9/14/88

Regulatory Guide 1.97 Compliance Evaluation

for

Pilgrim Nuclear Power Station I

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Summary

Regulatory Guide (Reg Guide) 1.97, Rev. 3 was issued to identify an acceptable method for evaluating design requirements of instrumentation necessary to monitor plant variables and systems during and following an accident. This report presents the results of the Pilgrim Nuclear Power Station (PNPS) Reg Guide 1.97 evaluation. Its objectives are (1) to identify how Boston Edison (BECo) meets the Reg Guide 1.97 guidance, (2) to identify deviations from the guidance, along with corresponding resolution(s) of those deviations, and (3) to identify the commitment schedule for correcting identified deviations.

The results of the PNPS Reg Guide 1.97 evaluation are summarized below:

- Fifty six (56) variables have been reviewed for the PNPS Reg Guide 1.97 evaluation and represent the following scope:

  21 Category 1 variables (779 instrument loops)
  21 Category 2 variables (99 instrument loops)
  14 Category 3 variables (158 instrument loops)

  The large number of Category 1 instrument loops is attributed to the large number of isolation valve position indicators evaluated.

- Thirty nine (39) variables comply without any need for exception or corrective action. These are identified in Table 3, Section I-3.1.1. Four (4)variables were downgraded (see Table 2, Section I-1.2) to allow compliance. This downgrading has been based on arguments provided by the Reg Guide 1.97 BWR Owner's Group and concurred in by BECo.

- Thirteen (13) variables do not comply at this time. These variables are identified on Table 4, Section I-3.1.2. Of these variables, 11 will comply when upgraded. The upgrading will require a modification, retrieval of additional documentation or a combination of the two (see Table 1, Summary).

  Two (2) of the 13 variables have been designated as "leave-as-is" (see Table 1, Summary). This disposition has been applied based generally on one of the following:

  (1) design configuration of the components involved
  (2) physical limitations (i.e., spatial)
  (3) satisfying earlier design requirements (i.e., previously responded to in NUREG 0737)

- The Post Accident Sampling System (PASS) will be evaluated and is anticipated to meet or exceed the design and qualification criteria for the following four (4) variables.

  - RCS Soluble Boron Concentration (Sample)
  - Analysis of Primary Coolant (Gamma Spectrum)
  - Primary Coolant and Sump
  - Radiation Level in Core Recirculation Loops

- One variable has varying degrees of compliance. A total of 743 instrument loops were reviewed for the variable, Primary Containment Isolation Valve Position. Of these, 598 instrument loops were found not be comply with Reg Guide 1.97. It should be noted that a majority of the non-conformances identified for this variable could be attributed to instruments not needed to follow an accident. This was especially true for the insert and withdrawal valves (i.e., 580 instrument loops) where the 1.97 design and qualification criteria could not be applied. The rationale for taking exception to upgrading these loops is provided in Section I-3.1.2 of this report.

- Two (2) broad areas of exception to the Reg Guide 1.97 guidance were electrical isolation and channel redundancy. The bases for these exceptions are evaluated in Section I-3.1.3 of this report.

- Quality Category 1 variables reviewed for PNPS will be environmentally qualified. The Category 1 variables requiring environmental qualification as a result of 1.97 guidance, will not be schedularly constrained by the 50.49 effort. Those variables are:

  Primary Containment Pressure
  Primary Containment Isolation Valve Position
  Post Accident Sampling System
  Containment and Drywell Oxygen Concentration
  Drywell Temperature

- Seismic qualification review for PNPS has been deferred pending resolution of Unresolved Safety Issue A-46. The basis for this deferral can be found in Section II-4 of this report.

- Implementation activities during Phase II will be completed by the end of Refuel Outage #8.

This report is presented in two (2) parts:

I. Boston Edison Analysis Methodology

The approach taken to establish conformance with Reg Guide 1.97 or need for action is shown on Figure 1. A statement regarding Boston Edison's intent to meet Rev. 3 of Reg Guide 1.97 is provided. Design and qualification information for existing plant equipment has been collected and entered into a computerized database. A brief explanation of the headings used in that database is presented on Figure 2. Exceptions were taken to the criteria in Reg Guide 1.97. These exceptions resulted in downgrading four (4) variables and are based on arguments presented by the 1.97 BWR Owner's Group and are presented in Section I-1.2.

The technical approach used to perform this evaluation utilizes a threshold acceptance criteria. The weighting factors used in development of this methodology and consistently applied throughout this evaluation have been based on engineering judgement and conversations with NRC. Boston Edison believes that its methodology does satisfy the basic intent of Reg Guide 1.97. Corresponding results indicating conformance to, exception to, or deviation from Reg Guide 1.97 are evaluated. Improvements to correct identified deviations are provided.

II. Conclusions

A description is provided of how the PNPS 1.97 database will be maintained. Some of the variables found to conform to 1.97 guidance may require additional information regarding specific design criteria. Attention to this situation is addressed. A general statement of Boston Edison's position regarding environmental qualification of applicable variables is provided. Seismic qualification requirements for Pilgrim are reviewed in light of Unresolved Safety Issue, A-46. Finally, a statement regarding Boston Edison's intent to complete Phase II requirements per Supplement 1 to NUREG 0737 is provided.

As prescribed by Supplement 1 to NUREG 0737, Boston Edison has attempted to perform its Reg Guide 1.97 evaluation in an integrated fashion with other related programs. Realizing this, it is anticipated that future scope changes (e.g., changes in the EOP's) may cause scope changes to Reg Guide 1.97 compliance which will be performed under 10CFR50.59 requirements without prior notification to NRC.

In submitting this document, Boston Edison satisfies its Phase I commitment in response to Supplement 1 to NUREG 0737.

A commitment summary of PNPS improvements to be implemented and exceptions taken in leaving an instrument loop(s) in their present configuration are identified in Table 1. Bracketed numbers in the lower left-hand corner of each box represent the present degree of conformance of each variable, while those numbers in the lower right-hand corner identify the expected degree of conformance, once improvements are made.

Table 1

PNPS Commitment Summary

Variable	Improvements*	Exceptions*
1. RPV Pressure[1], Type A Variable (This is the same as RCS Pressure for Type B & C variables. (Pressure is indicated twice under Type C variable.) [28] [92]	upgrade (provide for connection to redundant, safety-related power sources, Y3 & Y4 via safety cabling)	-------
2. RPV Water Level[1] (This is a Type A & B variable.) [54] [100]	upgrade (connect to redundant, safety related power sources)	-------
3. Hydrogen Concentration[1] (This applies to the Type A and C variable designations) [62] [80]	-------	leave as is

*See Section I-3.1-2 for details

[1]The PNPS 1.97 evaluation indicates that this variable does not comply with Reg Guide 1.97

Table 1 (cont'd)

Variable	Improvements*	Exceptions*
4. Primary Containment Isolation Valve Position[1]		*
- ZS7011 A & B [30]---->[94]	upgrade (connect to redundant safety-related power sources via safety cabling)	-------
- ZS7017 A & B [30]---->[94]	upgrade (same as above)	-------
- ZS4002	-------	leave as is
- ZS4356	-------	leave as is
- ZS9068 A & B [10]---->[94]	upgrade (Add a redundant safety-related power source and new position switches)	-------
- ZS8000	-------	leave as is
- ZS8001	-------	leave as is
- FCV-302-120 & 123	-------	leave as is
- SV302-121 & 122	-------	leave as is
- ZS5065-34 & 38	-------	leave as is
- ZS5065-32 & 36	-------	leave as is
5. Core Spray Flow[1]	upgrade (install redundant internal power supply)	-------
[66] [96]		

[1]The PNPS 1797 evaluation indicates that this variable does not comply with Reg Guide 1.97

Table 1 (cont'd)

Variable		Improvements*	Exceptions*
6. RHR Heat Exchanger Outlet Temperature[1]		(provide QA documentation and use existing computer hookup for trend information)	-------
[64]	[80]		
7. Cooling Water Temperature to ESF System Components[1]		use existing computer hookup to provide trend information	-------
[64]	[80]		
8. Radiation Exposure Rate[1]		upgrade (increase range of monitor & continuous loop availability)	-------
[58]	[94]		
9. Primary Containment Pressure[2]		Environmental Qualification only	-------
[86] [Cat 1]	[86]		
10. Primary Containment Isolation Valve Position[2]		Environmental Qualification only	-------
[Cat 1]	[76]		

[1]The PNPS 1*97 evaluation indicates that this variable does not comply with Reg Guide 1.97

[2]This Category 1 variable will be environmentally qualified since it is a key variable. (This is exclusive of the insert and withdrawal valves position indication)

Table 1 (cont'd)

	Variable	Improvements*	Exceptions*
11.	Post Accident Sampling System[2]	Environmental Qualification only	--------
[Cat 1]	[later]		
12.	Containment & Drywell Oxygen Concentration[2]	Environmental Qualification only	--------
[Cat 1]	[81]		
13.	Drywell Temperature[2]	Environmental Qualification only	--------
[Cat 1]	[90]		

[2]This Category 1 variable will be environmentally qualified since it is a key variable.

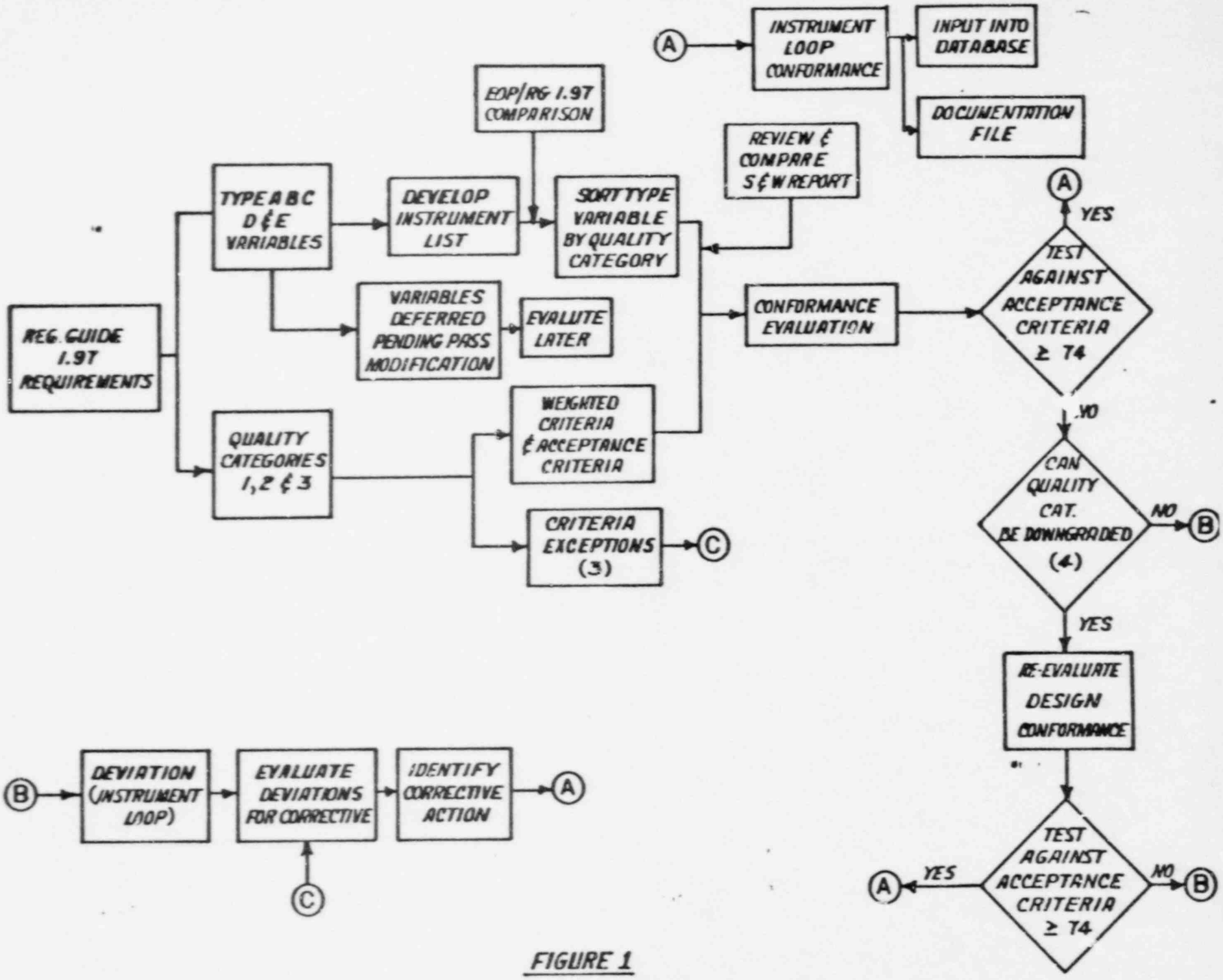

REG. GUIDE 1.97 REQUIREMENTS
TYPE A B C D & E VARIABLES
QUALITY CATEGORIES 1, 2 & 3
DEVELOP INSTRUMENT LIST
VARIABLES DEFERRED PENDING PASS MODIFICATION
EVALUTE LATER
EOP/RG 1.97 COMPARISON
WEIGHTED CRITERIA & ACCEPTANCE CRITERIA
CRITERIA EXCEPTIONS (3)
SORT TYPE VARIABLE BY QUALITY CATEGORY
REVIEW & COMPARE S&W REPORT
CONFORMANCE EVALUATION
INSTRUMENT LOOP CONFORMANCE
INPUT INTO DATABASE
DOCUMENTATION FILE
TEST AGAINST ACCEPTANCE CRITERIA ≥ 74
YES
NO
CAN QUALITY CAT. BE DOWNGRADED (4)
RE-EVALUATE DESIGN CONFORMANCE
TEST AGAINST ACCEPTANCE CRITERIA ≥ 74
DEVIATION (INSTRUMENT LOOP)
EVALUATE DEVIATIONS FOR CORRECTIVE
IDENTIFY CORRECTIVE ACTION
A
B
C

FIGURE 1

SECTION I - BOSTON EDISON ANALYSIS

I-1 Regulatory Guide 1.97 Requirements

A tabulation of the design and qualification criteria used in performing the PNPS 1.97 evaluation is provided in Appendix A. Although Boston Edison originally responded to Supplement 1 to NUREG 0737, by referencing Revison 2 of 1.97, Revision 3 was used in performing the PNPS Reg Guide 1.97 evaluation, since it represents the Staff's "latest thinking" regarding this guidance.

To evaluate PNPS Accident Monitoring Instrumentation (AMI) against the criteria in Reg Guide 1.97, the following major steps were executed:

- Identification of plant specific variables (Type A thru E). See Tables 3 and 4.

- Development of a PNPS database. See Figure 2.

- Development of a methodology for evaluating PNPS Accident Monitoring Instrumentation (AMI). See Section I-3.

- Identification of those PNPS variables found to comply with or deviate from Reg Guide 1.97. Exceptions to criteria also identified. See Sections I-3.1.1 and I-3.1.2.

- Identification of Boston Edison plans to correct identified deviations. See Section I-3.1.2.

- Identification of schedule for completing the above corrections. See Section II-5.

REQ. 1.97

DATE : 25 APR 1984

REV. : _____

NAME : _____

Example of BECo Reg Guide 1.97 Database

AMI VAR	EQUIPMENT NUMBER	SYS	PNPS DESCRIPTION	LOC	TYPE	CAT	REQ 197	REQ'D RANGE	ACTUAL RANGE	MSIQ	MSTYPE	ACTUAL ACCURACY	REF. DWGS	QFR	QMOD	QLIST
113-01	---	49	PRIM. CONT. PRESS. INST. LINE	C1298	B	1	1B	-5 TO +56 PSIG	---	-	-	---	---	-	--	NQLN
113-02	1"-130M3	49	GLOBE VALVE	---	B	1	1B	---	---	-	-	---	M241	-	--	NQLN
113-03	1001-38D	49	GLOBE VALVE	---	B	1	1B	---	---	-	-	---	M241	-	--	NQLN
113-04	PT1001-600B	49	DRYWELL PRESSURE TRANSMITTER	LOCAL	B	1	1B	0-56 PSIG	0-300PSIG	2	A	---	E125 PDCR 79-60 M241 REV A	R	1	NQLN
113-05	---	49	LOCAL MOUNTING	LOCAL	B	1	1B	---	---	-	-	---	PDCR 79-60	-	--	NQLN
113-06	SBPT600A	49	INST CABLING AT XMTR	LOCAL	B	1	1B	---	---	-	-	---	C	-	--	NQLN
113-07	C1298	49	LOCAL PANEL	C1298	B	1	1B	---	---	-	-	---	PDCR 80-09 PDCR 79-60	-	--	NQLN
113-08	---	49	CABLE TRAYS	C1298	B	1	1B	---	---	-	-	---	---	-	--	NQLN
113-09	C171	49	LOCAL PANEL	C171	B	1	1B	---	---	-	-	---	PDCR 80-09	-	--	NQLN
113-10	PB	49	PWR SUPPLY (24VDC)	C171	B	1	1B	---	---	-	-	---	PDCR 80-09	-	--	NQLN
113-11	---	49	INST CABLING AT PANEL	C171	B	1	1B	---	---	-	-	---	---	-	--	NQLN
113-12	PI1001-600B	49	DRYW. PRESS. INDICATOR	C171	B	1	1B	0-56 PSIG	0-225 PSIG	2	A	---	PDCR 79-60 E350 SHT 6	M	4	NQLN
113-13	---	49	INST CABLING AT IND.	C171	B	1	1B	---	---	-	-	---	---	-	--	NQLN
113-14	PR1001-600A	49	DRYW. PRESS. RECORDER	C170	B	1	1B	0-56 PSIG	0-225 PSIG	2	A	---	PDCR 80-09	M	3	NQLN
113-15	---	49	INST CABLING AT RECORDER	C171	B	1	1B	---	---	-	-	---	---	-	--	NQLN
113-16	---	49	CABLE TRAYS	C171	B	1	1B	---	---	-	-	---	---	-	--	NQLN
113-17	BUS Y4	49	EXT POWER SOURCE	C171	B	1	1B	---	---	-	-	---	E14	-	--	NQLN
113-18	1001-11D	49	GLOBE VALVE	---	B	1	1B	---	---	-	-	---	M-241	-	--	NQLN
113-19	PT1001-601B	49	DRYWELL PRESS. XMTR	LOCAL	B	1	1B	-5 TO +5 PSIG	-5 TO +5 PSIG	-	A	---	PDCR 79-60	-	--	NQLN
113-20	---	49	LOCAL MOUNTING	LOCAL	B	1	1B	---	---	-	-	---	PDCR 79-60	-	--	NQLN
113-21	SBPT601A	49	INST CABLING AT XMTR	LOCAL	B	1	1B	---	---	-	-	---	C	-	--	NQLN
113-22	ES1001-604B	49	PWR SUPPLY (24VDC)	C171	B	1	1B	---	---	-	-	---	E350 SHT 4	-	--	NQLN
113-23	---	49	INST CABLING AT PANEL	C171	B	1	1B	---	---	-	-	---	---	-	--	NQLN
113-24	PI1001-601B	49	DRYW. PRESS. INDICATOR	C171	B	1	1B	-5 TO +5 PSIG	-5 TO +5 PSIG	-	A	---	PDCR 79-60 E350 SHT 6	-	--	NQLN
113-25	---	49	INST CABLING @ INDICATOR	C171	B	1	1B	---	---	-	-	---	---	-	--	NQLN
113-26	PR1001-601B	49	DRYW. PRESS.	C171	B	1	1B	-5 TO +5 PSIG	-5 TO +5 PSIG	-	A	---	PDCR 80-09	-	--	NQLN

TYPICAL

Figure 2

Attachment to Figure 2

Description of Headings Used in PNPS Reg Guide 1.97 Database

- AMI VAR - a unique number provided for each Accident Monitoring Instrumentation variable. This is to be used in retrieving applicable information from the computerized database.
- Equipment Number - refers to the alphanumeric designation used to identify individual plant components.
- PNPS Description - brief description of what the component is.
- Location - indicates where the component is located in the plant.
- Type - refers to the type of variable (i.e., A, B, C, D, or E) as defined by Reg Guide 1.97.
- CAT - refers to the design and qualification requirements that corresponds to the applicable type variable as defined in Reg Guide 1.97.
- Req'd Range - refers to the range requirement specified in Reg Guide 1.97.
- Actual Range - refers to the range provided by the actual plant component.
- MSIGI - refers to the component providing the measured signal (i.e., RTD).
- STYPE - refers to the signal output type (i.e., analog or digital).
- Actual Accuracy - refers to limits which bound the departure of a measured value from the true value of a quantity. Includes accumulated errors.
- Ref Dwgs - refers to drawing(s) and or supporting documentation used in identifying actual component/system configuration.
- MFR - identifies the manufacturer of the components, where available.
- MOD - identifies the model number of the component.
- SYS and Q-List headings are provided for internal use.

I-1.1 Type Variables

Because of plant configuration it was appropriate to group the following variables under a different single variable:

- RCS Soluble Boron Concentration (Sample)
- Analysis of Primary Coolant (Gamma Spectrum)
- Primary Coolant and Sump
- Radiation Level in Core Recirculation Loops

In these cases, the Post Accident Sampling System (PASS) will be used to evaluate conformance with Reg Guide 1.97, pending completion of system installation and associated documentation by the end of Refuel Outage #6. This evaluation will be completed by Refuel Outage #8. Functionally, PASS will be used to monitor the above variables. The addition of this system provides Pilgrim with the capability of obtaining representative liquid and gas samples from within the primary containment for radiological and/or chemical analysis in association with a possible LOCA. It should be noted that the recent meeting (May 2, 1984) of the BWROG-TMI generated some concern about the PASS dissolved gas capability for BWR's. It is likely that Boston Edison will take exception to the 1.97 guidance pending results of near term meeting(s) with NRC (i.e., 1.97 required range is 0 - 2000 cc/kg, BWROG recommended range is 0 - 400 cc/kg). The remainder of the type variables are categorized in accordance with Reg Guide 1.97.

I-1.2 Quality Categories

In the course of performing the Reg Guide 1.97 evaluation, general design requirements for certain Reg Guide 1.97 variables were reduced consistent with positions provided by the Reg Guide 1.97 BWR Owners Group. A particular variable may have been identified as Category 1 by the Reg Guide, but was reduced to Category 3, for example, based on the rationale submitted by the Reg Guide 1.97 BWR Owners Group. The effected variables and their corresponding rationale are identified in Table 2.

Table 2

Downgrade of 1.97 Design Requirements

	Variable	R.G. Cat./PNPS Cat.	Reason
1.	Drywell Sump Level	1/3	Based on the BWR Owner's Group recommendation, the drywell sump level neither automatically initiates safety related systems nor alerts the operator to the need to take safety related actions during and following an accident. The designation has been changed from Category 1 to Category 3.
2.	Drywell Drain Sump Level	1/3	Based on the BWR Owner's Group recommendation, the drywell sump level neither automatically initiates safety related systems nor alerts the operator to the need to take safety related actions during and following an accident. The designations has been changed from Category 1 to Category 3.
3.	*Standby Liquid Control	2/3	Based on the BWR' Owner's Group recommendation, it was felt that the tank level should be designated Category 3 because of anticipated future changes to the SLCS design as a result of ATWS. At such time, the SLCS instrumentation should be reevaluated to ensure adequacy.

* The current design basis for the SLCS recognizes that the system has an importance to safety that is less than the importance to safety of the RPS and the engineered safeguards systems. Therefore, in accordance with the graded approach used for design and quality criteria specified in Reg Guide 1.97, it is unnecessary to apply a full quality assurance program to this instrumentation. This variable is more appropriately considered a Category 3 variable.

Table 2 (cont'd)

Downgrade of 1.97 Design Requirements

	Variable	R.G. Cat./PNPS Cat.	Reason
4.	Neutron Flux	1/2	Based on the BWR Owner's Group recommendation, it is concluded (this variable not considered to be a key variable) that a Category 2 classification is responsive to the intent of R.G. 1.97. (At the time of this evaluation Boston Edison was not aware of the availability of a suitably qualified drive unit.) The operator is alerted to a rise in neutron flux as identified in the PNPS EOP's. At 3% power the APRM downscale lights come on.

I-2 Boston Edison Database of !.97 Variables

Boston Edison has tabulated design and qualification information of existing instrumentation at Pilgrim. This information has been entered in a computer database. Detailed evaluation of each variable is also identified in this database.

I-3 Evaluation Methodology

To establish a framework for evaluating specific instrument loops, an Accident Monitoring Instrumentation (AMI) variable list (see Appendix B) for PNPS I was developed. It identified those variables required to be monitored during and following an accident. A typical database printout of instrument loop parts list as shown in Figure 2 was used in comparing the installed plant instrumentation to the guidance provided by Reg Guide 1.97.* Data gathered in support of each identified variable was placed into individual document files. These document files were established to facilitate an auditable record and to assure BECo of adequate instrumentation for safe operation. An evaluation was then performed to identify areas of conformance and non-conformance related to PNPS I instrument design and Reg Guide 1.97 design and qualification criteria. A typical Matrix Evaluation sheet is shown in Figure 3. The evaluation results have only been shown on the first line or entry of an AMI variable number. However, the results apply to all appropriate entries within a particular AMI variable number series (i.e., 001-01 thru 001-xx). The first six columns of the evaluation sheet have been copied from the "instrument data sheet" (Figure 2). Finally, the format to be used to identify the justification or resolution related to a particular deviation is shown in Figure 4.

Consistent with the graded approach used in Reg Guide 1.97, a prioritized listing of design and qualification criteria was developed. Prioritization is reflected by weighting factors used to quantitatively identify the degree of importance of each design and quality criteria in Reg Guide 1.97. The ranking is as follows:

MOST IMPORTANT	Weighting Factor
1. Instrument Range environmentally qualified for event conditions and the range needing to be measured;	20
2. Power Source for reliable operation of the instrument loop;	16
3. Seismic Qualification of equipment for durability and reliability;	14
4. Availability of the display instrumentation when needed;	12
5. Independence from a redundant channel, and from event conditions;	12

*Please realize that this page is an example of a very large printout.

MODERATELY IMPORTANT	Weighting Factor
6. Display and/or recording methods;	8
7. Redundancy of display channels when needed;	6
8. Isolation of electrical interfaced needing greater independence;	6
9. Quality Assurance requirements satisfied and documented;	4
LEAST IMPORTANT	
10. Operational considerations including periodic test and access;	1
11. Identification markings to distinguish AMI displays.	1

A value of 74 or above has been selected as a conformance index number. This value was selected to preclude not satisfying any two major design and qualification criteria. This approach was based on conversations with the NRC during development of the listing. This value indicates that the variable, and thus, the instrumentation designated to monitor that variable, meets the intent of Reg Guide 1.97. Not achieving this value indicates a number of deviations, a need for additional information (NI) or a combination of the two (2). Note that a NI designation is not grounds for stating that a variable does not comply with the guidance in Reg Guide 1.97, unless a point total of 74 or greater cannot be met because of the number of NI's. Where further information is required, further research will be performed for completeness. If the information was not found, the variable was conservatively evaluated with respect to the missing information.

These weighting factors were also used for identifying alternative solutions for correcting deviations resulting from the BECo evaluation. Overall, the following criteria were used for identifying those alternatives that may have warranted further consideration:

- The overall best technical solution in terms of meeting the Reg Guide 1.97 and
- The sets of corrective actions that produced a conformance index number greater than 74, where conformance index number represents the degree of conformance (DC) of plant equipment in comparison to Reg Guide 1.97 guidance.

A decision tree approach was used to assess the merit of combinations of alternative solutions to resolve deviations (see Figure 5).

Beyond identifying specific results, the basic intent of the 1.97 evaluation for PNPS I was to ensure that a consistent, systematic, and documentable process be developed and used in the generation of those specific results. Boston Edison believes that its methodology for evaluating PNPS instrumentation loops is consistent and systematic and also provides the foundation for assuring traceability.

REG GUIDE 1.97 REV

DATE : 17 OCT 1984 NAME :

MATRIX EVALUATION SHEET 2

* CONDENSATE AND FEEDWATER SYSTEM *

AMI VAR	EQUIPMENT NUMBER	LOC	TYPE	C A T	REG 1.97	CHAN INDEP	DISPLAY RECORD	CHAN REDUND	ELEC ISOL
040-01	*NI*	---	D	3	35	A. RG 1.97 does not require channel independence for this variable; hence, the present PNPS-1 design is satisfactory.	A. RG 1.97 does not require channel recording for this variable; hence, the present PNPS-1 design is satisfactory. Two indications of feedwater flow and a recording of total FW flow are provided in the main control room.	A. RG 1.97 does not require redundancy for this variable; hence, the present PNPS-1 design is satisfactory.	A. RG 1.97 does not require isolation for this variable; hence, the present PNPS-1 design is satisfactory.
040-02	FE641A	---	D	3	35				
040-03	FE641B		D	3	35				
040-04	DPT644A	C50	D	3	35				
040-05	DPT644B	C50	D	3	35				
040-06	C50	C50	D	3	35				
040-08	*NI*	---	D	3	35				
040-09	C918	C918	D	3	35				
040-10	640-10	C918	D	3	35				
040-11	640-11	C918	D	3	35				
040-12	640-14A	C918	D	3	35				
040-13	640-14B	C918	D	3	35				
040-14	NAND8	C918	D	3	35				
040-15	640-40A	C918	D	3	35				
040-16	640-40B	C918	D	3	35				
040-17	640-31	C918	D	3	35				
040-18	NAND8	C918	D	3	35				
040-19	640-17B	C918	D	3	35				
040-20	640-21	C918	D	3	35				
040-21	---	C918	D	3	35				
040-22	*NI*	C918	D	3	35				
040-23	*NI*	C918	D	3	35				
040-24	C905	C905	D	3	35				
040-25	640-24A	C905	D	3	35				
040-26	640-24B		D	3	35				
040-27	NAND8	C905	D	3	35				
040-28	640-26	C905	D	3	35				
040-29	NAND8	C905	D	3	35				
040-30	---	C905	D	3	35				
040-31	*NI*	C905	D	3	35				

TYPICAL

Figure 3

REG [illegible] 1 97 REV. :

DATE : 3 OCT 1984 NAME :

EVALUATION OF DEVIATIONS

****
* REACTOR COOLANT PRESSURE BOUNDARY *
****

AMI VAR	EQUIPMENT NUMBER *	LOC	TYPE	C A T	REG 197	IDENTIFICATION OF PLANT DEVIATIONS FROM RG 197 REQUIREMENTS	RESOLUTION/JUSTIFICATION OF PLANT DEVIATION	REF. SOURCE
003-01	*NI*	C2205	C	1	23			
003-02	263-13A	1 30	C	1	23			
003-03	263-2-18A	*NI*	C	1	23			
003-04	263-2-19A	*NI*	C	1	23			
003-05	PT-647A	C2205	C	1	23			
003-06	C2205	C2205	C	1	23			
003-07	NAN2C	C2205	C	1	23			
003-08	*NI*	*NI*	C	1	23			
003-09	640-3A	C918	C	1	23			
003-10	NAN2C/0	C918	C	1	23			
003-11	C918	C918	C	1	23			
003-12	ES-640-1	C918	C	1	23			
003-13	NAN2C/0	C918	C	1	23			
003-14	PR-640-27	C905	C	1	23			
003-15	NAN2D	C905	C	1	23			
003-16	PI-640-25A	C905	C	1	23			
003-17	NAN20	C918	C	1	23			
003-18	C905	C905	C	1	23			
003-19	*NI*	C905	C	1	23			
003-20	BUS Y2	C918	C	1	23			
003-21	Y209D/A	CSR	C	1	23			
004-01	*NI*	C2206	C	1	23			
004-02	263-13B	1 30	C	1	23			
004-03	263-2-18B	*NI*	C	1	23			
004-04	263-2-19B	*NI*	C	1	23			
004-05	PT-647B	C2206	C	1	23			
004-06	C2206	C2206	C	1	23			
004-07	N31BC	C2206	C	1	23			
004-08	*NI*	*NI*	C	1	23			
004-09	640-3B	C918	C	1	23			
004-10	N31BC/BD	C918	C	1	23			
004-11	C918	C918	C	1	23			
004-12	ES-640-10	C918	C	1	23			
004-13	N31BC/BD	C918	C	1	23			
004-14	PR-640-27	C905	C	1	23			
004-15	NAN2D	C905	C	1	23			
004-16	PI-640-25B	C905	C	1	23			
004-17	N31BD	C905	C	1	23			
004-18	C905	C905	C	1	23			
004-19	*NI*	C905	C	1	23			
004-20	BUS Y2	C916	C	1	23			
004-21	Y209D/A	CSR	C	1	23			
005-01	*NI*	C2205	C	1	28			

TYPICAL

Figure 4

EVALUATION WORKSHEET EXAMPLE

VARIABLE: REACTOR PRESSURE

Deviations

1. PI Range is 1200, not 1500 psig
2. Seismic Qualification not done
3. Non-1E Power Bus Source
4. Panel 905 Wiring not separated
5. Pow[illegible] Source not battery-backed
6. ID Markings not on displays
7. Redundant Recorder for PT-6478
8. Environmental Qualification not done

Base-Line Index Calculation

20	EQ. Range
16	Power
14	Seismic
12	Avail.
12	Indep.
8	Disp/Rec.
6	Redund.
6	Isol.
4	QA
1	AMI Display
99	Out of 100 possible

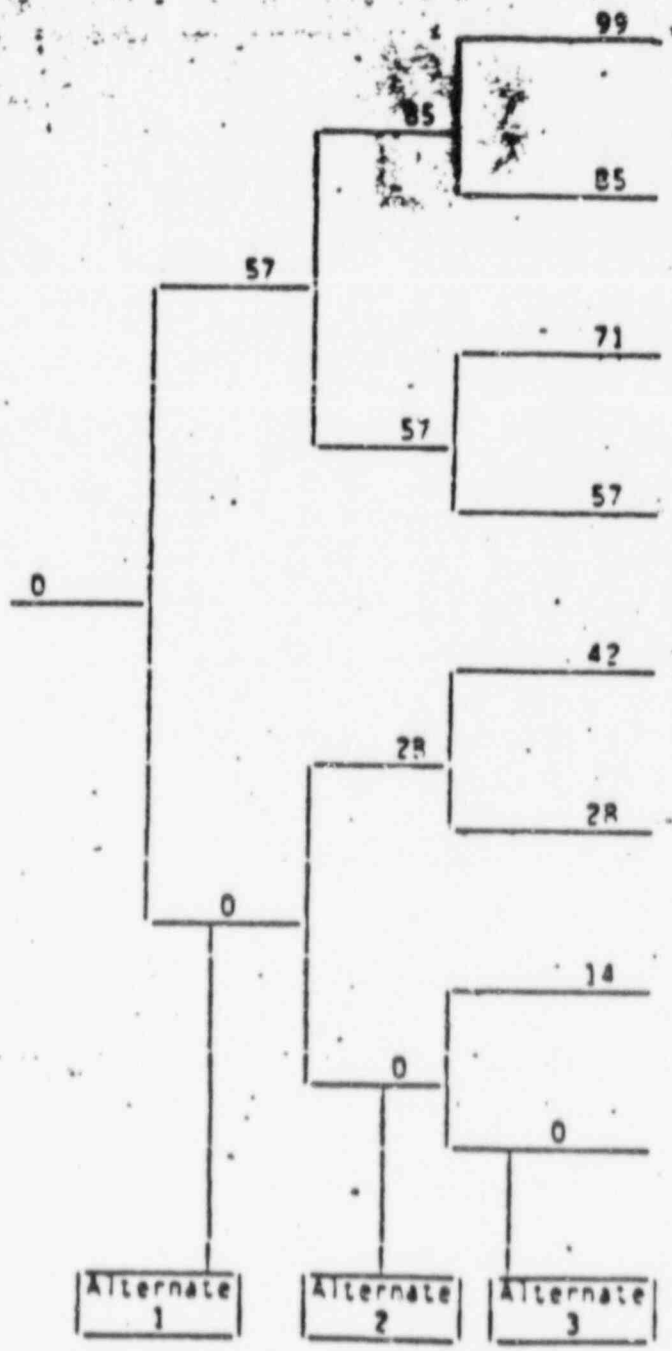


Figure 5

I-3.1 Results of Evaluation

This section of the report contains identified areas of conformance, deviation, and exception relative to the guidance in Reg Guide 1.97. Tables 3 and 4 in Section I-3.1.1 and I-3.1.2 respectively, Evaluation Results Matrices, identify the results of the PNPS I Reg Guide 1.97 evaluation of all 56 variables. Four (4) designations have been used to denote the degree of conformity of variables evaluated for each design and quality criteria. They are:

A	acceptable
AWJ	acceptable with justification
NI	need information (further review or documentation required)
1, 2...	deviation

Bracketed numbers in the lower left-hand corner of each variable box in Tables 3 and 4 identify the quality category designation (i.e., Category 1, 2, or 3) for each variable. Bracketed numbers in the lower right-hand corner identify the numerical value of the degree of conformity for each variable which is compared with the acceptance value of 74.

I-3.1.1 Conformance

Table 3 is a tabulation of all variables reviewed and found to conform to Reg Guide 1.97 guidance. Acceptance of these variables was predicated on the degree of conformance of plant equipment being equal to or greater than the 74 conformance index number. For the PNPS 1.97 evaluation, Category 1 variable is considered acceptable if the range criteria is met along with other design and quality criteria, the sum of which either equals of exceed the 74 conformance index number. The necessity for meeting environmental qualification requirements for Category 1 variables has been deferred (to be completed by RFO #8) for the PNPS conformance evaluation.

The neutron flux variable quality category was downgraded from Category 1 to Category 2 and was subsequently found to conform with Reg Guide 1.97. Part of the reason for this downgrade was based on the unavailability of a suitably qualified drive unit as noted in Reference 3.

Table 3
Pilgrim Nuclear Power Station I
Evaluation Results Matrix -
Conformance

TYPE A	EQ/ Range	Power Source	Seismic Qual.	Loop Avail.	Chan. Indep.	Display Record	Chan. Redund.	Elec. Isol.	QA Reqmt.	Test Access	ID Mark
Torus Temperature [1]* [100]**	A[1]	A	A	A	A	A	A	A	A	A	A
Torus Water Level [1] [100]	A[1]	A	A	A	A	A	A	A	A	A	A
Primary Containment Pressure [1] [86]	A[2]	A	NI	A	A	A	A	A	A	A	A
Drywell Temperature [1] [76]	AHJ[2]	A	NI	A	A	A	A	I	NI	A	A
TYPE B	EQ/ Range	Power Source	Seismic Qual.	Loop Avail.	Chan. Indep.	Display Record	Chan. Redund.	Elec. Isol.	QA Reqmt.	Test Access	ID Mark
REACTIVITY CONTROL											
Neutron Flux (APRM/SRM) [2] [85]	A	A	NI	A	A	A	A	A	AHJ	A	NI
Control Rod Position [3] [100]	A	A	A	A	A	A	A	A	A	A	A

[1] This equipment is being environmentally qualified under the scope and schedule requirements of 10CFR50.49.
[2] Category I variables will be environmentally qualified by the end of Refuel Outage #8.

*[ ] This number identifies the quality category.
**[ ] This number identifies the degree of conformance.

Table 3
Pilgrim Nuclear Power Station I
Evaluation Results Matrix -
Conformance

TYPE B	EQ/ Range	Power Source	Seismic Qual.	Loop Avail.	Chan. Indep.	Display Record	Chan. Redund.	Elec. Isol.	QA Reqmt.	Test Access	ID Mark
RCS Soluble Boron Concentration (Sample) [3]	See Section I-1.2										
MAINT. RX COOLANT SYSTEM INTEGRITY											
Drywell Pressure [1] [86]	A[2]	A	NI	A	A	A	A	A	A	A	A
Drywell Sump [3] [100]	A	A	A	A	A	A	A	A	A	A	A
MAINT. CONTAINMENT INTEGRITY											
Primary Containment Pressure [1] [86]	A[2]	A	NI	A	A	A	A	A	A	A	A

[2] Category 1 variables will be environmentally qualified by the end of Refuel Outage #8.

Table 3
Pilgrim Nuclear Power Station I
Evaluation Results Matrix -
Conformance

TYPE B	EQ/ Range	Power Source	Seismic Qual.	Loop Avail.	Chan. Indep.	Display Record	Chan. Redund.	Elec. Isol.	QA Reqmt.	Test Access	ID Mark
Primary Containment Isolation Valve Position (excluding check valve) [1] [76]	AHJ[2]	A	NI	A	A	AHJ	A	1	NI	A	A
TYPE C	**EQ/ Range**	**Power Source**	**Seismic Qual.**	**Loop Avail.**	**Chan. Indep.**	**Display Record**	**Chan. Redund.**	**Elec. Isol.**	**QA Reqmt.**	**Test Access**	**ID Mark**
FUEL CLADDING											
Rad. Level in Core Recirc. Loop [1]	See Section I-1.2										
Analysis of Primary Coolant (Gamma Spectrum) [3]	See Section I-1.2										
RX COOLANT PRESS. BOUNDARY											
Drywell Drain Sumps Level (Identified & Unidentified Leakage) [3] [100]	A	A	A	A	A	A	A	A	A	A	A

[2] Category 1 variables will be environmentally qualified by the end of Refuel Outage #8.

Table 3
Pilgrim Nuclear Power Station I
Evaluation Results Matrix -
Conformance

TYPE C	EQ/ Range	Power Source	Seismic Qual.	Loop Avail.	Chan. Indep.	Display Record	Chan. Redund.	Elec. Isol.	QA Reqmt.	Test Access	ID Mark
Suppression Pool Water Level [1] [100]	A[1]	A	A	A	A	A	A	A	A	A	A
Drywell Pressure [1] [86]	A[2]	A	NI	A	A	A	A	A	A	A	A
CONTAINMENT											
Containment and Drywell Oxygen Concentration (for inerted containment plants) [1] [81]	AHJ[2]	AHJ	NI	A	A	A	A	A	NI	NI	A
Containment Effluent Radioactivity Noble Gases (from identified release points including Standby Gas Treatment System Vent) [3] [99]	A	A	A	A	A	A	A	A	A	NI	A

[1] This equipment is being environmentally qualified under the scope and schedule requirements of 10CFR50.49.

[2] Category 1 variables will be environmentally qualified by the end of Refuel Outage #8.

Table 3
Pilgrim Nuclear Power Station I
Evaluation Results Matrix -
Conformance

TYPE C	EQ/ Range	Power Source	Seismic Qual.	Loop Avail.	Chan. Indep.	Display Record	Chan. Redund.	Elec. Isol.	QA Reqmt.	Test Access	ID Mark
Effluent Radioactivity -Noble Gases (from buildings or areas where penetrations and hatches are located, e.g., secondary containment and auxiliary buildings and fuel handling buildings that are in direct contact with primary containment [2] [80]	NI	A	A	AHJ	A	A	A	A	A	A	A
Primary Containment Pressure [1] [86]	AHJ[2]	A	NI	A	A	AHJ	A	A	A	A	A
TYPE D	**EQ/ Range**	**Power Source**	**Seismic Qual.**	**Loop Avail.**	**Chan. Indep.**	**Display Record**	**Chan. Redund.**	**Elec. Isol.**	**QA Reqmt.**	**Test Access**	**ID Mark**
CONDENSATE & FEEDWATER											
Main Feedwater Flow [3] [100]	A	A	A	A	A	A	A	A	A	A	A

[2] Category 1 variables will be environmentally qualified by the end of Refuel Outage #8.

Table 3
Pilgrim Nuclear Power Station I
Evaluation Results Matrix -
Conformance

TYPE D	EQ Range	Power Source	Seismic Qual.	Loop Avail.	Chan. Indep.	Display Record	Chan. Redunc.	Elec. Isol.	QA Reqmt.	Test, Access	ID Mark
Condensate Tank Storage Level [3] [80]	NI	A	A	A	A	A	A	A	A	A	A
PRIMARY CONTAINMENT RELATED SYSTEMS											
Drywell Pressure [2] [86]	A	A	NI	A	A	A	A	A	A	A	A
Suppression Pool Water Level [2] [100]	A[1]	A	A	A	A	A	A	A	A	A	A
Drywell Atmosphere Temperature [2] [90]	AHJ	A	A	A	A	A	A	1	NI	A	A
Drywell Spray Flow [2] [82]	AHJ	A	NI	A	A	A	A	A	NI	A	A
Suppression Pool Water Temperature [2] [100]	A[1]	A	A	A	A	A	A	A	A	A	A

[1] This equipment is being environmentally qualified under the scope and schedule requirements of 10CFR50.49.

Table 3
Pilgrim Nuclear Power Station I
Evaluation Results Matrix -
Conformance

TYPE D	EQ/ Range	Power Source	Seismic Qual.	Loop Avail.	Chan. Indep.	Display Record	Chan. Redund.	Elec. Isol.	QA Reqmt.	Test Access	ID Mark
SLCS Storage Tank Level [3] [100]	A	A	A	AWJ	A	A	A	A	A	A	A
LPCI System Flow [2] [82]	AWJ	A	NI	A	A	A	A	A	1	A	A
RHR SYSTEMS											
RHR System Flow [2] [82]	AWJ[1]	A	NI	A	A	A	A	A	1	A	A
COOLING WATER SYSTEM											
Cooling Water Flow to ESF System Components [2] [81]	AWJ	A	NI	A	A	A	A	A	1	2	A

[1] This equipment is being environmentally qualified under the scope and schedule requirements of 10CFR50.49.

Table 2
Pilgrim Nuclear Power Station I
Evaluation Results Matrix -
Conformance

TYPE D	EQ/ Range	Power Source	Seismic Qual.	Loop Avail.	Chan. Indep	Display Record	Chan. Redund.	Elec. Isol.	QA Reqmt.	Test Access	ID Mark
RADWASTE SYSTEMS											
High Radioactivity Liquid Tank Level [3] [80]	NI	A	A	A	A	A	A	A	A	A	A
VENTILATION SYSTEM											
Emergency Ventilation [2] [96]	AMJ	A	A	A	A	A	A	A	NI	A	A
POWER SUPPLIES											
Status of Standby Power and status of other energy sources Important to Safety (pneumatic) [2] [82]	AMJ	A	NI	A	A	A	A	A	NI	A	A

Table 3
Pilgrim Nuclear Power Station I
Evaluation Results Matrix -
Conformance

TYPE E	EQ/ Range	Power Source	Seismic Qual.	Loop Avail.	Chan. Indep.	Display Record	Chan. Redund.	Elec. Isol.	QA Reqmt.	Test Access	ID Mark
AIRBORNE RAD. MAT'LS RELEASED FROM PLANT											
Primary Containment Area Radiation - High Range [1] [74]	A'	A	NI	A	1	A	A	A	A	A	A
Noble Gases and Vent Flow Rate - Common Plant Vent or Multipurpose Vent Discharging any of Above Releases (if drywell or SGTS purge is included) [2] [90]	A	A	A	A	A	A	A	1	NI	A	A

' This equipment is being environmentally qualified under the scope and schedule requirements of 10CFR50.49.

ble 3
Pilgrim Nuc ar Power Station I
Evaluation Results Matrix -
Conformance

TYPE E	EQ/ Range	Power Source	Seismic Qual.	Loop Avail.	Chan. Indep.	Display Record	Chan. Redund.	Elec. Isol.	QA Reqmt.	Test Access	ID Mark
METEOROLOGY											
Wind Direction [3] [100]	A	A	A	A	A	A	A	A	A	A	A
Wind Speed [3] [100]	A	A	A	A	A	A	A	A	A	A	A
Estimation of Atmospheric Stability [3] [100]	A	A	A	A	A	A	A	A	A	A	A
ACCIDENT SAMPLING CAPABILITY											
Primary Coolant and Sump [3]	See Section I-1.2										

I-3.1.2 Deviations and Corrective Actions

Table 4 provides a summary of identified variables that do not meet the 74 conformance index number. A detailed evaluation of each of these variables is provided on Matrix Evaluation Sheets found in this section of the report.

This section also identifies the resolution of those deviations. Where improvements will be made, a decision tree shows alternates considered and the action planned. Where more than one quality category is applied to a variable, the corrective action meets the more stringent of the quality categories. Some deviations were found to be acceptable upon further examination. In these cases, a rationale is provided indicating the justification for leaving the affected portion of the instrument loop as is.

Table 4
Pilgrim Nuclear Power Station I
Evaluation Results Matrix -
Deviations

TYPE A	EQ/ Range	Power Source	Seismic Qual.	Loop Avail.	Chan. Indep.	Display Record	Chan. Redund.	Elec. Isol.	QA Reqmt.	Test Access	ID Mark
RPV Pressure [1]* [28]**	AMJ[2]	1	NI	2	3	4	5	A	NI	A	A
RPV Water Level [1] [54]	AMJ[2]	1	NI	NI	A	A	A	A	NI	A	A
Hydrogen Concentration [1] [62]	1[1]	A	NI	A	A	A	A	A	NI	A	A
TYPE B	EQ/ Range	Power Source	Seismic Qual.	Loop Avail.	Chan. Indep.	Display Record	Chan. Redund.	Elec. Isol.	QA Reqmt.	Test Access	ID Mark
CORE COOLING											
Coolant Level in Reactor [1] [54]	AMJ[2]	1	NI	NI	A	A	A	A	NI	A	A

[1] This equipment is being environmentally qualified under the scope and schedule requirements of 10CFR50.49.

[2] Category 1 variables will be environmentally qualified by the end of Refuel Outage #8.

*[ ] This number identifies the quality category.
**[ ] This number identifies the degree of conformance.

Table 4
Pilgrim Nuclear Power Station I
Evaluation Results Matrix -
Deviations

TYPE B	EQ/ Range	Power Source	Seismic Qual.	Loop Avail.	Chan. Indep.	Display Record	Chan. Redund.	Elec. Isol.	QA Reqmt.	Test Access	ID Mark
MAINT. RX COOLANT SYSTEM INTEGRITY											
RCS Pressure [1] [28]	AWJ[2]	1	NI	2	3	4	5	A	NI	A	A
MAINT. CONTAINMENT INTEGRITY											
ZS7011 A & B [1] [30]	AWJ[2]	1	NI	2	3	AWJ	4	5	NI	A	A
ZS7017 A & B [1] [30]	AWJ[2]	1	NI	2	3	AWJ	4	5	NI	A	A

[2] Category 1 variables will be environmentally qualified by the end of Refuel Outage #8.

Table 4
Pilgrim Nuclear Power Station I
Evaluation Results Matrix -
Deviations

TYPE B	EQ/ Range	Power Source	Seismic Qual.	Loop Avail.	Chan. Indep.	Display Record	Chan. Redund.	Elec. Isol.	QA Reqmt.	Test Access	ID Mark
ZS4002 [1] [64]	AWJ[2]	A	NI	AWJ	1	AWJ	AWJ	2	NI	A	A
ZS4356 [1] [48]	AWJ[2]	1	NI	AWJ	2	AWJ	AWJ	3	NI	A	A
ZS9068 A & B [1] [10]	1[2]	2	NI	3	4	AWJ	5	6	NI	A	A
ZS8000 [1] [28]	AWJ[2]	1	NI	2	3	AWJ	4	5	NI	6	7
ZS8001 [1] [28]	AWJ[2]	1	NI	2	3	AWJ	4	5	NI	6	7
FCV-302-120 & 123 [1] [0]	1[2]	2	3	4	5	6	7	8	9	10	11
SV-302-121 & 122 [1] [0]	1[2]	2	3	4	5	6	7	8	9	10	11

[2] Category 1 variables will be environmentally qualified by the end of Refuel Outage #8.

Table 4
Pilgrim Nuclear Power Station I
Evaluation Results Matrix -
Deviations

TYPE B	EQ/ Range	Power Source	Seismic Qual.	Loop Avail.	Chan. Indep.	Display Record	Chan. Redund.	Elec. Isol.	QA Reqmt.	Test Access	ID Mark
ZS5065-34 & 38 [1] [56]	1[2]	A	NI	A	A	AHJ	A	2	NI	A	A
ZS5065-32 & 36 [1] [56]	1[2]	A	NI	A	A	AHJ	A	2	NI	A	A
TYPE C	**EQ/ Range**	**Power Source**	**Seismic Qual.**	**Loop Avail.**	**Chan. Indep.**	**Display Record**	**Chan. Redund.**	**Elec. Isol.**	**QA Reqmt.**	**Test Access**	**ID Mark**
RX COOLANT PRESS. BOUNDARY											
RCS Pressure [1] [28]	AHJ[2]	1	NI	2	3	4	5	A	NI	A	A
CONTAINMENT											
RCS Pressure [1] [28]	AHJ[2]	1	NI	2	3	4	5	A	NI	A	A
Containment and Drywell Hydrogen Concentration [1] [62]	1[1]	A	NI	A	A	A	A	A	NI	A	A

[1] This equipment is being environmentally qualified under the scope and schedule requirements of 10CFR50.49.

[2] Category 1 variables will be environmentally qualified by the end of Refuel Outage #8.

Table 4
Pilgrim Nuclear Power Station I
Evaluation Results Matrix -
Deviations

TYPE D	EQ/ Range	Power Source	Seismic Qual.	Loop Avail.	Chan. Indep.	Display Record	Chan. Redund.	Elec. Isol.	QA Reqmt.	Test Access	ID Mark
SAFETY SYSTEMS											
Core Spray System Flow [2] [66]	AHJ'	1	NI	A	A	A	A	A	2	A	A
RHR SYSTEMS											
RHR Heat Exchanger Outlet Temperature [2] [66]	AHJ	A	NI	A	1	A	A	2	3	A	A
COOLING WATER SYSTEM											
Cooling Water Temp to ESF System Components [2] [64]	AHJ	A	NI	A	1	A	A	2	3	A	A

' This equipment is being environmentally qualified under the scope and schedule requirements of 10CFR50.49.

Table 4
Pilgrim Nuclear Power Station I
Evaluation Results Matrix -
Deviations

TYPE E	EQ/ Range	Power Source	Seismic Qual.	Loop Avail.	Chan. Indep.	Display Record	Chan. Redund.	Elec. Isol.	QA Reqmt.	Test Access	ID Mark
CONTAINMENT RADIATION											
Radiation Exposure Rate (inside bldg. access is required to service equipment important to safety) [2] [58]	1[2]	A	A	NI	A	A	A	2	NI	A	A

[2] Category I variables will be environmentally qualified by the end of Refuel Outage #8.

Matrix Evaluation Sheet

RPV PRESSURE

EQ RANGE (20): [AMJ] The reactor pressure monitoring channels meet all plant emergency procedure operating requirements, and Reg Guide 1.97 range requirements for the identical Type B and C Category 1 variables. The PT-647A and B transmitters will be required to satisfy environmental qualification requirements. This Type A Category 1 design requirement is considered to be acceptable based on satisfying the range requirement.

POWER SOURCE (16): [1] The bus Y2 vital instrument power source used for both PT-647A and B transmitters does not meet Reg Guide 1.97 requirements for redundancy and independence.

SEISMIC QUALIFICATION (14): [*NI*] (Need to confirm seismic qualification of the reactor pressure transmitter, local racks C2205 and C2206, panel C918, and the recorder mounted on panel C905). Seismic qualification is required by Reg Guide 1.97 for Type A Category 1 variables.

LOOP AVAILABILITY (12): [2] Bus Y2 and panel C918 do not provide sufficient redundancy to assure high availability; however, an independent transmitter is provided for each reactor pressure monitoring channel.

CHANNEL INDEPENDENCE (12): [3] The two channels of reactor pressure monitoring do not fulfill the independence requirement of Reg Guide 1.97 for this variable because of the Y2 power source, single recorder, C918 and C905 panels, and cabling, which has been identified as non-safety related.

DISPLAY RECORDED (8): [4] A single recorder with two pens covering a 0 to 1500 psig range is provided on main control room panel C905. Because of the importance of trend information for reactor pressure, each channel is required to be recorded by Reg Guide 1.97.

CHANNEL REDUNDANCY (6): [5] Redundant pressure transmitters, local racks, and control room indicators are provided; however, other portions of the two reactor pressure channels do not meet the redundancy requirement of Reg Guide 1.97.

ELECTRICAL ISOLATION (6): [A] Confirmation that cable tray and conduit routing meets separation requirements in all respects has been and is assured by approved departmental procedure, vendor specifications, and industry standards (i.e., BECAM, Bechtel Design Criteria for Electrical Installations and GE Specifications #22A1421, E-347, IEEE279-1971). This also applies to confirming adequate separation and electrical isolation for existing wiring by reviewing and approving associated pull cards.

QA REQUIREMENTS (4): [*NI*] (Need to determine whether sufficient QA controls were applied to the original design of the reactor pressure monitoring channels).

TEST ACCESSIBILITY (1): [A] All equipment associated with the reactor pressure monitoring channels is accessible during all plant operating modes.

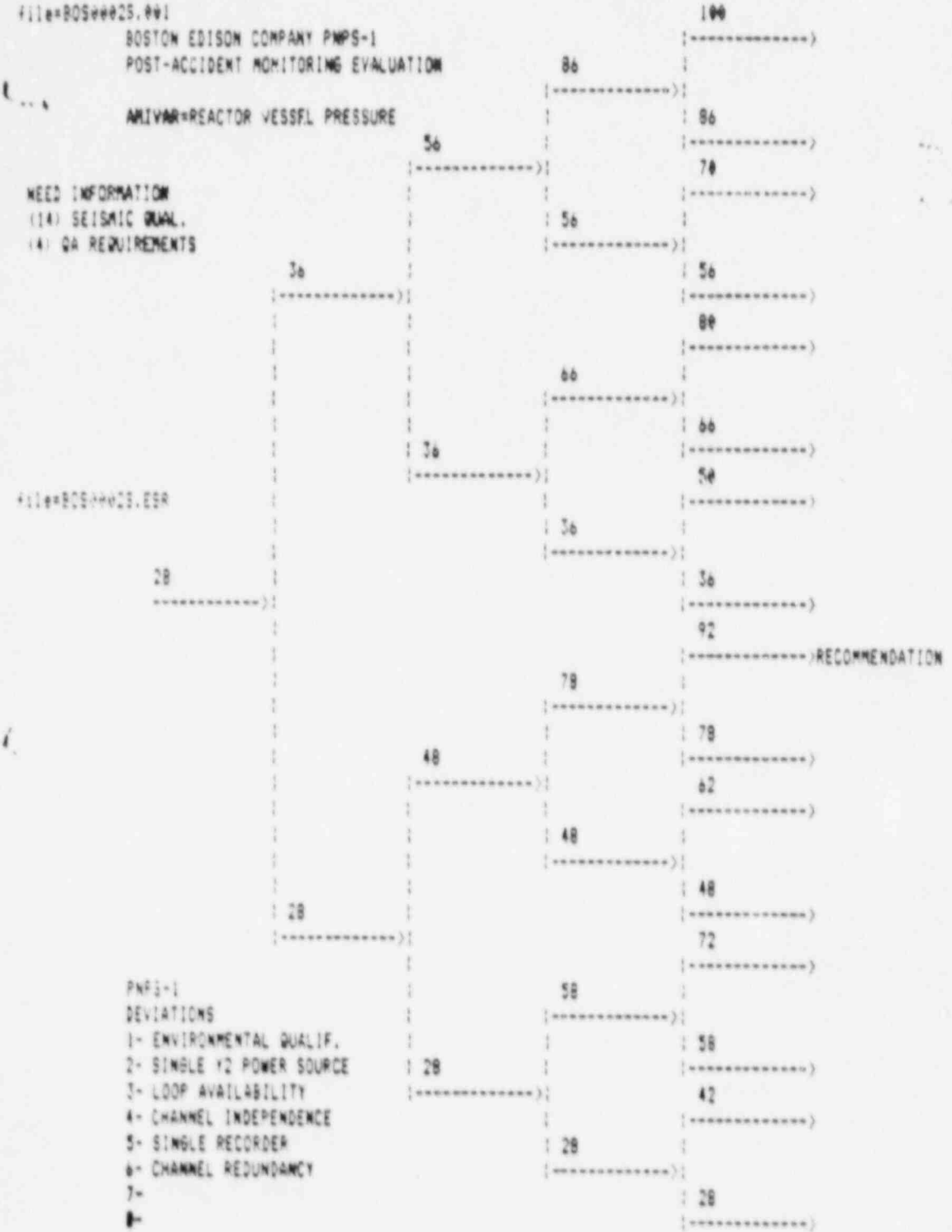
IDENTIFICATION MARKINGS (1): [A] Identification marking for the pressure recorder on C905 is distinctively marked.

RPV PRESSURE

IMPROVEMENTS

This is a Type A Category 1 variable. The intent of this variable is to provide the operator primary information for manual action when (1) depressurizing RPV and maintaining safe cooldown rate by any of several systems, such as main turbine bypass valves, HPCI, RCIC, and RWCU and (2) manually opening one SRV to reduce pressure to below SRV setpoint if any SRV is cycling. Boston Edison presently intends to install an analog trip system which will replace certain reactor pressure switches. Use of the analog trip system which will be Class 1E can be used to provide reactor pressure signals to the control room. Boston Edison, therefore, plans to implement the above improvements by taking advantage of derived benefits resulting from the analog trip system effort. (See Figure 6)

It has been identified that a redundant pressure recorder on panel C905 should be installed in order to meet the Type A variable trend information requirement. Closer examination of the panel indicates that there is physically not sufficient room for the addition of another recorder. However, operator utilization of the SPDS will compensate for this. Boston Edison, therefore, intends not to install a redundant recorder.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BOSTON EDISON COMPANY PNPS-1
POST-ACCIDENT MONITORING EVALUATION
ANIVAR=REACTOR VESSEL PRESSURE
NEED INFORMATION
(14) SEISMIC QUAL.
(4) QA REQUIREMENTS
file=BOS###23.ESR
PNPS-1
DEVIATIONS
1- ENVIRONMENTAL QUALIF.
2- SINGLE Y2 POWER SOURCE
3- LOOP AVAILABILITY
4- CHANNEL INDEPENDENCE
5- SINGLE RECORDER
6- CHANNEL REDUNDANCY
7-
8-
100
86
86
70
5a
5a
56
80
66
66
3a
50
3a
3a
92
RECOMMENDATION
78
78
48
62
48
48
2B
72
58
58
2B
42
2B
2B
ALTERNATIVE 1 (DEV. 5) PROVIDE REDUNDANT RECORDER TO MEET TYPE A VARIABLE TREND INFO REQUIREMENT
ALTERNATIVE 2 (DEV. 2) PROVIDE CONNECTION TO REDUNDANT, SAFETY-RELATED POWER SOURCES
ALTERNATIVE 3 (DEV. 3,4,6) PROVIDE INDEPENDENCE AND SEPARATION OF REDUNDANT CHANNEL WITH RESPECT TO SAFETY SOURCES
ALTERNATIVE 4 (DEV. 1) PROVIDE SEISMIC QUALIF. INFORMATION AND PERFORM ENVIRONMENTAL QUALIFICATION

FIGURE 6

RPV WATER LEVEL

EQ RANGE (20): [AHJ] Two overlapping reactor vessel water level instrumentation channels in each division provide measurement ranges that approximate, but do not precisely meet, Reg Guide 1.97 range requirements. LITS263-59A and B extend from +432 to +532 inches of water relative to vessel zero and are used to display reactor water level during both normal and abnormal operating modes. DPT1001-650A and B extend from +205 to +505 inches of water and are used to display reactor water level during abnormal operating modes whenever the recirculation pumps are tripped. Under accident conditions, the overlapping range of these instruments does not fully encompass the Reg Guide 1.97 required range of +186 to +604 inches of water relative to vessel zero.

This Type A Category 1 variable will require full EQ review.

PDCR-81-34 added new differential pressure transmitters DPT1001-650A/B for the fuel zone (i.e., wide range) level measurement in lieu of existing LITS263-73A/B instruments and requires that the water level modification comply with IEEE Stds 323-1974 and 344-1975 and USNRC Reg Guide 1.89 and 1.100. This Rosemount 1153 transmitter DPT1001-650A and B will also require full EQ review.

POWER SOURCE (16): [1] Redundant, safety related power sources, Y3 & Y4 are used to power DPT1001-650A and B channels, respectively. However, LITS263-59A and B are powered from a single non-safety power source, Y1. This design is, therefore, not acceptable under Reg Guide 1.97 requirements.

SEISMIC QUALIFICATION (14): [*NI*] (Need to confirm seismic qualification of the four reactor vessel water level instrument channels). Seismic qualification is required by Reg Guide 1.97 for this variable. Seismic analysis of the C2251 and C2252 instrument racks is provided in PDCR-81-34 Appendix B.

LOOP AVAILABILITY (12): [*NI*] (Need to confirm that each narrow range and wide range channel provides an independent sensor, a vital instrumentation power source, and uses a portion of a PAM panel recorder).

CHANNEL INDEPENDENCE (12): [A] Two redundant and physically separate trains of reactor vessel level monitoring are specified on M-253 revision 12 design revision A.

DISPLAY RECORDED (8): [A] Redundant recorders covering a +205 to +505 inches of water range and an overlapping +432 to +532 inches of water range are provided on PAM panels C170 and C171 per PDCR-79-60.

CHANNEL REDUNDANCY (6): [A] Redundant trains for reactor vessel level monitoring are specified on M-253 revision 12 design revision A.

ELECTRICAL ISOLATION (6): [A] Confirmation that cable tray and conduit routing meets separation requirements in all respects has been and is assured by approved departmental procedure, vendor specifications, and industry standards (i.e., BEQAM, Bechtel Design Criteria for Electrical Installations and GE Specifications #22A1421, E-347, IEEE279-1971). This also applies to confirming adequate separation and electrical isolation for existing wiring by reviewing and approving associated pull cards.

QA REQUIREMENTS (4): [*NI*] (Need to confirm implemented QA for PDCR-81-34 modification and for existing LITS263-59A and B and associated channel instrumentation.

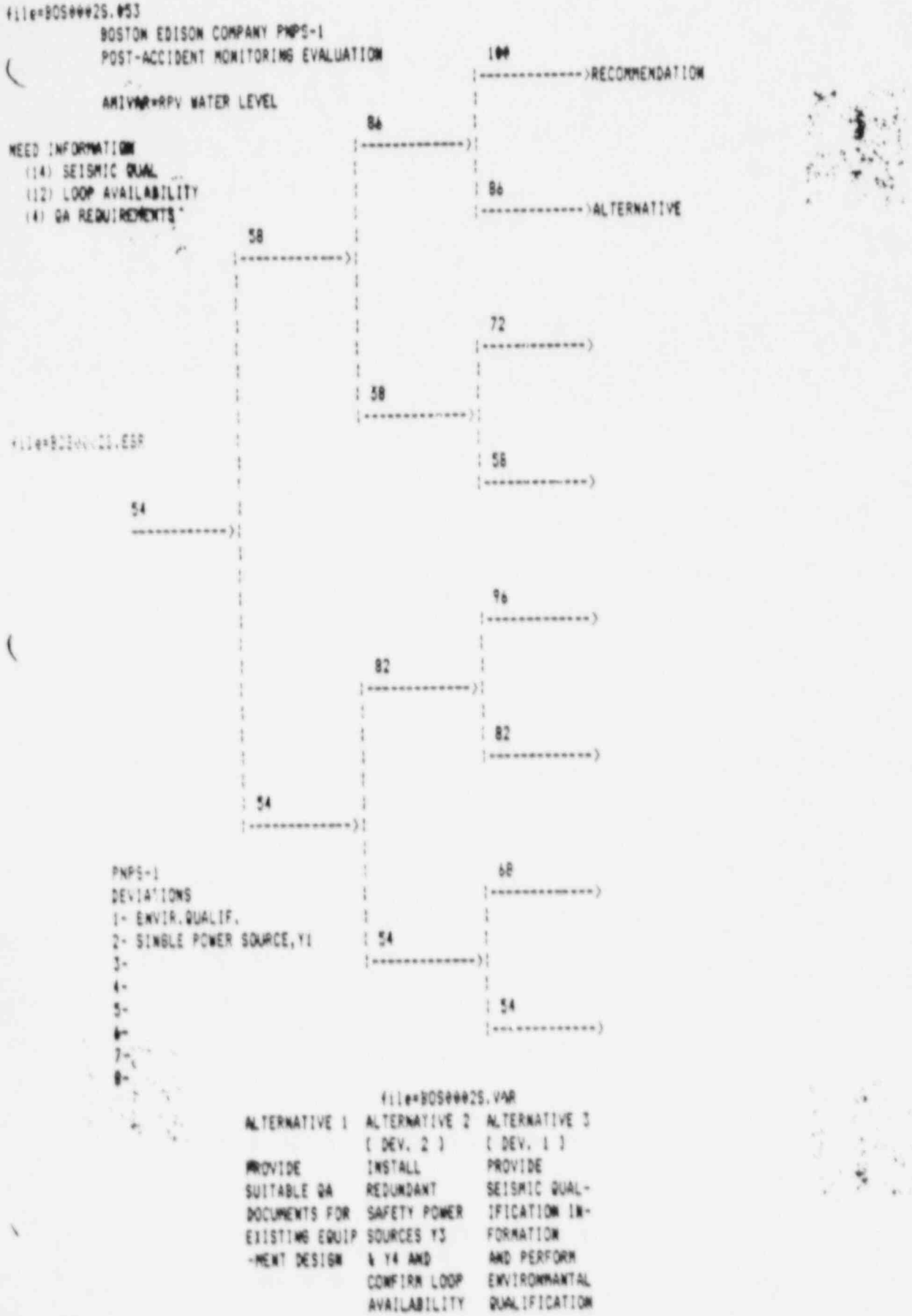
TEST ACCESSIBILITY (1): [A] Equipment mounted on panels C170 and C171 is accessible during all plant operating modes. Redundant differential pressure transmitters are mounted on racks readily accessible for maintenance.

IDENTIFICATION MARKINGS (1): [A] PAM panels C170 and C171, which contain the wide and narrow range reactor vessel level monitoring recorders, are distinctively marked.

RPV WATER LEVEL

IMPROVEMENTS

This is a Type A Category 1 variable. Its intent is to provide the operator primary information when restoring or maintaining water level. As identified in the PNPS I evaluation, LITS263-59A & B are powered from a single non-safety power source, Y1. The cabling up to LITS263-59A & B is safety related, with non-safety cabling for LI263-106A & B. It is recommended based on Figure 7 that redundant, safety related power sources be employed for this instrument loop and that seismic information be obtained for the four(4) reactor vessel level instrument channels. Activity is presently underway to replace the Yarway's at PNPS I with an analog trip system. LITS263-59A & B has been designated for this replacement. As such, safety related cabling will be used throughout the loop along with redundant safety related power sources. Since this would represent a new modification, associated seismic qualification information and confirmation is required as part of Boston Edison's plant modification process and could, therefore, be obtained when implemented. Suitable QA documentation should then be obtained. Boston Edison intends to perform the above improvements.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BOSTON EDISON COMPANY PNPS-1
POST-ACCIDENT MONITORING EVALUATION
ARIVAR=RPV WATER LEVEL
NEED INFORMATION
(14) SEISMIC QUAL
(12) LOOP AVAILABILITY
(4) QA REQUIREMENTS
RECOMMENDATION
ALTERNATIVE
PNPS-1
DEVIATIONS
1- ENVIR.QUALIF.
2- SINGLE POWER SOURCE,Y1
3-
4-
5-
6-
7-
8-
file=BOS0002S.VAR
ALTERNATIVE 1
PROVIDE SUITABLE QA DOCUMENTS FOR EXISTING EQUIP -MENT DESIGN
ALTERNATIVE 2
(DEV. 2)
INSTALL REDUNDANT SAFETY POWER SOURCES Y3 & Y4 AND CONFIRM LOOP AVAILABILITY
ALTERNATIVE 3
(DEV. 1)
PROVIDE SEISMIC QUAL-IFICATION IN-FORMATION AND PERFORM ENVIRONMANTAL QUALIFICATION

FIGURE 7

HYDROGEN CONCENTRATION

EQ RANGE (20): [1] The Hydrogen Analyzer purchase specification, M-522, lists its range as 0 to 10% with 0.2% accuracy which does not meet the Reg Guide 1.97 range requirement of 0 to 30%. Moreover, it is a plant addition to be installed in accordance with PDCR's 80-09, 80-30, and 80-40, and must meet applicable environmental requirements. This Type C Category 1 variable will require full environmental qualification compliance.

POWER SOURCE (16): [A] Redundant hydrogen analyzer channels are on separate control room panels, and are powered by redundant on-site AC power sources (Y3 and Y4) as required by Reg Guide 1.97 for this variable.

SEISMIC QUALIFICATION (14): [*NI*] (Need to confirm the seismic qualification of the hydrogen monitor channels; in the interim, the instrumentation is assumed to be unqualified for Reg Guide 1.97 Type C Category 1 applications).

LOOP AVAILABILITY (12): [A] Redundant hydrogen monitoring channels, redundant power sources and control room panels, and redundant PAM panel recorders are being added as specified in the previously listed PDCR's. This PNPS I modification satisfies this Reg Guide 1.97 requirement.

CHANNEL INDEPENDENCE (12): [A] Two redundant trains for hydrogen monitoring are specified in the aforementioned PDCR's. Cabling found to be safety related.

DISPLAY RECORDED (8): [A] Redundant recorders are provided on PAM panels C170 and C171 by this plant modification.

CHANNEL REDUNDANCY (6): [A] Redundant trains are provided by the PNPS I design modification.

ELECTRICAL ISOLATION (6): [A] Confirmation that cable tray and conduit routing meets separation requirements in all respects has been and is assured by approved departmental procedure, vendor specifications, and industry standards (i.e., BEQAM, Bechtel Design Criteria for Electrical Installations and GE Specifications #22A1421, E-347, IEEE279-1971). This also applies to confirming adequate separation and electrical isolation for existing wiring by reviewing and approving associated pull cards.

QA REQUIREMENTS (4): [*NI*] (Need information on the extent of QA requirements applied to the proposed modification).

TEST ACCESSIBILITY (1): [A] The redundant recorders mounted on C170 and C171 are accessible during all plant operating modes. Local panels C172 and C173 are located in low rad area outside secondary containment (mezzanine over "hot" machine shop).

IDENTIFICATION MARKINGS (1): [A] PAM panels C170 and C171, which contain the hydrogen monitoring recorders, are distinctively marked.

HYDROGEN CONCENTRATION

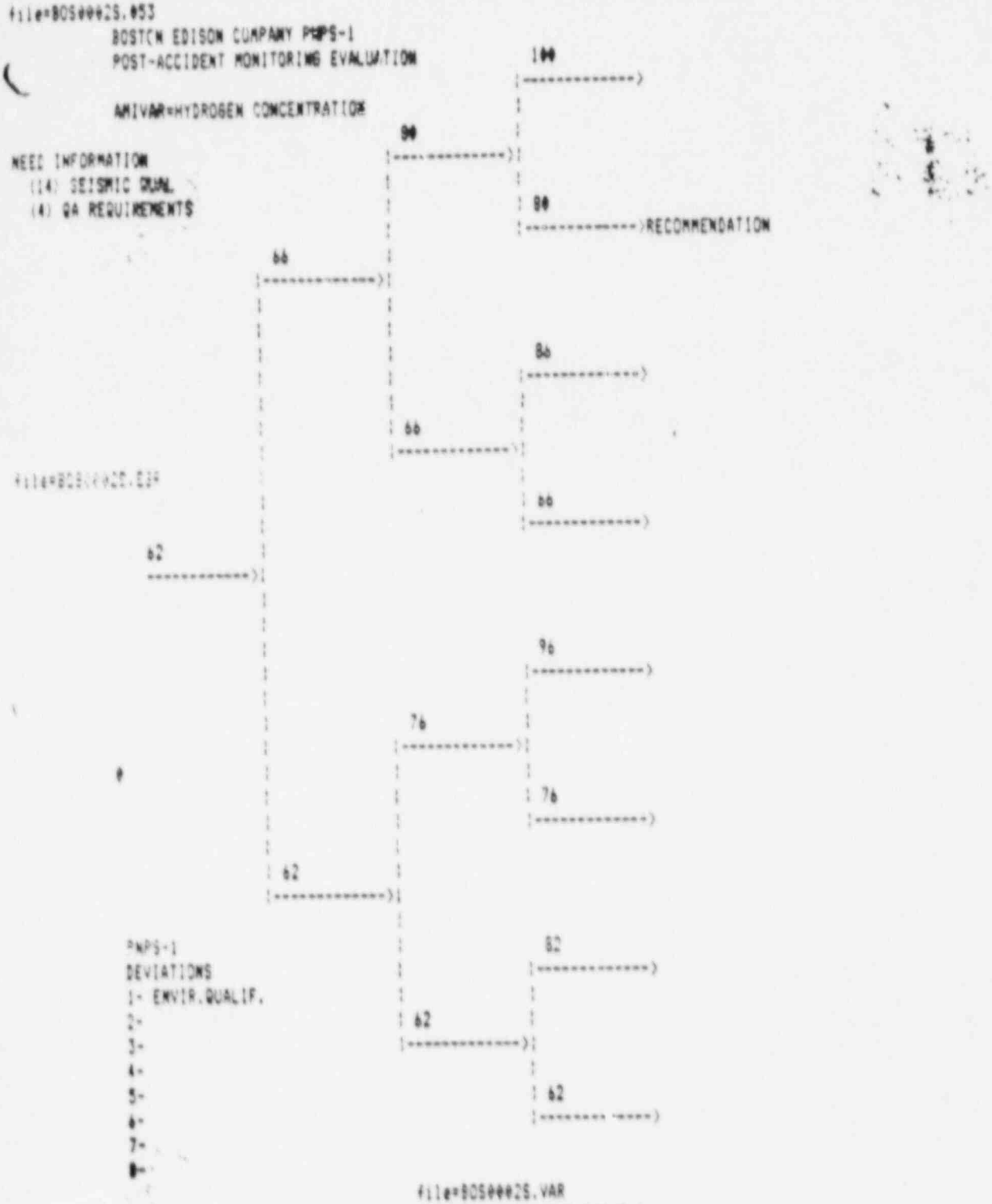
EXCEPTION

This is a Type A, Category 1 variable. Based on Figure 8, Boston Edison will not increase the range (i.e., 0 - 30%) as identified in Reg Guide 1.97. Boston Edison was committed to meeting NUREG-0737, II.F.1, Attachment 6, Containment Hydrogen Monitor. As identified

> "Measurement capability shall be provided over the range of 0 to 10% hydrogen concentration under both positive and negative ambient pressure."

Boston Edison considers the range requirement to be satisfied. In addition, hydrogen concentration can be measured from 0 - 20% concentration.

Per Boston Edison's internal design modification report, the H_2O_2 Monitoring System will be installed to comply with IEEE344-1975, "Seismic Qualification of Class 1E Electrical Equipment for Nuclear Power Generating Station". Boston Edison will investigate seismic qualification compliance for this variable.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BOSTON EDISON COMPANY PSPS-1
POST-ACCIDENT MONITORING EVALUATION
AMIVAR=HYDROGEN CONCENTRATION
NEED INFORMATION
(14) SEISMIC QUAL
(4) QA REQUIREMENTS
RECOMMENDATION
file=BOS0002S.DIF
PSPS-1
DEVIATIONS
1- ENVIR.QUALIF.
2-
3-
4-
5-
6-
7-
8-
file=BOS0002S.VAR
ALTERNATIVE 1
PROVIDE SUITABLE QA DOCUMENTS FOR EXISTING EQUIP -MENT DESIGN
ALTERNATIVE 2
PROVIDE SEISMIC QUAL INFORMATION
ALTERNATIVE 3
[DEV. 1]
INCREASE RANGE FOR HYDROGEN ANALYZER AND PERFORM ENVIRONMENTAL QUALIFICATION

Figure 8

Matrix Evaluation Sheet

PRIMARY CONTAINMENT ISOLATION VALVE POSITION (ZS7011A & B)

EQ RANGE (20): [AHJ] The ZS7011A & B position switches for the Radwaste Collection, Drywell Equipment Sump isolation valves meets the "closed-not closed" range requirement of USNRC Reg Guide 1.97 for this Type B Category 1 variable. Justification for acceptance of these switches is based on meeting the range requirement. These switches will be reviewed to establish compliance with 10CFR50.49.

POWER SOURCE (16): [1] Power is provided for the position indication channel by a single power source, Y1. This source is not safety related. This existing design, therefore, does not meet 1.97 requirement.

SEISMIC QUALIFICATION (14): ["NI"] (Need to confirm seismic qualification of the valve position switches). Reg Guide 1.97 requires seismic qualification for this variable.

LOOP AVAILABILITY (12): [2] Although, the combination of inboard and outboard position indication channels is required to meet the single failure criterion in order to satisfy the Reg Guide 1.97 loop availability requirement, the cabling has been identified as non-safety related therefore, this design is unsatisfactory.

CHANNEL INDEPENDENCE (12): [3] (Need to confirm that independence is maintained between the position indications of redundant isolation valves in piping penetrating primary containment). Note, again, that the cabling is non-safety related.

DISPLAY RECORDED (8): [AHJ] Reg Guide 1.97 requires a continuous real- time indication display and recording of one channel for Type B Category 1 variables to provide direct and immediate trend or transient information to the plant operator. Primary reactor containment isolation valve position, whether "closed" or "non-closed", provides current status rather than either trend or transient information even though it is a Type B variable. GE specification 22A1132AK requires that the indicating lights provide a direct status indication of each respective isolation valve. Using the panel C904 graphic mimic display, the plant operator can ascertain overall effectiveness of the primary containment isolation system based on color pattern recognition. Hence, the present PNPS I design is satisfactory.

CHANNEL REDUNDANCY (6): [4] The combination of two position indication channels for isolation valves outside primary containment is required to meet the single failure criterion in order to satisfy the Reg Guide 1.97 channel redundancy requirement. Therefore, auxiliary equipment must be safety related. This design does not meet this requirement.

ELECTRICAL ISOLATION (6): [5] As presently configured, fuses have been used in the valve position indication channel. However, Reg Guide 1.75 considers fuses to be an unacceptable isolation device since they are actuated by fault current. The existing PNPS I design does not meet this requirement.

QA REQUIREMENTS (4): ["NI"] (Need to confirm that full QA requirements were applied to the isolation valve position switches).

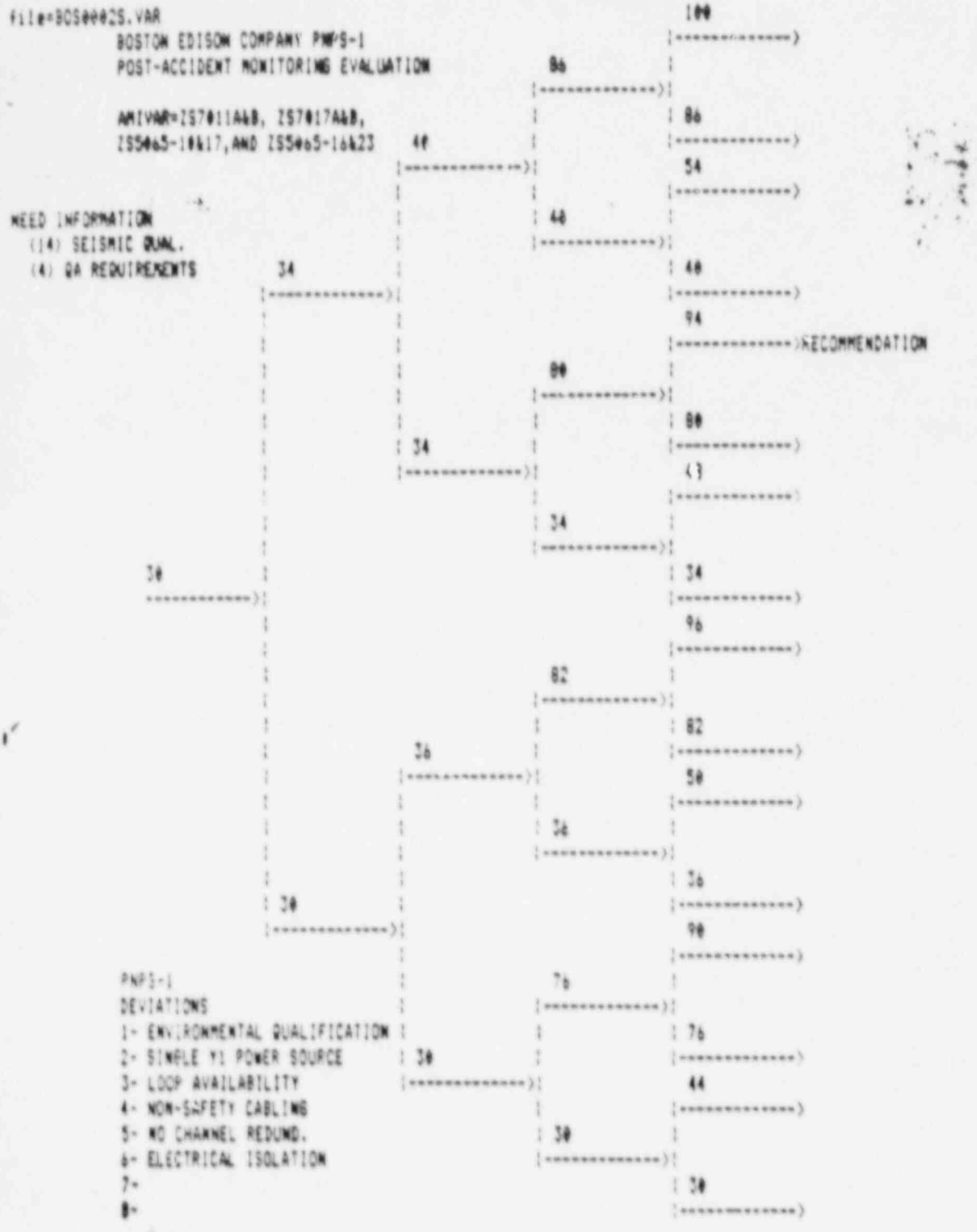
TEST ACCESSIBILITY (1): [A] Equipment mounted on panel C904 is accessible during all plant operating modes. Locally mounted isolation valve position switches may not be immediately accessible during accident conditions.

IDENTIFICATION MARKINGS (1): [A] Reg Guide 1.97 requires distinctive markings for this variable which is satisfied by the PNPS I graphic mimic display on panel C904.

PRIMARY CONTAINMENT ISOLATION VALVE POSITION (ZS7011A & B)

IMPROVEMENTS

These position switches are used to indicate valve position on the discharge line of the Drywell Equipment Drain Sump. These Class B valves are located outside of the drywell. The valves are isolated on drywell isolation. These valves serve to prevent transmission of radioactive effluent outside of secondary containment. At present, the cabling and power source for this Type B Category 1 variable are non-safety related. Because of its isolation function, the instrument channel loops for this variable must meet the single failure criterion. Boston Edison, based on Figure 9, intends to use redundant safety related power sources (i.e., Y3 and Y4). Existing non-safety cabling will be replaced with safety related cabling. Associated QA documents will also be obtained.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BOSTON EDISON COMPANY PNPS-1
POST-ACCIDENT MONITORING EVALUATION
ARIVAR=ZS7011A&B, ZS7017A&B,
ZS5065-1&17,AND ZS5065-16&23
NEED INFORMATION
(14) SEISMIC QUAL.
(4) QA REQUIREMENTS
PNPS-1
DEVIATIONS
1- ENVIRONMENTAL QUALIFICATION
2- SINGLE Y1 POWER SOURCE
3- LOOP AVAILABILITY
4- NON-SAFETY CABLING
5- NO CHANNEL REDUND.
6- ELECTRICAL ISOLATION
7-
8-
ALTERNATIVE 1
PROVIDE QA DOCUMENTS FOR EXISTING EQUIP -MENT DESIGN
ALTERNATIVE 2 (DEV. 6)
PROVIDE SUITABLE ISOLATION DEVICES
ALTERNATIVE 3 (DEV. 2-5)
CONNECT TO SAFETY POWER SOURCES, Y1&Y4 AND CONFIRM INDEPENDENCE OF SAFETY CABLING
ALTERNATIVE 4 (DEV. 1)
PROVIDE SEISMIC QUAL INFORMATION AND PERFORM ENVIRONMENTAL QUALIFICATION
RECOMMENDATION

Figure 9

Matrix Evaluation Sheet

PRIMARY CONTAINMENT ISOLATION VALVE POSITION (ZS7017A & B)

EQ RANGE (20): [AWJ] The ZS7017A & B position switches for the Radwaste Collection, Drywell Floor Sump isolation valves meets the "closed-not closed" range requirement of USNRC Reg Guide 1.97 for this Type B Category 1 variable. Justification for acceptance of these switches is based on meeting the range requirement. These switches will be reviewed to establish compliance with 10CFR50.49.

POWER SOURCE (16): [1] Power is provided for the position indication channel by a single power source, Y1. This source is not safety related. This existing design, therefore, does not meet 1.97 requirement.

SEISMIC QUALIFICATION (14): [*NI*] (Need to confirm seismic qualification of the valve position switches). Reg Guide 1.97 requires seismic qualification for this variable.

LOOP AVAILABILITY (12): [2] Although, the combination of inboard and outboard position indication channels is required to meet the single failure criterion in order to satisfy the Reg Guide 1.97 loop availability requirement, the cabling has been identified as non-safety related therefore, this design is unsatisfactory.

CHANNEL INDEPENDENCE (12): [3] (Need to confirm that independence is maintained between the position indications of redundant isolation valves in piping penetrating primary containment). Note, again, that the cabling is non-safety related.

DISPLAY RECORDED (8): [AWJ] Reg Guide 1.97 requires a continuous real- time indication display and recording of one channel for Type B Category 1 variables to provide direct and immediate trend or transient information to the plant operator. Primary reactor containment isolation valve position, whether "closed" or "non-closed", provides current status rather than either trend or transient information even though it is a Type B variable. GE specification 22A1132AK requires that the indicating lights provide a direct status indication of each respective isolation valve. Using the panel C904 graphic mimic display, the plant operator can ascertain overall effectiveness of the primary containment isolation system based on color pattern recognition. Hence, the present PNPS I design is satisfactory.

CHANNEL REDUNDANCY (6): [4] The combination of two position indication channels for isolation valves outside primary containment is required to meet the single failure criterion in order to satisfy the Reg Guide 1.97 channel redundancy requirement. Therefore, auxiliary equipment must be safety related. This design does not meet this requirement.

ELECTRICAL ISOLATION (6): [5] As presently configured, fuses have been used in the valve position indication channel. However, Reg Guide 1.75 considers fuses to be an unacceptable isolation device since they are actuated by fault current. The existing PNPS I design does not meet this requirement.

QA REQUIREMENTS (4): [*NI*] (Need to confirm that full QA requirements were applied to the isolation valve position switches).

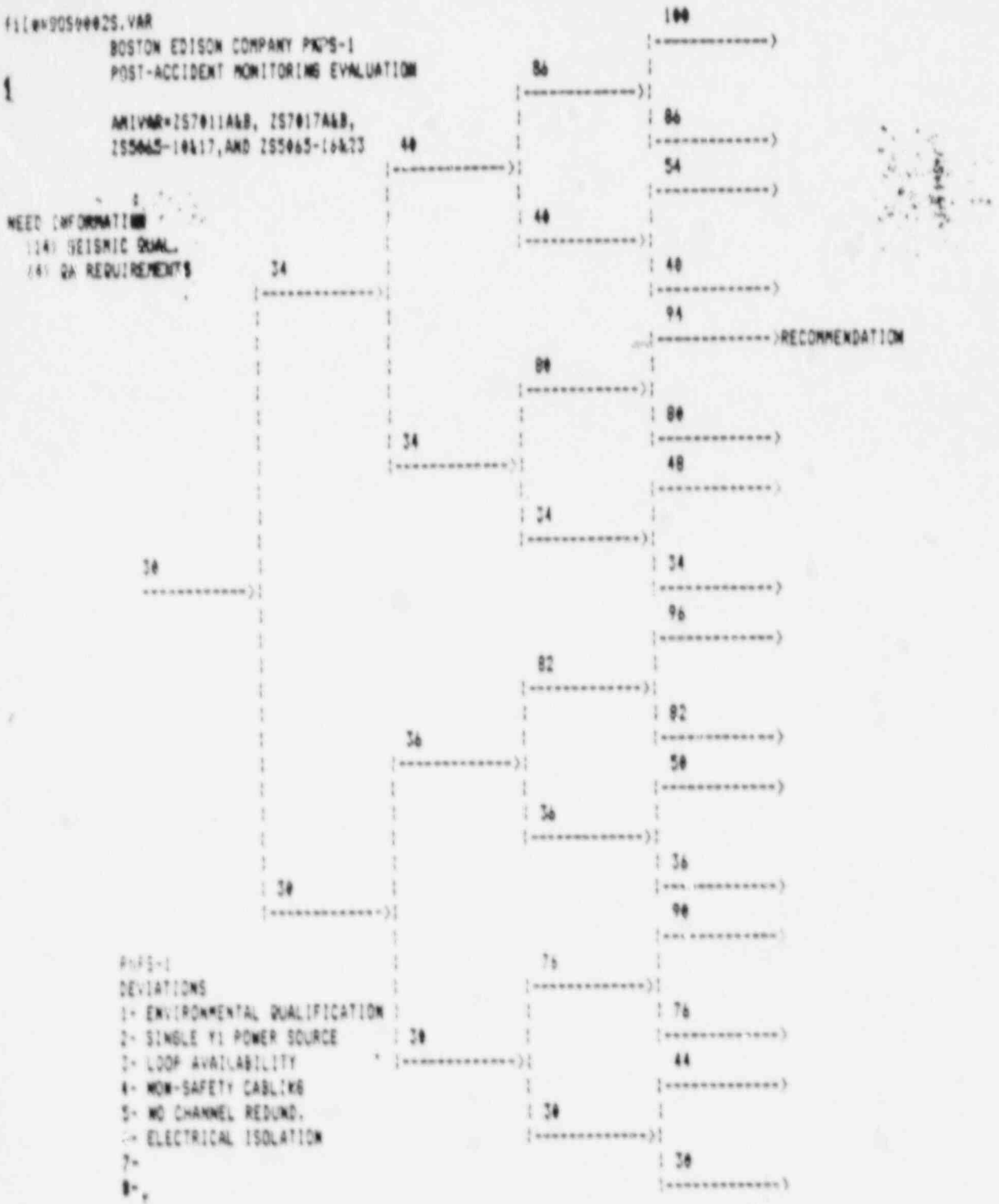
TEST ACCESSIBILITY (1): [A] Equipment mounted on panel C904 is accessible during all plant operating modes. Locally mounted isolation valve position switches may not be immediately accessible during accident conditions.

IDENTIFICATION MARKINGS (1): [A] Reg Guide 1.97 requires distinctive markings for this variable which is satisfied by the PNPS I graphic mimic display on panel C904.

PRIMARY CONTAINMENT ISOLATION VALVE POSITION (ZS7017A & B)

IMPROVEMENTS

The valves for these position switches serve the same function as ZS7011A & B, namely to prevent transfer of radioactive effluent outside secondary containment. Both valves and position switches are located outside the drywell. The same improvements indicated for ZS7011A & B will be performed for this Type A Category 1 variable. (See Figure 10)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BOSTON EDISON COMPANY PNPS-1
POST-ACCIDENT MONITORING EVALUATION
ARIVAR=IS7011A&B, IS7017A&B,
IS5065-10&17,AND IS5065-16&23
NEED INFORMATION
(14) SEISMIC QUAL.
(6) QA REQUIREMENTS
RECOMMENDATION
PNPS-1
DEVIATIONS
1- ENVIRONMENTAL QUALIFICATION
2- SINGLE Y1 POWER SOURCE
3- LOOP AVAILABILITY
4- NON-SAFETY CABLING
5- NO CHANNEL REDUND.
6- ELECTRICAL ISOLATION
7-
8-
ALTERNATIVE 1
PROVIDE QA DOCUMENTS FOR EXISTING EQUIP -MENT DESIGN
ALTERNATIVE 2 (DEV. 6)
PROVIDE SUITABLE ISOLATION DEVICES
ALTERNATIVE 3 (DEV. 2-5)
CONNECT TO SAFETY POWER SOURCES, Y3&Y4 AND CONFIRM INDEPENDENCE OF SAFETY CABLING
ALTERNATIVE 4 (DEV. 1)
PROVIDE SEISMIC QUAL INFORMATION AND PERFORM ENVIRONMENTAL QUALIFICATION

Figure 10

Matrix Evaluation Sheet

PRIMARY CONTAINMENT ISOLATION VALVE POSITION (ZS4002)

EQ RANGE (20): [AWJ] The ZS4002 position switch for the RBCCW Return isolation valves meets the "closed-not closed" range requirement of USNRC Reg Guide 1.97 for this Type B Category 1 variable. Justification for acceptance of these switches is based on meeting the range requirement. These switches will be reviewed to establish compliance with 10CFR50.49.

POWER SOURCE (16): [A] Power is provided for this position indication channel by a single safety related power source, B18. This existing design, therefore, does meet 1.97 requirements.

SEISMIC QUALIFICATION (14): [*NI*] (Need to confirm seismic qualification of the valve position switches). Reg Guide 1.97 requires seismic qualification for this variable.

LOOP AVAILABILITY (12): [AWJ] This indication channel reflects a design that conforms to 10CFR50 Appendix A General Design Criterion 57, covering closed systems penetrating primary reactor containment (At least one containment isolation is required to be located outside containment).

CHANNEL INDEPENDENCE (12): [*] (Need to confirm that independence is maintained between the position indications of redundant isolation valves in piping penetrating primary containment). Note, again, that the cabling is non-safety related.

DISPLAY RECORDED (8): [AWJ] Reg Guide 1.97 requires a continuous real- time indication display and recording of one channel for Type B Category 1 variables to provide direct and immediate trend or transient information to the plant operator. Primary reactor containment isolation valve position, whether "closed" or "non-closed", provides current status rather than either trend or transient information even though it is a Type B variable. GE specification 22A1132AK requires that the indicating lights provide a direct status indication of each respective isolation valve. Using the panel C904 graphic mimic display, the plant operator can ascertain overall effectiveness of the primary containment isolation system based on color pattern recognition. Hence, the present PNPS I design is satisfactory.

CHANNEL REDUNDANCY (6): [AWJ] This variable is designed in conformanced with 10CFR50 Appendix A General Design Criterion 57 covering closed system penetrating primary reactor containment.

ELECTRICAL ISOLATION (6): [2] As presently configured, fuses have been used in the valve position indication channel. However, Reg Guide 1.75 considers fuses to be an unacceptable isolation device since they are actuated by fault current. The existing PNPS I design does not meet this requirement.

QA REQUIREMENTS (4): [*NI*] (Need to confirm that full QA requirements were applied to the isolation valve position switches).

TEST ACCESSIBILITY (1): [A] Equipment mounted on panel C904 is accessible during all plant operating modes. Locally mounted isolation valve position switches may not be immediately accessible during accident conditions.

IDENTIFICATION MARKINGS (1): [A] Reg Guide 1.97 requires distinctive markings for this variable which is satisfied by the PNPS I graphic mimic display on panel C904.

PRIMARY CONTAINMENT ISOLATION VALVE POSITION (ZS4002)

EXCEPTION

This Type D Category 1 variable was found to deviate from the following 1.97 requirements:

- Channel Independence
- Electrical Isolation

The cabling and power source for ZS4002 were found to be safety related. Only one(1) valve serves as isolation for the RBCCW return line. Thus, only one instrument loop is available for position indication. Therefore, channel independence can not be applied. The design configuration is acceptable based on original design criteria and meets the requirements under 10CFR50 Appendix A, Criterion 57. This variable will not be modified to meet 1.97 requirements, in light of the above information.

Matrix Evaluation Sheet

PRIMARY CONTAINMENT ISOLATION VALVE POSITION (ZS4356)

EQ RANGE (20): [AWJ] The ZS4356 position switch for the Instrument Air isolation valves meets the "closed-not closed" range requirement of USNRC Reg Guide 1.97 for this Type B Category 1 variable. Justification for acceptance of these switches is based on meeting the range requirement. These switches will be reviewed to establish compliance with 10CFR50.49.

POWER SOURCE (16): [1] Power is provided for the position indication channel by a single power source, Y1. This source is not safety related. This existing design, therefore, does not meet 1.97 requirement.

SEISMIC QUALIFICATION (14): [*NI*] (Need to confirm seismic qualification of the valve position switches). Reg Guide 1.97 requires seismic qualification for this variable.

LOOP AVAILABILITY (12): [AWJ] Part of this requirement is accomplished with an outboard check valve in the PNPS I design in conformance with Class B isolation valves identified in GE specification 22A1132AK. In this configuration, maintenance and/or testing can be performed without compromising system effectiveness. Therefore, the present design complies with Reg Guide 1.97 requirements.

CHANNEL INDEPENDENCE (12): [2] (Need to confirm that independence is maintained between the position indications of redundant isolation valves in piping penetrating primary containment). Note, again, that the cabling is non-safety related.

DISPLAY RECORDED (8): [AWJ] Reg Guide 1.97 requires a continuous real- time indication display and recording of one channel for Type B Category 1 variables to provide direct and immediate trend or transient information to the plant operator. Primary reactor containment isolation valve position, whether "closed" or "non-closed", provides current status rather than either trend or transient information even though it is a Type B variable. GE specification 22A1132AK requires that the indicating lights provide a direct status indication of each respective isolation valve. Using the panel C904 graphic mimic display, the plant operator can ascertain overall effectiveness of the primary containment isolation system based on color pattern recognition. Hence, the present PNPS I design is satisfactory.

CHANNEL REDUNDANCY (6): [AWJ] Part of this requirement is accomplished with an outboard check valve in the PNPS I design in conformance with Class B isolation valves identified in GE specification 22A1132AK. In this configuration, maintenance and/or testing can be performed without compromising system effectiveness. Therefore, the present design complies with Reg. Guide 1.97 requirements.

ELECTRICAL ISOLATION (6): [3] As presently configured, fuses have been used in the valve position indication channel. However, Reg Guide 1.75 considers fuses to be an unacceptable isolation device since they are actuated by fault current. The existing PNPS I design does not meet this requirement.

QA REQUIREMENTS (4): [*NI*] (Need to confirm that full QA requirements were applied to the isolation valve position switches).

TEST ACCESSIBILITY (1): [A] Equipment mounted on panel C904 is accessible during all plant operating modes. Locally mounted isolation valve position switches may not be immediately accessible during accident conditions.

IDENTIFICATION MARKINGS (1): [A] Reg Guide 1.97 requires distinctive markings for this variable which is satisfied by the PNPS I graphic mimic display on panel C904.

PRIMARY CONTAINMENT ISOLATION VALVE POSITION (ZS4356)

EXCEPTION

This Type B Category 1 variable was found to deviate from the following 1.97 design requirements:

- Power Source
- Channel Independence
- Electrical Isolation

The cabling and power source for ZS4356 were found to be non-safety. Since this variable is considered to be containment isolation valve position, the single failure criterion must be met. However, the present valve lineup (one check valve and one air operated valve) precludes meeting the channel independence requirement (note: check valves are not reviewed under 1.97).

One check valve and one air operated valve are provided, both outside containment. The air operated valve is operated manually from the Control room with no automatic signals or diversity. Only the check valve is seismic Class I.

This GE design, considered acceptable by the NRC in a letter dated 12/18/79, satisfies the original plant design requirements.

Instrument air is maintained at a pressure in excess of the maximum accident pressure expected in the drywell. Should instrument air be reduced to less than containment pressure, the 3" check valve in series with the remote manual air operated valve in the essential instrument air header will provide adequate isolation.

Therefore, this variable will not be modified since the installation of redundant safety related position indicators for a single valve would not meet the single failure criterion. The instrument configuration precludes meeting the single failure criterion specified in 1.97. Nevertheless, the original plant design requirements are satisfied.

Matrix Evaluation Sheet

PRIMARY CONTAINMENT ISOLATION VALVE POSITION (ZS9068A & B)

EQ RANGE (20): [1] ZS9068A & B position switches for the HPCI Gland Seal Condenser do not meet the range for Reg Guide 1.97. Direct measurement of valve is requirement. The above switches employ relays (see E455 & E449) which must be energized before indication of valve closure is provided on control room panel C903. The above design does not meet the 1.97 range requirements for for this Type B Category 1 variable. This variable will be reviewed to establish compliance with 10CFR50.49.

POWER SOURCE (16): [2] Power is provided by a single safety related power source, D5.

SEISMIC QUALIFICATION (14): [*NI*] (Need to confirm seismic qualification of the valve position switches) Reg Guide 1.97 requires seismic qualification for this variable.

LOOP AVAILABILITY (12): [3] The position switches for this Type B Category 1 variable does not provide sufficient latitude to accommodate testing and maintenance requirements that will be necessary during power operation. Note that cabling is safety related. This design does not meet Reg Guide 1.97 requirements.

CHANNEL INDEPENDENCE (12): [4] Sufficient independence is not provided based on installation of single power source.

DISPLAY RECORDED (8): [AWJ] Reg Guide 1.97 requires a continuous real- time indication display and recording of one channel for Type B Category 1 variables to provide direct and immediate trend or transient information to the plant operator. Primary reactor containment isolation valve position, whether "closed" or "non-closed", provides current status rather than either trend or transient information even though it is a Type B variable. GE specification 22A1132AK requires that the indicating lights provide a direct status indication of each respective isolation valve. Using the panel C904 graphic mimic display, the plant operator can ascertain overall effectiveness of the primary containment isolation system based on color pattern recognition. Hence, the present PNPS I design is satisfactory.

CHANNEL REDUNDANCY (6): [5] Sufficient redundancy is not provided by the instrument loops for the condensate drain pot position switches. This design does not comply with Reg Guide 1.97.

ELECTRICAL ISOLATION (6): [6] As presently configured, fuses have been used in the valve position indication channel. However, Reg Guide 1.75 considers fuses to be an unacceptable isolation device since they are actuated by fault current. The existing PNPS I design does not meet this requirement.

QA REQUIREMENTS (4): [*NI*] (Need to confirm that graded QA requirements were applied to the isolation valve position switches).

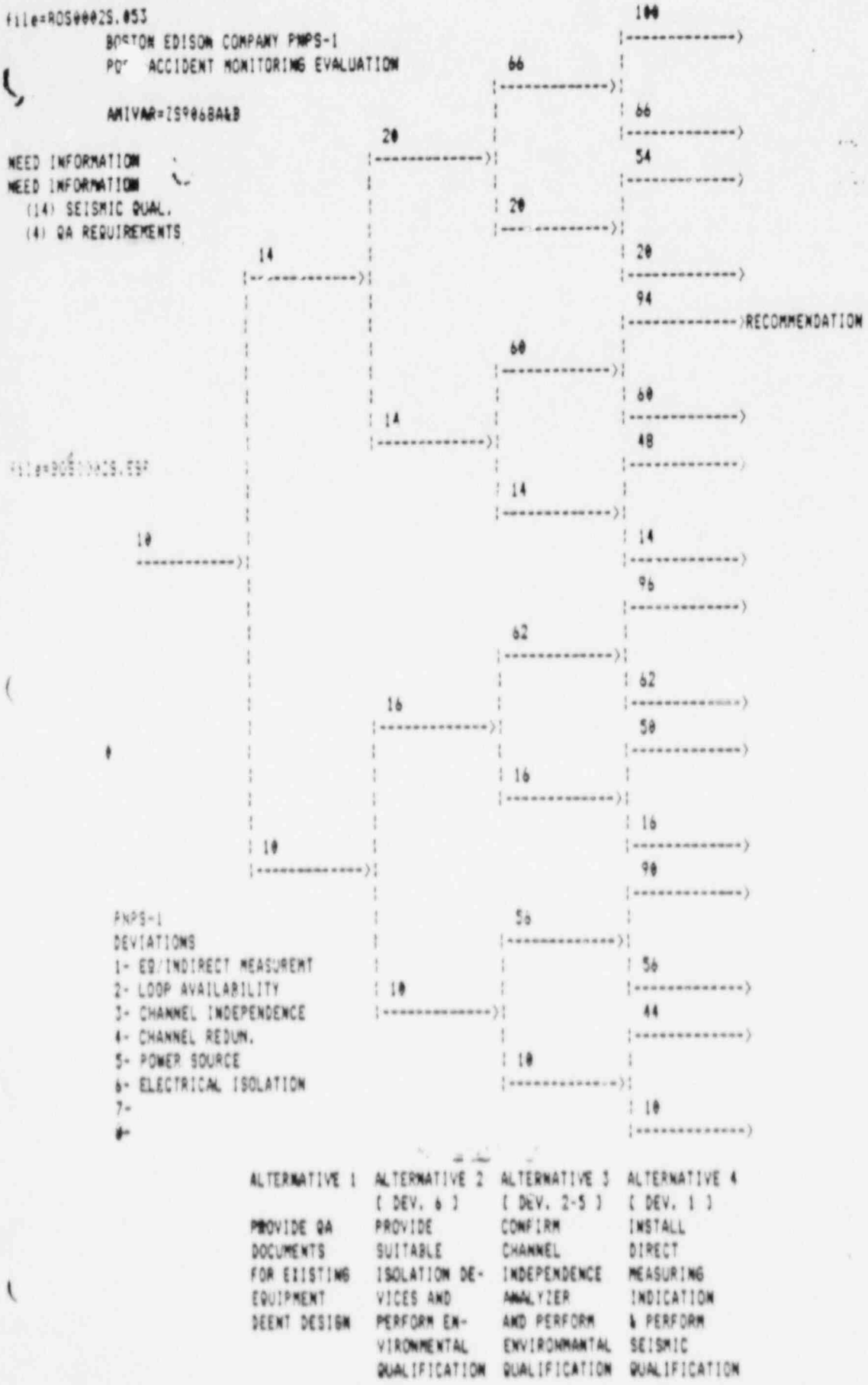
TEST ACCESSIBILITY (1): [A] Equipment mounted on panel C904 is accessible during all plant operating modes. Locally mounted isolation valve position switches may not be immediately accessible during accident conditions.

IDENTIFICATION MARKINGS (4): [A] Reg Guide 1.97 requires distinctive markings for this variable which is satisfied by the PNPS I graphic mimic display on panel C904.

PRIMARY CONTAINMENT ISOLATION VALVE POSITION (ZS9068A & B)

IMPROVEMENTS

This is a Type B Category 1 variable. This indication is used to monitor the valve position of the Condensate Drain Pot Drain valves on the HPCI system. Upon receipt of a low pressure isolation signal, SV9068A & B isolate. This assures that the HPCI exhaust line is properly isolated to preclude a possible breach of primary containment under accident conditions. A direct measurement of valve position is, therefore, required to provide status on valve position. Based on Figure 11, Boston Edison will add a redundant, safety related power source to this variable instrument loop. The addition of a redundant power source would preclude consequences of single failure. Installation of direct measuring position indication will also be performed. The addition of new position switches would minimize any ambiguity regarding actual isolation of these valves. Again, QA documents will be provided in support of proper installation of these switches.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BOSTON EDISON COMPANY PNPS-1
PDI ACCIDENT MONITORING EVALUATION
ANIVAR=IS9068A&B
NEED INFORMATION
NEED INFORMATION
(14) SEISMIC QUAL.
(4) QA REQUIREMENTS
file=ROS0002S.ESP
PNPS-1
DEVIATIONS
1- EQ/INDIRECT MEASUREMT
2- LOOP AVAILABILITY
3- CHANNEL INDEPENDENCE
4- CHANNEL REDUN.
5- POWER SOURCE
6- ELECTRICAL ISOLATION
7-
8-
ALTERNATIVE 1
PROVIDE QA DOCUMENTS FOR EXISTING EQUIPMENT DEENT DESIGN
ALTERNATIVE 2
(DEV. 6)
PROVIDE SUITABLE ISOLATION DEVICES AND PERFORM ENVIRONMENTAL QUALIFICATION
ALTERNATIVE 3
(DEV. 2-5)
CONFIRM CHANNEL INDEPENDENCE ANALYZER AND PERFORM ENVIRONMANTAL QUALIFICATION
ALTERNATIVE 4
(DEV. 1)
INSTALL DIRECT MEASURING INDICATION & PERFORM SEISMIC QUALIFICATION
RECOMMENDATION

Figure 11

PRIMARY CONTAINMENT ISOLATION VALVE POSITION (ZS8000 & ZS8001)

EQ RANGE (20): [AWJ] The ZS8000 & ZS8001 position switches for the Torus Makeup from Condensate Storage Tank isolation valves meets the "closed-not closed" range requirement of USNRC Reg Guide 1.97 for this Type B Category 1 variable. Justification for acceptance of these switches is based on meeting the range requirement. These switches will be reviewed to establish compliance with 10CFR50.49.

POWER SOURCE (16): [1] Power is provided for the position indication channel by a single power source, Y1. This source is not safety related. This existing design, therefore, does not meet 1.97 requirement.

SEISMIC QUALIFICATION (14): [*NI*] (Need to confirm seismic qualification of the valve position switches). Reg Guide 1.97 requires seismic qualification for this variable.

LOOP AVAILABILITY (12): [2] Although, the combination of inboard and outboard position indication channels is required to meet the single failure criterion in order to satisfy the Reg Guide 1.97 loop availability requirement, the cabling has been identified as non-safety related therefore, this design is unsatisfactory.

CHANNEL INDEPENDENCE (12): [3] (Need to confirm that independence is maintained between the position indications of redundant isolation valves in piping penetrating primary containment). Note, again, that the cabling is non-safety related.

DISPLAY RECORDED (8): [AWJ] Reg Guide 1.97 requires a continuous real- time indication display and recording of one channel for Type B Category 1 variables to provide direct and immediate trend or transient information to the plant operator. Primary reactor containment isolation valve position, whether "closed" or "non-closed", provides current status rather than either trend or transient information even though it is a Type B variable. GE specification 22A1132AK requires that the indicating lights provide a direct status indication of each respective isolation valve. Using the panel C904 graphic mimic display, the plant operator can ascertain overall effectiveness of the primary containment isolation system based on color pattern recognition. Hence, the present PNPS I design is satisfactory.

CHANNEL REDUNDANCY (6): [4] The combination of two position indication channels for isolation valves outside primary containment is required to meet the single failure criterion in order to satisfy the Reg Guide 1.97 channel redundancy requirement. Therefore, auxiliary equipment must be safety related. This design does not meet this requirement.

ELECTRICAL ISOLATION (6): [5] As presently configured, fuses have been used in the valve position indication channel. However, Reg Guide 1.75 considers fuses to be an unacceptable isolation device since they are actuated by fault current. The existing PNPS I design does not meet this requirement.

QA REQUIREMENTS (4): [*NI*] (Need to confirm that full QA requirements were applied to the isolation valve position switches).

TEST ACCESSIBILITY (1): [6] Locally mounted isolation valve position switches may not be immediately accessible during accident conditions.

IDENTIFICATION MARKINGS (1): [7] Since the panel indication is locally mounted in a harsh environment (i.e. not in the control), this requirement is moot.

PRIMARY CONTAINMENT ISOLATION VALVE POSITION (ZS8000 & ZS8001)

EXCEPTION

These position switches provide valve indication when torus makeup from the Condensate Transfer System is required. The cabling and power source for this variable were found to be non-safety related. Neither the valves, nor the Condensate Storage Tank are seismically qualified. No isolation signal is provided to automatically close the valve. In addition, the panel that provides valve position indication for this Type B Category 1 variable is located outside of the Control Room in the RHR and Core Spray Pump Room "B" which is considered to be a harsh environment. The operator, therefore, could not readily identify valve position for AO8000 & 8001 during an accident.

To compensate for this situation, the Secondary Containment Control guideline in the Emergency Procedure Guidelines identifies certain operator actions to be taken if, for example, torus water level were to fall below the downcomer level and a release path developed as a result of failure of non-seismic portion of the system located in the RHR & Core Spray Pump Room "B".

The instrument channels for ZS8000 and 8001 will not be upgraded to satisfy 1.97 guidance in light of the above information.

Matrix Evaluation Sheet

PRIMARY CONTAINMENT ISOLATION VALVE POSITION (FCV-302-120 & 123 and SV-302-121 & 122)

EQ RANGE (20): [1] These directional control valves on the Hydraulic Control Units are not provided with position switches. FDC-302-120 & 123 (insert) and SV-302-121 & 122 (withdraw) are typical of the 145 Hydraulic Control Units at Pilgrim. Since no valve position indication is provided, the 1.97 range requirement cannot be met. This Type B Category 1 variable will be reviewed to establish compliance with 10CFR50.49.

POWER SOURCE (16): [2] Since there are no position switches designed for this variable, no power supply is available. The acceptability vs unacceptability of the power supply is, therefore, moot.

SEISMIC QUALIFICATION (14): [3] Since no instrument channels are designed for this variable, seismic qualification cannot be applied.

LOOP AVAILABILITY (12): [4] This criteria, again, cannot be applied to this variable, in light of its design characteristics.

CHANNEL INDEPENDENCE (12): [5] This criteria cannot be applied.

DISPLAY RECORDED (8): [6] This criteria cannot be applied.

CHANNEL REDUNDANCY (6): [7] This criteria cannot be applied.

ELECTRICAL ISOLATION (6): [8] This criteria cannot be applied.

QA REQUIREMENTS (4): [9] This criteria cannot be applied.

TEST ACCESSIBILITY (1): [10] This criteria cannot be applied.

IDENTIFICATION MARKINGS (11): [11] This criteria cannot be applied.

PRIMARY CONTAINMENT ISOLATION VALVE POSITION (FCV-302-120 & 123 and SV-302-121 & 122)

EXCEPTIONS

These directional control valves (580), when energized and opened in coordinated pairs, facilitate rod movement either in the insert or withdrawal mode. These valves are normally closed, except during rod movement and are used during normal operation. These valves are, therefore, normally positioned in the safe direction. Where these valves are found to be inoperable, the control rods will be electrically disarmed and placed in such a position that the shutdown margin requirements are satisfied (NOTE: observation of drive water flow during insert and withdrawal cycle on C905 will provide indication of directional valve problems, i.e., failed closed or open). It should be noted that there are 580 valves which would require position indication. This appears to be very cost prohibitive and unnecessary, since these valves are not required for scram. No position switches will be provided for these valves in light of the above information.

Matrix Evaluation Sheet

PRIMARY CONTAINMENT ISOLATION VALVE POSITION (ZS5065-34 & 38, ZS5065-32 & 36)

EQ RANGE (20): [1] The ZS5065-32, 34, 36 & 38 position switches for the Hydrogen Analyzer do not meet the range for Reg Guide 1.97. Direct measurement of valve position is required. The above switches employ relays (see E455 & E449) which must be energized before indication of valve closure is provided on control room panels C904 or C902. The above design does not meet the 1.97 requirements for range requirements. This Type B Category 1 variable will be examined for environmental qualification compliance.

POWER SOURCE (16): [A] Power is provided by redundant safety related power sources, both AC and DC powered. The power sources are Y3 and Y4 and D4 and D5.

SEISMIC QUALIFICATION (14): [NI] (need to confirm seismic qualification of the valve position switches). RG 1.97 requires seismic qualification for this variable.

LOOP AVAILABILITY (12): [A] The position switches for the hydrogen analyzer instruments channels provide sufficient latitude to accommodate testing and maintenance requirements that will be necessary during power operation. Note that cabling is safety related. This design meets Reg Guide 1.97 requirements.

CHANNEL INDEPENDENCE (12): [A] Sufficient independence is provided based on installation of safety related components in the channel

DISPLAY RECORDED (8): [AWJ] Reg Guide 1.97 requires a continuous real- time indication display and recording of one channel for Type B Category 1 variables to provide direct and immediate trend or transient information to the plant operator. Primary reactor containment isolation valve position, whether "closed" or "not-closed", provides current status rather than either trend or transient information even though it is a Type B variable. GE specification 22A1132AK requires that the indicating lights provide a direct status indication of each respective isolation valve. Using the panel C904 graphic mimic display, the plant operator can ascertain overall effectiveness of the primary containment isolation system based on color pattern recognition. Hence, the present PNPS I design is satisfactory.

CHANNEL REDUNDANCY (6): [A] Sufficient redundancy is provided by the instrument loops for the hydrogen analyzer position switches. This design complies with Reg Guide 1.97.

ELECTRICAL ISOLATION (6): [2] As presently configured, fuses have been used in the valve position indication channel. However, Reg Guide 1.75 considers fuses to be unacceptable isolation device since they are actuated by fault current. The existing PNPS I design does not meet this requirement.

QA REQUIREMENTS (4): [*NI*] (Need to confirm that graded QA requirements were applied to the isolation valve position switches).

TEST ACCESSIBILITY (1): [A] Equipment mounted on panel C904 is accessible during all plant operating modes. Locally mounted isolation valve position switches may not be immediately accessible during accident conditions.

IDENTIFICATION MARKINGS (1): [A] Reg Guide 1.97 requires distinctive markings for this variable which is satisfied by the PNPS I graphic mimic display on panel C904.

PRIMARY CONTAINMENT ISOLATION VALVE POSITION (ZS5065-34 & 38, ZS5065-32 & 36)

EXCEPTION

This is a Type B Category 1 variable. The purpose of this variable is to monitor accomplishment of isolation. The position switches provide an indirect measure of valve position. Drawings E449 and E555 indicate that a relay is used to energize contacts for light indicators on panels C904 and C902. Even though the PNPS 1.97 evaluation has identified that relays are used, this design is considered to meet 1.97 guidance. The use of relays to energize contacts for lights on C904 and C902 in conjunction with diverse safety related power sources (i.e., 125v DC and 120v AC) provides sufficient assurance that the operator will have available sufficient information to establish accomplishment of isolation for this variable. This variable will not be upgraded in light of the above information.

Matrix Evaluation Sheet

CORE SPRAY FLOW

EQ RANGE (20): [AWJ] The existing instrument range of 0 to 5000 gallons per minute meets the USNRC required range of 0 to 3960 GPM equivalent to 110% of design flow as shown in FSAR Table 6.3-1. These transmitters, FT1461A and B are included in the BECo Environmental Qualification Master List. Justification for acceptance is based on range compliance.

POWER SOURCE (16): [1] The flow measurement in each core spray loop is supplied from a common E/S1450-6 power supply in panel C919 (Reference I&CS 84-11/S&SA 84-14), and does not meet the Reg Guide 1.97 requirement for a reliable power source for this Type D Category 2 variable. A safety related standby power source is not required for the flow measurement in either core spray loop; however, continued use of a common power source for both flow measurements could lead to increased plant outage because of Technical Specification limits resulting from Reg Guide 1.97 section 1.3.2.c. Independent and reliable power sources are recommended for the core spray loop A and loop B flow measurements.

SEISMIC QUALIFICATION (14): [*NI*] (Need to confirm seismic qualification of the flow element and locally mounted flow transmitter). Core Spray local racks C2201 and C2260 have been seismically qualified for PNPS I as described in GE Seismic Qualification Summary specification 17489075. Similarly, panels C919 and C903 used for portions of the Core Spray flow instrumentation have been seismically qualified as described by GE specification 235A1963 and 235A1958 in this same summary.

LOOP AVAILABILITY (12): [A] This Cat 2, Type D variable meets the 1.97 design requirement in that the out of service interval is based on the Core Spray System Tech. Spec. 3.5 for Pilgrim.

CHANNEL INDEPENDENCE (12): [A] Channel independence has been established for the core spray flow measurement in C919 by approved departmental procedures, vendor specifications, and industry standards. This has been reflected via appropriate elementary drawings. Therefore, it is felt that sufficient assurance is provided for maintaining core spray loop independence from appropriate divisions of RHR, HPCI, ADS, and RCIC loops in C919.

DISPLAY RECORDED (8): [A] Reg Guide 1.97 does not require recording for this variable hence, the present PNPS I design is satisfactory.

CHANNEL REDUNDANCY (6): [A] Reg Guide 1.97 does not require redundancy for this variable; hence, the present PNPS I design of one flow measurement per core spray loop is appropriate.

ELECTRICAL ISOLATION (6): [A] Confirmation that cable tray and conduit routing meets separation requirements in all respects has been and is assured by approved departmental procedure, vendor specifications, and industry standards (i.e., BEQAM, Bechtel Design Criteria for Electrical Installations and GE Specifications #22A1421, E-347, IEEE279-1971). This also applies to confirming adequate separation and electrical isolation for existing wiring by reviewing and approving associated pull cards.

QA REQUIREMENTS (4): [3] The core spray flow instrument loops are non-safety related based on the original plant design, and does not satisfy the application of graded QA requirements specified in Reg Guide 1.97.

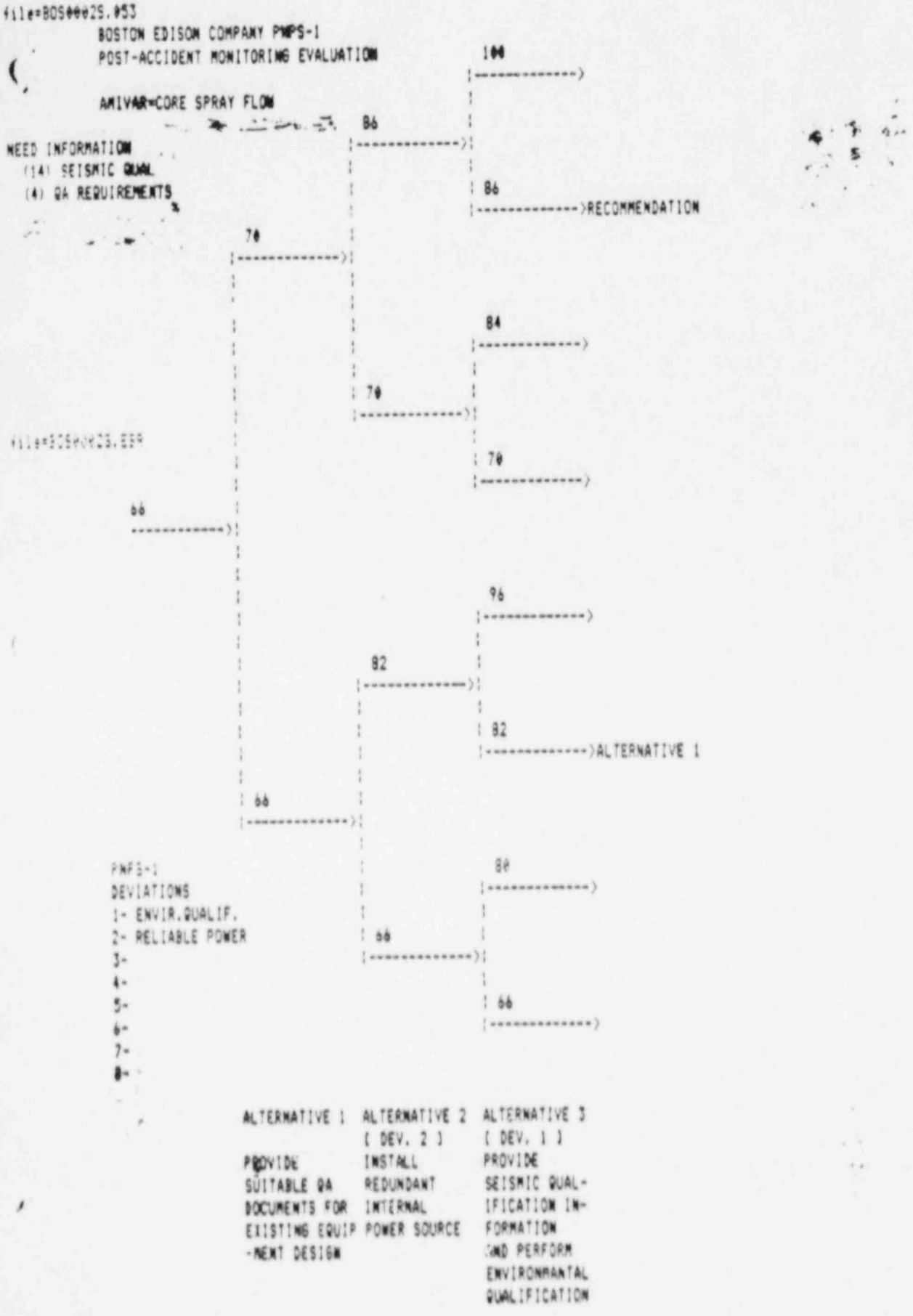
TEST ACCESSIBILITY (1): [A] Equipment mounted on panels C919 and C903 is accessible during all plant operating modes. Core spray flow transmitters mounted on instrument racks C2201 and C2260 may not be accessible for certain design basis events.

IDENTIFICATION MARKINGS (1): [A] Reg Guide 1.97 does not require distinctive markings for Type D Category 2 variables; hence, the present PNPS I design is satisfactory.

CORE SPRAY FLOW

IMPROVEMENTS

This Type D Category 2 variable is used to monitor operation of the Core Spray System. Because 1.97 specifies that the out-of-service interval should be based on the Tech Spec limitations for the system, a redundant, internal power supply will be added (see Figure 12) to minimize loop unavailability due to failure of the existing common power supply. Associated QA documents will be provided.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BOSTON EDISON COMPANY PNPS-1
POST-ACCIDENT MONITORING EVALUATION
AMIVAR=CORE SPRAY FLOW
NEED INFORMATION
(14) SEISMIC QUAL
(4) QA REQUIREMENTS
10
86
86
RECOMMENDATION
70
84
70
file=BOS###25.E59
70
66
96
82
82
ALTERNATIVE 1
66
PNPS-1
DEVIATIONS
1- ENVIR.QUALIF.
2- RELIABLE POWER
3-
4-
5-
6-
7-
8-
80
66
66
ALTERNATIVE 1
PROVIDE SUITABLE QA DOCUMENTS FOR EXISTING EQUIP -NEXT DESIGN
ALTERNATIVE 2 (DEV. 2)
INSTALL REDUNDANT INTERNAL POWER SOURCE
ALTERNATIVE 3 (DEV. 1)
PROVIDE SEISMIC QUAL-IFICATION IN-FORMATION AND PERFORM ENVIRONMENTAL QUALIFICATION

Figure 12

RHR HEAT EXCHANGER OUTLET TEMPERATURE

EQ RANGE (20): [AHJ] The existing instrument range of 0 to 600°F for RHR heat exchanger temperature elements meets the USNRC required range of 32 to 350°F. Temperature elements TE1047A and B will be reviewed to establish compliance with 10CFR50.49. Justification is based on the existing range will be required since the sensors may not be qualified for their service conditions.

POWER SOURCE (16): [A] The TR2340-9 temperature recorder used to record the RHR heat exchanger temperature values is connected to instrument bus Y1, which meets the Reg Guide 1.97 reliable power source requirement for this Type D Category 2 variable.

SEISMIC QUALIFICATION (14): [*NI*] (Need to confirm seismic qualification of the temperature element and control room panel C921).

LOOP AVAILABILITY (12): [A] The RHR heat exchanger temperature measurement is subject to meeting the system's technical specification requirement as a result of Reg Guide 1.97. PNPS I Tech Spec Section 3.5 accommodates this requirement.

CHANNEL INDEPENDENCE (12): [1] The common recorder for RHR heat exchanger temperature monitoring and its single power source do not satisfy this Reg Guide 1.97 requirement. However, this design configuration could prove to be unnecessarily prohibitive, since the out-of-service interval for the system could be limited to the failure frequency of the common recorder, TR2340-9.

DISPLAY RECORDED (8): [A] Reg Guide 1.97 does not require recording for this variable. However, trend information regarding the temperature of the RHR, RBCCW, or the SSW cooling loop is considered important. Since the rate of change of any one of these variables with time is relatively slow, recorded trend information may assist the operator in detecting equipment malfunctions in these three cooling loops. The present PNPS I design provides recording of RBCCW RHR heat exchanger outlet temperature for each RBCCW loop, and also provides recording of RHR heat exchanger outlet temperature for each RHR loop. Recording of one RHR loop temperature and one RBCCW loop temperature in each cooling train on one recorder fulfills the redundant channel requirement since these variables will behave in a similar manner.

CHANNEL REDUNDANCY (6): [A] Reg Guide 1.97 does not require redundancy for this variable; hence the present PNPS I design of one temperature measurement per RHR heat exchanger loop is appropriate.

ELECTRICAL ISOLATION (6): [2] The use of one recorder and one power source for RHR heat exchanger temperature monitoring does not meet physical separation or electrical isolation requirements.

QA REQUIREMENTS (4): [3] The RHR heat exchanger temperature monitoring instrument loops are non-safety related based on the original plant design, and do not satisfy the application of graded QA requirements specified in Reg Guide 1.97.

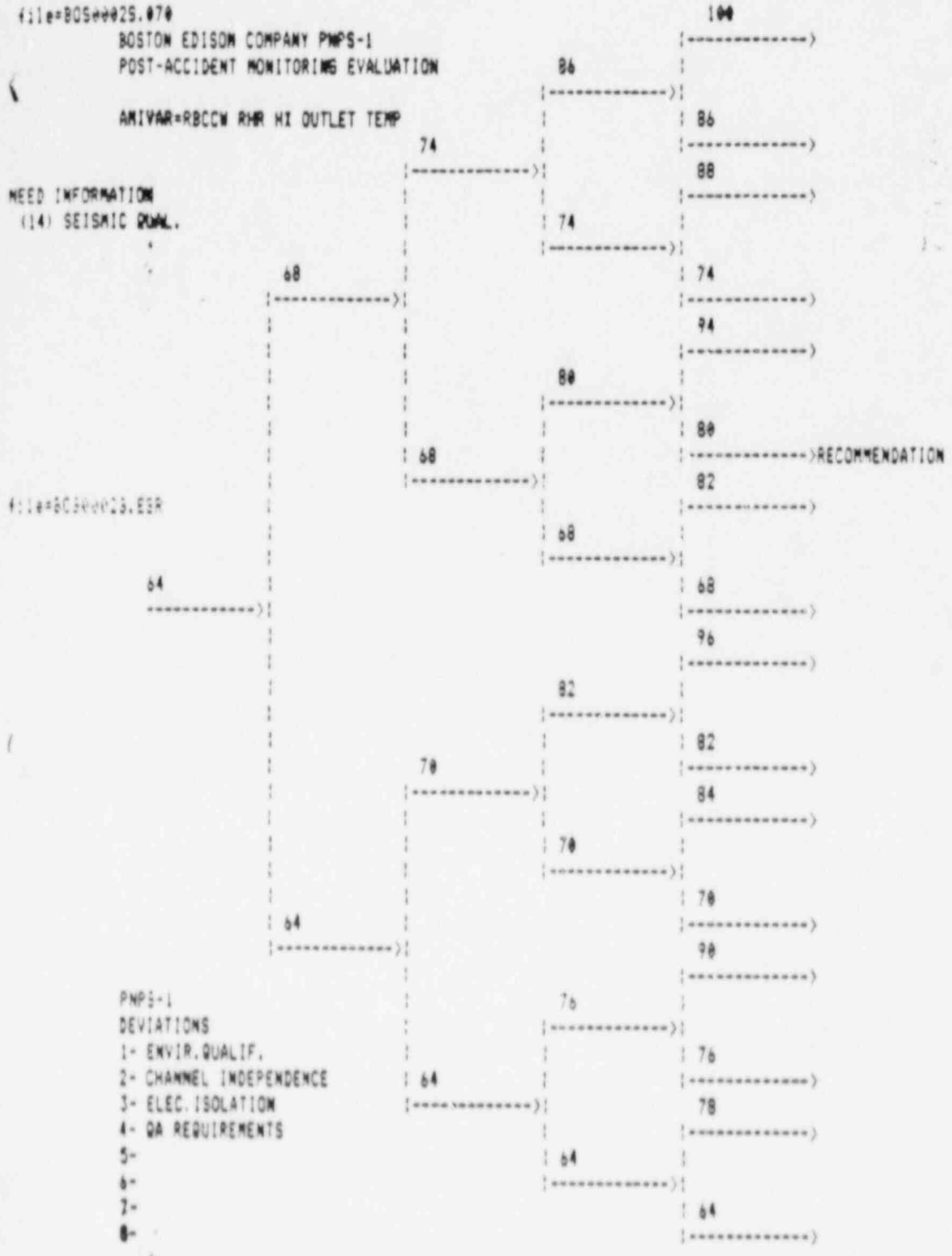
TEST ACCESSIBILITY (1): [A] Equipment mounted on panel C921 is accessible during all plant operating modes. RHR heat exchanger temperature s..ors may not be immediately accessible during accident conditions.

IDENTIFICATION MARKINGS (1): [A] Reg Guide 1.97 does not require distinctive markings for Type D Category 2 variables; hence, the present PNPS I design is satisfactory.

RHR HEAT EXCHANGER OUTLET TEMPERATURE

IMPROVEMENT

A single recorder on panel C921 has been identified for readout of both channels for this Type D Category 2 variable. Space, however, does not permit installation of a redundant recorder. Therefore, a redundant recorder cannot be installed. To compensate for this, credit can be taken for computer link-up which provides an update of the heat exchanger outlet temperature (i.e., A1084 & A1085). Additional credit can be taken for SPDS. Associated QA documents, will be provided for existing equipment design to establish extent of compliance with graded QA requirements. These improvements are identified on Figure 13.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BOSTON EDISON COMPANY PNPS-1
POST-ACCIDENT MONITORING EVALUATION
ANIVAR=RBCCW RHR HI OUTLET TEMP
NEED INFORMATION
(14) SEISMIC QUAL.
File=BOSeee25.EER
PNPS-1
DEVIATIONS
1- ENVIR.QUALIF.
2- CHANNEL INDEPENDENCE
3- ELEC. ISOLATION
4- QA REQUIREMENTS
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RECOMMENDATION
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ALTERNATIVE 1 [DEV. 4] PROVIDE SUITABLE QA DOCUMENTS FOR EXISTING EQUIPMENT DESIGN
ALTERNATIVE 2 [DEV. 3] INSTALL SUITABLE ISOLATION DEVICES
ALTERNATIVE 3 [DEV. 2] INSTALL SEPARATE/REDUNDANT RECORDER OR PROVIDE FOR COMPUTER HOOK-UP
ALTERNATIVE 4 [DEV. 1] PROVIDE SEISMIC QUALIF. INFORMATION AND PERFORM ENVIRONMENTAL QUALIFICATION

Figure 13

Matrix Evaluation Sheet

COOLING WATER TEMPERATURE TO ESF (RBCCW - RHR OR SSW - RBCCW)

EQ RANGE (20): [AWJ] The existing instrument range of +32 to +600°F for the Reactor Building Closed Cooling Water RHR heat exchanger outlet temperature element meets the USNRC required range of 32 to 200°F for this Type D Category 2 variable. The TE1045A and B sensors will be reviewed to determine compliance with 10CFR50.49. Acceptance is presently based on range capability.

POWER SOURCE (16): [A] The TR2340-9 temperature recorder used to record the RBCCW RHR heat exchanger outlet temperature value is connected to instrument bus Y1, which meets the Reg Guide 1.97 reliable power source requirements for this Type D Category 2 variable.

SEISMIC QUALIFICATION (14): [*NI*] (Need to confirm seismic qualification of the temperature element and control room panel C921). Reg Guide 1.97 does not require seismic qualification for this variable.

LOOP AVAILABILITY (12): [A] Requirement related to out of service interval is related to RBCCW/SSW pump capacity as noted in PNPS I Tech Spec Section 3.5. Flow as opposed to temperature is the criteria used when determining operability of the system.

CHANNEL INDEPENDENCE (12): [1] The common recorder for RBCCW RHR heat exchanger outlet temperature monitoring and its single power source do not satisfy this Reg Guide 1.97 requirement. Reg Guide 1.97 does not require redundant channels within each RBCCW RHR heat exchanger loop; hence, the present PNPS I design of one temperature measurement per RBCCW train is appropriate.

DISPLAY RECORDED (8): [A] Reg Guide 1.97 does not require recording for this variable. However, trend information regarding the temperature of the RHR, RBCCW, or the SSW cooling loop is considered important. Since the rate of change of any one of these variables with time is relatively slow, recorded trend information may assist the operator in detecting equipment malfunctions in these three cooling loops. The present PNPS I design provides recording of RBCCW RHR heat exchanger outlet temperature for each RBCCW loop, and also provides recording of RHR heat exchanger outlet temperature for each RHR loop. Recording of one RHR loop temperature and one RBCCW loop temperature in each cooling train on one recorder fulfills the redundant channel requirement since these variable will behave in a similar manner.

CHANNEL REDUNDANCY (6): [A] Reg Guide 1.97 does not require redundancy for this variable; hence, the present PNPS I design of one temperature measurement per RBCCW loop is appropriate.

ELECTRICAL ISOLATION (6): [2] The use of one recorder and one power source for RBCCW RHR heat exchanger outlet temperature monitoring does not meet physical separation or electrical isolation requirements.

QA REQUIREMENTS (4): [3] The RBCCW RHR heat exchanger outlet temperature monitoring instrument loops are non-safety related based on the original plant design, and do not satisfy the application of graded QA requirements specified in Reg Guide 1.97.

TEST ACCESSIBILITY (1): [A] Equipment mounted on panel C921 is accessible during all plant operating modes. RBCCW RHR heat exchanger outlet temperature sensors may not be immediately accessible during accident conditions.

IDENTIFICATION MARKINGS (1): [A] Reg Guide 1.97 does not require distinctive markings for Type D Category 2 variables; hence, the present PNPS I design is satisfactory.

COOLING WATER TEMPERATURE TO ESF (RBCCW - RHR OR SSW - RBCCW)

IMPROVEMENT

The evaluation of channel independence for this Type D, Category 2 variable indicated that a single recorder is unacceptable. However, the addition of a redundant recorder is precluded since sufficient space for installation of the recorder is not available. Boston Edison will, therefore, not install a redundant recorder. To compensate for this, a computer link-up is available to provide adequate information regarding ESF Temperature (i.e, A1083 & A1082). Additional credit can be taken for SPDS. Figure 14 identifies the modifications to be performed for this variable.

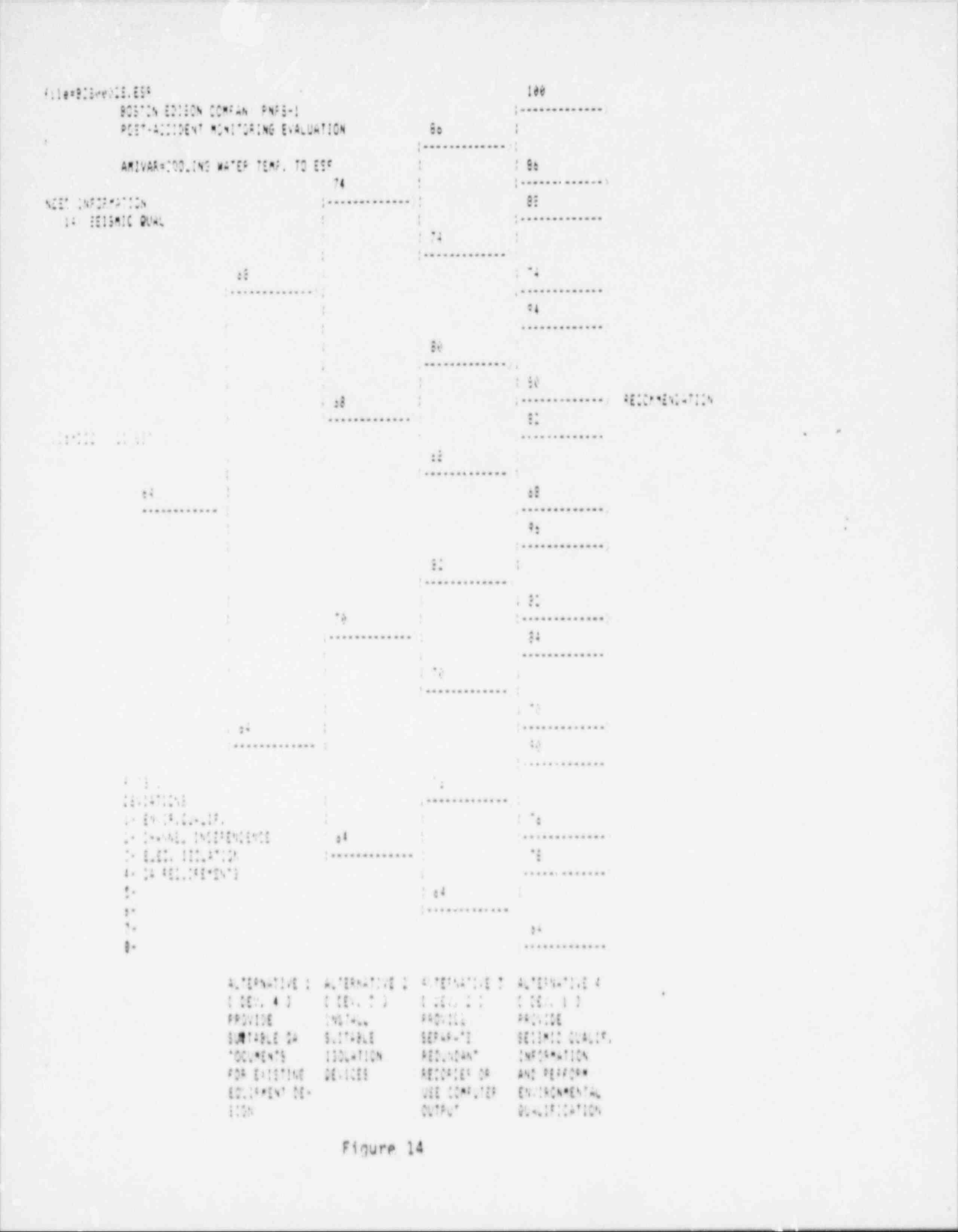
BOSTON EDISON COMPAN PNPS-1
POST-ACCIDENT MONITORING EVALUATION
AMIVAR=COOLING WATER TEMP. TO ESF
NEED INFORMATION
14 SEISMIC QUAL
RECOMMENDATION
ALTERNATIVE 1
(DEV. 4)
PROVIDE
SUITABLE DA
DOCUMENTS
FOR EXISTING
EQUIPMENT DE-
SIGN
ALTERNATIVE 2
(DEV. 7)
SUITABLE
ISOLATION
DEVICES
ALTERNATIVE 3
PROVIDE
SEPARATE
RECORDER OR
USE COMPUTER
OUTPUT
ALTERNATIVE 4
(DEV. 1)
PROVIDE
SEISMIC QUALIF.
INFORMATION
AND PERFORM
ENVIRONMENTAL
QUALIFICATION

Figure 14

Matrix Evaluat on Sheet

RADIATION EXPOSURE RATE

EQ RANGE (20): [1] The ranges of the reactor, turbine and radwaste building access area radiation monitor measurement do not meet the USNRC specified range requirement (10^{-1} to 10^{+4} R/hr) for this Type E Category 2 variables. According to GE drawing 112C2230, the RE10 (1802) area radiation monitor can cover a four decade range extending from 10^{-5} to 10^{-1} R/hr. The area radiation monitor RE10 will be reviewed for environmental qualification. The exposure rate monitor's upper range does not meet 1.97 guidance.

POWER SOURCE (16): [A] Electrical power is provided through Y1, from panel C911 (see M1U-2-2). As such Y1 is powered from a reliable source (DG) and therefore the present PNPS design is satisfactory.

SEISMIC QUALIFICATION (14): [A] Reg Guide 1.97 does not require seismic qualification for this variable; hence, the present PNPS I design is satisfactory.

LOOP AVAILABILITY (12): [*NI*] (Need to confirm that the reactor building access area radiation monitoring channel meets the system technical specification requirements since Reg Guide 1.97 places a Technical Specification availability requirement on this variable.

CHANNEL INDEPENDENCE (12): [A] Reg Guide 1.97 does not require redundant channels for this variable; hence, the present PNPS I design is satisfactory.

DISPLAY RECORDED (8): [A] Reg Guide 1.97 does require channel recording for effluent monitoring variables. The existing PNPS I radiation monitoring channels satisfy this requirement by recorder RR1815-6 on the C902 main control room panel.

CHANNEL REDUNDANCY (6): [A] Reg Guide 1.97 does not require redundancy for this variable; hence, the present PNPS I design is satisfactory.

ELECTRICAL ISOLATION (6) [2] Reg Guide 1.97 requires isolation devices having maintenance access provisions for this variable. The present PNPS I design does not include electrical isolation devices, and therefore, does not satisfy this requirement.

QA REQUIREMENTS (4): [*NI*] (Need to confirm application of graded QA requirements for this area radiation monitoring channel since Reg Guide 1.97 requires graded QA for this variable).

TEST ACCESSIBILITY (1): [A] Equipment located on panels C911 and C902 is accessible during all modes of reactor operation. Area radiation monitoring instruments locally mounted may not be immediately accessible during accident conditions.

IDENTIFICATION MARKINGS (1): [A] Reg Guide 1.97 does not require identification markings for Type E variables; hence, the present PNPS I design is satisfactory.

RADIATION EXPOSURE RATE

IMPROVEMENTS

The evaluation for this Type E Category 2 variable indicates that the range requirement does not satisfy the 1.97 range requirement. Reg Guide 1.97 specifies a range of 10^{-1} to 10^{4} R/hr for this variable. PNPS I actual range is 10^{-6} to 10^{-1} R/hr. In addition, confirmation of loop availability is required to establish whether Tech Spec availability requirements are satisfied. The purpose of this variable is to provide a means of detecting significant releases inside buildings or areas where access is required to service equipment important to safety. Therefore, based on Figure 15, the range of the RE-10 monitor will be increased to coincide with range requirement in Reg Guide 1.97. Confirmation of loop availability will be performed.

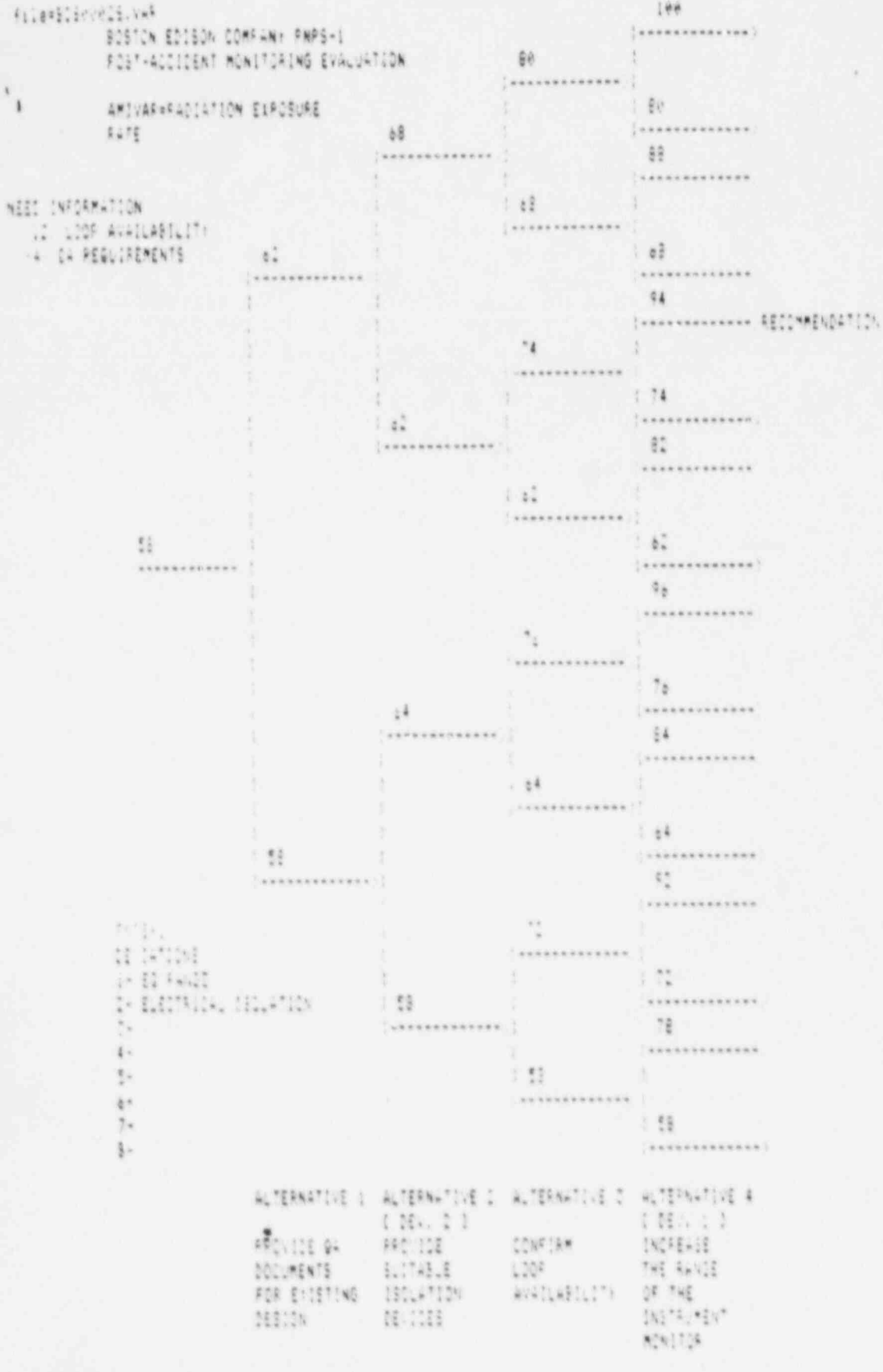
BOSTON EDISON COMPANY PNPS-1
POST-ACCIDENT MONITORING EVALUATION
AMIVAR=RADIATION EXPOSURE
RATE
NEED INFORMATION
LOOP AVAILABILITY
D4 REQUIREMENTS
RECOMMENDATION
ALTERNATIVE 1
ALTERNATIVE 2
ALTERNATIVE 3
ALTERNATIVE 4
CONFIRM
LOOP
AVAILABILITY
INCREASE
THE RANGE
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Figure 15

I-3.1.3 Exceptions to Design and Qualification Criteria

Two general areas of design and qualification criteria noncompliance were identified as a result of the PNPS I evaluation centered on electrical isolation devices and channel redundancy.

Electrical Isolation

It is Boston Edison's intent to forego replacement of fuses for some other type of isolation devices (i.e., relays, fibre optics connectors, etc.). Reg Guide 1.97 indicates that Reg Guide 1.75 will serve as the standard for the separation of circuits and equipment that are redundant. Pilgrim, which pre-dates Reg Guide 1.75, was designed to meet proposed IEEE Criteria for Nuclear Power Plant Protection Systems dated March, 1968. Boston Edison met this requirement which was subsequently approved by the Atomic Energy Commission.

Installed fuses are UL approved and have been used at Pilgrim over the past 10 years without any generic problems. Further assurance of fuse continuity is provided via pre-scheduled functional tests of Class 1E systems. In light of the above information, Boston Edison will not replace instrument fuses.

Channel Redundancy

Another point of contention relates to the following design and qualification criteria specified in Reg Guide 1.97:

> "Where failure of one accident monitoring channel results in information ambiguity (that is, the redundant displays disagree) that could lead operators to defeat or fail to accomplish a required safety function, additional information should be provided to allow the operators to deduce the actual conditions in the plant."

Boston Edison takes exception to the criteria to provide a means of resolving information ambiguities caused by an assumed single failure in one channel based on the following:

- the instrumentation channels are independent and must meet class IE requirements and
- these channels are to be environmentally qualified for quality category, thus minimizing the effects of common mode failure

Based on the above information, Boston Edison does not plan to make any modifications in order to conform to the above two criteria. However, to the extent possible, Boston Edison will identify alternate courses of action (i.e., cross checking with an independent channel which monitors a different variable which has known relationship to the primary variable.)

SECTION II - CONCLUSIONS

II-1 Database Maintenance

Supplement 1 to NUREG 0737 indicates that "staff review will be in the form of an audit that will include a review of the licensee's method of implementing Regulatory Guide 1.97 (Rev. 2) guidance and the licensee's supporting technical justification of any proposed alternatives." The methodology used by Boston Edison has already been discussed in this report. However, to assure that traceability is maintained, the PNPS 1.97 document files and computerized database will be maintained in a controlled fashion.

II-2 Corrective Actions to Complete Database Information

As noted on Table 3, additional information (NI) is required for certain variables. Even though the plant specific variables identified on Table 3 have been found to be acceptable an attempt to replace NI with the associated information will be made for completeness.

II-3 Environmental Qualification

As indicated in Supplement 1 to NUREG 0737,

> "It is acceptable to rely on currently installed equipment if it will measure over the range indicated in Regulatory Guide 1.97 (Rev. 2), even if the equipment is presently not environmentally qualified. Eventually, all the equipment required to monitor the course of an accident would be environmentally qualified in accordance with the pending commission rule on environmental qualification."

This has served as a basis for accepting (i.e., EQ/Range design requirement) many of the existing instrument channels reviewed for the PNPS I 1.97 evaluation. All Category 1 variables reviewed for Pilgrim will be environmentally qualified by the end of Refuel Outage #8.

Category 2 variables will not be environmentally qualified subject to the design and qualification criteria in Reg Guide 1.97. This position is based on the fact that Category 1 variables will be environmentally qualified as a result of Reg Guide 1.97 since they are key variables. The only Category 2 variables that will be environmentally qualified will be qualified as a result of 10CFR50.49 requirements.

II-4 Seismicity

A concern exists that the margin of safety provided in the electrical and mechanical equipment important to safety of operating plants may vary considerably. Specifically, the implication is that the margins of safety that are provided in the existing equipment to resist seismically induced loads and to perform the extended safety functions may vary considerably. The concern, however, does not imply that the safety margins are not adequate.

This has arisen because seismic qualification criteria and methods have undergone rapid development in recent years. The methods for demonstrating component operability have changed significantly and because the design of the operating plants were completed prior to the establishment of current seismic qualification criteria and guidelines. This would especially apply to older plants like Pilgrim. Unresolved Safety Issue A-46 was initiated to address the above concern. When resolved, a NRC generic letter containing consistent requirements for seismic and dynamic qualification will be applicable to Pilgrim and other operating plants. Pending the issuance of the generic letter, Boston Edison will defer re-assessing the margin of safety of existing electrical equipment to resist seismically induced loads at Pilgrim Station. This would apply to those items identified by R.G. 1.97 as requiring seismic qualification. It should be noted, however, that Boston Edison will continued where deemed appropriate to use IEEE344-1975 in applying seismic qualification requirements to future electrical equipment modifications. IEEE344-1975 provisions are included in Reg Guide 1.100 and are cited in Reg Guide 1.97.

II-5 Commitment Action Plan

Per Supplement 1 to NUREG 0737, Boston Edison will implement identified improvements (see Section I-3.1.2) by the end of Outage #8 at Pilgrim Station. At such time, Boston Edison will notify the NRC of its completion of Phase II requirements.

References

1. Regulatory Guide 1.97, Rev. 2, Instrumentation for Light-Water Cooled Nuclear Power Plants to Access Plant and Environs Conditions During and Following An Accident, December, 1980.

2. Nuclear Utility Task Action Committee, Regulatory Guide 1.97 (Accident Monitoring Instrumentation) Implementation Guideline, INPO 83-049 (NUTAC), December, 1983.

3. BWR Owners Group, Position on NRC Regulatory Guide 1.97, Rev. 2, July, 1982.

4. ANSI/ANS-4.5-1980, Criteria for Accident Monitoring Functions in Light-Water-Cooled Reactors.

5. Generic Letter #82-33: Supplement 1 to NUREG 0737 Requirements for Emergency Response Capability, December 17, 1982.

6. BECo Letter #83-97: Response to NRC Generic Letter #82-33 dated December 17, 1982.

7. IEEE 497-1981, IEEE Standard Criteria for Accident Monitoring Instrumentation for Nuclear Power Generating Stations, 1981.

8. INPO83-048 (NUTAC), Guidance for an Integrated Implementation Plan for Emergency Response Capabilities.

Appendix A

Reg Guide 1.97 Design and Qualification Criteria

R.G. 1.97, Rev. 3 Requirements		Qual. Category 1	Qual. Category 2	Qual. Category 3
1.	Seismic Qualification	R.G. 1.100; Accuracy After DBE	No	No
2.	Environmental Qualification	R.G. 1.89; NUREG 0588[1]	Same as Cat. 1[3]	No, but must meet service[2] environment conditions
3.	Single Failure Criteria	Yes	No	No
	Redundancy	Yes, 2 maybe 3 channels	No	No
	Isolation from Safety System	R.G. 1.75 Isol. Devices	Same as Cat. 1	Not applicable
4.	Power from On-Site Standby Sources	R.G. 1.32	No	No
	Power from Battery-Backed Bus	Yes, if interruption not tolerable	Same as Cat. 1	No
	Power from Highly Reliable Bus	No	Yes	No
5.	Display is continuous, real-time	Yes, 1 channel	No	No
	Display is also recorded	Yes, all channels[4]	Effluent radioactivity, area RAD monitors	Effluent radioactivity, area RAD monitors, Meteorology monitors
	Display is uniquely identified	Yes, types A, B, C	Same as Cat. 1	No
	Display is Dedicated Trend recorders	Yes, if needed for operator info or action	Same as Cat. 1	Same as Cat. 1
6.	Quality Assurance	Yes	Yes, but graded QA application possible	No
7.	Periodic Test Capability	Yes, R.G. 1.118	Yes, same as Cat. 1	Yes

R.G. 1.97, Rev. 3 Requirements	Qual. Category 1	Qual. Category 2	Qual. Category 3
8. Channel Availability Prior to Accident	Yes	Conform to system Tech. Spec.	No
9. Instruments overlay on range	Yes	Yes	Yes
10. Direct measurement by variable	Yes	Yes	Yes
11. Human factors considerations[5]	Yes	Yes	Yes

1 Qualification delayed if ranges meet R.G. 1.97 (Ref. 1, Page 13)

2 Meteorological instruments OK if historically reliable (Ref. 1, Page 13)

3 Cat. 2 Type C instruments qualified per ANS 4.5 para 6.3.5 rather than just Cat. 1 Type C
Relaxation of requirements versus R.G. 1.97, Rev. 2

4 All channels recorded rather than just one channel. Hintze (NRC) says this is now changed to one channel 2/25/82
Escalation of requirements versus R.G. 1.97, Rev. 2

5. Please note that human factors consideration limited to identifying adequacy of instrument markings, since no relocation of displays was required as a result of the PNPS evaluation.

References: (1) NUREG 0737 Supplement 1 12/17/83