

**QUESTION: When released to the atmosphere, uranium hexafluoride (UF<sub>6</sub>) reacts with water vapor and undergoes hydrolysis producing hydrogen fluoride (HF) and uranyl fluoride (UO<sub>2</sub>F<sub>2</sub>). What Protective Action Criterion (PAC) and Threshold for Early Lethality (TEL) value(s) should be used when analyzing UF<sub>6</sub> releases for Emergency Planning Hazards Assessments (EPHAs)?**

**ANSWER:** The plume resulting from a release of UF<sub>6</sub> to the atmosphere will be a mixture of UF<sub>6</sub>, UO<sub>2</sub>F<sub>2</sub> and HF in proportions that vary, depending on the rate of hydrolysis and distance from the release point.

According to supporting documentation, the development of the AEGL values for UF<sub>6</sub> considered the following:

- 1) Inhaled UF<sub>6</sub> produces biological damage through its hydrolysis products (UO<sub>2</sub>F<sub>2</sub> and HF);
- 2) Inhaled UF<sub>6</sub> is quickly hydrolyzed in the airways and lungs; and
- 3) The dominant biological effect that is the basis for the AEGL-2 value (kidney damage) is attributed to the intake of the soluble uranium compound UO<sub>2</sub>F<sub>2</sub>.

Since no AEGL values are currently available for UO<sub>2</sub>F<sub>2</sub> and because of the disparity (cf. ANS presentation cited below) between the TEEL-2 value for UO<sub>2</sub>F<sub>2</sub> and the AEGL-2 value for UF<sub>6</sub>, the AEGL-2 and -3 values for UF<sub>6</sub> should take precedence in estimating health impacts from UF<sub>6</sub> and UO<sub>2</sub>F<sub>2</sub>. This preference for AEGL values over TEEL values reflects a greater level of confidence associated with AEGLs, which are developed through a rigorous, peer-reviewed assessment of basic toxicological data. In contrast, TEELs are meant to be conservative default values developed primarily using other exposure limits, with some consideration of selected toxicological data. TEELs are intended for use when no AEGL or ERPG is available for a substance. With respect to exposures to the other hydrolysis component HF, since the hydrolysis products can be considered to act independently (i.e., they affect different target organs), using the UF<sub>6</sub> AEGL-2 and AEGL-3 as PAC and TEL values will be conservative with regard to HF exposure at concentrations near the PAC and TEL values.

Based on the information presented above, the transformation of UF<sub>6</sub> to its hydrolysis products during transport is not a major consideration for emergency planning and response purposes, since the health effect from inhaling a given concentration of UF<sub>6</sub> gas is expected to be the same as for inhalation of the equivalent concentrations of the two hydrolysis products. If, for example, an atmospheric transport model calculates the plume concentrations of either the two hydrolysis products or total “soluble uranium,” those results should be converted to an equivalent UF<sub>6</sub> concentration, which should then be compared to the UF<sub>6</sub> AEGL-2 and -3 values to make planning and response decisions.

**DOE O 151.1C FAQ**

**Program Element(s): Hazards Survey/Hazards Assessment; Consequence Assessment**

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The technical basis for this recommended approach is described in the paper entitled *Proposed Department of Energy Protective Action Criteria for Uranium Hexafluoride* published in the proceedings of the American Nuclear Society (ANS) International Joint Topical Meeting on Emergency Preparedness and Response and Robotic and Remote Systems (February 11-16, 2006)..