TENNESSEE VALLEY AUTHORITY

CHATTANOOGA, TENNESSEE 37401
400 Chestnut Street Tower II

September 20, 1983

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 | ) | 50-391 |

Please refer to my letters to you dated September 14 and October 29, 1981, which provided TVA's initial and revised responses to NUREG-0737, Item II.B.3. Enclosed is TVA's final response to this item. As indicated in response to item 2a, details of the interim methodology for estimating core damage will be provided by December 2, 1983 for NRC approval.

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

Very truly yours,

TENNESSEE VALLEY AUTHORITY

L. M. Mills

L. M. Mills, Manager
Nuclear Licensing

Sworn to and subscribed before me
this 20th day of September 1983
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, Regional Administrator
101 Marietta Street, NW, Suite 2900
Atlanta, Georgia 30303

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ITEM 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 three hours or less from the time a decision is made to take a sample.

RESPONSE

Each unit has a postaccident sampling facility (PASF) that is located on elevation 729 between columns A5, W, and X (for unit 1) and A11, W, and X (for unit 2). Each PASF contains all equipment for sample acquisition and those portions of the chemical analysis which are performed inline (except for containment air $H_2$ analysis). For additional information, refer to the responses to items 2(b) and 2(d). The radiochemical laboratory located on elevation 713 between columns A1, S, and U will be used for required boron and isotopic analysis. The time to travel from the PASF to the radiochemical laboratory had been estimated to require 4.0 minutes.

Sample acquisition and portions of the chemical analysis is 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 for 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 Radiological and Chemical Technology (RCT) containment atmosphere separations device 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 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 0.10 ml can be partitioned.

SEC provided the following sample acquisition and analysis times:

| | | |
|---|---|---|
| a. | Reactor coolant (RC) diluted sample | 30 minutes |
| b. | RC inline chemical analysis (Ph, conductivity, dissolved oxygen, and chloride) | 45 minutes |
| c. | RC offgas and dissolved $H_2$ | 35 minutes |
| d. | Containment atmosphere sample | 15 minutes |

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

The sampling and analyses will be performed within three hours as required.

ITEM 2

The licensee shall establish an onsite radiological and chemical analysis capability to provide, within the three-hour time frame 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) We are presently preparing an interim method for estimating core damage. Details of this interim methodology will be submitted by December 2, 1983 for NRC approval. Also, the Westinghouse Owners Group (WOG) has recently decided to commission the preparation of a final generic methodology for estimation of core damage. As a member of the WOG, we expect to use this final methodology after its development.

2(b) The Comsip Delphi, Model KIIIM, containment hydrogen analyzer, used to fulfill the requirements of NUREG-0737, item II.F.1, Attachment 6, "Containment Hydrogen Monitor" will determine the hydrogen levels in the containment atmosphere.

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<br>1-20 ppm | ± 15%<br>± 20% |
| Dissolved Hydrogen | 10-2000 cc/kg | ± 15% |
| Dissolved Oxygen | 0-20 ppb<br>0-200 ppb<br>0-20 ppm | ± 10% |
| Dissolved Oxygen | 0.1-5 ppm<br>1-10 ppm<br>1-20 ppm | ± 10% |
| pH Determination | pH 1-13 | ± 0.5% |

The range of the Comsip-Delphi hydrogen analyzer is 0-10%.

Isotopic analysis will be performed in range of 1 $\mu$Ci/g--10 Ci/g and has a sensitivity better than 1 $\mu$Ci/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 0.5 ppm to 20 ppm and has an uncertainty of 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.

All the above analysis will be performed 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 item 2(c). The SEC CAP uses the following inline instrumentation:

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

As indicated in response to item 2(c), the boron analysis will be performed by a Dionex ion chromatograph.

ITEM 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 an isolated auxiliary system. Sampling operations will require overriding containment isolation signals on select valves. These remotely operated valves meet IEEE Class 1E requirements.

ITEM 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 LSP has the capability to obtain pressurized liquid samples which are then depressurized and degassed. The depressurized coolant and stripped gas are then routed to the CAP for dissolved hydrogen and oxygen analysis.

ITEM 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 four days. The chloride analysis does not have to be done onsite.

RESPONSE

See the response to Item 2.

ITEM 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 $\geq$ 4000).

To reduce plateout in the containment atmosphere sampling lines, the lines are heat traced to maintain a surface temperature of 280$^{\circ}$ 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, reduce residual radioactivity in the lines, thereby aiding in the prevention of sample distortion.

11.A.4 Provisions 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 Provisions for flow restrictions to limit reactor coolant loss from rupture of the sample line:

The sample line at the hotleg is 0.245" inside diameter which limits reactor coolant losses from the rupture of the sample line to acceptable levels. (For comparison, TVA class B piping connected to the reactor coolant system uses 0.375" flow restrictors to limit reactor coolant losses to acceptable levels). If the rupture is outside containment, reactor coolant loss can be stopped by closure of the containment isolation valves.

Redundant IEEE Class 1E solenoid operated isolation valves, which remain closed except when a sample is being taken, can be closed by operator action from either the main control room or the postaccident sampling facility.

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

11.B The exhaust air from the postaccident sampling facility is routed through an air cleanup unit during sampling operations. The air cleanup unit consists of a prefilter, electric heating coil, charcoal filter, and HEPA filter.