UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION IV
611 RYAN PLAZA DRIVE, SUITE 1000
ARLINGTON, TEXAS 76011

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APR 24 1986

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MEMORANDUM FOR: Clemens J. Heltemes, Jr., Director
Office for Analysis and Evaluation
of Operational Data

FROM: Robert D. Martin
Regional Administrator

SUBJECT: INPUT TO THE ABNORMAL OCCURRENCE REPORT TO CONGRESS

In accordance with your April 7, 1986, memorandum on input to the "Report to Congress on Abnormal Occurrences" for the first quarter period of calendar year 1986, we have reviewed activities in this region for reportability to Congress. We are aware of no Region IV reportable issues aside from those three issues referenced in your memorandum. Our comments on those AEOD-identified issues are as follows.

1. Ruptured Uranium Hexaflouride Cylinder: Our input on this incident and the subsequent overfill incident is attached.

2. Alleged violations at Pathfinder Mines Corporation: The Region is in the process of preparing an order. We expect the order to be issued in the second quarter of CY 1986, and we will consult with AEOD as to the reportability on this matter during the preparation of next quarter's input.

3. Exposure of Radiographic Personnel Due to Management and Procedural Control Deficiencies: This issue will be updated upon approval from the Office of Investigations; an approval is not imminent.

Any questions on our input may be directed to Dale A. Powers at FTS: 728-8195.

Robert D. Martin
Regional Administrator

cc: P. Bobe, AEOD
R. Smith, URFO
R. Bangart, RIV

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ABNORMAL OCCURRENCE REPORT

RUPTURE OF URANIUM HEXAFLUORIDE CYLINDER AT THE SEQUOYAH FUELS FACILITY

Date and Place

At 11:30 a.m. on January 4, 1986, a cylinder filled with uranium hexafluoride (UF_6) ruptured while it was being heated in a steam chest at the Sequoyah Fuels Corporation's Sequoyah Facility near Gore, Oklahoma. One worker died because he inhaled hydrogen fluoride fumes, a reaction product of UF_6 and airborne moisture. Much of the facility complex and some offsite areas to the south were contaminated with hydrogen fluoride and a second reaction product, uranyl fluoride. The interval of release was approximately 40 minutes.

On March 12, 1986, the licensee began draining UF_6 from process vessels to shipping cylinders. This operation was necessary in order to enable modification of facilities and equipment at the plant, which had been shut down since the January 4 accident. During the course of the draining process on March 3, a cylinder was filled with 26,017 pounds of UF_6, an amount 4,987 pounds greater than the cylinder's maximum shipping weight specification of 21,030 pounds. The draining process was to have been conducted in accordance with special licensee procedures, which further limited each cylinder to be filled with no more than 20,000 pounds of UF_6.

Nature and Probable Consequences

At approximately 10:00 a.m. on January 3, 1986, the filling of a 14-ton capacity cylinder with UF_6 was commenced. This operation continued during the following work shifts. During the early morning of January 4, a chemical operator was unable to add further material into the cylinder, even though the targeted load of 27,500 pounds had not been achieved. The cylinder and its attendant cart had been placed on a scale during the filling process in order to monitor the net weight of the cylinder. At this time, the scale indicated that the cylinder contained 26,400 pounds of product.

The chemical operator inspected the cylinder and observed that the cart on which it sat had not been fully moved onto the scale platform. This condition occurred because the cylinder, being the largest design filled at the facility, was not properly positioned on the cart so as to allow clearance at the front end of the cylinder when the cart was moved onto the scale platform. When the cart and cylinder were repositioned onto the scale platform, the scale dial indicator registered its maximum possible reading of approximately 29,500 pounds. The cylinder had been filled with a quantity of UF_6 in excess of the amount measurable with the scale and in excess of the maximum shipping weight specification of the cylinder which is 27,560 pounds.

At approximately 6:15 a.m., the chemical operator began to evacuate UF_6 from the cylinder back into plant process vessels. He was relieved by the day shift chemical operator at 8:00 a.m., and the evacuation process continued until the

material began to solidify in the cylinder. The operator consulted with the assistant shift supervisor, who is the ranking production manager on site, and who instructed the operator to move the cylinder to a steam chest located outside the process building. The steam chest was to be used to heat the cylinder to approximately 210°F, thus liquifying the contained UF_6. Although some material had been removed from the cylinder, the scale indicator still registered approximately 29,500 pounds before the cylinder was removed. Heating an overfilled cylinder was later noted to be contrary to company procedures.

At approximately 11:30 a.m., the cylinder ruptured in the steam chest. The cylinder ruptured while it was being heated because of the expansion of uranium hexafluoride as it changed from the solid to the liquid phase. Liquid UF_6 flowed from the 4-foot, lengthwise rupture and rapidly reacted with moisture in the air to form uranyl fluoride and hydrofluoric acid. The resulting vapor cloud was carried south by southeast by a wind gusting to 25 mph.

The cloud enveloped the process building, and the acidic vapor fatally injured the chemical operator located within a structure approximately 70 feet southwest of the cylinder. Most of the approximately 40 workers at the site were in the plant lunch room and quickly evacuated the building. The airborne release continued for about 40 minutes crossing an interstate highway one mile to the south and private residences beyond.

The licensee immediately notified various local, state, and federal officials. Four injured workers were transported to a local hospital. A private physician arrived at the site within one hour of the accident and examined plant workers. During the afternoon, downwind residents were personally notified to go to nearby hospitals and clinics for examinations.

The NRC Region IV Duty Officer was notified of the incident by the NRC:HQ Operations Officer by pager at approximately 12:25 p.m. The Region IV Incident Response Center was manned and communication links with NRC Headquarters and the licensee began at 12:55 p.m. Six NRC personnel were immediately dispatched and began arriving at the site at 6:00 p.m. Additional NRC personnel were dispatched to the site during the following days to oversee bioassay of workers and residents, evaluation of offsite effluents, and decontamination of the plant complex. An NRC Augmented Investigation Team was formed to investigate the incident. Their findings were reported in NUREG-1179, Vol. 1, published during February 1986. An assessment of the public health impact of the accident was published during March 1986 as NUREG-1189.

After the January accident, the licensee planned to drain UF_6 remaining in plant vessels into 10-ton shipping cylinders in order to enable modification of facilities and equipment at the plant. A procedure for the work was reviewed by NRC and the work commenced on March 12, 1986. The procedure limited the filling of the cylinders to 20,000 pounds each. The maximum shipping weight specification of the cylinders was 21,030 pounds. During the draining, a scale

malfunctioned which caused UF_6 to be drained into a cylinder in excess of both of the above limits. The final net weight of the cylinder was 26,017 pounds. Most of the excess material was immediately evacuated from the cylinder before the UF_6 solidified. The final net weight of the cylinder was 21,202 pounds.

The cause of this second incident was identified as inadvertent damage to a scale apparently when it was decontaminated after the first incident. Results of NRC investigation of this overfilling are reported in NUREG-1179, Vol. 2.

Cause or Causes

The NRC Augmented Investigation Team (AIT) which investigated both incidents reported the following causes in NUREG-1179:

First Incident

1. The cylinder was overfilled because it was not placed fully on the scales. Plant facilities were not designed to accommodate 14-ton cylinders, and associated equipment were not designed to prevent improper positioning of cylinders on the scales.

2. The time required for filling the cylinder was long enough to allow partial solidification of the UF_6, which inhibited product removal from the cylinder.

3. The precise weight of the cylinder was not readily determinable after it was overfilled.

4. There was no secondary or alternative way to measure the quantity of material in a cylinder being filled.

5. Employees violated company procedures when they heated an overfilled cylinder. Workers, including line management personnel, had not been sufficiently trained in regard to company procedures. Procedural controls such as checklists or approval points were not used.

6. Equipment for monitoring or automatically venting cylinders that are being heated was not used.

In summary, the factors can be aggregated into the following causes of the accident:

* The physical equipment and facilities used for filling and weighing UF_6 cylinders were inappropriate for safe use with 14-ton cylinders.

* The training of workers in operating procedures and ensuring the implementation of these procedures were not carried out effectively.

Second Incident

1. The scale used for weighing the cylinder being filled malfunctioned.

2. The procedures for draining did not include any provisions for ensuring proper scale function.

3. The supervision in charge of the operation did not recognize early indications of malfunction. (An operator advised his management of peculiar scale behavior during the filling of the cylinder.)

Actions Taken To Prevent Recurrence

Both NRC and licensee actions to prevent recurrence are currently in progress. The following summarizes actions as of mid-April 1986.

Licensee - The licensee has committed to keep the plant shut down until equipment modifications are made, plant personnel are retrained, plant procedures are rewritten, organization changes have been implemented, and NRC approves plant restart.

NRC - A Lessons Learned Task Group is reviewing regulatory practices in regard to such fuel facilities in general. A request to restart the facility has not been received by NRC. NRC is monitoring licensee plant modification work. Enforcement actions are pending.

The event remains under review by the NRC, and future reports will be made as appropriate.