

Lessons Learned from a Tc-99 Glovebox Deflagration at a Chemical Laboratory

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In June 1999, a glovebox in the Chemical and Metallurgical Research (CMR) facility over-pressurized, bursting a glove and releasing high levels of Tc-99 contamination into a laboratory room. Fortunately, this particular room was unoccupied at the time, and no personnel contamination or injuries occurred.

At the time of the incident, CMR personnel were evaporating approximately 5L of aqueous waste that was highly contaminated with Tc-99. The waste also contained ammonium ions, nitrates, hydrogen peroxide, sulfates, potassium, fluorides, and quantities of various metals. RCRA metals in excess of regulatory limits were also discovered after the incident.

During lunch, a deflagration burst a glove and released contamination throughout the room. Investigators later hypothesized that as the solution evaporated, the ammonium nitrate in solution concentrated and then rapidly decomposed to N₂, NO_x and water vapor. Normally, this decomposition reaction would occur at temperatures higher than the 80 C used to evaporate the waste solution. However, we believe that the presence of transition metal ions catalyzed the decomposition reaction at a much lower temperature producing a deflagration.

Investigation revealed numerous deficiencies in the work control process:

- The work was performed outside of the established review and approval process. This resulted in a lack of adequate review and authorization prior to accepting the work at CMR.
- The laboratory used for this work had unreliable engineering controls.
- The change control process was inadequate when unanticipated hazards were identified.

The lessons learned from this incident has been incorporated into CMR facility operations. As a result, the CMR Laboratory has steadily improved their safe work practices and conduct of operations.