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# MAB4-O-08 CHARACTERIZATION OF OPERATIONS IN THE FIRST U.S. BUILDING THAT PRODUCED PLUTONIUM COMPONENTS FOR ATOMIC WEAPONS TO SUPPORT ESTIMATION OF AIRBORNE EFFLUENTS AND DOSES TO MEMBERS OF THE PUBLIC

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**Introduction:** A building constructed in 1943 at a U.S. scientific laboratory was the first facility in the world to process gram and then kilogram quantities of plutonium. As increasing amounts of the new and largely unknown plutonium were received from reactor sites, processing was scaled up to produce the first two plutonium-based atomic bombs. A state-of-the-art air conditioning system, provided to keep dust out of the rare plutonium, was poorly suited to contain airborne releases from the heavily contaminated building. Effluents via numerous roof-top vents were unfiltered and unmonitored. Official compilations of effluents from the laboratory include no contribution from this facility, which housed chemical and metallurgical research until the early 1950s.

**Methods:** An extensive document retrieval and assessment project has focused in part on this facility. An independent team of scientists and engineers had unprecedented access to historical records, and thousands of documents that describe the facility's operations were reviewed, as were photographs and drawings. To supplement this research, scientists who worked in this facility during the 1940s and 1950s were identified for a roundtable meeting to address information gaps.

**Results:** It was determined that plutonium arrived in the form of relatively impure plutonium nitrate, which was first converted into plutonium (III) oxalate by wet chemical techniques. This compound was subsequently converted into plutonium oxide and then fluorinated using hydrogen fluoride and oxygen, forming plutonium tetrafluoride. This plutonium halide was then reduced in the presence of a more electropositive metal such as calcium, resulting in plutonium metal. The metal was remelted and fabricated into a variety of shapes and coated to protect surfaces from oxidation. Residues and waste streams were returned to the recovery group to be recycled. Equipment, reagents, and reactions used in each processing step were characterized. Methods developed to estimate historical releases consider the equipment and processes used, quantities of plutonium processed, methods of transfer, indoor and environmental measurements, and reasonable release fractions.

**Discussion and Conclusions:** This facility was suspected to be an important contributor to releases from the laboratory, and the desire to quantify releases from this facility was heightened by the fact that residential areas were in close proximity. Methods were developed and data assembled that assess the assignment of the priority of plutonium releases relative to other materials also considered for detailed dose reconstruction.