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**CONCEPTUAL DESIGN REPORT
FOR
TRITIUM LIQUID WASTE
RECOVERY SYSTEM**

JULY 16, 1979

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MOUND FACILITY

Miamisburg, Ohio 45342

operated by

MONSANTO RESEARCH CORPORATION

a subsidiary of Monsanto Company

for the

U. S. DEPARTMENT OF ENERGY

Contract No. DE-AC04-76-DP00053

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CONCEPTUAL DESIGN REPORT
FOR
TRITIUM LIQUID WASTE RECOVERY SYSTEM

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July 16, 1979

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1. PROJECT SYNOPSIS

This project will provide a waste water treatment system to efficiently strip tritium from certain Mound generated waste water streams. After stripping the tritium from the water stream, the tritium will be further purified into a fully reusable form. The by-product streams, both liquid and gaseous, will be within applicable standards and can be released directly to the environment.

The major components of the system consist of the following: an organic cleanup unit for the incoming waste stream, to be located inside a new glovebox in SW 149B; catalytic exchange columns and electrolysis cells, and a hydrogen recombiner to be located inside new gloveboxes in T-57; hydride storage beds and a cryogenic distillation unit to be located inside new gloveboxes in T-16; control instrumentation, and tie-in lines to utilities as required. All major components of this system have been tested and successfully operated in a small pilot plant.

Sketches of the system flow chart and room locations are contained in Appendix A of this report.

Existing facilities will be used for housing this system for optimum utilization and minimum difficulty in installation. Construction will be limited to minor room modifications and the extension of existing utilities to the major system components. A new Effluent Recovery system line will be extended from SW Building and a house vacuum system will be added to T-16 to serve the new glovebox systems in T-16 and 57. The total floor space required for the system hardware and control instrumentation will be about 1300 square feet.

The total project was submitted as a FY 1982 line item with PE&D expected to start in FY 1980. The project construction is expected to begin in FY 1982 and be complete by the third quarter of 1984.

TEC of this project is \$2,445,000.

2. JUSTIFICATION

In December 1970, the Atomic Energy Commission requested their contractors to take positive steps toward limiting the release of tritium and other radioactive effluents. Subsequent communiques suggested that the point of concentration measurement be moved from plant boundary limits to the end of the waste discharge pipeline or the top of the stack. Since 1970, Monsanto Research Corporation has been involved in an intensive tritium emission control effort at Mound Facility. That effort has as its ultimate goal the objective of approaching zero emissions. As a result, Mound has reduced its airborne tritium effluents from 315,000 curies in 1969 to 7350 curies in 1978. This represents a reduction of 98%.

Although the tritium control program at Mound Facility was initially oriented toward the control of airborne effluents, its natural evolution has been to include the liquid waste problem. The state-of-the-art technology for removing tritium from gaseous effluents involves oxidizing the elemental tritium to water and removing the water from the air stream. This captured water must be managed since its release to the biosphere is unacceptable. The existing method for handling this liquid is to package it in an approved container and bury it at a suitable site. In light of recent events concerning transportation and burial of radioactive materials, the package is becoming more complex and burial grounds are becoming less available. Also, public acceptance of long-term storage of radioactive waste is uncertain. This document proposes that Mound aqueous tritium waste be recovered instead of buried. Since tritium is a valuable resource that is needed in the civilian fusion power program, it is clear that recovery and recycle is a better choice than burial.

In 1972, a program was initiated at Mound to develop the technology for recovering tritium from internally generated liquid wastes. The technology is now available and will be used in this system. For Mound generated aqueous waste this facility will effect a 75%-90% reduction in the quantity of tritium which is currently shipped to Nevada Test Site for burial. The primary justification for this facility is to treat Mound generated aqueous waste; however, it is planned that the small quantities of concentrated aqueous waste generated by SLL and LASL will be processed in this facility. The Princeton Plasma Physics Laboratory has also expressed interest in using this system for recycle of aqueous tritium that results from TFTR experiments.

End products of the recovery process consist of the following:

- a. Clean, detritiated water which may be safely released to the environment.
- b. Enriched tritium that can be recovered and reused.

3. SITE SELECTION

The system will be located in the SW and T Buildings at Mound Facility; see Sketch #1 (Site Plan) and Sketch #2 through #6. The system will be linked to operational systems already installed in these areas.

Only the feed water cleanup system will be located in SW Building. SW Building was chosen for the cleanup system since most of the tritiated water is generated by the Effluent Removal System (ERS) in SW Building. The recovery process system will be located in T Building, Rooms 16 and 57. T Building was chosen for the recovery process system because it is the safest and most secure and least crowded facility available and will minimize risk to the environment. Other new tritium operations are also being planned for location in T Building which meets criteria for tornado and earthquake loadings. This project will not interfere with any of these other operations.

4. CONSTRUCTION

4.1 Improvements to Land

There will be no land improvements since this installation will take place inside existing buildings.

Since all design, procurement and installation will be performed by MRC, no additional security requirements are necessary.

4.2 Building

4.2.1 Architectural and Structural

No building construction will be necessary. Modifications required include the rearrangement of a small amount of

laboratory equipment left over from another project, installation of gloveboxes, system materials and control instrumentation, and the blocking up of the partial wall existing between Rooms 57 and 58 in T Building.

4.2.2 Mechanical

The present HVAC system in T Building is adequate for this program. Some modification of air flow rates may be required.

A vacuum system for the process and associated gloveboxes and pass boxes will be enclosed in a glovebox and installed in T Building, Room 16. Modification of the air flow in SW-149B extension will also be required to accommodate the feed water clean up glovebox.

4.2.3 Electrical

Electrical requirements will be satisfied by tying in to previous connections and outlets that now exist in SW and T Building; no major upgrading or new installation work is anticipated at this time. All other electrical work is in conjunction with process equipment installation. Process equipment is expected to require 150KW 220V service.

4.3 Other Structures

No new or additional structures are required for this project.

4.4 Special Facilities

The Tritium Liquid Waste Recovery System consists of a series of specially engineered modules to be located in specially designed gloveboxes with sophisticated system control instrumentation. The individual modules consist of the following:

An organic cleanup unit for the incoming liquid waste stream, catalytic exchange columns, an electrolysis unit, hydride storage beds, a cryogenic unit, and a re-combiner.

These items and their functions are described in Section 5.

4.5 Utilities

Utilities will be extended from existing systems in T and SW Buildings. A new gaseous nitrogen line will be extended from the existing liquid nitrogen tank near HH Building. Gaseous nitrogen supply lines within T Building are already in existence but presently are not connected to a supply source.

4.6 Standard Equipment

No major items of "off the shelf" equipment or furnishings are required for this project.

4.7 MRC Work

Engineering and installation will be totally accomplished by MRC personnel. A minimum amount of design scale-up will be required, however, this scale-up and installation will be best controlled by MRC scientists and engineers already familiar with technical design and limitations of the system. Also, details of operational support work are restricted to authorized Q-cleared personnel. MRC trades personnel are best qualified to assemble and install the process equipment and to make the tie-ins required to activate this project within the planned installation period.

5. EQUIPMENT DESCRIPTION AND FUNCTIONS

General

The proposed system (see Process Flow Diagram, Sketch #7) will consist of six major processing steps. The processing steps are discussed here in the following order:

<u>Process Step</u>	<u>Building Location</u>
1. Feed Water Clean Up	SW-149
2. Catalytic Exchange	T-57
3. Electrolysis	T-57
4. Recombiner	T-57
5. Hydride Storage	T-16
6. Cryogenic Distillation	T-16

1. Feed Water Cleanup Module

The system feed water, which is known to contain organics and other substances poisonous to the exchange catalyst and electrolysis membranes, must be cleaned up before further processing can be accomplished. This system will be designed to handle 1500 liters/year H₂O.

The apparatus for this system will consist of 3 contact tanks, a physical coalescer tank, a packed adsorption filter column, a deionizer column, and a hold tank. (See Sketch #8.)

The feed water will be added to three agitated and heated storage/contact tanks. Hydrogen peroxide will be added to help break down some of the organics. These three tanks will also serve as feed water storage prior to processing.

Water from the three storage/contact tanks will next be pumped into a physical coalescer tank. The coalescer removes the organic liquid contamination from the continuous liquid water phase with which it is immiscible. The entrained liquid, in the form of small droplets, passes through a porous element where the droplets are coalesced into larger size droplets for ease of removal.

The water from the coalescer will be passed through a packed adsorption column. The water will then be filtered and passed through a packed deionizer column. The cleaned tritiated water will be stored in a hold tank prior to packaging and transporting to T Building.

The water cleanup module will be located in SW-149 extension in a glovebox (see Sketch #3). The glovebox required for the equipment will be approximately eight feet long by four feet wide by seven feet tall.

2. The Catalytic Exchange Module

3. The Electrolysis Module

4. The Recombiner Module

The catalytic exchange, electrolysis and recombinder modules will be discussed in one section because they are all parts of a single system. The purpose of the system is to produce a decontaminated water stream, which will

be released to the environment, and a tritium enriched hydrogen gas stream from the feed water supplied by the feed water cleanup module. The system will be designed to operate at a water feed rate of 10cc/minute. (See Sketch #9).

A catalytic exchange column consists of a hydrophobic catalyst-filled pipe. There will be ten columns ten feet long by one inch diameter operated in series. The first nine columns constitute the stripping section. The last column contains the enriching section. The water feed from the cleanup module is introduced to the system between the stripping and enriching sections. Water passing downward through the stripping columns is introduced at the top of the first stripping column from the cooled recombiner. Hydrogen gas from the electrolysis cells passes upward through the catalytic exchange columns where the tritium and deuterium atoms displace protium atoms in the water which is flowing downward through the columns. Pumps between each pair of columns move water from the bottom of one column to the top of the next. A hydrogen recycle stream from the cryogenic distillation unit via the hydride storage system will also be introduced into the columns unless it is clean enough for direct stacking.

The ten catalytic exchange columns will be located in T-Building, Room 57. (See Sketch #6.) The glovebox required for the columns and associated pumps and controls will be approximately twelve feet long by four feet wide by twelve feet high.

The hardware for the electrolysis section will consist of twelve General Electric SPE (solid polymer electrolyte) stacks containing eight cells each. The SPE stacks are operated in parallel. The enriched water stream coming from the catalytic exchange columns acts as both the reactant and the coolant for the electrolysis system. DC power is used to electrochemically reduce the feed stream to gaseous hydrogen and gaseous oxygen. Most of this hydrogen is recycled to the catalytic exchange columns, but a small percentage goes through two molecular sieve dryers to the hydride storage module as feed for the cryogenic distillation module. Oxygen from the electrolysis cells is sent to the recombiner module. The hydrogen and oxygen streams from the electrolysis cells each contain entrained water which must be removed before the hydrogen can be sent back to the catalytic exchange columns and before the oxygen can be

sent to the recombiner module. Two independent phase separator/feed tank systems are used to separate the water from these gaseous streams and recycle the water back to the electrolysis cells. Most of the water feed to the cells will come from the oxygen phase separator/feed tank and the feed system will switch to the hydrogen phase separator/feed tank when the hydrogen tank is full of water.

The twelve electrolysis stacks will be located in T Building, Room 57. (See Sketch #6) The glovebox required for the electrolysis module will be six feet long by four feet wide by seven feet high.

The recombiner module takes the oxygen stream from the oxygen phase separator/feed tank and reacts the stream with the tritium depleted hydrogen stream from the catalytic exchange columns to produce detritiated water for recycle back to the columns or release to the environment. A recombiner is a simple stainless steel reaction vessel filled with platinum or palladium catalyst. The oxygen stream from the phase separator/feed tank first passes through a heated recombiner to react any hydrogen that might be present in the stream. The oxygen stream then passes through a molecular sieve dryer before it enters the cooled recombiner where it reacts with the hydrogen stream. An oxygen bottle station is used to supply an excess of oxygen for complete combustion. The steam product from the recombiner is then condensed into a detritiated liquid for recycle back to the columns and for release to the environment.

The recombiner system will also be located in T Building, Room 57. (See Sketch #6) The glovebox required for the system will be approximately three feet long by four feet wide by seven feet tall.

5. The Hydride Storage Module

The purpose of the hydride storage module is to provide storage for the gaseous hydrogen. This storage is required for the gas feed from the electrolysis cell module to the cryogenic distillation module and the recycle gas stream from the cryogenic distillation module back to the catalytic exchange module.

The apparatus for this process will consist of two tanks, three uranium beds, transfer pumps and associated pipes, instrumentation and controls. (See Sketch #10)

The hydrogen undergoes a reversible reaction with the activated uranium bed. Although hydrogen will combine with the uranium bed, helium-3 created by tritium decay will not react and can be pumped away. The hydrogen gas is removed from the uranium bed when needed by heating the bed. The two tanks are used to hold the hydrogen gas until one of the three uranium beds becomes available for use and also for PVT measurements.

The hydride storage module will be located in T Building, Room 16. (See Sketch #5) The glovebox required for the equipment will be approximately six feet long by four feet wide by seven feet tall.

6. Cryogenic Distillation Module

The purpose of the cryogenic distillation module is to further enrich the tritium enriched hydrogen gas stream which was produced by the electrolysis cells and catalytic exchange columns. The final tritium enriched product stream will be such that it can be handled and further purified by the existing SW Building facility for reuse in existing programs.

The apparatus for this system will consist of two cryogenic distillation packed columns (approximately one inch in diameter by three feet long) located in one vacuum chamber, two helium refrigeration units, one equilibrator and one small product uranium bed. (See Sketch #11)

The hydrogen gas feed will be pumped to the first distillation column from the hydride storage module by the uranium bed upon which it is stored. The cryogenic distillation module will need to be operated continuously with automatic control due to the small volume of gas which will be handled. The overhead from the first distillation column will be used for reflux on the first column with a side draw stream which will be sent back to hydride storage. This side draw stream will be monitored to check for tritium contamination, then it will either be released to the stack or sent back to the catalytic exchange columns. The bottom product from the first distillation column will be passed through an equilibrator and then fed to the second distillation column. The equilibrator is a small vessel packed with a platinum catalyst which allows the isotopes of hydrogen to recombine in a random order to produce the

six possible molecular species, H₂, HD, HT, D₂, DT and T₂. The overhead from the second distillation column will be used for reflux on the second column with a side draw which is recycled back to the feed for the first distillation column. The tritium enriched bottom product from the second column will be stored in a small uranium bed until it is used by the existing SW Building facility.

The cryogenic distillation module will be located in T Building, Room 16 (See Sketch #5). The glovebox required for this module will be approximately ten feet long by four feet wide by eight feet tall.

6. PROCUREMENT AND CONSTRUCTION PLANS

All engineering design, procurement and installation will be performed by MRC since this is a special facilities type construction project. No architect-engineer (A-E) or construction contractor will be utilized. The tentative schedule is as follows:

<u>Activity</u>	<u>Start Date</u>	<u>Completion</u>
Design	October 1979	September 1981
Tear-out & Room Modification	October 1981	March 1982
Procurement	October 1981	March 1983
Installation	April 1982	October 1983
Check-Out	November 1983	May 1984
Operational	June 1984	

7. SAFETY PROVISIONS

This project will not introduce any new hazard. Safety procedures for the SW and T Buildings have already been established. Fire protection equipment is already in place. Radiation detection equipment will be installed as required. The MRC Health Physics staff monitors all activities in radioactive (hot) areas on a routine, daily basis. No additional safety procedures or equipment appear to be required at this time. All handling of hydrogen gas will be in leak-tight systems which will be housed in inert atmosphere gloveboxes.

8. QUALITY ASSURANCE PROGRAM

This project has been designated for Quality Assurance in accordance with the AL Chapter 08XA ALO Quality Control Program. Specific QA items and actions will be developed and incorporated into the design criteria. However, at this time two project items are considered to be necessary to achieve the desired level of quality in this project. These two tentative items are summarized below.

1. Tritium Liquid Waste Recovery Process System.
2. Gloveboxes.

For further definition of the QA program, an assigned QA team will meet prior to the preparation of the Design Criteria document. This team will be responsible for identifying the appropriate QA elements of 08XA for each item of the QA program, and for integrating QA actions into procurement documents, plans and specifications where applicable. The QA program details will be incorporated into the Design Criteria.

The QA Plan will be fixed at the completion of Title I Engineering and Design.

APPENDIX A

SKETCHES & DIAGRAMS

CLASSIFICATION
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MINNANTO RESEARCH CORPORATION
NORTH LABORATORY
MIAMI, FL, ORSO

SITE PLAN FOR THE TRITIUM
LIQUID WASTE RECOVERY SYSTEM
SKETCH I

DATE: 6/25/79	APPROVALS:
CHECKED: 786	DATE: 7-79
APPROVED: 104	DATE: 7-79
JOB NO: 104	NO: M36120
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1. BLDG SERVICE FLOOR

TRITIUM LIQUID WASTE RECOVERY SYSTEM
BUILDING LAYOUT

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1958	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055	2056	2057	2058	2059	2060	2061	2062	2063	2064	2065	2066	2067	2068	2069	2070	2071	2072	2073	2074	2075	2076	2077	2078	2079	2080	2081	2082	2083	2084	2085	2086	2087	2088	2089	2090	2091	2092	2093	2094	2095	2096	2097	2098	2099	2100	2101	2102	2103	2104	2105	2106	2107	2108	2109	2110	2111	2112	2113	2114	2115	2116	2117	2118	2119	2120	2121	2122	2123	2124	2125	2126	2127	2128	2129	2130	2131	2132	2133	2134	2135	2136	2137	2138	2139	2140	2141	2142	2143	2144	2145	2146	2147	2148	2149	2150	2151	2152	2153	2154	2155	2156	2157	2158	2159	2160	2161	2162	2163	2164	2165	2166	2167	2168	2169	2170	2171	2172	2173	2174	2175	2176	2177	2178	2179	2180	2181	2182	2183	2184	2185	2186	2187	2188	2189	2190	2191	2192	2193	2194	2195	2196	2197	2198	2199	2200	2201	2202	2203	2204	2205	2206	2207	2208	2209	2210	2211	2212	2213	2214	2215	2216	2217	2218	2219	2220	2221	2222	2223	2224	2225	2226	2227	2228	2229	2230	2231	2232	2233	2234	2235	2236	2237	2238	2239	2240	2241	2242	2243	2244	2245	2246	2247	2248	2249	2250	2251	2252	2253	2254	2255	2256	2257	2258	2259	2260	2261	2262	2263	2264	2265	2266	2267	2268	2269	2270	2271	2272	2273	2274	2275	2276	2277	2278	2279	2280	2281	2282	2283	2284	2285	2286	2287	2288	2289	2290	2291	2292	2293	2294	2295	2296	2297	2298	2299	2300	2301	2302	2303	2304	2305	2306	2307	2308	2309	2310	2311	2312	2313	2314	2315	2316	2317	2318	2319	2320	2321	2322	2323	2324	2325	2326	2327	2328	2329	2330	2331	2332	2333	2334	2335	2336	2337	2338	2339	2340	2341	2342	2343	2344	2345	2346	2347	2348	2349	2350	2351	2352	2353	2354	2355	2356	2357	2358	2359	2360	2361	2362	2363	2364	2365	2366</
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27.

CORRIDOR 3

RM. 16

CRYOGENIC
DISTILLATION

HYDRIDE
STORAGE

VACUUM SYSTEM

CORR. 3

T-61

SCALE: 1/4" = 1'

JOB NO. 10486

CLASSIFICATION

LEVEL UNCL

DATE

MONSANTO RESEARCH CORPORATION
MOUND FACILITY
MIAMISBURG, OHIO

T-BLDG RM 16 SKETCH 5
TRITIUM LIQUID WASTE
RECOVERY SYSTEM RM LAYOUT

ENG. A. TENNIN, III | DATE 5-1-73

APP. 7-1-73 | DATE 5-1-73

APP. 1 | WO. M36120

SKETCH NO. 3653

CORRIDOR 1

SCALE: 1" = 56'

JOB NO. 10486

CLASSIFICATION

LEVEL UNCL

DATE 11-1-75

MONSANTO RESEARCH CORPORATION
MOUND FACILITY
MIAMISBURG, OHIO

T-BLDG RM 57 SKETCH 6
TRITIUM LIQUID WASTE
RECOVERY SYSTEM RM. LAYOUT

ENG. A. TENTMANZ DATE 11-1-75

APP. 11-1-75 APP.

APP. W.O. M36120

SKETCH No. 3654

SK-C-3655

P25966

W.O. NO. M35120

MONSANTO RESEARCH CORPORATION

W.O. NO. M35120

PROCESS FLOW DIAGRAM

DATE	TIME	DATE	TIME	DATE	TIME
10/4/96	10:49	10/4/96	10:49	10/4/96	10:49
10/4/96	10:49	10/4/96	10:49	10/4/96	10:49
10/4/96	10:49	10/4/96	10:49	10/4/96	10:49
10/4/96	10:49	10/4/96	10:49	10/4/96	10:49
10/4/96	10:49	10/4/96	10:49	10/4/96	10:49
10/4/96	10:49	10/4/96	10:49	10/4/96	10:49
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SK-C-3655

THIS PLAN IS THE PROPERTY OF MONSANTO RESEARCH CORPORATION AND MUST BE RETURNED TO DRAWING CONTROL BOUND FACILITY REPRODUCTION IS PROHIBITED WITHOUT PERMISSION OF BOUND FACILITY

[illegible]

FORM 1041-2 (F)	BRIEF CLASSIFICATION
UNCLASSIFIED	
DATE	
BY	
CODE (FORM 1041-2)

MONSANTO RESEARCH CORPORATION
RECORD LABORATORY
MINNEAPOLIS, OHIO

PROGRAM TITLE T-BLDG RM. 16

DRAWING TITLE ENGINEERING FLOW DIAGRAM
 HYDRIDE STORAGE MODULE
 TRITIUM LIQUID WASTE RECOVERY SYSTEM
 SKETCH 10

REV	DATE	BY	CHK	APP	DATE	REV	DATE	BY	CHK	APP
1	10/15/75	J. J. J.				1	10/15/75	J. J. J.		
2	10/15/75	J. J. J.				2	10/15/75	J. J. J.		
3	10/15/75	J. J. J.				3	10/15/75	J. J. J.		
4	10/15/75	J. J. J.				4	10/15/75	J. J. J.		
5	10/15/75	J. J. J.				5	10/15/75	J. J. J.		
6	10/15/75	J. J. J.				6	10/15/75	J. J. J.		
7	10/15/75	J. J. J.				7	10/15/75	J. J. J.		
8	10/15/75	J. J. J.				8	10/15/75	J. J. J.		
9	10/15/75	J. J. J.				9	10/15/75	J. J. J.		
10	10/15/75	J. J. J.				10	10/15/75	J. J. J.		

REV	DATE	BY	CHK	APP	DATE	REV	DATE	BY	CHK	APP
1	10/15/75	J. J. J.				1	10/15/75	J. J. J.		
2	10/15/75	J. J. J.				2	10/15/75	J. J. J.		
3	10/15/75	J. J. J.				3	10/15/75	J. J. J.		
4	10/15/75	J. J. J.				4	10/15/75	J. J. J.		
5	10/15/75	J. J. J.				5	10/15/75	J. J. J.		
6	10/15/75	J. J. J.				6	10/15/75	J. J. J.		
7	10/15/75	J. J. J.				7	10/15/75	J. J. J.		
8	10/15/75	J. J. J.				8	10/15/75	J. J. J.		
9	10/15/75	J. J. J.				9	10/15/75	J. J. J.		
10	10/15/75	J. J. J.				10	10/15/75	J. J. J.		

THIS DRAWING IS THE PROPERTY OF MONSANTO RESEARCH CORPORATION AND SHALL BE RETURNED TO MONSANTO RESEARCH CORPORATION UPON REQUEST. NO PART OF THIS DRAWING IS TO BE REPRODUCED OR TRANSMITTED IN ANY FORM OR BY ANY MEANS, ELECTRONIC OR MECHANICAL, INCLUDING PHOTOCOPYING, RECORDING, OR BY ANY INFORMATION STORAGE AND RETRIEVAL SYSTEM, WITHOUT PERMISSION IN WRITING FROM MONSANTO RESEARCH CORPORATION.

MONSANTO RESEARCH CORPORATION
GROUND LABORATORY
 800 N. MICHIGAN AVE., CHICAGO

PROGRAM TITLE T BLS: AY. 5

PROCESSING AND RECOVERY FLOW DIAGRAM
CRYOGENIC DISTILLATION MODULE
TITRIUM LIQUID WASTE RECOVERY SYSTEM
SKETCH II

OWG TYPE EFD

DWG. CLASSIFICATION

UNCL

1000

DATE 11/1/94

DATE 6:57:27 AM

CODE IDENT. NO. 14065

PROPERTY OF MONSANTO DES
MOBILE ALABAMA 36602-0001

A		ORIGINAL ISSUE
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MS	DATE	REASON
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APPENDIX B

COST ESTIMATE

PROJECT COST ESTIMATE SUMMARY

U.S. DEPARTMENT OF ENERGY MOUND FACILITY				BUDGET YEAR FY 82	SHEET 1 OF 2
BASIS OF ESTIMATE Check One (w/date):		☐ Conceptual Design ☒ Budget Data Sheet ☐ Des. Crit.	☐ Prel. Prop. ☐ EWO (Outside) ☐ Spec. Eng. Study	ENGINEER CLARK & DOUGH	CONST. YEAR FY 82
PROJECT TITLE TRITIUM WASTE WATER RECOVERY				ESTIMATOR CBS / DB	CHECKED BY DATE THIS EST. 7-12-79
DESCRIPTION				SUB-TOTAL	TOTAL
10. DETAIL OF COST ESTIMATE:					
a. E.D. & I. @ APPROX. 20 % OF CONSTRUCTION COST					300,000
b. LAND & LAND RIGHTS				- 0 -	1,506,000
c. CONSTRUCTION COST					
1. IMPROVEMENTS TO LAND				- 0 -	
2. BUILDING MODIFICATIONS				196,000	
T BLDG. MODIFICATIONS				196,000	
3. SPECIAL FACILITIES				1,310,000	
FEED WATER CLEAN-UP MODULE				102,000	
CATALYTIC EXCHANGE MODULE				226,000	
ELECTROLYSIS MODULE				187,000	
RECOMBINER MODULE				68,000	
HYDRIE STORAGE MODULE				216,000	
CRYOGENIC DISTILLATION MODULE				273,000	
ELECTRICAL & INSTRUMENTATION				238,000	
4. UTILITIES				- 0 -	
d. STANDARD EQUIPMENT					- 0 -
e. START-UP & TESTING					80,000
f. MRC & A WORK					70,000

PROJECT COST ESTIMATE SUMMARY

[illegible]

CONSTRUCTION COST ESTIMATE DETAIL

U.S. DEPARTMENT OF ENERGY MOUND FACILITY					BUDGET YEAR 1983		SHEET 1 OF 12	
BASIS OF ESTIMATE See Cost Estimate Summary Sheet			BRANCH		EWO NO. 1736120		CONST. YEAR 1983	
PROJECT TITLE TRITIUM WASTE RECOVERY SYSTEM T-57-16					ESTIMATOR D. BENDEL		CHECKED BY	
							DATE THIS EST. 07-12-79	
DESCRIPTION	QUAN.	MAT. UNIT	LABOR UNIT	MATERIAL	LABOR	TOTAL		
1. INSTALL 6' X 7' 1 3/4" DOORS AND FRAME IN CONCRETE WALL FROM T-57 TO T-46	1 EA	540	300	540	300	840		
2. ALLOW FOR SPECIAL HARDWARE, EXIT DEVICES, CLOSERS AND COORDINATION	1 SE	200	80	200	80	280		
3. PAINT DOORS + TRIM	1 EA	30	170	30	170	200		
4. INSTALL COVE BASE REPAIR FLOOR TILE	ALLOW	40	160	40	160	200		
5. INSTALL COMPRESSED AIR LINES AND ROOMS T-57 T-16 WITH PRV STATION IN MAIN AREA	2 EA	200	400	400	800	1200		
6. INST. CHILLED WATER PIPING	200 LF	4.70	5.90	940	1180	2120		
7. INSULATE PIPING + FITTINGS	200 LF	3.161	1.65	65	330	395		
8. REMOVE CEILING PANELS + T-BARS ABOVE WALL ADJOINING T-58	ALLOW		100		100	100		
9. REMOVE METAL PLATES ON TOP OF EXISTING WALL 1/4" X 3" - 1/4" X 13" 1/4" X 7" - 1/4" FT. LONG	ALLOW		200		200	200		

CONSTRUCTION COST ESTIMATE DETAIL

U.S. DEPARTMENT OF ENERGY MOUND FACILITY					BUDGET YEAR 1983	SHEET 3 OF 12	
BASIS OF ESTIMATE See Cost Estimate Summary Sheet		BRANCH		EWO NO. M36120	CONST. YEAR 1983	ORIG. EST. DATE	
PROJECT TITLE				ESTIMATOR D. BENDEL	CHECKED BY	DATE THIS EST. 07-12-79	
DESCRIPTION	QUAN.	MAT. UNIT	LABOR UNIT	MATERIAL	LABOR	TOTAL	
10. ERECT AND REINFORCE SCAFFOLD FOR LAYING BLOCK AND PLASTERING WALL. PROCURE AND RETURN TO STORAGE AREA	ALLOW		300		300	300	
11. LAY CONCRETE BLOCK ON WALL TO UNDERSIDE OF 2ND FLOOR; TIE INTO CONCRETE PILASTERS AND COLUMNS. REINFORCE w/DURORWALL EVERY 2ND COURSE	396 SF.	.88	2.52 LA.	350	920	1270 ⁰⁰	
12. PLASTER CONCRETE BLOCK WALL ABOVE CONCRETE WALL	30 SF.	2.10	8.98	65	270	335	
13. ALLOWANCE FOR MOVING SHELVING & MATERIAL STORED NEXT TO WALL BEING MODIFIED	ALLOW				100	100	
14. REMOVE WIRE FENCE AND CEILING IN TWO PLACES	ALLOW				160	160	
15. REPLACE CEILING T-BARS AND PANELS AT WALL - CUT EXISTING TO FIT BOTH SIDES OF WALL 881.F.	ALLOW			100	250	350	

CONSTRUCTION COST ESTIMATE DETAIL

U.S. DEPARTMENT OF ENERGY MOUND FACILITY					BUDGET YEAR 1983	SHEET 3 OF 12	
BASIS OF ESTIMATE See Cost Estimate Summary Sheet		BRANCH		EWO NO. M36120	CONST. YEAR 1983	ORIG. EST. DATE	
PROJECT TITLE TRITIUM WASTE RECOVERY SYSTEM T-57 16				ESTIMATOR R F EMMEL	CHECKED BY	DATE THIS EST. 7-12-79	
	DESCRIPTION	QUAN.	MAT. UNIT	LABOR UNIT	MATERIAL	LABOR	TOTAL
16.	EXTEND CONDUIT WIRING FROM PANEL IN T-16 TO T-57 (NEW TRANSFORMER AND 100 AMP PANEL INSTALLED APRIL 1979)	ALLOW			800	1200	2000
17.	Run Nitrogen Line LINE FROM STORAGE TANK AT H H BLDG THRU TUNNEL INTO T-BLDG TO ROOM T-57. FLOOR PLATES IN T-11, T11-B AND CORRIDOR #1 REMOVABLE TO ALLOW INSTALLATION. REMOVABLE CABINET ON WALL WITH EXISTING LINE CAN BE UTILIZED TO INSTALL LINE INTO CRAWL SPACE AND INTO T-57.	450 LF.	35	10	15750	4500	20250
18.	INCLUDE PHASE SEPARATOR AND LINE TO T-16 W/BRACKET FOR MOUNTING PHASE SEPARATOR	1 EA	1200	460	1200	400	1600
19.	EXTEND EXHAUST DUCT FROM T-57 THRU SOUTH WALL TO CONNECT TO E-22 DUCT IN CRAWL SPACE OVER CORRIDOR #1	435#	.36	1.40	160	600	760

CONSTRUCTION COST ESTIMATE DETAIL

U.S. DEPARTMENT OF ENERGY MOUND FACILITY					BUDGET YEAR 1983	SHEET 4 OF 12
BASIS OF ESTIMATE See Cost Estimate Summary Sheet		BRANCH		EWO NO. 1136120	CONST. YEAR 1983	ORIG. EST. DATE
PROJECT TITLE TRITIUM WASTE RECOVERY SYSTEM T-57-16				ESTIMATOR D. F. HALL	CHECKED BY	DATE THIS EST. 7-12-79
DESCRIPTION	QUAN.	MAT. UNIT	LABOR UNIT	MATERIAL	LABOR	TOTAL
20. CUT HOLE THRU WALL FOR DUCT PENETRATION REPAIR AFTER INSTALLATION	6.3 CF.	3 rd	40	20	260	280
21. INSTALL D.O.P TEST PORTS AND EXTEND THRU CORRIDOR CEILING	2 EA.	10	80	20	160	180
22. E.C.S. T-57	ALLOW.			1500	6900	8400
23. MONITORS	ALLOW			6000	2000	8000
24. PAINT ROOM AND COLOR CODE PIPING	ALLOW			950	8000	8950
25. HOUSE VACUUM SYSTEM				24000	24,000	48000
TOTALS				53130	53340	106470
OUTID 60% on LABOR						32000
TOTAL						138470
ESC. -- 4 YRS. @ 9%						196600

CONSTRUCTION COST ESTIMATE DETAIL

U.S. DEPARTMENT OF ENERGY MOUND FACILITY					BUDGET YEAR FY 82		SHEET 5 OF 12	
BASIS OF ESTIMATE See Cost Estimate Summary Sheet			BRANCH SPEC. FAC.		EWO NO. M36120		CONST. YEAR FY 83	
PROJECT TITLE TRITIUM WASTE WATER RECOVERY					ESTIMATOR C.B.S.		CHECKED BY DATE THIS EST. 7-12-79	
DESCRIPTION			QUAN.	MAT. UNIT	LABOR UNIT	MATERIAL	LABOR	TOTAL
FEED WATER CLEAN-UP MODULE			—	MRC	PURCHASE & INSTALL			
HEATED CONTACT TANKS			3 EA	1,000 ⁰⁰	80 ⁰⁰	3,000	240	3,240
TANK AGITATORS			3 EA	300 ⁰⁰	80 ⁰⁰	900	240	1,140
COALESCER			1 EA	200 ⁰⁰	80 ⁰⁰	200	80	280
ADSORPTION COLUMN			2 EA	300 ⁰⁰	80 ⁰⁰	600	160	760
FILTER			1 EA	200 ⁰⁰	80 ⁰⁰	200	80	280
DEIONIZER SYSTEM			1 EA	400 ⁰⁰	80 ⁰⁰	400	80	480
MICROPUMPS			5 EA	300 ⁰⁰	320 ⁰⁰	1,500	1,600	3,100
FLOWMETERS			3 EA	200 ⁰⁰	80 ⁰⁰	900	240	1,140
VALVES			8 EA	50 ⁰⁰	—	400	—	400
PH METERS			1 EA	700 ⁰⁰	—	700	—	700
SYSTEMS PIPING & FITTINGS			ALLOW	1,000 ⁰⁰	1,600 ⁰⁰	1,000	1,600	2,600
TEMP. MEASURING CONTROLS & READOUT			ALLOW	3,900	240 ⁰⁰	3,900	240	4,140
PRESSURE GAUGE			4 EA	100 ⁰⁰	—	400	—	400
GLOVE BOX			8 LF	4000 ⁰⁰	800 ⁰⁰	32,000	6,400	38,400
MISC. HARDWARE			ALLOW	1,000 ⁰⁰	—	1,000	—	1,000
ELECTRICAL TIE-IN			ALLOW	500 ⁰⁰	300 ⁰⁰	500	800	1,300
SPECIAL INSTRUMENTATION			ALLOW	3,000 ⁰⁰	800 ⁰⁰	3,000	800	3,800
PRODUCT TANK			1 EA	1,000 ⁰⁰	400 ⁰⁰	1,000	400	1,400
SUB TOTAL						51,600	12,960	64,560
TOTAL INCL'S 60% O/H ON LABOR & ESC @ 9% FOR 4 YEARS.								102,000

CONSTRUCTION COST ESTIMATE DETAIL

U.S. DEPARTMENT OF ENERGY MOUND FACILITY				BUDGET YEAR FY 82	SHEET 6 OF 12	
BASIS OF ESTIMATE See Cost Estimate Summary Sheet		BRANCH SPEC. FAC		EWO NO. M36120	CONST. YEAR FY 83	ORIG. EST. DATE
PROJECT TITLE TRITIUM WASTE WATER RECOVERY				ESTIMATOR CRS	CHECKED BY	DATE THIS EST. 7-12-78
DESCRIPTION	QUAN.	MAT. UNIT	LABOR UNIT	MATERIAL	LABOR	TOTAL
CATALYTIC EXCHANGE MODULES -		MRC	PURCHASE & INSTALL			
COLUMNS 1" X 10' PACKED	10 EA	2500 ⁰⁰	400 ⁰⁰	25000	4000	79000
PUMPS	10 EA	300 ⁰⁰	320 ⁰⁰	4000	4480	8480
FEED WATER TANK	1 EA	1000 ⁰⁰	200 ⁰⁰	1000	240	1240
FEED SYSTEM - PUMP & PACKAGING	ALLOW	1000 ⁰⁰	1600 ⁰⁰	1000	1600	2600
FUME HOOD	1 EA	4000 ⁰⁰	1600 ⁰⁰	4000	1600	5600
GLOVE BOX	12 LF	5000 ⁰⁰	800 ⁰⁰	60000	9600	69600
COLUMN PIPING & VALVES	ALLOW	9000 ⁰⁰	7200 ⁰⁰	9000	7200	16200
MISC HARDWARE	ALLOW	2000 ⁰⁰	800 ⁰⁰	2000	800	2800
COLUMN CATALYST	ALLOW	5000 ⁰⁰	-	5000	-	5000
CATALYST TEST & INSPECTION	ALLOW	1500 ⁰⁰	-	1500	-	1500
SUB-TOTAL				112,700	29,520	142,220
TOTAL INCL. 60% ON LABOR & ESC @ 9% FOR 4 YEARS						\$ 226,000

CONSTRUCTION COST ESTIMATE DETAIL

U.S. DEPARTMENT OF ENERGY MOUND FACILITY					BUDGET YEAR FY 82	SHEET 7 OF 12
BASIS OF ESTIMATE See Cost Estimate Summary Sheet		BRANCH Spec. Fac.	EWO NO. M 36120	CONST. YEAR FY 83	ORIG. EST. DATE	
PROJECT TITLE TRITIUM WASTE WATER RECOVERY			ESTIMATOR CBS	CHECKED BY	DATE THIS EST. 7-12-79	
DESCRIPTION	QUAN.	MAT. UNIT	LABOR UNIT	MATERIAL	LABOR	TOTAL
ELECTROLYSIS MODULE - MRC PURCHASE & INSTALL						
CELL STACKS	12 EA	3,000 ⁰⁰	175	36,000	2,100	38,100
POWER SUPPLIER	12 EA	700 ⁰⁰	-	8,400	-	8,400
O ₂ PHASE SEPARATOR / FEED TANK	1 EA	300 ⁰⁰	1,120 ⁰⁰	300	1,120	1,420
H ₂ PHASE SEPARATOR / FEED TANK	1 EA	300 ⁰⁰	1,120 ⁰⁰	300	1,120	1,420
PUMPS	2 EA	300 ⁰⁰	600 ⁰⁰	600	1,200	1,800
LEVEL CONTROLS	2 EA	70 ⁰⁰	-	140	-	140
PROCESS PIPING	ALLOW	9,000 ⁰⁰	11,000 ⁰⁰	9,000	11,000	20,000
CRYOGENIC MOLECULAR SIEVE	2 EA	5,000 ⁰⁰	400 ⁰⁰	10,000	800	10,800
GLOVE BOXES	6 LF	4,000 ⁰⁰	800 ⁰⁰	24,000	4,800	28,800
ELECTRICAL	ALLOW	250 ⁰⁰	-	250	-	250
MISC. HARDWARE	ALLOW	1,000 ⁰⁰	800 ⁰⁰	1,000	800	1,800
ROOM TEMP. MOLECULAR SIEVE	2 EA	1,000 ⁰⁰	400 ⁰⁰	2,000	800	2,800
HYDROGEN REGENERATION PUMPS	1 EA	2,000 ⁰⁰	400 ⁰⁰	2,000	400	2,400
SUB TOTAL				93,990	24,140	118,130
TOTAL INCL'S 60% O/H ON LABOR & ESC @ 9% FOR 4 YEARS.						187,000

CONSTRUCTION COST ESTIMATE DETAIL

U.S. DEPARTMENT OF ENERGY MOUND FACILITY					BUDGET YEAR FY82	SHEET 8 OF 12
BASIS OF ESTIMATE See Cost Estimate Summary Sheet		BRANCH SPEC. FAC.		EWO NO. M 36120	CONST. YEAR FY83	ORIG. EST. DATE 7-12-79
PROJECT TITLE TRITIUM WASTE WATER RECOVERY				ESTIMATOR CBS	CHECKED BY	DATE THIS EST.
DESCRIPTION	QUAN.	MAT. UNIT	LABOR UNIT	MATERIAL	LABOR	TOTAL
RECOMBINER MODULE —	MRC	PURCHASE	2	INSTALL		
HEATED RECOMBINER	1 EA	200 ⁰⁰	1,200 ⁰⁰	200	1,200	1,400
MOLECULAR SIEVE	2 EA	1,000 ⁰⁰	400 ⁰⁰	2,000	800	2,800
REGENERATION PUMP	1 EA	2,000 ⁰⁰	400 ⁰⁰	2,000	400	2,400
O ₂ GAS BOTTLE STATION	1 EA	1,000 ⁰⁰	1,600 ⁰⁰	1,000	1,600	2,600
COOLED RECOMBINER	1 EA	200 ⁰⁰	1,200 ⁰⁰	200	1,200	1,400
PHASE SEPARATOR/CONDENSER	1 EA	400 ⁰⁰	800 ⁰⁰	400	800	1,200
PUMP	1 EA	300 ⁰⁰	400 ⁰⁰	300	400	700
PRODUCT WATER TANK	1 EA	500 ⁰⁰	1,600 ⁰⁰	500	1,600	2,100
GLOVE BOX	2 LF	4,000 ⁰⁰	800 ⁰⁰	12,000	2,400	14,400
ELECTRICAL	ALLOW	200	—	200	—	200
MISC HARDWARE	ALLOW	1,000 ⁰⁰	800 ⁰⁰	1,000	800	1,800
PIPING, VALVES & FITTINGS	ALLOW	4,000 ⁰⁰	4,000 ⁰⁰	4,000	4,000	8,000
SUB TOTAL				23,800	15,200	39,000
TOTAL INCL'S 60 % OF ON LABOR & ES&C @ 9% FOR 4 YEARS						68,000

CONSTRUCTION COST ESTIMATE DETAIL

U.S. DEPARTMENT OF ENERGY MOUND FACILITY					BUDGET YEAR FY 82	SHEET 9 OF 12
BASIS OF ESTIMATE See Cost Estimate Summary Sheet		BRANCH SPEC. FAC.		EWO NO. M 36120	CONST. YEAR FY 83	ORIG. EST. DATE
PROJECT TITLE TRITIUM WASTE WATER RECOVERY				ESTIMATOR CBC	CHECKED BY	DATE THIS EST. 7-12-79
DESCRIPTION	QUAN.	MAT. UNIT	LABOR UNIT	MATERIAL	LABOR	TOTAL
HYDRIDE STORAGE MODULE	— MRC.	PURCHASE	1 ASE	1 INSTALL.		
LARGE U BEDS	3 EA	15,000 ^{sq}	1,200 ^{sq}	45,000	3,600	48,600
VACUUM TANK	2 EA	200 ^{sq}	1,500 ^{sq}	400	2,000	2,400
PUMPS	2 EA	10,000 ^{sq}	600 ^{sq}	20,000	1,200	21,200
VALVES	48 EA	150 ^{sq}	—	7,200	—	7,200
Pipe & FITTINGS	ALLOW	1,700 ^{sq}	15,500 ^{sq}	1,700	15,500	17,200
GLOVE BOX	6 LF	2,000 ^{sq}	500 ^{sq}	24,000	4,800	28,800
ELECTRICAL	ALLOW	200 ^{sq}	—	200	—	200
MISC HARDWARE	ALLOW	300 ^{sq}	4,000 ^{sq}	3,000	4,000	7,000
VCR 1/2	100 EA	200 ^{sq}	—	2,000	—	2,000
SUB TOTAL				103,500	31,100	134,600
TOTAL INCL'S 60% O/H ON LABOR & ESC. @ 9% FOR 4 YEARS						\$216,000

CONSTRUCTION COST ESTIMATE DETAIL

U.S. DEPARTMENT OF ENERGY MOUND FACILITY					BUDGET YEAR	SHEET 10 OF 12	
BASIS OF ESTIMATE		BRANCH		EWO NO.	CONST. YEAR	ORIG. EST. DATE	
See Cost Estimate Summary Sheet		SPEC. FAC.		M 36120	FY 82		
PROJECT TITLE				ESTIMATOR	CHECKED BY	DATE THIS EST.	
TRITIUM WASTE WATER RECOVERY				CBS		1-12-79	
DESCRIPTION	QUAN.	MAT. UNIT	LABOR UNIT	MATERIAL	LABOR	TOTAL	
CRYOGENIC DISTILLATION MODULE - 1425 KVA REFRIG. & INSTAL.							
DISTILLATION CO ₂ CONDENSERS & REBOILERS	2 EA	2,500 ⁰⁰	2,400 ⁰⁰	5,000	4,800	9,800	
HE REFRIGERATION COMP	2 EA	15,000 ⁰⁰	4,000 ⁰⁰	30,000	800	30,800	
COLUMN VACUUM CHAMBER	1 EA	500 ⁰⁰	1,200 ⁰⁰	500	1,200	1,700	
VACUUM CHAMBER SHIELD	1 EA	100 ⁰⁰	400 ⁰⁰	100	400	500	
PRODUCT SMALL U-BED	1 EA	8,000 ⁰⁰	1,200 ⁰⁰	8,000	1,200	9,200	
PUMPS	2 EA	10,000 ⁰⁰	400 ⁰⁰	20,000	800	20,800	
EQUILIBRATOR	1 EA	100 ⁰⁰	400 ⁰⁰	100	400	500	
GLOVE BOX	10 LF	4,000 ⁰⁰	800 ⁰⁰	40,000	8,000	48,000	
ELECTRICAL	ALLOW	100 ⁰⁰	-	100	-	100	
MISC HARDWARE	ALLOW	2,000 ⁰⁰	800 ⁰⁰	2,000	800	2,800	
HASTING FLOW METERS	4 EA	2,000 ⁰⁰	80 ⁰⁰	8,000	320	8,320	
TRITIUM MONITORS	3 EA	12,000 ⁰⁰	-	36,000	-	36,000	
VACUUM SYSTEM	1 EA	5,000 ⁰⁰	1,600 ⁰⁰	5,000	1,600	6,600	
VACUUM SYSTEM INSTRUMENTATION	ALLOW	5,000 ⁰⁰	400 ⁰⁰	5,000	400	5,400	
SUB TOTAL				159,800	20,720	180,520	
TOTAL INCL'S 60% O/H ON LABOR & ESC @ 9% FOR 4 YEARS.						\$273,000	

CONSTRUCTION COST ESTIMATE DETAIL

U.S. DEPARTMENT OF ENERGY MOUND FACILITY					BUDGET YEAR FY 82	SHEET 11 OF 12
BASIS OF ESTIMATE See Cost Estimate Summary Sheet		BRANCH SPEC. FAC.		EWO NO. M36120	CONST. YEAR FY 83	ORIG. EST. DATE
PROJECT TITLE TRITIUM WASTE WATER RECOVERY				ESTIMATOR CDS	CHECKED BY	DATE THIS EST. 7-12-79
DESCRIPTION	QUAN.	MAT. UNIT	LABOR UNIT	MATERIAL	LABOR	TOTAL
ELECTRICAL & INSTRUMENTATION				MRC PURCHASE & INSTALL		
COALESCER CONDUCTIVITY METER	1 EA	3,000 ⁰⁰	300 ⁰⁰	3,000	300	3,200
HEATED CONTACT TANK LEVEL INDICATORS	3 EA	50 ⁰⁰	50 ⁰⁰	150	150	300
GLOVE BOX TRITIUM MONITOR SYSTEM	3 EA	6,000 ⁰⁰	1,000	18,000	3,000	21,000
FEEDWATER MODULE ELECT. FEED-THRU	20 EA	100 ⁰⁰	50 ⁰⁰	2,000	1,000	3,000
CABINETS	2 EA	500 ⁰⁰	200 ⁰⁰	1,000	400	1,400
MICRO COMPUTER SYSTEM	1 EA	2,000 ⁰⁰	500 ⁰⁰	2,000	500	2,500
CAT COL. PUMP MOTOR STARTERS	11 EA	50 ⁰⁰	50 ⁰⁰	550	550	1,100
COLUMN CONTROL VALVES	12 EA	1,100 ⁰⁰	200 ⁰⁰	13,200	2,400	15,600
COLUMN D/P CELLS	10 EA	1,100 ⁰⁰	400 ⁰⁰	11,000	4,000	15,000
FLOW METER COLUMN:	1 EA	1,500 ⁰⁰	300 ⁰⁰	1,500	300	1,800
FLOW LOOPS COLUMNS	2 EA	1,500 ⁰⁰	300 ⁰⁰	3,000	600	3,600
PROGRAMMABLE CONTROLS	3 EA	5,000 ⁰⁰	1,000 ⁰⁰	15,000	3,000	18,000
CABLE	ALLOW	2,000 ⁰⁰	500 ⁰⁰	2,000	500	2,500
CELL FLOW SWITCH	14 EA	60 ⁰⁰	50 ⁰⁰	840	700	1,540
PRESSURE SWITCH CELL	2 EA	70 ⁰⁰	50 ⁰⁰	140	100	240
DP SWITCH	1 EA	100 ⁰⁰	80 ⁰⁰	100	80	180
LEVEL CONTROL LOOP RECOMBINER	1 EA	800 ⁰⁰	400 ⁰⁰	800	400	1,200
MOLECULAR SIEVE CONTROLS	2 EA	3,500 ⁰⁰	500 ⁰⁰	7,000	1,000	8,000
FLOW LOOP RECOMBINER	2 EA	1,500 ⁰⁰	500 ⁰⁰	3,000	1,000	4,000
TEMP. READOUT LOOP RECOMBINER	2 EA	1,000 ⁰⁰	300 ⁰⁰	2,000	600	2,600
FLOW TRANSMITTER	2 EA	1,500 ⁰⁰	500 ⁰⁰	3,000	1,000	4,000
CONTROL VALVE	1 EA	1,200 ⁰⁰	300 ⁰⁰	1,200	300	1,500
HYDRIDE PUMP STARTERS	5 EA	80 ⁰⁰	50 ⁰⁰	400	250	650
FLOW LOOPS	3 EA	1,500 ⁰⁰	500 ⁰⁰	4,500	1,500	6,000
TEMP. LOOPS	5 EA	600 ⁰⁰	100 ⁰⁰	3,000	500	3,500
PRESSURE TRAN.	6 EA	500 ⁰⁰	100 ⁰⁰	3,000	600	3,600
STORAGE TANK TEMP.	1 EA	300 ⁰⁰	100 ⁰⁰	300	100	400
CONTROL VALVES CRYOGENICS	5 EA	1,200 ⁰⁰	200 ⁰⁰	6,000	1,000	7,000
FLOW LOOPS	3 EA	1,800 ⁰⁰	500 ⁰⁰	5,400	1,500	6,900
TEMP LOOPS	3 EA	1,100 ⁰⁰	200 ⁰⁰	3,300	600	3,900

CONSTRUCTION COST ESTIMATE DETAIL

[illegible]

APPENDIX C

ENVIRONMENTAL IMPACT ASSESSMENT

DEPARTMENT OF ENERGY

ALBUQUERQUE OPERATIONS OFFICE

DAYTON AREA OFFICE

MONSANTO RESEARCH CORPORATION

MOUND FACILITY

TRITIUM LIQUID WASTE RECOVERY SYSTEM

Prepared: June 7, 1978

By: Lane W. Metcalf

INTRODUCTION

Purpose

This Environmental Impact Assessment of the Tritium Liquid Waste Recovery System Project was prepared per DOE IAD No. 0510-5. The information provided follows the format given in 10 CFR 711.25 and demonstrates that:

- (1) There is a justifiable need for the project to proceed.
- (2) The project's objectives can be accomplished with no significant environmental impact as a result of project activities.
- (3) The end result of the project is a positive (beneficial) impact on the environment.

The project is described in more detail in the Conceptual Design Report.

ENVIRONMENTAL IMPACT ASSESSMENT

I. Description of the Proposed Action

This project will provide a waste water treatment system to efficiently strip tritium from certain DOE generated waste water. After stripping the tritium from the water stream, the tritium will be further purified into a fully reusable form. The by-product streams, both water and gaseous, will be well within the Radioactive Concentration Guide (RCG) levels and can be released directly to the environment. The system will be located in Rooms 16 and 57 of the existing T Building. An existing Effluent Removal System (ERS) will service the process to minimize tritium effluents during normal operations.

II. Description of the Existing Environment

Currently high-activity tritium liquid waste from Mound Facility is solidified and shipped to Nevada for burial.

III. Potential Environmental Impacts

The project will have a positive beneficial impact on the environment by significantly reducing the amount of tritium liquid waste that is being buried by Mound Facility and other contractors.

There will be no significant adverse effects during the construction or operation of this addition within the T Building. Site restoration required will be minimal for this addition. Since this is an addition within an existing building, no land or streams will be committed to the project.

IV. Coordination with Federal, State, Regional or Local Plans

Because of the limited scope of this on-site project, it will not interfere with any state, regional, or local plans. It will also be consistent with the intent of Executive Order 11752, "Prevention, Control, and Abatement of Air and Water Pollution at Federal Facilities." In addition, there is no known endangered or threatened species at Mound Facility and this proposed project complies with the requirements of the Endangered Species Act.

V. Description of Alternatives

Two alternatives to the proposed project were considered:

- (a) No action - continue to bury tritium liquid waste.
- (b) Relocate project to another DOE site.

An evaluation of the alternatives on technical feasibility vs. cost vs. benefit vs. risk basis showed that the proposed project would be the best overall approach to protecting the environment.

SUMMARY

As demonstrated in this document, the Tritium Liquid Waste Recovery System project should be completed. The project will have a beneficial impact on the environment by significantly reducing the amount of tritium liquid waste that is being buried by Mound Facility and other contractors.

APPENDIX D

ENERGY CONSERVATION EVALUATION

APPENDIX D

ENERGY CONSERVATION EVALUATION TRITIUM LIQUID WASTE RECOVERY SYSTEM

1. Design Conditions - Interior shall be 68° D.B. winter, 80° D.B. summer with $\pm 2^\circ$ tolerances. Close control related to process requirement, tritium. (Both duty, non-duty hours.)
2. Design conditions - Maximum 50% relative humidity.
3. Design Conditions - Exterior - Not Applicable, utilizing existing buildings.
4. Building Envelope Construction - Not applicable, utilizing existing buildings.
5. HVAC system is existing and consists of a conventional air handling unit, brine coil, heat arrangement, and single pass air flow for fumehood requirements. Energy conservation measures to be utilized will be a reduced air requirement during periods of non-occupancy to maintain specified temperature conditions and still comply with tritium safety requirements. Energy conservation reviews will be continually in process.
6. Lighting levels will conform to energy conservation standards.
7. Energy Consumption

	<u>Building*</u> <u>Energy/Yr</u>	<u>Process</u> <u>Energy/Yr</u>
Electricity	None	245,000 KWHR
Oil	<u>None</u>	<u>None</u>
TOTAL ENERGY/YR	None	245,000 KWHR
TOTAL ENERGY/FT ² /YR	None	N/A

* Building is existing with no additional energy loads except new process.