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INTERIM OPERATION OF THE PUREX 241-A
WASTE WET FARM CONDENSATE DISPOSAL FACILITY

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September 14, 1956

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INTERIM OPERATION OF THE PUREX 241-A
WASTE TANK FARM CONDENSATE DISPOSAL FACILITY

Reference: HW-44506, "Design Bases and Performance
Characteristics of the Purex 241-A Waste Tank
Farm Condensate Disposal Facility" by L. R.
Michels and L. L. Zahn, dated July 29, 1956.

This letter presents recommendations for the interim operation of the Purex 241-A Waste Tank Farm Condensate Disposal Facility and outlines briefly the status of design studies either in progress or to be initiated in the near future to overcome its shortcomings.

As outlined in the reference document, the 216-A8 Tank Farm Crib was designed to dispose of 2,900 gallons per minute of condensate from the tank farm contact condensers during "burps". During the acceptance test, the crib handled 2,000 gallons-per minute, with unknown liquid level. Towards the end of July 1956, the crib capacity had been reduced to between 400 and 500 gallons per minute and at present the crib percolation rate is about 250 gallons per minute with the crib essentially full of liquid. The crib percolation rate has been adversely affected by the presence of gross quantities of organic solvent emulsion in the tank farm condensate and by the presence of silt and fungal slime in the "used" raw water fed to the contact condensers.

Process Design and Development is now preparing the scope design of a surface condenser facility for the 241-A Tank Farm which is intended to remove the limitations of the present contact condensers. Progressively increasing waste tank heat release and decreasing crib capacity dictate the following interim measures to assure satisfactory operation of the present contact condensers and 216-A8 Crib prior to completion of the surface condenser facility.

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RECOMMENDATIONS

1. The flow of "used" cooling water to the E-411 Contact Condenser should be reduced to about 120 gallons per minute as soon as possible to lower the liquid level in the crib to provide adequate crib surge volume for "burps".

Reduction of cooling water flow to this value will result in increased condensate temperature which will be beneficial in the destruction of fungal slime in the crib.

2. Repair of the pressure sensing line of TK-103 should be expedited to permit operation of the 10-inch dump valve for waste tank burps. This, in turn, will permit the 4-inch diaphragm operated valve to be placed on flow control, as designed, to handle the normal heat load.
3. "New" raw water should be substituted for "used" water as feed to the E-411 Condenser by the end of October 1956, to accommodate the anticipated increase in heat duty of the Waste Tank Farm.
4. Jets to remove organic solvent from Tanks G-8 and R-8 should be placed in service as soon as possible to reduce the organic flow to the waste tanks.
5. Emergency facilities will be required for the disposal of contact condenser effluent from April 1957 until the Surface Condenser Facility can be placed in service. The emergency condensate disposal facilities would consist of either an enlarged pond which can be backfilled when its use is no longer required or a supplemental crib either in parallel or in series with the present 216-A8 Crib. Scoping studies on the above emergency facilities will be initiated by Process Design and Development shortly.

DISCUSSION

Figure I, attached, presents the results of a study of tank farm heat evolution and required crib percolation rate as a function of time through May 1957. This study was based on a 1.5 Purex capacity factor, a 70 per cent operating factor, and wastes corresponding to slug irradiation at 500 MWD/T, 4.5 MW/T, and 100 day cooling prior to disposal to waste tanks.

The present tank farm heat evolution is believed to be of the order of 3 million BTU/hour. The present heat evolution can only be approximated however owing to uncertainties of instrument calibration and low scale readings at the low heat duty. Heat evolution is expected to increase to about 9.5×10^6 BTU/hour by June 1, 1957.

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The curves of Figure I showing the required 216-A8 Crib percolation rate (consistent with the above heat duty) as a function of condenser inlet water temperature indicate the marked reduction in crib duty which can be realized through the eventual use of "new" raw water. By March 1957, the required percolation rates using raw water of 125, 100, 70 and 40 degrees Fahrenheit inlet temperatures are 315, 220, 152 and 125 gallons per minute, respectively, based on a condenser effluent temperature of 175°F. Two curves are presented in Figure I showing predictions of both the "normal" and "emergency" crib capacity for the next six months. "Normal" crib capacity would be realized if the level of liquid in the crib were say 12-inches or less, with about 70 inches of crib depth available to handle intermittent "burp" flow. "Emergency" crib capacity represents operation with the crib essentially full of liquid, with burps giving rise to crib overflow. Intersections of the flow curves for the various inlet cooling water temperatures with the predicted crib capacity curves establish the dates when cooling water of reduced inlet temperature would be required.

The temperature of used Purex cooling water is about 100°F, although water economy studies are in progress to increase this temperature to the design value of 125°F. With 100°F used cooling water, "normal" crib operation would be possible only until the end of September 1956, at which time new raw water should be substituted for used water. With 60°F raw water, normal crib operation should be possible until mid-October. Operation under emergency conditions (crib full of liquid) should be possible until about April 1957, at which time the inlet water temperature would be about 43°F.

The waste circulators have been in service in the Purex 241-A Waste Tanks since September 6, 1956, using portable compressors for motive air supply. Prior to September 6th, burps occurred on a daily basis, and a maximum of three burps per day have been noted. A maximum burp intensity of about 50 million BTU per hour has been recorded.

Since the waste circulators have been placed in service, tank farm heat evolution has been remarkably uniform at the present value of about 3 million BTU/hour, with complete absence of burps. During the month of August 1956, the average activity of condenser effluent was 1.2×10^{-7} Beta curies per gallon. Assuming the continued absence of burps through operation of the waste circulators, and continued low activity in the condenser effluent, operation of the 216-A8 Crib under emergency conditions is not considered hazardous.

If the capacity of the 216-A8 Crib continues to decrease as predicted in Figure I, additional facilities for disposal of condensate will be required by April 1957. Process Design and Development is presently engaged in scoping studies on surface condensers at the tank farm, to be installed either as a substitute for the present contact condensers or to be installed in series with contact condensers such that the surface condensers would handle normal heat evolution and the contact condensers would handle burp heat evolution. The scope design of the new surface condenser.

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facility should be completed by about November 1, 1956. Completion of construction of a new facility on a normal construction basis could not be expected before February 1958 or before September 1957 on an expedited basis. On this basis emergency facilities for the disposal of contact condenser effluent will be required at least five months before a surface condenser facility can be placed in operation.

As outlined in the reference document, the ultimate maximum normal heat evolution of wastes in the 241-A Facility would be about 32 million BTU per hour at a 4.0 capacity factor, 70 per cent operating factor, with incoming wastes corresponding to fuel irradiation at 7.5 MW/T, 500 MWD/T, and 90 days cooling, with a final waste volume of 100 gallons per ton and with all tanks full. Using surface condensers, where only condensed waste tank vapor would be cribbed (cooling water would be discharged to a swamp), the ultimate normal flow to the 216-A8 Crib would be about 64 gallons per minute, which the present crib might be able to handle, assuming the absence of organic solvent and fungal slime in the condensate from the surface condensers. For the foreseeable future, however, the condensate flow to the 216-A8 Crib from surface condensers should be no greater than about 30 gallons per minute.

The following alternates are to be considered in the design of emergency supplemental facilities for disposal of contact condenser effluent, which may be required in the interim between April 1957 and completion of the surface condenser facility:

1. Installation of a supplemental crib to operate in parallel with the existing 216-A8 Crib.
2. Installation of a supplemental crib handling overflow from the present crib.
3. Installation of a decanter for organic solvent in the overflow line from the present crib, along with a new small crib for disposal of the organic phase and a pond for disposal of the aqueous phase.
4. Enlargement of the emergency pond area recently constructed to confine overflow from the 216-A8 Crib.

The fourth alternate, enlargement of the emergency pond area, is preferred for economic reasons to avoid expenditures for supplemental cribs which may not be required on a long range basis.

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