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SUBJECT: Procedure for Cleaning the Low and High-Pressure
Fuel and Blanket Systems with Tri-sodium Phosphate
HRT Engineering Test Procedure

TO: R. Van Winkle

FROM: H. K. Search

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PROCEDURE FOR CLEANING THE LOW
AND HIGH-PRESSURE FUEL AND BLANKET SYSTEMS
WITH TRI-SODIUM PHOSPHATE
HRT ENGINEERING TEST PROCEDURE

I. Introduction

The low and high-pressure fuel and blanket systems will be treated with tri-sodium phosphate for the removal of grease and oil contamination. The procedure outlined below is a summary of a more detailed procedure to be used by the operators.

II. General

It is assumed in this procedure that the reactor cell components and piping have been completely assembled and have been hydrostatically tested for leaks as a unit. It is further assumed that (1) sampling stations are not installed, (2) No chemical processing equipment will be ready for tri-sodium phosphate cleaning, (3) strainers are installed in place of feed-block valves HCV-337 and HCV-437 (strainer adapter assembly contains a hand valve operable in the same manner as the remotely operated valves they replace, (4) strainers are installed in the discharge lines from the circulating pumps, and (5) all valves are operable.

The cleaning solution will be 3% sodium phosphate, tri-basic, which will remain in each system at a temperature of 100°C for a minimum of 3 hours. Two batches (assuming mixing tank capacity of 1900 liters) amounting to a total of 3400 liters (capacity of blanket dump tank system plus an amount for losses) will be required. Facilities for condensing building steam, tanks for storing the condensate and a solution mixing tank are installed with solution feed lines connected to lines 162 and 262 for feeding solution to either dump tank. Solution will be transferred from one system to another to conserve reagent grade (low chloride content) sodium phosphate. Transfer of solution will be accomplished by nitrogen pressurization rather than evaporation to prevent buildup of solids on the surfaces of the dump tanks. The solution will be drained to the 12,000-gal waste tank, concentrated in the waste evaporators and collected for reuse if it is not badly contaminated during the initial system cleaning.

Rinsing of the system for removal of tri-sodium phosphate will be accomplished with distilled water. The system will be filled and drained several times until the drain sample indicates a pH of 8 to 8.5 and a specific resistance greater than 25,000 ohm-cm. The procedure for rinsing will be the same used for the tri-sodium phosphate cleaning procedure. The water rinse will be repeated twice using distilled water for the first and second rinses to assure rinsing of all surfaces contacted by tri-sodium phosphate. The temperature of the water should be maintained at 100°C for 1 hour rather than 3 hours for this procedure. If this method of rinsing effectively reduces the pH and conductivity, it may be repeated to completion; however, if it is not effective, each system may have to be rinsed separately. Rinse water will be directed to the drainage ditch rather than the 12,000-gal waste tank.

During the cleaning and rinsing operations, samples of tri-sodium phosphate solution and rinse water will be taken for analysis by the chemical laboratory for control purposes.

Temporary piping and valves will have to be installed in various places in the system to facilitate filling, transferring, draining and flushing of various lines. In addition to weighing instruments and level instruments, temporary gauges of tygon tubing will be installed to determine the level of the solution or water in each system.

The temperature of the solution will vary throughout each system. The temperature elements to be used to maintain the required 100°C are tabulated in Table I.

The estimated volumes of the various components of the fuel and blanket system are tabulated in Table II.

III. General Procedure

The general procedure for cleaning and rinsing will be:

1. Fill the fuel and blanket dump tanks with enough solution to clean the fuel and blanket high-pressure system. Heat to 100°C.
2. Pump solution to fuel and blanket high-pressure system to completely fill pressurizers.
3. Heat solution in pressurizers and clean pressurizers, pressurizer vent lines, pressure tap instrument lines, purge line from pressurizer to purge pump discharge flange, and suction line, purge pumps for circulating pumps to discharge flange.
4. Drain pressurizers, pressurize high-pressure systems, heat and circulate solution in high-pressure systems for cleaning high-pressure components and piping and to clean feed lines, let-down lines, high-pressure sampling lines, circulating pump purge lines to purge pump discharge flange, chemical processing lines and dump lines.
5. Transfer solution to fuel dump and storage tanks flushing lines 134 and 234, lines 138 and 238, lines 164 and 264, line 148 to the loading pit, the holdup tank and the low-pressure sampling stations during this transfer.
6. Heat solution in fuel dump and storage tanks and clean fuel low-pressure systems, pressure tap instrument lines on fuel dump and storage tanks, line 141, pressurizer purge pump and gas addition line.
7. Transfer solution to blanket dump tanks and complete filling from mixing tanks.
8. Heat solution in blanket dump tanks and clean system including pressure tap instrument lines, line 241, pressurizer purge pump and gas addition line.
9. Transfer required amount of solution to fill the blanket storage tanks.

TABLE I

Temperature Elements Required for T.S.P. Cleaning

Blanket Pressurizer - - - - -	TE-267
Blanket High-Pressure System - - - - -	TE-271 (line 201)
Blanket Dump Tank - - - - -	TE-491 or TE-492 (evaporator)
Blanket Storage Tank - - - - -	TE-489 or TE-490 (evaporator)
Fuel Pressurizer - - - - -	TE-167
Fuel High-Pressure System - - - - -	TE-171 (line 101)
Fuel Dump Tank - - - - -	TE-391 or TE-392 (evaporator)
Fuel Storage Tank - - - - -	TE-389 or TE-390 (evaporator)

TABLE II

Estimated Component Volumes

	<u>Volume-Liters</u>	
	<u>Core</u>	<u>Blanket</u>
High-Pressure Circulating System (to Press. Flange)	490	1722*
Pressurizers	103	103*
Dump Tanks and Evaporators	990	2780
Entrainment Separators	80	80
Recombiner	40	40
Recombiner Condenser	130	130
Condensate Tanks	210	210
Storage Tanks and Evaporators	995*	2780*
Storage Tanks Reflux Condensers	130*	110*
	<u>3168</u>	<u>7955</u>

* Actual volume measurements.

10. Heat solution in blanket storage tanks and clean system including pressure tap instrument lines.

11. Empty solution in blanket dump and storage system to cell drains for jetting to 12,000-gal waste tank.

12. Dump all solution collected in drums in fuel and blanket sampling stations for drainage to the 12,000-gal waste tank.

13. Open all vents and drains in all systems to assure complete removal of solution from system.

14. Repeat 1. to 13. above using distilled water but reduce soaking time to 1 hour and dispose of rinse water to drainage ditch rather than 12,000-gal storage tank. Repeat rinses until rinse water shows a pH of 8 to 8.5 and the specific resistance is greater than 25,000 ohm-cm.

15. Jet solution from 12,000-gal storage tank to waste evaporators and collect concentrated tri-sodium phosphate in drums at evaporator loading pit.

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