Atlantic Richfield Hanford Company
Richland, Washington 99352

ARH-CD-804

CONCEPTUAL DESIGN REPORT
244-S CATCH STATION

NOTICE

J. S. Garfield

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October 15, 1976

PREPARED FOR THE U.S. ENERGY RESEARCH AND DEVELOPMENT
ADMINISTRATION UNDER CONTRACT E (45-1) 2130

MASTER

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**CONCEPTUAL DESIGN REPORT
244-S CATCH STATION**

J. S. Garfield

**Conceptual Design Engineering
Development Engineering Department
Research and Engineering Division**

October 15, 1976

**Operated for the Energy Research and Development Administration
by Atlantic Richfield Hanford Company under Contract EY-76-C-06-2130**

CONCEPTUAL DESIGN REPORT
244-S CATCH STATION

J. S. Garfield

Conceptual Design Engineering
Development Engineering Department
Research and Engineering Division

October 15, 1976

This document has been reviewed and approved as a basis for project action:

Submitted by:

Robert A. Yoder
Manager - Conceptual Design Engineering

12-16-76
Date

Approved by:

RC Raal
Development Engineering Department
Atlantic Richfield Hanford Company

12/22/76
Date

Approved by:

J. Adams
U. S. Energy Research and
Development Administration
Richland Operations Office

3/22/76
Date

SUPPLEMENTAL APPROVAL SHEET
CONCEPTUAL DESIGN REPORT
244-S CATCH STATION

To: R. C. Roal
From: *R.G. Yoder*
R. A. Yoder

Document ARH-CD-804, "Conceptual Design Report - 244-S Catch Station,"
October 15, 1976, has been approved by the following project representatives.

R. C. Roal

Tank Farm Operations

18 NOV 76

Date

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R. G. Yoder

Engineering

11-22-76

Date

12/5 *H. C. Huff*

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12-7-76

Date

A. J. Larson

Quality Assurance

11/15/76

Date

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Environmental and Occupational Safety

12/1/76

Date

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CONCEPTUAL DESIGN REPORT 244-S CATCH STATION

1.0 PROJECT SYNOPSIS

This report describes the conceptual design for the 244-S Catch Station based on the functional criteria (reference 1). The facilities described in this project will provide a direct route from the 241-S-151 and 241-U-151 Diversion Boxes to the 241-SY Tanks. The 244-S Catch Station will consist of a 20,000 gallon primary tank contained within a concrete vault lined with carbon steel. Encased three-inch carbon steel process lines will be extended to the catch station pump pit from the 241-SY Tank Farm, the 241-S-151 Diversion Box and the 241-U-151 Diversion Box encasement. The facility will have its own ventilation system for exhausting the primary tank and the annulus area. A small instrument shack will house locally mounted instrumentation and controls. Existing designs for Project B-103 will be used where similarities exist (H-2-38200). The project is expected to cost \$1,900,000 and require 19 months for the initiation of Title I design until construction is complete.

2.0 JUSTIFICATION

The facilities described in this report will serve to reduce the number of active single-shell tanks in 200 West Area by providing an encased route to the double-shell 242-S Evaporator Feed Tank (241-SY-102) from the Redox Lab, T Plant, and the existing 204-S customer waste unloading facility which will be replaced after construction of Project B-133. The piping will also provide a route connecting the cross country pipeline to 200 East Area with any 241-SY Tank. Since the 241-SY Tank Farm is hydraulically higher than portions of the routes to the farm, a trap is formed which must be drained to the catch station. When the volume of liquor drained back approaches the capacity of the catch tank, the contents can be pumped to the 241-SY-102 Feed Tank.

3.0 SITE LOCATION

The 244-S Catch Station will be located between the 241-S-151 Diversion Box and the 241-SY Tank Farm on the east side of the 241-S Tank Farm. Piping and tank locations are shown on the attached plot plan SK-2-22587.

4.0 CONSTRUCTION

4.1 CATCH STATION

The 244-S Catch Station will consist of a primary tank surrounded by a secondary containment vessel (vault) with access ports for pumps, instrumentation, and ventilation piping on top of the vault. In the event of a primary tank leak the vault floor will drain the leakage to a sump equipped for pump out. The primary tank will contain drain back from process transfer lines.

4.1.1 Tank Vault

A reinforced rectangular concrete vault lined with carbon steel on the bottom and sides will be designed to contain any potential leakage to solution from the primary vessel. The carbon steel liner will extend high enough on the walls of the vault to contain the contents of the primary tank. The vault will be designed to contain an existing tank currently located in the 211-T Tank Farm (CVI 71511). The vault floor will slope toward a sump located directly below the pump pit. The sump pump and leak detection equipment will enter the vault through the pump pit. The sump riser flange will be equipped with a sample access port. Two six-inch risers will be used to visually inspect the vault. A manhole in the pump pit floor will provide access to the vault for nonroutine entry.

4.1.2 Primary Tank

The primary tank will be an existing carbon steel tank SQ-145 (CVI 71511) located in the 211-T Tank Farm and supplied by Atlantic Richfield Hanford Company (ARHCO). This tank is 10 feet in diameter and 33 feet long with spherical ends having a radius of 10 feet. The volume is approximately 20,000 gallons. The steel in the tank is class A-10 or A-70. Since the tank was originally installed the ASTM classifications A-10 and A-70 have been discontinued and replaced by A-283 and A-285 respectively. The existing manhole will be modified with a remote pump flange to receive a transfer pump. The plug valve assemble will be removed and the drain nozzle will be cut off flush with the tank and sealed by welding. In addition to the necessary instrumentation penetrations, the primary tank will be equipped with the following three-inch piping:

- drains for the pump pit and filter pit
- two process nozzles for line drain back
- two spare nozzles, one of which will serve as the sample access

A four-inch ventilation line will extend from the primary tank to the filter pit. Other existing nozzles or risers not used for the above needs will be cut flush with the tank and sealed by welding.

4.1.3 Pump Pit

All process piping and drain piping routing to the primary tank will go through the pump pit. Nozzles and flanges discussed in Section 4.1.2 will be secured to the floor of the pump pit. The annulus sump pump, the weight factor and specific gravity lines, and the sump leak detection will enter the annulus through risers in the pump pit floor. Process lines will be connected to wall mounted remote nozzles.

The pump pit will be located over the risers entering the primary tank and the vault sump. Any leakage in the pump pit will drain through a floor drain and a seal loop to the primary tank.

Piping and spray nozzles for the decontamination of the pump and rotating equipment housed within the pump pit will be fabricated into the pump pit structure and connected to hose bibs external to the pit. Spray rings will be used to decontaminate the pump as it is removed from the tank by jets directed internally within the pump riser. Design consideration will be given to providing a means of total containment during the removal of contaminated equipment. The pump pit floor will be decontaminated by overlapping sprays from nozzles in the walls of the pit.

The pump pit will be a reinforced concrete structure designed in accordance with all seismic and loading criteria contained in the functional criteria, ARH-CD-705. Cover blocks will be designed to attenuate radiation to 0.5 milliroentgen per hour (mR/hr) at the surface assuming jumpers and the primary tank contain waste with a cesium-137 concentration of three curies per gallon.

4.1.4 Flush Pit

The components for mixing steam and water for back flushing the pump and for decontamination will be located in a pit next to the 244-S Catch Station. The pit will be similar in design to the flush pit depicted in H-2-46206 (not included). The piping layout will have all the safety components shown in H-2-46206 and two hot water outlets: one connected to a nozzle in the pump pit and the other terminating in the hose bib within the flush pit. The pipe and components will be contained in corrugated, galvanized metal pipe with a concrete floor. Pit drainage will be through a seal loop into the pump pit.

4.1.5 Ventilation Components

The filter pit and ventilation components will be similar or identical to the 244-A Lift Station. Existing designs will be used for the filter pit and all ventilation components wherever possible (H-2-38233, 38234, 38235, 38214, 38215). The inlet air to the vault will be drawn by the exhaust fan through a HEPA filter and a heater while the tank will be supplied by air in-leakage from the vault. The filter pit will house the high efficiency particulate air (HEPA) filters. In-place testing capability of the HEPA filters will be provided. A stack sampler will be provided to monitor radiation in the exhaust air. The sampler will be interlocked with the exhaust fan to shut down on high radiation.

4.2 PROCESS PIPING

Process piping will be routed as shown on the attached plot plan. The routings will include five major components:

1. One line connecting line V456 in the 241-U-151 Diversion Box encasement with the 244-S Pump Pit.
2. One line connecting nozzle C₁ in the 241-S-151 Diversion Box with the 244-S Pump Pit.
3. One line connecting nozzle C₂ in the 241-S-151 Diversion Box with the 244-S Pump Pit.
4. One line extending from the 244-S Pump Pit to nozzle L-15 in the 241-SY-A Valve Pit.
5. One line extending from the 244-S Pump Pit to nozzle R-15 in the 241-SY-B Valve Pit.

All process lines will be encased but not heat traced. The process piping will be constructed with three-inch schedule 40 ASTM A53 seamless carbon steel pipe. The encasement piping will be constructed with six-inch schedule 40 ASTM A53 seamless carbon steel pipe. All process lines will maintain a minimum average slope of 0.25 percent and drain toward the 244-S Pump Pit. All buried piping will be wrapped with a suitable material for corrosion protection and have a minimum of 36-inches of earth cover. Each line will be equipped with a test riser and encasement drain at the low end and an encasement hydrotest riser at the upper end. The 1-1/2 inch encasement drains will terminate in the pump pit. The process piping will be designed in accordance with American National Standards Institute (ANSI) B31.1 to withstand a maximum pressure of 275 pounds per square inch gauge (psig) at 200° F and 100 psig saturated steam purging.

4.2.1 Jumpers

Jumpers in the pump pit and filter pit will be provided to physically obtain the nozzle connections and valving requirements shown in the attached flow diagram (SK-2-22689). Five process jumpers and six instrumentation and electrical jumpers will be required in the pump pit. Seven jumpers will be required in the ventilation pit (H-2-38233).

The following jumpers will be required in other diversion boxes:

<u>240-S-151:</u>	Redox Lab Waste,	U7 to L5
	Customer Waste,	U17 to L17
<u>241-S-151:</u>	Redox Lab Waste,	U16 to C ₂
	Customer Waste,	U6 to C ₁
	Cross Country Transfers,	U3 to C ₁

Before fabrication of the jumpers in the diversion boxes existing jumpers will be reviewed to determine if there are rigid or flex jumpers available which can be used in the place of new jumpers.

The following jumpers will be required in the 241-SY Valve Pits:

241-SY-A: L15 to D nozzle of an existing jumper (H-2-46231)

241-SY-B: A jumper will be provided containing two three-way ball valves connecting nozzles R14, R15, D nozzle and F Nozzle (see H-2-37779)

All process jumpers will be fabricated, tested, and assembled in accordance with the latest revision of HWS-5786.

4.2.2 Pumps

Two pumps will be supplied by this project. The primary tank will require a modified turbine pump which extends from the floor of the pump pit to the bottom of the tank. The vault sump pump will be a submersible pump which would be operable even in the event of a catastrophic loss of liquid from the tank to the vault. The tank pump and sump pump will be rated at 100 and 30 gallons per minute, respectively, with adequate head to pump into the 241-SY Tanks.

4.3 INSTRUMENTATION

Locally mounted instrumentation components will be housed in a suitable weatherproof building located near the 244-S Catch Station (H-2-38206). All alarms and controls integral to the operability and safety of the 244-S Catch Station will be mounted in the 242-S Evaporator Control Room. The instrumentation required and the location, whether locally mounted or mounted in the 242-S Evaporator Control Room, will be similar to that shown on drawing H-2-38217.

4.4 UTILITIES

4.4.1 Steam and Water

Steam and raw water will be obtained from existing lines in the 241-S Tank Farm as shown on SK-2-22587.

4.4.2 Compressed Air

Compressed dry air will be provided to operate instrumentation by either a small local compressor or by piping instrument air from the 242-S Evaporator Building.

4.4.3 Electrical

Electrical power will be obtained from the 241-S or SX Tank Farms for instrumentation, pumps, ventilation, lighting, and outlets.

4.5 CIVIL

Contamination may be encountered in portions of the excavation near the 216-S-3 and 216-S-15 condensate cribs. Although it is likely that the excavation will not be hindered, a retaining wall could be used to leave the crib area undisturbed. Information on the cribs can be obtained from ARH-2155.

A new gravel access road into the 241-SY Tank Farm will be required during interim construction period for operating equipment. A portion of the road location must be rerouted permanently to bypass the catch station.

All ground work supporting piping, the vault, or pits will be compacted and tested to verify proper compaction.

4.6 LEAK DETECTION

Leak detectors will be installed in the vault sump and the pump pit. The pump pit leak detector will be interlocked with the primary pump to shut down in the event of a leak. Each process line will be provided with a test riser to detect contamination leakage from the main process line in the pipe encasements. The vault air will be sampled with the apparatus shown on SK-2-22689.

5.0 SAFETY AND POLLUTION CONSIDERATIONS

5.1 RADIATION

Earth cover over buried piping and cover blocks over pits will be designed to attenuate radiation to less than 0.5 mR/hr assuming a cesium-137 concentration of three curies per gallon. Ventilation through HEPA filters will be provided for the tank and vault.

5.2 PROCESS LINE AND TANK LEAKAGE

Buried piping will be encased within a secondary pipe which drains to the pump pit. The primary tank will be contained within a concrete vault lined with carbon steel. The design philosophy calls for a secondary barrier to collect and detect any leakage that could occur from primary vessels or pipes containing radioactive alkaline liquid.

5.3 WIND

Above ground facilities will be in compliance with the Uniform Building Code, Section 2308. The tank vault, piping, and ventilation systems are all below ground and not subject to wind loads.

5.4 SEISMIC

The primary tank, vault, pump pit, and process lines will be capable of withstanding earthquake criteria defined in Hanford Plant Standards Standard Design Criteria SDC 4.1, Category I. Other facilities will comply with criteria in the Uniform Building Code for seismic Zone II.

5.5 CONSTRUCTION AND OPERATION

Hazards associated with the construction and operation of these facilities are routinely encountered in similar projects. Contamination during excavation will require surveillance by radiation monitoring. A retaining wall may be required in the vicinity of the 216-S-3 and S-15 cribs. No new or unique hazards are expected to be encountered.

6.0 QUALITY ASSURANCE

Quality assurance (QA) activities for all contractors involved in the design, construction, and testing of the new facilities shall be formulated and executed to assure that the design, construction, and testing will be accomplished in a manner such that all components will perform as required for safe and reliable process operation.

Three levels have been established for classifying structures and components according to the degree of quality assurance required by safety consideration for system design as defined in reference 2. Components of this project are classified as follows:

- Level I - Tank structures (including concrete, primary tank and vault liner) pump pit, filter pit, (including pit covers, embedded piping, and caissons) pipe encasements, instrumentation for radiation leak detection, and the ventilation system components up to and including the HEPA filters.
- Level II - Encased piping, ventilation systems components not in Level I tank risers, instrumentation (including electrical interlocks), pumps, remote pit jumpers and electrical equipment.

Level III - Raw water, steam, and compressed air piping and components, and civil groundwork.

7.0 REGULATIONS, CODES, STANDARDS, AND GUIDES

Design and construction shall be in accordance with the following regulations, codes, and standards.

- ° Energy Research and Development Administration (ERDA) Manual Chapter 6101, "Administration of the Construction Program"
- ° ERDA Manual Chapter Appendix 6301, "General Design Criteria"
- ° ERDA Manual Chapter 0550, "Operational Safety Standards"
- ° ERDA Manual Chapter 0524, "Standards for Radiation Protection"
- ° ERDA Manual Chapter 0511, "Radioactive Waste Management"
- ° American National Standards Institute Standards B31.1 and N13.1
- ° HWS-5786, "Specification for Jumper Fabrication"

Applicable Hanford Plant Standards shall be used.

8.0 ENVIRONMENTAL PROTECTION

The design of the new facilities will be consistent with applicable guides and standards which invoke concentration limits for radioactive materials at the stack exhaust. The only normal releases to the environment by the facilities will be via the exhaust ventilation system which has two stages of HEPA filters and monitors to alert to off standard releases. No chemical, toxic, or noxious salts will be released from these facilities.

9.0 REFERENCES

1. ARH-CD-705 (unclassified), June 23, 1976, J. S. Garfield, "Functional Design Criteria - 244-S Catch Station."
2. ARH-MA-150 (unclassified), January 10, 1975, "ARHCO Quality Assurance Policy Manual."

VITRO ENGINEERING CORPORATION
Architects • Engineers

APPENDIX A

PROJECT COST ESTIMATE SUMMARY

TITLE Catch Station 244-S		PREPARED FOR ARHCO		PREPARED BY DGH	CHECKED BY MM	PROJECT NO. CK-0223	DATE 12-17-76
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	TITLE I			TITLE II			TITLE III			TOTAL		
A. ENGINEERING												
ARCHITECT - ENGINEER	16,000			139,200			101,100			256,300		
OTHER ENGINEERING - SPECIFY												
SUBTOTAL	16,000			139,200			101,100			256,300		
ESCALATION	3 %	7 %	17 %	500			9,800			17,200		
CONTINGENCY	20 %	20 %	20 %	3,300			29,800			23,700		
SUBTOTAL ENGINEERING	19,800			178,800			142,000			340,600		
OPERATING CONTRACTOR												
TOTAL A	340,600											
B. CONSTRUCTION												
(1) IMPROVEMENTS TO LAND												
(2) BUILDINGS												
BUILDING NO. _____ SQ. FT.												
BUILDING NO. _____ SQ. FT.												
(3) OTHER (DETACHED) STRUCTURES												
(4) SPECIAL FACILITIES AND INSTAL.												
(5) UTILITIES												
(6) OPERATING EXPENSE CHARGES												
(7) CONTRACT ADMINISTRATION												
(8) WASHINGTON STATE TAX												
SUBTOTAL	468,600											
ESCALATION 14 % @ _____ YEARS	631,100											
CONTINGENCY 20.6 % Ave.	23,400											
TOTAL B	10,300											
C. STANDARD EQUIPMENT												
TOTAL C	1,133,400											
D. TRANSFERRED CAPITAL PROP. OR EQUIPMENT												
TOTAL D	159,200											
	266,800											
	1,559,400											
CURRENT ENR. COST INDEX												
BUILDING 1484.1	CONSTRUCTION 2489.7											
TOTAL PROJECT ESTIMATE \$ 1,900,000												

[Fixed Price Constr.
CPAF Constr.

PROPOSED FUNDS ALLOCATION			TYPE OF ESTIMATE: Budget		REMARKS:
FUNDS PURPOSE	OPER. CONTR.	ERDA - RL	APPROVALS	DATE	
ENGINEERING	256,300		 R. Anderson ESTIMATING	12-17-76	
PROCUREMENT					
CONSTRUCTION	1,123,100				
ESCALATION	186,700				
CONTINGENCY	323,600				
TCP/TCE			PROJECT MANAGER		
WASH. STATE TAX	10,300		CLIENT ENGINEER		
TOTAL	1,900,000				

PROJECT TITLE 244 S CATCH STATION

DATE 11/11/76

PROJECT NUMBER CK-0223

REVISION NO. 1-0

PROJECT SCHEDULE USED FOR ESTIMATE

FISCAL YEAR																
CALENDAR YEAR	1976				1977				1978							
TITLE I				H												
TITLE II																
TITLE III																

REMARKS
Esc. Title I = 3%
Esc. Title II = 7%
Esc. Title III = 17%

ESCALATION
76 2 Mo @ .79 = 1.58
77 12 " " .83 = 9.96
78 3 " " .83 = 2.49

14.03

SAY 14%