

TENNESSEE VALLEY AUTHORITY

CHATTANOOGA, TENNESSEE 37401
400 Chestnut Street Tower II

April 22, 1980

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

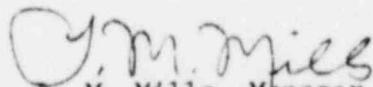
Enclosed are 10 copies of the additional information you requested on the Sequoyah Nuclear Plant (SNP) Process Control Program in your March 25, 1980, letter to H. G. Parris.

Enclosure 1 is the response to the requests contained in your letter. Enclosure 2 is the interfacing procedure to be used with the mobile solidification system at SNP. Enclosure 3 is an ANEFCO test report on solidification of wastes and resin formulations.

If you have any questions, please get in touch with D. L. Lambert at FTS 854-2581.

Very truly yours,

TENNESSEE VALLEY AUTHORITY



L. M. Mills, Manager
Nuclear Regulation and Safety

Enclosures

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ENCLOSURE 1

RESPONSE TO NRC QUESTIONS ON SEQUOYAH NUCLEAR PLANT PROCESS CONTROL PROGRAM

Question 1

Provide a list of interfaces between the plant and the trailer mounted equipment. What plant services are required for waste input, transfer liquid return, flush water, overflow, drainage, compressed air, ventilation air, phone and electric power? What special features are involved in connecting the trailer equipment to the plant, such as line size, connectors, hose fittings, and controls. Is lifting equipment necessary? If the container is filled on a truck bed, how are spills contained?

Response

The ANEFCO ECOPAC II Solidification System, hereafter referred to as the ECOPAC System, is interfaced with Sequoyah Nuclear Plant equipment according to ANEFCO procedure entitled "ANEFCO Inc. ECOPAC System Procedure for On-Site Solidification of Low-Level Radioactive Waste at Sequoyah Nuclear Plant", Revision 0. A copy of the above mentioned procedure is included as Enclosure 2.

Lifting equipment is only necessary to place the steel liners into the truck mounted cask. Since, the container is filled within the cask which is mounted on a truck bed, the actual cask itself will contain any spills and contain inadvertent overflow.

Question 2

Indicate the location for the trailer at the plant. Show any permanent or temporary shielding for the trailer mounted equipment to assure radiation protection. Show curbs and drains or other provisions that return spills to the plant.

Response

The ECOPAC System mobile trailer will be located in the refueling bay in accordance with Drawing #2 of the interfacing procedure Rev. 0.

Radiation protection and spill containment are designated in shielding and containment Drawing #15169-02 of the interfacing procedure. The dual purpose containment provides lead shielding for radiation protection for system operators. Also, the lower curbing and drainage provisions would contain any radiological spills and provide return capabilities to plant systems. The resin catch tank has an upper curb designed to prevent uncontrolled releases of radioactive material due to spillage. Additionally, no solidification will commence until the refueling bay doors are closed.

Question 3

Where will the onsite bulk storage tank for the A-SET solidification agent be located? The catalyst acid? What climate and temperature controls are to be established for A-SET and catalyst chemical storage? What is the expected storage life of these chemicals?

Response

The mobile A-SET* tank and acid catalyst tank will be located as shown in Drawing #2 of the interfacing procedure Rev. 0, 1/31/80. Effective temperature range of pumping and discharge of A-SET Resin is 10°C to 90°C.

The normal storage life of the A-SET resin is 90 days. Thereafter, the shelf life may be extended in 30-day increments by the addition of solvent to the A-SET Resin to maintain viscosity.

* Registered Trademark.

Question 4

The PCP does not provide the pretreatment specifications or require that adjustments be recorded. For example, if the waste pH must be between 3 and 7 for waste to be acceptable to the trailer equipment, how do you determine how much caustic (liquid or solid) shall be added at what point in the system, how is the waste rechecked and the results recorded? If the pH is over 7, what acid is used, where is it added, how is the waste rechecked and the results recorded? Describe the pretreatment limits and adjustments for high oil content, waste temperature, antifoaming agent, specific gravity, sulfate and boron. How will the waste radioactive concentration and nuclides be determined and recorded?

Response

All pretreatment specification are covered under plant surveillance instruction SI-420 and technical instruction TI-16. These instructions ensure that the pH range is met. All data is recorded on data sheets which accompany the instructions. Waste is delivered to the ECOPAC System at a pH of 8.5 to 10.0. The proper amount of catalyst acid (phosphoric) to be added is calculated from the results of a test specimen analysis. The acid is added in the mixing chamber of the positive displacement pump thus ensuring uniform mixing and achieving the desired pH of 3.0 to 7.0. Other specifications are maintained as follows:

High Oil Content - greater than 1% oil content requires removal by mechanical separation, i.e., oil pillows or skimming.

Waste Temperature - if temperature is greater than 90°C the liquid will be cooled to below 90°C as required by A-SET resin solidification criteria.

Antifoaming Agent - added to evaporator as required during operation.

Specific Gravity - equivalent to 20% by weight of solids.

Sulfate and Boron - maximum concentration as boron of 25,000 ppm or equivalent pH of 4.5.

Nuclide Determination - all waste will be sampled and analyzed using a Ge-Li detector and multichannel analyzer.

Question 5

Include a set of acceptable specifications for the testing of the A-SET and catalyst. Define the limits for specific gravity, pH and color beyond which the chemicals should not be used. Are tests run daily for 30 days or each 30 days on stored A-SET?

Response

The following is a set of acceptance specifications for the A-SET Resin and catalyst.

Specification: A-SET Resin
Viscosity @25C 700-1400 Cps
Specific Gravity #25/25°C 1.290-1.310
Non-Volatile 64-66%
pH 7.4-7.7
Color: no effect
Solvent: Water

Specification: Catalyst
Specific Gravity: 1.694-1.639
85%-80% H_3PO_4
61.4-57.8% P_2O_5

Specific gravity is tested by use of a hydrometer and pH is determined by use of a standard pH meter. Color has no effect upon the chemicals. Chemicals are tested initially upon arrival and each day before solidification.

Question 6

The batch size, the container size and the expected annual volume of each type of waste from the Sequoyah Nuclear Station will be compared to the trailer mounted equipment. Provide the capacity for each type of waste to be solidified by the trailer mounted equipment for this comparison.

Response

The batch size is such that the solidified waste volume will be contained in 80 ft³ liners or greater. These liners will be transferred in shielded casks. Sequoyah Nuclear Plant anticipated annual volume is 500 ft³ resins and 1200 ft³ evaporator concentrates. Trailer mounted equipment is capable of solidifying the expected annual output.

Question 7

What initial tests have been completed using the trailer mounted equipment to assure that the starting ratios could result in solidification of each type of waste? What catalyst ratio is recommended to be used with each UF/waste ratio? Will the acid ratio require adjustment for waste pH when the pH is adjusted in the pretreatment stages?

Response

Typical waste volume ratios by constituents are as follows:

- | | |
|-------------------------|---|
| A. Ion exchange resin: | (50-65) % resin waste
(50-35) % A-SET resin |
| B. Evaporator Bottoms: | (65-75) % evaporator bottoms
(35-25) % A-SET resin |
| C. Boric Acid Solution: | (70-85) % Boric Acid Solution
(max 67% by volume)
(30-15) % A-SET resin |

The phosphoric acid (H⁺ constituent) is typically 3% of the A-SET volume stoichmetrically.

For more specific solidification parameters and data the ANEFCO report, "Experimental Simulations of Radioactive Waste and A-SET Resin Formulations," has been included as Enclosure 3.

Question 8

The PCP assures solidification only through test specimen solidification, although TV observation is included as a final check for complete solidification. Provide information which supports that the test specimen method using a procedure different from the actual process is representative of that which occurs during actual operation. Why are the test specimens mixed by a magnetic stirrer for 10 minutes when the actual process does not depend on mixing? Why is the pH adjustment critical to the test specimens, but the actual operation does not monitor pH continuously during container filling? How have the initial tests been factored in to the pretreatment specifications and the chemical specifications? What initial tests show that residual liquids are compatible with the liner and/or container materials? How will these liquids be made neutral in the future?

Response

Urea-formaldehyde chemistry is well defined. The polymerization reaction after initiation is a positive chemical polymer reaction which goes to completion. The dynamic mixing of the positive displacement pump ensure complete mixing of the constituents. The magnetic stirrer used in the laboratory tests simulates the action of the positive displacement pump.

Before wastes are transferred to the ECOPAC System, the pH of the liquid in the tank to be processed is adjusted as stated in response to Question 4.

Test specimen results are used to calculate the flowrates of UF, acid catalyst, and waste.

The reactivity of A-SET resin is negligible with carbon steel. The corrosive effect is less than 0.008 mm at 50% Rh and 23°C (ASTM Test Method B-152.79).

Question 9

Describe the accuracy of delivery of the waste flow, A-SET flow and catalyst flow, and give the dependency of the solidification process on the accurate delivery of these fluids.

Response

The accuracy of the control units of the ECOPAC System for the A-SET Resin and the waste streams are $\pm 5\%$ full scale at reference conditions (25°C 40% Rh). Process variable meter accuracy is $\pm 2\%$ full scale. These variables are significantly more accurate than the solidification criteria acceptance range of $\pm 25\%$ for the ECOPAC System.

Question 10

Describe how spent demineralizer resins will be moved from the catch tank to the waste loader. What will prevent further drying of the resin and eventual clumping, which may lead to non-uniform feed rates into the mixing manifold. Provide a sketch or drawing of the catch tank screw feeder.

Response

The purpose of the catch tank is to dewater the resin slurry and maximize the waste volume shipped. It also serves to prevent clumping of resin by the cone shape of the tank and the auger feed mechanism. Catch tank design specifications can be found on Drawing #15169-01 of the interface procedure.

Question 11

Is the equipment to be flushed after use? If the flush water is added to the liner, will the flush water addition have any effect on the solidification process? Explain "wick" action and describe A-SET foam uptake of water in Section 2.6. What initial tests support this wick action of how much water?

Response

The ECOPAC System equipment is flushed after use and returned to Sequoyah Nuclear Plant. The flush water is not added to the liner.

A-SET foam initially absorbs ("wick" action) the free standing trace quantities of water, which is then chemically combined with the other chemicals present in the A-SET foam to form a chemical colloidal bond in an adsorption reaction as distinguished from the initial absorption process.

See Enclosure 3 for test data.

Question 12

The acceptance criteria must include the acceptance requirement at the burial site. The staff's position has been that the amount of free standing liquid should be essentially zero when leaving the plant site in order to assure that the burial site free standing liquid (or trace quantities) requirements are satisfied. If visible or drainable free standing liquids are present when waste leaves the plant, additional data must be provided to assure liquids are not generated or separated during storage and shipment. What initial tests have been performed to assure that vibration, heat, freezing and storage will not release liquid from the solidified mass prior to arrival at the burial site? What steps are to be taken to implement acceptance criteria related to 0.5% or one gallon per container (whichever is less) as trace quantities in future requirements by January 1, 1981?

Response

No excess liquids will be visible or drainable when the waste leaves the site. The solidified end product is not affected by vibration, heat, or freezing. The normal operating temperature is 10° C to 90° C. The liners are dewatered with the polyethylene piping matrix located on the bottom of each liner in order to ensure complete solidification and meet the free standing water criteria. In addition, A-SET foam is injected into the liner to absorb/adsorb any trace residual free standing liquid.

Question 13

Provide a copy of the form SQNP-PCP for review with the revised PCP. The final PCP should have PORC review, approvals, date and method of indicating revisions to agree with the Technical Specifications 3/4.11.3 and 6.13. How will actual mixture ratios within the approved range be transmitted to the operator of the trailer mounted equipment. How will he be informed if the batch test or the test specimen fails to meet the acceptance criteria and new parameters are approved? Does the form provide for a plant management approval step prior to changing the conditions of the PCP?

Response

The initial process control program (PCP) as submitted in my February 7, 1980, letter to L. S. Rubenstein has been reviewed by the Plant Operating Review Committee (PORC). Changes to the PCP will be made in accordance with technical specification 6.13. A copy of the form SQNP-PCP is included in the plant interfacing procedure. The ECOPAC System trailer operators are officially notified only by means of form SQNP-PCP. The operators have no authority to perform solidification without a signed SQNP-PCP.