TENNESSEE VALLEY AUTHORITY

CHATTANOOGA, TENNESSEE 37401

400 Chestnut Street Tower II

October 23, 1979

Director of Nuclear Reactor Regulation
Attention: Mr. L. S. Rubenstein, Acting Chief
Light Water Reactors Branch No. 4
Division of Project Management
U.S. Nuclear Regulatory Commission
Washington, DC 20555

Dear Mr. Rubenstein:

In the Matter of the Application of	)	Docket Nos. 50-327
Tennessee Valley Authority	)	50-328

Enclosed is information to document our telephone conversation of September 25, 1979, with a Reactor Systems Branch Reviewer, J. Graves, regarding the Reactor Coolant System (RCS) loop layout and the hydraulic resistances of the RCS loop and the reactor vessel upper head region in Diablo Canyon unit 1 and Sequoyah unit 1. We expect to submit additional information in regard to flow split to the pressurizer spray by October 29, 1979.

Very truly yours,

TENNESSEE VALLEY AUTHORITY

L. M. Mills, Manager
Nuclear Regulation and Safety

Enclosure

1216 307

B001
SE
1/1

7910260305

ENCLOSURE

CONFIRMATORY INFORMATION ON NATURAL CIRCULATION WITH RESPECT TO SEQUOYAH UNIT 1 AND DIABLO CANYON UNIT 1

With respect to the RCS loop piping and components, the general configuration is the same in both plants. The two elements controlling natural circulation capability, the elevation difference between the heat source and the heat sink and the hydraulic resistance in this path, were evaluated in detail.

The loop piping and Reactor Coolant Pump (RCP) were evaluated as a composite. Both plants have a model 93A pump; and the elevation head represented by the pump and the loop piping up to the steam generator nozzles is the same in both plants. The Diablo Canyon pump, unlike the Sequoyah pump, does have a weir, which is also included in the loop piping for calculational purposes. This explains why the piping resistance for Diablo Canyon is higher by 6×10^{-10} ft/(gpm/loop)^2. Model 51 steam generators are used in both Sequoyah and Diablo Canyon. Details of the specific units were compared to ascertain any variation (e.g. primary volume, tube height, tube diameter) that could affect natural circulation capability by changing the effective elevation of the heat sink or the hydraulic resistance seen by the primary coolant. It was concluded that there are no differences in the design of the steam generators in the two plants that would affect the natural circulation characteristics. (Sequoyah does have field installed nozzle closure rings. While having a very small effect on primary side volume, they do not have any measurable effect on flow.) The higher resistance indicated for the Sequoyah steam generator is the result of a higher loop flow rate. The best estimate flow rate in Sequoyah is approximately 2 percent higher than in Diablo Canyon. The associated increase in frictional pressure loss is reflected as a variation in hydraulic resistance of $.8 \times 10^{-10}$ ft/(gpm/loop)^2.

With respect to the core and lower reactor internals the plants are the same. The upper reactor internals for the plants are different. The Sequoyah plant incorporated the Upper Head Injection system (UHI). Diablo Canyon does not have UHI. In order to ensure that the Sequoyah vessel upper head region fluid is maintained at the cold leg temperature, approximately 4 percent of the total vessel cold leg flow enters the upper head region. This is flow which bypasses the core and the reactor internals upstream of the core. Diablo Canyon, which does not maintain the upper head region fluid at the cold leg temperature, has less flow (by at least 3 percent of the total vessel flow) bypassing the core and reactor internals upstream of the core. Therefore, if one assumed both plants had the same loop flow rate, the hydraulic resistance of the Sequoyah internals and core would be less than for Diablo Canyon. The above hydraulic resistance is 5.8×10^{-10} ft/(gpm/loop)^2 less than the corresponding Diablo Canyon data.

The reactor internals and vessel outlet nozzle configuration for both plants is the same. The radius of curvature between the vessel inlet nozzle and downcomer section of the vessel on the two plants is different. Based on 1/7 scale model tests performed by Westinghouse and other literature, the radius on the vessel nozzle/vessel downcomer juncture influences the hydraulic resistance of the flow turning from the nozzle to the downcomer. The Diablo Canyon vessel inlet nozzle radius is significantly smaller than for Sequoyah. The result is the Sequoyah vessel inlet nozzle hydraulic resistance is 9.6×10^{-10} ft/(gpm/loop)^2 less than the corresponding Diablo Canyon data.

The following table presents a summary of the flow paths into or out of the Sequoyah and Diablo Canyon Vessel upper head region.

Flow Path	Sequoyah Flow Area (ft^2)	Sequoyah Hydraulic Resistance (ft^4)	Diablo Canyon Flow Area (ft^2)	Diablo Canyon Hydraulic Resistance (ft^4)
Head Cooling Spray Nozzles	0.45	6.07	0.02	4177.
Guide Tubes	0.75	2.70	0.75	2.70
Support Columns and/or UHI Flow Conduits	1.52	2.91	0	∞
Totals	2.72	0.28	0.77	2.57

It can be seen from the table that Diablo Canyon exhibits an effective hydraulic resistance that is 9.2 times greater than Sequoyah. Sequoyah which utilizes the UHI system has flow paths between the vessel upper head and reactor internals upper plenum region which are not present in Diablo Canyon. In addition, Sequoyah has increased head cooling spray nozzle flow area between the "downcomer" and vessel upper head region.

With respect to a comparison of the fluid and metal volumes associated with the upper head region, the following data is offered.

	Sequoyah	Diablo Canyon
Upper head region fluid volume	770 Ft^3	[illegible]93 Ft^3
Upper head region metal mass	515 Ft^3	419 Ft^3

The fluid volume represents the region from the upper support to the vessel closure head. The metal volumes include the vessel closure head, reactor internals upper support plate, upper guide tubes, and thermal sleeves. If one calculates the ratio of metal to fluid volumes for the 2 plants, Diablo Canyon has a higher ratio of metal to fluid volume than Sequoyah. This data coupled with the increased upper head region flow communication present in Sequoyah implies that the vessel heat cooling results of the Diablo Canyon natural circulation test should be conservative with respect to Sequoyah.

1216 309