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CC: R. Maher, 703-A
 O. M. Morris, 704-H
 J. W. Crichton, 704-2F
 D. C. Nichols, 704-1H
 E. J. O'Rourke, 704-2F
 G. H. Street, 706-2H
 C. W. Swindell, 706-1H
 D. B. Jett (3), 704-1H
 E. W. Holtzscheiter, 679-G
 R. S. Ondrejcin, 773-A
 H. H. Elder, 706-1H
 J. C. Bailey, 706-2H
 G. M. Johnson, 704-2F
 G. L. Albert, 704-2F
 J. E. Hoisington, 679-G
 Tech File, 706-1H

INTER-OFFICE MEMORANDUM

SAVANNAH RIVER PLANT

RECORDS ADMINISTRATION



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TO: J. H. HERSHEY, 704-F

FROM: E. B. SNELL, 706-1H *EPS*

SECOND TANK 16 ANNULUS CLEANING TEST PROCESS AND EQUIPMENT DESCRIPTION

INTRODUCTION & SUMMARY

Tank 16H annulus cleaning operations, conducted under TA-2-850(1), were suspended in March 1978 after removal of 80 percent of the solids and 70 percent of the radioactivity. About 22,000 lbs. of residue containing 30,000 curies of activity (primarily Cs¹³⁷) remain in tank 16 annulus. The major components of the residue, natrodavyne (3NaAlSiO₄·Na₂CO₃) and sand, are not water soluble. Some water soluble salts may be present, however, most were removed during the earlier annulus cleaning test. This letter presents a program for removing the residual activity and most of the solids from the annulus using oxalic acid. Equipment and instrument requirements are outlined in the scope of work. Please initiate an REA to the Project Department to provide the annulus cleaning facilities by April, 1981. Also, please request a flex analysis of the tank 16 annulus transfer lines to tanks 14 and 15. These lines were not included in the line flex study done by the Engineering Department.

DISCUSSION

First Annulus Cleaning Test Results

Water soluble salt in the annulus was removed by circulating water with steam activated S-1 jets (25 gpm) in both the East and South risers discharging clockwise. After 190 hours of S-1 jet operation, a type "D" jet (75 gpm) was installed in the

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West annulus riser. Operation of the type "D" jet was alternated with the S-1 jets for a total "D" jet operating time of 32 hours. Total operating time for each S-1 jet was about 600 hours. The type "D" jet discharge was directed counterclockwise so that adequate temperature monitoring could be provided to avoid exceeding the 80°C temperature limit. This temperature limit and guidelines on inhibitor concentrations were imposed to minimize the potential for stress corrosion cracking of the secondary pan or primary tank wall (2). Initial specific gravity of the dissolved salt solution was 1.39. Annulus salt removal was discontinued when the specific gravity of the solution decreased to less than 1.01.

Photographic inspections of the annulus after salt removal revealed that the majority of the residue is in the northern half of the annulus (See Figure 1). This was the area receiving the least agitation during the annulus cleaning test. The area most effectively cleaned was the southwest quadrant where the "D" jet discharge was directed.

Samples were obtained from beneath inspection ports (IP) 118, 151, 207 and 262 after annulus cleaning was suspended. The samples were primarily natrodavine and sand (3). Another sample was recently removed (8/80) from beneath IP 118 for further characterization of the residue in this area.

Process Description - Second Annulus Cleaning

The proposed method of annulus cleaning uses 4-8% oxalic acid as the solvent. SRL tests using actual annulus waste samples indicated that 4% oxalic acid was effective in dissolving more than 50% of the solids and more than 99% of the activity (3).

Inhibited ballast water (.01M NaOH) in tank 16 interior is required to overcome the buoyant force exerted on the primary liner by the annulus solutions. A hydrostatic pressure in the annulus which exceeds the hydrostatic pressure in the primary would result in deformation of the primary bottom. Maintaining a ballast level of 27 inches in the tank is adequate for annulus liquid levels up to 25 inches.

Assuming a 1.1 maximum specific gravity of annulus solutions, these liquid levels, plus the weight of the primary tank bottom, would result in a net downward force on the primary of 4 inches water column. This approach is conservative since the specific gravity of annulus solutions near the conclusion of Phase I annulus cleaning were <1.01 .

An inhibited water wash of $\sim 10,000$ gallons will be performed to remove any remaining water soluble salts prior to acid cleaning. Each acid wash will be added as a 6,000 gallon batch of 8% oxalic acid. Acid concentration will decrease during annulus cleaning due to jet dilution and reaction. About 12,000 gallons of solution, diluted to 4% oxalic acid or less, will be sampled and transferred to tank 14. The number of acid washes required will be determined by inspection and sample analysis. Acid and water will be added from an existing oxalic acid header on tank 16 through a new line which will extend into the annulus air inlet duct.

Agitation will be provided by three type "D" jets (75 gpm) located in the East, South, and West risers, circulating clockwise. Intermittent operation of the jets may be required to stay below the maximum allowable oxalic acid solution temperature of 90°C . A temperature limit of 80°C must be observed for the initial water rinse (4).

Solution temperature will be monitored by thermocouples located in IP 18, 39, 118, 154 and 207. For the "D" jets in the East and South risers, an operating temperature limit of 85°C, monitored about 20 feet from the jet discharge, will be observed. Since the west jet temperature is monitored 50 feet from the discharge, the operating limit will be 80°C.

During the acid and water washes, low pressure steam (15 psig) will be added slowly (~500 pph) to the annulus through new lances in IP 18 and 154 for additional decontamination of the primary and secondary walls. The lances should be installed 50 inches above the annulus floor for more effective cleaning of the secondary. The lance discharge should be tangential to the tank wall. Ventilation will be provided by exhausting the annulus air via a new duct from IP 35 to the tank interior (riser 5) and out the purge exhaust system.

Acid solutions will be transferred from tank 16 annulus to tank 14, riser 7, through an existing transfer line. The acid solution will be neutralized in tank 14 by adding 50% NaOH in riser 7 during the transfer from tank 16 annulus. Caustic will be added from a 500 gallon portable caustic tank. About 700 gallons of 50% NaOH is required for neutralization of each 6,000 gallon, 8% acid wash. After the acid solution is transferred to jet heel (~8"), 8,000 gallons of water will be added to the annulus to dilute the remaining acid to <2%.

The final wash will be transferred to tank 14 until the jet heel is reached. A small transfer of 2,000 gallons to tank 15 is required to reduce the annulus liquid level to the minimum heel of 4 inches. The annulus will be dried using the existing dehumidification system.

Annulus solution transfers to tanks 14 and 15 will be made through existing jacketed lines (stainless steel core, carbon steel jacket). Both lines may be pressure tested and have leak detection capabilities. The transfer line to tank 14 was replaced in 1977 after the original unjacketed line failed. The transfer line to tank 15 was installed in 1978. Neither line was included in the Engineering Department's line flex study. A flex analysis should be performed for these lines before they are returned to service.

References

- (1) TA-2-850, "Salt Removal From Walls and Annulus of Tank 16", R. L. Hooker - D. W. Tharin, July 28, 1975.
- (2) DPST-75-292, "Metallurgical Aspects of Cleaning Annuli of Waste Storage Tanks", S. P. Rideout to K. W. French, June 27, 1975.
- (3) DPST-79-360, "Summary of Current Data on Tank 16H Annulus Samples", L. Reynolds to C. Comly, January 9, 1979.
- (4) DPST-80-570, "Tank 16H Annulus Cleaning Demonstration", J. E. Hoisington to J. K. Okeson, September 26, 1980.

SCOPE OF WORK

This section summarizes the equipment required for decontaminating tank 16 annulus. The equipment arrangement is shown in Figure 2. Table 1 lists the drawings of the equipment used for the first annulus cleaning test.

Circulation Jets

- o Remove the S-1 jets from the East and South annulus risers and install two new type "D" jets (75 gpm). Design should allow rotating the jet in the riser.
- o Rotate the existing type "D" jet in the West riser to discharge clockwise.
- o Install the steam and air supply to each jet and steam lance. Piping to the jets should have a short flex hose at the jet connection to permit easy rotation of the jets. An automatic air-blow feature should be provided for each jet to prevent a "suck back" in case of steam loss.

Acid And Water Addition

- o Provide a new acid/water line from riser 8 rotary spray piping and extend into the annulus air inlet duct to 30 inches above the secondary floor.

Neutralization

- o Remove the berm from tank 14, riser 7, and lead shield the transfer line discharge at the riser. Provide new facilities for adding 50% NaOH to riser 7 from a 500 gallon caustic dumpster.

Ventilation System

- o Provide the duct work for venting the annulus to the tank interior.

Instrumentation

- o Install thermowells in IP 118 and 207. Thermowells are currently installed in IP 18, 39, and 154. Provide thermocouples at 5 inches, 15 inches, and 120 inches above the secondary bottom. Locate recorders for the thermocouples in the tank 16 motor control center.
- o Return to service the liquid level and specific gravity dip tubes located in IP 42 and the annulus pressure indication in the South riser.
- o Provide instruments for measuring steam consumption on the jets and lances (0-2000 pph).
- o Provide high level conductivity probe in the annulus air inlet duct to alarm at 27 inches.

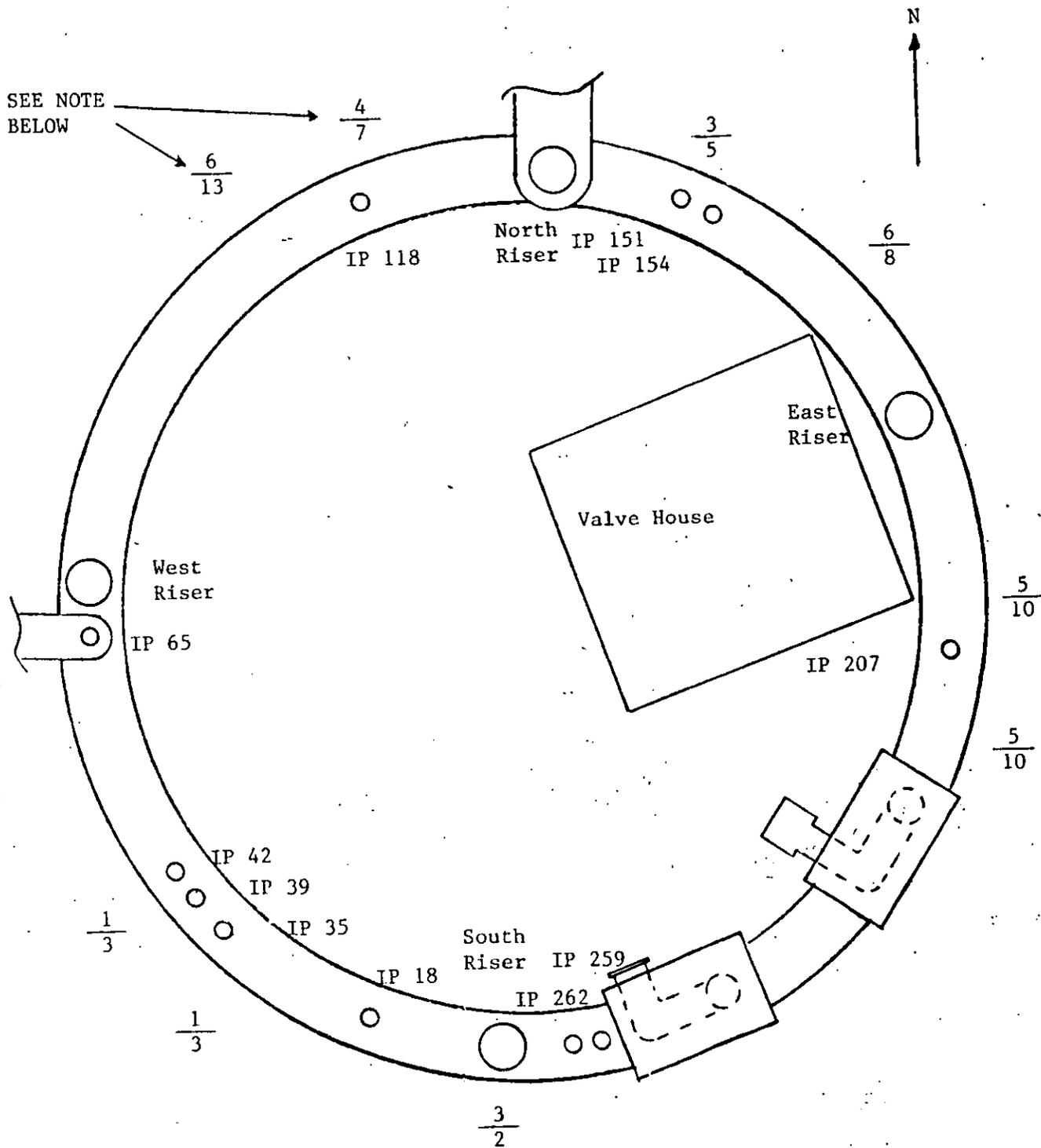
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TABLE 1

PHASE I ANNULUS CLEANING EQUIPMENT PRINTS

SSK5-2-3129	Piping Plan
-3130	Piping Sections
-3131	South Mixing Jet
-3132	East Mixing Jet
-3133	Details
-3134	Instrument Diagram
-3141	Demister
-3242	West Mixing Jet
-3285	Transfer Line - Tank 16 Annulus To Tank 15
-3324	Transfer Line - Tank 16 Annulus To Tank 14
S5-2-5793	Alarm System Electrical Diagram

FIGURE 1
ANNULUS RESIDUE DEPTH



NOTE: Fraction indicates salt height as follows:

$\frac{\text{Depth between vent duct and secondary liner (inches)}}{\text{Depth between vent duct and primary liner (inches)}}$

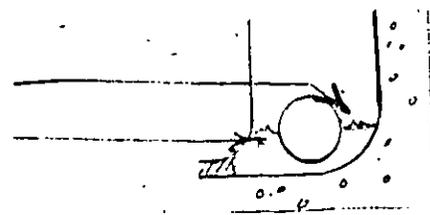


FIGURE 2
ANNULUS CLEANING EQUIPMENT

