

PUBLIC AFFAIRSFigure 8. Fact Sheet 2: Medical Department Fact Sheet on Plutonium

FACT SHEET 2

MEDICAL DEPARTMENT FACT SHEET ON PLUTONIUM

(For Medical Personnel)

Plutonium is a highly reactive element that may exhibit five oxidation states, from three to seven. The principal routes into the body are through inhalation and contaminated wounds; ingestion and contaminated intact skin are unimportant.

Inhalation is probably the most significant route of contamination in a nuclear weapon accident. Retention in the lungs depends on particle size and the chemical form of plutonium involved. Usually, in a weapons accident, plutonium is in the form of an oxide that has a pulmonary retention half-time of up to 1,000 days.

Absorption through wound contamination results in a translocation of some of the material to the skeleton and liver. The majority remains in the vicinity of the wound and may result in the formation of a fibrous nodule within months to years. The possible development of a sarcoma or carcinoma in such nodules is a matter of concern, although there have been no reports of such in the medical literature.

After entry into the body, some of the plutonium is solubilized by the body fluids, including blood, and is redistributed within the body. Ultimately, it is distributed by the blood to the skeleton (45 percent), liver (45 percent), and the other tissues (10 percent). The retention half-times are estimated to be 200 years (whole body), 100 years (skeleton), and 40 years (liver).

All medical treatment for plutonium contamination or inhalation should be coordinated with the appropriate Service Medical Department or with the REAC/TS because of the hazard of the substances involved. DTPA compounds are defined as investigational drugs that require the advice and concurrence of the REAC/TS before administration. The REAC/TS may be contacted at: (423) 576-3131.

Treatment of plutonium-contaminated wounds should involve copious washing and irrigation to try to dislodge the contamination. If possible, washings should be saved for later counting to determine contamination levels. More extensive treatment by excision requires judgment in assessing the area involved, the difficulty of excision, and the total quantity in the wound. Greater than 4 mCi of Pu embedded in a wound should be considered a candidate for such treatment. It is not expected that the physician will need to make this determination, since a specialized team to perform such monitoring may be made available from the Incident Commander or his or her representative. Immediate chelation therapy with DTPA (consult the REAC/TS for protocol) should be accomplished before surgical excision to prevent possible systemic absorption of plutonium. In burn cases, flushing with sterile saline or water removes a great deal of contamination. The remainder is likely to be removed when the eschar sloughs off. DTPA treatment given immediately after wound or burn treatment has been shown to remove up to 96 percent of the remaining plutonium. In the case of inhaled plutonium, the results have been relatively disappointing, since the oxide forms of plutonium are transferred at a relatively slow rate from the lungs into the systemic circulation. Thus, little systemic burden of plutonium is available for chelation in the early period after exposure and there is never a time when a sizable systemic burden is available in the extracellular spaces for effective chelation.

In spite of this, DTPA should be used as soon as possible after significant inhalation exposures, since the oxides may not be the only compound present. Attempts to stimulate phagocytosis and the mucociliary

response, or to use expectorant drugs, have not been successful in animal studies; however, this may not be true in humans.

The only demonstrated useful procedure in enhancing the clearance of insoluble particles, such as plutonium oxides, from the lung is bronchopulmonary lavage. The risk of this procedure versus the risk of future health effects from the estimated lung burden must be very carefully weighed. The use of repeated lavages should remove 25 to 50 percent of the plutonium that should otherwise be kept in the lung. Again, advice should be sought from the Service medical command and the REAC/TS.