TENNESSEE VALLEY AUTHORITY

CHATTANOOGA, TENNESSEE 37401
400 Chestnut Street Tower II

November 23, 1982

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

The Safety Evaluation Report (SER) for Watts Bar Nuclear Plant specified that TVA must submit the results of an insulation survey to resolve SER confirmatory item 20. Enclosed are revised responses to NRC questions Q212.116 and Q212.133 which provide the requested information. These responses will be provided in Amendment 48 of the Final Safety Analysis Report.

If you have any questions concerning this matter, please get in touch with D. P. Ormsby at FTS 858-2682.

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 Nov 1982

Bryant M. Lowery
Notary Public
My Commission Expires 4/8/86

Enclosure
cc: U.S. Nuclear Regulatory Commission (Enclosure)
Region II
Attn: Mr. James P. O'Reilly Administrator
101 Marietta Street, Suite 3100
Atlanta, Georgia 30303

B001

212.116 (6.3) <u>Question:</u>

With regard to the potential for debris impairing containment sump/ECCS performance, four considerations should be addressed;

1) containment design and potential sources of sump debris (e.g., insulation, etc.),

2) Maintenance of containment 'as licensed' cleanliness (free of loose debris),

3) instrumentation and alarms to alert the operator to a degradation in post-LOCA ECCS performance,

4) procedures to be taken in the event of post-LOCA ECCS performance degradation.

For item 1, a detailed survey of insulation and other potential debris sources is required; however, this item may be resolved by providing a general summary of the insulation used at Watts Bar, an assessment by the applicant of its potential to produce post-LOCA debris, and a commitment to provide a detailed survey prior to startup following the first refueling outage.

The following questions are provided as guidance into the nature and detail of the type of response expected to resolve the above concerns.

For item that have been previously resolved, you may respond by referring to the previous documentation. Items 1, 2, and 3 must be resolved prior to full power operation; item 4 must be resolved prior to startup following the first refueling.

1. In addition to insulation debris resulting from LOCA effects, debris can be generated within the containment from other sources, such as (1) degraded materials (paint chips), and (2) items which are taken into and left in the containment following maintenance and inspection activities.

   Describe how the housekeeping program for Watts Bar will control and limit debris accumulation from these sources. The objective is to assure that debris capable of defeating the post-LOCA core cooling functions are identified and removed from the containment. The response should include references to specific procedures or other means to assure that 'as licensed' cleanliness will be attained prior to initial operation and prior to each resumption of operation.

2. Address the degree of compliance of Watts Bar with the following recommendation which is also set forth as item C.14 of Regulatory Guide 1.82:

'Inservice inspection requirements for coolant pump components (trash racks, screens, and pump suction inlets) should include the following:

a. Coolant sump components should be inspected during every refueling period downtime, and

b. The inspection should be a visual examination of the components for evidence of structural distress or corrosion.'

3. The resolution of the concerns noted below plus the provisions of adequate NPSH under non-debris conditions, and adequate housekeeping practices are expected to reduce the likelihood of problems during recirculation. However, in the event that LPI recirculation system problems such as pump cavitation or air entrainment to occur, the operator should have the capability to recognize and contend with the problems.

Both cavitation and air entrainment could be expected to cause pump vibration and oscillations in system flow rate and pressure. Show that the operator will be provided with sufficient instrumentation and appropriate indications to allow and enable detection of these problems. List the instrumentation available giving both the location of the sensor and the readout.

The incidence of cavitation, air entrainment or vortex formation could be reduced by reducting the system flow rate. The operator should have the capability to perform indicated actions (e.g., throttling or terminating flow, resort to alternate cooling system, etc). Show that the emergency operating instructions and the operator training consider the need to monitor the long-term performance of the recirculation system and consider the need for corrective actions to alleviate problems.

4. With regard to the sump tests on Watts Bar, the responses to the following concerns pertaining to potential sump screen blockage are required:

a. Various types of insulation may be used in the containment. For each type provide the following information:

(1) The manufacturer, brand name, volume and area covered.

(2) A brief description of the material and an estimate of the tendency of this material either to form particles small enough to pass through the fine screen in the sump or to block the sump trash racks or sump screens.

(3) Location of the material (metal mirrored, foam glass, foam rubber, foam concrete, fiberglass, etc.) with respect to whether a mechanism exists for the material to be transported to the sump.

b. Provide an estimate of the amount of debris that the sump inlet screens may be subjected to during a loss-of-coolant accident. Describe the origin of the debris and design features of the containment sump and equipment which would preclude the screens becoming blocked or the sump plugged by debris. Your discussion should include consideration of at least the following sources of possible debris: equipment insulation, sand plug materials, reactor cavity annulus sand tanks or sand bags for biological shielding, containment loose insulation, and debris which could be generated by failure of non-safety related equipment within the containment. Entry of sand plug materials into the containment sump and the possibility of sand covering the recirculation line inlets prior to the initiation of recirculation flow from the containment should be specifically addressed.

Please provide this information along with your conclusion regarding the percentage of the screens which would be expected to be blocked by particles of all sizes, including those greater than 250 mils.

c. With respect to the conclusion that debris with a specific gravity greater than unity will settle before reaching the sump cover, consider the potential for flow paths which may direct significant quantities of debris laden coolant into the lower containment in the vicinity of the sump and the availability or lack of sufficient horizontal surface areas or obstructions to promote settlings or holdup of debris prior to reaching the sump.

d. Does metal mirror insulation house other materials, fibrous or otherwise, which could become debris is the insulation were blown off as a result of a LOCA?

e. If the Watts Bar containment contains loose insulation, include examples of how the insulation will be precluded from reaching the sump.

5. Provide a schematic drawing of the post-LOCA water level in containment during the recirculation mode relative to the elevation of the ECCS sump floor. Include on this drawing the location of the containment water level sensor and the elevations corresponds to readings of zero and 100 percent of range on the control room indicator.

6. Provide several large scale drawings of the containment structures, systems and components at elevations.

7. Does the Watts Bar utilize or similar materials in the containment during power operation for purposes such as reactor cavity annulus biological shielding (e.g., sand tanks or sand bags) or reactor cavity blow out sand plugs?

Response

It is TVA's understanding that resolution of Generic Task A-43 'Containment Emergency Sump Reliability' is being evaluated by Burns and Roe as consultants.

TVA's interim position on task A-43 was submitted to NRC by letter dated September 11, 1981 from L. M. Mills to E. Adensam.

To support resolution of this issue the above requested information was provided to Mr. R. Reyer of Burns and Roe by letters dated October 20, 1980 and December 23, 1980.

A visual inspection is performed before establishing containment integrity, whenever containment is entered 46 after containment integrity has been established, and at least once every 18 months. This inspection is performed through the use of the appropriate surveillance instructions for the containment area and for the RHR sump area. 46

The RCS is monitored at all times during an accident for indication of inadequate core cooling through plant emergency operatig instructions.

4a(1):

Manufacturer	Brand Name	Volume and Area Covered
Mirror Insulation Division Diamond Power Specialty Corporation	Mirror Insulation	Reactor vessel, steam generators, pressurizer, reactor coolant pumps and piping, RHR piping, SIS piping, main steam and feedwater piping
Pittsburgh Corning Corporation	Foamglass	Refrigerant lines and ducts to instrument room, 4-foot high band around containment vessel, 80 percent of ice condenser piping
Rubatex Corporation	Rubatex	20 percent of Ice Condenser piping 48
Owens/Corning Fiberglass	Fiberglass	Piping inside air handling units located in upper plenum area of ice condenser (approximately 1 foot of pipe per air handling unit. Also used for crane wall insulation, wall insulation, and sealing joints of wall panels of ice condenser
Christiansen Foam Corporation	Polyurethane Foam	Wall panel insulation between steel air cooling ducts and the concentric steel containment shell
E. R. Carpenter	Polyurethane Foam	Top deck insulation of ice condenser
(Furnished by Westinghouse)	Urethane Foam	Insulating inside ice condenser doors

Forty-Eight Insulators Incorporated	Mineral Wool	Main pipe penetrations of containment vessel

4a(2) & 4a(3):

Mirror Insulation is an all-metal reflective insulation constructed of austenetic stainless steel. The metallic reflective insulation is strong mechanically and composed of sections which are latched together when in place. The sections will not segment or breakup into small particles. The sections will sink to the bottom and will remain stationary. Insulation in the vicinity of the pipe break will be blown or stripped off. It is not considered that the sections would be torn apart due to their strong mechanical construction.

Foamglass Insulation is a rigid insulation composed of sealed glass cells. Each cell is an insulating air space. Foamglass is all-glass and is completely inorganic. The insulation on refrigerant lines, ducts, and piping is covered and banded by stainless steel jacketing to minimize or eliminate the conditions whereby the insulation could crumble. The insulation on the containment vessel is covered by a stainless steel sheath. This insulation is also located in areas least affected by postulated pipe breaks (i.e., in upper regions of the containment and outside the crane wall). In addition to it being completely encased as well as being located in areas protected from the effects of pipe breaks, this insulation will float and cannot enter the sump because of an 8.0-foot minimum water level which exists over the sump coverplate before recirculation begins. 48

Rubatex Insulation is a flexible closed cell rubber type insulation. This insulation is located on portions of the ice condenser system where it is least affected by postulated pipe breaks (i.e., upper plenum area of the ice condenser). This insulation is not expected to suffer damage from any primary system pipe break; however, it should be noted that the insulation will float and could not enter the sump because of an 8.0-foot minimum water level which exists over the sump coverplate before recirculation begins.

Fiberglass Insulation is a glass fiber preformed pipe insulation encased in a vapor barrier jacket for the air handling units. For the ice condenser crane wall insulation, end wall insulation, and for sealing the joints in the ice condenser wall, the glass fiber is in blanket form enclosed in polyethylene bags and covered by metal panels. The insulation in all cases is behind metal (i.e., inside housing of air handling unit or under metal wall panels) to protect and assure it does not have a pathway to the sump.

Polyurethane and Urethane Foam Insulation is closed cell urethane resin foam. The polyurethane foam between the air ducts and the containment vessel does not have a pathway to the sump. The polyurethane foam insulating the top deck of the ice condenser is a blanket between stainless steel sheaths. The assembly rests on floor grating and is hinged at the crane wall to form doors that open upon a LOCA. This assembly maintained its integrity when tested under blowdown conditions that exceeded the worst LOCA. The urethane foam insulating the ice condenser inlet doors is completely enclosed. Refer to FSAR figure 6.7-17 and 6.7-20. These doors have been tested rigorously.

Mineral Wool Insulation is a refactory fiber block insulation laminated and bonded by high temperature binders. The insulation is between the process piping and the penetration sleeve and would not be subject to direct sprays and water from pipe breaks. 48

4b:

Restraints will prevent pipe whip thereby limiting the amount of insulation that could be blown off to that around the pipe at the break location. The worst case would be a break located immediately under the point at which two sections of mirror insulation abut in the longitudinal direction of the pipe. No more than half of the abutted insulation section could be blown toward the sump.

The mirror insulation is cylindrical on the straight portions of the primary system piping. Over elbows, the outside surface is composed of flat sections in the shape of rectangles of the outside and inside bends of the elbow, and in the shape of trapezoids on the elbow sides. The largest single flat outside surface area of the insulation covering an elbow is 6.88 square feet. In cross section, a section end has a parting surface area of 1.79 square feet and the longest straight length has a parting surface area in the longitudinal direction of 2.0 square feet.

The sump is located beneath the refueling canal to provide protection from high energy piping failures.

Additionally, the area around the sump is enclosed on two sides by concrete walls and on two sides by walls consisting of structural steel and 1/4-inch mesh backed by 1 1/2-inch grating. Considering the curvature of the insulation over straight portions of the primary system piping, the angularity of the insulation over elbows, and the quantity of equipment and supports anchored to the containment floor that would prevent movement of settled insulation sections, the maximum possible screened area that could be blocked is very small. Any contact between an insulation section and the screen wall would most probably be along a line or at a point in the unlikely event that some of the mirror insulation were to fall against the screen wall. Since the insulation covering one elbow together with the insulation covering one straight length of piping is all that could be affected by a given break, there is only one outer flat surface of insulation available to contact the screen wall. The only other flat surfaces either are along longitudinal or transverse parting surfaces.

In the most conservative hypothetical case, the largest flat surfaces area of insulation covering an elbow together with the largest parting surface of the longest straight section could be assumed to be against the screen wall. The total area blocked by these two sections of mirror insulation would be 8.88 square feet of the sump screen area of 265.9 square feet. Therefore, this small blockage would have a negligible effect on sump operation. 48

4c:

There would be a minimum time of 15 minutes following a LOCA before suction would be taken from the sump. This time interval will assure that debris with a specific gravity greater than unity would settle and come to rest before recirculation would begin. It should be noted that the mirror insulation is designed to be cleansed easily by internal flushing; thus, it contains no closed cells which trap air and with a metal density more than eight times that of water will sink rapidly. In addition, the large amount of obstructions near and at the containment floor level, such as supporting structures for piping and other equipment, would impede the motion of any debris.

4d:

Mirror insulation is made entirely of stainless steel sheet material and does not contain any other materials.

4e:

Mirror Insulation will not segment or break up into small particles. The sections will sink to the bottom and remain stationary.

Foamglass and Rubatex are installed in a manner and/or in locations that will preclude damage from primary system pipe breaks; however, it should be noted that the insulation will float and could not enter the sump because of an 8.0-foot minimum water level which exists over the sump coverplate. This insulation is located outside the crane wall.

Fiberglass is located within the housing of the air handling units used to cool the ice condenser or is covered by metal panels or sheaths. This protection assures that the insulation will not enter the sump. 48

Polyurethane and Urethane is sandwiched between the steel cooling ducts and the containment vessel or is covered by metal panels or sheaths. This will assure the insulation will not enter the sump.

Mineral Wool is located between the sleeves and the process pipe for the penetrations. The spider construction of the penetration will prevent the insulation from being pushed from within the penetration. There should be no turbulence or direct sprays directed into the penetration cavities. The penetrations are located outside the crane wall. This should prevent any passageway of the insulation to the sump.

212.133 <u>Question</u>
(6.3)
(212.116)

The responses (FSAR Amendments 46 and 48 to RSB questions concerning sump debris (Q212.116) and the letters referenced do not provide all the information (per Q212.116) necessary to perform a plant specific analytical assessment (similar to that performed for Sequoyah) which would confirm the conclusions expressed in our SER (based on general containment similarities to the Sequoyah design already accepted, predominantly metal reflexive insulation design used at Watts Bar adequate housekeeping procedures, and adequate alarm and response procedures, Watts Bar sump debris design is acceptable). To confirm our acceptance of Watts Bar, provide the detailed insulation survey requested in Q212.116. We require that this information be provided prior to startup after the first refueling outage.

<u>Response</u>

See the revised response to Q212.116, parts 4a, 4b, 4c, 4d, and 4e. 48