ChemRisk/Shonka Research Associates, Inc., Document Request Form 1839

(This section to be completed by subcontractor requesting document)

~~J. Lamb~~ T. Bennett / 1034A
Requestor Document Center (is requested to provide the following document)

Date of request 12/8/95 Expected receipt of document 1/8/95

Document number KB.1381 Date of document 7/6/51

Title and author (if document is unnumbered)

(This section to be completed by Document Center)

Date request received 12/12/95

Date submitted to ADC 1/5/96

Date submitted to HSA Coordinator 12/12/95

(This section to be completed by HSA Coordinator)

Date submitted to CICO 1/5/96

Date received from CICO 1/31/96

Date submitted to ChemRisk/Shonka and DOE 2/1/96

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

Date document received

Signature

UNCLASSIFIED

[redacted] COMPANY CORRESPONDENCE

(INSERT NAME) COMPANY CARBIDE AND CARBON CHEMICALS DIVISION Union Carbide and Carbon Corporation LOCATION Post Office Box P OAK RIDGE, TENN.

THIS DOCUMENT CONSISTS OF 8 PAGE(S)
NO. 16 OF 20 COPIES, SERIES A

TO	Mr. M. F. Schwenn
LOCATION	K-303-8
ATTENTION	Mr. K. W. Bahler
COPY TO	Mr. R. M. Batch
	Mr. E. C. Bollinger
	Dr. A. D. Callihan
	Mr. S. J. Cromer
	Mr. R. H. Dyer
	Dr. H. F. Henry
	Mr. A. P. Huber
	Mr. W. B. Humes
	Dr. F. W. Hurd
	Mr. G. B. Kearns
	Dr. R. L. Macklin
	Mr. A. J. Mallett
	Mr. T. W. Morton
	Mr. J. A. Parsons ✓
	Mr. G. W. Sell
	Mr. R. D. Shaffer
	Mr. H. G. P. Snyder (2)

DATE July 16, 1951

ANSWERING LETTER DATE

SUBJECT Interim Report on Special Hazards Study

PLANT RECORDS DEPT. CENTRAL FILES REC. K-13485

This document consists of 8 pages No. 6 of 7 copies, Series A
KP-1381

KP 1381 6 A
KP 1381 6A

AUTHENTICATED JUL 18 1951
U. S. ATOMIC ENERGY COMMISSION
BY W B Humes per J A Parsons
DOCUMENT NO. 1683-16A

INVENTORIED NOV 1 1951 By H L Floyd

INVENTORIED MAY 1 1952 By H L Floyd

T W Sellers 1/31/96 for ASST

NOT TO BE LOANED FROM PLANT RECORDS K-1034

As per your recent request, a study has been initiated to determine the revisions required to make the cascade operation safe from a special hazards viewpoint during the coming changes in the plant assay gradient. The operation of K-31 and the subsequent contribution of the Paducah plant will cause a general increase in the assay level throughout most of the K-25 cascade. This change will be step-wise and will be initiated with the startup of K-602-4 in the latter part of July. The increase will continue until late in 1953, after the last stages of C-33 are placed in operation. The following table summarizes the currently anticipated assays and the dates they will be attained.

	K-29		K-27		K-302-5		K-303-10	
	Assay	Date	Assay	Date	Assay	Date	Assay	Date
K-31	1.8	2-1-52	3.2	2-10-52	7.8	2-20-52	21.6	3-1-52
C-31	2.4	10-15-52	4.3	11-1-52	10.4	11-10-52	27.1	11-20-52
C-33	3.9	5-15-53	6.9	6-1-53	16.7	6-10-53	39.1	6-20-53

In order to operate safely at the higher assays, it will be necessary to modify many of the present auxiliary operations. Each operation has been

Carbide and Carbon Chemicals Corporation Operating Contractor for the U.S. Atomic Energy Commission.

Classification changed to: UNCLASSIFIED (level and category)
By authority of: CG-PGD-4 (classification guide)
Thomas W. Sellers 8/23/94
ADC or ADD signature (first reviewer) Date
[signature] 9/7/94
ADD signature (final reviewer) Date

CLASSIFICATION CHANGED TO [redacted]
BY AUTHORITY OF J A Parsons thru A D Callihan, AEC
BY [signature] DATE MAR 10 1958

WCX-163 (1-50) THIS FORM FOR INTER-COMPANY CORRESPONDENCE ON [redacted]

UNCLASSIFIED

investigated to determine the probable extent of the required revisions and the time available to complete the changes. The units investigated to date include the K-413 cold trap room, the K-402-8 cold trap room, the K-302-5 cold trap room, the K-302-5 purge and product room, the K-302-5 accumulator tanks, and the K-101 C-816 removal system.

The general approach to the problem has been to set up an "always safe" type of operation wherever it appeared to be realistically possible. It was felt that batch-type operation is too restrictive and that a "partly safe" system is probably uneconomical in the long run because of the time and effort which must be continually expended to demonstrate that the system is being operated within the specified limits. Some compromises have been made in an attempt to save a portion of the existing installation by anticipating that the forthcoming "5% critical mass tests" will permit Special Hazards to relax their requirements in the lower assay ranges.

Meetings have been held with Operations personnel to establish a possible method of operation of the surge-for-purge facilities and other auxiliaries which would probably be acceptable to Special Hazards, and still perform their required function on an efficient basis. Under the present arrangement, only the K-302-5 cold trap room services that portion of the surge system from K-303-1 to K-303-10. This portion of the cascade presently has an assay range from 5% to 17%. The remainder of the trapping facilities which were investigated serves the portion of the cascade with an assay of 5% or less. The suggested arrangement of the surge-for-purge system would be as follows:

1. The surge-for-purge system from K-304-1 to K-306-7 would not be altered.

2. The K-303 surge system would remain isolated, as at present, except that provisions would be made for possible emergency tie-ins with the upper surge system to as high as K-304-5. This would permit purging of the K-303 system from the side purge. The K-302-5 cold trap room and the K-302-5 purge and product room would be modified so that they could safely purge the K-303 system.

3. The lower surge system (K-25, below K-302-5) would be operated as at present and could be serviced by modified installations in K-413, and the two trapping rooms in K-302-5.

4. The K-31 surge system and that portion of the surge system servicing K-27 and the lower buildings could be served by the K-31 cold traps and the K-402-8 cold trap room. This operation is tentative, since the traps in these rooms can only be approved for 5% operation at present. However, on the basis of present estimates it appears to be quite probable that 8-inch traps can be operated on 7% material. If this proves to be wrong, these traps could still service this system on a batch basis or the purge system could be broken at the 5% point, and the upper portion could be serviced from the same system of traps as in (3) above.

5. K-101 would continue to draw its feed from the cascade at K-302-5. At some future date (probably no sooner than June, 1953), it might be desirable to make a tie-in to Building K-306-7.

6. The K-302-5 accumulator tanks would be operated as at present.

The following table indicates the assays for which the various units have been approved and the dates these assays will be exceeded under the present anticipated mode of operation. The maximum assays and the dates the assays will be reached are also included.

System	Present Assay Approval	Date Assay Exceeded	Future Maximum Assay, Proposed Operation	Date Maximum Assay is Reached
K-101	5%	10-15-51	16.7%	6-10-53
K-302-5 P&P Room	5%	10-15-51	53.0% *	6-25-53
K-302 5 CT Room	20%	1-1-52	53.0% *	6-25-53
K-413 CT Room	5%	10-15-51	16.7%	6-1-53
K-402-8 CT Room	4%	10-1-52	6.9%	6-1-53
K-31 CT Room	5%	-	6.9%	6-1-53

*This assay would be reached only if the K-303 surge system were tied into the upper system to K-304-5. The maximum assay at K-303-10 is 39.1% and is to be reached 6-20-53.

The assays presented in this letter were obtained from the Design and Development Department and are based on Schedule I feed rates and the budgeted schedule of startup for the new installations. Variations in feed rates or the startup schedule will cause a corresponding change in the assay level.

A more detailed description of the probable changes in each installation has been prepared. The following discussion covers the systems which have been studied to this time:

K-101 C-816 Removal System

The present unit for removal of coolant from the cascade gas stream consists of a six-inch, packed distillation column, a six-inch reflux drum, an eight-inch condenser, a pumping system (composed of "W" and "J" pumps), and the necessary piping to provide flow for distillation process. The present system which is approved for operation with material not exceeding an assay of 5%, receives its feed from Building K-302-5. Since the cascade withdrawal point is fixed by the break-point between the low quality barrier in the K 303 section and the high quality barrier in Section K-302, it is not feasible to shift the withdrawal point downward in the cascade as the uranium 235 gradient increases.

Therefore, in order to continue the present method of coolant removal, it will be necessary to redesign the unit from a critical hazards consideration. Since the anticipated assay for K-302-5 is 16.7%, it is recommended that the distillation equipment be made "always safe." It should be noted that if the barrier in the K-303 section is replaced in the stage improvement programs it would be desirable to connect Building K-306-7 with the K-101 building.

Preliminary calculations for an "always safe" system are under way and should be completed by July 22. It is estimated that the required field changes should be completed by October 15, 1951, at which time the assay at K-302-5 will exceed 5%. A work order has been released and preliminary design and equipment procurement has been initiated by Plant Engineering.

The equipment is being redesigned to operate with the same flows and separating characteristics as the present system. The calculations are based on column, reflux drum, and condenser diameters of five inches. The results to date, indicate that the length of the column and reflux drum should be increased to approximately 27 and 4 feet, respectively. Should the present spacing of the "W" and "J" pumps prove unsatisfactory, it would probably be possible to relocate them to the positions now provided for spare pumps, since no spare pumps have been provided for this building to date. The pump lubrication system will probably require modification to restrict the depth of the oil in the reservoir to less than 1.5 inches. In order to maintain a more uniform temperature on the equipment and lines, it is also recommended that as much of the installation as is practical be located within a heated enclosure. This would reduce the present difficulties in the system where the lack of uniform temperature frequently causes freezing and vapor locks in the lines. The enclosure would reduce the problem of providing insulation which would be acceptable to Special Hazards and also would provide a more practical method of containing material which might be released from process leaks. In this regard, consideration should be given to an air exhaust system with suitable traps or filters.

The preliminary study indicates that it should be possible to build the new unit without any serious interruption in the use of the existing system. If sufficient free space is not presently available, it should be possible to remove the old "crude still" and utilize that position for the new column.

K-302-5 Cold Trap Room

The cold trap room presently is approved for operation on material with an assay as high as 20% - the limiting factors being the Size 4 cold traps and the 50 cfm Beach-Russ pumps. Specifically, the cold traps are four inches in diameter with a 3.5-foot end section which has an inside diameter of 5-7/8 inches. The end section consists of a cyclone separator and a nickel wool mist filter. With an assay of 20%, the Beach-Russ pumps have been limited to a suction concentration of not more than 20 mol percent uranium hexafluoride. The room consists of three Size 4 cold traps, three 50 cfm Beach-Russ pumps, and "always safe" alumina traps.

Since a proposal was made to possibly operate this room as far up the cascade as K-304-5, it is recommended that the equipment in this room be made "always safe." However, an interim approval for operation on the present K-303 surge system at an assay of 21.6% would prove very advantageous in that it would allow additional time for the alterations which will be necessary at the highest assay level. The operation of K-31 will increase the assay at K-303-10 to 21.6%. If approval for operation at an assay of 21.6% cannot be granted, changes to the room should then be completed by January 1, 1952. A temporary alternative might be to purge the top cells in the K-303 section to the upper surge system and move down the cascade with the K-302-5 cold trap room; however, the large cell volumes in K-303 would restrict this operation because of the limited holding capacity of the upper system.

The Size 4 trap can be converted to an "always safe" trap by the insertion of a plug in the oversize section or by removing the six-inch section from the trap. Should the end section be removed and a replacement found necessary, it could be replaced with an "always safe" section of pipe. It appears probable, however, that the end section could be removed completely without serious losses in efficiency. In June, 1947, an investigation was made in which a Size 4 trap was made equivalent to a four-inch trap by the insertion of aluminum plugs in the large end section. It was demonstrated that this revision is mechanically possible; however, the unit was never operated to determine whether its performance was altered. Before either method is adopted, tests should be conducted to determine the effects of the modification on the operation of the trap.

The present limitations on the use of the 50 cfm Beach Russ pumps are not considered to be too serious; however, with an increase in uranium 235 concentration the restrictions may become prohibitive. Should physical alterations to the pump be required, it appears probable that a sleeve could be placed around the rotor assembly to limit the amount of oil that can be accumulated in the pump itself. Some time ago, a test pump was modified in this manner and was apparently satisfactory from a critical hazards viewpoint; however, as was the case in the modified cold trap, no performance data are available. In order to make the entire pump unit safe, changes would be required in the oil reservoir above the pump. Should either of these alterations prove unsatisfactory from an operational or special hazards viewpoint, it would be possible to replace the 50 cfm Beach-Russ pumps with the "always safe" 27 cfm Beach-Russ pumps.

K-302-5 Purge and Product Room

The purge and product room, which presently contains three 8-inch cold traps, three 50 cfm Beach-Russ pumps, and "always safe" alumina traps is approved for operation with material not exceeding an assay of 5%. In order to operate this room according to the previous proposal, it appears advisable to convert the room to an "always safe" installation. This would require replacing the eight-inch cold traps and probably some modifications to the 50 cfm Beach-Russ pumps.

The eight inch traps could be replaced by modified Size 4 traps as outlined in the section on the K-302-5 cold trap room. There are seven of

the present Size 4 cold traps available for this purpose. The 50 cfm Beach-Russ pumps could be treated in a manner similar to that outlined above.

The present use of the room is restricted to all buildings below and including K-302-5. The uranium 235 concentration at K-302-5 is 5% and it is estimated that it will exceed the 5% value by October 15, 1951. The operation of K-31 will elevate the assay at K-302-5 to a value of 7.8%. Approval for the operation of the room at this assay would allow much more time for the revisions; however, it is improbable that the 5% critical mass tests will yield sufficient information in time to make this possible.

K-413 Cold Trap Room

The K-413 cold trap room consists essentially of two 8-inch cold traps, a 16-inch cold trap, three 50 cfm Beach-Russ pumps, three 8-inch alumina traps, two 36-inch alumina traps, and two 250 cfm Beach-Russ pumps with oil bubblers for chlorine trifluoride usage. The 16-inch cold trap is limited to waste material and was installed primarily for test work. The restrictions placed on the operation of the cold traps limit the material handled to assays of 5% or less. The 36-inch alumina traps and 250 cfm Beach-Russ pumps are presently approved for negative purge gas evacuation from cells containing 1.5% and 1.7% - depending upon the combination of alumina trap and pump used. The oil bubblers were installed to react chlorine trifluoride and its reaction products with oil before the gases reached the 250 cfm pumps.

Operation of the K-413 cold trap room on the surge-for-purge system as far up the cascade as K-302-5 would necessitate handling uranium 235 concentrations as high as 16.7%. Under these circumstances, it is recommended that the portion of the room operating on the surge system be made "always safe." This could be accomplished by the same procedure recommended for the K-302-5 cold trap room and the K-302-5 purge and product room. It would be necessary to replace the 8-inch cold traps. However, since the proposed operation of the 50 cfm pumps would be within the present approved assay limits, it might be feasible to leave them unchanged.

It is proposed to maintain one 8-inch cold trap, the 250 cfm Beach-Russ pumps, and the large alumina traps for servicing K-29 cells which have been treated with chlorine trifluoride and for the evacuation of K-29 cells which have been purged to a negative uranium hexafluoride analysis. The maximum assay anticipated for the top of K-29 is 3.9%. The system proposed to service K-29 cells could be separated completly from the rest of the K-413 equipment and could draw its feed directly from a new line from K-29.

The alterations in K-413 for that portion to be connected to the surge-for-purge system would have to be completed by October 15, 1951 if it is to be tied into the K-25 lower surge system. The changes required in spacing the large alumina traps and the 250 cfm Beach-Russ pumps should be made by January 1, 1952, at which time the assay at the top of K-29 will exceed 1.7%. However, the operation of K-31 will only increase the

uranium 235 assay in K-29 to 1.8%. Therefore, if approval is granted for the operation of the 250 cfm pumps and alumina traps at this assay, additional time would be available for completing the required changes.

K-402-8 Cold Trap Room

The K-402-8 cold trap room consists of three 8-inch cold traps, three 8-inch alumina traps, and a 50 cfm Beach-Russ pump. The cold traps are approved for 5% material, while the alumina traps are only approved for 4% material. Also included in the cold trap room are two 36-inch alumina traps and three 250 cfm Beach-Russ pumps which are used only for the evacuation of cells which have been purged to a negative uranium hexafluoride analysis. A two-inch air ejector has also been installed in the room in order to partly eliminate the operation of the 250 cfm pumps. The ejectors can be used to evacuate cells to a pressure of approximately 3.0 psia. If the cell contents cannot be evacuated to the cascade at this pressure, the 250 cfm pumps are required to attain the lower pressures.

Since it is believed that the critical mass tests at 5% will allow sufficient relaxation of Special Hazards requirements to permit the use of eight-inch traps on assays greater than 5%, it is recommended that the cold trap room remain unchanged. The eight-inch alumina traps could be changed so that the operation of the room would be restricted by the cold traps rather than the alumina traps. Under the proposed operation of the surge systems, the K-402-8 cold trap room would serve only K-27 and that portion of the cascade below the top of K-27. The maximum assay foreseen for the top of K-27 is 6.9% and will be attained after the last K-33 building is in operation (approximately June, 1953). The assay at the top of K-27 will exceed 5% by February 1, 1953.

If approval cannot be granted for operation of the room at the higher assay, it is suggested that the room be operated on a batch basis or that the lower K-25 surge system be extended down to the 5% point in K-27. No changes are anticipated for the large alumina traps and the 250 cfm Beach-Russ pumps, since they are operated only for the evacuation of cells which have been purged to a negative uranium hexafluoride analysis.

K-31 Cold Trap Room

The K-31 cold trap room is presently equipped with 8-inch cold traps, 4-inch alumina traps, and 50 cfm Beach-Russ pumps. The room is presently approved for operation at 5%, and under the proposed operation would service K-27 and the lower buildings in the plant. It is recommended that no changes be made to the K-31 cold trap room. The recommendations made for K-402-8 are also applicable for this installation.

K-302-5 Accumulator Tanks

The K-302-5 accumulator tanks are approved for any assay, providing the material is in the gaseous state and dry. However, there has been an accumulation of oil and sludge in the tanks which could cause a critical hazards problem. Since the continued use of the tanks is desirable, it is recommended that they remain in service with provisions for either

periodic inspection of the tanks or for draining the oil that might accumulate in the tanks.

General

While the various assays and dates are stated rather positively in this report, it should be noted that they are relatively uncertain. Aside from the variations brought about by changes in scheduling and the inherent imprecision in the calculations, cascade disturbances, large side feeds, and pressure variations might well cause serious changes. The operation in K-101 is probably the one point where this might be most serious because of the inflexibility of the feed point.

In addition to the equipment discussed in this letter, the seal exhaust systems, the interplant flow lines and the K-131 building will also be investigated. The relation of cascade temperature and pressure for normal on-stream operation is presently being studied. The results of these later studies will be released as soon as they are completed.

J. A. Parsons

GJDixon:ved