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④ ENGINEERING DATA TRANSMITTAL

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1	1	Design Agent KD Hein [signature] 01/27/00 S7-12	1	1	LJ Kripps [signature] 3/9/00 R1-44
1	1	Cog. Eng. GD Johnson [signature] 3/9/00 [illegible] R1-44	1	1	GD Johnson [signature] 3-9-00 R1-44
1	1	Cog. Mgr. RJ Cash [signature] 3/13/00 [illegible] R1-44			
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L. J. Kripps (10)	R1-44				
K. V. Scott	H3-28				

ENGINEERING STUDY TO SUPPORT RESOLUTION OF THE FLAMMABLE GAS USQ FOR CATCH TANKS

G. D. Johnson
CH2M HILL Hanford Group, Inc., Richland, Washington 99352
Richland, WA 99352
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ENGINEERING STUDY TO SUPPORT RESOLUTION OF THE FLAMMABLE GAS USQ FOR CATCH TANKS

Prepared by:
COGEMA Engineering Corporation
P.O. Box 840
Richland, Washington 99352

Author:
K. D. Hein

Prepared for:
CH2M HILL Hanford Group, Inc.
Richland, Washington 99352
Contract Number 4848, Release 45

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COGEMA
ENGINEERING CORP.

Engineering Study To Support Resolution Of The Flammable Gas USQ For Catch Tanks

Signature: K V Scott / for
Author, K. D. Hein,
Date: 3/8/00

Signature: K V Scott
Reviewed and Approved by, K. V. Scott,
Date: 3/8/00

Signature: Mark O. Rickerbach for
Reviewed and Approved by:
J. J. Zimmer, Director Engineering & Technology
Date: 3/8/00

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ACRONYM LIST

ALARA	as low as reasonably achievable
FGM	flammable gas meter
HEPA	high-efficiency particulate air (filter)
LFL	lower flammability limit
NOC	notice of construction
O&M	operations and maintenance
PFP	Plutonium Finishing Plant
PUREX	Plutonium-Uranium Extraction Plant
ROM	rough order of magnitude
RPP	River Protection Project
SHMS	Standard Hydrogen Monitoring System
TEDF	Treated Effluent Disposal Facility
USQ	Unreviewed Safety Question

1.0 PURPOSE

Thirteen small tanks associated with the Hanford Site tank farms, generally referred to as "catch tanks," need to be assessed to close the Unreviewed Safety Question (USQ) for flammable gas issues. Catch tanks act as secondary containment for transfer lines, seal loops, and diversion boxes. This study was established to identify possible flammable gas monitoring and ventilation system alternatives to ensure adequate removal of flammable gases from catch tanks to support closure of the Flammable Gas USQ, USQ-TF-96-0433 (WHC, 1996b). A preliminary analysis is used to compare and analyze these alternatives on a tank-by-tank basis.

2.0 SCOPE

The scope of this study is to evaluate viable alternatives for ventilating and monitoring flammable gases within tank farm catch tanks. The catch tanks applicable to this study contain or will contain radioactive waste. A list of River Protection Project (RPP) catch tanks and related information is shown in Table 1. This study concludes with a relative ranking process, based on factors such as future need, cost and schedule.

3.0 BACKGROUND

The volume and waste constituents of the materials in these tanks vary greatly, depending on the operational needs of the tank farm facilities. Most of these tanks are expected to contain small amounts of organic chemicals and low levels of radioactivity. Therefore, flammable gases could be generated and accumulate in these tanks.

The ventilation rates in the catch tanks are not known and are expected to vary. Some tanks are passively ventilated, while others are actively ventilated (e.g.,702-AZ). The passively ventilated tanks may have either breather filters or may be connected to other systems.

The effectiveness of the tank ventilation system in maintaining flammable gas inventory within acceptable limits is currently not determined through direct measurement means, as there are no installed monitoring systems for measurement of flammable gas concentrations within the head space of the catch tanks. The flammable gas hazards in the catch tanks could be reduced by implementing modifications that enhance the ability to periodically or continuously sample and monitor flammable gas concentrations within the tank vapor space (e.g., installation of a Standard Hydrogen Monitoring System [SHMS]) and also by providing additional ventilation.

Table 1. Catch Tanks and Related Information

ITEM NO.	Tank ID #	AGE (YRS)	Historic Usage	Capacity (GAL)	Construction Material	Active Ventilation & Method
1	241-A-302A	45	Drainage from 241-A-151 DB	8400	Carbon Steel	None
2	241-A-350	21	Drainage from A-FARM	800	SS	None
3	241-A-417	40	Drainage from 241-AY/AZ Ventilation	44,000	Concrete vault, carbon steel liner	None
4	241-AX-152	37	Drainage from 241-AX-155 Diversion Station, DB 241-AX-155, AY-501 and 702-A seal pot	11,000	Concrete vault, SS liner	Indirectly from 702-AZ system
5	241-AZ-151	27	Drainage from 241-AZ-152 DB, AZ Vemt, Loop seals LD pits, 801-AZ instr bld, precip/runoff	12,000	Concrete vault, carbon steel liner	Indirectly From 702-AZ System
6	241-AZ-154	27	Drainage from AZ-101/102 Steam Coils, precip/runoff	900	Concrete vault, carbon steel liner	Indirectly from 702-AZ system
7	241-ER-311	45	Drainage from DB's 151/152-ER	18,000	SS	None
8	204-AR-TK-1	19	Drainage from 204-AR Waste unloading facility	1500	SS	204-AR-waste unloading facility system
9	241-S-304	8	Drainage from 241-S-151 DB and precip/runoff	6000	Carbon steel	None
10	241-TX-302C	52	Drainage from 241-TX-154 DB and precip/runoff	18,000	Carbon steel	None
11	241-U-301B	55	Drainage from DB'S 241-U-151, -U-152, -U-153 and –U-252	36,000	Concrete (unlined)	None
12	241-UX-302A	52	Drainage from 241-UX-154 DB, 291-U stack and precip/runoff	18,000	Carbon steel	None
13	241-EW-151	44	Drainage from Former x-site transfer vent station	800	Concrete, SS liner	None

DB = Diversion Box
SS=Stainless Steel

4.0 METHODOLOGY

The selection of alternatives was done by engineering evaluation of the existing systems to identify improvements that are technically possible to implement. Flammable gas concentrations within the catch tanks are required to be maintained below 25 percent of the lower flammability limit (LFL) (LMHC, 1998a). Demonstration in satisfying this requirement can be improved to varying degrees by:

- monitored flammable gas concentration
- enhanced exhaust flow measurement capability
- increased air flow.

Selected flammable gas monitoring and ventilation system modification alternatives are geared to meet one or more of these functions. Alternatives are presented using a graded approach to modifications and component installations.

An evaluation was conducted to compare the selected alternatives in relation to.

- Cost
- Schedule (duration)
- Operability and Maintainability
- Technical Feasibility
- Desired Service Life
- ALARA (as low as reasonably achievable) Concerns

The results of this study will be used to recommend possible design modifications to catch tanks to support closure of the Flammable Gas USQ.

5.0 ASSUMPTIONS

The following basic assumptions were made regarding the selection and evaluation of alternatives in this study:

- The information in this study will be used as part of a control decision.
- Since this document presents order-of-magnitude cost information, detailed costs for the alternatives will be developed at a later date.
- This document considers elements of design, procurement, fabrication, installation of system alternatives and life cycle costs for operation, maintenance, and closure.

6.0 EVALUATED ALTERNATIVES

The subject tanks have significantly different designs. They vary in age, from 8 to 55 years, and in size, from approximately 800 to 44,000 gallons (LMHC, 1999a). Diverse construction materials were used, including carbon steel, stainless steel, and concrete, with some concrete vaults having steel liners. Some tanks have ready access through risers or associated pump pit drain lines, while others are direct-buried and may have some or all risers undergrade. Considering these design differences, no single scenario and sampling routine could apply to all tanks being evaluated.

Also for the purposes of this evaluation, installation and use of a SHMS unit was preferred for permanent monitoring applications. A flammable gas meter (FGM) will be used for periodic sampling applications. SHMS units may be available for continuous monitoring, thereby saving procurement costs, however, costs for procuring and fabricating new units were included in the estimates. A SHMS has much more capability than a FGM in qualifying and quantifying constituent gases. Also, the reliability, operability, and maintainability of a SHMS have been proven through extensive use at tank farms. Furthermore, a SHMS spare parts program is active, and operations and maintenance procedures are fully developed.

Determination of the frequency of periodic sampling and monitoring necessary to address potential flammable gas concerns is not in the scope of this evaluation.

Periodic sampling and monitoring are considered methods to address the flammable gas issue. Determination of the effectiveness of periodic sampling and monitoring, especially before, during, and after waste additions, may preclude any need to conduct continuous monitoring for flammable gas in the catch tanks.

6.1 ALTERNATIVE NO. 1 INSTALL SAMPLE PROBES AND CONNECTIONS FOR PERIODIC VAPOR SPACE SAMPLING/MONITORING.

Alternative No.1 provides access capability for periodic vapor sampling and monitoring of the tank vapor space for flammable gas concentrations, using existing tank penetrations where possible. This alternative would install both the necessary probes and sample lines through tank penetrations and the aboveground connections for attachment and use of portable FGM units.

6.2 ALTERNATIVE NO. 2 INSTALL SHMS FOR CONTINUOUS MONITORING OF TANK VAPOR SPACE

Alternative No. 2 installs a SHMS to directly and continuously monitor flammable gas concentrations within the tank vapor space. This alternative includes Alternative No. 1, with the fixed installation and connection of a SHMS unit, along with sample withdrawal and return configurations.

6.3 ALTERNATIVE NO. 3 INSTALL NEW BREATHER FILTER PLUS SAMPLE PROBES AND CONNECTIONS FOR PERIODIC VAPOR SPACE SAMPLING/MONITORING

Alternative No. 3 installs sample probes and connections to provide access for periodic vapor sampling and monitoring of the tank vapor space (Alternative No. 1) and a new breather filter. A Y-adapter would be employed such that only a single riser is needed. This alternative would provide both increased airflow capacities through the tank and the capability to monitor flammable gas concentration within the tank vapor space.

6.4 ALTERNATIVE NO.4 INSTALL NEW BREATHER FILTER AND SAMPLE PROBES AND CONNECTIONS FOR CONTINUOUS VAPOR SPACE SAMPLING/MONITORING (SHMS)

Alternative No. 4 installs a SHMS to directly and continuously monitor flammable gas concentrations within the tank vapor space and a new breather filter. This alternative would provide both increased airflow capacities through the tank and the capability to monitor flammable gas concentration within the tank vapor space.

6.5 ALTERNATIVE NO. 5 INSTALL PORTABLE EXHAUSTER WITH NEW BREATHER FILTER AND PERMANENT SHMS UNIT

Alternative No. 5 installs a portable exhauster, breather filter and a SHMS for permanent flammable gas monitoring. This would provide increased airflow through the tank, independent flow measurement capability and flow control for ventilation streams, and continuous flammable gas concentration measurement for the primary tank.

7.0 EVALUATION

The alternatives were evaluated and ranked relative to each other for each of six decision criteria: cost, schedule, technical feasibility, ALARA concerns, operability and maintainability, and desired service life. The alternatives were given a score of 1 through 5 for each criterion, with 5 being the best score. The scores were given without consideration to individual tank needs. Table 2 presents the ranking of the alternatives. The performance of each alternative was evaluated with respect to the individual criteria and in relation to the other alternatives. The total score for each alternative is the summation of the scores for each evaluation criterion and is shown in Table No.3.

TABLE 2. ALTERNATIVES RANKING

Alternative #	System Description	Criteria Number						
		1	2	3	4	5	6	XXXXXX
		Cost	Schedule	Technical Feasibility	ALARA	Operable & Maintainable	Desired Service Life	Total
1	Install Probes and Connections for Periodic Vapor Space Sampling/Monitoring with a FGM	5	5	5	5	4	5	29
2	Install SHMS and Connections for Continuous Monitoring of Tank Vapor Space	3	3	4	3	5	4	22
3	Install New Breather Filter plus Probes and Connections for Periodic Vapor Space Sampling/Monitoring with a FGM	4	4	3	4	2	3	20
4	Install New Breather Filter plus Install SHMS and Connections for Continuous Monitoring of Tank Vapor Space	2	2	2	2	3	2	13
5	Install Portable Exhauster with New Breather Filter and Permanent SHMS Unit	1	1	1	1	1	1	6

7.1 RANKING JUSTIFICATION DETAILS

The decision criteria are described in the following sections.

7.1.1 Cost

Rough order of magnitude (ROM) cost estimates that focused on construction and engineering costs were developed for each alternative. A cost comparison was performed among the selected alternatives. Included are ROM costs associated with design, review, procurement, fabrication, testing, installation, operations and maintenance procedures, and operational acceptance.

It is assumed that the selected alternative will be applied to all necessary catch tanks; therefore, a single average cost is provided for each alternative. The significant design differences between the catch tanks, specifically tank accessibility and penetration availability, may produce slightly different costs for certain activities.

7.1.2 Schedule

A comparison of alternatives was performed with respect to the time to implement or duration. This criterion is important because of its relationship to both the remaining mission life of each of catch tank and the ability to compete with other work for the necessary resources. Included in the schedule are the durations for design, procurement, installation, procedure development, and start-up testing.

7.1.3 Technical Feasibility

This criterion includes a comparison of the technical feasibility for each alternative with respect to complexity of design and field installation. Certain alternatives may require new designs and fabrications, while others will make use of existing and proven designs.

7.1.4 ALARA Concerns

A comparison was performed between the various installation and operation activities in regards to potential radiation exposure to construction crews, operators, and maintenance crews.

7.1.5 Operability and Maintainability

This criterion includes a comparison of the operations and maintenance (O&M) load resulting from installation of the various alternatives. O&M are assessed by the complexity of access, testing, reliability, and repairability of the associated systems and components.

7.1.6 Desired Service Life

A comparison of alternatives was performed for the ability of the implemented alternative to remain active throughout the expected mission of each catch tank. Factors such as wear and tear, transporting, storage and weatherization were considered for evaluating the alternatives.

7.2 ALTERNATIVE EVALUATION DETAILS

Each alternative and its associated evaluation details are discussed in this section.

7.2.1 Alternative No.1

Alternative No. 1 scored the highest for cost criteria because of relative simplicity of design work and sample line connections on the catch tanks. The estimated unit cost for implementation of this alternative is $173K. See Table 3 for individual tank cost details.

Alternative No.1 scored the highest for schedule. Schedule duration for some catch tanks may be slightly longer because of increased complexity of design work and sample line connections, though it is not anticipated that this would be significant. The average schedule duration for implementation of this alternative is 13 weeks.

Alternative No.1 presents the lowest risk for exposure of all the alternatives. Virtually no maintenance would be required for a system of installed probes, tubing, connections, etc Even with periodic sampling evolutions, Alternative No.1 presents the lowest potential for significant increase in operational and maintenance activities.

7.2.2 Alternative No. 2

Alternative No.2 scored third highest for cost with a unit cost of $446K. This estimate includes the work to procure SHMS units at $180K per unit. Costs for tanks without grade-level access are expected to be substantially more because increased design work, excavation, welding, and possibly pit entry are required to configure a system that would provide grade-level access and sample return for continuous tank vapor space sample withdrawal. See Table 4 for individual tank cost details.

Alternative No.2 scored third highest for the schedule criteria with estimated unit schedule duration of 32 weeks. These schedule estimates include the work to procure, fabricate, and install SHMS units. The schedule durations for catch tanks without convenient access would be more per unit. This is because increased design work, excavation, welding, and pit entry would be required to configure a system which provides grade-level access and sample return for continuous tank vapor space sample withdrawal.

Both cost and schedule for Alternative No.2 could be reduced if a spare SHMS unit were to become available for use. A spare unit would eliminate procurement time and fabrication costs associated with acquiring a new SHMS unit.

Alternative No.2 makes use of existing SHMS maintenance routines and spare parts, but provision of sample return to the tank from SHMS may require tank penetrations. Also, Alternative No.2 uses a proven operational and maintenance program for SHMS units.

7.2.3 Alternative No. 3

Alternative No. 3 scored second highest for the cost decision criteria. The estimated unit cost for this alternative is $286K for any tank using an existing breather filter design with tank penetrations accessible at grade level. Tanks requiring design work, excavation, welding, and pit entry will require substantially more money. See Table 5 for individual tank cost details.

Alternative No.3 scored second highest for the schedule decision criteria. The average estimated schedule duration for this alternative is 30 weeks per unit. For those tanks without existing penetrations the schedule would be longer because increased design work, excavation, welding, and pit entry may be required to configure a system that provides a grade-level breather filter.

Components associated with Alternatives No.3 are primarily located above grade and out of confined spaces that may be contaminated.

Alternative No.3 could take advantage of an existing engineering design (244-U breather filter design).

Alternative No.3 presents the second lowest risk for exposure of all the alternatives. Virtually no maintenance would be required for a system of installed probes, tubing, and connections. Even with periodic sampling evolutions, Alternative No.3 presents the second lowest potential for significant increase in operational and maintenance activities.

7.2.4 Alternative No. 4

Alternative No.4 scored second lowest among the alternatives for the cost criteria at an average estimated cost of $568K. This estimate includes the work to procure SHMS units at $180K per unit. Costs for catch tanks without direct access would be substantially more because increased design work, excavation, welding, and pit entry may be required. See Table 6 for individual tank cost details.

Alternative No.4 scored second lowest among the alternatives for the schedule decision criteria at an average estimated duration of 41 weeks per unit. Schedule durations for tanks without direct access would be longer, because increased design work, excavation, welding, and pit entry may be required.

Both cost and schedule for Alternative No. 4 could be reduced if a spare SHMS unit were to become available for use. A spare unit would eliminate procurement time and fabrication costs associated with acquiring a new SHMS unit. Alternative No.4 makes use of existing SHMS maintenance routines and spare parts.

Alternative No.4 scored second lowest for operability and maintainability because of the increased complexity and increased number of components requiring scheduled operational readings and preventive maintenance activities.

7.2.5 Alternative No.5

Alternative No. 5 scored lowest among the alternatives for the cost criteria at an average estimated cost of $1,927K. Costs for catch tanks without direct access would be substantially more, because increased design work, excavation, welding, and pit entry may be required. See Table 7 for individual tank cost details.

Alternative No. 5 scored lowest among the alternatives for the schedule decision criteria at an average estimated duration of 106 weeks, or approximately two years, per unit. A large portion of this time is taken by the Notice of Construction (NOC) review process. Schedule durations for tanks without direct access would be more, because increased design work, excavation, welding, and pit entry may be required.

Components associated with Alternative No.5, except ductwork, are primarily located above grade and out of confined spaces that may be contaminated. However, this alternative would require the changeout of the portable exhauster train high-efficiency particulate air (HEPA) filters. This would potentially expose personnel to contamination and elevated radiation levels during filter changeout operations.

Alternatives No. 5 will make use of existing SHMS maintenance routines and spare parts. The SHMS unit is envisioned to sample the tank exhaust stream, and therefore would not require additional tank penetration.

Alternatives No. 5 scored lowest for operability and maintainability because of the increased complexity and increased number of components requiring scheduled operational readings and preventive maintenance activities.

8.0 CATCH TANK MISSION DETAILS

This section presents details to support the most reasonable approach for tank monitoring on a tank-by-tank basis. The details will support the best option to minimize risks and costs by reducing or eliminating monitoring and operations activities with each tank.

8.1 CATCH TANKS WITH NO FUTURE MISSION

For the catch tanks with no future mission there will be no recommendations to employ any of the alternatives discussed. Catch tanks falling under this category are recommended to be isolated, pumped to a minimum heel, and prepared for final closure. Isolation activities may include performing operations to prevent condensate and rain from migrating into the tank.

241-A-302A - This catch tank collects drainage from 241-A-151 diversion box, which was used for PUREX transfers. Plutonium Uranium Extraction Plant (PUREX) transfers are now complete, and the catch tank is out of service. This tank is direct-buried and not mechanically ventilated.

The tank air space may be sampled through either of two, 4-inch risers if a blind flange, or a liquid-level gauge is removed. Annual accumulation for this tank is approximately 320 gallons from rain intrusion (WHC, 1996a).

241-A-417 - This tank collects condensate from A-702, three surface condensers, seal loop drains and AX-501 valve pit drainage. Upon completion of Project W-030, all condensate lines were isolated, and the valve pit drain for 241-AX-152 is no longer required. This tank should be prepared for closure.

The tank air space may be sampled through six, below-grade nozzles. It may also be sampled through the vent line, which has a passive filter to grade. Annual accumulation for this tank is approximately 170,000 gallons from condensate (WHC, 1996a).

241-AZ-154 - This catch tank collects condensate from 241-AY and 241-AZ steam coils. The steam coils have been blanked off, and Project W-030 was chartered to complete isolation work to the ventilation system. This tank is not mechanically ventilated.

The tank air space may be sampled through a 4-inch access hole in the pump pit, floor drain cover block. Annual accumulation for this tank is 0 gallons (WHC, 1996a).

241-EW-151 - This tank is located inside the concrete catch tank pit at the cross-site transfer line vent station and collects waste from the vent lines that may accumulate during venting. With completion of Project W-058, this catch tank is no longer needed. This tank is not mechanically ventilated.

The tank airspace may be sampled through either of two, 3-inch risers that are located 2 feet above grade. Annual accumulation for this tank is approximately 300 gallons, primarily from rain (WHC, 1996a).

241-TX-302C - This catch tank is used for drainage from 241-TX-154 diversion box, which accepts waste transfer from T-Plant. TX-154 has non-compliant lines, and waste transfers from T-Plant are now handled by railcar. This tank is direct buried and not mechanically ventilated.

The tank air space may be sampled through a 4-inch riser if a liquid level gauge is removed, or through a 4-inch spare riser, both of which extend one foot above grade. Annual accumulation for this tank is approximately 1000 gallons from rain seepage (WHC, 1996a).

8.2 CATCH TANKS WITH A SHORT-TERM MISSION

Complete replacements of these catch tanks and systems were not entertained. It is assumed tanks falling under this category will be less expensive to monitor and operate, and to perform limited upgrades where needed, than to replace them with a new system.

241-ER-311 - This tank collects drainage from 241-ER-151/152 diversion boxes. With the completion of Project W-058 and upon completion of saltwell pumping in B-Farm in 2002, this catch tank will no longer be needed. This tank is direct buried and not mechanically ventilated.

The tank air space may be sampled through a 4-inch riser that contains a liquid-level gauge, or through a 4-inch, flanged riser that extends one foot above grade. The flanged riser is connected to an encasement drain from ER-152 diversion box. Annual accumulation for this tank is approximately 1700 gallons from process drainage and rain (WHC, 1996a).

8.3 CATCH TANKS WITH LONG-TERM MISSION

Recommendations to employ Alternatives No.1 through No.5 are not discussed for this category tank. Complete replacements of these catch tanks and systems were not entertained. It is assumed tanks falling under this category will be cheaper to monitor and operate, and to perform limited upgrades where needed, than to replace with a new system.

241-A-350 - This tank receives drainage from 241-A-A and -B valve pits, and the 241-A clean out boxes. It also acts as a lift station for transferring waste from the 207-A retention basin to tank 241-AW-102. This transfer function must be maintained for when the 242-A evaporator condensate is sampled and found to be out of specification for the Treated Effluent Disposal Facility (TEDF).

The tank air space may be sampled through either of two, 3-inch risers that are blanked at the tank pump pit floor. Annual accumulation for this tank is approximately 740 gallons from process drainage and rain (WHC, 1996a).

204-AR-TK1 - This tank is used to collect potential leaks from primary systems during pumping of railcars. It collects leakage through the floor drain system in 204-AR Waste Unloading Facility, and provides secondary containment. Use of this tank will be needed indefinitely.

The tank airspace may be sampled through either of two spare risers, both of which are capped six inches above the tank. Sampling from both will require removal of grating and flanges. Annual accumulation for this tank is non-existent (WHC, 1996a).

241-AZ-151 - This tank receives condensate from 241-AZ-101 and -102 vent header seal loops, drainage from 241-AZ leak detection pits, drainage from 241-AZ-801A floor drain and from 241-AZ-152 transfer box. This tank will have a continued need to provide a secondary collection point for all of these locations and condensate drains from W-030 activities. When it comes time to remove sludge from AY and AZ farms, AZ-151 will receive waste solutions. This tank is not mechanically ventilated.

The tank air space may be sampled through a 1-inch riser that provides liquid-level access. Annual accumulation for this tank is approximately 31,500 gallons primarily from process drainage and about 1500 gallons from rain (WHC, 1996a).

241-AX-152 - This tank collects drainage and condensate from several sources, but is used primarily for secondary containment for AX-155 pit. Any waste transfer activities within AY or AZ tank farms will require use of this catch tank. As of this writing, the schedule shows need of this tank until 2005.

The tank air space may be sampled through a 1-inch riser that contains a liquid-level gauge. Annual accumulation for this tank is approximately 8400 gallons from process drainage and rain (WHC,1996a).

241-S-304 - This tank receives drainage from 241-S-151 diversion box, providing a secondary containment function. The diversion box will remain in operation to support Plutonium Finishing Plant (PFP) transfers.

The tank air space may be sampled through a spare, 4-inch riser located 4-inches above the top of the pump pit, or through a 4-inch riser containing a liquid-level instrument. Annual accumulation for this tank is about 150 gallons, primarily from process drainage and rain (WHC, 1996a).

241-U-301B - This tank receives drainage from the 241-U-151, -152 and -153 diversion boxes and provides secondary containment. The diversion boxes will remain in operation to support 244-TX-DCRT transfers, which will remain in operation through at least 2006. This tank is unlined, and therefore, is presumably porous. The scope of this document does not include recommendations for lining or replacement of the catch tanks. This tank is direct-buried and not mechanically ventilated.

The tank air space may be sampled through a 4-inch riser, or two 12-inch, capped risers, all located four inches above grade. The 4-inch riser contains a liquid-level gauge. Annual accumulation for this tank is approximately 500 gallons from rain (WHC, 1996a).

241-UX-302A - This tank receives drainage from the 241-UX-154 diversion box, providing a secondary containment function, as well as condensate from the 291-U stack drainage and encasement precipitation. The scope of Project W-058 originally included rerouting the drain line, but rescoping later eliminated this activity. No plans to complete the rerouting activity are imminent. This tank is direct buried and not mechanically ventilated.

The tank air space may be sampled through two, 4-inch risers, located 12 inches above grade. One is a spare and the other contains a liquid-level measuring device. Annual accumulation for this tank is approximately 1300 gallons from rain (WHC, 1996a).

Table 3. RPP Catch Tank Alternative No. 1 Equipment and Miscellaneous Costs (in $K)

TANK ID No	ALTERNATIVE No. 1					
	EQUIPMENT COSTS	EXCAVATION	COVER BLOCK	LIQUID LEVEL REMOVAL	MISC.	TOTAL
1 241-A-302A	173	0	0	10[(a)]	0	183
2 241-A-350	173	0	15	0	0	188
3 241-A-417	173	5	0	0	0	178
4 241-AX-152	173	0	0	10	0	183
5 241-AZ-151	173	0	0	10	0	183
6 241-AZ-154	173	0	15[(a)]	0	0	188
7 241-ER-311	173	0	0	10	0	183
8 204-AR-TK-1	173	0	15	0	5	193
9 241-S-304	173	0	0	10[(a)]	0	183
10 241-TX-302C	173	0	0	10[(a)]	0	183
11 241-U-301B	173	0	0	10[(a)]	0	183
12 241-UX-302A	173	0	0	10[(a)]	0	183
13 241-EW-151	173	0	0	0	0	173

a = riser dependent costs

Table 4. RPP Catch Tank Alternative No. 2 Equipment and Miscellaneous Costs (in $K)

TANK ID No	ALTERNATIVE No. 2					
	EQUIPMENT COSTS	EXCAVATION	COVER BLOCK	LIQUID LEVEL REMOVAL	MISC.	TOTAL
1 241-A-302A	446	0	0	10[(a)]	0	456
2 241-A-350	446	0	15	0	0	461
3 241-A-417	446	5[(a)]	0	0	0	451
4 241-AX-152	446	0	0	10	0	456
5 241-AZ-151	446	0	0	10	0	456
6 241-AZ-154	446	0	15[(a)]	0	0	461
7 241-ER-311	446	0	0	10	0	456
8 204-AR-TK-1	446	0	15	0	5	466
9 241-S-304	446	0	0	10[(a)]	0	456
10 241-TX-302C	446	0	0	10[(a)]	0	456
11 241-U-301B	446	0	0	10[(a)]	0	456
12 241-UX-302A	446	0	0	10[(a)]	0	456
13 241-EW-151	446	0	0	0	0	446

a = riser dependent costs

Table 5. RPP Catch Tank Alternative No. 3 Equipment and Miscellaneous Costs (in $K)

TANK ID No	ALTERNATIVE No. 3					
	EQUIPMENT COSTS	EXCAVATION	COVER BLOCK	LIQUID LEVEL REMOVAL	MISC.	TOTAL
1 241-A-302A	286	0	0	10[(a)]	0	296
2 241-A-350	286	0	15	0	0	301
3 241-A-417	286	5[(a)]	0	0	0	291
4 241-AX-152	286	0	0	10	0	296
5 241-AZ-151	286	0	0	10	0	296
6 241-AZ-154	286	0	15[(a)]	0	0	301
7 241-ER-311	286	0	0	10	0	296
8 204-AR-TK-1	286	0	15	0	5	306
9 241-S-304	286	0	0	10[(a)]	0	296
10 241-TX-302C	286	0	0	10[(a)]	0	296
11 241-U-301B	286	0	0	10[(a)]	0	296
12 241-UX-302A	286	0	0	10[(a)]	0	296
13 241-EW-151	286	0	0	0	0	286

a = riser dependent costs

Table 6. RPP Catch Tank Alternative No. 4 Equipment and Miscellaneous Costs (in $K)

TANK ID No	ALTERNATIVE No. 4					
	EQUIPMENT COSTS	EXCAVATION	COVER BLOCK	LIQUID LEVEL REMOVAL	MISC.	TOTAL
1 241-A-302A	568	0	0	10[(a)]	0	578
2 241-A-350	568	0	15	0	0	583
3 241-A-417	568	5[(a)]	0	0	0	573
4 241-AX-152	568	0	0	10	0	578
5 241-AZ-151	568	0	0	10	0	578
6 241-AZ-154	568	0	15[(a)]	0	0	583
7 241-ER-311	568	0	0	10	0	578
8 204-AR-TK-1	568	0	15	0	5	588
9 241-S-304	568	0	0	10[(a)]	0	578
10 241-TX-302C	568	0	0	10[(a)]	0	578
11 241-U-301B	568	0	0	10[(a)]	0	578
12 241-UX-302A	568	0	0	10[(a)]	0	578
13 241-EW-151	568	0	0	0	0	568

a = riser dependent costs

Table 7. RPP Catch Tank Alternative No. 5 Equipment and Miscellaneous Costs (in $K)

TANK ID No	ALTERNATIVE No. 5					
	EQUIPMENT COSTS	EXCAVATION	COVER BLOCK	LIQUID LEVEL REMOVAL	MISC.	TOTAL
1 241-A-302A	1766	0	0	10[(a)]	0	1776
2 241-A-350	1766	0	15	0	0	1781
3 241-A-417	1766	5[(a)]	0	0	0	1771
4 241-AX-152	1766	0	0	10	0	1776
5 241-AZ-151	1766	0	0	10	0	1776
6 241-AZ-154	1766	0	15[(a)]	0	0	1781
7 241-ER-311	1766	0	0	10	0	1776
8 204-AR-TK-1	1766	0	15	0	5	1786
9 241-S-304	1766	0	0	10[(a)]	0	1776
10 241-TX-302C	1766	0	0	10[(a)]	0	1776
11 241-U-301B	1766	0	0	10[(a)]	0	1776
12 241-UX-302A	1766	0	0	10[(a)]	0	1776
13 241-EW-151	1766	0	0	0	0	1766

a = riser dependent costs

9.0 REFERENCES

WHC, 1996a, WHC-SD-WM-ER-573, Rev 0, *Catch Tank Inhibitor Addition 200-East and 200-West Areas*, Westinghouse Hanford Corporation; Richland, WA

WHC, 1996b, TF-96-0433, Consolidation of Flammable Gas/Slurry Growth Unreviewed Safety Question Issues, Rev 12, Westinghouse Hanford Company, Richland, WA

LMHC,1998a, HNF-SD-WM-TSR-006, *Tank Waste Remediation System Technical Safety Requirements,* Lockheed Martin Hanford Corporation; Richland, WA

APPENDIX A – COST ESTIMATES AND SCHEDULES

Equipment to Resolve the Flammable Gas USQ for Catch Tanks
A99016
Kyle D. Hein
Cogema Engineering

Success Estimating and Cost Management System

Alt. #1 Flamm. Gas at Catch Tanks
PROJECT COST SUMMARY

Cost Code	Description	Escalated Total Cost	Contingency %	Contingency Total	Total Dollars
010	Title I Design	$30,000	30.00%	$9,000	$39,000
020	Title II Design	$45,000	31.00%	$14,000	$59,000
030	Title III Design	$5,000	40.00%	$2,000	$7,000
050	Construction Management	$8,000	25.00%	$2,000	$10,000
550	Other Structures	$9,000	33.00%	$3,000	$12,000
700	Special Equipment/Process Systems	$32,000	28.00%	$9,000	$41,000
788	HPT Support	$4,000	25.00%	$1,000	$5,000
	Total Estimated Cost (TEC)	$133,000	30.00%	$40,000	$173,000
	TOTAL PROJECT COST (TPC)	$133,000	30.00%	$40,000	$173,000

Type of Estimate: Rough Order of Magnitude	Remarks:
Architect/Engineer: TW [signature] KDH [signature]	Revision 2
Operating Contractor:	Final

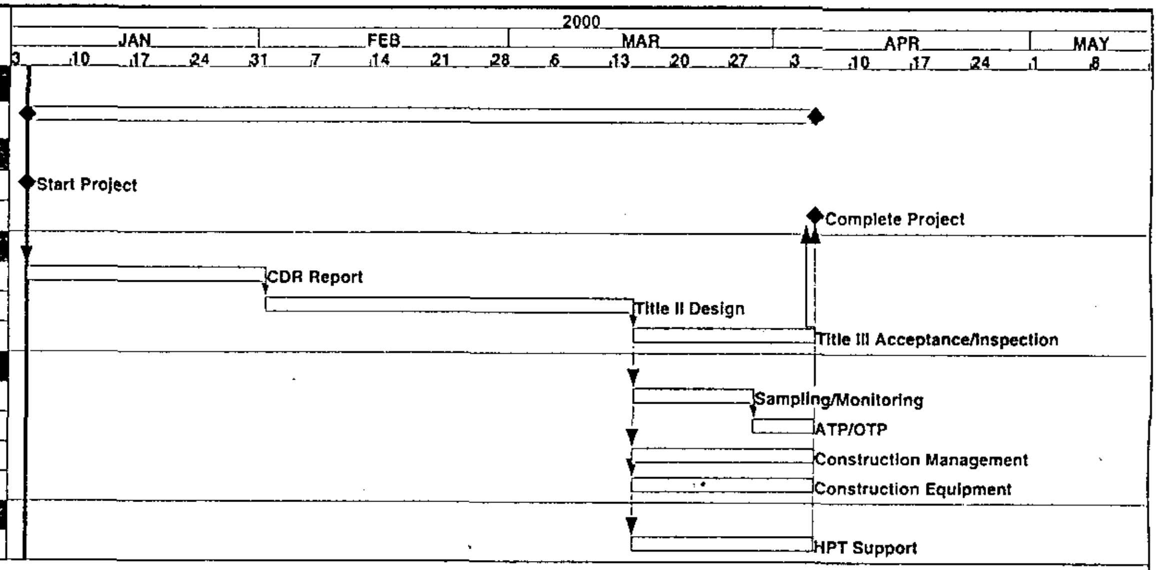
FINAL

Cogema Engineering
By: BT
12/28/1999

(Rounded to the nearest $ 1000)

Page No. 1

Activity ID	Activity Description	Orig Dur	Early Start	Early Finish
Flammable Gas At Catch Tanks-Alt #1				
Total		65	05JAN00	05APR00
Milestones				
0000	Start Project	0	05JAN00*	
9999	Complete Project	0		05APR00
Design				
100000	CDR Report	20	05JAN00	01FEB00
110000	Title II Design	30	02FEB00	15MAR00
120000	Title III Acceptance/Inspection	15	16MAR00	05APR00
Construction				
310000	Sampling/Monitoring	10	16MAR00	29MAR00
311000	ATP/OTP	5	30MAR00	05APR00
312000	Construction Management	15	16MAR00	05APR00
313000	Construction Equipment	15	16MAR00	05APR00
HPT Support				
320000	HPT Support	15	16MAR00	05APR00



Project Start	30SEP99	Early Bar	
Project Finish	05APR00	Progress Bar	
Data Date	05JAN00	Critical Activity	
Run Date	14JAN00		

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ALT1

Sheet 1 of 1

Flammable Gas At Catch Tanks

Alternative #1

Classic Schedule Layout

Equip. to resolve the Flammable Gas USQ for Catch Tanks
A99016
Kyle D. Hein
Cogema Engineering

Success Estimating and Cost Management System

Alt. #2 Estimate for Flamm. Gas at Catch Tanks
PROJECT COST SUMMARY

Cost Code	Description	Escalated Total Cost	Contingency %	Contingency Total	Total Dollars
010	Title I Design	$30,000	37.00%	$11,000	$41,000
020	Title II Design	$45,000	36.00%	$16,000	$61,000
030	Title III Design	$6,000	33.00%	$2,000	$8,000
050	Construction Management	$14,000	36.00%	$5,000	$19,000
550	Other Structures	$9,000	33.00%	$3,000	$12,000
700	Special Equipment/Process Systems	$215,000	35.00%	$75,000	$290,000
7060	Electrical	$3,000	33.00%	$1,000	$4,000
788	HPT Support	$8,000	38.00%	$3,000	$11,000
	Total Estimated Cost (TEC)	$330,000	35.00%	$116,000	$446,000
	TOTAL PROJECT COST (TPC)	**$330,000**	**35.00%**	**$116,000**	**$446,000**

Type of Estimate	Rough Order Of Magnitude
Architect/Engineer	TW KOH
Operating Contractor	

Remarks:
Revision 2
Final

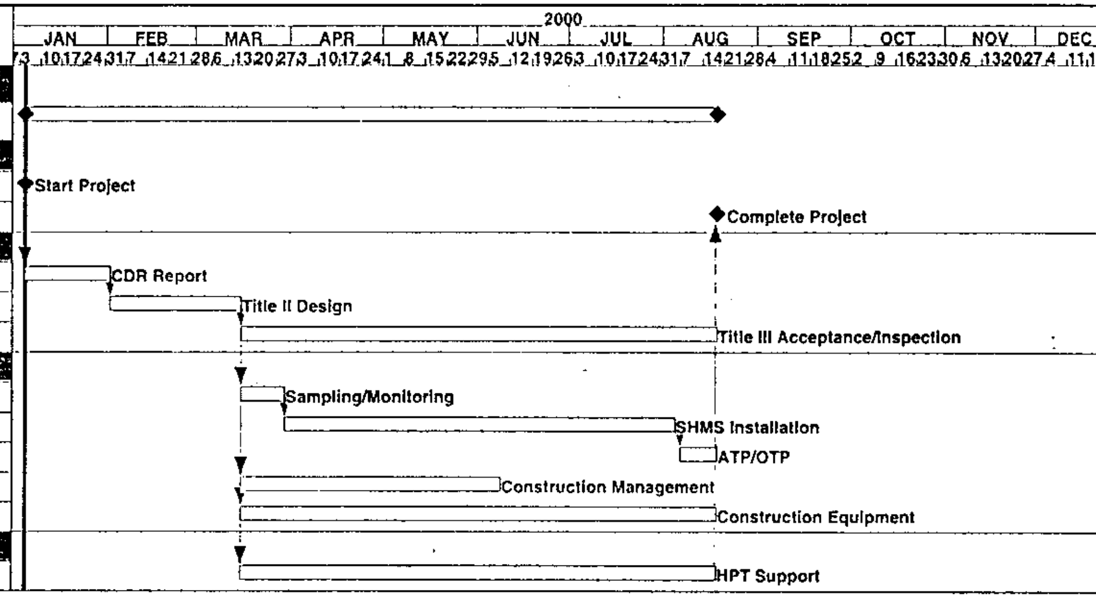
FINAL

Cogema Engineering
By: BT
12/28/1999

(Rounded to the nearest $ 1000)

Page No. 1

Activity ID	Activity Description	Orig Dur	Early Start	Early Finish
Flammable Gas At Catch Tanks-Alt # 2				
Total		160	05JAN00	18AUG00
Milestones				
0000	Start Project	0	05JAN00	
9999	Complete Project	0		18AUG00
Design				
100000	CDR Report	20	05JAN00	01FEB00
110000	Title II Design	30	02FEB00	15MAR00
120000	Title III Acceptance/Inspection	110	16MAR00	18AUG00
Construction				
310000	Sampling/Monitoring	10	16MAR00	29MAR00
310001	SHMS Installation	90	30MAR00	04AUG00
311000	ATP/OTP	10	07AUG00	18AUG00
312000	Construction Management	60	16MAR00	08JUN00
313000	Construction Equipment	110	16MAR00	18AUG00
HPT Support				
320000	HPT Support	110	16MAR00	18AUG00



Project Start	30SEP99	Early Bar	ALT2
Project Finish	18AUG00	Progress Bar	
Data Date	05JAN00	Critical Activity	
Run Date	17JAN00		

Sheet 1 of 1

Flammable Gas At Catch Tanks
Alternative # 2
Classic Schedule Layout

Equip. to resolve the Flammable Gas USQ for Catch Tanks
A99016
Kyle D. Hein
Cogema Engineering

Success Estimating and Cost Management System

Alt. #3 Estimate for Flamm. Gas at Catch Tanks
PROJECT COST SUMMARY

Cost Code	Description	Escalated Total Cost	Contingency %	Contingency Total	Total Dollars
010	Title I Design	$42,000	36.00%	$15,000	$57,000
020	Title II Design	$63,000	35.00%	$22,000	$85,000
030	Title III Design	$5,000	40.00%	$2,000	$7,000
050	Construction Management	$15,000	33.00%	$5,000	$20,000
550	Other Structures	$12,000	33.00%	$4,000	$16,000
700	Special Equipment/Process Systems	$66,000	35.00%	$23,000	$89,000
788	HPT Support	$9,000	33.00%	$3,000	$12,000
	Total Estimated Cost (TEC)	$212,000	35.00%	$74,000	$286,000
	TOTAL PROJECT COST (TPC)	**$212,000**	**35.00%**	**$74,000**	**$286,000**

Type of Estimate	Rough Order Of Magnitude
Architect/Engineer	
Operating Contractor	

Remarks:
Revision 2
Final

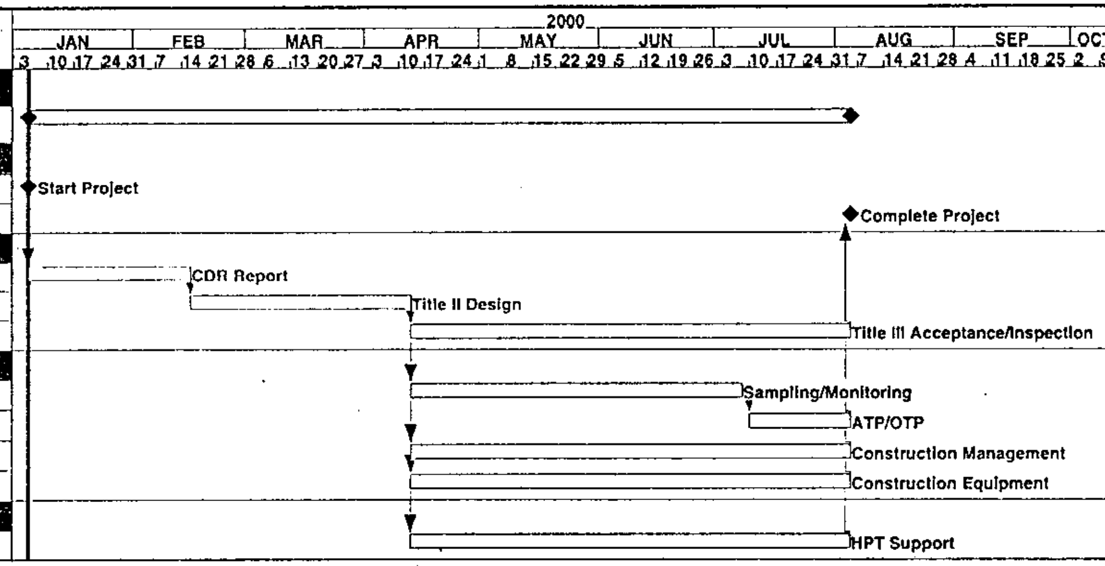
FINAL

Cogema Engineering
By: BT
12/28/1999

(Rounded to the nearest $ 1000)

Page No. 1

Activity ID	Activity Description	Orig Dur	Early Start	Early Finish
Flammable Gas At Catch Tanks-Alt # 3				
Total		150	05JAN00	04AUG00
[illegible]				
0000	Start Project	0	05JAN00	
9999	Complete Project	0		04AUG00
[illegible]				
100000	CDR Report	30	05JAN00	15FEB00
110000	Title II Design	40	16FEB00	12APR00
120000	Title III Acceptance/Inspection	80	13APR00	04AUG00
[illegible]				
310000	Sampling/Monitoring	60	13APR00	07JUL00
311000	ATP/OTP	20	10JUL00	04AUG00
312000	Construction Management	80	13APR00	04AUG00
313000	Construction Equipment	80	13APR00	04AUG00
[illegible]				
320000	HPT Support	80	13APR00	04AUG00



Flammable Gas At Catch Tanks
Alternative # 3
Classic Schedule Layout

Equip. to resolve the Flammable Gas USQ for Catch Tanks
A99016
Kyle D. Hein
Cogema Engineering

Success Estimating and Cost Management System

Alt. #4 Estimate for Flamm. Gas at Catch Tanks
PROJECT COST SUMMARY

Cost Code	Description	Escalated Total Cost	Contingency %	Contingency Total	Total Dollars
010	Title I Design	$42,000	36.00%	$15,000	$57,000
020	Title II Design	$63,000	35.00%	$22,000	$85,000
030	Title III Design	$8,000	38.00%	$3,000	$11,000
050	Construction Management	$20,000	35.00%	$7,000	$27,000
550	Other Structures	$12,000	33.00%	$4,000	$16,000
700	Special Equipment/Process Systems	$259,000	35.00%	$91,000	$350,000
7060	Electrical	$3,000	33.00%	$1,000	$4,000
788	HPT Support	$13,000	38.00%	$5,000	$18,000
	Total Estimated Cost (TEC)	$420,000	35.00%	$148,000	$568,000
	TOTAL PROJECT COST (TPC)	**$420,000**	**35.00%**	**$148,000**	**$568,000**

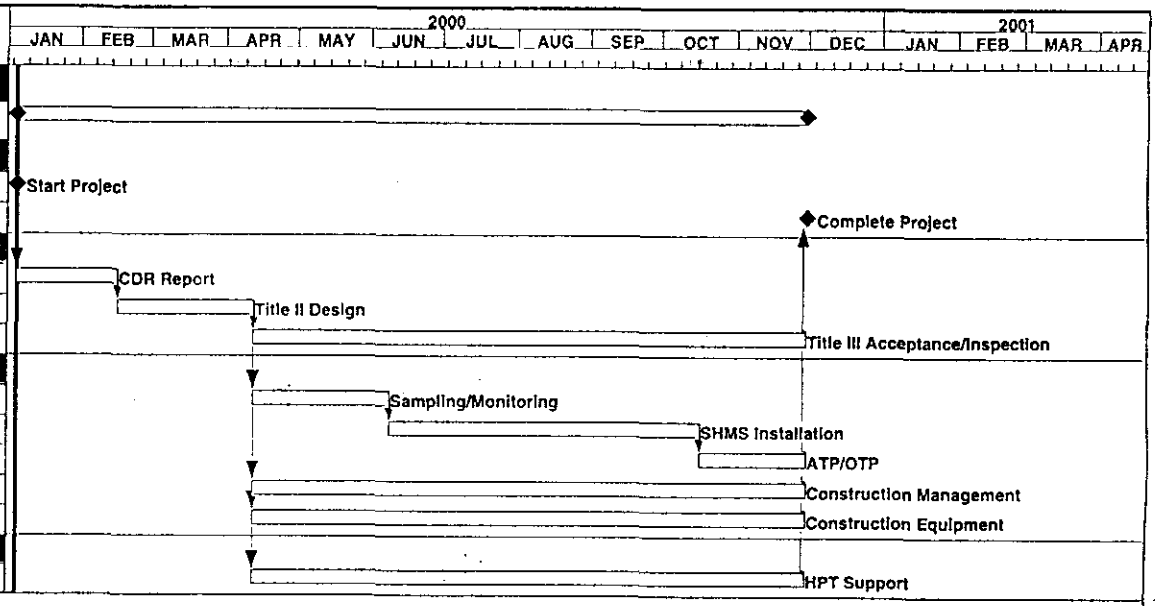
Type of Estimate: Rough Order Of Magnitude	Remarks:
Architect/Engineer: TW [signature] KDH	Revision 2
Operating Contractor:	Final

FINAL

Cogema Engineering
By: BT
12/28/1999

(Rounded to the nearest $ 1000)

Activity ID	Activity Description	Orig Dur	Early Start	Early Finish
Flammable Gas At Catch Tanks-Alt # 4				
Total		230	05JAN00	29NOV00
Milestones				
0000	Start Project	0	05JAN00	
9999	Complete Project	0		29NOV00
Design				
100000	CDR Report	30	05JAN00	15FEB00
110000	Title II Design	40	16FEB00	12APR00
120000	Title III Acceptance/Inspection	160	13APR00	29NOV00
Construction				
310000	Sampling/Monitoring	40	13APR00	08JUN00
310001	SHMS Installation	90	09JUN00	16OCT00
311000	ATP/OTP	30	17OCT00	29NOV00
312000	Construction Management	160	13APR00	29NOV00
313000	Construction Equipment	160	13APR00	29NOV00
HPT Support				
320000	HPT Support	160	13APR00	29NOV00



Project Start 30SEP99
Project Finish 29NOV00
Data Date 06JAN00
Run Date 17JAN00

Early Bar
Progress Bar
Critical Activity

ALT4

Sheet 1 of 1

Flammable Gas at Catch Tanks
Alternative #4
Classic Schedule Layout

Equip. to resolve Flammable Gas USQ for Catch Tanks
A99016
Kyle D. Hein
Cogema Engineering

Success Estimating and Cost Management System

Alt. #5 Estimate for Flamm. Gas at Catch Tanks
PROJECT COST SUMMARY

Cost Code	Description	Escalated Total Cost	Contingency %	Contingency Total	Total Dollars
010	Title I Design	$60,000	35.00%	$21,000	$81,000
020	Title II Design	$90,000	36.00%	$32,000	$122,000
030	Title III Design	$7,000	43.00%	$3,000	$10,000
550	Other Structures	$12,000	33.00%	$4,000	$16,000
700	Special Equipment/Process Systems	$1,124,000	35.00%	$393,000	$1,517,000
7060	Electrical	$3,000	33.00%	$1,000	$4,000
788	HPT Support	$11,000	36.00%	$4,000	$15,000
	Total Estimated Cost (TEC)	$1,307,000	35.00%	$458,000	$1,765,000
900	Other Project Costs	$120,000	35.00%	$42,000	$162,000
	Other Project Cost (OPC)	$120,000	35.00%	$42,000	$162,000
	TOTAL PROJECT COST (TPC)	**$1,427,000**	**35.00%**	**$500,000**	**$1,927,000**

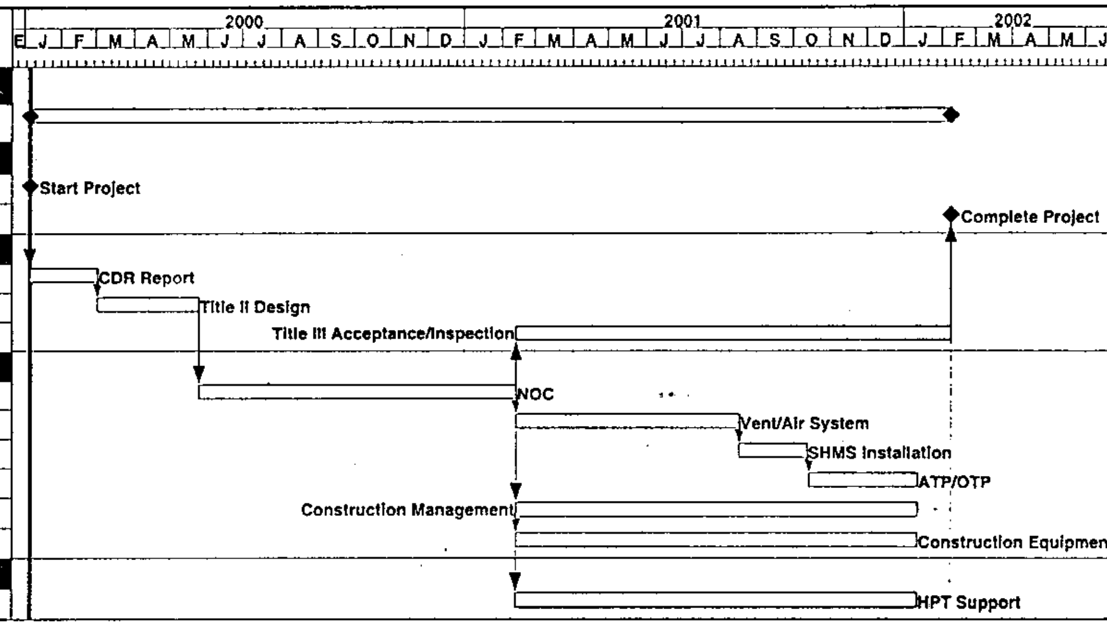
FINAL

Type of Estimate: Rough Order Of Magnitude	Remarks:
Architect/Engineer: TW [signature] KDA	Revision 3
Operating Contractor:	Final

Cogema Engineering
By: BT
01/14/2000

(Rounded to the nearest $ 1000)

Activity ID	Activity Description	Orig Dur	Early Start	Early Finish
Flammable Gas At Catch Tanks-Alt # 5				
Total		530	05JAN00	08FEB02
Milestones				
0000	Start Project	0	05JAN00	
9999	Complete Project	0		08FEB02
Design				
100000	CDR Report	40	05JAN00	01MAR00
110000	Title II Design	60	02MAR00	24MAY00
120000	Title III Acceptance/Inspection	250	13FEB01	08FEB02
Construction				
300000	NOC	180	25MAY00	12FEB01
310000	Vent/Air System	130	13FEB01	16AUG01
310A00	SHMS Installation	40	17AUG01	12OCT01
311000	ATP/OTP	60	15OCT01	11JAN02
312000	Construction Management	230	13FEB01	11JAN02
313000	Construction Equipment	230	13FEB01	11JAN02
HPT Support				
320000	HPT Support	230	13FEB01	11JAN02



Project Start [illegible]
Project Finish [illegible]
Data Date [illegible]
Run Date 14JAN00

Early Bar
Progress Bar
Critical Activity

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ALT5

Sheet 1 of 1

Flammable Gas At Catch Tanks
Alternative # 5
Classic Schedule Layout