

## NUCLEAR REGULATORY COMMISSION

## ABNORMAL OCCURRENCE

LOSS OF CONFINEMENT SYSTEM RESULTING IN PLUTONIUM  
DEPOSITION IN AN EMPLOYEE

Section 208 of the Energy Reorganization Act of 1974, as amended, requires the NRC to disseminate information on abnormal occurrences (i.e., unscheduled incidents or events which the Commission determines are significant from the standpoint of public health and safety). The following incident was determined to be an abnormal occurrence using the criteria published in the Federal Register on February 24, 1977 (42 FR 10950). Appendix A (Example III.B.1) of the Policy Statement notes that for fuel cycle licensees, an event which seriously compromised the ability of a confinement system to perform its designated function can be considered an abnormal occurrence. In this case, as a result of the confinement system failure, exposure to an operator appears to have exceeded that noted in Section 20.103, 10 CFR Part 20, "Exposure of individuals to concentrations of radioactive materials in air in restricted areas." The following is a description of the event and the remedial action taken.

Date and Place - The Babcock and Wilcox Company, Nuclear Materials and Manufacturing Division, Apollo, Pennsylvania, reported that on November 16, 1979, an operator, working in the Parks Township Plutonium Facility, received an apparent internal deposition of plutonium when the integrity of the glovebox, in which he was working, was compromised.

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- 2 -

Nature and Probable Consequences - On November 16, 1979, at about 8:00 a.m. a technician was repairing a powder blender in a plutonium contaminated glovebox. At this time he was pounding on a shaft removed from the blender with a hammer using the floor of the glovebox as a base while attempting to remove a frozen bearing from the shaft. Attached to the bottom of this glovebox was a "well" that was used to hold containers to collect discharges from the blending unit.

At about 8:30 a.m. a second technician, while monitoring himself for contamination prior to leaving the area, discovered elevated levels of alpha radiation apparently from plutonium contamination. The technician doing the repair work immediately monitored his shoes and work clothing and found elevated contamination levels on his work clothing in the area of his upper body. Other employees working in the area were requested to monitor themselves for contamination and contaminated shoes were found on several individuals. The area was evacuated.

Fifteen individuals were working in the area; twelve of the fifteen showed positive results on nose smears; only the individual working on the blender had excessively high nose smear contamination results. All twelve individuals were placed on a bioassay program and were whole body counted.

- 3 -

This incident involved occupational hazards due to the loss of confinement in the glovebox. There was no release of contamination to the off-site environment and the building containment systems were operable. Bioassay and whole body counting results indicated that eleven of the twelve individuals were not subjected to detectable internal deposition of radioactive material. The twelfth individual, according to the licensee's evaluation (which has been reviewed by NRC inspectors) was originally believed to have been subjected to an internal deposition in the lung of between forty to fifty nanocuries (nCi) of plutonium, as determined by in-vivo lung counting at the University of Pittsburgh. This individual is the person who was working at the glovebox at the time of the incident.

Recent in-vivo lung counting was performed on this individual at Los Alamos Scientific Laboratory (LASL) using a new, sophisticated phantom (human body mock-up). The evaluation by LASL indicates a lung burden of 10 to 15 nCi of plutonium plus about 3 nCi of americium 241. The new phantom is being routed to national laboratories and certain other facilities for calibration purposes; however, it is not expected to be available to the University of Pittsburgh for 3 to 4 months, and thus, it will be several months before it is known whether the apparent discrepancy in the counting results is due to calibration procedures. Isotopic analysis of an air sample collected at the time of the incident appears to support the LASL lung count.

- 4 -

Calculations have been performed based on the International Commission on Radiological Protection (ICRP) Task Group Lung Model and ICRP parameters for transfer of the inhaled material to the bone. For the upper value of 50 nCi, total dose to the lung would be about 100 rems, 95% of which would occur within about 6 years after the intake. The total bone dose in 50 years would be about 320 rems or 6 to 7 rems per year. Using ICRP risk weighting factors for partial body exposures, the effective whole body dose equivalent in the first year would be about 6 rems (compared to an average annual limit for whole body dose of 5 rems).

Review of available records indicates that a lung burden of 50 nCi of plutonium represents one of the three largest Pu burdens to an occupational worker at licensed facilities. Further, the lack of audible alarms indicates that the potential was present for larger burdens and exposure to additional personnel.

Cause or Causes - The cause of the airborne release was due to equipment/material failure. The seal located between the glovebox and the glovebox "well" located under the floor of the glovebox had apparently failed and/or bolts holding the "well" in place loosened.

Actions Taken to Prevent Recurrence

Licensee - Operations in the area were suspended pending decontamination of the room. The licensee has repaired the original seal and in addition

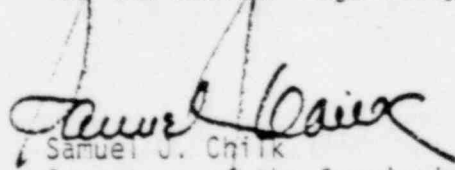
- 5 -

has installed a secondary seal between the glovebox floor and the well. Consultant medical attention was furnished to the employee directly involved. The employee involved has been removed from work in potentially contaminated areas indefinitely. Audible alarm, continuous air monitors were installed in the area as safety warning devices to supplement existing air sampling devices and provide more complete coverage of the work area.

The licensee will continue to evaluate the employee's medical condition and deposition plutonium body burden; however, it may be some time before better determination of the deposition is available and before the actual half-life in the lung (ICRP estimates 500 days) can be estimated.

NRC - An investigation was conducted in which several items (not event related) of noncompliance with regulatory requirements were identified. These items were corrected by the licensee. Subsequent action included a letter to the licensee confirming that a request for a license amendment will be submitted to the NRC which specifies the criteria for use and location of the audible alarm, continuous air monitoring devices. The NRC has also reviewed license commitments of other plutonium processing licensees to assure that the audible alarm, continuous air monitors are used in their operations.

For the Nuclear Regulatory Commission

  
Samuel J. Chilk  
Secretary of the Commission

Dated at Washington, D. C. this 30<sup>th</sup> day of June 1980.