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October 17, 1984  
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Office of Nuclear Reactor Regulation  
Attn: D. G. Eisenhut  
Division of Licensing  
U. S. Nuclear Regulatory Commission  
Washington, D.C. 20555

Dear Sir:

Three Mile Island Nuclear Station, Unit 1 (TMI-1)  
Operating License No. DPR-50  
Docket No. 50-289  
Diesel Generator Reliability (G.L. 84-15)

This is in response to Generic Letter 84-15 entitled "Proposed Staff actions to Improve and Maintain Diesel Generator Reliability".

Enclosure 1 describes actions which are being taken by GPUN to reduce the number of diesel generator fast starts to enhance the reliability of TMI-1 diesel generators by minimizing the degradation due to testing.

Enclosure 2 describes TMI-1 diesel generator reliability data including the assumptions which were made in order to qualify data, which was available, for use in determining reliability in accordance with R.G. 1.108. This demonstrates a 100% reliability for the last 20 valid starts of both diesel generators and a reliability of .99 and .98 for diesel generators A and B respectively for the last 100 valid starts. Table 1 provides a time history of the data, which was available, including valid and invalid tests. GPUN is not required to maintain records of diesel generator operational and failure data as outlined in R. G. 1.108 Section C.3.a. Therefore, retrieval of diesel generator start data was complicated by the need to search in different locations. Data entries also lacked the detail which would have permitted a more direct application of R. G. 1.108 valid start and failure criteria. In order to facilitate the monitoring of diesel generator reliability in the future, these records will be maintained as described in Enclosure 4 (GPUN comments on Section 9 of the staff's proposed performance specification).

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Enclosure 3 describes the current GPUN programs for attaining and maintaining the reliability of TMI-1 diesel generators at a high level of performance. Table 2 lists tasks performed during diesel generator routine maintenance and annual overhaul.

Enclosure 4 provides GPUN comments on the proposed performance specification. Included are commitments for improved record keeping and reliability monitoring.

GPUN disagrees with any performance standard which would require unnecessary challenges to emergency diesel generator equipment. After the cause for a failure has been identified and remedied, appropriate tests to verify the adequacy of repairs would depend on the failure mode and type of corrective action taken. Further testing to generate a required number of satisfactory starts to raise the reliability statistics in some instances could be counterproductive.

GPUN asserts that high reliability can be achieved through the use of good preventive and corrective maintenance practices, by following the manufacturer's recommendations for maintenance and operation, and not through excessive mandatory test programs following a failure. As a result of meeting the objectives of a good maintenance program, the reliability data obtained from surveillance testing should continue to demonstrate high reliability.

Sincerely,

H. D. Hukill  
Director, TMI-1

HDH:MRK:vjf

Enclosures

cc: R. Conte, NRC Resident Inspector

Sworn and subscribed before me this ~~17th~~ day of October, 1984.

Darla Jean Berry  
Notary Public

My commission expires June 17, 1985.

DARLA JEAN BERRY, NOTARY PUBLIC  
MIDDLETOWN BORO. DAUPHIN COUNTY  
MY COMMISSION EXPIRES JUNE 17, 1985

Item 1. Reduction in Number of Cold Fast Start  
Surveillance Tests for Diesel Generators

GPUN's diesel generator surveillance programs for TMI-1 has recognized the potential degradation effects of cold fast starts for a long time. TMI-1 Technical Specifications Section 4.5.1.1 requires that we perform cold fast starts every refueling interval to verify operability of the emergency sequence and automatic transfer (Surveillance Procedure 1303-11.10). Other planned tests or routine diesel starts follow the manufacturer's recommendations for pre-lube and warming in preparation for starting the diesels.

Surveillance procedures currently require a number of fast starts after warming. In an effort to improve diesel generator reliability by reducing the number of hot fast starts during routine surveillance performances, the following procedures are being modified as indicated:

- I. SP 1303-5.2 (Quarterly): Diesels A & B are pre-lubed and warmed prior to fast start by ESAS signal initiation. Both the A and B diesels are started 6 (six) times automatically and 2 (two) times manually. Procedure 1303-5.2 is being revised to reduce the number of automatic fast starts from 6 to 2 for each diesel.
- II. SP 1303-11.10 (Each Refueling): Diesels A and B are cold fast started 1 (one) time each. Each diesel is also fast started 2 (two) additional times to verify undervoltage relay contacts. Procedure 1303-11.10 is being modified to delete the two additional fast starts for each diesel generator.

The above procedure changes are to economize the number of diesel generator fast starts without compromising the effectiveness of either test procedure and without amending the TMI-1 Technical Specifications. On a yearly basis including refueling this will reduce the number of diesel generator (hot) fast starts by eighteen for each diesel.

TMI-1 Technical Specifications do not require tests of the emergency diesels for emergency cooling system operability. Therefore, changes to TMI-1 Technical Specifications are not needed.

Item 2. DIESEL GENERATOR RELIABILITY DATA

The reliability of the diesel generators at TMI-1 is shown below:

DG	FOR LAST 20 TESTS		FOR LAST 100 TESTS	
	# OF FAILURES	RELIABILITY	# OF FAILURES	RELIABILITY
A	0	1.0	1	.99
B	0	1.0	2	.98

The above results are based on the attached data, Table 1. These data were obtained from the following TMI-1 documents:

1. Control room operator log books.
2. Licensee Event Reports (LERs)
3. Technical Specification Completed Surveillance Procedures
4. Maintenance Computer Records of Diesel Repairs.

Table 1 lists both valid and invalid tests. Tests were not considered valid tests or failures where the diesels were successfully started, and then the tests were terminated intentionally without loading for less than one hour. Invalid tests are unnumbered and indicated by NA in the first column. Tests which were judged to be terminated intentionally before the completion of the one hour load tests because of a significant failure that would have prevented the diesels from operating during an actual emergency were considered to be valid failures. Start No. 77 on the 'A' diesel and starts No. 53 and 84 on the 'B' diesel were considered valid failures. If, however, the tests were aborted for reasons that were judged insignificant (i.e., would not prevent the diesel from operating during an actual emergency), the tests were considered to be invalid and hence were not counted as failures.

We believe that these definitions of valid and invalid tests agree with Regulatory Guide (R.G.) 1.108 criteria. The only exception to R.G. 1.108 is that a few tests, terminated after only 55 minutes for no apparent reason, were considered to be valid successful tests.

Item 3. DIESEL GENERATOR RELIABILITY

As indicated in the response to Item 2, Diesel Generator Reliability Data, the reliability of TMI-1 diesel generators is above the industry median value of 0.98/demand at 0.985/demand (average reliability for the last 100 test runs) and is significantly above 0.95/demand set by the NRC staff in the proposed resolution of USI A-44, as a minimum desired level.

This excellent record has been achieved with a preventive maintenance and annual overhaul program which consists of task items listed in Table 2. This work is included in our procedures and is consistent with the vendor's (Fairbanks Morse) recommendations.

NUREG/CR 0660 "Enhancement of On-Site Emergency Diesel Generator Reliability", February 1979 was reviewed for applicability to the diesel generator units at TMI-1. As indicated in our reliability data, we have not been subject to the failures that have occurred at other facilities. In the few instances of failures we have observed, "root causes" were vigorously pursued, corrected, and reported as required. Items that are planned for the TMI-1 diesel generators as recommended in NUREG/CR 0660 are:

- (1) Inspection of the air start system for corrosion degradation since we do not have air dryers. Installation of air dryers is under consideration.
- (2) Installation of additional generator protection to prevent damage in the event of fault occurrences. Relays have been maintained periodically, resulting in good reliability.
- (3) Other hardware modifications and practices recommended in Task V of NUREG/CR 0660 are being considered for implementation to maintain or improve the good reliability we now have.

Nuclear Safety Analysis Center (NSAC/79) "A Limited Performance Review of Fairbanks Morse and General Motors Diesel Generators at Nuclear Plants", April, 1984 was reviewed for applicability to TMI-1 diesel generators. The conclusions of this review: (1) implementing a well documented comprehensive, preventive maintenance program, (2) prelubing of the main bearings and turbocharger bearings, and (3) continuously heating the lubricating oil and cooling water, have been in effect at TMI-1 and have contributed to our good reliability record.

GPUN Comments on the NRC Staff's Example of Diesel Generator Performance  
Technical Specification

- Para. 1 A reliability of 0.95 per demand or greater is considered to be reasonable and achievable under present unit designs and operational conditions.
- Para. 2 Surveillance testing as included in the TMI-1 Technical Specification and summarized above does not include accelerated testing as a function of reliability degradation. Present maintenance procedures and/or practices require that repairs as a result of failures be tested sufficiently to ensure reliability of the diesel generators. "Root cause" investigations are carried out so that "permanent" modifications are accomplished as appropriate. It is these root causes that should be the determinate of any accelerated surveillance test program based on unique situations or case by case determinations. For example, heat exchanger failures are usually of a long term nature and are usually replaced by heat exchangers which have been tested by the vendor. Heat exchanger designs chosen will have accumulated many hours of operation in the field. Accelerated testing of the whole unit in this case, as suggested by the NRC staff would not be beneficial beyond the check-out test runs.
- Para. 3 Accelerated surveillance test frequency should be determined on a case by case basis as indicated in 2.0 above.
- Para. 4 Should the number of failures of a diesel generator system reach:

<u>Failures</u>	<u>Valid Tests</u>
3	20
6	100

the following remedial action by GPUN is planned:

- 4.1 The above limiting failure criteria would be detected by our Plant Analysis Group which plans to maintain reliability records for the DG units.
- 4.2 Plant Analysis would notify Technical Functions, Plant Engineering, and Plant Maintenance through their existing monthly reports, if the above failure criteria were met or exceeded.
- 4.3 Technical Functions, Plant Engineering, and Plant Maintenance would analyze the DG records as necessary for any modes of failure which may have occurred and determine any additional action that may be required. A report would be prepared to assess the DG unit in question and address the program required for the unit to attain the minimum desired reliability of 0.95/demand. This reliability improvement program plan would be available for NRC review.



4.4 A yearly data report will not be submitted. The reliability records maintained by Plant Analysis will be available at any time for NRC audit.

Para. 5 Should the number of failures of a diesel generator system reach:

<u>Failures</u>	<u>Valid Tests</u>
5	20
11	100

the following disqualification and requalification criteria would be used:

5.1 Disqualification should be determined upon a review by GPUN of the failure mode(s), repairs, and/or modifications implemented. This review would include the report described in 4.3 above.

5.2 Requalification should be determined upon a review by GPUN of the failure mode(s), and repairs, and/or modifications implemented. This review would include the report described in 4.3 above.

Para. 6 Should a requalification program fail, the unit would be declared inoperable and the action statement for one DG inoperable should be followed in accordance with T.S.

Para. 7 TMI-1 Technical Specifications allows 7 days of reactor operation with one DG out of service, not 72 hours. GPUN is opposed to placing an annual limit on the total accumulative time that a plant may operate with one D.G. inoperable. A yearly or annual limit would not, in our case, provide the flexibility for inspection, maintenance and overhaul.

Para. 8 The definitions of valid demands and failures in Regulatory Guide (R.G.) 1.108, C.2.e are concurred with unless specified otherwise.

Para. 9 Records of DG operational and failure data will be in compliance with R.G. 1.108 Section 3.a. DG operation and operational surveillance procedures will be modified to include a data sheet for operations personnel to fill out. This form will include items referred to in R.G. 1.108 Section 3.a. This data sheet will be transmitted by operations to Plant Analysis. Plant Analysis will maintain a continuous reliability record and publish it as part of their monthly performance report.

Reports of DG unit failures would be in accordance with R.G. 1.108 Section 3.a and Attachment 1 to Table 4.8-2 should the reliability of a unit fall to levels given in above table. These reports would be available at any time for NRC audit.

Rather than an annual data report submittal, GPUN recommends that NRC review of diesel generator reliability and reliability improvement program reports could be more efficiently done at the site by NRC Region 1.

TABLE 1

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## 1A EMERGENCY DIESEL GENERATOR START DATA

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START NO.	DATE	TIME	CAUSE (See Note 3)	GENERATOR TIME LOADED	COMMENTS
1	07/29/84	0135	1303-4.16	0150-0255 1 hour	
2	06/30/84	2057	1303-4.16	1 hour	
3	05/31/84	0324	1303-4.16	0346-0457	
NA	05/25/84	1150	1303-11.10	10 min.	
NA	05/25/84	1126	1303-11.10	20 min.	
NA	05/23/84	1615	1303-5.2	Data Sheet 4.16 1420-1440	8 starts were logged for 1303-5.2 also, unloaded only. Return to service after 1303-5.2
NA	05/23/84	0851	1303-5.2	15 min.	Output breaker test, ran at 2.0 MW prior to 1303-5.2
4	04/30/84	0040	1303-4.16	0050-0150 1 hour	
NA	04/18/84	0505	--	5 min.	Test of agastat timer relay
NA	04/10/84	0432	--	15 min.	Test of agastat timer relay
5	04/01/84	0056	1303-4.16	0110-0210	
6	03/01/84	0255	1303-4.16	Data Sh. Time 0223-0330	
7	01/31/84	0018	1303-4.16	0027-0138	
8	01/01/84	0230	1303-4.16	0305-0410	
NA	12/09/83	1028	1303-5.1		Partial E.S. Actuation During Testing
9	11/30/83	0205	1303-4.16	0205-0305	
10	11/04/83	1120	*	1200-2049	*Yearly test after maintenance
11	11/03/83	1401	*	1430-0555(11/04/83)	*Yearly test after maintenance - shutdown due to cracked fuel return tube to day tank.
NA	11/03/83	1023	--		Test after maintenance
12	10/25/83	0837	1303-4.16	0850-0950	
13	10/01/83	0110	1303-4.16	0118-0220	
14	09/24/83	1300		1323-1425	
15	09/23/83	1405	--	1 hour	CRO Log
NA	09/16/83	*	1303-11.10	0354-0457	3 starts for this diesel
16	09/01/83	0354	1303-4.16	1 hour	



TABLE 1

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## 1A EMERGENCY DIESEL GENERATOR START DATA

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START NO.	DATE	TIME	CAUSE (See Note 3)	GENERATOR TIME LOADED	COMMENTS
17	08/23/83	0445	--	>1 hour	Eng. hours 739.1-740.5, Data sheets for 1303-4.16 completed
NA	08/16/83	1613	--		Test run for training. Engine-hours 737.5-737.9 1303-4.16 data taken
18	08/12/83	1900	1303-4.16	1905-2010	
NA	08/12/83	--	--	0640-0710	Loaded to 2MW
NA	08/08/83	0933	*		*Diesel loaded onto bus due to Bus 4 loss (2 hours) of Power
19	08/02/83	CRO Log 1003	1303-4.16	1001-1107	
NA	08/01/83	0259	--	.9 hour	
20	07/19/83	0957	--	1 hour	
21	06/29/83	0415	1303-4.16	0430-0530	
22	06/07/83	--	1303-4.16	1235-1333	
NA	06/07/83		1302-5.30		Requires 3 starts for each diesel
23	06/01/83	0307	1303-4.16	0315-0420	
24	05/18/83	1418	*	1418-1519	Ran for Maintenance Department 1303-4.16
25	04/30/83	0240	1303-4.16	0240-0340	
26	04/01/83	0020	1303-4.16	0020-0123	
27	03/05/83	2123	1303-4.16	2123-2225	
28	01/29/83	0205	1303-4.16	0205-0311	
29	12/30/82	0245	1303-4.16	0245-0315 1330-1430	
30	11/29/82	1215	1303-4.16	1 hour	
NA	11/28/82	* 1330	--	--	Relief valve on jacket coolant lifted, gov. problems.
NA	11/26/82	1242	--	1242-1249	Relief valve on jacket coolant lifted, gov. problems.
31	11/19/82	CRO Log 0815	1303-4.16	0813-0915 0133-0233	
32	11/14/82	0125	1303-4.16	1 hour	
33	10/19/82		1303-4.16	0911 10/19/82 to 0918 10/20/82	24 hour test run

TABLE 1

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## 1A EMERGENCY DIESEL GENERATOR START DATA

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START NO.	DATE	TIME	CAUSE (See Note 3)	GENERATOR TIME LOADED	COMMENTS
NA	10/19/82	0858	--	3 min.	
34	10/12/82	0808	1303-4.16	0808-0911	
35	09/14/82	0056	1303-4.16	0056-0159	
36	08/12/82	0232	1303-4.16	0232-0334	
37	07/09/82	0357	1303-4.16	0357-0510	
38	06/19/82	1355	1303-4.16	1355-1500	
NA	06/19/82	1317	1303-4.16	1317-1329	Fuel oil leak (Note 1)
39	05/22/82	2109	--	1 hour	
40	05/13/82	CRO Log 0007	1303-4.16	0000-0120	
41	04/13/82	CRO Log 0350	1303-4.16	0347-0455	
NA	04/07/82	1421	--	19 min.	
42	03/13/82	0344	1303-4.16	0344-0446	
43	02/13/82	0310	1303-4.16	0322-0424	
44	01/13/82	0200	1303-4.16	0207-0308 0210-0310	
45	12/13/81	0210	1303-4.16	1 hour	
46	11/07/81	0930	1301-8.2	1045 11/07/81 to 1145 11/08/81	24 hour test run
47	11/03/81	0811	1303-4.16	0811-0941	
48	10/13/81	1006	1303-4.16	1006-1116	
49	09/30/81	1330	1303-4.16	1335-1435	
50	09/13/81	0415	1303-4.16	0415-0515	
NA	09/05/81	1058	1303-11.10		
51	09/04/81	1900	1303-4.16	1900-2020	
52	09/01/81	2125	1303-4.16	2130-2230	
53	09/01/81	0542	1303-4.16	0542-0642	

TABLE 1  
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1A EMERGENCY DIESEL GENERATOR START DATA

START NO.	DATE	TIME	CAUSE (See Note 3)	GENERATOR TIME LOADED	COMMENTS
54	08/13/81	0115	1303-4.16	0115-0220	
55	07/21/81	2008	1303-4.16	2010-2110 1809-1841 32 min.	
NA	07/21/81	1806	--		
NA	07/19/81	1608	--	1615-1620	
NA	07/14/81	0255	1303-4.16	0255-0306	
56	06/18/81	0115	1303-4.16	0120-0219	
57	06/03/81	1610	1303-4.16	1610-1718	
NA	06/03/81	1510	1302-5.30	1510-1512	at 1MW
NA	06/03/81	1502		1502-1503	
NA	06/03/81	1452	1302-5.30	1452-1458	at 1MW
58	05/28/81	2150	1301-8.2	2315 05/28/81 to 2316 05/29/81	24 hour load test
59	05/28/81	0925	1303-4.16	0925-1038	
NA	05/26/81	1200	Maint.	1200-1210	Balancing D.C.
NA	05/26/81	1050	1303-4.16	1050-1055	
NA	05/22/81	1033		1033-1104	
NA	05/22/81	0521		0521-0607	
NA	05/21/81			0638-0643	
NA	05/21/81			0605-0611	
NA	05/21/81			0453-0529	
60	05/20/81	2015	1303-4.16	2021-2125	
61	05/20/81	1632		1641-1910	
NA	05/20/81	0955			
NA	05/20/81	0845		0845-0904	
NA	05/20/81	0823		0823-0838	

TABLE 1

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## 1A EMERGENCY DIESEL GENERATOR START DATA

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START NO.	DATE	TIME	CAUSE (See Note 3)	GENERATOR TIME LOADED	COMMENTS
NA	05/20/81			0807-0820	
NA	05/20/81			0754-0800	For thrust bearing run in
62	05/05/81	1440		1445-1607	
NA	04/15/81			1308-1400	
63	04/13/81	0055	1303-4.16	0105-0208	
64	04/03/81			1750-1900	
65	03/09/81		1303-4.16	0102-0214	
NA	02/19/81		1303-4.16	0140-0153	
66	02/12/81	0216	1303-4.16	0225-0326	
67	01/13/81		1303-4.16	0450-0550	
68	12/14/80		1303-4.16	0240-0350	
69	11/14/80	1131	1303-4.16	1131-1239	
70	10/13/80		1303-4.16	0635-0140	
71	09/30/80	1728	1303-4.16	1735-1835	
NA	09/24/80		1303-4.16	0910-1000	
72	09/08/80	0853	1303-4.16 Data Sheet	0919-1030	
73	08/30/80		1303-4.16		1 hour loaded
NA	08/23/80	1120		1120-1135	
74	08/23/80	1240	1303-4.16	1240-1345	
75	08/13/80		1303-4.16	0227-0327	
76	07/13/80	0156	1303-4.16	0204-0304	
NA	07/08/80	2128		2137-2157	
NA	07/08/80		1303-4.16	1347-1402	
NA	06/27/80	0901			Z.S. Actuation started diesel, due to inverter problem
NA	06/12/80	1557		-1612	Local start PLR 1107-3
77	06/12/80	1726			1826 secured due to no voltage control (FAILURE)



TABLE 1

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## 1A EMERGENCY DIESEL GENERATOR START DATA

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START NO.	DATE	TIME	CAUSE (See Note 3)	GENERATOR TIME LOADED	COMMENTS
78	06/12/80		1303-4.16	2040-2240	
79	04/21/80	1025	1301-8.2 1303-4.16	1110-1210	Annual inspection
80	04/14/80		1303-4.16	0129-0245	
81	03/13/80	0113	1303-4.16	0120-0220	
82	02/13/80	0230	1303-4.16	0230-0331	
83	01/13/80	0301	1303-4.16	0301-0404	
84	12/17/79	0242	1303-4.16	0252-0352	
85	11/12/79	0312	1303-4.16	0312-0419	
86	11/10/79	1750	1303-4.16	1753-1859	Fast start, load to 3MW to prove operable
NA	11/09/79	2226			Started up to 900 RPM - no load
87	10/09/79	2220	SQP 1-79-60	2230 10/09/79 to 2234 10/10/79	SQP 1-79-60 24 hour test Tripped off during 24 hour run, governor linkage came off. Ran successfully > 1 hour.
88	10/09/79		1303-4.16	0840-1902	
89	09/13/79		1303-4.16	0513-0614	
90	08/12/79	0218	1303-4.16	0218-0318	
91	07/13/79	0817	1303-4.16	0817-0922	
92	06/13/79	0138	1303-4.16	0138-0241	
93	05/13/79		1303-4.16	0151-0251	Loaded
94	05/01/79	1045	1303-4.16	1045-1149	Declared operable after change modification work
95	04/12/79	0156	1303-4.16	0156-0258	
NA	03/23/79	1331		1331-1350	Loaded to 02.9 MW
96	03/17/79		1303-4.16	1315-1418	
97	03/15/79		1303-4.16	1515-1615	
98	03/05/79		1303-4.16	0218-0318	
NA	02/17/79	0925		1048-1140	
99	02/14/79		1303-4.16	0025-0127	





TABLE 1

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## 1B EMERGENCY DIESEL GENERATOR START DATA

Page 1 of 8

START NO.	DATE	TIME	CAUSE (See Note 3)	GENERATOR TIME LOADED	COMMENTS
1	07/29/84	0055	1303-4.16	0110-0214	
2	07/01/84	0120	1303-4.16	0137-0241	
3	06/28/84	1755	1303-4.16	1755-1856	
NA	06/03/84				Auto start due to ES testing LER-84-002
4	06/01/84	0220	1303-4.16	0312-0427	
NA	05/25/84		1303-11.10 Data Sheet	* 1655-1848	* Loaded > 5 min., 3 times for 1303-11.10 20 min. at 3 MW - post maint. test after oil filter leak repair
NA	05/24/84	1741	1303-4.16	1741-1802	
NA	05/24/84	1215		NO	10 minute run unloaded
NA	05/23/84	2240	1303-5.2*	2240-2300	*Return to service after 1303-5.2
NA	05/23/84	CRO Log 1625	1303-4.16	1430-1450 2245-2345	20 min. at 2 MW for 1303-5.2 (1303-5.2 requires 9 starts each diesel)
5	05/20/84	2226	1303-4.16	1 hour	
6	05/01/84	0515	1303-4.16	0530-0630 1.0 hour	
NA	04/09/84	0413		3 min.	
NA	04/09/84	0338		14 min.	Ran for post maint. test BA 412329
7	04/02/84	0038	1303-4.16	0118-0228	
8	02/29/84	0140	1303-4.16	0147-0256	
9	02/01/84	0030	1303-4.16	0042-0151	
10	01/01/84	0438	1303-4.16	0435-0545	
11	12/01/83	0128	1303-4.16	0138-0250	
12	11/17/83	0850	*	Loaded 0900 11/17/83 Unloaded 0910 11/18/83	*24 hour test 1301-8.2
13	11/15/83		Data Sheet 1303-4.16	1356-1810	24 hour test try
14	11/15/83		1303-4.16	1145-1310	24 hour test try
NA	11/04/83	1320	Data Sheet 1303-4.16	1335-1430	
15	11/01/83		1303-4.16	0101-0207	
16	10/02/83	0014	1303-4.16	0014-0118	

TABLE 1

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## 1B EMERGENCY DIESEL GENERATOR START DATA

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START NO.	DATE	TIME	CAUSE (See Note 3)	GENERATOR TIME LOADED	COMMENTS
NA	09/22/83	0900			
NA	09/16/83		1303-11.10 Data Sheet		LER 83-027, 3 starts for 1303-11.10
17	09/12/83	1738	1303-4.16	1738-1740	Engine hours on log sheet shows 87.6-88.6 run time
18	09/01/83	0423		0423-0526	
NA	08/17/83	1640	1303-4.16	20 min.	
19	08/17/83	0610		1 hour 20 min.	Lineup for E.S. Standby
20	08/11/83	1117	1303-4.16 Data Sheet	1130-1231	Initially had fuel oil leak, ran 2 minutes engine hours (80.9-82.7)
NA	08/09/83	0850	1303-4.16	NO	Fuel oil leak (Note 1)
NA	09/08/83	0528			Check for fuel injector leaks
21	08/01/83	0510		0522-0622	
A	07/17/83	1820		14 min.	
22	06/30/83	0026	1303-4.16	0035-0136	
23	06/22/83	1305	1303-4.16	1305-1405	
NA	06/22/83	1156	1302-5.30 1107-3	24 min.	1 MWe
NA	06/22/83		1302-5.30	1103-1115	
24	06/01/83	0045	1303-4.16	0055-0200	
25	05/31/83	0955	*	0950-1050	*Started for electricians, filled in 1303-4.16 Data Sheets
26	05/28/83	1145	1303-4.16	1 hour	
27	05/27/83	0955	*	1 hour + later 25 min.	*for maint. balancing
NA	05/24/83	1322	*	31 min.	*for vibration checks
NA	05/24/83	1120	*	21 min.	*for vibration checks
NA	05/24/83	0937	*	52 min.	*for vibration checks
NA	05/20/83	1144	*	1144-1200	*Loaded to 3 MWe for Maint. Dept.
NA	05/19/83	1327	1303-4.16	1327-1400	
NA	05/18/83	1241	*	34 min.	Loaded to 3 MWe for Maint. Dept.

TABLE 1

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START NO.	DATE	TIME	CAUSE (See Note 3)	GENERATOR TIME LOADED	COMMENTS
28	05/12/83	1140	Data sheet 1303-4.16	1152-1330	
29	05/11/83	1405	Data sheet 1303-4.16	1407-1510	
30	05/01/83	0228	1303-4.16	0244-0345	
31	04/01/83	0226	1303-4.16	0234-0335	
32	03/01/83	0442	1303-4.16	0442-0516	
NA	03/01/83	0422	1303-4.16	*	*ran 14 minutes, developed an oil leak (Note 1)
33	01/29/83	0219	1303-4.16	0219-0323	
34	12/29/82	0030	1303-4.16	0030-0130	
35	11/30/82	1950	1303-4.16	2015-2115	
NA	11/25/82	0445		0445-0450	Shutdown - jacket coolant relief valve lifted (Note 1)
36	11/22/82	0757	1303-4.16	1 hour	
37	11/13/82	0239	1303-4.16	0239-0343	
NA	11/05/82	0945		27 min.	
38	11/03/82	1015	1303-4.16	1030-1410	
NA	10/29/82	1445	301-8.2		
39	10/28/82		1303-4.16	1317-1648	
40	10/27/82	1248		4 hours	F.O. Leak (Note 1)
NA	10/27/82	1003		27 min.	F.O. nozzle problem (Note 1)
41	10/21/82	0851	1303-4.16	0855-1000	
42	09/28/82	1025	1303-4.16	1025-1155	Manual surv. form
NA	09/27/82	2117	1303-4.16	2117-2137	
43	09/27/82	1940	1303-4.16	1940-2037	Only 57 min.
NA	09/27/82	1620	1303-4.16	1620-1650	
NA	09/27/82	1436	1303-4.16	1436-1510	

TABLE 1

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## 1B. EMERGENCY DIESEL GENERATOR START DATA

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START NO.	DATE	TIME	CAUSE (See Note 3)	GENERATOR TIME LOADED	COMMENTS
NA	09/27/82	1322		1322-1359	
44	09/27/82	1118		1118-1300	For Maint. Dept.
45	09/23/82	1130	1303-4.16	1130-1235	
46	09/12/82	0450	1303-4.16	0455-0600	
47	08/13/82	0047	1303-4.16	1 hr. 0047-0149	
48	07/09/82	0408	1303-4.16	0408-0521	
49	06/12/83	1331	1303-4.16	1331-1434	
NA	03/19/82	1405	1303-4.16 Data Sheet	7 min.	
NA	03/03/82	1118	1303-4.16	4 min.	Smoking on diesel (Note 1, Note 2)
50	02/26/82	1352		1352-1454	
51	02/26/82	1147		1147-1354	
52	02/26/82	0820		0820-0935	
NA	02/25/82	1457	1303-4.16	1457-1503	
NA	02/25/82	1305		1305-1400	
NA	02/25/82	1130		1130-1145	
NA	02/25/82	1050		1050-1110	
NA	02/25/82	1000		1000-1030	
NA	02/25/82	0814		0814-0855	
NA	02/24/82	1430		1430-1455	
NA	02/24/82	1330		1330-1408	
NA	02/24/82	1115		1115-1137	
NA	02/24/82	0955		0955-1035	
NA	02/24/82	0857		0857-0910	
NA	02/22/82	0853		0853-0947	



TABLE 1

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## 1B EMERGENCY DIESEL GENERATOR START DATA

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START NO.	DATE	TIME	CAUSE (See Note 3)	GENERATOR TIME LOADED	COMMENTS
53	02/11/82	1423	1303- 16	1423-1450	Breaker tripped open (FAILURE)
NA	02/11/82	1019	1303-4.16	1019-1046	For Maint. Dept.
NA	12/02/81	1040		1055-1110	
54	11/24/81	0855	1303-4.16	0855-1055	
55	11/23/81		1303-4.16	1401-1547	
56	11/21/81	505	1303-4.16 & 1301-3.2	1505 11/21/81 to 1754 11/22/81	24 hour run
NA	11/21/81	0300		0300-0325	
NA	11/21/81	0150		0150-0215	
NA	11/21/81	0105		0105-0130	
NA	11/20/81	2203		2203-2230	
NA	11/20/81	1953		2006-2044	For balancing Loaded and unloaded listed in Log, not specific about starts
NA	11/20/81	1600		1617-1658	For balancing Loaded and unloaded listed in Log, not specific about starts
NA	11/20/81			1334-1343	For balancing Loaded and unloaded listed in Log, not specific about starts
NA	11/20/81			1303-1308	For balancing Loaded and unloaded listed in Log, not specific about starts
NA	11/20/81		1303-4.16	1139-1149	For balancing Loaded and unloaded listed in Log, not specific about starts
NA	11/20/81		1303-4.16	1051-1133	For balancing Loaded and unloaded listed in Log, not specific about starts
57	11/20/81		1303-4.16	0830-1000	
58	10/06/81	1106		1114-1217	
NA	10/02/81		Data Sheet 1303-4.16	1847-1858	
59	10/02/82	1332	1303-4.16	1336-1436	
60	09/12/81		1303-4.16	0430-0531	
61	09/02/81	1847	1303-4.16	1854-1959	For operability after performing 1303-5.2
62	09/02/81		1303-4.16	0530-0658	
63	08/07/81	2207	1303-4.16	2216-2315	
64	07/17/81	2115	1303-4.16	2127-2227	

TABLE 1

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## 1B EMERGENCY DIESEL GENERATOR START DATA

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START NO.	DATE	TIME	CAUSE (See Note 3)	GENERATOR TIME LOADED	COMMENTS
NA	07/16/81		1303-4.16	0310-0321	F.O. Leak (Note 1)
NA	07/13/81		1303-4.16 & 1301-8.2	0426-0430 0725 (4/81) to 0829 (5/81)	Injector Leak (Note 1) 24 hour test
65	06/24/81	0715			
NA	06/24/81	0600	1301-8.2	0604-0645	
NA	06/20/81		1303-4.16	2045-2115	
NA	06/20/81		1303-4.16	1830-1915	
NA	06/19/81			2125-2135	
NA	06/19/81			1900-1905	
NA	06/19/81			1833-1837	
66	06/19/81		1303-4.16	1707-1810	
67	06/18/81		1303-4.16	1920-2045	
NA	06/03/81				1843-1905 No evidence of loading of generator
68	05/13/81		1303-4.16	0125-0226	
69	05/04/81		1303-4.16	0925-1150	
70	04/28/81	1800	1303-4.16	1816-1923	
NA	04/28/81	1615	1303-4.16	1627-1705	
71	04/13/81	0232	1303-4.16	0232-0427	Signed off as Sat. but with F.O. level low.
72	03/12/81		1303-4.16	0145-0300	
NA	02/27/81			1327-1335	Auto start due to loss of power
NA	02/19/81		1303-4.16	0205-0218	
73	02/13/81	0340	1303-4.16	0348-0519	
NA	02/13/81	0245	1303-4.16	0309-0323	Fire on manifold (Note 1, Note 2)
74	02/09/81		1303-4.16	1020-1140	
75	02/02/81		1303-4.16	1013-1212	

TABLE 1

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## 1B EMERGENCY DIESEL GENERATOR START DATA

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START NO.	DATE	TIME	CAUSE (See Note 3)	GENERATOR TIME LOADED	COMMENTS
NA	01/30/81		1303-4.16	2012-2021	
NA	01/30/81		1303-4.16	1942-1949	
NA	01/30/81		1503-4.16	1915-1922	
76	01/20/81	1335	1303-4.16	1335-1515	
77	01/14/81	0845	*1303-4.16	0845-1018	*Annual surveillance
NA	01/13/81	1400	1301-8.2 and 1303-4.16	1436-1446	Tripped manually by A.O.
78	12/13/80	0100	1307-4.16	1312-1421	
79	11/13/80	0124	1303-4.16	0124-0224	
80	10/13/80		1303-4.16	0031-0136	
81	09/13/80	0300	1303-4.16	0308-0411	
82	08/30/80	1717	1303-4.16	1726-1847	
NA	08/22/80	0931			S/D 0947, does not specifically state if loaded
NA	08/22/80	0530			Ran, had tach. problems, placed in standby
NA	08/21/80				At time 1435 listed as at 3 MW
83	08/21/80	0921		At 3 MW 1050-1154	0942 loaded to 1 MW
NA	08/20/80	1425		*	*Tripped at 1435 due to no governor control - Troubleshooting
NA	08/20/80	1413		*	*Tripped at 1416 due to no governor control - Troubleshooting
NA	08/20/80	1400		*	*Tripped at 1407 due to no governor control - Troubleshooting
84	08/20/80	1338		*	*Tripped at 1350 due to no governor control (FAILURE)
NA	07/09/80		1303-4.16	0022-0030	
85	07/07/80		1303-4.16	0040-0140	
86	06/12/80	0343	1303-4.16	0343-0449	
87	05/13/80	0228	1303-4.16	0255-0756	
NA	05/13/80	0125	1303-4.16	0135-0155	Flashing of oil on exhaust manifold (Note 1, Note 2)

TABLE 1

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## 1B EMERGENCY DIESEL GENERATOR START DATA

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START NO.	DATE	TIME	CAUSE (See Note 3)	GENERATOR TIME LOADED	COMMENTS
88	04/14/80		1303-4.16	0006-0112	
89	04/11/80	1224		1314-1435	Op. check for cooling water leaks (at 3 MW)
90	04/09/80		1303-4.16	1001-1107	
NA	03/25/80	1608*	1302-5.30		*Time that 1302-5.30 was complete
91	03/21/80	0909	1303-4.16	0909-1023	
NA	03/19/80	1550*	1302 5.30		*Time that 1302-5.30 was complete
92	03/13/80	0245	1303-4.16	0250-0350	
93	02/11/80	1835	1303-4.16	1845-1947	
94	01/17/80	2040	1303-4.16	2040-2143	
95	01/12/80		1303-4.16	1330-1430	
NA	01/11/80	2039	1303-4.16	2039-2047	Shutdown due to exhaust manifold fire (Note 1, Note 2)
96	12/21/79	1906	Data Sheet 1303-4.16	1906-2008	Loaded to 3 MW
97	12/17/79	0431	1303-4.16	0445-0547	
98	11/12/79	0451	1303-4.16	0451-0552	*Fast start and load to prove operability (loaded to 3 MW)
99	11/10/79	1555	*	1557-1658	*Started, ran up to 900 rpm only
NA	11/09/79	2210	*	(11/03/79) 1452 to (11/03/79) 1513	*24 hour run at 3 MW
100	11/03/79		*		

TABLE 1

Notes

1. It has always been the philosophy to shut down the diesel immediately, even for minor problems and take corrective action before continuing. There were no requirements to make an assessment as to whether or not the diesel would have been able to fulfill its function if there had been a need to continue diesel generator operation. In almost every case, tachometer problems, a leaking fuel oil return tube, fuel injector leak, jacket coolant relief valve lift, or smoking or flashing at the exhaust manifold would not be serious enough to necessitate shutting down the diesel generator in an emergency condition if emergency power were needed.
2. In almost every case, the type of exhaust manifold fire experienced by TMI-1 diesel generators could readily be extinguished by the diesel operator without an interruption of service if emergency power were needed. In 1982, in order to prevent exhaust manifold fires from occurring, GPUN replaced exhaust manifold insulation and gaskets at various flange joints with materials recommended by the manufacturer, Fairbanks Morse, and made procedural changes to bar the engine to prevent oil from entering the exhaust. We are evaluating the effectiveness of these changes.

3. Procedure Reference:

<u>No.</u>	<u>Title</u>
1303-4.16	Emergency Power System
1303-11.10	Engineered Safeguards Emergency Sequence and Power Transfer Test
1303-5.2	Load Sequence and Component Test and HPI Logic Channel Test
1303-5.1	RB Cooling and Isolaton System Logic Channel and Component Test
1303-8.2	Diesel Generator Annual Inspection
1302-5.30	Diesel Generator Protective Relaying
SOP 1-79-60	24 Hour Load Test of Emergency Generators
1107-3	Diesel Generator



TABLE 2

The following annual overhaul and Preventive Maintenance tasks are performed on TMI-1 Emergency Diesel Generator Units:

MECHANICAL INSPECTIONS:

- |                             |                       |
|-----------------------------|-----------------------|
| a) injection nozzles        | m) torsional dampers  |
| b) fuel lines               | n) attach pump drives |
| c) exhaust manifold         | o) governor           |
| d) air manifold             | p) air start system   |
| e) turbo-charger            | q) vertical drive     |
| f) piston rings & cylinders | r) flower drive       |
| g) crankshaft & bearings    | s) air blower         |
| h) cam shaft assembly       | t) filters            |
| i) crank strain             | u) water system       |
| j) crank lead               | v) fan drive assembly |
| k) timing chain             | w) supports           |
| l) engine timing            |                       |

ELECTRICAL INSPECTIONS:

- |  |  |
|--|--|
| a) generator cleanliness               | i) pre-insp./post-insp. vibration analysis - balance if required   |
| b) collector rings & brushes           | j) relay cabinet insp. - skid mounted cab & exciter cabinet        |
| c) check timer settings                | k) test molded case breakers on skid mounted AC distribution panel |
| d) BFD relay overtravel test           | l) DC motor insp. fuel oil transfer pump                           |
| e) calibrate synchronizing volt meters | m) inspect & test 4160 VAC breakers                                |
| f) calibrate frequency meters          | n) grease all aux. motors  |
| g) calibrate megawatt meters           | o) change gen. bearing oil   |
| h) generator outboard bearing          | p) test protective relays  |
|  | q) megger aux. motors  |

INSTRUMENTATION INSPECTIONS:

- |  |   |
|--|---|
| a) lube oil temp. alarm calibration  | h) low air pressure alarm cal.  |
| b) jacket coolant temp. alarm cal.   | i) cranking air press. cal.   |
| c) water heater thermostat cal.  | j) low jacket coolant press. alarm cal.                               |
| d) fan gear box thermostat cal.  | k) air compressor start-stop cal.                                     |
| e) low oil press. alarm & shut-down cal. (both normal & low speed press. switches) | l) expansion tank low level alarm cal.                                |
| f) crankcase pressure alarm & shut-down cal.                                       | m) low lube oil level alarm cal.                                      |
| g) fuel oil low press. alarm cal.  | *n) all engine mounted temperature & pressure indicators calibrations |

\*engine mounted PIs & TIs are calibrated every two years