ATTACHMENT A

EVALUATION OF REGULATORY GUIDE 1.97, REV. 2 "INSTRUMENTATION FOR LIGHT-WATER-COOLED NUCLEAR POWER PLANTS TO ASSESS PLANT AND ENVIRONS CONDITIONS DURING AND FOLLOWING AN ACCIDENT" IN ACCORDANCE WITH NUREG-0737, SUPPLEMENT 1

CONSOLIDATED EDISON COMPANY OF NEW YORK, INC.

INDIAN POINT UNIT 2

AUGUST 1985

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1.0 INTRODUCTION

Supplement 1 to NUREG-0737, "Requirements for Emergency Response Capability" (Generic Letter No. 82-33) dated December 17, 1982, requires licensees of operating reactors to submit a report describing: (a) their degree of compliance with Regulatory Guide 1.97, Rev. 2, (b) their plans and schedules to implement the Reg. Guide, and (c) deviations from the Reg. Guide, together with supporting justifications or alternatives.

On April 15, 1983, Con Edison submitted its response to NUREG-0737, Supplement 1, outlining the program to evaluate Reg. Guide 1.97, Rev. 2, and integrating the requirements of Supplement 1. On August 28, 1984, Con Edison submitted a detailed description of its Program Plan to assess the degree of compliance of IP-2 with Reg. Guide 1.97, Rev. 2. We have essentially carried out the August 28, 1984 program and this report summarizes the evaluation.

A review of the instrumentation currently installed at IP-2 is summarized in a Table of Variables as suggested by Section 6.2 of Supplement 1 to NUREG-0737. This Table is a summary listing that contains information on each of the variables as to its compliance with the intent of the Reg. Guide. In the "COMMENTS" column reference is made to notes that detail deviations, state the upgrading to be performed, or provide justifications as required. These notes are contained in the section labeled "Notes and Justifications."

The review of the long-term, post-accident monitoring instruments for R.G. 1.97 also includes an evaluation of the instrumentation for monitoring inadequate core cooling (Generic Letter No. 82-28), specifically the following components:

a) subcooling margin monitor,
b) core exit thermocouples, and
c) reactor vessel level instrumentation system.

These components comprise IP2's ICC instrumentation. Appendix I contains details of the proposed upgrade of the Core Exit Thermocouple system as requested in NRC letter of May 2, 1984, S. A. Varga to J. D. O'Toole.

2.0 TABLE OF VARIABLES

The following terminology and general notes apply for the Indian Point Unit 2 (IP-2) Table of Variables:

2.1 TERMINOLOGY

N.R. - Narrow Range
W.R. - Wide Range
HI.R. - High Range
N/R - Not Required
N/A - Not Applicable
N/S - Not Specified
D.F. - Design Flow

2.2 GENERAL NOTES

The transmitters' post-accident error (where qualified) is accounted for in the upgraded IP-2 emergency operating procedures (EOP), as applicable.

See Note 38 in Section 3.0 for details of Class 1E power source.

See Note 39 in Section 3.0 for details of seismic qualification.

The instruments designated as Types A, B and C and Categories 1 and 2 will be specifically identified on the panels so that the operator can easily discern that they are intended for use under accident conditions.

TYPE A

IP2 Summary Information Sheet For RG 1.97 Rev. 2

Item	Variable	CATEGORY R.G. 1.97	CATEGORY IP-2	Environmental Qualification	Seismic Qualification	Redundancy	RANGE R.G. 1.97	RANGE IP-2	Power Source	CCR Display	TSC	EOF	Comments
A1	RCS Pressure, W.R.	1	1	Yes	Yes	Yes	Plant Specific	0 to 3000 psig 0 to 750 psig	1E	Yes	Yes	Yes	
A2	RCS Hot Leg Water Temperature	1	1	Yes	Yes	Yes	Plant Specific	0 to 700°F	1E	Yes	Yes	Yes	
A3	RCS Cold Leg Water Temperature	1	1	Yes	Yes	Yes	Plant Specific	0 to 600°F	1E	Yes	Yes	Yes	
A4	Pressurizer Level	1	1	Yes	Yes	Yes	Plant Specific	0 to 100%	1E	Yes	Yes	Yes	
A5	Containment N.R. Pressure	1	1	Yes	Yes	Yes	Plant Specific	(-5) to +75 psig	1E	Yes	N/R	N/R	
A6	Steam Generator N.R. Level	1	1	Yes	Yes	Yes	Plant Specific	0 to 100%	1E	Yes	Yes	Yes	
A7	Containment Water Level	1	1	Yes	Yes	Yes	Plant Specific	See Item B11	1E	Yes	Yes	Yes	
A8	Steam Line Pressure	1	1	Yes	Yes	Yes	Plant Specific	0 to 1400 psig	1E	Yes	Yes	Yes	

TYPE A

IP2 Summary Information Sheet For RG 1.97 Rev. 2

Item	Variable	CATEGORY R.G. 1.97	CATEGORY IP-2	Environmental Qualification	Seismic Qualification	Redundancy	RANGE R.G. 1.97 / IP-2	Power Source	CCR Display	TSC	EOF	Comments
A9	AFW Flow	1	2	Yes	N/A	N/A	Plant Specific / 0 to 450 gpm	1E	Yes	Yes	Yes	Note 1
A10	Containment Radiation, HI.R.	1	1	Yes	Yes	Yes	Plant Specific / 1 to 10^7 R/hr	1E	Yes	Yes	Yes	
A11	CST Level	1	1	Yes	No	Yes	Plant Specific / 0 to 45' w.c.	1E	Yes	Yes	Yes	Note 2
A12	RWST Level	1	2	Yes	Yes	No	Plant Specific / 0 to 40' w.c.	1E	Yes	Yes	Yes	Note 3
A13	Core Exit Temperature	1	3	No	No	No	Plant Specific / 100°F to 2,200°F	1E	Yes	Yes	Yes	Note 4
A14	RCS Subcooling	1	2	Yes	N/A	N/A	Plant Specific / -800°F to +800°F	1E	Yes	Yes	Yes	Note 5
A15	SG Blowdown Radiation	1	2	No	No	N/A	Plant Specific / 10^{-5} to 10^{-2} $\frac{uCi}{cc}$	1E	Yes	Yes	Yes	Note 6

TYPE B

IP2 Summary Information Sheet For RG 1.97 Rev. 2

Item	Variable	CATEGORY R.G. 1.97	CATEGORY IP-2	Environmental Qualification	Seismic Qualification	Redundancy	RANGE R.G. 1.97	RANGE IP-2	Power Source	CCR Display	TSC	EOF	Comments
B1	Neutron Flux	1	3	N/A	N/A	Yes	10^{-6} to 100% Full Power	10^{-9} to 120% Full Power	1E	Yes	Yes	Yes	Note 7
B2	Control Rod Position	3	3	N/R	N/R	N/R	Full In or Not Full In	0 to 144"	1E	Yes	N/R	N/R	
B3	RCS Soluble Boron Concentration	3	3	N/R	N/R	N/R	0 to 6,000 ppm	60 to 6,000 ppm	1E	No	N/R	N/R	Note 8
B4	RCS Cold Leg Water Temperature	3	1	Yes	Yes	Yes	50°F to 400°F	0 to 600°F	1E	Yes	Yes	Yes	
B5	RCS Hot Leg Water Temperature	1	1	Yes	Yes	Yes	50°F to 750°F	0 to 700°F	1E	Yes	Yes	Yes	Range Satisfies Reg. Guide 1.97 Rev. 3
B6	RCS Cold Leg Water Temperature	1	1	Yes	Yes	Yes	50°F to 750°F	0 to 600°F	1E	Yes	Yes	Yes	Note 9
B7	RCS Pressure	1	1	Yes	Yes	Yes	0 to 3,000 psig	0 to 3,000 psig 0 to 750 psig	1E	Yes	Yes	Yes	Note 10

IP2 Summary Information Sheet For RG 1.97 Rev. 2

Item	Variable		CATEGORY R.G. 1.97	CATEGORY IP-2	Environmental Qualification	Seismic Qualification	Redundancy	RANGE R.G. 1.97	RANGE IP-2	Power Source	CCR Display	TSC	EOF	Comments
B8	Core Exit Temperature		3	3	N/R	N/R	N/R	200°F to 1,650°F	100°F to 2,200°F	1E	Yes	Yes	Yes	
B9	Coolant Level in Reactor		1	1	No	Yes	Yes	Bottom of Core to Top of vessel	0-120%	1E	Yes	Yes	Yes	Note 11
B10	RCS Degrees of Subcooling		2	2	Yes	N/R	N/R	200°F Subcooling to 35°F Superheat	-800°F to +800°F	1E	Yes	Yes	Yes	
B11	Containment Sump Water Level	N.R.	2	1	Yes	Yes	Yes	Narrow Range: Sump Wide Range: Bottom of containment to 600,000 gal. level equivalent	Bottom of Sump to Design Basis Flood level	1E	Yes	Yes	Yes	Range satisfies Reg. Guide 1.97 Rev. 3
		W.R.	1	1	Yes	Yes	Yes							
B12	Containment N.R. Pressure		1					0 to Design Pressure						Refer to Item A5
B13	Containment Isolation Valve Position		1	2	Yes	Yes	N/A	Closed - Not Closed	Closed - Not Closed	1E	No	N/R	N/R	Note 12

TYPE C

IP2 Summary Information Sheet For RG 1.97 Rev. 2

Item	Variable	CATEGORY R.G. 1.97	CATEGORY IP-2	Environmental Qualification	Seismic Qualification	Redundancy	RANGE R.G. 1.97	RANGE IP-2	Power Source	CCR Display	TSC	EOF	Comments
C1	Core Exit Temp.	1					200°F to 1,650°F						Refer to Item A13
C2	Radioactivity in RCS	1	3	N/A	N/A	N/R	1/2 Tech. Spec. Limit to 100 Times T.S. Limit	1 uci/g to 10 ci/g	1E	Yes	N/R	N/R	Note 13
C3	Analysis of Primary Coolant	3	3	N/R	N/R	N/R	10 uCi/g to 10 Ci/g	10 uCi/g to 10 Ci/g	1E	No	N/R	N/R	Note 14
C4	RCS W.R. Pressure	1					0 to 3,000 psig						Refer to Item B7
C5	Containment N.R. Pressure	1					10 psia to design pressure						Refer to Item A5
C6	Containment Sump Water Level N.R.	2					Narrow Range: Top to Bottom						Refer to Item B11
	Containment Sump Water Level W.R.	1					Wide Range: Plant Specific						

TYPE C

IP2 Summary Information Sheet For RG 1.97 Rev. 2

Item	Variable	CATEGORY R.G. 1.97	CATEGORY IP-2	Environmental Qualification	Seismic Qualification	Redundancy	RANGE R.G. 1.97	RANGE IP-2	Power Source	CCR Display	TSC	EOF	Comments
C7	Containment Area Radiation	3					1 R/hr to 10^4 R/hr						Refer to Item A10
C8	Effluent Radioactivity from condenser Air Ejector	3					10^{-6} to 10^{-2} $\frac{uCi}{cc}$						Refer to Item E6
C9	Containment Hydrogen Concentration	1	1	Yes	Yes	Yes	0 to 10%	0 to 10%	1E	Yes	Yes	Yes	
C10	Containment Pressure	1	1	Yes	Yes	Yes	10 psia to 3x Design Pressure	-10 psig to 150psig	1E	Yes	Yes	Yes	
C11	Containment Effluent Radio-Activity	2					10^{-6} to 10^{-2} $\frac{uCi}{CC}$						Refer to Item E7
C12	Effluent Radio-Activity From Buildings	2					10^{-6} to 10^{3} $\frac{uCi}{CC}$						Refer to Item E7

TYPE D

IP2 Summary Information Sheet For RG 1.97 Rev. 2

Item	Variable	CATEGORY R.G. 1.97	CATEGORY IP-2	Environmental Qualification	Seismic Qualification	Redundancy	RANGE R.G. 1.97	RANGE IP-2	Power Source	CCR Display	TSC	EOF	Comments
D1	RHR System Flow	2	2	Yes	N/R	N/R	0 to 110% D.F.	0 to 7000 gpm	1E	Yes	Yes	Yes	
D2	RHR Heat Exchanger Outlet Temperature	2	3	No	N/R	N/R	32° to 350°F	75° to 400°F	1E	Yes	Yes	Yes	Note 15
D3	Accumulator Tank Level	2	3	No	N/R	N/R	10 to 90% volume	0 to 100% span	1E	Yes	N/R	N/R	Note 16
D4	Accumulator Tank Pressure	2	3	No	N/R	N/R	0 to 750 psig	0 to 700 psig	1E	Yes	N/R	N/R	Note 16
D5	Accumulator Isolation Valve Position	2	2	Yes	N/R	N/R	Closed or Open	Closed - Open	1E	Yes	N/R	N/R	
D6	Boric Acid Charging Flow	2	N/A				0 to 110% Design Flow						Note 17
D7	Flow in HPI System	2	2	Yes	N/R	N/R	0 to 110% Design Flow	0 to 600 gpm	1E	Yes	N/R	N/R	
D8	Flow in LPI System	2					0 to 110% Design Flow						Refer to D1

IP2 Summary Information Sheet For RG 1.97 Rev. 2

Item	Variable	CATEGORY R.G. 1.97	CATEGORY IP-2	Environmental Qualification	Seismic Qualification	Redundancy	RANGE R.G. 1.97	RANGE IP-2	Power Source	CCR Display	TSC	EOF	Comments
D9	RC Pump Status	3	3	N/R	N/R	N/R	Motor Current	0 to 800 amp	1E	Yes	N/R	N/R	
D10	Pressurizer Safety and Relief Valve Position	2	2	Yes	N/R	N/R	Closed - Not Closed	Closed - Not Closed	1E	Yes	N/R	N/R	
D11	Pressurizer Heater Status	2	3	N/A	N/R	N/R	Current	Breaker Position	1E	Yes	N/R	N/R	Note 18
D12	Quench Tank (Pressurizer Relief Tank) Level	3	3	N/R	N/R	N/R	Top to Bottom	0 to 100 in Water	1E	Yes	Yes	Yes	Note 19
D13	Quench Tank (PRT) Pressure	3	3	N/R	N/R	N/R	0 to Design Press.	0 to 100 psig	1E	Yes	Yes	Yes	
D14	Quench Tank (PRT) Temperature	3	3	N/R	N/R	N/R	50° to 750°F	50° to 300°F	1E	Yes	N/R	N/R	Note 20
D16	Steam Generator Safety/Relief Valve Position or Main Steam Flow	2	N/A				Closed - Not Closed						Note 21
D17	Main FW Flow	3	3	N/R	N/R	N/R	0 to 110% D.F.	0 to 4×10^6 $\frac{LB}{hr}$	1E	Yes	Yes	Yes	

IP2 Summary Information Sheet For RG 1.97 Rev. 2

Item	Variable	CATEGORY R.G. 1.97	CATEGORY IP-2	Environmental Qualification	Seismic Qualification	Redundancy	RANGE R.G. 1.97	RANGE IP-2	Power Source	CCR Display	TSC	EOF	Comments
D18	Containment Spray Flow	2	2	Yes	N/R	N/R	0 to 110% D.F.	0 to 2400 gpm	1E	Yes	N/R	N/R	Note 22
D19	Heat Removal By The Fan-Cooler Units	2	3	No	N/R	N/R	Plant Specific	See Note 23	1E	Yes	N/R	N/R	Note 23
D20	Containment Atmosphere Temperature	2	3	No	N/R	N/R	40°F to 400°F	50°F to 150°F	1E	Yes	Yes	Yes	Note 24
D21	Containment Sump Water Temperature	2	N/A				50°F to 250°F						Note 25
D22	CVCS Make-up Flow-In	2	3	No	N/R	N/R	0 to 110% D.F.	0 to 120 gpm	1E	Yes	N/R	N/R	Note 26
D23	CVCS Letdown Flow-Out	2	3	No	N/R	N/R	0 to 110% D.F.	0 to 125 gpm	1E	Yes	N/R	N/R	Note 26
D24	Volume Control Tank Level	2	3	No	N/R	N/R	Top to Bottom	0 to 100%	1E	Yes	N/R	N/R	Note 26
D25	Component Cooling Water (CCW) Temperature to ESF System	2	3	No	N/R	N/R	32° to 200°F	50° to 200°F	1E	Yes	N/R	N/R	Note 27

IP2 Summary Information Sheet For RG 1.97 Rev. 2

Item	Variable	CATEGORY R.G. 1.97	CATEGORY IP-2	Environmental Qualification	Seismic Qualification	Redundancy	RANGE R.G. 1.97	RANGE IP-2	Power Source	CCR Display	TSC	EOF	Comments
D26	CCW Flow to ESF Systems	2	3	No	N/R	N/R	0 to 110% D.F.	2000 to 12,000 gpm	1E	Yes	N/R	N/R	Note 27
D27	High Level Radioactive Liquid Tank Level	3	3	N/R	N/R	N/R	Top to Bottom	0 to 150 in Water	Pneumatic	No	N/R	N/R	Note 28
D28	Radioactive Gas Hold-up Tank Pressure (Gas Decay Tanks)	3	3	N/R	N/R	N/R	0 to 150% D.P.	0 to 150 psig	Pneumatic	No	N/R	N/R	Note 29
D29	Emergency Ventilation Damper Position	2	2	Yes	N/R	N/R	Open - Close	Open - Close	1E	Yes	N/R	N/R	
D30	RWST Level	2	2	Yes	Yes	N/R	Top to Bottom	0 to 40' W.C.	1E	Yes	Yes	Yes	
D31	Pressurizer Level	1	1	Yes	Yes	Yes	Bottom to Top	Tap to Tap	1E	Yes	Yes	Yes	Note 30
D32	Steam Generator Level	1					From tube sheet to separators						Refer to A6

TYPE D

IP2 Summary Information Sheet For RG 1.97 Rev. 2

Item	Variable	CATEGORY R.G. 1.97	CATEGORY IP-2	Environmental Qualification	Seismic Qualification	Redundancy	RANGE R.G. 1.97	RANGE IP-2	Power Source	CCR Display	TSC	EOF	Comments
D33	S.G. Pressure (Steam Line Pressure)	2					From Atmospheric Pressure to 20% Above the Lowest Safety Valve Setting						Refer to A8
D34	AFW Flow	2	2	Yes	N/R	N/R	0 to 110% Design Flow	0 to 450 gpm	1E	Yes	Yes	Yes	
D35	CST Level	1					Plant Specific						Refer to A11
D36 -1	Status of Standby Power (480 Vac, Buses, Inverter Output Buses)	2	2	Yes	Yes	N/R	Voltages, Currents	Voltage Current, Megawatt	1E	Yes	N/R	N/R	
D36 -2	Status of Standby Power (6.9 kV Buses)	2	3	N/A	N/R	N/R	Voltages, Currents	Voltage Current, Megawatt	1E	No	N/R	N/R	See Note 31
D36 -3	Status of Instrument Air System	2	2	Yes	N/R	N/R	Pressure	0-160 psig	Pneumatic	Yes	N/R	N/R	No Hydraulic Energy Sources are in IP-2 Design

TYPE E VARIABLES

IP2 Summary Information Sheet For RG 1.97 Rev. 2

Item	Variable	CATEGORY R.G. 1.97	CATEGORY IP-2	Environmental Qualification	Seismic Qualification	Redundancy	RANGE R.G. 1.97	RANGE IP-2	Power Source	CCR Display	TSC	EOF	Comments
E1	Radiation Exposure Rate (Inside Bldgs. or Areas, Where Access is Req'd to Service Equipment Important to Safety)	3	3	N/R	N/R	N/R	10^{-1} to 10^{4} R/hr	10^{-4} to 10 R/hr	1E	Yes	Yes	Yes	Note 32
E2	Containment Area Radiation	1					1 to 10^{7} R/hr						Refer to Item A10
E3	Containment or Purge Effluent (Airborne Radioactivity Noble Gas)	2					10^{-6} to 10^{5} uCi/cc						Refer to Item E7
E4	Reactor Shield Building Annulus-Noble Gas						10^{-6} to 10^{4} uCi/cc						Not in IP2's Design
E5	Noble Gases Released From PAB, Including Waste Gas Decay Tank	2					10^{-6} to 10^{3} uCi/cc						Refer to Item E7
E6	Condenser Air Ejector Radiation-Noble Gas	2	3	No	N/R	N/R	10^{-6} to 10^{5} uCi/cc	10^{-6} to 10^{-3} uCi/cc	1E	Yes	Yes	Yes	Note 33

TYPE E VARIABLES

IP2 Summary Information Sheet For RG 1.97 Rev. 2

Item	Variable		CATEGORY R.G. 1.97	CATEGORY IP-2	Environmental Qualification	Seismic Qualification	Redundancy	RANGE R.G. 1.97	RANGE IP-2	Power Source	CCR Display	TSC	EOF	Comments
E6-1	Condenser Air Ejector Flow		2	N/A	N/A	N/A	N/A	0-110% Design Flow		N/A	N/A	N/A	N/A	The design flow of 20 CFM will be applied to release assessment.
E7	Noble Gases Released	RAD	2	2	Yes	N/R	N/R	10^{-6} to 10^{4} uCi/cc	10^{-7} to 10^{5} uCi/cc	1E	Yes	Yes	Yes	Note 34
	Thru Common Plant Vent	FLOW	2	3	No	N/A	N/R	0 to 110%	0 to 170,000 cfm	1E	Yes	Yes	Yes	Note 34
E8	Vent From SG Safety and Atmosphere Dump Valves-Noble Gas		2	N/A				10^{-1} to 10^{3} uCi/cc						Note 35
E9	All Other Identified Release Points -Noble Gas		2					10^{-6} to 10^{2} uCi/cc						Note 36
E10	Airborne Rad. Part & Halogens From All Identified Points		3	3	N/R	N/R	N/R	10^{-3} to 10^{2} uCi/cc	10^{-3} to 10^{2} uCi/cc	1E	N/A	N/A	N/A	See E7 for Flow Requirements and Compliance

TYPE E VARIABLES

IP2 Summary Information Sheet For RG 1.97 Rev. 2

Item	Variable	CATEGORY R.G. 1.97	CATEGORY IP-2	Environmental Qualification	Seismic Qualification	Redundancy	RANGE R.G. 1.97	RANGE IP-2	Power Source	CCR Display	TSC	EOF	Comments
E11	Airborne Radio-Halogens and Particulates (Portable Sampling with On-site Analysis Capability)	3	3	N/R	N/R	N/R	10^{-9} to 10^{3} $\frac{uCi}{cc}$	10^{-9} to 10^{3} $\frac{uCi}{cc}$	N/A	N/A	N/A	N/A	
E12	Plant and Environs Radiation. (Portable Instrumentation)	3	3	N/R	N/R	N/R	10^{-3} to 10^{4} R/hr 10^{-3} to 10^{4} rads/hr	Various H.P. Instruments Meet Ranges	N/A	N/A	N/A	N/A	
E13	Plant and Environs Radioactivity (Portable Instrumentation)	3	3	N/R	N/R	N/R	Multi-Channel Gamma-Ray Spectrometer	Multi-Channel Gamma-Ray Spectrometer	N/A	N/A	N/A	N/A	
E14	Wind Direction	3	3	N/R	N/R	N/R	0 to 360°	0 to 540°	1E	Yes	Yes	Yes	
E15	Wind Speed	3	3	N/R	N/R	N/R	0 to 30 MPS	0 to 56 MPS	1E	Yes	Yes	Yes	
E16	Estimation of Atm. Stability (Vertical Temperature Difference)	3	3	N/R	N/R	N/R	-9°F to (+18°)F	-10°F to (+10°)F	1E	Yes	Yes	Yes	Note 37

TYPE E VARIABLES

IP2 Summary Information Sheet For RG 1.97 Rev. 2

Item	Variable	CATEGORY R.G. 1.97	CATEGORY IP-2	Environmental Qualification	Seismic Qualification	Redundancy	RANGE R.G. 1.97	RANGE IP-2	Power Source	CCR Display	TSC	EOF	Comments
E17	Accident Sampling Capability - Analysis On-site	3	3	N/R	N/R	N/R	Grab Sample	Grab Sample	1E	N/A	N/A	N/A	

3.0 NOTES AND JUSTIFICATION

Note 1: Present instrumentation meets the requirements of NUREG-0737, Section II.E.1. Additionally, since the main purpose of this variable is to monitor steam generator heat removal capability, redundant indication is provided by the steam generator N.R. level instrumentation, (which is Category 1).

Note 2: One of the two transmitters will be upgraded to meet Seismic requirements.

Note 3: Upgrade is required to meet Category 1 requirements. A second qualified channel will be installed.

Note 4: The system will be upgraded to meet the intent of R.G. 1.97 and NUREG-0737 for instrumentation to monitor core cooling. (See Appendix I for details).

Note 5: Although all inputs to the existing subcooling margin monitor are redundant and qualified, the monitor and the computer do not meet Category 1 requirements. The subcooling margin monitor, added in good faith to meet post-TMI NUREG-0578 requirements, is considered adequate as Category 2. (See Appendix I for details).

Note 6: New instrumentation will be installed to satisfy environmental and seismic requirements. Additional information for SG tube rupture can be verified by main steam line radiation monitors and the condenser air ejector radiation monitor. Therefore, redundancy is not applicable.

Note 7: At IP-2 this is a category 3 variable. The conclusion that the existing equipment is adequate is based on the fact that upon a reactor trip, the nuclear instrumentation will provide an accurate indication of the shutdown status of the core before a "harsh" post-accident containment environment develops. In the longer term, to assure no return to power, boron sampling analysis is adequate for confirming proper boron concentration to ensure that the reactor is shutdown. Con Edison has made substantial plant modifications to implement the upgraded Post Accident Sampling System (PASS) in response to NUREG-0737 items II.B.3 and II.F.1. The key variable to determine the state of the core in the long term recovery is Core Exit Temperature (CET), which we are now proposing to upgrade. Thus, during the period of time required to obtain and analyze a coolant sample our proposed CET instrumentation will be available, and through the upgraded Emergency Operating Procedures (EOPs), the operator will be directed to take action to assure adequate core cooling. The actions to adequately cool the core use borated sources of water, as appropriate, thereby ensuring adequate shutdown status at the same time.

Note 8: Two displays are available; one locally in the High Radiation Sampling System (HRSS) room and another in the radiochem/counting room. This is Category 3 instrumentation and 6.2(g) of NUREG-0737, Supplement 1 accepts displays in locations other than the CCR.

Note 9: Existing instrument range will be upgraded to 0-700°F to meet the Regulatory Guide 1.97, Rev. 3 specified range

Note 10: One of the two existing recorders does not meet the range. An upgrade will be implemented to meet the required range.

Note 11: The original transmitters are being replaced with environmentally qualified transmitters during the 1986 refueling outage. All other components of the system are qualified.

Note 12: This variable serves as a backup variable in monitoring containment integrity. Containment pressure is the primary variable. Therefore, it is considered that Category 2 is more appropriate for valve position. Grouped position indication in the CCR for the containment isolation valves in the containment sampling system will be provided.

Note 13: This variable serves as a backup variable for monitoring fuel cladding breach. The methods include the delayed neutron gamma monitor and grab sampling for analysis. The key variable that it backs up is core exit temperature, which will be upgraded. Therefore, it is considered appropriate that this variable be classified as Category 3. The existing instrumentation meets the requirements of Category 3. The readout is available in the radiochem/counting room. Gross failed fuel detector indication is in the CCR.

Note 14: A Canberra isotopic analyzer is located in the waste gas compressor room. Its readout is available in the radiochem/counting room. This is Category 3 instrumentation and 6.2(g) of NUREG-0737, Supplement 1 accepts displays in locations other than the CCR.

Note 15: The upgraded IP-2 plant-specific Emergency Operating Procedures (EOPs) do not use this variable. This variable serves as a backup variable to the key variable, RHR flow. In addition, Component Cooling water T_{in} and T_{out} to the RHR heat exchangers can be used as verification of heat removal. Therefore, Category 3 is a more appropriate designation. The range of the existing instrument meets all anticipated operational occurrences.

Note 16: Accumulator tank level and pressure serve as means to determine accumulator tank status during normal operating conditions in order to assure capability to deliver water to the RCS. The existing level and pressure ranges cover all anticipated operational occurrences. The instruments are not intended for use during the post-accident period, except perhaps to verify the status of the system, for which they are backup variables, with the primary variables being HPI flow, RWST level and Accumulator Isolation Valve Position which are qualified for Category 2. For these reasons, accumulator level and pressure are more suitably designated as Category 3.

Note 17: This variable is not applicable to IP2's design. At IP2, the Operator has sufficient information to indicate boric acid flow into the RCS, viz. RWST level, discharge valve position, and status of the Safety Injection System. This instrumentation meets Category 2 requirements.

By letter dated August 2, 1985, Con Edison proposed removal of the entire Boron Injection Tank package, since sufficient margin exists within the RWST.

Note 18: Existing instrumentation monitors breaker position. An upgrade to install heater current monitoring instrumentation, qualified to Category 2 requirements, will be implemented.

Note 19: The existing range of 0-100 in. covers all anticipated operational occurrences.

Note 20: The range of existing instrumentation will be upgraded to 50-350°F, which covers saturation temperature of 338°F at tank design pressure of 100 psig.

Note 21: Indian Point 2 relies on Main Steam Line Flow (Low Range & Full Range), Steam Generator Pressure, and physical verification (audible and visible) of valve actuation.

Note 22: The existing flow instrumentation range of 0-2400 gpm covers the maximum possible flow during the recirculation phase and satisfies all anticipated post-accident conditions.

Note 23: IP2 monitors fan cooler unit heat removal from the containment by observation of a) the cooling water outlet flow, b) the fan motor status, and c) the fan-cooler dampers' position. The cooling water outlet flow transmitters will be upgraded to meet qualification requirements of Category 2.

Note 24: This variable is not essential for IP-2 post accident recovery and is not relied on in our EOPs. The purpose of this variable is to verify adequate containment heat removal. In IP-2 heat removal is accomplished by the Fan Cooler Units (FCUs) and Containment Spray (CS). By observing Service Water (SW) flow and Component Cooling Water (CCW) flow and inlet and outlet temperatures to these systems and the Δ T across the internal heat exchangers, adequate containment heat removal by the FCUs and CS is verified. In addition, containment pressure trending downward will also confirm heat removal. We are now proposing to upgrade the SW instrumentation as discussed in note 23 and CCW instrumentation for post accident monitoring. Thus the improved instrumentation will assure valid indication of containment heat removal.

Note 25: This variable is not applicable at IP-2. The NPSH calculations for IP-2 conservatively assume saturated conditions.

Note 26: The CVCS system (charging, letdown, volume control tank, etc.) is not a safety grade system and is not required for recovery at IP-2. The charging pumps are removed from the 1E buses after a SI signal and concurrent loss of off-site power. The system will be used, if available, but if not, the safety systems are relied on for recovery. Therefore, the CVCS flow and tank level instrumentation is considered to be Category 3. Also, if necessary, the charging pump running status lights in the CCR can be used to indicate their condition.

Note 27: The system will be upgraded with qualified sensors to meet the Category 2 requirements. Present range meets all operational requirements.

Note 28: The range of level measurement of this tank (the Waste Hold-Up Tank) covers all anticipated operational occurrences. The display is located on the Waste Disposal System (WDS) panel. The instrumentation is Category 3 and Section 6.2 (g) of NUREG-0737 Supplement 1 accepts displays in locations other than the CCR.

Note 29: The existing instrumentation covers 0-150 psig. This range covers all anticipated operational occurrences, since the waste gas compressor design pressure is 150 psig and the tank design pressure is 150 psig. Additionally, safety valves are set at 110 psig. The display location in the WDS panel is considered adequate. (See Note 28).

Note 30: Existing instrumentation range of 0 to 100% span covers 85% of total volume (tap-to-tap). Considering this large fraction and the severe non-linearity outside the tangent points, we have concluded that the present installation meets the intent of the R.G.

Note 31: There is no display in the Central Control Room (CCR) to monitor the alternate off-site source load on the 13.8/6.9 KV-20 MVA autotransformer. An ammeter will be provided to indicate the status of this alternate standby power supply. This instrument will be used by the Operator for diagnostic purposes of the alternate offsite source loading which is non-1E. Therefore, this instrument is considered to be Category 3.

Note 32: An area radiation monitor will be installed in the necessary breaker service access area. The range of the existing IP2 instruments is based on the fact that it covers all anticipated occurrences. In addition, the areas where exposure rate might exceed one R/hr are locked to preclude entry. If entry is needed, a health physics technician will monitor the area prior to access.

Note 33: The existing channel meets the requirements for Type C Category 3. However, the monitor will be replaced to meet the criteria for Category 2 and will meet the range requirements for Type E.

Note 34: Containment purge and PAB ventilation system discharge is through the common plant vent. The flow instrumentation satisfies the intent of the R.G. The system is designed so that in the event of its failure, the operator will set the microprocessor to a predetermined, conservative value of flow release rate which is at least as high as the value expected during all modes of system operation.

Note 35: The IP2 method for estimating releases through the atmospheric dump valves and the steam generator safety valves during the course of an accident is to obtain samples, taken upstream of the main steam isolation valves, of the entrapped noble gases for analysis in the on-site radiochem lab. Combining this information with total steam flow from the existing low range flow meters will yield the required data on quantity of radioactivity releases. Additionally, the FSAR, Sect. 14.2, conservatively concludes that a SG tube rupture would not result in significant radiation exposure to plant workers and members of the public.

Note 36: There are no other unmonitored release points.

Note 37: The existing system for estimation of atmospheric stability based on vertical temperature difference covers all anticipated conditions and all the historic atmospheric variations of the meteorological conditions in the plant vicinity.

Note 38: Power Supply (1E)

Qualification: The level of environmental qualification of IP2 power source safety related equipment (such as station instrument 118VAC vital buses and 480VAC MCC with safeguards and associated cable loads) is described in FSAR Sections 7.1.4 and 7.1.3.3.3.

Separation Criteria: The IP-2 electric systems do not conform to the recommendations contained in Reg. Guide 1.75 since this guide was not part of the original criteria for the design and construction of IP2. Proposed modifications will be integrated within our existing separation provisions.

Note 39: Active instrument channel components, including transmitter or sensor, and rack mounted signal conditioning equipment are seismically qualified. Control board indicators will be upgraded for seismic qualification. Containment isolation valve or damper limit switches and related active components are seismically qualified. The cable raceway system has been analyzed for seismic adequacy for the IP-2 DBE in the Indian Point Probabilistic Safety Study. The seismic design of the control boards is discussed in Section 7.2.1.11 of the IP2 FSAR, Rev. 2.

INDIAN POINT UNIT NO. 2
DOCKET NO. 50-247

APPENDIX I

INADEQUATE CORE COOLING INSTRUMENTATION

I.1 General:

Pursuant to NRC's Generic Letter No. 82-28 on Inadequate Core Cooling Instrumentation System, Con Edison's response was contained in a March 23, 1983 letter, which was reviewed in NRC letter of May 2, 1984.

The following information is provided in answer to the questions raised in the May 2, 1984 letter.

I.2 Subcooling Margin Monitor (SMM)

From the NRC letter of May 2, 1984, the Attachment says "... we will require additional information regarding the upgrading of the SMM to full compliance with the II.F.2 requirement." And from Enclosure 1, "Please provide additional information to address items 1, 2, 5 and 8 of the checklist in Appendix A of the Generic Letter No. 82-28." From this Appendix A, we have:

"Item 1. Description of the proposed final system including:

a. a final design description of additional instrumentation and displays;

b. details description of existing instrumentation systems;

c. description of completed or planned modifications"

Response: See Con Edison submittal of March 23, 1983 for description of the system. The replacement of the hot leg RTD's is complete.

"Item 2. A design analysis and evaluation of inventory trend instrumentation, and test data to support design in Item 1."

Response: See Con Edison submittal of March 23, 1983.

"Item 5. Describe computer, software and display functions associated with ICC monitoring in the plant."

Response: See Con Edison submittal of March 23, 1983.

"Item 8. Operator instructions in emergency operating procedures for ICC and how these procedures will be modified when final monitoring system is implemented."

Response: See Con Edison submittal of March 23, 1983. Additionally, the upgraded Emergency Operating Procedures which incorporate subcooling margin indication, are being implemented in accordance with our April 15, 1983 response to Supplement 1 and our June 4, 1984 submittal of the Procedures Generation Package. By October 1, 1985 Con Edison will have implemented upgraded IP-2 EOP's based on revision 1 Emergency Response Guidelines prepared by the Westinghouse Owners Group.

I.3 Reactor Vessel Level Instrumentation System (RVLIS)

Enclosure 1 says "Provide justification for not having upper head level measurement instrument"

Response: The function of upper head level measurement is to provide level indication above the hot leg pipe when the Reactor Coolant Pump (RCP) in the loop with the hot leg connection is not operating. The existing narrow range (NR) instrumentation (natural circulation scale), with no pumps operating, cover 0 to 120%, thereby encompassing the upper head level measurement. When the RCP's are running, the wide range (WR) instruments (pumps running scale)also encompass this upper head level measurement. The WR measurement overlaps the upper head level measurement NR and it is this WR reading that is relied upon for the EOP's. Upper range RVLIS is not part of the IP-2 EOP's. Existing design is redundant and adequately addressess the operator's needs for the purpose of ICC monitoring.

I.4 Core Exit Thermocouples
Additional Information

As per NRC letter of May 2,, 1984 on the subject of "IP2 - Incomplete Review of ICCI System", Enclosure 1, we submit the following information on the proposed upgrade to the Core Exit Thermocouple (CETC) System. The information is keyed to the appropriate requests issued by NRC, although not in the Enclosure 1 format.

A. From Generic Letter No. 82-28, Appendix,, p.2:

1. Provide diagram of core exit thermocouples locations or reference the generic description if appropriate.

   Responses: A diagram showing core exit thermocouple locations has been provided in Con Edison's March 23, 1983 submittal.

2. Provide a description of the primary operator displays including:

a. A diagram of the display panel layout for the core map and description of how it is implemented, e.g. hardware or CRT display.

b. Provide the range of the readouts.

c. Describe the alarm system.

d. Describe how the ICC instrumentation readouts are arranged with respect to each other.

Response: The primary control room display will consist of two train-oriented graphic displays, one per train. These will present, on demand, graphic core location maps and alphanumeric displays of the theromocouple readouts or of temperature differences across the core. The System's 65 core exit thermocouples are arranged to provide indication of the radial temperature profile and power distribution symmetry. Keypads will be used to call up the required functions and both keypad and screen will be human engineered.

A selective reading of core exit temperatures will be available on demand. The range of the readouts will be up to 2300°F (1260C). Appropriate alarm readout and capability will be provided consistent with Emergency Operating Procedure requirements. Alarm setpoints will be adjustable.

Attached Central Control Room layout drawing (Figure I-1) shows the panels on which the ICC readouts are currently located. We propose to install the upgraded CETC display on the Accident Assessment Panel.

LOCATION:

In core T/C -Rack D8

RCS Subcooling-Pan. FD

RVLIS -Acc. Ass Panel

Back-Up Displays (SAS & Plant Computer) -See Areas Designated

Note: SAS is not yet installed

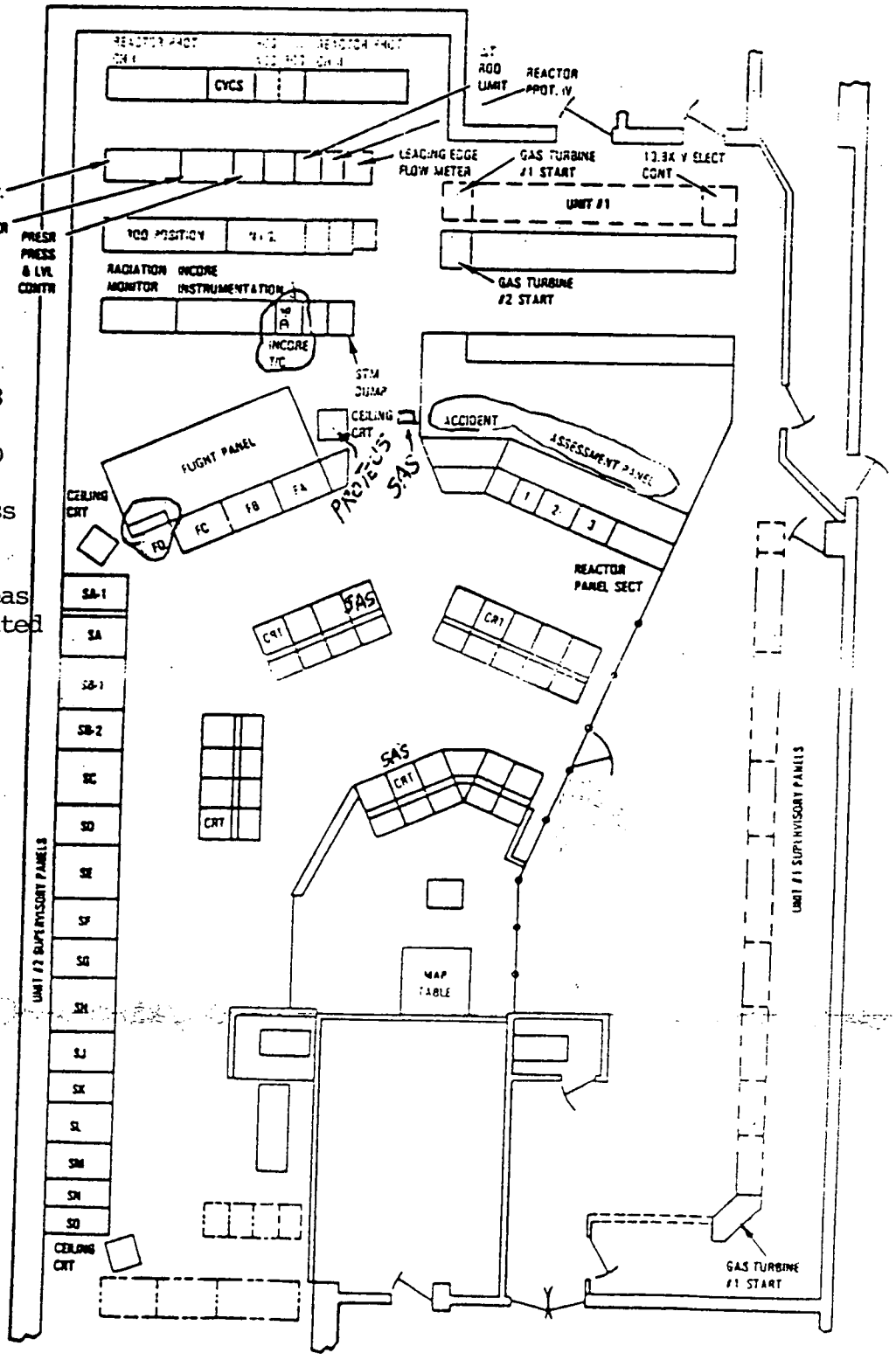

FIGURE I-1 LAYOUT OF CONTROL ROOM

The thermocouple reference junction compensation will be specified as part of the control room equipment. Thus no reference junction boxes will be in the Containment or other harsh environment.

3. Describe the implementation of the backup display(s) (including the subcooling margin monitors), how the thermocouples are selected, how they are checked for operability, and the range of the display.

Response: Backup displays are provided in the SAS/SPDS & Proteus (P2500) computers with the capability for selective reading of all thermocouples (min. of 9 per quadrant, max. total of 65), all within a time interval updated once every second (for the SAS computer). The range extends from 100°F to 2300°F. Thermocouples are checked for operability by software check against preselected limits. This feature will be retained in the upgraded system.

Trend capability and hard copy capability will be available on demand upon installation of SAS/SPDS.

The primary displays are protected from failures in the computer systems by optical isolators in the links between them.

4. Describe the use of the primary and backup displays. What training will operators have in using the core exit thermocouple instrumentation? How will the operator know when to use the core exit thermocouples and when not to use them? Reference appropriate emergency operating guidelines where applicable.

Response: The displays, both primary and backup, are used during normal as well as emergency operations. During normal operations, the operator uses the system to check the normality and consistency and to enhance their awareness of the reactor condition. He may also use the system as an aid in shim adjustment and flux flattening.

During emergency conditions, he uses the system in accordance with the Emergency Operating Procedures and Critical Safety Function Status Trees. The appropriate IP-2 EOPs are:

A) FR-C.1; "Response To Inadequate Core Cooling,

B) FR-C.2; "Response To Degraded Core Cooling:,

C) Status Tree F-0.2; "Core Cooling",

D) Foldout pages for E-0, E-1, E-3, and ECA series procedures in the "Red Path" summary section.

Utilization of the thermocouple readouts is part of the operator training program on the simulator for normal and emergency conditions. The training program will be revised, as necessary to include the new proposed CETC system installed.

5. Confirm completion of control room design task analysis applicable to ICC instrumentation. Confirm that the core exit thermocouples meet the criteria of NUREG-0737, Attachment 1 and Appendix B, or identify and justify deviations.

   Response: The core exit thermocouple system is designed to meet the intent of NUREG-0737, Attachment 1 and Appendix B, with the following deviations: Hard copy capability is available on the backup systems, the SAS/SPDS computer printout when installed and the Proteus P-2500 computer printout. This is justified on the basis that two backup systems exist, each with hard copy capability. This feature will be retained in the upgraded system.

   Para. (6) in II.F.2 of Attachment 1 calls for 1E power for the backup source, but allows non-1E power for the primary.

   The new proposed CETC's will be 1E-supplied, whereas the backups are the two computer systems and they are high-reliability non-1E powered (UPS systems with battery-backup). The current ICCI systems are part of our DCRDR program in accordance with our April 15, 1983 and January 26, 1984 responses to Supplement 1 and the DCRDR program plan.

6. Describe what parts of the systems are powered from the 1E power sources used, and how isolation from non-1E equipment is provided. Describe the power supply for the primary display. Clearly delineate in two categories which hardware is included up to the isolation devices and which is not.

   Response: In the new proposed CETC System the train-oriented primary displays, up to the isolation devices, will be powered by independent 1E power sources. Optical isolators are specified in purchasing the primary display systems. The backup systems, which are fed signals via these optical isolators, are powered by uninterruptible power supplies with battery backup.

7. Confirm the environmental qualification of the core exit thermocouple instrumentation up to the isolation device.

   Response: The installed thermocouples, which are being used in the upgraded system, are considered to meet the requirements, as per footnote 3 on p. 1.97-22 in Revision 3 of R.G. 1.97. The connectors and cables inside containment

will be qualified for its environment, as is the control room primary equipment for its environment. The containment penetrations have been purchased and installed as qualified assemblies. The cable runs and power supplies will be run as Class 1E. The specified control room primary equipment will contain optical isolators on the outputs to the backup system (the computers).

B. From Appendix B, p. 3 of Generic Letter 82-28:

Confirm explicitly the conformance to the Appendix B items listed below for the ICC instrumentation, i.e., the SMM, the reactor coolant inventory tracking system, the core exit thermocouples and the display systems.

The table below has been filled in for the proposed upgraded core exit thermocouples system and for the SMM and RVLIS see our March 23, 1983 letter and Section 2.0 of Attachment A to this submittal. The general configuration of the system is described in "A", above. Specific details will be determined as part of the procurement process. The specification of the proposed core exit thermocouple upgrade will generally track the provisions of Reg Guide 1.97, Rev. 2.

		Reference	Deviations
1.	Environmental Qualification	-	-
2.	Single Failure Analysis	-	-
3.	Class 1E Power Source	Not yet assigned	Primary display is 1E, backup is not.
4.	Availability prior to an accident	Self checking system	-
5.	Quality Assurance	CI240-1	-
6.	Continuous indications	-	-
7.	Recording of instrument outputs	-	-
8.	Identification of instruments	Not yet assigned	-
9.	Isolation	-	-

C. From Enclosure 1 of May 2, 1984 NRC Letter:

1. The following additional information is requested:

   o How may T/C's will be upgraded?

- o What is the qualification status of T/C cables, connectors, penetration and compensation junction boxes?
- o How many T/C's will be used for the primary display? If the same T/C signal is used for both backup and primary display, will there be a qualified isolation device for signals to the primary display?
- o What is the reliability of your computer system?

Response: A minimum of 36 T/C's (9 per quadrant) and a maximum of 65 T/C's will be upgraded. The T/C cables, connectors and reference junction equipment will be qualified to Regulatory Guide 1.97. Rev. 2 Category 1 requirements. (The reference junction will not be located inside containment). The two penetration assemblies are qualified Conax, chromel - alumel thermocouple type for 33 thermocouple pairs each.

All thermocouples will be wired to the primary display with qualified isolation devices in the outputs to the backup displays (the computer systems).

The computers used as backup for the core exit thermocouple system have availabilities determined as follows: a) for the SAS computer, the Con Edison Performance Spec calls for 99% availability, b) for the P2500 Proteus computer, the Proteus contract specifies 99% availability.

2. "Provide justification for the adequacy of the CET system during the interim period until upgrading can be completed."

Response: The justification is described in the Con Edison letter of March 23, 1983 and includes experience to date (since startup); upgraded temperature range; later addition of P2500 computer and the proposed SAS/SPDS computer; mapping, printout, trending and alarming capability of computers; excess number of T/C's used (65); electrical independence of primary and backup displays; and the fact that readouts from all 65 T/C's are available on both primary and backup. In addition, the current CET system can adequately handle virtually any accident condition; the probability of occurrence of the most severe accident for which qualification may be inadequate is very small.