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CLINTON ENGINEER WORKS
CARBIDE AND CARBON CHEMICALS CORPORATION
Research and Development Laboratories



REPORT OF SPECIAL HAZARD ACTIVITIES AT K-25 FOR MAY 1947-25

Clifford K. Beck

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- G. T. E. Sheldon
- S. Visner

Consultants:

- E. T. Booth
- H. P. Feynman
- P. Morrison
- E. W. Nordheim

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A B S T R A C T

The report of Special Hazard activities at K-25 for May 1947 is composed of two parts:

1. Agenda for meeting of K-25 Special Hazards Committee, which contains a report of the pertinent activities in special hazards during May, and
2. Minutes of meeting of Special Hazards Committee, at which the agenda mentioned above were discussed.

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AGENDA FOR MEETING OF K-25 SPECIAL HAZARDS COMMITTEE

June 4, 1947

Clifford K. Beck

S. C. Barnett
C. K. Beck
C. E. Center
R. W. Cook
M. J. Costello

S. Cromer
G. T. Felbeck
A. P. Huber
W. B. Humes
F. W. Hurd

J. A. Marshall
M. G. Means
G. T. E. Sheldon
S. Visner

A meeting of the K-25 Special Hazards Committee is called for Friday morning, June 6, at 10:00 AM in the K-1001 Conference Room. The purpose of this meeting is to discuss Special Hazard activities at K-25 during May 1947, as reported subsequently herein, and, if satisfactory, to approve submission of the report to the Atomic Energy Commission.

The activities to be reported fall into categories.

1. Minutes of meeting of Plant Radiations Hazards Committee.
2. Safety recommendations with respect to Alpha Contamination in Recovery process.
3. A request to the Consultants Committee for information on "Always Safe" Pipe Sizes.
4. Several approvals of proposed changes in operation and equipment.

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1. Abstract of Minutes of Meeting of Plant Radiation Hazards Committee Meeting May 20, 1947.

Mr. Visner outlined the functions and duties of the committee as follows:

1. It is a working committee with the purpose of studying, wherever necessary, proposed changes to the plant which involve special hazards consideration. Recommendations to the Approval Committee on Radiation Hazards will be made through the chairman.
2. The committee is to review the plant constantly with the objective of furthering plant safety wherever possible.
3. Individual members will accept responsibility for conducting investigations and studies that may be needed for making recommendations.

The committee discussed at length various Special Hazards problems involved in the Plant I Surge System. In particular, the precautions being taken at the "boundary valves" separating the "upper" and "lower" systems, the possibility of accumulating too much uranium in the oil of the Beach-Russ pumps, and the hazard of a 6" section presently included as a part of the 4" cold trap. Precautions are being taken in all those items, and further study is being given to the necessity of additional safety measures.

In a discussion of the possibility of designing a truck to carry more product cylinders than is now permitted, it was decided to defer action until details on cylinder design and shipping arrangements were further clarified.

2. Safety recommendations with respect to Alpha Contamination in Recovery process.

The recommendations made on this problem follow:

An Alpha Radiation Survey of the Recovery Process in the K-1303 Building was made by the Process Laboratory at the request of Radiation Hazards. As a result of the study, specific safety measures are recommended to safeguard the health of the operators in this Area.

The toxicity of uranium due to the alpha activity has become a predominate factor in health considerations. Active material can enter the body by breathing contaminated air, swallowing, and through abrasions of the skin. It is the policy on the Manhattan District to limit to extremely low values the quantity of alpha emitters ingested by personnel. In general, this is to be accomplished either by limiting surface and atmospheric alpha count to normal background levels, or taking of extreme protective measures. In many cases, a combination of the two is required.

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[REDACTED]

With respect to the recovery processes in K-1303, it appears feasible to control the health hazard by establishing two types of areas:

- (1). A "safe" area in which all operations are sufficiently enclosed or of such a nature that the possibility of spillage, or contaminating the atmosphere, or surfaces handled by personnel would be sufficiently remote that extensive protective equipment would not be necessary. In such an area, those processes that involved the dusting or spraying of uranium compounds would be completely enclosed in a tight housing.
- (2). Areas are to be designated as "hot" in which the processes are of such a nature that the contamination of the area cannot be prevented. Personnel entering a "hot" area would be required to wear protective equipment such as gas mask or respirator, rubber gloves, and special clothing.

This report is concerned at this time with locations that are definitely "hot" and require irrediate attention.

For this survey both air and surface readings were taken at many stages of recovery process, in order to achieve a comprehensive understanding of the origin and extent of the problem.

A. OPERATION OF GRINDING $T_3 O_8$

This operation has been performed at various locations.

Results of Survey - A maximum air count of 71 times tolerance was found. Surface counts were frequently beyond range of the instrument. Full scale reading on the Zeuto alpha counter, which has a probe area of 0.1 square foot, is equivalent to about 20,000 counts per minute. Air samples indicated an unsafe condition for longer than four hours after cleaning the grinder.

Recommendations

- (1). The grinder should be moved to the scale room in the 1301 Building.
- (2). The cubicle containing both the scale and grinder should then be designated as a "hot" area.
- (3). Respirator or mask and rubber gloves should be worn at all times in this cubicle.
- (4). Extra coveralls and shoes should be kept for men who are to enter the grinding and scale room, and they should wear these clothes only in this room. Such practice should be strictly confined to the areas in which they originate.

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(5). It would be desirable, if at all possible, to enclose the grinder in an air-tight box. In the event that a dust proof container for the grinder can be devised, it may be possible to omit the clothing change.

B. FURNACE ROOM FOR FURNACING URANIUM PRECIPITATES

Results of Survey - Air samples taken between operations were all below tolerance, but surface counts were high.

Recommendations

(1). Rubber gloves and a respirator should be worn while operators are in this cubicle.

(2). A thorough decontamination and caution in handling material would help to keep the surface count down.

C. FILTER PRESS CUBICLE FOR SEPARATING URANIUM PRECIPITATES FROM FILTRATE

Results of Survey - Air samples indicated up to 19 times tolerance. Surface counts were far above background, probably due to spills.

Recommendations

(1). This area should be designated as "hot".

(2). Rubber gloves and a respirator are required here.

(3). Decontaminating and painting the walls to a level of about six feet above the floor, and painting the floor and wooden stand, would facilitate the clean up of spills.

GENERAL RECOMMENDATIONS

It is evident from the results obtained from the survey, that firm measures are necessary to keep operators from inhaling, or coming in contact with, process material.

For "Hot" Areas

(1). Large signs at the entrance to the previously listed cubicles should indicate the type of location and the necessary equipment to be worn before entering.

(2). Respirators and rubber gloves should be worn in such hot areas.

(3). Smoking, eating, and the storing of food should be forbidden in these areas.

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(4). Personnel should wash frequently, especially before eating, smoking, or leaving work. Washing, in this case, consists of thorough scrubbing with a stiff bristle brush, and the use of a strong soap with large quantities of water.

For All Locations in K-1300 Not Previously Listed

(1). All personnel who normally work in this area should be kept on the medical recheck list.

(2). Protective equipment should be used whenever contamination is visible.

The survey of other operations in the K-1300 Area is being continued to determine the necessity for any further safeguards. The operations already studied will also be monitored.

RADIATION HAZARDS

/s/ Gerald J. Selvin

APPROVED: /s/ S. Visner

GJS/ljh/am

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3. Request to the Consultants Committee for Information on "Always Safe" Pipe Sizes.

This request, addressed to Dr. Nordheim, Chairman of the Consultants Committee, is as follows:

Introduction

In the K-25 process, material of various isotopic concentrations is transported throughout the plant in pipes. During normal operation, the pressures and temperatures are such that the material remains in the vapor phase. For some operations, however, it is necessary to condense the material in pipes or other cylindrical containers under such circumstances that it is neither feasible nor possible to limit the quantity to the "Always Safe" amount, 350 grams U-235. Impurities such as H_2 and water may be condensed along with the UF_6 . The uranium may also be in the form of UO_2F_2 or UF_4 .

Statement of Problem

It is required to know what pipe sizes are safe at various concentrations of U-235 for the condensation of UF_6 along with any other material that could be present. What is desired is a statement of the pipe sizes that are "Always Safe" for materials in the plant that may be present in any relationship to each other with the condition that the exterior of the pipe is surrounded by hydrogenous material. The maximum density of UF_6 that may be encountered in the plant is 4.5 g/cm^3 . No moderator, superior to ordinary water is present such as beryllium or heavy water.

The information available at the present time on "Always Safe" pipe sizes has come from Drs. Hoyt and Teller and pertains only to concentrations of U-235 up to 2590003%.

1. The so-called "three diameter" rule states that unlimited quantities of material may be safely accumulated in a pipe provided that diameter is such that the quantity contained within a length equal to three diameters does not exceed the "Always Safe" amount.
2. In addition, the following diameters are "Always Safe" up to the specified assay:

6 inches for 3370003%
4 1/2 inches for 3470002%
3 inches for 4788002%

No information on "Always Safe" diameters has been available for X assays above 4786002%. Arbitrarily, the two-inch diameter has been specified by the Radiation Hazards Group at K-25 as "Always Safe" for assays up to 21180003%.

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It is also requested that in light of present knowledge, the present specifications for assays up to 4786002% be reviewed with the possibility in mind of extending the maximum assay that may be handled by the various pipe sizes.

Application to Plant

The most important application in the K-25 plant of "Always Safe" diameters is to the problem of sizing cold traps.

DOE

Definite advantages to plant operation would result should it be permissible to revise upwards the maximum U-235 assays that may be handled by either or both the eight-inch and four-inch cold traps.

A possible application of cold traps now under consideration is for a combined operation of purging non-condensable contaminants

DOE

Along with this plan is a similar proposal for purging contaminants by means of a cold trap

DOE

The operation of purging in Plant II, the upper section of K-25, at present is being accomplished with the K-312 purge section. The substitution of cold traps for this operation will result in a great increase in economy and convenience of operation.

Very sincerely yours,

/s/ Clifford K. Beck
Chairman, K-25 Special Hazards Committee

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4. Several Approvals of Proposed Changes in Operation and Equipment.

A. Side Withdrawal at] - April 28, 1947.

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The size and spacing of the equipment used in the withdrawal operation are safe. To insure safe handling of the filled product cylinders which are two inches in diameter and ten inches long, the following recommendations should be followed:

1. For storing and transporting the product cylinders in the RR Area, exclusive use should be made of the cylinder buggies available in the K-306-7 Product Withdrawal Rooms.
2. These buggies should be modified so that only two cylinders can be placed on them, on opposite corners, approximately seventeen inches apart. The remaining two receptacles on the buggy should be closed off.
3. If more than one buggy is required, a minimum distance of two feet should be maintained between the nearest edges of adjacent buggies.

"The withdrawal operation is approved subject to incorporating the above recommendations into the procedures."

APPROVAL COMMITTEE ON RADIATION HAZARDS

(S) C. K. Beck

J. L. Waters for
S. Cromer

S. Visner

B. Process Pressures in K-306 Section, April 28, 1947.

"Consideration has been given to assigning maximum values of tails pressure for safe operation of the K-306 section."

All other factors such as equipment size and coolant temperatures are identical.

For identical pressures, the "X" inventories in the buildings would vary in a similar manner.

DOE
LSE
DOE

"Approval therefore is given to raising tails pressures in the K-306 section"

DOE

APPROVAL ~~CONFIDENTIAL~~ COMMITTEE ON RADIATION HAZARDS

(S) C. K. Beck

J. L. Waters for

S. Visner

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C. Introduction of C-216 into the Cascade. April 29, 1947

"Consideration has been given to the proposal to introduce C-216 into the bottom of the cascade at a rate not to exceed 75 standard cubic feet per day. The resultant C-216 concentration throughout the cascade will be of the order of 1% or less. Under these conditions the moderating effect of the C-216 is negligible.

"No hazard is anticipated and the proposal is therefore approved."

APPROVAL COMMITTEE ON RADIATION HAZARDS

(S) C. K. Beck For, J. L. Waters S. Visner
S. Cromer

D. Product Withdrawal With Refrigeration. - May 1, 1947

"The test proposal for withdrawing product at K-305-1, employing a B-4 pump and mechanical refrigeration has been considered from the Radiation Hazards aspect. It is understood that the pump will be heated since the exhaust pressure may reach 2.5 psia. Also, to avoid the possibility of reaction product accumulating in the stagnant regions of the pump provisions are being made for leak testing the set-up regularly.

"The proposed test appears safe and temporary approval is given"

(S) S. Visner, Radiation Hazards

E. Purge Test in [] - May 1, 1947

"A review has been made of the proposed test on purging Plant II, utilizing a cold trap, as outlined in a letter of April 29, 1947, by R.G. Jordan.

"With the exception of setting up [] as a side purge case and the routing of purge gases, as indicated in the proposal, the cascade will not be affected in any manner."

The cold trap is part of a mobile trap unit which also contains a Beach-Russ pump. It is understood that the pump will not be used and that adequate safeguards will be taken to prevent the material from entering the pump. At the conclusion of the test, the C-616 that was condensed in the cold trap will be vaporized and returned to

"No hazard is anticipated since three (3) inches has been specified as the "Always Safe" pipe diameter for C-616 at a maximum assay of 4790003%. The test proposal is therefore approved."

APPROVAL COMMITTEE ON RADIATION HAZARDS

(S) C. K. Beck For, J. L. Waters S. Visner
S. Cromer

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" A review has been made of the proposed C-816 removal unit and proposed changes in K-100 as shown in drawings AWP-4962-A, AWP-4341-B, and AWP-4342-D. The apparatus consists essentially of a type W pump, a six inch diameter distillation column 20 feet high, a reflux drum of the same diameter but 28 inches long and a condenser, eight inches in diameter and nine feet long. As described in a report, (1) the unit is designed to remove C-816 from C-816 - C-616 mixtures in the cascade, below K-303-1. The removed C-816 would contain 1% C-616 which will be monitored by chemical analysis. The hold up of C-616 in the tower has been estimated at 222 pounds.

" C-616 in a solid or liquid state will exist only in the tower, condenser, reflux drum, and interconnecting piping of diameter less than one inch. All other lines and the type W pump will be kept at temperatures sufficiently high to prevent the condensation of C-616.

" Unlimited quantities of C-616, of a maximum assay of 3370002%, may be safely accumulated in the tower and reflux drum since their diameter is "Always Safe" for this assay. Although the condenser diameter exceeds the "Always Safe" value, it will not be hazardous under these conditions since the hold-up of C-616 is limited by the volume of the 28 monel 5/8" O.D. hair-pin tubes within the condenser (2). Calculations on the interaction of the three components indicate that their spacing is safe.

"The radiation hazard problem due to UX_1 and UX_2 was considered (3) and the opinion given that radiation emanating from the tower, due to UX_1 and UX_2 , should be below the tolerance level. If however, the inside surfaces of the unit or if the waste C-816 are to be exposed to personnel, above tolerance radiation may exist. Checks should therefore be made of these materials before handling.

"The C-816 removal unit is approved for use with material of assay less than 3370002%." ✓ DCE

APPROVAL COMMITTEE ON RADIATION HAZARDS

(S) C. K. Beck

J. L. Waters
For, S. Cromer

S. Visner

- (1) No. 4.34.3, "Process Design of a C-816 Removal Unit," by J. A. Finneran and W. J. Fritz. 11/19/46.
- (2) "Possibility of Special Hazards in a Proposed C-616 Condenser", C. K. Beck to R. C. Olson, 11/14/46.
- (3) "C-816 Removal Unit", S. Visner to J. A. Finneran, 2/11/47.

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G. UF₆ Condensation Test in K-27. May 9, 1947

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"The proposed C-616 condensation test in K-402-4 has been considered with respect to Special Hazards. As outlined in "C-616 Condensation Study Test Procedures", by J. J. Kurtz and R. C. Olson, the K-27 cell will be charged with C-616 of normal feed assay and condensation induced by lowering the cell coolant temperatures.

"No hazard is anticipated since unlimited quantities of feed C-616 may be accumulated safely under the conditions of the test. The test is therefore approved."

APPROVAL COMMITTEE ON RADIATION HAZARDS

(S) C. K. Beck

For, J. L. Waters
S. Cromer

S. Visner

H. Cold-Trap Test in K-312-3. May 23, 1947.

"A review has been made of the proposed purging test, utilizing two cold traps, as outlined in a letter of May 22, 1947, from R. G. Jordan, to the writer.

"It is proposed to set up K-304-5 as a purge cascade and route the purge gas to K-312-3 where it will pass through the cold traps. Except for the details of the traps, the test is to be identical to the one described in a letter of April 28, 1947, by R. G. Jordan and approved by this Committee on May 1, 1947. The C-616, [redacted] will be condensed in the traps and later evaporated and returned to the cascade. DoE

"The cold traps specified for the test are as follows:

- a. A copper trap three inches in diameter by 20 inches long.
- b. A converter tube cold trap, Drawing No. A-510, two and one-half inches in diameter and 90 inches long.

The traps are "Always-Safe" for C-616 with an assay up to 4790003%.

"It is understood that the traps will be located at least two feet apart. The proposed test appears safe and it is therefore approved."

APPROVAL COMMITTEE ON RADIATION HAZARDS

(S) C. K. Beck

S. Cromer

S. Visner

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