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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 IV)

Reference: (a) BECo. Ltr. #82-145, A. V. Morisi to D. B. Vassallo, dated May 18, 1982

Dear Sir:

Continuing our submittals as discussed in Reference (a) above, attached are the design descriptions for the following NUREG-0737 positions:

II.F.1.1 Noble Gas Effluent Monitors

II.E.4.1 Dedicated Hydrogen Penetrations for External Recombiners or Post-Accident Purge Systems

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

Please do not hesitate to contact us concerning your review of this letter and attachments.

Very truly yours,

AVMorisi

A046

ATTACHMENT #1

ITEM II.F.1.1

NOBLE GAS EFFLUENT MONITORS

SYSTEM DESCRIPTION

gas effluent monitoring system installed at Pilgrim Station con- normal (operating) range monitors that were installed as original equipment and new high range monitors that have been installed in esponse to the subject NUREG item. The monitoring system has been designed to monitor noble gas release rates from the plant during normal plant conditions and following an accident.

The normal operating monitoring system consists of redundant channel sensors at the main stack and the reactor building vent. Continuous detection and recording capability is provided in the main control room for these monitors. No normal effluent path through the turbine building roof exists, so no normal range monitor is provided at this location.

The high range system consists of single channel sensors at the main stack, reactor building vent, and turbine building vent. Continuous detection and recording capability is provided in the main control room for these monitors. The range of the monitors provide for measurement of releases up to about 5×10^{10} μCi/sec.

All detectors are mounted in non-seismic structures and, therefore, are not seismically qualified. This is consistent with the requirements of NUREG-0578 position 2.1.8.b (the NRC guidance at the time of initial procurement of the high range detectors).

A) Normal Range Monitoring System

The normal range noble gas effluent monitors* (for the record building vent and main stack) continually indicate and record for concentrations of radioactive material released from these release points and alarm whenever abnormally high concentrations of radioactive material exist in the effluent. Each system consists of one isokinetic probe that extends into the duct (reactor vent & main stack), a sample rack and pump assembly, two radiation sampling chambers with associated gamma scintillation detectors, process radiation monitoring units with trip circuits, and a two pen recorder for each monitor. The radiation trip circuits, monitors, and two pen recorders are located in the control room. Instrument ranges are 10^{-1} to 10^{6} cps. Conversions of indicator readings (cps) to release rates are performed by the operators in accordance with procedures.

* The term monitor, as used in this NUREG item, refers to the readout module located in the control room.

B) High Range Monitoring System

High range noble gas effluent monitors for the reactor building vent, turbine building vent, and the main stack continually indicate and record the status of effluent whenever radiation levels at the sensors exceed 0.1 r/hr. Single channel detectors, monitors, and recorders are provided for each of the 3 detector locations. Local alarm and indicating units are provided at each of the field locations. Signals from the detectors are transmitted to the 3 monitors in the control room. All necessary signal conditioning and setpoint adjustments are provided in these monitors. The monitors transmit signals to a multipoint, 3 pen recorder and three indicators, located on PAM panel C-170 in the control room.

Vendor model numbers for this equipment are as follows:

High Range Radiation Monitors: General Atomic Model RP-2A

Field Detectors: General Atomic Model RD-2A

Local Indicators and Alarms: General Atomic Model No. RL-2

Control Panel Indicators: Westinghouse Type VX-252

3-pen Recorder: Westinghouse "Optimac" Cat. No. 6294A76

The high range noble gas monitors use on-line type detectors so that no off-line samping is required. (Therefore, ANSI 13.1 does not apply to the high range noble gas monitor installation).

The high range system power supply is a reliable supply (from 120V AC Safeguard Power Supply) fed directly from its own 480/120V, 3kVA control power transformer. Power will be supplied from a diesel generator in the event of a complete loss of offsite power. Individual power routing is provided. Power supply for local display units is obtained from lighting panels in the vicinity of local displays. There is no power interface between local display units and control room monitors.

RANGE, ACCURACY, AND CALIBRATION

The high range noble gas monitors on the Main Stack and Reactor Building vent, in conjunction with the normal range monitors on these release points, cover the range from normal (ALARA) releases through accident conditions.

The range of the high range noble gas monitors installed on the Main Stack and Reactor Building vent overlap the range of the normal monitors (in terms of activity release rate) by various factors out to 44 hours after a Design Basis Loss of Coolant Accident. No normal effluents pass through the Turbine Building vent; therefore, the Turbine Building high range monitor does not overlap any other monitors.

Ranges of the Main Stack and Reactor Building vent high range and normal monitors overlap by a factor of 10 (in terms of activity release rate) out to 2 hours post LOCA, and a factor of 1 to 10 out to 44 hours post LOCA. These overlaps are adequate to follow an accident during the most critical phases. Field teams would be dispatched to quantify environmental impacts during and after the period of substantial overlap in the detection ranges of the in-plant monitoring system.

The high range field detectors have a range of 10^{-1} to 10^{4} R/hr. The upper ranges of the high range noble gas monitors are adequate to measure release levels equivalent to the following concentrations of Xe-133:

Main Stack:	2×10^{5} microcuries/cc
Reactor Building Vent:	2×10^{4} microcuries/cc
Turbine Building:	1.5×10^{3} microcuries/cc

These ranges are adequate to insure that no credible accident will result in releases which exceed the upper limit of the high range monitor.

The decay of effluents was considered in correlating the monitor readings to the actual release rates at various times following an accident. The thickness of the pipe or duct wall at the locations of the monitors has been considered in establishing the correlation between release rates and monitor readings.

Instrumentation will operate under the following conditions:

Temperature Range, 10^{o} - 55^{o}C

Humidity - up to 95%

The overall accuracy of the Monitor/Detector system is expected to be within $\pm$ 20%, which is adequate to provide useful information to the operators on the magnitude of noble gas releases.

The high range radiation monitors were calibrated using a Cobalt-60 radiation source.

Periodic calibration testing of the high range monitoring system is performed once per refueling cycle; and instrument checks are performed daily. These tests/checks are performed in accordance with PNPS procedures.

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.

CONTROL ROOM EQUIPMENT & HUMAN FACTORS

The normal range noble gas monitoring system includes alarm lights, audible annunciators, and indicators in the main control room. In the event of an accident involving significant effluent releases, these alarms and/or other system alarms would alert the operator to the potential for higher effluent releases and would trigger the emergency procedures. Alarm lights only (no audible annunciators) are provided on the high range monitor panels in the main control room.

The noble gas high range monitor is located in its own rack of instrumentation. Each individual location being monitored is identified on the panel. The indication on the rate meters is always downscale during normal operation due to the high range monitored. The operator, however, has a front panel mounted "CHECK" switch which simulates "HIGH" signal and meter operation.

The indicating instruments for the high range system are located on a panel dedicated to Post Accident Monitoring, and the indicating and recording devices are clearly labeled. All PAM indicating equipment is physically separated from other equipment panels. Monitors are clearly marked to minimize confusion. There are no control switches or alarms in the high range monitor loops, as the operator would have been alerted by other system alarms prior to the low end of the range of these instruments being reached.

Both the normal range and high range noble gas monitoring systems have been incorporated into plant emergency procedures.

The recorders for the high range monitors were designed to record the measured parameter, i.e., radiation exposure rate. The conversion method, including nomograms and reference to the computerized Emergency Dose Assessment System, has been incorporated into PNPS Emergency Plan implementing procedures. Plant procedures are available to convert the R/hr recordings to microcuries/sec.

The annunciators at Pilgrim Station are of a standard design. Color coding of some annunciator windows is the only alarm prioritization scheme used. The alarms associated with this indication conform to this standard design and do not use color coded windows.

At present, no prioritization of PNPS alarms is being considered. Alarms during emergencies and the need for prioritization of alarms is an issue that should be addressed for the entire control room, and not for a single indication.

Operator training was conducted on PAM Panel on May 1, 2, 5, and April 29, 1980. Also, operator training relative to these monitors was included in the operator training for Mitigation of Core Damage (NUREG Item II.B.4).

DOCUMENTATION

Detailed design and operations information on the noble gas high range monitoring system is given in the vendor supplied reports, BECo design documents, and PNPS procedures. These documents, which include detector response characteristics, calibration details, and calculational methods to convert instrument readings to release rates are available at Boston Edison Company.

ATTACHMENT #2

ITEM II.E.4.1

DEDICATED PENETRATIONS FOR EXTERNAL RECOMBINERS OR POST-ACCIDENT PURGE SYSTEMS

SUMMARY

In order to meet the requirements of II.E.4.1 for Pilgrim Unit #1, a sub-system to the containment vent and purge system has been added for Post Accident Containment Combustible Gas Control (CCGC). This system would provide combustible gas contro' after a design basis LOCA with loss of off-site power and a single active failure without requiring access to areas that may not be reasonably accessible.

To meet this requirement, 16 solenoid valves have been added and arranged to provide redundant paths to and from the drywell and torus for venting and N_2 makeup. The solenoid valves are designed to remain closed against maximum containment pressure, to vent containment so that the maximum containment pressure will not be exceeded, and to provide a nitrogen flow sufficient to maintain the hydrogen concentration inside containment below the flammability limits.

In addition, penetrations through the primary containment have been provided such that later modification to permit use of external hydrogen recombiners, if required, would be facilitated.

DESIGN & QUALIFICATION

(A) Combustible Gas Control System

The valves in redundant paths are powered from independent Class IE distribution systems, each of which is powered from an emergency diesel generator after a loss of offsite power. The control switches for redundant valves are located in separate sections of a Class IE control panel in the main control room. All equipment and conduit is located in seismically designed, missile protected buildings, except all the fill connections, which are located outside of secondary containment, but separated. The redundant conduit has been routed to maximize the separation between the redundant conduit channels; however, it should be noted that the CAD system is only required for LOCA conditions and, therefore, need not be designed for non-concurrent events such as fire and pipe break outside containment. All conduit and equipment is supported to meet seismic Category I requirements.

The power to both valves of a series pair of isolation valves is from the same power supply, and their respective cables are routed in the same raceway. We believe that this is acceptable, because:

1) The only cables in the applicable raceways are to the isolation valves. Therefore, all cables to the isolation valves can be de-energized by moving all control switches to "close", and there will be no other source of voltage within the raceway to cause the valves to open inadvertently.

2) The valves are normally closed and would be opened for a very limited time for testing. This period of energization makes it extremely unlikely that both valves could be damaged due to over-voltage on the solenoid coils.

The solenoid valves are ASME III Class 2 and were procured to the requirements of IEEE 323-1974, IEEE 382-1973, and IEEE 344-1975 for the expected conditions. The valves are rated at 120 VAC and are designed to operate between 80 and 110 percent of rated voltage. This range is compatible with expected bus voltages at PNPS. The valves will fail close on loss of power.

The control switches have been qualified to the requirements of IEEE 323-1974 for operation in a control room environment. The switches are mounted on Class IE panels, and the combination has been procured to the requirement of IEEE 344-1975. The switch's electrical ratings exceed loading requirements.

The cable and wire used for this modification have been qualified to IEEE 383-1974 for fire and ambient conditions exceeding those required for this installation. The 600 volt #12 AWG control cable has voltage and current capabilities well above that required.

Based on the above, it is concluded that this system would perform its required function assuming a loss of offsite power and a single failure and that the installation is designed to withstand the effects of the most severe natural phenomena postulated.

Control of the solenoid valves is remote manual; there is no automatic isolation capability. Isolation signals have not been provided because:

1) The valves are always keylocked closed during normal operation.

2) The valves are required to be operated during a high drywell pressure condition and must be available independent of reactor water level. High drywell pressure and low reactor water level are the normal containment isolation signals.

3) The valves have a 1/4" diameter port and the maximum leakage would be less than that through an instrument line.

Indicator lights are provided to continuously monitor valve position. The indicators are driven by reed type limit switches mounted within the valve electrical housing. Contacts from all control switches are wired to an annunciator window to provide an alarm when a valve is open.

The only interface between the new components and existing systems are that the new valves are piped in parallel to the existing containment vent and purge valves, the new valves discharge to the standby gas treatment system, and both the new and existing vent/purge valves are powered from different circuit breakers in the same distribution panel boards.

The new vent and purge lines can supply 30 SCFM of nitrogen or air to the primary containment, if required, and the system is sized properly to meet the requirements of 10CFR50.44.

(B) Dedicated H_2 Penetrations

In addition, 4" diameter connections to the primary containment, 20" diameter vent/purge lines and suppression pool air space have been provided and are available for later implementation of external hydrogen recombiners, when and if required. These penetrations are accessible during normal operation to permit later work during plant operation to install primary containment recirculating recombiners. Presently the lines terminate inside the reactor building with "N" stamped gate valves and blind flanges.