

(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 ~~12/18/95~~ 2/16/96 Expected receipt of document ~~3/18/96~~ 3/16/96

Document number K2-7475 Date of document 1/24/53

Title and author (if document is unnumbered)

(This section to be completed by Document Center)

Date request received 2/20/96

Date submitted to ADC 2/21/96

Date submitted to HSA Coordinator 2/20/96

(This section to be completed by HSA Coordinator)

Date submitted to CICO 2/21/96

Date received from CICO 3/6/96

Date submitted to ChemRisk/Shonka and DOE 3/4/96

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

Date document received _____

Signature _____

m. Schussler

KZ-7475

~~OFFICIAL USE ONLY~~

CARBIDE AND CARBON CHEMICALS COMPANY
K-25 PLANT

Oak Ridge, Tennessee
January 24, 1953

To: Mr. K. W. Bahler
Mr. E. C. Bollinger
Mr. Sylvan Cromer
Mr. G. H. Dykes
Mr. A. P. Huber
Mr. W. B. Humes

From: Safety and Protection Division

Subject: Report of Material Release

Date of Incident: December 30, 1952
Nature of Incident: Process Material Released From Feed
Cylinder as a Result of a Valve Failure
Location: K-402-1 Building, Cell Floor

Dr. F. W. Hurd
Mr. J. A. Marshall
Mr. E. A. Pluhar
Mr. D. H. Rader
Mr. W. L. Richardson
Mr. M. F. Schwenn

This document has been reviewed for classification and has been determined to be UNCLASSIFIED.
Thomas W. Kelly
ADC Signature
2/22/96

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

While opening the valve of a heated feed cylinder preparatory to sampling the cylinder contents, an operator noted the escape of material from the valve and attempted to close it. As he did so, the valve stem shot out of its bonnet and a cloud of UF₆ emerged from the cylinder. The K-27 Buildings were evacuated of all personnel and the release was finally brought under control by removing the cylinder from its bath and freezing its contents with dry ice. Personnel involved were sent to the dispensary for a supervisory check and were returned to normal work. Rather extensive areas in some of the K-27 Buildings were contaminated.

FINDINGS

1. This particular cylinder had been filled at Paducah and shipped to K-25.
2. The events leading up to the release were as follows:
 - a. The cylinder was placed in the feed bath at 5:00 p.m., on December 29, 1952.
 - b. At 12:20 p.m., December 30, 1952, the sampling manifold was connected to the cylinder valve; the manifold was warmed until 12:30 p.m. when the cylinder valve was opened by R. L. Robinson, 13578, the only employee in the immediate vicinity of the cylinder.
 - c. The operator reported that when he had opened the valve about 1/4-turn, he noted UF₆ escaping so he immediately closed it. Since the gas continued to escape, however, he was attempting to close the valve more tightly when its stem shot out with such force that his arm and the wrench he was holding were violently pushed aside.
3. Both the Area I office and the Central Control Room were immediately notified of the release; at about the same time, a fire alarm was actuated by employees not directly concerned with the incident.

This document has been approved for release to the public by:
Robert K. Kelly
Special Information Officer
K-25 Site

~~OFFICIAL USE ONLY~~

4. Evacuation of K-27 personnel was requested over the public address system by the Central Control Room.
5. The steam supply to the K-27 feed baths was shut off so that continued heating of the cylinders in the bath would cease; in order to accomplish this, it was also necessary to shut off the steam supply to K-1131.
6. The ventilating fans in the basement of K-402-1 were stopped.
7. Attempts to freeze down the cylinder with CO₂ from 50-lb. extinguishers were unsuccessful.
8. The cylinder was removed from its bath with a Hyster and brought outside the building where the valve hole was plugged and the cylinder contents finally frozen with CO₂ ice.
9. All employees required to enter the UF₆ fog for operation or observation during the release were equipped with either a Chemox gas mask or an Army Assault mask, and the operator who shut off the ventilating fans wore an impermeable suit.
10. Thirty-three men, including two Maxon Construction Company employees, were sent to the dispensary for supervisory checks and returned to normal work.
11. At the time of the release, the air was heavily fogged; however, the results of samples taken showed below-P.A.L. contamination in all but a few locations by the end of the shift.
12. As a result of the settling of the hydrolyzed UF₆, the cylinder contents were rather uniformly distributed throughout the cell floors, pipe gallery, operating floors, and basements of the buildings affected, deposits being heaviest in K-402-1 and diminishing in successive buildings until little effect was noted beyond K-402-4; immediate radiation surveys of the locker rooms and canteen showed that they were unaffected. However, there were comparatively large piles of material in a few places in K-402-1 which were not considered special hazards problems because of the assay of the material concerned.
13. Approximately 2,506 lb. of material escaped from the cylinder; only about 300 lb. were retained.
14. Investigation showed that the accident was the direct result of the fracture of the union nut on the valve body; evidence indicated that this nut had previously cracked under strain and that this specific failure came as a result of the completion of the crack. It appeared that when the valve was opened the UF₆ escaped through the cracked nut; the act of closing the valve tightly put sufficient additional strain upon the nut that it split apart.
15. Metallurgical study indicated that the failure of this nut was caused by the selective attack of cylinder gases upon one of the phases of this binary alloy. This attack was probably accelerated by the high stresses in the metal, Duronze III.
16. In use, the nut had to be torqued sufficiently to provide a gas-tight metal-to-metal seal between the valve body and the bonnet, both of the same material. This frequently required a high torque and consequent overstressing of the nut.

17. A spot check of similar union nuts both at K-25 and at Paducah disclosed that cracks had already started in several of them.
18. The valve was a stock design of the manufacturer who claimed that no similar trouble had previously been encountered.
19. The valves originally installed in these cylinders were 3/4" one-piece valves which did not require the union nut. However, when operations required the use of 1" valves, the low-bid unit which was accepted is the present two-piece valve.

RESPONSIBILITY

The investigating committee consisting of R. H. Dyer, W. D. McCluen, and R. D. Shaffer of the Production Division and H. F. Henry of the Safety and Protection Division assigned the following responsibility for the release:

- 100% 2 - 1: In that the design of the valve was such as to necessitate overstressing the materials concerned in making gas-tight seals; in addition, operating specifications for valve closure failed to take this overstrain possibility into account.

RECOMMENDATIONS

1. That, as a temporary measure, the present union nuts of Duronze III material be replaced with plated steel nuts.
2. That a 1/32" thick P-10 gasket be used to effect a seal between the valve body and the union nut in all cases where these valves are used and that efforts be made to develop a satisfactory metal gasket for that seal.
3. That limitations on the torque applied in closing these valves be established for both the union nut and the stem.
4. That valves used on cylinders in inter-plant shipment be one-piece valves.
5. That consideration be given to providing an appropriate system for removing UF₆ from the air in those locations where similar incidents might be anticipated.
6. That, insofar as possible, all personnel who are assigned to locations where the operations include work with gaseous or liquid UF₆ under pressure be capable of using the Chemox mask and be so checked by the Medical Department.
7. That an ample emergency supply of CO₂ be maintained at all locations where either gaseous or liquid UF₆ is maintained under pressure.
8. That the plant policy of not calling the Fire Department in cases of material release be re-emphasized to plant personnel.

HFH:lja

cc: Mr. J. Arendt
Mr. R. H. Dyer
Mr. W. D. McCluen
Mr. J. A. Parsons
Mr. M. Schussler ✓
Mr. R. D. Shaffer
Mr. H. G. P. Snyder
Safety Dept. File-K25RC

Hugh F. Henry
H. F. Henry
Safety and Radiation Hazards