. Question

What surveillance practices in addition to those required by plant technical specifications have you instituted to assure optimum reliability of your diesel generators at your plant.

Response

Since the standby diesel engines at PNPP are not operational, surveillance practices are under development. However, the surveillance requirements specified by the TDI Owners Group DR/QR program will be adhered to.

ATTACHMENT A

PROCUREMENT SPECIFICATION

FOR

DELAVAL DIESEL GENERATORS

SP-562-4549-00