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ADDITIONAL FACILITIES TO HANDLE

PUREX TANK FARM VAPOR WASTES

Project CG-719

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Prepared By:

V. W. Wood

Radiological Design and Development
PROCESS DESIGN AND DEVELOPMENT
FACILITIES ENGINEERING OPERATION

January 7, 1957

This document has been reviewed and approved by the appropriate members of the Facilities Engineering Operation as a basis for preparation of a project proposal and detail designs for the installation of surface condensers at the Purex Tank Farm.

[Signature]
Manager, Process Design and Development

2-15-57
Date

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Manager, Facilities Engineering

2-5-57
Date

CHEMICAL PROCESSING DEPARTMENT
MANFORD ATOMIC PRODUCTS OPERATION
GENERAL ELECTRIC COMPANY

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ADDITIONAL FACILITIES TO HANDLE
PUREX TANK FARM VAPOR WASTES

Project CG-719

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ADDITIONAL FACILITIES TO HANDLEPUREX TANK FARM VAPOR WASTES

Project CG-719

I. INTRODUCTION

The liquid high-level radioactive wastes from the separations plant are stored in large underground tanks where radioactive decay of the fission products in storage gives off heat. In the case of the 241-A underground storage tank farm, for Purex wastes, advantage is taken of this heat to self-concentrate the wastes thus reducing the final stored volume.

The present practice is to permit boiling and concentration in the storage tanks. The vapors given off from the boiling wastes are collected in a vapor header and passed through a deentrainment vessel and on to two contact condensers where the vapors are condensed and intermixed with waste cooling water. The liquid effluent from these contact condensers is slightly radioactive. Samples taken of the waste vapors have shown a considerable amount of cesium-137 present as well as other types of radioactive material carry over from the waste tanks. For this reason the contact condenser effluent is discharged to an underground crib 216-A-8.

Underground disposal of the continually increasing volume of condenser effluent as larger waste volumes are accumulated in the underground tanks presents a critical problem. This is further complicated by the desirability to transfer the condensate waste to new disposal facilities near the 200 West area as recommended by the Chemical Effluent Technology Operation⁽¹⁾.

The 216-A-8 crib was placed in operation January 26, 1956 receiving the condenser effluent water. During the first six months of operation an unpredicted liquid level rise was experienced in the crib resulting in overflowing as first recorded on July 13, 1956. As a temporary expedient, operations personnel provided a large open pit to contain the overflow. During July, August and September considerable overflowing occurred. However, this condition has been temporarily corrected through activation of the air circulators in the storage tanks, and through a reduction in the cooling water volume used on the contact condensers.

The air circulators are sections of steel pipe installed vertically in the storage tanks. Air is introduced into these pipes to actuate waste circulation and promoting a more uniform vapor evolution to avoid bumping.

(1) Letter, "Recommended Location of New Purex Waste Disposal Facilities", D. W. Pearce to H. P. Shaw, November 13, 1956.

Bumping is described as follows:

"Bumping is postulated as being a spontaneous release of 'stored heat' from the lower levels of the tank. The stored heat is created by changes in the boiling point due to hydrostatic head, accelerated heat generation rates due to precipitated fission products, and poor heat transfer through the sludge." (2) With the circulators operating, no bumping has been experienced to date.

II. PURPOSE

- The intent of this report is to present the scope of facilities required to reduce the volume of potentially radioactive condensate waste from the 241-A tank farm and to dispose of this waste through supplemental cribbing.

III. SUMMARY AND CONCLUSIONS

An analysis of the 216-A-8 crib capabilities in relation to the projected flows clearly indicated that if other facilities which would materially reduce the contaminated waste stream volume were not provided, an extensive and costly crib system would be required in the immediate future.

The economical solution to the problem is to provide surface condensers which will permit segregation of the condensed waste vapors from the cooling water, condensate collection and transfer facilities, and a new condensate disposal crib near the 200 West Area. The surface condensers would be supplied with new raw water in place of the re-used water from the cell equipment condensing service.

The data which support this solution to the problem are as follows:

1. The surface condensers will keep the cooling water separate from the condensed vapors and reduce contaminated waste volumes 90 to 95 per cent.
2. This reduction in the contaminated waste stream volume reduces the size of the required cross country pumping and piping facilities to where the existing 200 East - 200 West waste transfer piping is adequate to handle the condensate flow to the new disposal crib, (216-A-23). See drawing SK-2-2247 Sheet 2 of 2, Appendix No. 9.
3. The use of cold raw water on the surface condensers will give a condensing capacity of 90×10^6 BTU per hour which is adequate for condensing the waste vapor stream from the 241-A tank farm under all ordinary circumstances.

(2) Document HW-41791 P2, "Purex Waste Storage Part II - 241-A Technology and Control", by G. L. O'Neill and W. H. Swift, dated October 29, 1956.

4. It is anticipated that the capacity of the 216-A-8 crib will be exceeded in four to six months, even with the cooling water conservation methods which have been placed in effect.
5. The surface condensers have a long range cost advantage through reduction and a savings of overall crib costs and in real estate requirements. Greater utilization of the ion exchange capacity of the soil column for removal of radioactive materials will result from reduction in volume of waste.
6. The 216-A-8 crib dispersal rate was calculated to be 9 gallons per square foot per day of bottom area in September 1956. This rate was expected to gradually decrease to approximately 50 percent of this amount within 6 months. This could be further reduced by another 50 percent within the following 18 months.

Alternates to providing the proposed surface condenser installation and a new condensate waste crib near the 200 West Area are an extensive crib farm at an estimated cost of one to two million dollars per year or to provide underground storage facilities sufficiently large to permit dilution to the point where boiling will not occur and which would cost an estimated \$4,500,000 per year.

It is estimated that the recommended facilities can be ready for use 14 months after date of authorization.

The design assumptions for this scope are:

1. Heat evolution from stored Purex wastes will reach a maximum net rate of 40×10^6 BTU's per hour when the farm is approximately 60 percent filled. (3)
2. Bumping conditions could develop on a frequent basis in event of circulator stoppage which would double the 40×10^6 BTU's per hour rate for periods up to four hours.
3. Under unusual conditions and on rare occasions with circulators inactive and simultaneous bumping in two tanks a heat evolution could occur which would be four times the normal rate. The large volume of combined cooling water and condensate from the contact condensers which would be used under these conditions could be sent to the existing 216-A-8 crib.
4. In-so-far as practical all potentially contaminated condensate from the tank farm vapor handling system will be sent to cribs in a selected area near the 200 West Area.

(3) HW-42565, "A Design Basis for Tank Farm Vapor Systems", by G. L. O'Neill, April 17, 1956.

5. The three stainless steel surface condensers which are now in storage in the 200 East area will be available for this project.
6. Disposal rates experienced at the existing crib are indicative of the waste stream characteristics to penetrate the subsoil in the general vicinity.
7. The existing 216-A-8 crib overflow facilities will be sufficient, through exercising special controls, to dispose of waste from the contact condensers which are in excess of the crib capacity until the recommended facilities can be provided.
8. Tank farm waste vapors can not be vented directly to the atmosphere.

IV. RECOMMENDATIONS

It is recommended that the following steps be taken to improve the vapor handling facilities at the 241-A Purex tank farm:

1. Install three surface condensers according to scope drawings SK-2-2134, SK-2-2914, SK-2-2142, SK-2-2144, and SK-2-2172; and provide the necessary instrumentation and regulation of the cooling water. Also provide a 20 foot by 17 foot addition on the North side of the present 241-A tank farm control house.
2. Construct a new 16 inch cold raw water supply line on the North side of 202-A building according to scope drawing SK-2-2795. Provide the necessary changes to the existing 8" cold raw water supply line to the 201 storage tank and other regulating features as indicated on the Engineering Flow Diagram SK-2-2914. Install an 8 inch raw water tie-in to the present 8 inch cold raw water supply line to the 241-A tank farm.
3. Build a new waste condensate crib, 216-A-23 and condensate holdup and transfer facilities according to scope drawings SK-2-2134 and SK-2-2247 Sheets 1 and 2. This will include installation of radiation detection equipment on the surface condenser waste cooling water line to the swamp and continuous proportional sampling of this stream after it leaves the condensers. It will also include representative sampling facilities for the contaminated waste condensate stream and test wells at the crib site.

V. DISCUSSION

1. Description and Limitations of Present Facilities

The two contact condensers are buried under an earth fill just South of the tank farm valve pit. A sketch of these condensers is shown on drawing SK-2-2175, Appendix No. 13. The vapor enters from the side of the contact condenser and is intermixed with the cooling water cascading from the baffle plates and distributor rings above. The cooling

water, condensed vapors and entrained vapors leave through the drain in the bottom of the condensers. The drain has a five foot trap to provide a seal at the bottom of the condensers. At the top of the contact condensers is a 6 inch vapor vent which exhausts non-condensables to the vent house. The condensers are supplied with a normal water system for cooling the waste tank farm vapors and an emergency water system. The normal water system is regulated by the heat level in the drain leg and operates continually. The emergency water system is regulated by the pressure buildup in the waste storage tanks. When the vapor pressure in the tanks reaches a predetermined level the emergency system is actuated. This is a safety feature to avoid blowing the condenser by-pass seal pot thus permitting contaminated waste vapor to directly enter the atmosphere. The intermixing of the cooling water with the waste vapor condensate creates too large a contaminated waste volume to be adequately handled by existing disposal facilities. In addition it is more costly to provide acceptable cribbing facilities than to construct the facilities recommended.

The contact condensers have been re-using Purax waste cooling water which normally would be at 125°F at the time it enters the contact condensers. As a result more water is required to lower the temperature of the waste vapor to the condensate level. The temperature of the regular raw water system is approximately 50°F lower. Assuming it's average temperature is 75°F, it would reduce the cooling water requirements on the contact condensers nearly 50%. Converting over to the use of cold raw water reduces the expected normal flow to approximately 700 GPM. It will help to reduce the present flow to within the existing limits of 216-A-8 crib for a very limited time. This time is short and may not be sufficient even with the cold raw water applied to the contact condensers to permit installation of recommended surface condenser facilities without overflowing the crib.

The present underground disposal facilities for the contaminated wastes was constructed according to drawing K-2-56157. (Not included in appendix.) This drawing shows the crib bottom is level at elevation 639.5. The crib overflow line is at elevation 645.7 which gives an effective depth of 6.2 feet. Any higher liquid level will cause the crib to overflow. Drawing SK-2-2144 gives some of the details on this crib and its general location with respect to the 241-A tank farm.

The horizontal dimensions of the crib bottom are 850 feet by 20 feet. Therefore, a 6.2 foot liquid depth with a 2:1 side slope on the crib gives 40,087 square feet of liquid surface at the full to overflowing stage. The disposal capacity of the crib with this liquid depth was less than 250 gallons per minute or less than 360,000 gallons per day in September 1956. On this basis, the dispersal rate was 360,000 or less than 9.0 gallons per square foot per day. 40,087

For normal operations there should be only a few inches (say 4 to 8) of liquid waste in the crib where the projected liquid surface area is 850 feet by 20 feet or 17,000 square feet. Using the 17,000 square feet of bottom area and the 9.0 gallons per square foot per day, the existing crib capacity would be a normal flow of only 153,000 gallons per day. (Or 106 gallons per minute for September). The capacity was predicted to be approximately half of this in six months. The normal flow rate for this waste stream which must be cribbed is expected to be 1340⁽⁴⁾ gallons per minute with Purex operating at normal capacity. This is 12.6 times the calculated 106 gallons per minute crib dispersal rate. A bumping condition at the tank farm is estimated to increase the crib waste flow rate to 2900 GPM for periods up to four hours. On the assumption of only one bumping condition per day this is equivalent to an average of 260 GPM for the 24 hour period in addition to the 1340 GPM. Under present conditions this 9.0 gallons per square foot per day rate during normal crib operations is too high to be a representative design rate for the following reasons:

1. The surge capacity of the crib which was designed and constructed to handle bumping conditions is being fully utilized to dispose of the smaller normal waste stream flow. The crib should normally operate with less than 8 inches of liquid except in cases of tank farm bumping conditions for which the additional volume was provided.
2. The interface of the crib exposed to the liquid waste is a controlling factor in the crib capacity. The added 74 inches of liquid head gives a much larger effective interface area and causes a greater amount of waste to percolate horizontally.
3. If the performance of this crib follows that of similar cribs which have been observed in the past, the percolation rate is expected to be reduced to 4.5 gallons per square foot per day by May 1957. See chart of predicted crib dispersion rates in appendix No. 2. It is evident that the present normal crib capacity is well below 106 gallons per minute and probably nearer 80 gallons per minute when adjustments are made for horizontal dispersion factors. A projected capacity for the 216-A-8 crib full to overflowing is 125 gallons per minute about March 1957, and on a normal crib level basis it is 50 gallons per minute. It is expected to be less than this by late summer 1957. Even the 50 gallons per minute is but 1/14th of the expected 700 gallons per minute normal waste stream with cold raw water being used on the contact condensers. If allowances are made for bumps, it falls below 1/20th of the required capacity.

(4) From page 4 Document HW-44506 "Design Bases and Performance Characteristics of the Purex 241-A Waste Tank Farm Condensate Disposal Facility", by L. R. Michels and L. L. Zahn, July 26, 1956.

2. Additional Facilities Required

The separation of vapor condensate from cooling water can be effected by installation of surface condensers. The surface condensers purchased in 1954 were placed in storage in the 200 East Area when the decision was made to install contact condensers (5). These surface condensers have a design capacity of 20×10^6 BTU's per hour each with an inlet water temperature of 125°F . Through the use of colder raw water, this capacity can be increased to 31×10^6 BTU's per hour.

The actual heat evolution after the initial waste buildup in storage is dependent upon the conditions of the Purax operation. Each 241-A tank vapor line is tied into a common header that leads to the condensing facilities. A normal heat evolution rate reaches a plateau when the deceleration rate of heat evolved from decaying fission products in storage equals the rate of heat evolution increase from the waste stream being added.

The assumed normal heat evolution rate from the 241-A tank farm and for the future 241-AI tank farm is 40×10^6 BTU's per hour with the maximum bump expected to double this rate. Thus, the three available stainless steel surface condensers with a capacity of 93×10^6 BTU's per hour are adequate for these condensing requirements.

These condensers will be installed in an all weather building which will permit a maximum of contact maintenance and protection from operating radiation hazards. The building should have a removable slab cover to permit ease of installation and removal of the surface condensers by portable cranes. It should be located on the North side of the tank farm area for easy access by the tank farm operating personnel and where the vapor header from the future 241-AI tank farm can be readily connected to the system. This provides greater distance between the construction area and the exhaust vent house which may emit contaminated vapors. The tank farm vapor and vent header will be extended to the new surface condenser installation as shown in Scope Drawing SK-2-2134, SK-2-2142, SK-2-2914 and SK-2-2172.

A 20 foot by 17 foot addition to the existing 241-A control house will be provided to permit the installation of additional instrumentation required for the surface condenser facilities and the future 241-AI tank farm.

Cold raw water is required to assure adequate capacity of the proposed surface condenser installation. Cold raw water will be supplied to the surface condensers through three tie-in sources in the proposed installation. These three tie-ins are required to insure an adequate water supply and are as follows:

- (5) Project CA-513A Revision Request No. 55 "Design Changes for 241-A Waste Tank Farm", by M. W. Cook and E. G. Johnson, April 5, 1954.

1. The existing 8 inch line from the 6 inch raw water line east of 202-A to the 750,000 gallon storage tank;
2. A new 16 inch tie-in line to be constructed from the east end of the 20 inch raw water supply line on the north side of 202-A building to the existing 16 inch line which runs from the 750,000 gallon storage tank to the surface condensers, and
3. An 8 inch tie-in line to the surface condenser header from the 8 inch raw water line which originates at the Hot Semi-Works and runs to the 241-A tank farm.

This installation of three water supply lines with the largest connected to the east end of the 202-A building header will give 10 to 15 psi lower pressure in the building header during emergencies than would be obtained with the alternate 16 inch raw water line around the south side of the 202-A building shown as an alternate proposal on drawing SK-2-2795. However, this reduced pressure is not excessive and such emergencies will be very infrequent. They will occur only when heat evolution exceeds the normal 40 X 10⁶ BTU's per hour during bumping when the air circulators are not operating. The use of cold raw water virtually eliminates the probability that the contact condensers will be required for emergency purposes and reduces the requirements for facilities to handle the large volumes of contaminated wastes that would be created when the contact condensers were used after the 216-A-8 disposal facilities were no longer available for use.

The soil conditions under the 200 East Area are much less favorable for the disposal of contaminated wastes to ground than are the conditions under the 200 West area as determined by test wells drilled in the last three years and other exploratory and research work. As a result of the poorer subsoil conditions, it has been recommended that all future Purex contaminated waste cribs be located at a site near the 200 West Area. (1) The transfer and disposal of the contaminated condensate will require hold up tanks, transfer pumps and lines, and a crib as indicated on scope drawings SK-2-2134, SK-2-2144, SK-2-2914, SK-2-2247 Sheets 1 and 2. Representative batch sampling facilities for the condensate stream, a monitor and proportional sampler on the waste cooling water effluent stream, and test wells at the crib site will be provided. Included are transfer lines to the present 241-A-152 diversion box for future recycle and tie lines to the 241-CR-151 diversion box stubs as shown on SK-2-2247 Sheet 1 of 2. It is possible that future facilities to permit recycling of the condensate to each individual underground waste tank will be required. However, these are not included in this scope.

(1) Letter, "Recommended Location of New Purex Waste Facilities", by D. W. Pearce to H. P. Shaw, November 13, 1956.

The condensate transfer facilities will make regular use of two existing 3 inch stainless steel waste transfer lines between the 241-CR-151 boxer and the 241-J-152 diversion box in the 200 West Area. A third line will be held in reserve as a spare. The main section of the transfer line has six - 3 inch stainless steel lines which will be available for this service upon completion of the waste metal recovery program this year.

The new 216-A-23 crib with associated test wells required to handle the undiluted 241-A tank farm vapor wastes is shown on drawing SK-2-2247 Sheet 2 of 2. The expected flow is 80 GPM or 115,200 gallons per day. At a 10 gallons per square foot per day dispersal rate this requires 11,520 square feet of crib area. The proposed crib has 2,500 lineal feet with a 5 foot bottom width or an area of 12,500 square feet. The 10 gallons per square foot per day is optimistic for two years of crib operation. However the flow to the crib will be less than 80 GPM during the first year of operation and some condensate may be recycled to the underground waste storage tanks. The proposed crib has a high ratio of crib interface area to bottom area and is expected to perform better than the 216-A-8 crib. Although, undiluted condensate is not expected to move through the interface as rapidly as the waste now going to the 216-A-8 crib. Only after several months of actual crib experience with the specific condensate will it be possible to determine when and how much the new crib will need to be expanded. Based on information at hand it is expected that the proposed crib will give two years of service.

3. Alternate Facilities

As one alternate, the continued use of the contact condensers would require an extensive annual crib replacement program. Disregarding the need to locate the new cribs near the 200 West Area and also assuming the present crib configuration design to be suitable, an order of magnitude cost for replacement cribs may be calculated as follows:

$$\frac{(670-53)}{53} \times \$74,500 = \$867,000$$

The bases for these calculations are:

1. The number 670 is one half of 1340 GPM (the estimated future cooling water flow with contact condensers), and is the lowest that could be expected from using cold raw water on the contact condensers.
2. The number 53 is the estimated average crib dispersal rate in gallons per minute over a two year period.
3. The \$74,500 is the 216-A-8 crib cost derived from \$59,500 for the contractors price plus \$15,000 for materials furnished the contractor by General Electric.

It should be pointed out here that the \$74,500 does not include other materials furnished the contractor at no cost by the AEC. Nor does it include costs for test wells, engineering, contingencies, administrative expense or escalation. The actual crib cost including the replacement cost would be from 50 to 100 per cent greater. Not only is crib replacement cost unattractive from the initial cost point of view, but it is unattractive from: (1) the high annual replacement cost, (2) the high rate of utilization of real estate and, (3) the added high cost of transport facilities to transfer the larger volumes (700 or 1340 GPM normal to 2900 GPM for four hours during an emergency) to a suitable cribbing site. The latter costs were purposely omitted in the previous cost example.

A second alternate would be to provide additional storage tanks for the waste condensate, and assuming an average heat evolution rate of 40×10^6 BTU's per hour from the process waste in the form of vapor which is to be condensed in the existing contact condensers and then the combined wastes stored, the cost becomes exorbitant. For example, the 40×10^6 BTU's per hour would require approximately 48,000 gallons of cold raw water per hour to condense the vapors. This added to the condensate would result in approximate 53,000 gallons of waste to store per hour. If we use the 50 cents per gallon cost for storage, storage costs for this waste would run at \$26,500 per hour.

Another approach to the storage problem is dilution of the initial wastes to prevent boiling. The present cost for underground storage of radioactive wastes is in excess of 50 cents per gallon. If we assume a 10 percent heat loss to the ground from the Purex tanks and that a 6×10^6 gallon tank farm is good for six years on a self-concentration basis, the order of magnitude cost of the new facilities for underground storage of diluted waste is:

$$\frac{6 \times 10^6 \times .50 \times (10-1)}{6} = \$4,500,000 \text{ per year.}$$

Some reduction in the cost derived in this example might be possible with tanks designed with special heat radiation facilities, but this would still be high compared with the cost of the recommended facilities.

4. Surface Condenser Installation

- a. The recommended layout is to install the surface condensers in parallel with the contact condensers. This includes three surface condensers, condensate hold up and transfer facilities, a new crib near the 200 West Area, and the use of raw water for cooling. The parallel installation is recommended instead of a series installation for the following reasons:

1. Less pressure drop in vapor header during heavy loading. See Table 1 of appendix No. 14.
2. Less field work is required on contaminated equipment.
3. The full capacity of the surface condensers can be utilized when the contact condensers are in use.
4. The surface condensers can be used to full capacity with both contact condensers completely out of service.
5. Greater flexibility of the vapor header system can be provided when the proposed 241-AI tank farm is tied-in to the system. It also eliminates the bottle neck at the present cyclone separator or de-entrainment section, resulting from routing the vapors from both tank farms through the common vapor header at the separator as in the case of a series arrangement.

Other methods of installing the surface condensers which were considered are:

1. Surface condensers installed in series with and down stream from the existing contact condensers.
2. Various combinations of only one, or two surface condensers in series or parallel with the contact condensers.
3. Locating the surface condenser installation on the South side of the tank farm area.

The reasons why a series type installation was not selected are:

1. Greater pressure drop in vapor header system.
2. Added metal fabrication work in the field on contaminated equipment.
3. Only one contact condenser would be available at a time.
4. Condensate carry over to the surface condensers during emergencies.
5. In an emergency all vapors would have to pass through the contact condensers.
6. At no time could both contact condensers be taken out of service.
7. Future operating experience with the air circulators may indicate the contact condensers can be completely removed from service.

The reasons why the installation of only one or two surface condensers was not recommended are:

1. At a 40×10^6 BTU per hour heat evolution rate at least two surface condensers are required. To provide a reasonable margin of coverage for tank bumps and/or a spare for use during maintenance or adjustments a third surface condenser is desirable.
2. The third surface condenser provides a larger combined heat sink capacity to handle sharp changes in the heat evolution rate.
3. The three surface condenser installation permits more efficient use of the cooling water.
4. The three surface condenser installation reduces the probability that the contact condensers will be needed when a bumping condition occurs. This is highly desirable, because the cost for handling the large volume of waste from the contact condensers will be excessive once the 216-A-8 crib can no longer be used.

A project proposal HW-46524 dated November 17, 1956 requesting \$60,000 in engineering funds to complete the scope on this project (CG-719) and to do detail design work has been issued. Also a letter request to the AEC for \$8,000 advanced engineering was issued and approved by HEW Direction No. HW-412 dated December 21, 1956. It is estimated that detail design can be started one month after authorization and can be completed in five months.

It is also estimated that construction work can start seven months after authorization and can be completed in seven months, or fourteen months after authorization.

Radiological Design and Development
Facilities Engineering Operation

VW WOOD:al

GRAPHIC PRESENTATION - CONTAMINATED WASTE VOLUMES SURFACE CONDENSER VS CONTACT CONDENSER

NOTE:

COSTS FOR WASTE DISPOSAL FACILITIES, IN THIS CASE, ARE DIRECTLY PROPORTIONAL TO WASTE VOLUMES WITH MINOR EXCEPTIONS.

V.W. WOOD

12-10-58

ESTIMATED COPR PERFORMANCE IN GALLONS PER SQ. FT. PER DAY

APPENDIX NO. 2

HW-47046

HW-47046

LEGEND

- CV — CONTROL VALVE
 - COND — CONDENSATE
 - CW — COOLING WATER
 - CV — EXHAUST VALVE
 - LIC — LIQUID LEVEL CONTROL
 - MS — MOTOR START SWITCH
 - PS — PRESSURE SWITCH
 - FW — FLOW WATER
 - IM — SAMPLE INJECT
 - IV — ISOLATION VALVE
 - TDC — TEMPERATURE DIFFERENCE CONTROLLER
 - VH — VAPOR HEADER
 - WCW — WHITE COOLING WATER
 - M — MOTOR
 - N.C. — NORMALLY CLOSED
 - N.A. — NEW PANEL MOUNTED COMPONENT
 - EXISTING EQUIPMENT
 - NEW EQUIPMENT
- NEW CV
NEW HAND VALVE
EXISTING HAND VALVE
- EXISTING CV
EXISTING HAND VALVE

SCOPE

1. TO HAVE PROVISIONS
MADE, TAKING CARE
PREVENT ACCIDENTAL
HEATER
PRESSURE CONTROLLER
DIFFERENTIAL OF 10 P.S.I.
OR 5 EFFLUENT WATER
WHEN TANK REACHES
MAX LEVEL & STOP
REACHES PREDETERMINED

2. BE RESTRICTED TO
2 RATE TO PREVENT
OR LINE.

3. FOR INSTRUMENT SYMBOLS NOT NOTED
ON DWG. REFER TO HARRIS DRAFTING
PRACTICE MANUAL FOR HARRIS
N.B.C. 1480 1485 & 1486.
4. DRAWING TO BE IN ACCORDANCE WITH
HARRIS - 5014
5. POINT & PUMPING CODES AND AND JOURNAL
FOR FURNISHING INFO SUCH AS HARRIS
HARRIS, HARRIS, HARRIS, HARRIS
HARRIS & HARRIS HARRIS.

APPROVED FOR DESIGN NOT FOR CONSTRUCTION	
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DESIGN: NONE	DATE: 7/25/77
7625-777	CO-0035
E. L. ATOMIC ENERGY CORPORATION HARRIS ATOMIC PRODUCTS OPERATOR CENTRAL PLANT	
ENGINEERING FLOW DIAGRAM	
PAPER FACILITY - E-201-A TRUCK AREA	
E-201-A-E-401	

APPENDIX NO.3

NOTE

OF 10, 12 DEEP TANKS
OF STEEL LINER AND 15"
REINFORCED CONCRETE
SHELL PROVIDE PUMP BARS
AT TANK BOTTOMS.

OVERFLOW TO CATCH TO
BE AT ADEQUATE LEVEL
THAT THE 10 IN
OVERFLOW

SPACE RESERVED FOR SHUTTER
TO DIVERSION BOX IN PROPOSED
DIVERT BOX FORM.

GENERAL NOTES

1. EACH SURFACE CONDENSER TO HAVE VIBRO TEMPERATURE AND PRESSURE RECORDING INSTRUMENTATION AT THE CONTROL HOUSE ADDITION.
2. WATER SEALS TO HAVE PROVISIONS FOR FILLING AND DRAINING ALSO INSTRUMENTATION FOR INDICATING WATER DEPTHS IN SEALS.
3. EACH SURFACE CONDENSER TO HAVE COOLING WATER FLOW REGULATOR CONTROLLED BY TEMPERATURE OF EFFLUENT WATER.
4. SURFACE CONDENSER CELLS TO BE REINFORCED CONCRETE WITH PRE-CAST REMOVABLE COVERS. DEPTH OF CELLS APPROXIMATELY 4 FEET. AREA TO BE BACK-FILLED AROUND SURFACE CONDENSER CELLS FOR OVER-DRAIN AND ACCESSIBILITY PURPOSES.

APPENDIX NO. 4

ELEVATION - SURFACE CONDENSER CELL
 SIZE - 8' x 14'

HW-47046

APPROVED
FOR DESIGN
NOT FOR CONSTRUCTION

CLASSIFICATION None	DATE 10/1/54
A. J. ATOMIC ENERGY COMMISSION DIVISION OF ATOMIC PRODUCTS OPERATION GENERAL ELECTRIC	
SURFACE CONDENSER HOUSING & PIPING ASSEMBLY (See Drawing HW-47046, 1st Rev)	

APPENDIX NO. 5

HW-47046

LEGEND

- 1. MAIN TOWER
- 2. MAIN COOLING WATER
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APPROVED
FOR DESIGN
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DATE	REV	BY	CHK
5-2-44			
NONE			
E. A. ATOMIC ENERGY COMMISSION			
SABODAG ATOMIC PRODUCTS OPERATION			
GENERAL ELECTRIC			
WASTE COOLING WATER DISPOSAL FACILITIES			
PLANT PLAN, BY 4000			
5-2-44

HW-47046

GENERAL NOTES:

- 1. 71,000 GALLON TANK BE AUTOMATICALLY FILLED FROM NEW 16" RAW WATER LINE.
- 2. WATER TO BE DRAWN FROM 71,000 GALLON RAW WATER STORAGE TANK TO TANK FARM IN EVENT OF PRESSURE LOSS IN 16" RAW WATER SUPPLY LINE.
- 3. EXISTING 71,000 GALLON STORAGE TANK TO BE CLEANED AND FLUSHED AT THIS NEW TANK IN 1960.

LEGEND:

- EXIST. RAW WATER
- PROPOSED RAW WATER
- EXIST. STEAM LINE
- EXIST. STEAM LINE
- POWER PLANT POLES
- CABLE TRENCH

APPROVED
FOR DESIGN
NOT FOR CONSTRUCTION

SCOPE

NO.	DESCRIPTION	DATE	BY	CHKD.
REVISIONS				
NO.	DESCRIPTION	DATE	BY	CHKD.
1	SK-2-2795	10-1-60	J. R. R.	J. R. R.
SCALE: 1" = 100'-0"				
DESIGNED BY	CHECKED BY	DATE	APPROVED	
J. R. R.	J. R. R.	10-1-60	J. R. R.	
PROJECT NO. 10330				
PROJECT A-00608				
U. S. ATOMIC ENERGY COMMISSION				
HANFORD ATOMIC PRODUCTS OPERATION				
GENERAL ELECTRIC				
PROPOSED FRESH RAW WATER FOR COOLING 241A TANK FARM CONDENSATE				
341A SK-2-2795

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12742

CONDENSATE DISPOSAL
TO PROPOSED
214-A-23 CR18

~~SECRET~~

3900

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Lynn P.
7/10/00

500 45

U.S. DEPARTMENT OF JUSTICE
FEDERAL BUREAU OF INVESTIGATION

A large, dense, black and white image showing a complex, abstract pattern, possibly a microscopic view or a highly textured surface. The pattern consists of numerous small, dark, irregular shapes and lines, creating a highly textured appearance. The overall effect is one of intense detail and complexity.

APPROVED
FOR SERVICE
BY THE COMMISSIONER

12742

COMMUNIST DESPOL
TO PROPOSED
24-A-23 CIB

SECTION A-A

SECTION B-B

PLAN

END VIEW

APPROVED
FOR CONSTRUCTION
FOR G. E.

GENERAL NOTES
 1. VESSEL TO BE DESIGNED & FABRICATED IN ACCORDANCE WITH SPECIFICATION NO. 5520
 2. ALL MATERIALS TO BE STRAINLESS STEEL EXCEPT AS NOTED
 3. TUBES TO BE 1/2\"/>

DESIGN		REVISION	
NO.	DATE	NO.	DATE
1	11-10-60	2	11-10-60
DESIGNED BY: [Signature]		CHECKED BY: [Signature]	
DRAWN BY: [Signature]		CALCULATED BY: [Signature]	
U.S. ARMY, ARMY COMMISSION DEFENSE ATOMIC PRODUCTS OPERATION GENERAL ELECTRIC			
CONDENSER CONTRACT			
INFORMATION DRAWING			
PURE WASTE DISPOSAL FACILITY			
DATE: 11-10-60		BY: [Signature]	

HW-47046

CONDENSER DATA SHEET		
SIZE: 36-1/2" x 9'-0"	TYPE: SHELL & TUBE	SURFACE: 1340 SQ. FT.
HEAT EXCHANGED 2024000 BTU	M.T.D. CONC. - 57.5	TRANSFER RATE: 1000-270
	SUBC. - 1.5	SERVICE: SUBCOOL-CC
FLUID CIRCULATED	SHELL SIDE	TUBE SIDE
TOTAL FLUID ENTERING	Process Fluid	Water
FLUID CONDENSED	20,000 lbs. per hour	800 Gals.
TEMPERATURE IN	212°F	125°F
TEMPERATURE OUT	200°F	176°F
OPERATING PRESSURE	12" H ₂ O Vacuum	125 PSI
NUMBER OF PASSES	1	6
DESIGN PRESSURE	External 5 PSI	125 PSI
DESIGN TEMPERATURE	212°F	212°F
TEST PRESSURE	10 PSI	185 PSI
CONNECTIONS	IN: 13" OUT: 2 - 3", 1 - 4"	IN: 8" OUT: 8"
CORROSION ALLOWANCE	NONE	NONE
TUBES	Seamless per ASTM A269-52. 36 Tubes, 1" O.D., 12 B.G., 9'-0" Long, 1-1/4" Equilateral Triangular Spacing	
SHELL	ASTM A167-44, Radiographed Shell, 36-1/2" I.D.	
CHANNEL COVER	ASTM A167-44, Formed Flanged & Welded Head, Radiographed	
TUBE SHEETS	ASTM A167-44, Stationary	
BAFFLES	ASTM A167-44, Horizontal Cross and 1/2"	
TUBE SUPPORTS	Combined with baffles	
GASKETS	Compressed asbestos	
CODE REQUIREMENTS	ASME Boiler and Pressure Vessel Code, Section VIII, 1952 with exceptions required by H.S.-5620. No code stamp required. No stress relief required.	
REMARKS	Inlet cooling water at 35°F may be used at times. Fabricator shall submit detailed shop drawings and design calculations. PURCHASE SPECIFICATION - H.S.-5620.	
Approved for Construction for G.E. Hansford Works 11-14-53		5311-373-49
GENERAL ELECTRIC CO. HANFORD WORKS		Rev. 1 2-11-52
DATA SHEET-CONDENSER CONTRACT INFORMATION DRAWING		SCALE NONE APPROVED DATE 6-20-53 CHECKED BY E. R. NO. 11-522 BLDG. NO. 11-522
		DWG. NO. H-2-56029 SH-2 OF 2

APPENDIX NO. II

072

4-105

[illegible]

APPENDIX NO. 2

TABLE 1

SURFACE CONDENSER INSTALLATION

Reference: Drawings SK-2-2172 and SK-2-2175

Condition	Heat Evolution BTU's Per Hour	Vapor Pressure Drop (in inches of water) Point A to D	
		Parallel	Series
1)	One tank farm 40×10^6	2.68	3.02
2)	One tank farm 100×10^6	16.61	22.13
3)	60×10^6 with 20×10^6 from 241-A balance from 241-AI	3.41	7.97
4)	120×10^6 with 20×10^6 from 241-AI balance from 241-A	18.87	32.70
5)	200×10^6 with 50% from each farm	25.69	88.52

Appendix No. 14

END

DATE
FILMED
9 / 10 / 93