UF_6 PROTECTIVE ACTION CRITERION (PAC)

QUESTION: When released to the atmosphere, uranium hexafluoride (UF_6) reacts with water vapor and undergoes hydrolysis producing hydrogen fluoride (HF) and uranyl fluoride (UO_2F_2). What Protective Action Criterion (PAC) and Threshold for Early Lethality (TEL) value(s) should be used when analyzing UF_6 releases for Emergency Planning Hazards Assessments (EPHAs)?

ANSWER: The plume resulting from a release of UF_6 to the atmosphere will be a mixture of UF_6, UO_2F_2 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_6 considered the following:

1) Inhaled UF_6 produces biological damage through its hydrolysis products (UO_2F_2 and HF);

2) Inhaled UF_6 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_2F_2.

Since no AEGL values are currently available for UO_2F_2 and because of the disparity (cf. ANS presentation cited below) between the TEEL-2 value for UO_2F_2 and the AEGL-2 value for UF_6, the AEGL-2 and -3 values for UF_6 should take precedence in estimating health impacts from UF_6 and UO_2F_2. 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_6 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_6 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_6 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_6 concentration, which should then be compared to the UF_6 AEGL-2 and -3 values to make planning and response decisions.

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)..