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October 19, 1995

Mr. Alexander Adams, Jr.
Senior Project Manager
Non-power Reactors and Decommissioning
Project Directorate
U.S. Nuclear Regulatory Commission
M.S. 0-11-B-20
Rockville
MD
20852-2738

Subject: NRC Questionnaire and U.Va. Answers relative to proposed Amendment to the Safety Analysis Report (SAR) for the University of Virginia Reactor, Docket No. 50-62, License R-66, pertaining to its Heat Exchanger.

Dear Mr. Adams:

In response to the request for additional information regarding U.Va.'s proposed SAR amendment request of October 10, 1995, please find in attachment our answers to the NRC questionnaire. As a component of our response to NRC question 6, we are submitting additional information in the form of another proposed UVAR SAR section (Section 9.20.8), which should be included with our previously proposed amendment to the UVAR SAR. To facilitate matters, we are enclosing a complete replacement copy of the proposed SAR amendment. The pages on which wording changes were made, and any new pages, are listed in a "List of Enclosures," also in attachment.

We appreciate very much the expedited review NRC is giving to U.Va.'s SAR amendment request. Let me know if I can provide you with additional information.

Sincerely,

Robert U. Mulder, Director
U.Va. Reactor Facility &
Assoc. Prof. of Nuclear Eng.

City/County of Albemarle
Commonwealth of Virginia

I hereby certify that the attached document is a true and exact copy of a letter (type of document) presented before me this 19th day of October, 1995.

by Robert Mulder (name of person seeking acknowledgement)

Notary Public

My commission expires 2/28 19[redacted]

cc: Mr. Craig Basset, NRC Region II, Atlanta, Ga.
Document Control Desk, NRC, Washington, DC

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LIST OF ENCLOSURES

Please find in attachment the following documents:

1. NRC Questionnaire and U.Va. Answers

2. Complete replacement copy of proposed SAR Amendment

   The pages where wording was changed, or those that are new, are:

i thru vi	Changed the Table of Contents
4-7-A	Wording changes as described in "U.Va. Answers".
4-7-B	Typo's corrected.
4-8	Change of Table 4.1 title.
4-8-A	Change of Table 4.1.A title and "surveillance" wording changes as described in "U.Va. Answers".
9-78	Typo's fixed and addition of radioactive decay constants to Table 9.20.1.
9-81	Typo's fixed.
9-82	Typo's (font) fixed.
9-83	Typo's fixed and last sentence of second paragraph added.
9-84	Table 9.20.2 headings clarified, Mg-27 limit corrected. Sum of temporary ratios did not change.
9-85	Table 9.20.3 headings and text of paragraph below clarified.
9-86	Page number changed.
9-96	Page number changed.
9-97 thru 9-99	Renumbered reference pages and new Reference #34.
9-87 thru 9-96	New proposed UVAR SAR Section 9.20.8

NRC QUESTIONNAIRE AND U.VA. ANSWERS

1. Page 4-7-A, Section 4.6.1. Paragraph 1, line 3:

   Your discussion is limited to replacements only. Do you want this discussion to also apply to repairs and modifications? If so, please propose amended wording for this section.

We had indeed intended to make Section 4.6.1 apply to repairs and modifications, as well as replacements of heat exchanger system components. Therefore, we are submitting a revised page 4.7-A with slight wording additions in this paragraph.

2. Page 4-7-A, Section 4.6.1, Paragraph 2, line 5:

   A 50.59 analysis is broader than a determination of the capability of a structure, system, or component to perform their intended functions. Please justify your wording in light of the requirements of 50.59(a)(2) or propose amended wording for this section.

We recognize that a 10CFR50.59 analysis goes beyond the determination of a component to perform its intended function. Accordingly, we are proposing a small change in the previous wording of this paragraph, to take into account the other 50.59 conditions that also need to be satisfied in the performance of such an analysis.

3. Page 4-8, Table 4.1:

   Does the use of the word "current" in the title of Table 4.1 mean that the information in the table represents the condition of the heat exchanger today, or is the information in this table design specifications? Please clarify.

The information presented in this table constitutes the heat exchanger **design** specifications, and does not represent the **exact** condition of the heat exchanger today. A revised page 4-8, Table 4.1 is hereby being submitted, to reflect this through an amended table title. Similarly, Table 4.1.A.'s title on page 4-8-A was amended for consistency and a replacement page 4-8-A is being submitted as well.

4. Page 4-8-A, Table 4.1.A., "Surveillance interval":

   Your table does not place a definite upper limit on the number of plugs that may be installed in the heat exchanger. Since additional heat exchanger tube plugging may be necessary in the future, please justify your surveillance of the removal and inspection of one plug from the longest installed group of plugs annually or

propose a surveillance based on inspecting periodically a sample whose number is a fraction of the total installed plugs. Also, please discuss the practice of removing plugs for inspection as opposed to visually confirming the condition of installed plugs and verifying plug torque. Please justify why this surveillance should not be in the technical specifications or propose a technical specification for plug surveillance that includes the surveillance to be performed and the maximum interval between surveillance.

We agree that the removal of a single tube plug for inspection serves no useful purpose and that such a practice could have potential drawbacks. Instead, verifying the torque on all plugs would insure that they will maintain the leaking tubes sealed. Please find enclosed a revised page 4-8-A. We are now proposing to visually inspect all plugs annually without removing any of them. (Plugs that leak will be observed to wet the tube sheet at the affected end(s)). In addition, the torque on all plugs shall be checked during the annual inspection, and where necessary they shall be retorqued to design specifications.

The current proposed surveillance wording is:

Surveillance interval: annual, for in-situ visual inspections and installation torque check of all installed plugs.

We believe that there is no need for a new UVAR Technical Specification (TS) to cover this annual inspection. Annual surveillance of tube plugs is already described in the SAR and required by a new UVAR Standard Operating Procedure. Also, the probability of plug failure in a one-year surveillance interval is very small and the consequences negligible. Plug failures are tolerable, for at worst, they result in resumption of leakage through the heat exchanger. Significant renewed leakage would be noted within the one-hour to ten-day time frame considered in the SAR leak analysis. This time frame is much shorter than the plugs' annual surveillance. Furthermore, the purpose of plug surveillance is to follow the aging of the plugs and assure that the torque on them is sufficient to maintain corroded tubes sealed off. Were a heat exchanger leak to be determined by radioisotopic analysis or unaccounted-for pool level changes, staff would drain the heat exchanger and establish whether the source of leakage was a failing plug or an additional number of corroded and/or thinned tubes.

5. <u>Page 9-73, Section 9.19, line 5-6</u>:

The monitoring of secondary pressures on the heat exchanger input and outlet are important following plug insertion. Your SAR states that pressure shall be monitored without discussing monitoring frequency. Please discuss your monitoring plans for a period of sufficient length after plug installation to confirm that heat exchanger working pressures are not exceeded.

(NRC Questionnaire, page 3, cont.)

Following tube repairs, the secondary system shall be refilled and readings of the coolant system pressure gauges taken and recorded, first in the static mode. Then, readings shall be taken alternately with the primary pump and secondary pumps in operation. Finally, readings shall be taken with both pumps on. At each step in the process, the readings shall be compared with heat exchanger design specifications so as not to exceed working pressures. The effect of secondary system throttle valve setting changes (if and when performed) on system pressures shall be monitored, again, not to exceed working pressures. These pressure readings will assure that under no conceivable flow conditions can the design pressures be exceeded.

Once post-repair readings have been taken and found satisfactory, the reactor may be operated. Follow-up pressure gauge readings shall be performed daily during the next five working days to verify that they are holding steady. The secondary system pressure readings can be expected to change whenever secondary system throttle valves are readjusted. Otherwise, there is no obvious reason for the pressures to change once the system configuration is stable. Pressure readings are not expected to change noticeably even with heat exchanger leaks of high flowrate.

Leaks through the heat exchanger will be detected visually by inspection of reactor pool level, change in the pool water make-up frequency, or audibly through the sounding of the reactor low-pool level alarm, or through radioisotopic analysis of cooling tower water, or a combination of the above.

6. <u>Page 9-77, Section 9.20</u>:

Your analysis assumes a 1 ml/sec leak rate for ten days. Is this the combination of leakrate and staff discovery time that will result in the maximum consequence to the public? If not, please analyze the combination of leakrate and staff discovery time that results in the maximum impact on the public.

The above stated 1ml/sec leakrate is based on the realistic assumption that leaks start small and then grow. A leak starting slowly is likely to be determined first by radioisotopic analysis of cooling tower water while still less than 1ml/sec, although it may be possible to determine it as well from unexplained slow continuous pool level drop once it reached 1ml/sec. While this scenario takes into account the most likely leak development mechanism, it is possible to hypothesize a leak volume and staff discovery time that would result in a maximum (although still negligible) impact on the public.

To arrive at the limiting hypothetical scenario, wherein up to 700 gallons of poolwater could go into the secondary system prior to discovery of the leak's existence, it is necessary to make the totally unrealistic assumption (for the UVAR heat exchanger) that a sudden guillotine break of a secondary coolant tube would occur, with leakage of primary shell-side coolant through both tube ends. Such a double-ended pipe break now

has been analyzed and is presented, in attachment, in a new SAR Section 9.20.8 which we request be added to our original proposed SAR amendment. The analysis of this limiting scenario indicated that, although the amount of radionuclides released to the environment likely would be higher than with the 1ml/sec leak case, the calendar-year-averaged effluent release limits would not be exceeded.

7. **Page 9-79, Section 9.20.5 and Page 9-85, Section 9.20.7.4:**

Please discuss the feasibility of analyzing (leakrate and radionuclide analysis) cooling tower water on an accelerated basis for several weeks following reactor restart after plugging heat exchanger tubes to confirm proper plug performance. You propose the measurement in the long-term of secondary coolant samples for activity weekly. Please propose a technical specification for this surveillance that contains the surveillance to be performed and the maximum interval for the surveillance or justify not including this type of surveillance in your technical specifications.

It is prudent to verify that the heat exchanger repair has been successful and all leaking tubes have been identified and sealed. During working days of the first two weeks following the heat exchanger repair, primary water quality (conductivity) shall be monitored at least daily and cooling tower water samples shall be collected for radioisotopic analysis by the end of any day that the reactor has been operated.

The cooling tower water surveillance frequency does not require addressing in a new UVAR Technical Specification (TS). Limits on effluent release are already addressed in UVAR TS 3.4 Radioactive Effluents , which covers airborne and liquid effluents. The long-term surveillance of cooling tower water will follow a weekly schedule. This schedule has been increased from a previous monthly frequency by a change in UVAR Standard Operating Procedures (SOPs).

Typically, TS are formulated to enforce adherence to Limiting Conditions of Operation (LCO). There is no reason to establish a Limiting Condition of Operation with regard to a reactor poolwater leakrate. The recent SAR analysis indicates that detectable leaks will be found within a time frame sufficiently short to assure that calendar-year-averaged effluent limits will not be exceeded. From the most-restrictive water-effluent pathway sum-of-ratios value in SAR Table 9.20.3., it can be estimated that a continuous leakrate of 3 gph (72 gallons per day) of primary water with maximum (equilibrium) radionuclide concentrations could be sustained continuously without violating effluent limits. Still higher leakrates could be tolerated temporarily, provided the calendar-year-average leakrate was under 3 gph.