UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

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In the matter of: :

METROPOLITAN EDISON COMPANY : Docket No. 50-289 (Restart)

(Three Mile Island Unit 1) :

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25 North Court Street,
Harrisburg, Pennsylvania

Thursday, March 26, 1981

Evidentiary hearing in the above-entitled matter was resumed, pursuant to adjournment, at 9:00 a.m.

BEFORE:

IVAN W. SMITH, Esq., Chairman,
Atomic Safety and Licensing Board

DR. WALTER H. JORDAN, Member

DR. LINDA W. LITTLE, Member

Also present on behalf of the Board:

MS. DORIS MORAN,
Clerk to the Board

8103310315

APPEARANCES:

On behalf of the Licensee, Metropolitan Edison Company:

GEORGE F. TROWBRIDGE, Esq.
ERNEST BLAKE, Esq.
MS. KNOWLES
Shaw, Pittman, Potts and Trowbridge,
1800 M Street, N.W.,
Washington, D. C.

On behalf of the Commonwealth of Pennsylvania:

WILLIAM DORNSIFE,
Nuclear Engineer

On behalf of Three Mile Island Alert:

JOHN MURDOCK

C O N T E N T S

P R O C E E D I N G S

(1:05 p.m.)

CHAIRMAN SMITH: We were wondering if the testimony yesterday of Mr. Keimig and Haverkamp included the memorandum of March 13, 1981 from Keimig to Swanson. If it did not, we think that was an excellent treatment of the problem. It completes the record and should be included.

Do you recall, Mr. Tourtellotte?

MR. TOURTELLOTTE: It was supposed to have been there. If it was not, why, we will provide it.

CHAIRMAN SMITH: If it is not, we can put it in some other time, I suppose, but I think it should be part of the evidentiary record.

MR. TOURTELLOTTE: Okay. I thought it was part of that package that I handed to the Reporter.

DR. LITTLE: They were included in the package, but after thinking about it, we could not determine whether this was attached to the testimony or just happened to be packaged along with the testimony.

MR. TOURTELLOTTE: It was attached to the testimony as a part of the testimony. It was supposed to be. I will work it out with the Reporter. If it is not, well --

CHAIRMAN SMITH: Fine. I mean, I see no problem so long as you remember it was part of it. We will check the transcript when it comes in.

MR. TOURTELLOTTE: Incidentally, Mr. Chairman, two other things. One is that I attempted to get a witness here on IREP so it would help fill up the time and tried to get his schedule rearranged. It turns out it doesn't make any difference because he is ill anyway, and so I could not do that, but I tried.

And the other thing I wanted noted in the record is I have made a transmittal to Mr. Basdekas, the transmittal posing the questions as I understood those questions should be posed after our discussion on the record last week, and I have also discussed it with him on the phone, and he tells me that he will have an answer to us by April 10, perhaps before. So I will report back as soon as I can.

Also, one other thing. The Board indicated that they had an interest in knowing what items that were outstanding were going to be resolved or in some way may affect the hearing, and I have had Mr. Gray and Cutchin working on this for the past several days with the technical staff and with FEMA staff, and we will report to the Board just as soon as we have an answer, but we frankly just do not have the answer yet. And I do not really have a good enough indication of how those issues might be resolved or what might be required to even give you an intelligent guestimate right now, but I will report as soon as I know anything.

CHAIRMAN SMITH: Is there any other preliminary business?

MR. BLAKE: Mr. Smith, I have one. Since Dr. Jordan is here today, when Mr. Koppe was here, Dr. Jordan, at the end of his presentation at transcript page 13,412, you asked Mr. Koppe to do a couple of things. The first was to identify for you the sources of the numbers that he had used from WASH-1400. I will provide you the answer from Mr. Koppe on that.

The actual calculations of the numbers Mr. Koppe reports are described in Appendix II to WASH-1400, and within Appendix II the system failure rates which he quoted are presented on the following pages. For diesel generators, on page --

DR. JORDAN: What?

MR. BLAKE: Diesel generators on page 94.

DR. JORDAN: Ninety-four?

MR. BLAKE: Yes, sir.

For HPIS, on page 144. For LPIS, on page 137. And for AFWS, on page 103. And with respect to AFWS he notes in particular that that number has to be obtained by summing five values presented on that page, 103.

You also asked him at that same transcript page to verify again indeed that the numbers corresponded to the challenge rates in WASH-1400, and he reports that he has reviewed WASH-1400 again to verify that the numbers that he quoted indeed represent the system failure rates. And I wanted to get back to you and provide that information to you.

That's all I have.

DR. JORDAN: All right. Thank you.

MR. TROWBRIDGE: Let me call Mr. Hartman and Mr. Torcivia.

Mr. Chairman, Mr. Hartman has not been previously sworn. Mr. Torcivia has.

Whereupon,

CHARLES E. HARTMAN

AND

JOSEPH A. TORCIVIA

were called as witnesses by counsel for the Licensee and, having been duly sworn by the Chairman, were examined and testified as follows:

DIRECT EXAMINATION

BY MR. TROWBRIDGE:

Q Gentlemen, I refer you to a document with a cover page dated 3-12-81 entitled "Licensee's Testimony of Charles Hartman and Joseph A. Torcivia on Diesel Loading in the

Event of Loss of Offsite Power."

This is a document consisting of a cover page, outline, seven pages of text to which are attached two figures and two tables.

Gentlemen, I ask each of you whether the testimony attributed to you in this prepared testimony was prepared by you and under our supervision or under your supervision?

A (WITNESS HARTMAN) Yes, it has.

A (WITNESS TORCIVIA) Yes, sir.

Q Do you have any corrections to make in the testimony?

A (WITNESS HARTMAN) No, sir, I do not.

A (WITNESS TORCIVIA) No, sir.

Q Do you adopt the testimony as your testimony in this proceeding?

A (WITNESS HARTMAN) Yes, sir.

A (WITNESS TORCIVIA) Yes, sir.

CHAIRMAN SMITH: Mr. Hartman, would you verify that your microphone is turned on and then move the microphone quite close?

WITNESS HARTMAN: Okay. Is that better?

CHAIRMAN SMITH: Yes, sir.

WITNESS HARTMAN: Thank you.

BY MR. TROWBRIDGE: (Resuming)

Q Attached to the testimony, the last page is a statement of professional qualifications of Charles Hartman.

Mr. Hartman, was this prepared by you or under your supervision?

A (WITNESS HARTMAN) Yes, sir, it was.

Q Is it a correct statement of your professional qualifications?

A (WITNESS HARTMAN) Yes, sir.

MR. TROWBRIDGE: I note for the Board that Mr. Torcivia's professional qualifications have previously been entered into the record. They are at the end of previous testimony following transcript 9,098.

BY MR. TROWBRIDGE: (Resuming)

Q Gentlemen, I think I have asked all the necessary preliminary questions.

MR. TROWBRIDGE: I ask that the testimony and statement of Mr. Hartman's qualifications be admitted in evidence and bound into the transcript as though read.

CHAIRMAN SMITH: If there are no objections, the testimony is received.

(The information referred to follows:

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2/26

LIC 3/12/81

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of	)	
	)	
METROPOLITAN EDISON COMPANY	)	Docket No. 50-289
	)	(Restart)
(Three Mile Island Nuclear Station, Unit No. 1)	)	
	)	

LICENSEE'S TESTIMONY OF

CHARLES HARTMAN AND JOSEPH A. TORCIVIA

ON DIESEL LOADING IN THE EVENT

OF LOSS OF OFF-SITE POWER

OUTLINE

Previous witnesses have testified that loading of the pressurizer heaters to the diesel generator may be desirable both in the case of a loss of off-site power condition and in the case of a loss of off-site power accompanied by a small break in the reactor coolant system. This testimony demonstrates that a single diesel generator has sufficient capacity to accommodate connection of the pressurizer heater load in addition to all safety-related loads required in each of the two cases.

This testimony also explains how the size of individual loads has been calculated.

INTRODUCTION

This testimony, by Mr. Charles Hartman, Lead Electrical Engineer, Plant Engineering, GPU, and Mr. Joseph A. Torcivia, Senior Project Engineer, GPU, supplements previous testimony on UCS Contention No. 4 (Connection of Pressurizer Heater to Diesel) and responds to the Board's request for further information on diesel loading in the event of a loss of off-site power.

Mr. Hartman's testimony covers the loading sequence and cumulative loads for two cases - loss of off-site power only and loss of off-site power combined with a small break LOCA.

Mr. Torcivia's testimony explains how the size of the individual loads enumerated by Mr. Hartman has been calculated.

TESTIMONY

BY MR. HARTMAN:

Figure 1 attached to this testimony shows the size and timing of loads which would be connected to the diesel generator in the event of a loss of off-site power only. Figure 2 provides similar information for the case of a loss of off-site power combined with a small break LOCA. For both cases B Diesel is assumed to be unavailable. Thus all loads are loaded on A Diesel. If both diesels are available the load would be divided between the two diesels and the load on either diesel would be less than the loading shown.

Tables A and B, also attached to this testimony, present in tabular form the same information as Figures 1 and 2 and, in addition, supply a detailed listing of each of the loads connected to the diesel generator.

Previous witnesses have testified that loading of a pressurizer heater group to the diesel generator may be desirable both in the case of a loss of off-site power condition and in the case of a loss of off-site power accompanied by a small break in the reactor coolant system. Figures 1 and 2 and their associated tables demonstrate that the diesel generator, rated at 3000 kw, has sufficient capacity to accommodate connection of the pressurizer heater load in addition to all safety-related loads required in each of the two cases. The pressurizer heaters are shown in Figures 1 and 2 to be added two hours after the loss of off-site power.

DISCUSSION OF FIGURE 1

The loading sequence shown for the case of a loss of off-site power only includes all safety-related loads required for that event. Note that Figure 1 also includes a number of non-safety related loads which, in the case of a LOCA, would be automatically disconnected upon receipt of an ES signal.

The loads in Figure 1 include valve loads which are required for two minutes or less before they complete their function and stop. For simplicity's sake all valves are shown as instantaneous loads and are discontinued after ten minutes.

Safety-related loads are defined for purposes of this testimony as those required to achieve and maintain the Unit in a safe shut-down condition or to support safety-related equipment. The major loads for those functions are:

a. Makeup Pump (HPI)

b. Motor Driven Emergency Feedwater Pump (although turbine driven Pump is sufficient)

c. Decay Heat River Pump

d. Nuclear Services River Water Pump

e. Nuclear Services Closed Cooling Water Pump

f. Decay Heat Closed Cooling Water Pump (LPI)

g. Control Building Ventilation

h. Reactor Building Ventilation

i. Inverters

j. Battery Chargers

k. Radiation Monitors

l. Area Lighting

m. Spent Fuel Cooling (required after 24 hours)

Major loads which are not safety-related but which are desirable for equipment protection or ease of operations are:

a. Instrument Air Compressors

b. Pressurizer Heaters

c. Intermediate Closed Cooling Water Pump

d. Heat Trace

e. Main Turbine Turning Gear and Lift Oil Pumps

f. Substation Control Power

g. Screen Wash Pumps

h. Penetration Cooling Fan

i. Sump Pumps

Not all of the safety-related loads would necessarily be required for the entire duration of the loss of off-site power. For example, assuming the availability of the Turbine Driven EFW Pump, the Motor Driven EFW Pump can be turned off. Figure 1 shows this load change after 12 hours although switching to the Turbine Driven EFW Pump could be accomplished at any time after the loss of off-site power. Another load which could potentially be shed (but which is not shown to be turned off in Figure 1) is the Makeup Pump after the RCS has been cooled down to less than approximately 320 psig and 250°F. The operator could also reduce load on the diesel by realigning Nuclear Service Closed Cooling Water services to the Makeup Pump and then turning off Decay Heat Closed Cooling Water and Decay Heat River Water Pumps.

Actual loads for major pumps would probably be less than the maximum loads shown on Figure 1. For example, in the no LOCA scenario the Makeup Pump would be operating at about 120 gpm and would require 414 kw rather than 561 kw.

DISCUSSION OF FIGURE 2

Figure 2 loadings are based on small break sizes where the break is not sufficiently large enough to depressurize the RCS within a two hour period to the Low Pressure Injection System operating range. In larger break sizes where the Reactor

Coolant System depressurizes to Low Pressure Injection System operating range within the first two hours, the pressurizer heaters would not be of value.

The loading sequence shown in Figure 2 includes all safety-related loads required for a loss of off-site power coupled with a small break LOCA. The Reactor Building Spray Pump is assumed not to be operating since it starts when reactor building pressure is 30 psig. Small breaks which will not depressurize the Reactor Coolant System to the Low Pressure Injection range (and therefore possibly call for the use of the pressurizer heaters) would not result in reactor building pressures as great as 30 psig.

The safety-related loads for loss of off-site power with small break are automatically connected in a five block sequence by block loading timers and are similar to the loss of off-site power situation, except that the following two additional loads automatically start:

a. Decay Heat Removal Pump (auto starts, but is not required until RCS pressure is less than 300 psig.)

b. A second Reactor Building Ventilation Unit Fan.

The following loads are automatically tripped to reduce diesel loading:

a. Screen Wash Pump

b. Instrument Air Compressor

c. Main Turbine Lift Oil Pumps

d. Main Turbine Turning Gear

e. Reactor Coolant Pump Lift Oil Pump

f. Spent Fuel Cooling Pump

g. Intermediate Closed Cooling Water Pump

h. Borated Water Storage Tank Heater

i. Pressurizer Heaters (if connected to the class 1E Bus)

Some of the loads that are automatically tripped may be manually started at a later time consistent with diesel loading. Examples of such loads are Instrument Air Compressor and Spent Fuel Cooling Pump, which are shown to be manually added in Figure 2 after tripping the Motor Driven EFW Pump.

BY MR. TORCIVIA

CALCULATION OF LOADS

This portion of our testimony explains how loads were calculated for the individual items of equipment listed in Tables A and B.

The majority of loads on the diesel generators are induction motors. The following formula has been used in calculating motor loads and converting Brake Horsepower (B.H.P.) ratings to Kilowatt (K.W.) ratings:

$$\text{Load (K.W.)} = \frac{\text{B.H.P. X 0.746}}{\text{Efficiency}}$$

For motors used to operate pumps, B.H.P. value is taken from the manufacturer's pump curve where available and from the name plate rating of the motor where pump curves are not available. Since motors are offered commercially in standard sizes, it is not uncommon to purchase motors with a higher rating than required to operate the pump and the full horsepower rating of the motor is not used at the design operating point. Service factor of the motors has been taken as 1.

The factor of 0.746 is a standard factor for converting horsepower to kilowatts. Motor efficiency data has been taken from Westinghouse and Reliance Applied Engineering Data for various size motors.

Following is an example calculation of the motor load for the Reactor Building Emergency Cooling River Water Pump, RR-P1A:

Motor Nameplate Rating = 400 H.P.

Pump Curve Rating = 380 H.P.

Efficiency = 0.92

$$\text{Load (K.W.)} = \frac{380 \times 0.746}{0.92} = 308$$

Pure resistance loads, such as the pressurizer heater, are identified by their simple kilowatt rating. Corrections for efficiency are not required.

TMI Unit 1 Engineered Safequards Diesel Generator Loading Sequence on Loss of Offsite Power Only. 1A Diesel Generator Loading (1B Diesel Generator Not Available)

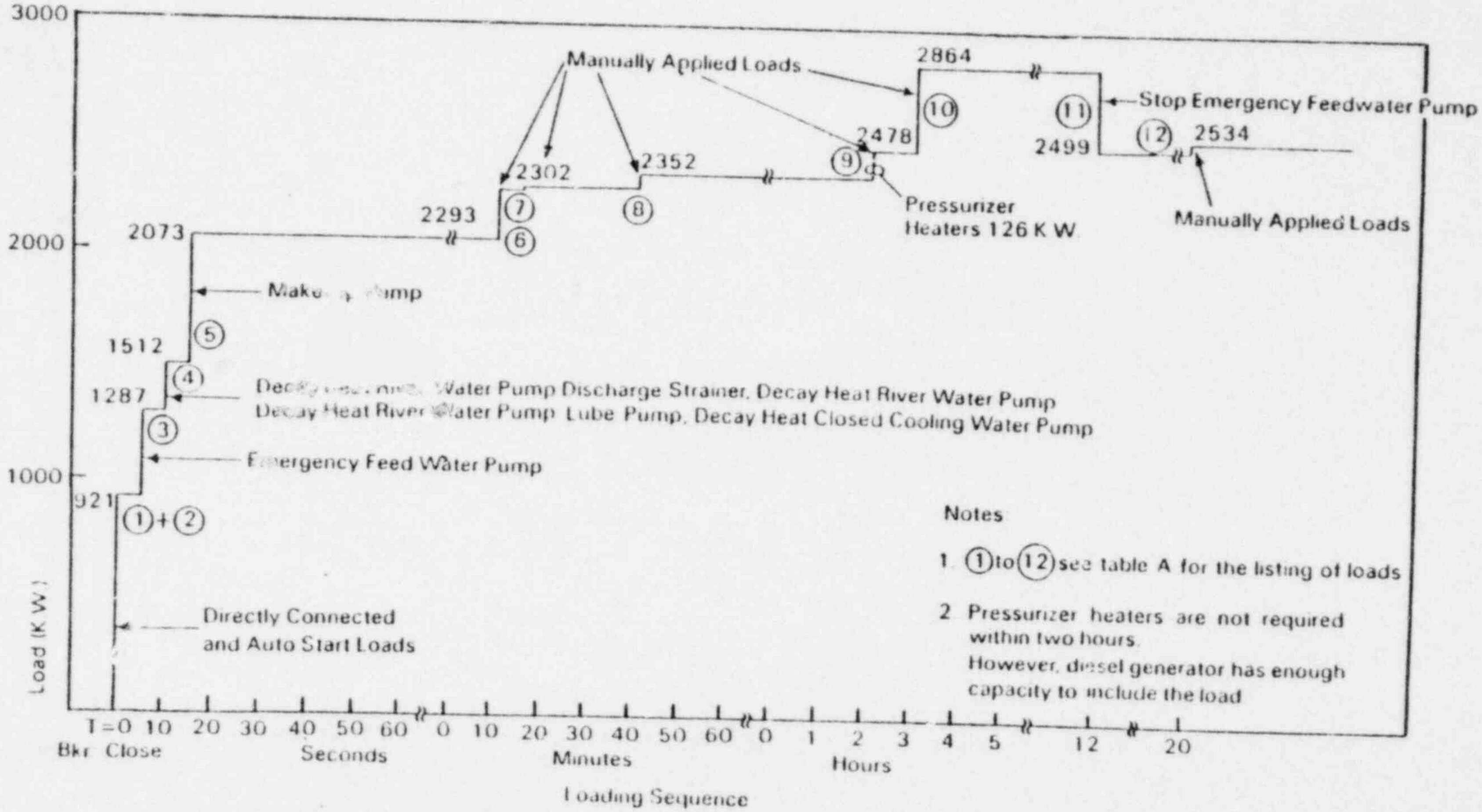

Figure 1

TMI Unit 1 Engineered Safequards Diesel Generator Loading Sequence on Loss of Offsite Power with Small Loca 1A Diesel Generator Loading (1B Diesel Generator Not Available)

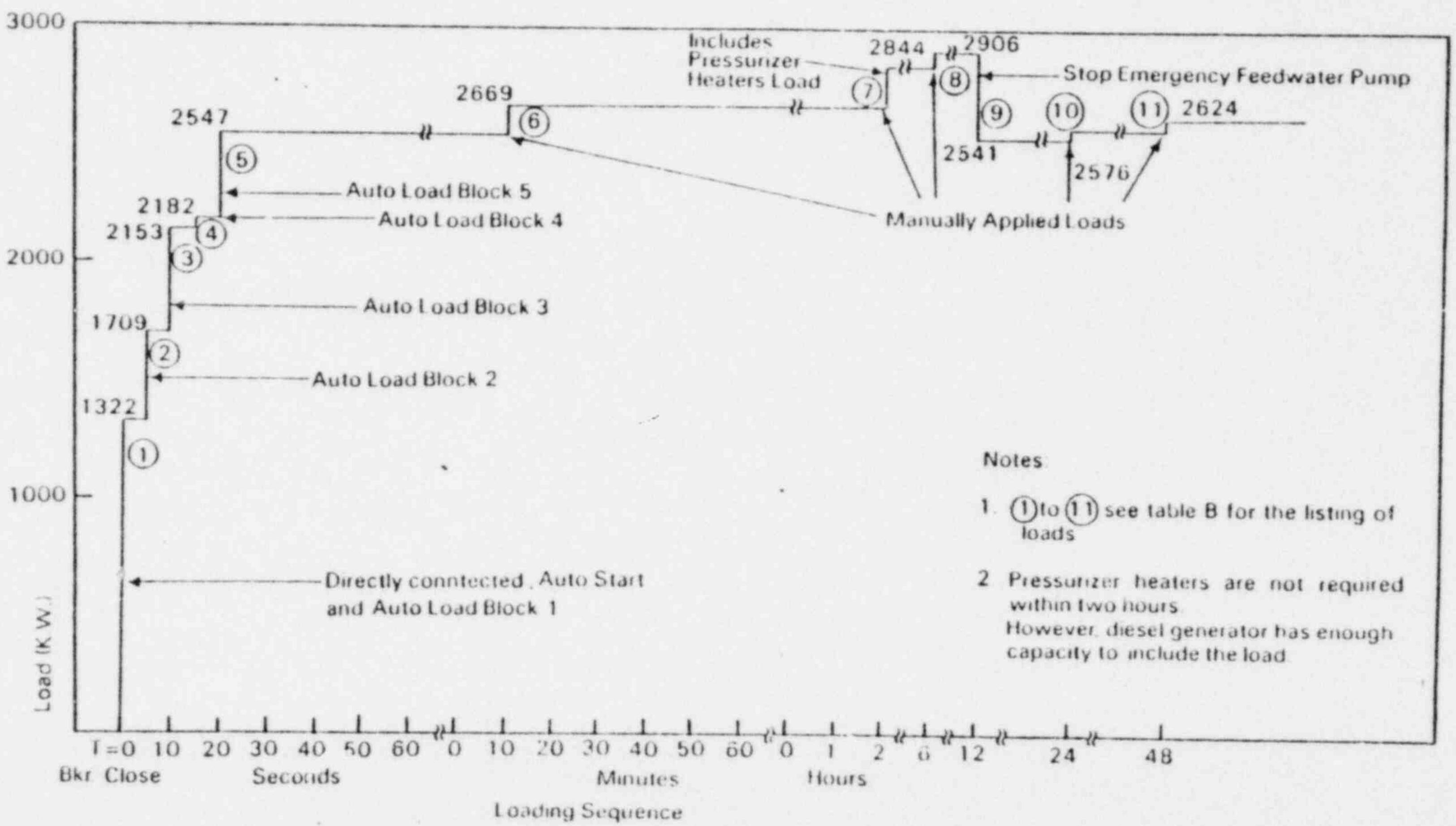

Figure 2

TABLE A
DIESEL GENERATOR LOADING
ON LOSS OF OFFSITE POWER ONLY

1A Diesel Generator Loading -
(1B Diesel not available)

		K.W.
1.	Directly connected and auto start loads	
	SW-P2A, Screen House Vent Equipment Pump	12.4
	SW-P3A, Screen House Pump Lube Pump	1.3
	SW-P4A, Screen House Vent Pump Lube Pump	1.3
	IC-P1A, Intermediate Closed Cooling Pump	62
	NS-P1B, Nuclear Services Closed Cooling Pump	94.3
	NR-P1B, Nuclear Services River Water Pump	122
	EG-P1A, Emergency Diesel Generator Start Compressor	3
	IA-P1A, Instrument Air Compressor	49
	DF-P1A, Diesel Generator A.C. Fuel Pump	0.5
	*RC-P2A, Reactor Coolant Pump Hi Pressure Oil Lift Pump	8.5
	*RC-P2C, Reactor Coolant Pump Hi Pressure Oil Lift Pump	8.5
	AH-P8A/B, Control Tower Instrument Air Compressor	0.5
	SW-P1A, Screen Wash Pump	49
	SW-S1A, Screen House Pump Discharge Strainer	0.7
	CO_2 Pump	1.4
	WDL-P5A, Auxiliary Building Sump Pump	4.6
	SD-P3A & 4A, Emergency Feedwater Pump Sump Pump	1.4
	Valve Loads	91
		511.4

*Stop in 15 minutes

TABLE A

		K.W.
2.	Auto Applied Loads (immediate)	
	Panels SH-1	4.
	Lighting Panel AB-1	1.1
	Regulating Transformer TRA	10
	Turbine Building Lighting Panel, TB1, 2 & 3	9.5
	Control Building Lighting Panel, CT-2	12.3
	480-120/280V Feeder CT-5	26.5
	Lighting Panel CT-1	13.4
	Substation Control Power Transformer	49
	Distribution Panel, AB-E	12
	Emergency Lighting Panel, CVE	2.3
	Heat trace, BS-T1B	7.3
	Count Room MG Set	10
	Heat Trace Panel, 3A-1	6.7
	Heat Trace Panel, 3A-2	4.9
	Borated Water Storage Tank Heater BWH1	45.5
	Heat Trace Panel, 4A	13.1
	Heat Trace Panel, 3A	6.6
	Heat Trace Panel, 2A	14.4
	Heat Trace Panel, 2A-1	4.6
	Boric Acid Mix Tank Htr.	17.5
	Inverters	45
	Battery Chargers	47
	Instrument Air Dryer	10
	Radiation Monitor RMA4, 6 & 9	5.7

TABLE A

2.	MU-P-3A, Make-up Pump - Main Oil Pump	0.5
	MU-P-3B, Make-up Pump - Main Oil Pump	0.5
	Diesel Generator Auxiliaries	21.
	Fire System Jockey Pump Controller	1.4
	Radiation Monitor, RM-A1	1.0
	Radiation Monitor, RM-L7	7.5
		410.3
	Diesel Loading 511.4 + 410.3 =	921.7
3.	Auto Start in 5 seconds:	
	EF-P2A, Emergency Feedwater Pump	365.7
	Diesel Loading 921.7 + 365.7 =	1287.4
4.	Manual started loads in 10 seconds:	
	DR-S1A, Decay Heat River Water Pump Discharge Strainer	1.3
	DR-P1A, Decay Heat River Water Pump	148.
	DR-P2A, Decay Heat River Water Pump Lube Pump	1.3
	DC-P1A, Decay Heat Closed Cooling Water Pump	74.6
		225.2
	Diesel Loading 1287.4 + 225.2 =	1512.6
5.	Manual started loads in 15 seconds:	
	MU-P1A, Make-up Pump	561.
	Diesel Loading 1512.6 + 561 =	2073.6

TABLE A

		K.W.
6.	Manual started loads in 10 minutes:	
	Valve Loads Removed	-91
	Control Building Chiller	130.
	AH-E24A, Air Cool Fan for EFW Pump	12.5
	AH-E15A, Air Cool Fan for DH & NSP	3.
	AH-E27, Screen House Air Handling Unit	12.4
	AH-E29A, Diesel Generator North Fan	21
	AH-P3A, Control Building Chilled Water Pump	17
	AH-E19A, Control Building Exhaust Fan	9
	AH-E17A, Normal Vent Supply Fan	41
	AH-E95A, Control Building Boost Fan	1.5
	CA-P1A, Boric Acid Pump	1.4
	AH-E9A, Penetration Cooling Fan	62
		219.8
	Diesel Loading 2073.6 + 219.8 =	2293.4
7.	Manual started loads in 15 minutes:	
	RC-P2A, Reactor Coolant Pump Hi Pressure Oil Lift Pump (Stopped)	- 8.5
	RC-P2C, Reactor Coolant Pump Pressure Oil Lift Pump (Stopped)	- 8.5
	LOP-7C/D, Turbine Oil Lift Pump	8.7
	LOP-7E/F, Turbine Oil Lift Pump	8.7
	LOP-7A/B, Turbine Oil Lift Pump	8.7
		9.1
	Diesel Loading 2293.4 + 9.1 =	2302.5

TABLE A

		K.W.
8.	Manual started loads in 40 minutes	
	GN-Y1, Turbine Turning Gear	50
	Diesel Loading 2302.5 + 50 =	2352.5
9.	Manual started loads in 2 hours	
	Pressurizer Heaters	126
	Diesel Loading 2352.5 + 126 =	2478.5
10.	Manual started loads in 3 hours	
	AH-E1A, Reactor Building Vent Unit Fan	76
	RR-P1A, Reactor Building Emergency Cooling River Water Pump	308
	RR-P2A, Emergency Cooling Lube Pump	1.3
	RR-S1A, Reactor River Water Pump Discharge Strainer	1.
	TOTAL	386.3 k.w.
	Diesel Loading 2478.5 + 386.3 =	2864.8 k.w.
11.	Manual stopped load in 12 hours	
	EF-P2A, Emergency Feedwater Pump	-365.7 k.w.
	Disel Loading 2864.8 - 365.7 =	2499.1
12.	Manual started loads in 20 hours	
	SF-P1A, Spent Fuel Pump	33
	AH-E8A, Spent Fuel Pump Air Unit	2
		35
	Diesel Loading 2499.1 + 35 =	2534.1

TABLE B

DIESEL GENERATOR LOADING ON LOSS OF OFFSITE POWER WITH SMALL LOCA

1A Diesel Generator Loading
(1B Diesel - not available)

1. Directly connected and auto start loads

	KW
Panel SH-1	4
Lighting Panel AB-1	1.1
Regulating Transformer, TRA	10
Turbine Building Lighting Panel TB-1, TB-2 and TB-3	9.5
Control Building Lighting Panel, CT-2	12.3
480-120/208V feeder, CT-5	26.5
Lighting Panel CT-1	13.4
Substation Control Power Transformer	49
Distribution Panel, AB-E	12
Emergency Lighting Panel, CVE	2.3
Heat Trace, BS-T1B	7.3
Heat Trace Panel, 3A-1	6.7
Heat Trace Panel, 3A-2	4.9
Heat Trace Panel, 4A	13.1
Heat Trace Panel, 3A	6.6
Heat Trace Panel, 2A	14.4
Heat Trace Panel, 2A-1	4.7
Boric Acid Mix Tank Heater	17.5
Inverters	45
Battery Chargers	47
Instrument Air Dryer	10
Radiation Monitor RMA4, 6 & 9	5.7
MU-P3A, Make-up Pump Main Oil Pump	0.5
MU-P3B, Make-up Pump Main Oil Pump	0.5
Diesel Generator Auxiliaries	21

TABLE B

Fire System Jockey Pump Controller	1.4
Radiation Monitor, RM-A1	1.0
Radiation Monitor, RM-L7	7.5
Count Room MG Set	10
Valve Loads	91
TOTAL	455.9 k.w.

Auto Load Block 1

MU-P1A, Make-up Pump	561
DH-P1A, Decay Heat Pump	275
EG-P1A, Emergency Diesel Generator Start Compressor	3
WDL-P5A, Auxiliary Building Sump Pump	4.6
SD-P3A, Emergency Feedwater Pump Sump Pump	0.7
SD-P4A, Emergency Feedwater Pump Sump Pump	0.7
AH-P8A, Control Tower Instrument Air Compressor	0.5
DF-P1A, Diesel Generator A. C. Fuel Pump	0.5
AH-E29A, Diesel Generator North Fan	21
TOTAL	867

Diesel Loading 455.9 + 867 = 1322.9 k.w.

2. Auto Load Block 2

AH-E1A, Reactor Building Vent Unit Fan	38
AH-E1C, Reactor Building Vent Unit Fan	38
RR-P2A, Emergency Cooling Lube Pump	1.3
RR-S1A, Reactor River Water Pump Discharge Strainer	1
RR-P1A, Reactor Building Emergency Cooling River Water Pump	308
TOTAL	386.3 k.w.

Diesel Loading 1322.9 + 386.3 = 1709.2 k.w.

TABLE B

3. Auto Load Block 3

NR-P1A, Nuclear Services River Water Pump	122
DR-P1A, Decay Heat River Water Pump	148
DC-P1A, Decay Heat Closed Cooling Water Pump	74.6
NS-P1A, Nuclear Services Closed Cooling Pump	94.3
NR-S1A, Nuclear River Water Discharge Strainer	1.0
DR-S1A, Decay Heat River Water Pump Discharge Strainer	1.3
NR-P2A, Nuclear River Water Pump Lube Pump	1.3
DR-P2A, Decay Heat River Water Pump Lube Pump	1.3
TOTAL	443.8
Diesel Loading 1709.2 + 443.8 =	2153. k.w.

4. Auto Load Block 4

SW-P2A, Screen House Vent Equipment Pump	12.4
SW-P4A, Screen House Vent Pump Lube Pump	1.3
AH-E27A, Screen House Air Handling Unit	12.4
AH-E15A, Air Cool Fan for DH & NSP	3
TOTAL	29.1
Diesel Loading 2153 + 29.1 =	2182.1 k.w.

5. Auto Load Block 5

EF-P2A, Emergency Feedwater Pump	365.7
Diesel Loading 2182.1 + 365.7 =	2547.8 k.w.

TABLE B

6.	Manual started loads in 10 minutes		
	Valve Loads Stopped		-91
	Control Building Chiller		130
	AH-E95A, Control Building Boost Fan		1.5
	AH-E19A, Control Building Exhaust Fan		9.
	AH-P3A, Control Building Chilled Water Pump		17.
	AH-E18A, Control Building Emergency Supply Fan		41.
	AH-E24A, Air Cool Fan for Emergency Feedwater Pump		12.5
	Boric Acid Pump		2.
		TOTAL	122
	Diesel Loading 2547.8 + 122 =		2669.8 k.w.
7.	Manual started loads in 2 hours		
	IA-P1A, Instrument Air Compressor		49
	Pressurizer Heaters		126
		TOTAL	175
	Diesel Loading 2669.8 + 175=		2844.8 k.w.
8.	Manually started loads in 6 hours		
	AH-E9A, Penetration Cooling Fan		62
	Diesel Loading 2844.8 + 62 =		2906.8 k.w.
9.	Manual stopped load in 12 hours		
	EF-P2A, Emergency Feedwater Pump		-365.7
	Diesel Loading 2906.8 - 365.7 =		2541.1
10.	Manually started load in 24 hours		
	AH-E8A, Spent Fuel Pump Air Unit		2
	SF-P1A, Spent Fuel Pump		33
		TOTAL	35
	Diesel Loading 2541.1 + 35 =		2576.1 k.w.

TABLE B

11. Manually started load in 48 hours

H_2 Recombiner	48
Diesel Loading 2576.1 + 48 =	2624.1 k.w.

PROFESSIONAL QUALIFICATIONS OF CHARLES HARTMAN

EDUCATION: Bachelor of Engineering Technology in Electircal Engineering 1970, Capitol Campus of the Pennsylvania State University

EXPERIENCE: Lead Electrical Engineer, Metropolitan Edison Company TMI-1, 1973 to present. Responsible for the support of plant operations and maintenance activities relating to electrical systems and components, including review of safety related procedures. Member of the Plant Operations Review Committee. Licensed Senior Reactor Operator for one year (1979)
Project Engineer, TMI-1, Metropolitan Edison Company 1970 to 1973. Duties included review of procurement specifications and vendor proposals, and preparation and/or review of operating test and maintenance procedures for TMI-1.
Engineering Assistant, TMI-1, Metropolitan Edison Company 1969, review of drawings and preparation of procedures.

Technician
Bell Telephone Laboratories
1967 to 1968

United States Army
Military Police
1965 to 1967

PROFESSIONAL AFFILIATIONS: Member of IEEE, Registered Professional Engineer in the Commonwealth of Pennsylvania

CHAIRMAN SMITH: I am reminded about a problem that the Board has recently discussed, Mr. Tourtellotte. It would be very helpful if the Staff would put on the first page of its testimony the date that the testimony is submitted.

I realize that very often the testimony is accompanied by a cover letter with the date on it, but sometimes the testimony gets separated from the cover letter, and it is helpful for us to know when we read the testimony just how current it is. So it would be helpful if all parties would have some place in the testimony the date it was prepared and preferably on the first page.

The Licensee has used the method of putting it up in the upper righthand corner which is helpful to us.

MR. TOURTELLOTTE: You want the date that it is admitted into the record or the date that it is submitted?

CHAIRMAN SMITH: The date that it is submitted and the reason -- just whatever date is convenient to the Staff to give us some idea of its currency so that we know at a glance whether the testimony has taken into account subsequent developments in the case.

MR. TOURTELLOTTE: We try to do that in every case. I do not know specifically --

CHAIRMAN SMITH: Well, it is not -- well, for example, I am looking at Mr. Curry and Vermeil's testimony, and it is not there.

MR. TOURTELLOTTE: I noted yesterday Keimig and Haverkamp did have it on theirs, but I guess it must have been overlooked with Vermeil and --

CHAIRMAN SMITH: I am looking at Haverkamp's and Keimig's and it did, yes, that is right.

Mr. Dornsife, do you have questions?

MR. TROWBRIDGE: Mr. Chairman, I would ask one supplemental question only.

BY MR. TROWBRIDGE: (Resuming)

Q Mr. Hartman, on page 1 of the testimony you indicate that the diesel loading tables and figures have been prepared on the assumption that one diesel is not available and that is the B diesel. Would there be a significant difference in these tables if you had assumed that the B diesel was available and the A diesel was not?

A (WITNESS HARTMAN) No, sir. There was no significant difference.

MR. TROWBRIDGE: Thank you. That is the only question.

CHAIRMAN SMITH: Mr. Dornsife.

MR. DORNSIFE: Mr. Chairman, I was sorry I was a few minutes late. Is Mr. Pollard going to be here to question on this issue?

CHAIRMAN SMITH: Apparently not. The last word we had last evening was that he may or may not come.

MR. TROWBRIDGE: Our word through Tom Baxter is that UCS will not be represented this afternoon.

MR. DORNSIFE: I am sorry. Will not?

MR. TROWBRIDGE: Will not be represented this afternoon.

MR. DORNSIFE: How about tomorrow?

MR. TROWBRIDGE: We expect them to be here for emergency feedwater tomorrow. I have no other intelligence.

MR. DORNSIFE: I just have several short carryover questions from the original questioning on this testimony.

CROSS EXAMINATION

BY MR. DORNSIFE:

Q Mr. Torcivia, isn't it true that induction motors when they start have a large in-rush current?

A (WITNESS TORCIVIA) That is correct.

Q What is typically the magnitude of the in-rush current?

A (WITNESS TORCIVIA) From five to six times on the average.

Q And let's say the diesel generator was near its maximum continuous capacity and a large induction motor were started. What effect would that have on the diesel?

A (WITNESS TORCIVIA) Well, to begin with, to preface that question, before the diesel can be at its capacity, no such motor would be started. It must be assumed that the motor has been lost and restarted. On that basis the diesel will be able to pick it up. In other words, the in-rush current will be of such a value that the diesel voltage will dip quickly and come right back up as a result of the action of the regulator.

Q Say hypothetically the diesel were operated for some reason right at its 2,000 hour -- 3,000 kw capacity and right below that, and the induction motor was started. How high would the in-rush current need to be to cause any adverse or could it ever cause any adverse problems with the diesel picking it up?

A (WITNESS TORCIVIA) Well, I think you must recognize that I do not profess to be a diesel expert, but I will say this, based on the electrical characteristics of the diesel which in turn is the generator, in essence, the generator will be fully capable of accepting the in-rush current of any motor at any time within the capacity of the diesel.

Q What is the rating of the diesel typically based on, the time rating?

A (WITNESS TORCIVIA) I presume you are speaking in terms of the 2,000 hour rating.

Q Yes.

A (WITNESS TORCIVIA) Again I want to preface that.

I am not a diesel expert, but I did have some discussions with diesel people, and their estimation on that point is based on the interest of having the bearings checked out, the oil checked, no major modifications or changes. They are not talking about a major overhaul. They are talking about clearances of shafts and bearings and things of that nature. That is what I have been told. The diesel would be just as good in 2,500 hours as 2,000 hours. Two thousand hours is like a 5,000 mile checkup on your oil in your engine. It is one of those figures. That is the impression they left me with.

Q Would that include the half hour rating? Is that of any special significance?

A (WITNESS TORCIVIA) In terms of a half hour rating, I never really questioned them in that sense in terms of what it would do to the engine itself. I may say this, that the welfare of any piece of equipment is primarily based on temperature rise. For example, as far as the generator is concerned, that can accept an extended period of overload before it has a large temperature rise.

In my opinion the diesel being involved with the temperature rise of the oil, the bearings, those points, it would depend on a temperature rise. It is entirely possible to run that 20 percent overload for hours and hours if the temperatures do not rise beyond its set point. That is all

I do know about the diesel.

Q If the diesel, let's say, were overloaded and either because of instrument error or some other reason the operators were not immediately aware of it, are there alarms in the control room which would indicate pending problems before the diesel would trip on some condition?

A (WITNESS TORCIVIA) I think that question --

A (WITNESS HARTMAN) I think perhaps I can answer that. There are overload alarms in the control room. There are also temperature alarms from the diesel. Typically when the diesel is running we also take readings no less frequently than hourly to assure that oil temperatures, coolant temperature, exhaust temperatures are in the required band.

Q So you feel the operator could have sufficient time to trip off selected loads if these conditions were in fact approaching or imminent or in fact occurring.

A (WITNESS HARTMAN) Yes, sir.

MR. DORNSIFE: I have no more questions.

CHAIRMAN SMITH: Mr. Tourtellotte.

BY MR. TOURTELLOTTE:

Q When there is an emergency, does the diesel start automatically or manually?

A (WITNESS HARTMAN) I believe the question was when there is an emergency does the diesel start automatically.

Q Right. Or manually.

A (WITNESS HARTMAN) The diesel starts automatically on a loss of voltage to the bus or on an engineered safeguard signal.

Q Okay. If there appeared somewhere in your testimony that it was to start manually within 15 seconds would that be in error after the -- into an emergency? Would it be in error for someone to suggest that it was a 15-second manual start afterwards?

A (WITNESS HARTMAN) Sir, could you direct me to the portion of the testimony?

Q As I recall, in one of the tables it talks about 15-second manual start.

A (WITNESS TORCIVIA) This testimony here?

Q Yes.

(WITNESS TORCIVIA) Oh, we do not mean the manual start in terms of starting the diesel. We mean in terms of applying the load to the diesel.

Q Okay. Can you explain that then?

A (WITNESS TORCIVIA) I beg your pardon.

Q Can you explain that, applying the load to the diesel?

A (WITNESS HARTMAN) Sir, I believe I can address that question. When the diesel automatically starts, some loads are directly connected to the diesel or would start automatically due to a level pressure or some other signal. I am referring now to the loss of offsite power situation.

Following that, those automatically started loads, the operator would start manual loads. The time that we picked, the 15 seconds, there is an arbitrary, somewhat arbitrary time which we have selected, considering that the operator would not start the load any earlier than that. It could have been shown later and perhaps would be more realistically shown later.

Q I guess the one I am referring to is on Table A, number 5.

A (WITNESS HARTMAN) Yes, sir, that is the makeup pump, and we show that starting in 15 seconds. There is no -- that would be a manual start. There is no requirement that it be started at 15 seconds. That is a time we picked for this chart, because we felt that it was a reasonable amount of the earliest time that an operator could do that.

Q Where is the operator at the time that he would have to do that?

A (WITNESS HARTMAN) There are two considerations on starting the makeup pump. One would be restoration of fuel injection to the reactor coolant pumps. The other is to maintain pressurizer level. And I do not have an exact time for that. However, the pressurizer, for a reactor trip the pressurizer does not go empty. In other words, it would remain on scale, and you would have to restore makeup prior to cooling down.

Q Well, the reason I am asking the question is I seem to recall in some earlier testimony -- and this is simply my recall; I do not have any transcripts to cite -- but as I was looking at that, it seems like previous testimony indicated there was quite a distance between the place that one would manually start loads and where the operator would be located, and 15 seconds seemed like a terribly short time.

So I guess my question is directed as to whether 15 seconds is unrealistic, and even if it is unrealistic, does that have any safety significance?

A (WITNESS HARTMAN) I think that is a very short time. I would not expect the operator to respond that quickly or certainly not any more quickly than that. The only effect from the standpoint of diesel loading would be that these loads would appear later on in the chart.

MR. TROWBRIDGE: Let me suggest, Jim, you may have been referring to previous testimony about loading the pressurizer heaters manually or connecting where one would have to go outside the control room to another location to accomplish that.

I think the question here for Mr. Hartman was essentially as to the makeup pumps where is the operator when he adds the makeup pumps to the diesel.

WITNESS TORCIVIA: Where is the control switch?

WITNESS HARTMAN: The control switch is on the center console. The operator would be nearby at the time this occurred. The 15 seconds is not meant to imply that action is required in that time. It was a somewhat arbitrary time that was picked with the intention of showing that it could not be any earlier than that.

BY MR. TOURTELLOTTE: (Resuming)

Q But then what you are telling me now is he is within a physical proximity of the switch such that he could reach it within 15 seconds if he chose to.

A (WITNESS HARTMAN) Yes, sir, I believe that is true.

A (WITNESS TORCIVIA) That is right.

MR. TOURTELLOTTE: I have no other questions.

BOARD EXAMINATION

BY DR. JORDAN:

Q When you say the diesel has a rating of 3,000 kilowatts does that tell you the type of load? Is that a resistive load or is it a load with a power factor of a .8 or something like that? Do you know?

A (WITNESS HARTMAN) Sir, that 3,000 kw rating is at a .8 power factor.

Q And has it been determined that the loads that you are putting on the di ..l will indeed produce a load with .8 or larger power factor?

A (WITNESS HARTMAN) The power factor of the load would vary depending on the ratio of motors to resistance heaters and other sorts of loads. The power factor at light load considering pumps being in a throttled condition could approach or perhaps exceed -- I am sorry -- be a lower power factor than .8. However, in that case the kw load would be less, and it would be acceptable within the capability curve of the machine to have a power factor lower than .8.

Q Well, yes, but your diagram shows the time when the various loads do come on, some of which are resistive, some have power factors, .8, .7, whatever. Now, do you take that into account and do you know, therefore, that at any time that the power factor will be indeed .8 or above during this loading curve?

A (WITNESS HARTMAN) Yes, sir, we did consider that in this chart, and I believe the power factor would be less -- would be greater than .8.

Q I see. Fine. That is what I wan ed to know.

The loads that you have shown in your tables and figures I presume are calculated on the basis of the known ratings of the various machines, the efficiencies and so forth.

Now, is there ever an occasion in which you test or simulate an offsite power failure and actually have a recording of the loading of the diesels so that you know that the numbers -- your estimates, calculations are accurate?

A (WITNESS HARTMAN) There is a refueling interval surveillance test where we simulate a loss of offsite power concurrent with actuation of the engineered safeguard signal, and we have -- we do record the megawatt load on the diesel during that test. That is recorded manually from the meter in the control room.

Q If that has actually been done, then do those numbers check out well with the numbers that you have on the figures here. The figures that you have shown, the tables, I believe, are calculated numbers.

A (WITNESS HARTMAN) Yes, sir.

Q Now, how did the experimental numbers then check with the calculated figures?

A (WITNESS HARTMAN) The load during the test is much lower than the calculated numbers. One reason for that is the fact that many of the pumps are running at recirc flow rates rather than at the full flow rates, full design flow rates assumed in this study.

Q Upon loss of power are all of these loads -- well, many of these pumps I presume and engineered safety features are normally operating, is this correct, and upon a loss of power those loads are dropped.

A (WITNESS HARTMAN) Yes, sir.

Q And at that time then the diesels are restarted, and that is the first thing that happens upon a loss of power, is that right, that automatically the diesels are started.

A (WITNESS HARTMAN) Yes, sir.

Q And then is there a timer which times the loading cycle or is that all done by operator?

A (WITNESS HARTMAN) There are many directly connected loads as shown on our table. There is one timer that is associated with the motor-driven emergency feed pump. With the exception of that timer, the loads are manually applied.

Let me perhaps clarify that a bit farther. The engineered safeguard loads which were previously running, for example, if a nuclear service closed cooling pump might have previously been running, there is an automatic start circuit there that the standby pump would start. In that case it has been shown as directly connected or automatically starting load. It does not have a specific time delay after the diesel breaker has closed. It is shown as starting immediately.

Q But you don't want that to happen, do you? Don't you want the diesel to get up to full speed prior to the connection of any load?

A (WITNESS HARTMAN) The diesel does come up to full speed. The breaker closes when it reaches operating voltage and speed.

Q I see. So there is no power connected to the bus until the breaker closes, and so therefore, none of these loads can come on, but as soon as that breaker closed, then these loads that are normally connected are picked up at that time, is that correct?

A (WITNESS HARTMAN) Yes, sir, that is correct.

Q How does that show on the figure?

A (WITNESS HARTMAN) That is shown on Table A in block -- in section 1 and 2. They are labeled directly connected and autostart loads and autoapplied loads, immediate.

Q So there is then -- and this shows now on the figure at time zero, and by time zero, however, that is the time at which the breaker closes, is that right?

A (WITNESS HARTMAN) Yes, sir.

Q Not the time at which the power is lost.

A (WITNESS HARTMAN) Yes, sir. It is the time at which the diesel breaker closes.

Q All right. That was not clear to me from the diagram. And so, therefore -- I see. So at that time, at that instant one picks up instantly a load from Figure 1 of

921 -- let's see. That is kilowatts.

A (WITNESS HARTMAN) Yes, sir.

Q All right.

Now, are you saying that even under a worst case situation, assuming that the pumps are running full capacity, and you mentioned that some of them would not be running necessarily at full capacity but under a worst case situation, that the maximum load that would be connected and be required to be connected to the diesel, a single diesel, would be less than the 3,000 kilowatts.

A (WITNESS HARTMAN) Yes, sir, that is correct.

DR. JORDAN: All right. I have no further questions then.

CHAIRMAN SMITH: Any further questions?

(No response.)

CHAIRMAN SMITH: None?

(No response.)

CHAIRMAN SMITH: All right, gentlemen. Thank you very much. You are excused.

(The witnesses were excused.)

(Board conferring.)

DR. JORDAN: I might just say that I appreciate the response that the Licensee and the witnesses have given. I thought they did an exceptionally good job responding to all concerns.

MR. TORCIVIA: Thank you, sir.

(Board conferring.)

CHAIRMAN SMITH: Any further business this afternoon?

(No response.)

DR. LITTLE: I did have one comment I wanted to make for the record in reference to yesterday's discussions with health physics. In the case of Ms. McAllister I was not intending to personally criticize her when I was talking to Mr. Neeley. On the contrary, we felt that she was quite capable, highly motivated, enthusiastic about her work; and the questions arose because of the apparent dissimilarity of her background to her present function, and this appears to be the type of thing that she will be capable of upgrading, upgrading her qualifications by additional training in the area of health physics or radiological hygiene.

MR. BLAKE: Dr. Little, I appreciate your making that comment because I wondered -- I obviously -- it was not a stacked deck. I went out and picked the lowest instructor I could find to bring to talk with you. Quite frankly, during some of the questioning I wondered if you had not really wanted a higher class of instructor to maybe talk to the rad technicians. If you want to talk to somebody like that, I will bring another one.

DR. LITTLE: Well, I was not --

MR. BLAKE: I appreciate your comments.

DR. LITTLE: I was personally interested in seeing just what we saw, what type of person is responsible for teaching the general workers in regard to radiation principles.

MR. BLAKE: That was our intent.

DR. LITTLE: The dissimilarity in background and present function is what aroused questions in my mind.

CHAIRMAN SMITH: If there is nothing further, then we will adjourn until 8:30 tomorrow.

(Whereupon, at 1:42 p.m., the hearing was recessed until 8:30 a.m., the following day, Friday, March 27, 1981.)

NUCLEAR REGULATORY COMMISSION

This is to certify that the attached proceedings before the

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in the matter of: METROPOLITAN EDISON COMPANY (TMI Unit 1)

Date of Proceeding: March 26, 1981

Docket Number: 50-289 (Restart)

Place of Proceeding: Harrisburg, PA.

were held as herein appears, and that this is the original transcript thereof for the file of the Commission.

David S. Parker

Official Reporter (Typed)

(SIGNATURE OF REPORTER)