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ARH-2026

May 26, 1971

PROJECT PROPOSAL
242-T EVAPORATOR BOTTOMS COOLER DEMONSTRATION FACILITY
(Project HCP-661)

FACILITIES PLANNING — CHEMICAL PROCESSING DIVISION

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BM-6400-008 (1-68) AEC-RLOO RICHLAND, WASH.
54-6000-031 (10-68)
AEC-RL RICHLAND, WASH.

14

DATE May 26, 1971

PROJECT NO. HCP-661 REV. NO. 0

TITLE

242-T EVAPORATOR BOTTOMS
COOLER DEMONSTRATION FACILITY

Total Funds Requested	$ 300,000
Value of Transferred Capital Property	-0-
Estimated Project Cost	$ 300,000

RESPONSIBLE DIVISION

Chemical Processing

PROJECT MANAGEMENT

Atlantic Richfield Hanford Company
Contract AT(45-1)-2130

SCHEDULE: (MONTHS AFTER AUTHORIZATION OF PROJECT AS PROPOSED HEREIN)

	START	COMPLETE
DESIGN	1	5-1/2
PROCUREMENT	3	10
BENEFICIAL USE	--	14
PHYSICAL PERFORMANCE	5	16

CLASSIFICATION OF PROJECT & SOURCE OF FUNDS

This project has been classified as a process addition, chargeable to capital accounts.

Source of Funds: FY 1971 02 Program
General Plant Projects

ATTACHMENTS

A. Project Cost Estimate

B. Unit Cost Summary

PREPARED BY:

D. C. Braden
Facilities Planning

APPROVED:

Vice President - Operations DATE

President
ARHCO DATE

BM-5400-034 (8-67)
AEC-RL RICHLAND, WASH.

PROJECT PROPOSAL
242-T EVAPORATOR BOTTOMS COOLER DEMONSTRATION FACILITY
(Project HCP-661)

Reference: ARH-2087 (unclassified), May 7, 1971, R. A. Kyle, "Design Criteria, 242-T Evaporator Bottoms Cooler Demonstration Facility"

I. INTRODUCTION

A. PURPOSE AND SCOPE OF PROJECT

The purpose of this project is to provide a demonstration facility for cooling the waste concentrates from the 242-T Evaporator. A high velocity (process side), water-cooled heat exchanger would be installed to evaluate the feasibility of cooling evaporator bottoms recycle streams in order to increase the 242-T Evaporator boiloff rate and operating efficiency by reducing the salt concentration of the recycle feed stream.

B. REQUEST FOR AUTHORIZATION

Authorization is requested for total project funds in the amount of $300,000 with Atlantic Richfield Hanford Company to (1) manage the project and (2) perform final instrument calibration and testing.

II. DESCRIPTION OF PROPOSED WORK

The proposed work consists of the design and installation of a demonstration facility, utilizing a water-cooled, shell and tube heat exchanger with a high process solution velocity (12 feet per second) on the tube side, in the 241-TX Tank Farm for cooling the 242-T Evaporator bottoms recycle stream. As currently conceived, a large batch (200,000-250,000

gallons) of bottoms at 120 F would be collected in 241-TX-112 Tank and cooled to 80 F by pumped recirculation through the heat exchanger; the solids formed would settle out in the tank and the supernatant liquid would be returned to the 242-T Evaporator as feed. The proposed technique should minimize exchanger scaling and plugging problems, with a resultant decrease in heat transfer rate, by effecting only a small temperature drop per recirculation pass.

The proposed facilities include the following major components:

A. Shell and Tube Heat Exchanger

This high velocity, water-cooled exchanger would have a nominal design duty of 1×10^6 Btu per hour with carbon steel construction, except for the Type 304-L stainless steel tubes and tube sheet. The cooling water would flow up through the shell at two to six feet per second and the process solution down through the tubes at twelve feet per second, directly into the tank.

B. Pump and Cooler Pits

The pump pit and cooler pit would be constructed over the existing east and west 42-inch risers of 241-TX-112 Tank, respectively, with the airlift circulators and associated piping now mounted in the riser to be removed. Remote jumpers would be installed for the required service and process connections. The pits would drain back into the tank via the risers; 18-inch thick concrete (or equivalent) covers would be provided for radiation shielding.

C. Pumps

Two new pumps would be required: (1) a slurry pump (2,000 gpm at 70 feet head) for recirculating the bottoms through the shell and tube heat exchanger; and (2) a cooling water pump (200 gpm at 50 feet head) for tempering the cooling water

(50 F minimum) to the heat exchanger by recirculation of a portion of the discharge flow under temperature control to prevent excessive tube scaling.

D. Accessory Equipment

This equipment would include the required: (1) process and service piping and valves for slurry recirculation and raw water supply and discharge; (2) control instrumentation for cooling water flow rate and integration, pressure, temperature, leak detection, etc.; (3) electrical switchgear; and (4) steam-water backflushing facilities. The pump controls and all alarms would be located in the 242-T Evaporator Control Room; all other instrumentation would be locally mounted.

Additional conceptual details pertinent to the proposed project are contained in the reference design criteria document.

III. ADVANTAGES TO BE GAINED AND JUSTIFICATION FOR THE PROPOSED WORK

The Hanford Waste Management Program includes four major steps: (1) removal of the long-lived cesium 137 and strontium 90 fission products from stored and current high level wastes, now in progress at the B Plant Waste Fractionization Facility; (2) purification and encapsulation of the isolated strontium 90 and cesium 137 for long-term storage by Project HAP-631 facilities, now under construction; (3) storage of the liquid waste after cesium 137 and strontium 90 removal for short-lived fission product decay; and (4) concentrating the remaining waste for bulk salt cake storage in existing underground tanks. The AEC and Atlantic Richfield Hanford Company have set December 31, 1975 as the goal date for having all stored wastes, except for "in-process" material, processed through the solidification units.

The 242-T Evaporator and ITS Units No. 1 and 2 generate concentrates from the non-boiling, high-level wastes as

part of the in-tank solidification program; they will be supplemented by the new 242-S Evaporator system to be provided by Project HAP-655.

Current operating data from the 242-T Evaporator indicate that a deficiency exists in the existing bottoms tank air cooling system. A solid crust forms on the solution surface and cooling ceases; the airlift circulators will not prevent this crust formation. This cooling deficiency has resulted in a high salt concentration in the supernatant recycle stream to the evaporator since the saturated bottoms stream is not cooled to a sufficiently low temperature to promote effective crystallization and precipitation of its dissolved salts. Operating experience has shown that the 242-T Evaporator boiloff rate is decreased markedly at high feed salt concentrations. The proposed facilities would provide additional cooling in the 241-TX bottoms tank system to enhance crystallization and precipitation of dissolved salts from the evaporator bottoms stream. The supernatant recycled to the 242-T Evaporator as feed would be less concentrated with a corresponding improvement in the evaporator boiloff rate. The proposed facilities could be utilized for several years by their movement to other bottoms tanks, probably until the completion of the 242-T Evaporator in-tank solidification program. Successful operation of the proposed demonstration facility should increase the efficiency and production rate of the 242-T Evaporator facility.

IV. WHY ALTERNATIVE FACILITIES CANNOT BE USED

Bottoms cooling for the 242-T Evaporator is currently accomplished by forced air circulation in the underground tanks. Operating data indicate that this system does not supply sufficient bottoms cooling to promote adequate crystallization and precipitation of dissolved salts. The formation of a crust on the solution surface stops further cooling; the airlift circulators are not adequate to preclude this crust development. The proposed facility was chosen as the most economical

alternate for providing additional bottoms cooling to enhance the operating efficiency and boiloff rate of the 242-T Evaporator system.

V. METHODS OF PERFORMING WORK

It is recommended that: (1) Atlantic Richfield Hanford Company (a) manage the project and (b) perform final instrument testing and calibration work; (2) the onsite Architect-Engineer perform the design and Title III services; and (3) the CPFF Construction Service Contractor physically perform the construction work.

The primary consideration in the recommendation for Atlantic Richfield Hanford Company project management is to assure the operating continuity of the 200 Areas waste tank farms and the Hanford Waste Management Program. The construction work must be performed in an operating facility with the definite potential for encountering radioactive contamination. With special training and experience in this type of work, the CPFF Construction Service Contractor is recommended for performance of the construction activities.

Minor deviations from the above recommended methods of performing work may be made in accordance with policies regularly in effect at Hanford.

VI. EFFECT ON OPERATING CONTINUITY

With closely coordinated work scheduling, it is expected that construction of the proposed facilities can be accomplished without significant interference with tank farm operations, 242-T Evaporator operations, and other Waste Management Program activities. The proposed facilities would enhance the operating continuity of the in-tank solidification phase of the program to assure the meeting of established goal dates.

VII. SPECIAL SAFETY CONSIDERATIONS

The purpose of the in-tank solidification program is to minimize the potential for the loss of radionuclides to the environs by reducing the liquid wastes by evaporation to salt cake for bulk storage in existing underground tanks. The proposed facilities are considered a necessary addition to the in-tank solidification program.

All process piping connections would be made in a concrete pit with remote jumpers. Process leaks would drain back into the underground tank; leak detection instrumentation would automatically shut off the slurry pump. The bottoms recirculation line from the pump pit to the cooler pit would be encased with all welded construction; the line would slope up to the cooler pit with encasement drainage to the pump pit and no traps permitted. Water pressure would be maintained on the cooler shell side so that, should a tube bundle leak develop, no radioactive process solution should enter the shell for discharge to the environs with the cooling water. An audible alarm and interlock would automatically shut off the slurry pump if the slurry side pressure should exceed the water discharge pressure. Further, a radiation monitor with alarm on the cooling water outlet would automatically shut off the slurry pump. The construction materials specified for the proposed process equipment would withstand the erosion and corrosion from the highly alkaline slurries handled for minimizing personnel radiation exposure. Line pluggage is a potential hazard in waste concentrate handling systems; line tracing, insulation, drainage and flush devices would be provided to reduce this hazard to acceptable levels. With no volatile or combustible materials to be handled, the fire and explosion hazards during operation of the proposed facilities would be insignificant. The fissile material concentration in the bottoms is extremely small; with no identifiable mechanism for further concentration, the potential for a criticality incident would be practically nonexistent. The tank pump and cooler pits and the slurry recirculation line would be shielded (18 inches concrete or equivalent) to minimize personnel radiation exposure.

VIII. REMARKS

Early authorization of this project is recommended to assure the operating continuity of the in-tank solidification program and its time schedule commitments.

The project would be responsible for only the original installation and functional operability of the proposed facilities; process testing and any resultant modification work would require funding from other sources.

No additional personnel will be required for the operation and maintenance of the proposed facilities.

This project proposal was prepared by Facilities Planning of Facilities Engineering, Chemical Processing Division, Atlantic Richfield Hanford Company.

Vitro HANFORD ENGINEERING SERVICES
A DIVISION OF VITRO CORPORATION OF AMERICA

PROJECT COST ESTIMATE SUMMARY

CE-0683

TITLE	PROJECT NO.	DATE
242-T EVAPORATOR BOTTOMS COOLER DEMONSTRATION FACILITY	HCP-661	5-1-71
PREPARED FOR	**PREPARED BY**	**CHECKED BY**
ARHCO	R.L.L.	ICL

	DESIGN TITLE I AND II	CONSTRUCTION TITLE III	$ TOTAL
A. ENGINEERING	40,000	5,000	45,000
OPERATING CONTRACTOR	5,000		5,000
ARCHITECT – ENGINEER	35,000	5,000	40,000
OTHER ENGRG. – SPECIFY			
B. CONSTRUCTION			182,000
(1) IMPROVEMENTS TO LAND			
(2) BUILDINGS			
BUILDING NO. ____ ____ SQ. FT.			
BUILDING NO. ____ ____ SQ. FT.			
(3) OTHER (DETACHED) STRUCTURES			
(4) SPECIAL FACILITIES AND INSTAL.		182,000	
(5) UTILITIES			
(6) OPERATING EXPENSE CHGS.			
C. STANDARD EQUIPMENT			
D. CONTINGENCY (APPROX. 22 % A PLUS B PLUS C) AND ESCALATION (APPROX. 1 YRS. AT 10 %)			73,000
E. TRANSFERRED CAPITAL PROP. OR EQUIP.			
		TOTAL PROJECT ESTIMATE	300,000

PROPOSED FUNDS ALLOCATION

FUNDS PURPOSE	OPER. CONTR.	AEC RL
ENGINEERING	45,000	
PROCUREMENT		
CONSTRUCTION	182,000	
CONTINGENCY	73,000	
TCP/TCE		
OTHER		
TOTAL	300,000	

TYPE OF ESTIMATE: Preliminary

APPROVALS	DATE
Roland L. Lysher (ESTIMATING)	31 May 71
M M Raile (ENGINEERING)	5-5-71
[illegible] (FINANCE)	5-18-71

REMARKS

CE-0683

HANFORD ENGINEERING SERVICES
A DIVISION OF VITRO CORPORATION OF AMERICA

PROJECT COST ESTIMATE

PROJECT NO.	TITLE	DATE PREPARED
HCP-661	242-T EVAPORATOR BOTTOMS COOLER DEMON'N FACILITY	5-1-71

CODE	WORK DIRECTED BY CPFF CONSTRUCTION SERVICE CONTRACTOR				
	DESCRIPTION	LABOR	MATERIAL	EQUIP. US.	TOTAL
	Area Preparation & Cleanup	1,400	200	400	2,000
	New Pump Pit	8,500	3,100	900	12,500
	New Cooler Pit	10,000	4,000	1,000	15,000
	Process Recirculation Line	2,500	1,200	300	4,000
	Water Supply & Discharge System	24,300	12,400	2,300	39,000
	Equipment	11,000	31,000	1,000	43,000
	Electrical	3,300	4,100	200	7,600
	Instrumentation	3,500	11,700	200	15,400
	SUB TOTAL "A"	64,500	67,700	6,300	138,500
730	PAYROLL BURDEN 15 %	9,700			9,700
	SUB TOTAL "B"	74,200			
703	SMALL TOOLS	4 %	3,000		
707	D.C. MATERIAL HANDLING	3 %	2,200		
710	LAUNDRY	3 %	2,200		
711	CONSTRUCTION SUPERVISION	8 %	6,000		
712	SWP TIMEKEEPING	4 %	3,000		
780	INSPECTION CHARGES	%			
751	CONTRACTOR INDIRECT AND FEE	18 %	13,400		
	APPLY TO SUBTOTAL "B"			40 %	29,800
	Shop Overhead				2,000
	TOTAL ESTIMATED DIRECT AND OVERHEAD COST				$180,000

HES-19 (1-69) AEC-RL RICHLAND, WASH.

CE-0683

HANFORD ENGINEERING SERVICES
A DIVISION OF VITRO CORPORATION OF AMERICA

PROJECT COST ESTIMATE

PROJECT NO.	TITLE	DATE PREPARED
HCP-661	242-T EVAPORATOR BOTTOMS COOLER DEMONSTRATION FACILITY	5-1-71

CODE	WORK PERFORMED BY OPERATING CONTRACTOR			
	DESCRIPTION	LABOR	MATERIAL	TOTAL
	Calibration & Testing of Instruments	800		800
	(1) SUBTOTAL DIRECT COST	800		800
	(2) OTHER DIRECT COSTS			
	(3) INDIRECT COSTS (150 % OF LABOR – ITEM 1)			1,200
	(4) TOTAL OPERATING CONTRACTOR'S COST			2,000

PAGE 3 OF 3

HES-20 (10-68) AEC-RL RICHLAND, WASH.

HCP-661
CE-0683

242-T EVAPORATOR BOTTOMS COOLER
DEMONSTRATION FACILITY

UNIT COST SUMMARY:

Description	Unit	Unit Cost	Total
Area Preparation & Cleanup		LS	$ 4,500
New Pump Pit	1	Ea	18,000
New Cooler Pit	1	Ea	21,000
Process Recirculation Line		LS	5,500
Water Supply & Discharge System		LS	52,000
Equipment		LS	51,000
Electrical		LS	10,000
Instrumentation		LS	18,000
Instrument Calibration & Testing		LS	2,000
TOTAL Estimated Direct & Overhead Cost			$182,000

NOTE: The above estimated cost should not be used to delineate the scope of the work.

RLL:vm
Date: 5-1-71

PROJECT PROPOSAL

Atlantic Richfield Hanford Company

CHEMICAL PROCESSING DIVISION

ARH-2026

INTER-DIVISION SUPPLEMENTAL APPROVAL SHEET

DATE May 26, 1971

PROJECT NO. HCP-661 REV. NO. 0

TITLE

PROJECT PROPOSAL
242-T EVAPORATOR BOTTOMS
COOLER DEMONSTRATION FACILITY

PREPARED BY Dean E. Braden 5-13-71
Facilities Planning DATE

APPROVED

D R Gustavson 5-14-71
Project Management DATE

J B Techt 5-14-71
Process Design Engineering DATE

G E Backman 5/17/71
Personnel Protection DATE

Clyde R Bergdahl 5/20/71
Work Review DATE

E M Hobbs 5-18-71
Financial DATE

J B Techt 5-24-71
Facilities Engineering DATE

Paul W Smith 5-20-71
Operations Support Engineering DATE

M K Harmon 5-21-71
Production DATE

H T Shaw 5-24-71
Manufacturing DATE

J W Warren 5-25-71
Operations and Waste Management Coordination DATE

C W Malody 5/18/71
Purex, Waste Encapsulation and Solidification Date

L W Jones 5/13/71
Facilities Planning Date

BM-6400-008.1 (8-67)
AEC-RL RICHLAND, WASH.