TENNESSEE VALLEY AUTHORITY
CHATTANOOGA, TENNESSEE 37401
400 Chestnut Street Tower II

March 24, 1985

Director of Nuclear Reactor Regulation
Attention: Ms. E. Adensam, Chief
Licensing Branch No. 4
Division of Licensing
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Ms. Adensam:

In the Matter of the Application of) Docket Nos. 50-390
Tennessee Valley Authority

Please refer to TVA's letters dated September 14 and October 29, 1981, August 12, 1982 and June 7, 1983 which provided TVA's initial and revised responses, to NUREG-0737 item II.F.1, "Additional Accident-Monitoring Instrumentation" for the Watts Bar Nuclear Plant (WBN).

Enclosed is a supplemental response providing information required by Attachment 1 "Noble Gas Effluent Monitor" to the subject NUREG item. Enclosure 1 provides a description of (1) the as-installed noble gas monitors and (2) the procedures used for monitor calibration. Enclosure 2 provides a procedure for converting radiation monitor readings to noble gas release rates. During the process of developing this response, it was discovered that several subsections and tables of FSAR Section 11.4 require revision. These FSAR revisions were submitted as part of FSAR Amendment No. 55.

Please note that NRC clarification item (4)(a)(iv) requests that the design description include "assurance of the capability to obtain readings at least every 15 minutes during and following an accident." TVA believes that this description is not meaningful for the WBN instruments which provide continuous detection and which have continuous analog readouts in the main control room. Therefore, this item is not addressed in the enclosed response.

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Director of Nuclear Reactor Regulation March 24, 1985

If you have any questions concerning this matter, please get in touch with Dave Ellis at FTS 858-2681.

Very truly yours,

TENNESSEE VALLEY AUTHORITY

J. A. Domer

J. A. Domer
Nuclear Engineer

Sworn to and subscribed before me
this 24th day of Mar. 1985.

Paulette H. White
Notary Public

My Commission Expires 8-24-88

Enclosurea
cc: U.S. Nuclear Regulatory Commission (Enclosurea)
Region II
Attn: Dr. J. Nelson Grace, Regional Administrator
101 Marietta Street, NW, Suite 2900
Atlanta, Georgia 30323

ENCLOSURE 1

WATTS BAR NUCLEAR PLANT

DESCRIPTION OF RADIATION MONITORS PROVIDED TO MEET REQUIREMENTS OF NUREG-0737, ITEM II.F.1, ATTACHMENT 1, NOBLE GASES

I. Radioactivity Release Points

During all accidents for which large quantities of noble gas releases from the plant are postulated, the Auxiliary Building ventilation exhaust is isolated. Therefore, except for release from the secondary system, the only paths for high specific noble gas activity releases are the unit Shield Building vents. High specific activity noble gas release paths from the secondary system are the condenser vacuum pump exhausts and the steam generator atmospheric relief valves.

II. Upgraded Instrumentation Capability

For the Shield Building vents, the originally purchased and installed normal range monitors (supplied by GA Technologies, Incorporated (GA Technologies)) have been replaced with instrumentation (supplied by Eberline Instrument Corporation (Eberline)) that can detect noble gases over the range of specific activities from normal operations through accident conditions.

For the condenser vacuum pump exhausts, originally purchased and installed instrumentation (supplied by GA Technologies) has been supplemented with high range instrumentation (purchased from Eberline).

Instrumentation has been added to quantify noble gas releases from the steam generator atmospheric relief valves.

The Shield Building vent, condenser vacuum pump exhaust and steam generator atmospheric relief valve radiation monitoring instruments are described below.

1. Shield Building Vent Monitors

The Shield Building vent monitors are described in FSAR Section 11.4.2.2.4 and in FSAR Tables 11.4-2 and 11.4-3. This section augments and highlights the FSAR description with respect to the noble gas detection capabilities of the monitors.

Two monitors per reactor unit provide the required range for detection of noble gas activity in the Shield Building vent discharge. The unit 1 monitors are identified by TVA as 1-RE-90-400 for the normal range, and 1-RE-90-401 for the accident range. The unit 2 monitors are similarly designated. Power to the monitors is nontrained and diesel-generator backed.

The normal range is provided by the noble gas detectors of an Eberline SPING-3 monitor, which also has particulate and iodine monitoring channels. The accident range is provided by the noble gas detectors of an Eberline NGP-1, a component of the Eberline AXM-1, which also provides particulate and iodine grab samples for laboratory analyses.

Noble gas detection in the SPING-3 is accomplished with the SA-13 sampler assembly. Two detectors, one low range and one medium range, both view the same sample volume located within the SA-13 assembly. The low-range detector is a beta scintillation detector (Eberline Model RDA-3A), and the medium-range detector is an energy-compensated GM tube.

The low-range detector provides detection of Xe-133 from 1.1(-7)* μCi/cc to 4.3(-2) μCi/cc. The medium-range detector provides detection of Xe-133 from 9.2(-4) μCi/cc to 1.8(+3) μCi/cc. The combined range of the SPING-3 for Xe-133 detection is 1.1(-7) μCi/cc to 1.8(+3) μCi/cc.

The AXM-1 NGP-1 utilizes two detector assemblies, an SA-14 low range and an SA-15 high range. Each of the detectors is an energy-compensated GM tube. For Xe-133, the SA-14 detection range is 1.3(-4) μCi/cc to 4.6(+1) μCi/cc and the SA-15 range is 1.0(-1) μCi/cc to 1.4(+5) μCi/cc. The combined range of the AXM-1 NGP-1 for Xe-133 detection is 1.3(-4) μCi/cc to 1.4(+5) μCi/cc. The overall range of the SPING-3 and AXM-1 NGP for Xe-133 detection is 1.1(-7) μCi/cc to 1.4(+5) μCi/cc, as listed in FSAR Table 11.4-2.

Monitor 1-RE-90-400 is calibrated at least once per 18 months. The Eberline SPING unit is calibrated using NBS (National Bureau of Standards) traceable transfer calibration sources and an analog calibration is performed using a pulse generator.

Monitor 1-RE-90-401 is calibrted at least once per 18 months. The Eberline high-range monitor is calibrated by placing a CS-137 gamma source such that the detector is in a 10 MR/hr field and then verifying calibration by placing a NBS traceable Kr-85 sealed source in place of the sample tubing. The detector is then placed by a pulse generator and the entire range is verified.

2. Condenser Vacuum Pump Exhaust Monitor

The condenser vacuum pump exhaust monitors are described in FSAR Section 11.4.2.2.2 and in FSAR Tables 11.4-2 and 11.4-3. This section augments and highlights the FSAR description of the monitor noble gas detection capabilities.

Three monitors per reactor unit provide the required range for detection of noble gas activity in the condenser vacuum pump exhaust. TVA has designated the unit 1 monitors:

Low-range:	1-RE-90-119
Mid-range:	1-RE-90-99
Postaccident:	1-RE-90-404

The unit 2 monitors are similarly designated. Monitor power is nontrained and diesel-generator backed.

The low-range monitor is a GA Technologies RD-32-01 beta scintillation detector assembly. Its range for detection of Xe-133 is given in FSAR Table 11.4-2.

*Read 1.1(-7) as 1.1×10^{-7} and similarly for other numbers in parenthesis.

The mid-range monitor is a GA Technologies RD-32-08 beta scintillation detector assembly. Its range for detection of Xe-133 is given in FSAR Table 11.4-2.

The postaccident monitor is an Eberline NGP-1. The NGP-1 employs two detectors, as described in the previous section to provide the range for the detection of Xe-133 given in FSAR Table 11.4-2.

The overall range of the low-, mid-, and high-range monitors for the detection of Xe-133 is 2.3(-7) μCi/cc to 1.4(+5) μCi/cc. The range data show that, over the range of 1-RE-90-99 (the designated mid-range monitor), redundant monitoring capability is provided since there is ample overlap of the detection ranges of monitors, 1-RE-90-119 and 1-RE-90-404.

Monitor 1-RE-90-99 and 1-RE-90-119 are calibrated at least once per 18 months. The GA Technologies monitors are calibrated using an NBS traceable transfer calibration standard and an analog calibration is done using a pulse genertor to calibrate the radiation analyzer and then a reference voltage generator within the analyzer to calibrate other system components.

Monitor 1-RE-90-404 is calibrated at least once per 18 months. This monitor is calibrated using the same technique for 1-RE-90-401 described above.

3. Steam Generator Discharge Radiation Monitors

The steam generator discharge radiation monitors are described in FSAR Section 11.4.2.2.7 and in FSAR Tables 11.4-2 and 11.4-3. This section augments and highlights the FSAR description of the monitor noble gas detection capabilities.

Four monitors per reactor unit, one monitor for each steam line, provide detection of radioactivity in the steam from primary to secondary leakage in the steam generators. The radiation measurements are used in the quantification of radioactivity released via steam generator atmospheric relief valves. The unit 1 monitors are designated by TVA as follows:

1-RE-90-421
1-RE-90-422
1-RE-90-423
1-RE-90-424

The unit 2 monitors are similarly designated. Monitor power is nontrained and diesel-generator backed.

Each monitor is a GA Technologies extended range SLM. The overall monitor detection range of 1.0(-2) mR/h to 1.0(+7) mR/h is obtained with two detectors. The lower part of the range is provided by the RD-11 GM tube detector with a range of 1.0(-2) mR/h to 1.0(+3) mR/h. The upper part of the range is provided by an RD-2B, an ion chamber with a range of 1.0(+2) mR/h to 1.0(+7) mR/h.

The overall detection range of nine decades includes the range of exposure rate at the detector locations corresponding to the range of 1.0(-1) μCi/(cc of steam) to 1.0(+3) μCi/(cc of steam), listed in Regulatory Guide 1.97, revision 2, for the monitors in their function as category E instrumentation.

Monitors 1-RE-90-421,-422,-423,-424 are calibrated at least once per 18 months. These are split range detectors with a low range of 10^{-2} to 10^{3} MR/hr and a high range of 10^{2} to 10^{7} MR/hr. The low range is calibrated by using a CS-137 gamma source and placing the source at two certified distances from the detector. The high range detectors are calibrated by placing a CS-137 source with an activity of 100 MR/hr a certified distance from the detector. The detector is replaced with a current source and the higher ranges are simulated and verified.

The radiation monitoring procedures are to be written and performed in accordance with the Watts Bar technical specifications. All of the subject Eberline monitors feed a contrally located data logger display unit in the main control room. Each channel is verified at the time of each individual unit calibration.

ENCLOSURE 2
WATTS BAR NUCLEAR PLANT
PROCEDURES FOR CONVERTING RADIATION MONITOR READINGS
TO NOBLE GAS RELEASE RATES DURING ACCIDENT CONDITIONS

I. Noble Gas Release Rates Through Shield Building Vents

For the Shield Building vents, noble gas release rates are the products of air volume flow rates through the vents and nuclide-specific activities.

The air volume flow rates are obtained with pitot-tube type instrumentation supplied by Air Monitor Corporation (AMC). In addition to sample uptake probes, the duct assembly supplied by AMC includes a large number of pressure probes designed and positioned to provide average values of total and static pressure. These values establish the air velocity which is combined with the duct cross sectional area by the instrumentation software to determine air volume flow rates.

Shield building vent noble gas detector background-corrected counting rates (cpm) are converted to nuclide-specific activities using known or assumed nuclide spectra and instrument nuclide detection efficiencies.

For the SPING-3 noble gas detectors, the nuclide spectrum is generally based on laboratory measurements of grab samples. As a conservative default spectrum, all noble gas is assumed to be Kr-85. For the AXM-1 NGP-1 noble gas detectors, the default spectrum corresponds to Regulatory Guide 1.4 assumptions. This accident spectrum is altered with time after shutdown to take into account radioactive decay.

For the SPING-3 low-range noble gas detector, nuclide detection efficiencies are based on nuclide decay schemes and a calibration curve developed by Eberline Instrument Corporation (Eberline) which relates the beta scintillation detector efficiency for detecting a decay by beta emission to the average beta energy. For the SPING-3 medium-range noble gas detector and for each of the AXM-1 NGP-1 noble gas detectors, Eberline has determined detector counting rates as functions of Kr-85 and Xe-133 specific activities. These three detectors are energy-compensated GM tubes designed to measure exposure rates. The exposure rate measurements corresponding to photon energies greater than a few hundred keV should be acceptably accurate. Therefore, the above relationship determined by Eberline for Kr-85, which emits a 514 keV photon in 0.216 percent of its decays, is used to relate calculated exposure rates to expected detector counting rates for assumed nuclide-specific activities. Assumed specific activities are then multiplied by the ratio of actual background-corrected counting rate to expected counting rate.

This procedure is employed for all nuclides except Xe-133, in which case the explicit relationship determined by Eberline is utilized.

II. Noble Gas Release Rates Via Condenser Vacuum Pump Exhausts

For the condenser vacuum pump exhausts, radioactivity release rates are the products of measured air volume flow rates through the exhaust vents and nuclide-specific activities.

Detector background-corrected counting rates (cpm) are converted to nuclide-specific activities using known or assumed nuclide spectra and nuclide detection efficiencies.

For the low- and mid-range monitors, the nuclide spectra are generally based on laboratory measurements of noble gases in the primary coolant. The primary coolant noble gas activities given in ANSI N237-1976, "Source Term Specification," provide the basis for a default spectrum.

For the NGP-1 detectors, the nuclide spectrum is based on the equilibrium core inventory of noble gases. This spectrum is altered with time after shutdown to take into account radioactive decay.

For the low- and mid-range monitors, nuclide detection efficiencies are based on nuclide decay schemes and calibration curves developed by by GA Technologies, Incorporated (GA Technologies) which relate the beta scintillation detector efficiency for detecting a decay by beta emission to the maximum beta energy.

The high-range monitoring is performed with an NGP-1 identical to the AXM-1 NGP-1 used to monitor the Shield Building vent. Therefore, the method which uses assumed spectra and detector counting rates to obtain nuclide-specific activities, as described in the previous section for the Shield Building vent, is applicable.

III. Noble Gas Release Rates Through Steam Generator Atmospheric Relief Valves

Radioactivity release rates through the steam generator atmospheric relief valves are the products of steam mass release rate and nuclide-specific activities in the steam. Instrumentation with which the steam mass release rate is determined has been added. Nuclide-specific activities in the steam are determined by the following method: (1) the nuclide-specific activities, with assumed spectrum, that are necessary to produce a calculated exposure rate of 1.0 mR/h at the locations of the steam generator discharge radiation monitor detectors are determined. The assumed spectrum used for this determination is normally based on measurements of primary coolant noble gas activities. The default spectrum corresponds to the primary coolant noble gas activities in ANSI N237-1976, "Source Term Specification." For the upper part of the detection range, the spectrum used corresponds to the equilibrium core noble gas inventory as adjusted for time after shutdown; and (2) the nuclide-specific activities are multiplied by the background corrected monitor readings to yield the actual specific activities used in the noble gas release calculations.