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

March 23, 1984

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	)	Docket Nos. 50-327
Tennessee Valley Authority	)	50-328

By my November 23, 1983 letter to you, we requested NRC approval of a proposed license amendment concerning postaccident sampling for the Sequoyah Nuclear Plant, units 1 and 2. Additional submittals were made by my December 21, 1983, January 9 and January 10, 1984 letters to you. As a result of the meeting at Sequoyah on February 28, 1984 with Jay Lee of the NRC, enclosure 1 provides revised responses to the November 23, 1983 and the January 9, 1984 letters. Also included is additional information to resolve NRC concerns expressed in the February 28, 1984 meeting. The revised and additional information being provided by this letter was discussed with Jay Lee in a telephone conversation on March 16, 1984.

Enclosure 3 provides a list of drawings associated with the postaccident sampling modifications.

If you have any questions concerning this matter, please get in touch with Jerry Wills at FTS 858-2683.

Very truly yours,

TENNESSEE VALLEY AUTHORITY

L M Mills

L. M. Mills, Manager
Nuclear Licensing

Sworn to and subscribed before me
this 23rd day of March 1984

Paulette H. White

Notary Public
My Commission Expires 9-5-84

Enclosure
cc: U.S. Nuclear Regulatory Commission (Enclosure)
Region II
Attn: Mr. James P. O'Reilly Administrator
101 Marietta Street, NW, Suite 2900
Atlanta, Georgia 30303

A046
1/1

ENCLOSURE 1

POSTACCIDENT SAMPLING, ITEM II.B.3
OF NUREG-0737

REVISED RESPONSES TO LETTERS DATED
NOVEMBER 23, 1983 AND JANUARY 9, 1984
TO ADDRESS NRC CONCERNS IDENTIFIED
IN A FEBRUARY 28, 1984 MEETING

Criterion 1

The licensee shall have the capability to promptly obtain reactor coolant samples and containment atmosphere samples. The combined time allotted for sampling and analysis should be 3 hours or less from the time a decision is made to take a sample.

Response

Each unit has a separate postaccident sampling facility (PASF) that is located in the auxiliary building on elevation 706 between columns A5, W, and X (for unit 1) and A11, W, and X (for unit 2). The PASF contains all the necessary equipment for sample acquisition and portions of the required chemical analysis (except the containment hydrogen, boron, and isotopic analyses). The existing containment hydrogen analyzers will be used to determine the hydrogen content inside containment. Boron and isotopic analyses will be performed in the existing plant radiochemical laboratory located in the auxiliary building on elevation 690 between columns A1, S, and U.

Sample acquisition and portions of the chemical analysis are performed by the Sentry Equipment Corporation (SEC) "Model A" High Radiation Sampling System (HRSS). This system is composed of the liquid sample panel (LSP), chemical analysis panel (CAP), containment air sample panel (CASP), and their associated control panels. During accident conditions, the following samples can be obtained from the LSP:

(a) Undiluted and diluted (1000:1) liquid grab samples from the reactor coolant.

(b) An inline sample of reactor coolant which is depressurized and degassed in place. The stripped gas and depressurized coolant is then sent to the CAP.

(c) Diluted (15000:1) stripped gas grab samples from the reactor coolant pressurized liquid samples.

The LSP, CASP, and CAP have the capability to purge lines before sampling to assure representative samples can be obtained. Sample lines from the LSP, CASP, and CAP can be flushed after the sampling operations are complete to reduce residual radioactivity in the lines.

The LSP uses shielded cart/casks for the removal of the reactor coolant. The cask is mounted on a cart, which allows the samples obtained to be mobile. A shielded syringe is used to acquire a 5 ml aliquot of diluted (1000:1) reactor coolant from the cart/cask. This aliquot will then be handcarried to the radiochemical laboratory for offline boron and isotopic analysis. In the laboratory this 5 ml aliquot will be placed in a beaker shielded by 2-inch-thick lead bricks in a fume hood.

Also, a 15000:1 diluted stripped gas sample, from the reactor coolant, will be acquired and transported to the laboratory in a shielded carrier for isotopic analysis. Further dilutions, if necessary, will be made using gas syringes in a shielded fume hood.

Samples from the CASP can be collected in shielded cart/casks which are similar to those described for the LSP. TVA will use the containment atmosphere separations device provided by Radiological and Chemical Technology (RCT) for obtaining an aliquot of the sample. The RCT device separates the containment air sample into particulates, iodine, and noble gases. Particulates and iodine are removed by a filter and the nobles gases are then obtained in a sample vial. This system provides samples that can be handcarried to the radiochemical laboratory for isotopic analysis. Also, samples as small as .10 ml can be partitioned.

SEC provided the following sample acquisition and analysis times:

a. Reactor coolant (RC) diluted sample

b. RC inline chemical analysis (Ph, conductivity, dissolved, oxygen, and chloride)

c. RC offgas and dissolved H_2

d. Containment atmosphere sample

The offline boron analysis is expected to require approximately 10 minutes.

It is our intent to meet the three-hour sampling and analysis times.

Criterion 2

The licensee shall establish an onsite radiological and chemical analysis capability to provide, within the three-hour timeframe established above, quantification of the following:

(a) certain radionuclides in the reactor coolant and containment atmosphere that may be indicators of the degree of core damage (e.g., noble gases, iodines and cesiums, and nonvolatile isotopes);

(b) hydrogen levels in the containment atmosphere;

(c) dissolved gases (e.g., H_2), chloride (time allotted for analysis subject to discussion below), and boron concentration of liquids.

(d) alternatively, have inline monitoring capabilities to perform all or part of the above analysis.

Response

2(a) The plant radiochemical laboratory is equipped with multiple high resolution germanium detectors and an ND6620 computerized gamma ray spectroscopy system. This equipment will be used to quantify the noble gases, iodines and cesiums, and nonvolatile radionuclides in the required samples.

2(b) The Comsip Delphi, Model EIIIM, containment hydrogen analyzer, used to fulfill the requirements of NUREG-0737, item II.F.1, attachment 6, will determine the hydrogen levels in the containment atmosphere. The analyzer has a range of 0-10% and an accuracy of ± 1%.

2(c) Most of the chemical analyses, on the reactor coolant, will be performed by the SEC CAP. Its capabilities are as stated below:

Analysis	Range	Accuracy
Chloride Concentration	100-1000 ppb 1-20 ppm	± 15% ± 20%
Dissolved Hydrogen	10-2000 cc/kg	± 15%
Dissolved Oxygen	0-20 ppb 0-200 ppb 0-20 ppm	± 10%
pH Determination	pH 1-13	± 0.5%

Isotopic analysis will be performed in the range of 1 μCi/g--10 Ci/g and has a sensitivity better than 1 μCi/g.

The boron analysis will be performed by a Dionex ion chromatograph using 2 ml of the 1000:1 diluted sample. This analysis has a range of .5 ppm to 20 ppm and has an uncertainty less than 6 percent (2 sigma percent error).

The 1000:1 diluted reactor coolant will be diluted further, as required, to perform the isotopic analysis if the original activity exceeds 10 Ci/g.

It is TVA's intent to do all the above analysis within the three-hour time limit, with the exception of the chloride analysis. The chloride analysis will be done within four days.

2(d) See the response to 2(c). The SEC CAP uses the following inline instrumentation (or equivalent):

a. Baseline Gas Chromatograph - Model 1030A
b. Beckman pH Monitor - Model 960B

c. Dionex Ion Chromatograph - Model 10
d. Rexnord Dissolved Oxygen Analyzer - Model 3400-5
e. YSI Dissolved Oxygen Analyzer - Model 56

Criterion 3

Reactor coolant and containment atmosphere sampling during postaccident conditions shall not require an isolated auxiliary system (e.g., the letdown system, reactor water cleanup system (RWCUS)) to be placed in operation in order to use the sampling system.

Response

Reactor coolant and containment atmosphere sampling during accident conditions do not require the use of isolated auxiliary system. The samples are acquired from the following locations:

Sample	Location
1. Reactor Coolant (2 locations)	Hot leg loops 1 and 3
2. Containment Sump (2 locations)	Discharge of residual heat removal system (RHR) pumps (TRAIN 'A' and 'B')
3. Containment Atmosphere	Upper and lower containment

However, sampling operations will require opening select containment isolation valves. These remotely operated valves meet IEEE Class 1E requirements.

Criterion 4

Pressurized reactor coolant samples are not required if the licensee can quantify the amount of dissolved gases with unpressurized reactor coolant samples. The measurement of either total dissolved gases or H_2 gas in reactor coolant samples is considered adequate. Measuring the O_2 concentration is recommended, but is not mandatory.

Response

The SEC LSP has the capability to obtain pressurized liquid samples. The normal sampling sequence is to depressurize and degas a liquid sample. The depressurized coolant and stripped gas are then routed to the SEC CAP for dissolved hydrogen and oxygen analysis.

Criterion 5

The time for a chloride analysis to be performed is dependent upon two factors: (a) if the plant's coolant water is seawater or brackish water and (b) if there is only a single barrier between primary containment systems and the cooling water. Under both of the above conditions the

licensee shall provide for a chloride analysis within 24 hours of the sample being taken. For all other cases, the licensee shall provide for the analysis to be completed within 4 days. The chloride analysis does not have to be done onsite.

Response

Factors (a) and (b) described in Criterion 5 do not apply to Sequoyah; therefore, the analysis will be performed within four days. The analysis will be done by the CAP on undiluted samples. For the equipment range and accuracy, see the response to Criterion 2(c).

Criterion 6

The design basis for plant equipment for reactor coolant and containment atmosphere sampling and analysis must assume that it is possible to obtain and analyze a sample without radiation exposures to any individual exceeding the critera of GDC 19 (Appendix A, 10 CFR Part 50) (i.e., 5 rem whole body, 75 rem extremities). (Note that the design operational review criterion was changed from the operational limits of 10 CFR Part 20 (NUREG-0578) to the GDC 19 criterion (October 30, 1979, letter from H. R. Denton to all licensees.)

Response

The design basis for plant equipment for reactor coolant and containment atmosphere sampling and analysis are consistent with the radiation exposure limits of GDC 19 (Appendix A 10 CFR Part 50).

Criterion 7

The analysis of primary coolant samples for boron is required for PWRs. (Note that Revision 2 of Regulatory Guide 1.97, when issued, will likely specify the need for primary coolant boron analysis capability at BWR plants.)

Response

Sequoyah Nuclear Plant is a PWR; therefore, boron analysis will be performed. The range and the method to perform this analysis is discussed in the response to item 2(c).

Criterion 8

If inline monitoring is used for any sampling and analytical capability specified herein, the licensee shall provide backup sampling through grab samples, and shall demonstrate the capability of analyzing the samples. Established planning for analysis at offsite facilities is acceptable. Equipment provided for backup sampling shall be capable of providing at least one sample per day for 7 days following onset of the accident and at

least one sample per week until the accident condition no longer exists.

Response

The SEC panels provide inline analysis as well as backup grab samples. See the response to Criterion 1 for a discussion of the SEC equipment and its capabilities.

The capability to obtain additional samples through grab sampling exists with the SEC equipment. Portions of the inline analysis will be backed by the shipment of the reactor coolant to an offsite laboratory for analysis. Arrangements have been made for a DOT-approved shipping cask and we will have a contract with an offsite laboratory to perform the analysis. The analyses to be performed will include pH, chloride, boron, and gamma-ray spectroscopy.

Criterion 9

The licensee's radiological and chemical sample analysis capability shall include provisions to:

(a) Identify and quantify the isotopes of the nuclide categories discussed above to levels corresponding to the source terms given in Regulatory Guide 1.3 or 1.4 and 1.7. Where necessary and practicable, the ability to dilute samples to provide capability for measurement and reduction of personnel exposure should be provided. Sensitivity of onsite liquid sample analysis capability should be such as to permit measurement of nuclide concentration in the range from approximately 1 Ci/g to 10 Ci/g.

(b) Restrict background levels of radiation in the radiological and chemical analysis facility from sources such that the sample analysis will provide results with an acceptably small error (approximately a factor of 2). This can be accomplished through the use of sufficient shielding around samples and outside sources, and by the use of ventilation system design which will control the presence of airborne radioactivity.

Response

9(a) The isotopic analysis will be performed in the range of 1 μCi/g to 10 Ci/g. This analysis has a sensitivity better than 1 μCi/g. Also, see the responses to Criterion 1 and 2.

9(b) The isotopic measurement will be performed in a 4-inch lead shield or equivalent to reduce the background and produce results with a range of accuracy within a factor of 2.

Also, the postaccident radiation levels are not expected to have any measurable effect on the accuracy of measurement components, of the

CAP and the Dionex ion chromatograph, which will be exposed to radiation. The radiation levels are expected to have a negligible effect on the operating lifetime of those components. These conclusions are based upon information provided by the equipment supplier, limited testing results, literature reviews, and contacts with experienced personnel engaged in similar analyses under high radiation levels.

Criterion 10

Accuracy, range, and sensitivity shall be adequate to provide pertinent data to the operator in order to describe radiological and chemical status of the reactor coolant systems.

Response

See the response to Criterion 2.

Criterion 11

In the design of the postaccident sampling and analysis capability, consideration should be given to the following items:

(a) Provisions for purging sample lines, for reducing plateout in sample lines, for minimizing sample loss or distortion, for preventing blockage of sample lines by loose material in the RCS or containment, for appropriate disposal of the samples, and for flow restrictions to limit reactor coolant loss from a rupture of the sample line. The postaccident reactor coolant and containment atmosphere samples should be representative of the reactor coolant in the core area and the containment atmosphere following a transient or accident. The sample lines should be as short as possible to minimize the volume of fluid to be taken from containment. The residues of sample collection should be returned to containment or to a closed system.

(b) The ventilation exhaust from the sampling station should be filtered with charcoal absorbers and high-efficiency particulate air (HEPA) filters.

Response

11.A.1 Provisions for purging sample lines.

The LSP has the capability of regulating a pre- and post-sample purge of 1900 milliliters per minute.

The flow on the CASP sample can be varied by adjusting the nitrogen flowrate on an eductor. The eductor draws the containment air sample from the disabled unit to the sampling panel.

11.A.2 Provisions for reducing plateout in sample lines.

To reduce plateout in liquid sampling lines, the purge flow shall be turbulent (Reynolds number > 4000).

To reduce plateout in the containment atmosphere sampling lines, the lines are heat traced to maintain a surface temperature of 280°F and are thermally insulated. This heat trace shall maintain the sample stream temperature en route to the PASF, thus reducing iodine plateout and steam condensation, thereby retaining the sample integrity.

11.A.3 Provisions for minimizing sample loss or distortion.

To minimize sample losses, a tight system must be maintained. The sampling lines will be pressure tested after being installed. All valves, whether hand, check, or solenoid, and line welds were chosen for their abilities to minimize fluid leakage. To minimize sample distortion the samples should arrive at the PASF with basically the same characteristics as the systems being sampled. See our response 11.A.2.

Following each sample acquisition process, the liquid lines are backflushed with demineralized water, and the atmosphere sampling lines are backflushed with nitrogen. These flushing operations clean out the previous sample fluids and reduce residual radioactivity in the lines; thereby aiding in the prevention of sample distortion.

11.A.4 Provision for preventing blockage of sample lines by loose material in the RCS or Containment.

No strainers or filters are used to prevent line blockage of RCS or containment atmosphere samples. These devices would conflict with one of the goals of the sampling system which is to obtain representative samples.

Loose material and some plateout, if they exist, will be swept out by the flushing fluids which empty into the disabled reactor unit. Also, pipe scale or crud should be minimized due to the use of stainless steel as the piping and tubing material.

The samples are taken at right angles from the sampled sources and constitute a relatively small volume of the systems being sampled. Therefore, it is our belief that only fine entrained particles will be present in the samples.

11.A.5 Provisions for appropriate disposal of the samples.

All samples will be returned back to the disabled unit or to a

closed system.

The sampling system has in its design a 250 gallon waste tank. Samples from the PASF will be routed to this tank. From this tank they can be routed to the disabled reactor unit during accident conditions. During training exercises, the contents of the waste tank are routed to the radwaste system.

11.A.6 Flow restrictions to limit reactor coolant loss from rupture of the sample line.

Redundant IEEE Class 1E solenoid operated isolation valves which trip by operator action are used for this function.

11.A.7 The postaccident reactor coolant and containment atmosphere samples should be representative of the reactor coolant in the core area and the containment atmosphere following a transient or accident.

Those samples are acquired from the locations described in the response to criterion 3. These sample locations are expected to provide representative samples of the reactor coolant and containment atmosphere.

Criterion

11.B The ventilation exhaust from the sampling station should be filtered with charcoal adsorbers and high-efficiency particulate air (HEPA) filters.

Response

During normal plant operation, ventilation air is supplied to the PASF via the auxiliary building general ventilation system and an auxiliary supply fan. Exhaust air is ducted directly to the Auxiliary Building general ventilation system.

During postaccident conditions or sampling operations, the normal supply and exhaust systems are isolated, and ventilation air is taken directly from the outside at a point on the roof of the unit 1 additional equipment building. Both the unit 1 and unit 2 systems share this common intake. A supply fan provides air to the sampling side of the facility in response to a differential pressure controller. Air is drawn from both the sample and valve gallery areas by an exhaust fan. This air then passes through the postaccident sampling facility gas treatment system (PASF GTS) air cleanup unit and is then routed to the exhaust duct downstream of the Auxiliary Building gas treatment system (ABGTS) air cleanup unit. The air cleanup unit consists of a prefilter, electric heating coil, charcoal filter, and HEPA filters upstream and downstream of the charcoal filter beds. Design, testing, and maintenance of the unit complies with the requirements of Regulatory Guide 1.140 (Design, Testing, and Maintenance Criteria for

Normal Ventilation Exhaust System Air Filtration and Adsorption Units of Light-Water-Cooled Nuclear Power Plants). The sampling area is maintained at a positive pressure of 0.125 inch water gauge (WG) with respect to atmosphere while the valve gallery is kept at a negative pressure of -0.25 inch WG with respect to the sample side.

The radiological gas treatment subsystem, of the PASF GTS, consists of one HEPA/Charcoal-type air cleanup unit located just upstream of the exhaust fan. Air supplied to the facility during postaccident conditions or sampling operations is processed through the air cleanup unit before being discharged to the atmosphere.

The postaccident sampling facility environmental control system is not a nuclear safety-related system. However, it has redundant isolation capability in all ductwork that interfaces with the ABGTS or penetrates the auxiliary building secondary containment enclosure (ABSCE). The isolation valves and ductwork which interface with the ABGTS and ABSCE are designed to seismic category 1 criteria. Also, the isolation valves are backed by Class 1E power. All remaining portions of the system are designed to seismic category I(L) criteria requirements.

ENCLOSURE 2

Additional Information on Postaccident
Sampling to Address NRC Concerns

NRC Concern

Please identify the operational procedures planned for utilizing the ventilation system and the sampling system.

TVA Response

The following procedures will be revised to incorporate all the necessary instructions for operation of the postaccident sampling system:

1. System Operating Instructions (SOI-30, -70) used for system configuration controls (valve alignment, etc.);

2. Emergency Operating Instruction (EOI) which specifies when system is required;

3. Technical Instruction (TI-66.1) which gives operating instructions in use of equipment.

All procedure changes will be implemented before unit 1 criticality.

NRC Concern

Please provide a commitment to verify the design flow for the ventilation system during the postmodification tests.

TVA Response

Verification of the system design flow for the PASF ventilation system is a test requirement specified in the EN DES issued scoping document for Postmodification Test PMT-14. Change sheet number 1 to the scoping document adds the requirement of design flow verification during ABGTS operation. These requirements are incorporated in the test procedure for PMT-14.

NRC Concern

Provide an explanation of the power source for equipment and how they are affected by loss-of-offsite power.

TVA Response

All equipment in the PASF which is required to be operational during postaccident operations will have power supplied by two independent offsite

power supplies through the vital bus. Table 3 of NRC Regulatory Guide 1.97 shows accident sampling instrumentation to be classified as Category 3. Table 1 of Regulatory Guide 1.97 states that Category 3 equipment has specific power requirements. However, in the very remote possibility of a severe accident and loss of offsite power, a portable generator could be utilized to power the PASF cleanup fans which is the only equipment not powered by the vital bus.

NRC Concern

Please address the availability of a procedure for assessment of core damage.

TVA Response

A procedure currently exists for determining core damage. TVA in conjunction with the WOG has developed a more comprehensive assessment methodology.

A copy of the WOG core damage assessment methodology has been previously transmitted to NRC by a letter dated February 29, 1984 from J. J. Sheppard, Chairman of the WOG, to J. A. Norris, Project Manager of Operating Reactors Branch 1. This methodology will be available for use by TVA.

ENCLOSURE 3

DRAWINGS ASSOCIATED WITH THE POSTACCIDENT SAMPLING MODIFICATIONS

47W610-43-9	R1
47W610-43-10	R1
47W611-43-1	R1
47W625-14	R5
47W625-15	R4
47W625-16	R1
47W625-17	R4
47W920-40	R4
47W920-41	R3
47W920-42	R3