ChemRisk/Shonka Research Associates, Inc., Document Request Form

(This section to be completed by subcontractor requesting document)

J. Lamb / 1034A

Requestor / Document Center (is requested to provide the following document)

Date of request 8/18/95 Expected receipt of document 9/19/95

Document number K-138 K/EM-184 Date of document 2/17/48

Title and author (if document is unnumbered)

(This section to be completed by Document Center)

Date request received 8/~~30~~/95

Date submitted to ADC 8/30/95

Date submitted to HSA Coordinator 8/24/95

(This section to be completed by HSA Coordinator)

Date submitted to CICO 8/30/95 9/12/95

Date received from CICO 9/6/95

Date submitted to ChemRisk/Shonka and DOE 9/27/95

(This section to be completed by ChemRisk/Shonka Research Associates, Inc.)

Date document received

Signature

ChemRisk Document No. 2370

K/EM-184

SANITIZED VERSION OF CHEMICAL OPERATIONS DEPARTMENT ANNUAL REPORT 1947

(Sanitized Version of CRD Document # K-138)

Compiled by
S. G. Thornton
Environmental Management Division
OAK RIDGE K-25 SITE
for the Health Studies Agreement

September 12, 1995

Oak Ridge K-25 Site
Oak Ridge, Tennessee 37831-7314
managed by
LOCKHEED MARTIN ENERGY SYSTEMS, INC.
for the U.S. DEPARTMENT OF ENERGY
under Contract DE-AC05-84OR21400

[redacted]

S-E-C-R-E-T

CONFIDENTIAL AEC RESEARCH AND DEVELOPMENT REPORT

Approved for issue by: W. C. Hartman
Date of issue: February 17, 1948

This document consists of 13 pages.
No. 4 of 32 copies, Series A.

Report No. K-138

CARBIDE AND CARBON CHEMICALS CORPORATION

PROCESS DIVISION

CHEMICAL OPERATIONS DEPARTMENT ANNUAL REPORT 1947

W. C. Hartman

DISTRIBUTION

Cy. 1. Barnett, ...
2. Center, C. E.
3 & 4. Clements, A. T.
5. Humes, W. B.
6 & 7. Randall, G. E.
8 & 9. Engineering Development Central Files
(Margrave, Mrs. H. K.)
Attn: Cromer, S.
(Preston, C. M.)
Attn: Korsmeyer, R. B.
10,11,12. Maintenance Division Central Files
(Speyers, B.)
Attn: Speyers, B.
Williams, R. M.
Winkel, R. A.
13. Plant Engineering Central Files
(Mitchell, Mrs. J. E.)
Attn: Batch, R. M.
14 & 15. S. & I. Central Files
(Kirstowsky, M.)
Attn: Dunlap, A. P.
Visner, S.

Cy. 16-32. Process Division Central Files
(Stubbs, G. E.)
Attn: Anderson, L. W.
Carnes, H. W.
Culbert, H. J.
Dykstra, J.
Hartman, W. C.
Huber, A. P.
Jordan, R. G.
Kearns, G. B.
Lofland, C. W.
Marshall, J. A.
Paluzelle, R.
Schwenn, M. F.
Seyfried, M. P.
Sheldon, G. T. E.
Snyder, H. G. P.
Stone, W. A.
Willson, L. C.

K-138

S-E-C-R-E-T

CONFIDENTIAL

[redacted]

S-E-C-R-E-T

Title: CHEMICAL OPERATIONS DEPARTMENT
ANNUAL REPORT FOR 1947

Submitted By: W. C. Hartman

CARBIDE AND CARBON CHEMICALS CORPORATION

PROCESS DIVISION

CHEMICAL OPERATIONS DEPARTMENT

ABSTRACT

This first annual report of the Chemical Operations Department indicates the production, major developments, and services for the year of 1947.

S-E-C-R-E-T

CHEMICAL OPERATIONS DEPARTMENT

ANNUAL REPORT FOR 1947

TABLE OF CONTENTS

I. CHEMICAL AREA (C-216 Area)

1. Fluorine Plant:

6,145 pounds of fluorine were produced in K-1301 during the year 1947. Few troubles have been encountered in the operation of the generators. However, two After Pump Absorbers were installed to increase the purity of the product by decreasing the HF content. At first, a sodium fluoride powder and crystalline alumina were used as the absorbent but later replaced with the pellet type sodium fluoride.

Freeze-down of the electrolyte has proved to be harmless to the operation of the generators. Therefore, in order to conserve on utilities, the generators are allowed to cool off between times of operation.

Generators No. 6 and No. 7 have been removed from their K-1301 cubicles in order to provide more space for the Oxide Conversion Unit.

In March, the yard piping was rearranged so that all waste fluorine could be vented to the brick stack located near the K-1302 building. The K-1405 building has been completely dismantled of fluorine disposal equipment.

The storage and surge tanks at K-1302 were inspected during the months of April and May. Some pitting of the tanks was observed and repairs were made before placing back in service.

2. Nitrogen Plant:

The nitrogen plant located at K-1408 supplied 23,206,494 cubic feet of nitrogen as G-74 during the past year. The demand for G-74 decreased to the point that excessive blow-off gas occurred when using two cold converters. Therefore, since the month of October, operations have proceeded using only one cold converter.

A G-74 tie-in was completed in November, so that G-74, at 35 psig, could be supplied to the Barrier Plant. At the same time, the K-1401 and K-1301 supply lines were tied into the new K-1037 line which allowed G-74 to be provided at a value nearer to the pressure desired for the operations in these buildings.

35,908,735 cubic feet of nitrogen as L-28 was distributed during the year of 1947.

3. Oxide Conversion Unit:

Approximately 575 kilograms of UF_6 were produced in the Oxide Conversion Unit during the year 1947. Several changes were made on the unit to provide for a more efficient operation. The process piping was rearranged so that the reactors could be operated either in parallel or series. Operating the reactors in series produces an exhaust gas from the scrubber containing less than 5% fluorine.

In order to preserve hygiene standards, carbon filters were installed on the vents to the caustic system, eliminating the OF_2 present in the discharge gas.

A sludge trap has been installed at the discharge of the caustic tank so that the volume of used caustic produced is prevented from recirculating.

4. Decontamination:

175,776 items were decontaminated during the past year, recovering 332.95 pounds of "U". During the past year, much emphasis has been placed on the decontamination operations. At present, no universal method has been found that will entirely free contaminated surfaces of alpha, beta, and gamma radiation. To date, a 20%-30% sulfuric acid solution agitated with air has proved to be the most overall effective decontaminating agent.

The surface area and the condition of the surface are the chief factors governing any decontaminating operation. The use of a wire brush is a benefit in some cases but not all surfaces can be reached by a brush.

The latest developed process utilizing a nitric acid-aluminum nitrate spray chamber is undergoing extensive tests at the present time.

In December, a new process for decontaminating clothing was placed in service. Formerly all coveralls were soaked in a sodium carbonate solution before being sent to the laundry. Now all incoming coveralls are checked with an alpha radiation counter and only those indicating counts above tolerance are washed in a 2½% sodium bicarbonate solution. A Bendix washer and a tumble drier have been installed for this operation. After drying, these coveralls are again checked for alpha radiation before sending to the laundry. Records indicate that 3.5% of the incoming coveralls are contaminated.

5. Water Media Recovery Unit:

The Water Media Recovery Unit produced a net of 358.6 kilograms of "T" during the year 1947. Experiments conducted on the washing process, freeing the ammonium diuranate of the sodium chloride impurities, indicate that two washings with small amounts of water remove 85% of the impurity. Three additional washings are necessary to remove another 10% of the impurities. Due to the time saving and the possible loss of uranium material upon further washings, the standard practice is to use only two washings.

During the months of August and September, tests were conducted to determine whether or not the tube evaporator could concentrate both weak and strong solutions of sodium uranyl carbonate and produce a condensate containing less than 1 ppm of "T". All efforts failed to produce a condensate containing less than 10 ppm of "T". The conclusion reached was that the evaporator has too small a vapor space as compared with the heating surface area. Operations were reverted to the open type pan evaporators.

The acid corrosion problem necessitated several changes. Buffalo blowers were installed on the roof of K-1303 and the old type sheet metal ducts were replaced with ones of stainless steel. Operation of the blowers causes a strong sweep of air through the evaporators, carrying all vapors away before the vapors can condense.

In November, a 12" x 12" plate and frame Sperry filter press was installed for the purpose of filtering ammonium diuranate. This operation was formerly performed in the large 24" x 24" plate and frame filter press used primarily to filter incoming feed to the unit.

6. Freon Recovery:

A total of 2,734.8 pounds of Freon 113 was recovered during the past year. This recovery still was installed in July of 1947. During the first few runs, the vaporization loss of Freon 113 was high, since its temperature from the still condenser was in the range of 25° to 35°C at which temperature the vapor pressure of Freon 113 is high. A 5-gallon receiving can surrounded with dry ice eliminated this high loss.

7. Oil Recovery Unit:

2,843 pounds of C-2144 and 2,986 pounds of MFL oils were recovered during the year 1947. Some losses are incurred in this operation since, in many instances, the incoming oil was not entirely oil alone. Shipping containers contained not only the coded oil but sometimes solvent, mechanical or hydrocarbon oil, and sludges. This loss in weight is absorbed by the recovery unit. Also, it has been determined that 4 to 8 pounds of oil per run are lost or gained in the super-cel filter cake.

7. Oil Recovery Unit: (Cont'd.)

The uranium bearing material is removed from the incoming oil by heating the oil just enough to make it pourable and then filtering through Hyflo-super-cel. This process removes any TF_4 sludges, foreign material, and TF_6 so the temperature of the oil can be maintained below 110°F.

8. Mercury Recovery Unit:

10,345 pounds of mercury was recovered during the past year, maintaining a percentage recovery of 99%. No difficulties in the operation of this unit have been encountered to date. A small loss of mercury results when the triple distilled mercury is given a final drying by allowing the mercury to pass through a column of silica-gel.

9. Lime Flocculing:

Lime flocculing of weak uranium solutions was one of the next processes developed by the Chemical Operations Department during the past year. Until this process was developed, nothing had been done with these weak solutions. They could not be discarded since they contained more than the allowed "T" content. The process involves passing lime through the solutions and then filtering out the lime and adhered uranium materials. This process was successful in reducing the "T" concentration to less than 1 ppm of uranium for Classes A, B, and C and to ½ ppm for Classes D, E, L, and M. Solutions meeting these low concentration specifications were emptied into the K-1239 pit and/or the pond located north of the K-1300 Area.

9,532.2 grams of "T" was charged into the process as weak solutions of which 8,990.3 grams of "T" was removed in the filter cake. The remaining "T" found in the filtrate met the low "T" content specifications and was subsequently discarded.

10. Personal Cleanliness:

Personal cleanliness requirement of operators has been stressed during the past year. Such cleanliness has necessitated several changes to be made in the area. The K-1409 change house has been rearranged and each operator has been provided a locker for his street clothes plus a locker for his contaminated clothing. Each operator is encouraged to take a shower whenever leaving the area. A Poppy radiation meter has been located in the change house to record the hand counts of all personnel after washing at lunch time and at quitting time.

Drinking fountains have been located in non-operational areas. Safety shoes and coveralls are provided each operator by the company so that contaminated clothing can not be worn home.

II. CASCADE SERVICES DEPARTMENT

1. Vacuum Testing:

A total of 120 vacuum test jobs were performed excluding the vacuum testing of approximately 5000 product cylinders and cylinder heads. The major testing was cell and building block valves and other miscellaneous valves during the installation of P-10 valve seats in conjunction with the converter change program.

Several new methods of vacuum testing were attempted. A leak detector was installed at the Line Recorder station and valved into a cell which was probed with helium. Tests were run both with the cell on stream and with the cell isolated but neither method proved much better than probing with CO_2 which can be detected by the line recorder. A more successful method was discovered by admitting 5 psig of helium to the cell and then probing the outside of the system. This method also facilitates simultaneous soap testing and the use of many leak detectors and probe hoses. However, none of the above methods are as efficient or sensitive as the original method of vacuum testing with the system under test at almost a complete vacuum and helium admitted to the outside of the system.

2. Pressure Testing:

A total of 178 pressure testing jobs were performed during 1947, mostly in connection with the converter change program. Tests were conducted which indicated that leaks of a magnitude of .01 SCFD are detectable if soap can be applied directly over the leak. For this reason, pressure testing has replaced vacuum testing in most cases. Other pressure testing methods were tried but were found to be inadequate or hazardous. A few examples are C-216 or SO_2 pressure with an ammonia spray detector, CO_2 pressure with a lime water spray detector and Freon pressure with an alcohol torch detector.

3. C-816 Leak Testing:

During May, C-816 leak testing was transferred from the straight-day group to the shift group and each shift was assigned an area for routine testing. Under the current program, all cells in Plants I and II are tested with an infra-red analyzer once per month. Cells in Plant III are tested only upon request.

Results of tests indicate that the infra-red analyzer will detect leaks as small as .05 pounds of C-816 per day.

4. Enriched Feed Charging:

138 cylinders of enriched feed were charged into 56 cells. A mobile charging unit, capable of charging two cylinders simultaneously was designed, constructed, and placed in service. Use of flexible copper bellows hose has been abandoned and replaced with a rigid adjustable monel charging pipe.

5. Fluorine Charging:

Charging of fluorine for conditioning was done on 247 occasions during the year.

Due to entry restrictions, fluorine charging in Plant III is now done through the Line Recorder manifold. To facilitate this charging, the standard portable fluorine storage cylinder carriage had to be rebuilt to fit the elevators and outfitted with eight rubber tires to permit safe usage on the operating floor. Two such carriages have been constructed to date.

6. Carbon Traps:

Carbon trap servicing during the year included recharging of 404 traps and discharging 432 traps. This operation involved the handling of approximately 3000 pounds of carbon, 12,000 pounds of alumina, and comparatively small amounts of salt and soda lime. The use of the large traps in K-631, the cold trap rooms, and on the C-616 disposal units has been discontinued.

7. C-816 Handling:

A total of 125,610 pounds of dry C-816 were transferred from K-300-C to other process buildings. Receipts totaled 60,234 pounds of wet C-816.

The C-816 distillation tower was not operated during 1947 but an attempt was made in August to decant and filter C-816 from the bottom of the wet C-816 storage tank. The operation resulted in 1,517 pounds of C-816 at 1.3% inertness. This coolant was considered satisfactory for reuse.

The reserve coolant stock has been estimated to last for 7 years.

8. Field Decontamination:

Field decontamination has expanded appreciably during the year due to many additional duties including decontamination of excess alpha radiation, use of radiation meters, and the adoption of special equipment to conform with "always safe" policies in regards to critical mass and radiation.

1,280 decontaminating jobs were performed of which 7 consisted of decontamination of valves removed in a building during the seat replacement program and 283 were requests for decontamination of excessive alpha radiation. The remaining 990 jobs included cleaning AC pump casings in position, process lines, pump flushing, and releases.

The change house at K-303-8 is used for personnel engaged in this work and provides for two lockers for each man, one for work clothing and one for street clothing. In addition, they have been issued special safety shoes and rubber overshoes, supplementing the normal protective clothing such as gloves, coveralls, masks, etc..

9. Mobile Equipment:

The mobile cold trap unit "A" was successfully operated for the first time in April to determine its trapping and flashback efficiency. In three separate operations, 2,738 grams of C-616 were pumped through the cold traps and all but 3.5% was flashed from the unit into a special container. Trace indicator tests of exhaust gases indicated that no C-616 had escaped the trap. The major portion of the losses were attributed to an intermediate C-616 surge cylinder used in the test.

In May and June, the cold trap was installed at K-312-3 in a Plant III side purge circuit for experiments to determine the feasibility of a cold trap replacing the operation of the K-312 Section.

Dismantling of eight C-716 units, one heads unit, and one dry ice trichlorethylene cold trap was completed during 1947. This equipment was put on surplus.

10. Miscellaneous Services:

Approximately 600 coolant coolers were backwashed weekly until routine backwashing was discontinued in March. Backwashing is currently performed only upon request.

During the year, approximately 600 valves were purged and/or buffered. A new procedure has been devised for purging valves to the cell through the C-216 charging line, reducing the purging time appreciably.

In March, the Line Recorder Supply functions were placed on a straight-day basis. During an average week, this group crushed and handled over 22,000 pounds of dry ice, 4,000 gallons of L-28 and 60 gallons of trichlorethylene, all of which were delivered to consumers in the Process Area.

III. FIELD LABORATORY SECTION

There were 14,212 laboratory samples taken of which 8,719 determinations were made. In addition, 1,450 carbon trap scans, 562 beta-gamma surveys, 576 alpha surveys, and 1,626 air samples were taken.

Equipment utilizing the thorium nitrate method of determining low concentrations of HF in air was constructed and placed in service.

Experience has shown that the existing dew point apparatus is inadequate for all uses. A dew point meter, using a photo-electric cell, was tried but was found to be too sensitive for field use. Several types of cold fingers and chambers have been tried without success. At present, a dew point meter is being developed that will obtain dew points of chambers in which the pressure is below atmospheric pressure. This type of apparatus can be used for checking the dew points of such systems as the seal exhaust system.

Special sampling problems such as C-616 sampling at low pressures, HF in gas at atmospheric pressure, C-216 sampling from Line Recorder stations and analyzing C-216 for impurities have resulted in the designing and construction of 11 special sampling buggies.

One of the new duties assumed by the Field Laboratory during the year was the calibration of radiation meters. Calibration procedures for Victoreen 263 meters, L & W survey meters, alpha meters, and air samplers were developed and placed in service. In order to determine accurately the alpha count in air, a flow meter was designed and constructed for use on the Filter Queen air sampling equipment.

IV. RADIATION MONITORING SECTION

The Radiation Monitoring Section was organized the latter part of December. The function of this group will be to monitor all work or operations where radiation might be present. This will include such jobs as AC pump changes, seal changes, converter changes, field decontamination, K-1300 operations, etc.. Reports of their findings will be issued weekly.

V. FLUOROTHENE PLANT

The Fluorothene process and equipment (which was moved here from Tonawanda) have been revised and redesigned for use in the K-413 building. Nearly all the construction is completed and operations are expected to begin sometime during the month of February.

VI. DEPARTMENTAL ACCOUNTS

On November 1, 1947, four new operating accounts became effective. They are: PU, PX, PY, PZ, for Carbon-Alumina Recovery, Water Media Recovery, Oxide Conversion, and Fluorocarbon Oil Recovery respectively. A new account PP has been allocated for the manufacture of Fluorothene and will be effective when the plant goes into operation.

VIII. TABLES

Oxide Conversion Unit:

Received as Oxide	494,163 grams	or 374,363 grams	"T"
Received as TF_4	1,392 grams	or 1,090 grams	"T"
Received as Ash	159,031 grams	or 61,168 grams	"T"
Received as Decontamination Cake	11,366 grams	or 2,504 grams	"T"
Totals	665,592 grams	or 439,126 grams	"T"
Produced as TF_6	574,686 grams	or 388,554 grams	"T"
Produced as Ash	200,398 grams	or 51,250 grams	"T"
Produced as Caustic Waste	2,843 liters	or 151 grams	"T"
Produced as other materials		239 grams	"T"
Total		440,194 grams	"T"

Gain in "T" probably due to laboratory analysis and scale readings.

Water Media Recovery Unit:

	Solutions Received (liters)	Filtrate Shipped to Coded Chemicals (liters)	Oxide Produced (grams)
Class A	7,685	3,123	209,317.8
Class B	21,403	31,237	221,068.7
Class C	21,131	31,017	23,688.9
Class D	34,405	12,356	25,545.9
Class E	1,828	751	1,165.0
Class M	18,787	461	6,108.0
Totals			486,894.0

Freon Recovery Unit:

Received:

1. Freon - C-2144 mixture	3,638.9	pounds
2. Freon - MFL mixture	664.4	pounds
3. Freon - Hydrocarbon Oil Mixture	540.0	pounds
Total	4,845.3	pounds

Freon Recovery Unit: (Cont'd.)

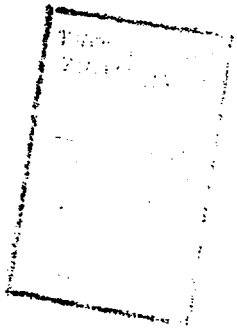
Recovered:

1.	Freon 113	2,734.8 pounds
2.	C-2144	1,142.7 pounds
3.	MFL	202.0 pounds
4.	Hydrocarbon Oil	229.0 pounds
	Total	4,308.5 pounds

Efficiency of operation ---- 89%.

Oil Recovery Unit:

1.	Contaminated C-2144 received	3,196.2 pounds
2.	C-2144 recovered	2,843.1 pounds
3.	Contaminated MFL received	3,739.0 pounds
4.	MFL recovered	2,671.3 pounds
5.	T-MFL received	563.6 pounds
6.	MFL recovered	314.7 pounds



DISTRIBUTION

1. K-25 Site Records (RC)
2. ChemRisk/Shonka Research Associates
3. DOE Public Reading Room
4. S. G. Thornton (K-25 EMD)