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File Index KS-254

Date 12-10-51

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Classification

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Series A

c 69103

K-31 UF_6 Recovery System

Short Title of Document

C. E. Newlon

Author

K25RC

NOT TO BE LOANED FROM PLANT RECORDS K-1031

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WCX-894 (7-51)

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INTER-COMPANY CORRESPONDENCE

(INSERT NAME) COMPANY CARBIDE AND CARBON CHEMICALS COMPANY LOCATION Post Office Box P OAK RIDGE, TENN.

TO Mr. M. F. Schwenn
LOCATION K-303-8

DATE December 10, 1951

ANSWERING LETTER DATE
APPROVAL LETTER NO. 80

ATTENTION
COPY TO ~~Mr. K. W. Bahler~~ Mr. R. M. Batch, Mr. E. C. Bollinger, Dr. A. D. Callihan, Mr. S. Cromer, Mr. V. B. Goddard, Dr. H. F. Henry-K25RC, Mr. A. P. Huber, Mr. W. B. Humes, Dr. F. W. Hurd, Dr. R. L. Macklin, Mr. J. A. Marshall, Mr. J. P. Murray, Mr. J. A. Parsons, Mr. D. H. Rader, Mr. H. G. P. Snyder, Mr. E. O. Sternberg

SUBJECT K-31 UF_6 Recovery System

KS-254

M-40520

KS 254 8 A

Introduction

Special hazards considerations have been given to the equipment and operation of the K-31 UF_6 recovery system where UF_6 is removed from cell purge gases and returned to the cascade.

Equipment

The UF_6 recovery system is located south of the K-31 control room in a 100' x 120' x 12' concrete block enclosure which is partitioned into several rooms. Each room and its equipment is listed below. (See attached drawing.)

Cold Trap Room

Cold Traps: Three 8" I.D. x10'3" size 3 traps. Kellex Dwg. 468-A. Each trap is coated with 0.016" cadmium and spaced on 7' centers.

Pumps: Four special 50 cfm. Beach-Russ pumps. Beach-Russ Dwg. SP-50-4. C&CCC Dwg. AW-M3380. Three additional Beach-Russ pumps will be placed 8' north of the cold trap room for extra pumping capacity. All pumps will be spaced on 6-1/2' centers.

Piping Heaters: One hundred and twenty-nine electric heater elements grouped into 14 major units, each of which is thermostatically controlled. G&V Dwgs. M-157 and M-158. Provision is made to check heaters by noting any drop in normal amperage requirements.

This document has been approved for release to the public by [redacted] Date 4/19/96
Technical Information Officer
Oak Ridge K-25 Site

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

Alumina Trap Room

Six 4" I.D. x 42" long alumina traps equipped with spacers. G&V Dwg. M-151.

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(5"d) 6-21-61
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ADC or ADD signature (first reviewer) Date 7/14/95
ADD signature (final reviewer) Date 25Aug95

WCX-169 (3-51) THIS FORM FOR INTER-COMPANY CORRESPONDENCE ONLY

Refrigeration Room

Two York Freon-12 1-1/2 ton refrigeration units. G&V Dwg. M-155.

Surge Drum Room

Twenty 2000 ft.^{3} capacity drums for purge gas storage. G&V Dwgs. M-151 and M-152. The room is heated by 4 thermostatically controlled 10 kw. electric hot air heaters.

Holding Drum

Four 300 ft.^{3} holding drums for UF_6 gas storage. G&V Dwg. M-151. The room is heated by 2 thermostatically controlled 10 kw. electric hot air heaters.

Operation

The standard procedures for cell evacuation and purging will be followed and the resultant N_2-UF_6 mixtures transferred to one or all of 4 groups of 5 evacuated surge drums by pressure equalization, and then pumped through a cold trap where traces of UF_6 in the purge gases are condensed.

Normally, condensed UF_6 will be vaporized in a cold trap and returned directly to an appropriate cascade position. However, the UF_6 may be stored temporarily in one of the 4 holding drums.

Special Hazards

The special hazards considered were the geometry and spacing of the individual equipment items and the provisions for maintaining UF_6 in the gas phase where the equipment is geometrically unsafe.

Holding Drums: Since pressures in a cold trap during UF_6 vaporization are higher than those required for condensation at the holding drum room temperature, close control over the holding drum UF_6 inventories is necessary in order that pressure equalization between a cold trap and a holding drum does not produce condensation.

The thermostatically controlled holding drum room temperature of 150°F. is approximately 20°F. higher than the condensation temperature for UF_6 at 12 psia. which is the maximum pressure at which the holding drums will be operated. In the event that these conditions are not maintained, low room temperature and high drum pressure alarms both audible and visible will actuate at a panel board in the cold trap room. If conditions warrant, either cold trap isolation or pressure reduction by transfer of holding drum inventories to other UF_6 equipment will be made.

Should MFL oil mist from the Beach-Russ pumps carry over to the holding drums, the resultant MFL-UF_6 sludge may create a special hazards problem. In order to minimize the possibility of either gradual or sudden accumulations of material therein, routine monthly surveys for uranium deposits with a high pressure argon probe will be made of the holding drums, and additional surveys will be made immediately after any abnormal operation which may have caused MFL oil carry-over.

Surge Drums: The surge drum room temperature will be thermostatically controlled above 120°F. which is adequate to keep UF_6 in the gas phase even if a cell of UF_6 at the maximum anticipated operating pressure of 8 psia. were valved to the drums. Thus, the surge drums do not appear to present a special hazards problem.

Cold Traps: The 8" I.D. traps, which have been previously approved for assays up to 5%,[1] are spaced on 7' centers. The maximum solid angle at the center trap is an allowable 0.33 steradian which includes the interaction contribution from the Beach-Russ pumps and a UF_6 withdrawal cylinder positioned 4' from the north cold trap.

The design and operation of the cold traps is essentially unchanged, except Freon-12 rather than CO_2 will be used as the cold trap refrigerant. There is no apparent special hazards problem in the use of Freon-12 rather than CO_2, since tests indicate that Freon-12 is relatively inert to UF_6,[2] and its chemical composition is such that it is not a good moderator.

Beach-Russ Pumps: It is conservatively estimated that the pump and pump oil reservoir will hold no more than 4.7 gallons of MFL oil when in operation. Thus, the maximum UF_6 absorption in the pump and oil reservoir is estimated to be 35 lb., on the basis that one gallon of MFL oil will absorb approximately 7.5 lb. of UF_6.[3] Since the pump reservoir is normally filled with only 2 gallons of MFL oil, there seems little possibility of the 5% safe batch quantity of 35 lb. of UF_6 in the pump and pump oil reservoir being exceeded.

In calculating the interaction between components of the Beach-Russ pumps, it was assumed that uranium would accumulate only in the MFL oil and not in the mist filters or oil separators, since sludging tests[4] indicate that negligible quantities of uranium will accumulate in these sections when heated. Temperatures of the oil separators and piping at the mist filters as well as the amperage requirements of the electric process piping heaters will be checked at least once each shift during pump operation. On this basis, the maximum solid angle interaction calculated at any pump is an allowable 0.20 steradian, which includes movement either of a contaminated oil container or an alumina trap along specified routes as indicated on the attached sketch.

1 Henry, H. F., Minutes of Meeting of K-25 Special Hazards Committee, 12-16-49, (KS-98)
2 Hurd, F. W., Investigation of Freon-12 as Possible Evaporative Coolant, 11-17-49
3 Dudley, I. T., Solubility of C-616 in MFL in Beach-Russ Pumps, 3-24-48, (K-191)
4 Dudley, I. T., Beach-Russ Sludging Test, July 19, 1948, (K-244)

Alumina Traps: The alumina traps are geometrically safe for any assay material and will be so spaced that the maximum calculated interaction, which will occur at a central trap in fixed position with another trap in transit along the approved withdrawal route, is an allowable 0.33 steradian.

Conclusion

The various components of the K-31 cold trap system therefore appear safe for operation at a maximum assay of 5% provided:

1. The specified holding drum temperatures and pressures are not exceeded.
2. Surveys are made of the holding drums for uranium accumulation at monthly intervals and immediately after abnormal operations.
3. UF_6 piping and Beach-Russ pump electric heaters are checked each shift.
4. Correct spacing of uranium equipment is maintained at all times.

C. E. Newlon

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Safety and Radiation Hazards

HFH:AJM:bjn

APPROVAL COMMITTEE ON RADIATION HAZARDS

A. D. Callihan H. F. Henry R. L. Macklin

K-31 UF_6 RECOVERY SYSTEM