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50-439 Bellefonte Nuclear Plant, Unit 2, Tennessee Valley Au 05000439
AUTH.NAME AUTHOR AFFILIATION
SHELL,R.H. Tennessee Valley Authority
RECIP.NAME RECIPIENT AFFILIATION
ADENSOM,E. Licensing Branch 4

SUBJECT: Forwards response to remaining 831229 questions re TDI emergency diesel generators.Unit 1 insp results & unit 2 insp schedule will be provided by 851101.

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TENNESSEE VALLEY AUTHORITY
CHATTANOOGA, TENNESSEE 37401
400 Chestnut Street Tower II

August 1, 1985

Director of Nuclear Reactor Regulation
Attention: Ms. E. Adensam, Chief
Licensing Branch No. 4
Division of Licensing
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Ms. Adensam:

In the Matter of the Application of) Docket Nos. 50-438
Tennessee Valley Authority) 50-439

Your letter to H. G. Parris, dated December 29, 1983, contained a series of questions that the staff developed regarding Emergency Diesel Generators manufactured by Transamerica Delaval, Inc. TVA responded to a majority of the questions on August 17, 1984. Enclosed is a response to the remaining questions. The unit 1 inspection results and the unit 2 inspection schedule will be provided by November 1, 1985.

If you have any questions concerning this matter, please get in touch with Dennis Terrill at FTS 858-7840.

Very truly yours,

TENNESSEE VALLEY AUTHORITY

R. H. Shell

R. H. Shell
Nuclear Engineer

Sworn to and subscribed before me
this 1st day of August 1985

Paulette D. White
Notary Public
My Commission Expires 8-24-88

Enclosure
cc: U.S. Nuclear Regulatory Commission (Enclosure)
Region II
Attn: Dr. J. Nelson Grace, Regional Administrator
101 Marietta Street, NW, Suite 2900
Atlanta, Georgia 30323

B001
1/1

ENCLOSURE
TVA RESPONSE TO QUESTIONS ON TRANSAMERICA DELAVAL, INCORPORATED (TDI)
DIESEL GENERATORS

Question 3A

Identify the materials used in the design of the diesel generators (DGs) at your plant (specifically limiting components such as crankshafts, camshafts, piston rocker arms, bearing materials, cylinder blocks, cylinder heads, pumps, turbochargers, etc.).

Response 3A

Listed on Attachment A are the DG parts, part numbers, and the materials used in the design of the DG.

Question 11

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 nondestructive 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 11

As a result of the failure of the Shoreham crankshaft, the TDI DG Owners Group (TDI-OG) 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 April 20, 1984, under letter No. TDI-17, on May 24, 1984, under letter No. OGTP-39, and on June 15, 1984, under letter No. OGTP-76.

The FaAA reports recommended torsiograph 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).

To date, TVA has completed inspection of the oil holes in the crankshafts for the unit 1A and 1B DGs and torsiograph testing of the unit 1A DG crankshaft. Results of the inspection are not known at this time. The results will be included in the TDI-OG Design Review/ Quality Revalidation (DR/QR) Report for Bellefonte and forwarded to the NRC by November 1, 1985. Inspection of the unit 2 diesels is unscheduled.

Question 12

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:

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 installations,

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 12

4. The TDI-OG, of which TVA is a member, has developed a program which addresses these questions. The program provides for a component by component comparison of the TVA diesel engine with failure history developed by the TDI-OG for nuclear and non-nuclear diesel engines. This process is described in the TDI-OG Program Plan as the Component Selection Process transmitted to the NRC on March 2, 1984.

5. The TDI-OG has performed an independent design review and has specified quality revalidation requirements for each component as applicable. The results of these reviews have been received by TVA but the inspection results have not been incorporated into the report. TVA anticipates having all inspection results on the unit 1A and 1B DG incorporated into the BLN report by November 1, 1985, at which time the entire DR/QR Report will be forwarded to the NRC. Inspection of the unit 2 diesels is unscheduled.

6. The TDI-OG Program for addressing TDI Emergency Diesel Generator concerns is in two phases. The first phase is complete. This phase addressed 16 possibly generic problems with the TDI diesel engines. A detailed review was performed to identify the cause of these 16 problems and to recommend corrective action. The results of the review identified the need for better installation procedures, component design changes, and periodic component

maintenance and inspection. TVA and the TDI-OG maintain that the resolution of these 16 generic problems will ensure that the TDI DG will perform reliably. As a confirmatory effort, a second phase of the program has been performed to review nearly all the diesel engine components. This phase has identified additional enhancements in engine design, operation, and maintenance to further improve its reliability. Upon implementation of the appropriate second phase enhancements, TVA believes the BLN DGs will be capable of performing their intended function.

Question 14

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 14

The FaAA 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 the 12-inch-diameter bearing shells will not exhibit the same failure mode. The report also analyzed the DSRV-16-4 bearing shells and concluded their acceptability. FaAA was unable to establish that the original bearing shells met design specifications in the area of tensile strength and elongation. The reason for the discrepancy was attributed to the inability to obtain a large enough test specimen of the finished bearing shell. However, tensile and ductile properties of the material were not identified as the root cause of the failure.

The FaAA report recommends radiography of the bearing shells to ensure that casting voids greater than 0.050 inch are not present in the critical areas of the bearing shells. The FaAA report recommends that this inspection be done on a sampling basis.

TVA has inspected the connecting rod bearing shells for unit 1A and 1B diesels and found no voids greater than 0.050 inch. The inspection results will be forwarded to the NRC in the DR/QR report. Inspection of the unit 2A and 2B connecting rod bearing shells is unscheduled.

Question 15

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 inspecton 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 the 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 problems. Are you aware of this and has TDI transmitted this service information to you?

Response 15

The TDI-OG has completed an extensive review of the piston skirt designs utilized in all TDI DGs in nuclear service. FaAA reports FaAA-84-2-14 dated May 1984, FaAA-84-10-30 dated November 1984, and FaAA-84-5-18 dated June 1984, document the reviews of AE, AF, AH, and AN type piston skirts. The Shoreham DGs were orginally furnished with AF type skirts whereas the BLN DGs were furnished with type AH skirts.

In lieu of demonstrating the acceptability of the type AH skirts by performing a 750-hour endurance test, TVA replaced the type AH piston skirts with type AE skirts which were qualified by endurance runs at Shoreham and Catawba.

TVA is aware of the TDI information; however, TVA chose to replace the BLN AH type piston skirts with AE type skirts.

ATTACHMENT A
DIESEL ENGINE MATERIALS
SHEET 1

I. ENGINE PRESSURE OR LOAD BEARING PARTS

GROUP 305	PART NO.	MATERIAL	
Base	02-305-07-AA	ASTM-A48 CL 40	CI
Cap, Bearing	02-305-03-AL (typ)	AISI-C1040 (ASTM-148)	STL
Stud, Bearing Cap	R-3191	AISI 4140	STL
Nut, Bearing Cap	R-3194	ASTM 194 GR2	STL
GROUP 310			
Crankshaft	02-310-08-AE	Steel Forging A668E, of AISI C-1042	
Shell, Bearing	R-3313 (typical)	Alum Alloy B-850 T5	
GROUP 311			
Crankcase	02-311-03-AL	ASTM A48 CL 40	CI
Seal, C'case to Base	JA-046-005	Type E 60C Viton	
Bolt, C'case to Base	97140	AISI 4140	STL
Nut, Lower	97145	AISI 4142	STL
Nut, Upper	02-311-03-AJ	AISI 4142	STL
GROUP 315			
Block, Cylinder	02-315-03-AE	ASTM A48 CL 40	CI
Seal, Block to C'case	JA-046-008	Type E 60C Viton	
Bolt, Cyl. Bl. to C'case	02-315-02-OD	AISI 41L42	
Nut, C.B. to Bolt	97150	ASTM 194 GR2	
Nut, CB to Bolt	02-315-04-AK	ASTM 194 GR2	

ATTACHMENT A
DIESEL ENGINE MATERIALS
SHEET 2

GROUP 316	PART NO.	MATERIAL
Adapter, Water Inlet	02-316-04-AD	A-36 STL
Bracket	02-316-04-AB	A-36 STL
U-Bolt	CK-014-011	Carbon Steel
Pipe Water Inlet	02-316-04-AA	A-53 STL PIPE
Coupling, 6"	CG-019-006 (Dresser)	Carbon Steel
GROUP 317		
Pipe, Cyl. Hd. to Manifold	02-317-14-AH (typ)	ASTM A-587 & A-27
Manifold	02-317-18-AF (typ)	A-181 GR1, A-106, A 53-S
Pipe, Outlet	02-317-18-AD (typ)	A-181 GR1, A 53-S
Gasket	77686	1/16" thick Buna N, Cloth Reinforced
GROUP 340		
Rod, Conn. (Master)	02-340-11-AJ	Forged Steel, A 668-78, AISI A 4142
Box, Conn. Rod	Part of Above	Forged Steel AISI A 4142
Shell, Conn. Rod	02-340-04-AG	Aluminum B750 TS
Rod, Link	02-340-11-AS	Forged Steel AISI A 4142

ATTACHMENT A
DIESEL ENGINE MATERIALS
SHEET 3

GROUP 341	PART NO.	MATERIAL
Piston Crown	03-340-04-AE	Cast Steel ASTM A 148 GR 30/60
Piston Skirt	03-341-02-AH	Nod. Iron ASTM A 536-7
Pin, Piston	R-3019	AISI A 8630, Steel
Stud, Crown	03-341-02-AE	SAE 4140
GROUP 350		
Camshaft	02-350-04-OK	AISI C-1045 Gnd Steel
Cam	02-350-04-OT (typ)	Forged Steel AISI 4815
GROUP 375		
Inlet Manifold	02-375-07-AS	A 53S & A 36
Balance Pipe	02-375-07-AJ (typ)	A 53S & A 36
GROUP 380		
Pipe, Exhaust	02-380-06-OP (typ)	A 53-S
Ring, Seal	JA-012-000	Inconel
GROUP 420		
Shaft, L.O. Pump	02-420-02-OA	AISI C-1018 CS
Casing, L.O. Pump	08-420-04-OQ	ASTM A48 CL 30 CI

ATTACHMENT A
DIESEL ENGINE MATERIALS
SHEET 4

GROUP 425	PART NO.	MATERIAL
Shaft, Water Pump	02-425-03-AF	ASTM 303 St. Stl.
Case, Water Pump	RA-004-001	ASTM A 48 CL 30 CI
Impeller, Water Pump	02-425-03-BB	ASTM A 48 CL 30 CI
GROUP 436		
Pipe, Intercooler In/Out	02-436-14-AA (typ)	A 181 GR1, A 53S, A 106
GROUP 437		
Pipe, Water, Outlet	02-437-15-AA (typ)	A 53S & A 36, A 106
Pipe, Water, Inlet	02-437-15-AG (typ)	A 53 S
GROUP 441		
Manifold, St. Air	02-441-13-AC (typ)	A 53 S & A 35, A 181 GR1
Pipe, Man, to Cyl. Hd.	02-441-15-AC	A 53 S, A 106
Flange, Blind	CL-011-008	A 181 GR1
Strainer Y	SE-007-001	A 216
Valve, Block	KR-001-000	ASTM A 27, C. Stl.
Pipe, Valve to Man.	02-441-14-AH (typ)	A 53S, A 181 GR1
Tubing, Control	CJ-011-011 (typ)	1/4 OD A 269, ASTM 316
STRAINER L.O.		
Special Fabrication	SE-025-000	Carbon Steel A 53

ATTACHMENT A
DIESEL ENGINE MATERIALS
SHEET 5

GROUP 465	PART NO.	MATERIAL	
Flange, Header	CL-025-010	ASTM A 181 GR1 Forged	
Pipe, L.O. Hdr.	02-465-19-AD	A 181 GR1, A 53 S	
Pipe, Str. to Hdr.	02-465-19-AE (typ)	A 106, A 36	
Bracket, Strainer	02-465-21-AJ	A 36	
Valve, Check 6"	F-144-032	Nod. Iron	
Valve, Filter, 3-Way	KL-007-000	A 216	CS
Valve, Check 2"	KE-009-000	A 216	CS
Valve, Check 2-1/2"	KE-017-005	A 445	DI
GROUP 475			
Bracket, Turbo	02-475-21-AG (typ)	ASTM A 36	
Adapter	00-491-01-OX	ASTM A 36	
GROUP 495			
Adapter, Exhaust	00-495-03-AQ (typ)	A 106, A515	

II. FOUNDATION PARTS

GROUP 550		
Sole Plates, Engine	02-550-02-AD (typ)	ASTM A 536 Nod. I
Chock Plates, Engine	02-550-02-AA (typ)	A 36
Anchor Assy., Engine	00-550-02-AG (typ)	A 36, A 194
Anchor Bolt, Engine	00-550-02-AF	AISI 4140
Found. Bolt, Generator	00-550-02-AD	AISI 4140
Nut, Found. Bolt	F-090-065 (typ)	A 194

GROUP 550 (Cont'd)	PART NO.	MATERIAL
Found. Bolt, Aux. Base	00-550-02-AC (typ)	AISI 4140
Found. Bolt, St. Air Rec.	00-550-02-AM	AISI 4140

III. SELECTED PIPING SYSTEM PARTS

GROUP 700

Standpipe	02-700-01-AX	A 252 GR2, A 36

GROUP 717

Rel. Valve, Roll Back	KD-040-00 (typical all valves)	SA 216 WCB
Sub Base	02-717-01-JM	A 36
Pipe, F.O. Inlet	02-717-01-LC (typ)	A 105, A 106
Tube	02-717-01-LY (typ)	A 179
Flange	CL-025-003 (typ)	A 105
U Bolt	Ck-014-004 (typ)	Carbon Steel
Nut	CB-034-004 (typ)	A 194
Flange	CL-001-003 (typ)	A 181 GR1
Gasket	101230 (typ)	1/16" Raybestos K 68
Capscrew	GB-122-099	A 307B
Nut	GB-121-005	A 307B
Support, Piping	02-717-01-VH (typ)	A 105, A 106
Support, Pipe	02-717-01-PW (typ)	A 279
Pipe, J.W.	02-717-01-KD (typ)	A 105, A 106
Pad, J.W. Piping Support	02-717-01-PS	A 36

GROUP 717 (Cont'd)	PART NO.	MATERIAL
Tie Rod	02-717-01-MG (typ)	C.R. Carbon Steel
Nut	GB-034-007	A 194
Support, L.O. Piping	02-717-01-LM (typ)	A 36
Pipe, L.O.	02-717-01-NG (typ)	A 105, A 106
Bracket, Eng. to Sub Base	02-717-01-QG (typ)	A 36
Support, Air Silencer	02-717-01-WY (typ)	A 36
Brace, Lower, Std. Pipe	02-717-01-XB (typ)	A 36, A 106
Brace, Lower, R.B.	02-717-01-XN (typ)	A 36, A 106

IV. ACCESSORIES

GROUP 805

Intake Air Filter	75080-116	Made from Carbon Steel Sheet A36
Intake Air Silencer	75080-117	Made from Carbon Steel Sheet A36
Exhaust Silencer	75080-118	--
Exhaust Expansion Joint	74080-122	321 St. Steel & A 515 Plate
Intake Flex Connection	F-077-020	Buna N or Neoprene

GROUP 810

Jacket Water Cooler	75080-113	Shell = SA 53B Tubes = SA 249 304L ASME Sect VIII Div I
J.W. Keepwarm Pump	75080-112	316 Stainless Steel
J.W. Thermostatic Valve	F-157-202	A48 CL. 40 CI
J.W. K.W. Heater Flange	BD-017-000	A 105

ATTACHMENT A
DIESEL ENGINE MATERIALS
SHEET 8

GROUP 820	PART NO.	MATERIAL
Lube Oil Cooler	75080-111	Shell = SA 53B Tube = SA 249 304L ASME Sect VIII Div I
Aux. L.O. Pump	74080-108	SA 216 WCB
3-Way Valve	75080-127	SA 216 WCB
L.O. Filter, Main	74080-110	SA 285, SA 515
L.O. K.W./Prelube Pump	75080-109	A 216 WCB
L.O. K.W./Prelube Filter	75080-123	--
L.O. K.W./Prelube Strainer	74080-129	SA 285, SA 515
L.O. K.W. Heater Flange	BD-021-000	A 105
GROUP 825		
F.O. Feed Pump	75080-104	SA 216 WCB
F.O. Transfer Pump	75080-105	SA 216 WCB
Check Valve	75080-133	St. Steel SA 351 GR C8 FN
Relief Valve	74080-134	SA 216 WCB
Back Pressure Valve	KD-051-000	SA 216 WCB
Strainer	75080-130	Carbon Steel Case
Valve, Globe	75080-140	St. Steel SA 351 GR C8 FN
GROUP 835		
Skid, Air Comp/Recr.	02-835-01-DK	A 36, A 240
Pipe	02-835-01-CL (typ)	A 105, A 106
Pipe	02-835-01-DL (typ)	A 105, A 106

GROUP 835 (Cont'd)	PART NO.	MATERIAL
Valve, Globe	75080-136	St. Steel SA 351 GR C8 FN
Dryer, St. Air	75080-121	Carbon Steel
Valve, Check	75080-138	St. Steel SA 351 GR C8 FN
Pipe	02-835-01-CM	A 105, A 106
Valve, Globe	75080-137	St. Steel SA 351 GR C8 FN
Valve, Relief	75080-135	SA 216 WCB
Flange Blind 1"	ZG-013-003	A 105
Capscrew	ZG-002-122 (typ)	A 325 or 449
Nut	ZG-001-002 (typ)	A 194 GR 2H
Valve	75080-139	SA 216 WCB
Air Receiver	75080-114	SA 285 GR C, SA 515-70

V. OPERATING PRESSURE AND TEMPERATURES

Fuel Oil System	50-60 psig/100°F
Lube Oil System	70-100 psig/180°F
Jacket Water System	40-50 psig/170°F
Starting Air System	200-275 psig/150°F