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MAY 19 1994

U.S. Nuclear Regulatory Commission
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Gentlemen:

In the Matter of the Application of	)	Docket Nos. 50-390
Tennessee Valley Authority	)	50-391

WATTS BAR NUCLEAR PLANT (WBN) UNITS 1 AND 2 - NUREG-0737, ITEM II.F.1.1 - NOBLE GAS RADIATION MONITORS - REVISED RESPONSE

This letter provides a revised response to TVA's letter dated March 24, 1985, concerning the subject NUREG-0737 item for WBN.

Enclosure 1 provides a description of the upgraded digital noble gas monitors and the methods used for monitor calibration. Enclosure 2 provides the description of the process for converting radiation monitor readings to noble gas release rates during an accident. As previously committed in TVA's January 3, 1991 letter, the capability for continuous collection of plant gaseous effluents, whenever exhaust flow occurs, including implementing procedures and system upgrades, will be in place before fuel load of the respective units.

Enclosure 3 provides a list of commitments identified in this letter. If you should have any questions concerning this matter, please telephone John Vorees at (615) 365-8819.

Sincerely,

Dwight E. Nunn

Enclosures
cc: See page 2

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MAY 19 1994

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ENCLOSURE 1

WATTS BAR NUCLEAR PLANT (WBN) UNITS 1 AND 2
NUREG-0737, ITEM II.F.1.1, NOBLE GAS RADIATION MONITORS
REVISED RESPONSE

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 Shield Building vents. Due to Auxiliary Building gas treatment configuration, Auxiliary Building releases may be routed to either the Unit 1 or 2 Shield Building vents. This exception to NUREG-0737 Item II.F.1.1 was approved by the NRC in Supplemental Safety Evaluation Report (SSER) 5, Section 11.7.1. 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. Instrumentation Provided

For the Shield Building vents, the radiation monitoring upgrades to digital off-line wide range gas monitors (WRGMs) are furnished by Sorrento Electronics Company (SE). As previously committed, these monitors will be installed and operational before Unit 1 fuel loading for both the Unit 1 and Unit 2 Shield Building vents. The monitors are designed to detect noble gases over the range of specific activities from normal operations through accident conditions.

The condenser vacuum pump exhaust monitors include a low range analog off-line gas monitor supplied by General Atomic (GA), (now SE), and a mid and high range digital off-line gas monitor furnished by Eberline Instrument Corporation (Eberline). These monitors are currently installed on the condenser vacuum pump exhaust. The Unit 1 monitor will be operational by Unit 1 fuel load, and the Unit 2 monitor will be operational by Unit 2 fuel load.

Digital on-line area monitor detectors are installed upstream of the main steam safety valves to sense radioactivity levels in the main steam lines. For Unit 1, TVA has completed shielding calculations as a basis for correction of the reading at the monitors to the actual radiation level which could exist inside the main steam lines. These monitors are supplied by GA (now SE). The Unit 1 and Unit 2 monitors will be operational by the respective fuel load dates.

The Shield Building vent, condenser vacuum pump exhaust, and steam generator atmospheric relief valve radiation monitoring instruments are described in more detail as follows.

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. The revised portions of this text were submitted to NRC in Amendment 77.

ENCLOSURE 1

WATTS BAR NUCLEAR PLANT (WBN) UNITS 1 AND 2
NUREG-0737, ITEM II.F.1.1, NOBLE GAS RADIATION MONITORS
REVISED RESPONSE

One WRGM per reactor unit provides real time detection of noble gas activity in the Shield Building vent discharge. Each WRGM utilizes three detectors in order to achieve the desired range. The Unit 1 and 2 monitors are identified by TVA as 1-RE-90-400 and 2-RE-90-400, respectively. Power to the monitors is non-divisional with a diesel generator backup supply.

The low (normal) range is provided by the SE model RD-52 beta scintillation noble gas detector. The mid/high (accident) range is provided by two SE model RD-72 cadmium telluride (CdTe) noble gas detectors. Particulate and iodine grab sample capability is also provided for use in laboratory analysis. The grab sample equipment is located on a separate skid, 1-RE-90-402 for Unit 1 and 2-RE-90-402 for Unit 2.

A TVA calculation derives the total gas response factors for the three detectors with the following results:

Low range,	RD-52:	3.91E+07 cpm/(μCi/cc)
Mid range,	RD-72:	6.60E+04 cpm/(μCi/cc)
High range,	RD-72:	2.17E+02 cpm/(μCi/cc)

The following are the calculated ranges for these detectors for total gas concentrations:

Low range,	RD-52:	1.59E-07 to 2.56E-01 μCi/cc
Mid range,	RD-72:	3.80E-05 to 1.52E+02 μCi/cc
High range,	RD-72:	1.58E-02 to 4.61E+04 μCi/cc

These ranges overlap as required. The ranges envelope the requirements of Regulatory Guide (RG) 1.97 Revision 2 (R2), which requires a detection range of 1E-6 to 1E+4 μci/cc for Shield Building exhausts that also includes containment purge. TVA committed to meet the RG 1.97 R2 range requirements in a letter dated August 31, 1990 and in the request for additional information response letter dated October 29, 1991.

The primary sample is obtained from a sample probe array of isokinetic nozzles located near the top of the Shield Building vent stack. The probe array is preceded by a flow straightener, and primary sample withdrawal velocity control is made in accordance with totalized mass flow from the four contributing air streams: emergency gas treatment system (EGTS), Auxiliary Building gas treatment system (ABGTS), and two purge air exhaust ducts. The Unit 2 flow elements and path for the EGTS and the containment purge will not be installed for Unit 1, therefore, the only flow element required for the Unit 2 Shield Building is from the ABGTS. The Unit 2 EGTS and the containment purge flow elements will be installed and operational by Unit 2 fuel load. The flow measurement is made with

Kurz K-Bar heated wire anemometer probes. In this way, a representative sample is ensured up to the radiation monitor secondary sample withdrawal point. The multiple probe array and flow straightener ensures a representative gas sample, and the isokinetic control for the primary sample ensures a minimal loss of particulates and iodines for the grab sample skid. The secondary sample flow rate is controlled isokinetically by the WRGM equipment between 7,000 and 14,000 scfm.

Monitors 1-RE-90-400 and 2-RE-90-400 are calibrated at least once every 22-1/2 months. The units are calibrated using National Bureau of Standards (NBS) traceable solid transfer calibration sources. Background correction is accounted for at each calibration and alarm setpoints are adjusted accordingly.

Indicators and recorders displaying vent stack release rate and radiation level are located in the main control room. Normal operation release calculations are based on relative isotope abundances determined by sampling. For a discussion of the alternate method of determination of release rates per unit time during and following an accident, see Enclosure 2.

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. The revised portions of the text were submitted in Amendment 77.

Two monitors per reactor unit provide the required range for detection of noble gas activity in the condenser vacuum pump exhaust. The low range monitor is identified by TVA as 1-RE-90-119 for Unit 1 and 2-RE-90-119 for Unit 2. The mid/high range functions are provided by monitors 1-RE-90-404 and 2-RE-90-404 for Unit 1 and 2, respectively. Power to the monitors is non-divisional with a diesel generator backup supply.

There is also an additional mid-range monitor identified as 1-RE-90-99 for Unit 1 and 2-RE-90-99 for Unit 2.

The low range monitor is an SE model RD-32-01 beta scintillation detector assembly. The mid/high range is provided by an Eberline NGP-1, a component of the AXM-1. The NGP-1 utilizes two detector assemblies to achieve the required range. The SA-14 mid-range detector and the SA-15 high range detector are both energy compensated GM tubes. The additional mid-range monitor contains an SE model RD-32-08 beta scintillation detector assembly.

A TVA calculation derived the total gas response factors for the three detectors with the following results (t = 0, post accident):

ENCLOSURE 1

WATTS BAR NUCLEAR PLANT (WBN) UNITS 1 AND 2
NUREG-0737, ITEM II.F.1.1, NOBLE GAS RADIATION MONITORS
REVISED RESPONSE

Low range,	RD-32-01:	3.66E+7 cpm/(μCi/cc)
Mid range,	SA-14:	1.61E+4 cpm/(μCi/cc)
High range,	SA-15:	5.00E+2 cpm/(μCi/cc)
Mid range,	RD-32-08:	5.59E+5 cpm/(μCi/cc)

The following are the calculated ranges for these detectors for total gas concentrations at t = 0:

Low range,	RD-32-01:	2.35E-7 to 2.73E-1 μCi/cc
Mid range,	SA-14:	8.23E-3 to 7.47E+1 μCi/cc
High range,	SA-15:	2.34E-2 to 2.40E+3 μCi/cc
Mid range,	RD-32-08:	1.82E-5 to 1.79E+1 μCi/cc

The above values for response factors and ranges vary as the event progresses. The ranges overlap as required. However, the range does not meet the required RG 1.97 R2 range of 1E-6 to 1E+5 μci/cc. TVA's request for an exemption to the required range was submitted May 9, 1994. The FSAR has also been updated to describe the justification for this deviation to the required range in Amendment 81, Chapter 7.5, Variable 95, Deviation 33.

The condenser vacuum pump exhaust sample is extracted directly via a cylindrical sampling manifold extending across the duct diameter. The sample enters the manifold through upstream facing holes that are uniformly spaced along the cylindrical surface of the manifold. The sample is drawn through sample lines by the monitor pumps. The sample velocity is determined with the use of a differential pressure flow element in the condenser vacuum pump exhaust line.

Monitors 1-RE-90-119, 1-RE-90-99, 1-RE-90-404, 2-RE-90-119, 2-RE-90-99 and 2-RE-90-404 are calibrated at least once every 22-1/2 months. The SE RD-32-01 and RD-32-08 are calibrated with an NBS traceable solid transfer calibration source. The SA-14 and SA-15 are calibrated by using a CS-137 gamma source to achieve a specific field intensity at the detector. The SA-15 may be further calibrated by exposure to an NBS traceable KR-85 sealed source. Proper response of monitor electronics is demonstrated over the entire range by simulating detector outputs at the input to the electronics. Background correction is accounted for manually at each calibration by measurement and corresponding adjustment of the alarm setpoint.

Indicators and recorders are provided on the main control boards for condenser vacuum pump exhaust radiation level. The flow rate out of the condenser vacuum pump exhaust is monitored on the plant computer and the Technical Support Center (TSC) computer. Normal operation release calculations are based on relative isotope abundances determined by sampling. For a discussion of the

alternate method of determination of release rates per unit time during and following an accident, see Enclosure 2.

3. Steam Generator Discharge Radiation Monitors

The steam generator discharge radiation monitors are described in FSAR Section 11.4.2.2.7 and FSAR Tables 11.4-2 and 11.4-3. The revised portions of this text were submitted in Amendment 77.

Four monitors per reactor unit, one monitor for each steam line, provide detection of radioactivity in the steam line resulting 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 1-RE-90-421 (steam generator 1), 1-RE-90-422 (steam generator 2), 1-RE-90-423 (steam generator 3), and 1-RE-90-424 (steam generator 4). The unit 2 monitors are similarly designated as 2-RE-90-421, 2-RE-90-422, 2-RE-90-423, and 2-RE-90-424. Monitor power is nondivisional with a diesel generator backup supply.

Each monitor is an SE extended range steam line monitors (SLM). The necessary range is provided by two separate detectors for each SLM. The lower range is monitored by the SE model RD-11 GM tube detector and the upper range is monitored by the SE model RD-2B ion chamber.

TVA calculated the sensitivity to radiation in the steam lines for these detectors to be as follows:

RD-11, pre-shutdown spectrum:	2.99E-3 (μCi/cc)/(mR/hr)
RD-11, post-shutdown spectrum:	1.09E-2 (μCi/cc)/(mR/hr)
RD-2B, post-shutdown, t = 0:	1.86E-2 (μCi/cc)/(mR/hr)

The sensitivity decreases with time such that at t = 8 hours, the sensitivity of the RD-2B is 1.38E-2 (μCi/cc)/(mR/hr).

TVA calculated the ranges for the two detectors for the total ion mixes expected in the steam line as follows:

RD-11, pre-shutdown normal operational	1.60E-5 μCi/cc to 2.99E+0 μCi/cc
RD-11, post-shutdown, normal operation	5.82E-5 μCi/cc to 1.09E+1 μCi/cc
RD-2B, post-accident, t = 0	1.86E+0 μCi/cc to 1.86E+5 μCi/cc

Both the minimum detectable concentration and the maximum measurable concentration increase as a function of time postaccident.

ENCLOSURE 1

WATTS BAR NUCLEAR PLANT (WBN) UNITS 1 AND 2
NUREG-0737, ITEM II.F.1.1, NOBLE GAS RADIATION MONITORS
REVISED RESPONSE

The ranges overlap sufficiently as required. These detectors also meet the range requirement of RG 1.97 R2, which is 1E-1 μCi/cc to 1E+3 μCi/cc.

Since these detectors monitor the steam lines directly upstream of the relief valves, there is no sample line involved. Mass steam flow release rates are calculated by the plant process computer based on atmospheric relief valve position information provided by acoustic monitors, and the main steam line steam flow rates provided by differential pressure transmitters on the main steam lines.

Monitors 1-/2-RE-90-421, 1-/2-RE-90-422, 1-/2-RE-90-423, and 1-/2-RE-90-424 are calibrated at least once every 22-1/2 months. The low range RD-11 detector is calibrated by using a CS-137 solid source positioned in proper geometry relative to the detector. The high range RD-2B detector is calibrated similarly for the low end of the range. For the high end, the detector is replaced with a certified current source. Proper response of the monitor electronics is demonstrated over the monitor range by simulating detector outputs at the inputs to the electronics. The detectors are heavily shielded and aimed directly at the steam line and in close proximity, therefore, background radiation interference is considered negligible.

Main steam line radiation levels are indicated and recorded in the main control room. Main steam safety valve and power operated relief valve positions are recorded in the Auxiliary Instrument Room and the flow rates are available to the operator on the plant process computer and TSC computer. For a discussion of the method of determination of accident release rates per unit time, see Enclosure 2.

ENCLOSURE 2

WATTS BAR NUCLEAR PLANT (WBN) UNITS 1 AND 2
PROCESS FOR CONVERTING RADIATION MONITOR READINGS
TO NOBLE GAS RELEASE RATES DURING ACCIDENT CONDITIONS

During and following an accident, there is a high probability that immediate samples will not be available to provide specific isotope relative abundances based on laboratory analysis. For these cases, the following methods are used to provide a conservative estimate of total radioactive releases.

I. Noble Gas Release Rates Through Shield Building Vents

Noble gas release rates are the products of air volume flow rates through the vents, radiation monitor response and the radiation monitor total gas calibration factor for the given plant condition and time following an accident.

The air volume flow rates are determined based on the summed velocity signals from heated wire anemometer probes placed in the four contributing ducts for each of the Shield Building vents. The totalized and averaged velocity is combined with the duct cross sectional area to determine the air volume flow rate. This computation is accomplished by a microprocessor in the Kurz Instruments flow monitoring panels for the two Shield Building vents.

Shield Building vent noble gas detector total gas response has been determined by TVA calculations based on isotope relative abundance and in accordance with the detector energy dependent response curves provided by the vendor. This total gas response is available to Operations for determination of total release based on monitor response, total gas calibration factor for accident type and time following an accident and mass flow from the stack. TVA calculations are based on two spectra, post-accident. The first (low range) occurs following an accident with no significant fuel damage and is based on ANSI/ANS-18.1-1984, (formerly ANSI N237-1976) "Source Term Specification." The second (mid and high range) occurs with significant fuel damage and is based on RG 1.4, "Assumptions Used for Evaluating the Potential Radiological Consequences of a Loss of Coolant Accident for Pressurized Water Reactors," and on a TVA calculation.

II. Noble Gas Release Rates Through Condenser Vacuum Pump Exhausts

For the condenser vacuum pump exhausts, noble gas release rates are the products of air volume flow rates through the vents, radiation monitor response, and the radiation monitor total gas calibration factor for the given plant condition and time following an accident.

The air volume flow rates are determined based on differential pressure measurement of the flow through the exhaust vents.

Condenser vacuum pump exhaust vent noble gas detector total gas response is determined in a TVA calculation based on isotope relative abundance, and in accordance with the detector energy dependent response curves provided by the vendor. This total gas response is available to

ENCLOSURE 2

WATTS BAR NUCLEAR PLANT (WBN) UNITS 1 AND 2
PROCESS FOR CONVERTING RADIATION MONITOR READINGS
TO NOBLE GAS RELEASE RATES DURING ACCIDENT CONDITIONS

Operations for determination of total release based on monitor response, total gas calibration factor for the type of accident and time segment following the accident and mass flow from the exhaust vent. TVA calculations are based on two spectra, post-accident. The first (low range) occurs following an accident with no significant fuel damage and is based on ANSI/ANS-18.1-1984, "Source Term Specification." The second (mid and high range) occurs with significant fuel damage and is based on Technical Information Document (TID) 14844 methodology.

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

For the steam generator atmospheric relief valves, radioactivity release rates are the products of calculated steam mass flow rates through the relief valves, detector response and total isotopic calibration factor for the detector for the given plant condition and time following the accident.

Steam mass flow rates through the relief valves are calculated by a data logger based on relief valve position measured by acoustic monitors on the valves and main steam flow rates measured by differential pressure loops in the main steam piping. This information is provided to the Technical Support Center computer.

Main steam line monitor calibration factors equal to the ratio of the steam specific activity to the exposure rate reading of each detector were determined by an analysis. The calibration factors were determined based on isotope relative abundance at various time segments following an accident, the shielding geometry between the steam line contents and the detector and the relative response of the tube. TVA post-accident calculations are based on maximum allowable Technical Specification reactor coolant activities, with a preexisting iodine spike factor of ten. These calibration factors are available to Operations for determination of total release based on monitor response, calibration factor for the time segment following accident, and mass flow from the relief valves.

ENCLOSURE 3
NUREG-0737, ITEM II.F.1.1
LIST OF NEW COMMITMENTS

1) The condenser vacuum pump exhaust monitors for Unit 1 will be operational by Unit 1 fuel load.

2) The condenser vacuumm pump exhaust monitors for Unit 2 will be operational by Unit 2 fuel load.

3) The Unit 2 main steam line safety valve monitors will be operational by Unit 2 fuel load.

4) The Unit 2 EGTS and the containment purge flow elements will be installed and operational by Unit 2 fuel load.