

BOSTON EDISON COMPANY  
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BOSTON, MASSACHUSETTS 02199

May 18, 1982  
BECO Ltr. #82-145

A. V. MORISI  
MANAGER  
NUCLEAR OPERATIONS SUPPORT DEPARTMENT

Mr. Domenic B. Vassallo, Chief  
Operating Reactors Branch #2  
Division of Licensing  
Office of Nuclear Reactor Regulation  
U.S. Nuclear Regulatory Commission  
Washington, D. C. 20555

License No. DPR-35  
Docket No. 50-293

Implementation Review of NUREG-0737 (Submittal I)

- References: (a) NRC letter IE Inspection #82-13,  
dated May 11, 1982  
(b) BECo letter #82-105, dated April 16, 1982  
(c) Telecon - A. V. Morisi/K. Eccleston, dated  
May 13, 1982

Dear Sir:

In response to the inspection conducted April 12-16, 1982, by Dr. P. K. Eapen (Reference (a)), Boston Edison Company committed in Reference (b) to review all NUREG-0737 modifications installed and operable to date and identify exceptions from the NUREG guidance.

We believe it is inappropriate to use the NUREG document as a prescriptive auditing tool. This fact is best appreciated when the NUREG is viewed in historical context, taking into consideration the significant amount of dialogue and interface between the Staff and Licensees (including BWR Owners' Group). As the various requirements evolved through the post-TMI era, so did the clarifications and interpretations with some of the original objectives lost with subtle word changes and paraphrasing. For this reason, we are providing a comprehensive design description of each item such that a total picture of how our design meets the NUREG guidance can be seen, including exceptions and justifications.

We believe we meet the intent of the NUREG on this item and request your concurrence based upon your review of the attached information.

It should be noted that BECo has yet to receive equipment qualification test reports from General Electric Company for equipment procured from General Electric to NUREG-0737 requirements. Our design specifications meet the NUREG requirements, but our review of the qualification test reports to verify adequacy of the test records have not been completed at this time.

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As discussed with Mr. K. Eccleston of your staff in the Reference (c) telecon, the level of detail for our review was not fully appreciated at the time of our initial commitment and as such, the review is not complete as of this writing. However, our review for Item II.F.1.3 is provided as an attachment. A total of ten items comprise the full effort and as each review is completed, we will forward the results to your office. We are proceeding to complete the remaining reviews as a high priority effort.

We appreciate the helpful and cooperative efforts furnished by the Regional and Branch Staff, to date, in helping us resolve this issue. Please do not hesitate to contact us concerning your review of this letter and attachment.

Very truly yours,

*Harrison R. Balfour for A. V. Morisi*

Attachments

cc: Mr. R. C. Haynes  
Office of Inspection and Enforcement  
Region I  
U.S. Nuclear Regulatory Commission  
631 Park Avenue  
King of Prussia, PA 19406

### II.F.1.3

#### Containment High-Range Radiation Monitor

##### Description Including Range and Accuracy

The containment high radiation monitoring system consists of four detectors, two of which are mounted in drywell penetrations to view a large segment of the drywell volume and two of which are mounted in the torus compartment (outside torus proper) to view a large segment of the torus volume. No detectors are located high in the drywell. The detectors are accessible for replacement, maintenance and calibration. There is wide separation between the torus and drywell detectors of the same channel and between both channels of the torus detectors. The two drywell detectors are located in penetration sleeves approximately 24" apart (centerline to centerline). The location of the drywell detectors was dictated by the following:

- (1) The two penetrations used were the only existing penetrations available which view a large segment of the drywell.
- (2) The small volume of the drywell and the congestion caused by piping limits the number of acceptable locations for the drywell detectors and the ability to monitor widely separated and independent areas of the drywell.
- (3) The presence of main steam lines and structural shielding eliminates major portions of the drywell as acceptable locations.

A reasonable assessment of area radiation inside containment would be provided in the event of a significant violation of the reactor coolant system pressure boundary. Thick shielding has not been provided to increase the range of the detectors nor are the detectors protected by massive shielding.

Dose rate monitoring inside the drywell and torus is not required or conducted during normal operation. Personnel access to the drywell and torus is not normally permitted during periods when the reactor is at power. (Airborne off-line sampling and monitoring is continually conducted for the drywell to identify small leakages from the Reactor Coolant System.) The range of the drywell and torus detectors is adequate to follow radiation levels from 1 R/hr to the maximum expected in an accident where the release from the fuel is equivalent to 100% of the core inventory of Noble Gases, 50% of the Halogens and 1% of other isotopes.

The monitors have a range 1R/hr to  $1 \times 10^7$  R/hr (gamma). The monitors were specified to be sensitive to gamma photons with energies greater than 60 keV; however, verification of compliance with our specification is pending receipt of documentation from General Electric.

The accuracy of the monitors is such that usable information will be provided to the operator. Curves have been developed for the drywell and torus monitors which allow the operators to convert monitor readings into approximate percentage of fuel damage.

## Design and Qualification

Operational availability of each instrument channel can be checked (with the exception of the detectors and associated cable) by virtue of "hi cal/lo cal" test switches on the display which indicates functionality of panel equipment. The detectors, together with the complete instrument channel, will be tested once per cycle.

The design incorporates redundant channels; therefore, either channel may be removed and the other will still be able to measure the parameter. It would require a conscious effort on the part of the operator to de-energize both circuits, (i.e., two distinct steps). Each total channel is capable of being accessed during normal operation.

Conditions which would cause anomalous indication are minimized by the design features incorporated to address criteria stated in Appendix B and Table II-F-1-3 of NUREG-0737. The possibility of misinterpretation of readings is minimized by redundant high radiation monitors for both drywell and torus, the airborne off-line sampling system, and associated containment parameters (i.e., pressure, temperature, drywell sump levels etc.).

Surveillance testing, identification of any malfunction, and necessary repair can be effected in a timely fashion, because all components are located in areas which are accessible during normal operation. Also, normally indicating redundant channels can be used for comparison to recognize malfunctioning components.

Monitoring instrumentation inputs are derived from detectors that directly measure the desired variables.

Redundant channels for both drywell and torus monitors and physical separation are provided in accordance with Regulatory Guide 1.75 and are energized from station Class IE power sources.

The operator has been provided with the capability to monitor the variable at all times. The system includes four continuously energized indicators and two recorders located in the Control Room. These displays are mounted on dedicated post-accident monitoring panels to discern their intended use for post-accident conditions. The recorders provide trend information.

The signals from these sensors are not used for other purposes; therefore, isolation devices are not required.

Availability requirements for this instrumentation will be incorporated in a future revision to technical specifications upon receipt of model technical specifications from NRC including the basis.

Electrical equipment located in areas which could be subjected to harsh environment (resulting from accident conditions) have been specified to require qualification in accordance with IEEE-323-74. The supplier of the detectors (General Electric Company) has provided written confirmation but has yet to provide the qualification documentation specified in IEEE-323-74 for BECo's review and verification.

The coaxial cable used to carry the signal between the detectors and the Post Accident Monitoring panel is located in a harsh environment under accident conditions. The cables are qualified to the environment that they could be subjected to at PNPS-1 except that the service profiles are not enveloped for the first 10 seconds of the postulated accident. The cable is installed in conduit; and, therefore, the 10 second temperature differential is inconsequential.

Electrical equipment located in mild environments have also been specified to require qualification in accordance with IEEE-323-74. However, Boston Edison has not yet performed equipment qualification evaluations on safety-related electrical equipment located in areas subjected to only mild environments. When 10CFR50.49 and Regulatory Guide 1.89, Revision 1 are both finalized, Licensees will be able to get a clear understanding of the NRC's requirements to qualify Class IE equipment that is located in mild environment areas. At that time, Boston Edison will be able to perform a review of the equipment and their respective qualification documents in conjunction with its overall equipment qualification program.

Based on the environmental qualification information discussed above, the system is expected to perform its required function in an accident environment.

The 4 radiation detectors, 4 indicating transmitters, 2 recorders and 2 PAM panels and associated mountings were procured to IEEE 344-75 (which forms the substantive basis for Regulatory Guide 1.100). General Electric Company has provided written confirmation, but has yet to provide seismic qualification test reports for the detectors and indicating transmitters for BECo review and verification.

Seismic qualification analyses were performed for the PAM panels, cables and supports, and for the mountings for the panels and recorders using IEEE 344-75 as guidance.

The Boston Edison Quality Assurance Manual, Volume II (BEQAM II), Section 2, commits BECo to comply with the Regulatory Guides listed in Appendix B of the NUREG-0737.

#### Calibration and Testing

Periodic calibration testing of the system will be performed once per refueling cycle and daily instrument checks in accordance with applicable portions of Regulatory Guide 1.118 (IEEE-338-77, except Paragraphs 6.3.2 and 6.3.4) and a test procedure, which is now being prepared. The preoperational test, which was performed during startup from Refueling Outage #5, included calibration using electronic signal substitution and a calibrated radiation source. This startup test satisfied the periodic test requirement for the current operating cycle.

The high-range radiation monitors were calibrated in place with a radiation source at two values less than 10 R/hr.

BECo requested by letter that General Electric provide the calibration requirements specified in NUREG-0737 to:

- 1) Type test specimens at sufficient points to demonstrate linearity through all scales to  $10^6$  R/hr.
- 2) Prior to use, certify calibration of each detector for at least one point per decade between 1 R/hr and  $10^3$  R/hr.



General Electric responded that their method of testing is acceptable to the NRC for qualification of linearity and it is General Electric's interpretation that this should also satisfy the intent of NUREG-0737 for special calibration.

BECO has requested a copy of the records of the test results for review and verification.

#### Human Factors

Because the monitors are intended for post-accident conditions, the range is much greater than that required for normal conditions; therefore, indication does not include normal conditions.

No annunciator window is provided for this parameter because:

1. No operator action is required.
2. It is desirable to reduce the number of superfluous alarms.
3. It is desirable to minimize anomalous alarms, which potentially confuse the operator.

All post-accident recorders are physically located away from other equipment panels, but close enough to provide easy access and readability and monitors are labeled to minimize confusion.

The operators were instructed on the containment high-range radiation monitor system during the training program conducted prior to startup from Refueling Outage #5.