## K8 Distribution and Optical Purity of Methamphetamine Found in Toxic Concentration in a Civil Aviation Accident Pilot Fatality

*Patrick S. Cardona, BA*, Arvind K. Chaturvedi, PhD, John W. Soper, PhD, and Dennis V. Canfield, PhD, Bioaeronautical Sciences Research Laboratory (AAM-610), FAA Civil Aerospace Medical Institute, PO Box 25082, Oklahoma City, OK 73125-5066*

The authors will present toxicological findings of a pilot fatality involved in a unique methamphetamine-related civil aviation accident to aid investigations of such accidents.

This presentation will provide information on the distribution of methamphetamine present in toxic concentration and the stereoselective analysis of this amine in biological samples.

The Federal Aviation Administration's Civil Aerospace Medical Institute conducts toxicological evaluation of postmortem biological samples collected from pilots involved in fatal civil aircraft accidents. The submitted samples are primarily analyzed for the presence of primary combustion gases, alcohol/volatiles, and drugs. Related to such an evaluation, findings of a unique aircraft accident are described in this report. Upon colliding with terrain in weather conditions of poor visibility, a 1-occupant airplane was substantially damaged with no evidence of fire. Remains of the pilot were found outside the crashed aircraft. Pathological examination of the pilot's body revealed multiple blunt force injuries and vascular congestion, including subdural hemorrhage of the cerebral cortex. Autopsied samples—blood, brain, gastric contents, heart, liver, muscle, spleen, urine, and vitreous fluid—were submitted for toxicological analysis. The fluorescence polarization immunoassay disclosed the presence of 8.0 µg/mL amphetamines in urine. Subsequent gas chromatographic/mass spectrometric confirmatory analysis determined the presence of methamphetamine (1.134 µg/mL in blood and 59.171 µg/mL in urine) and amphetamine (0.022 µg/mL in blood and 1.495 µg/mL in urine). Both amines were present in all the submitted sample types, except for amphetamine, which was detected neither in vitreous fluid nor in muscle. The amount of methamphetamine found in gastric contents was 575-fold higher than that of amphetamine. Stereochemical analyses of gastric contents, blood, and urine using a chiral probe, (S)-(–)-N-(trifluoroacetyl)prolyl chloride, indicated that methamphetamine detected in the sample types was not optically pure. In gastric contents and urine, this secondary amine's optical isomers were present in equal proportions. The enantiomeric excess of (+)-methamphetamine over its (–)-form was about 32% in blood. Both optical forms of amphetamine were present in the ratio of 1.2–1.5:1.0 in the 3 sample types. The blood methamphetamine concentration found was in the range sufficient to produce toxic effects, including performance impairment. The observed variation in the ratios of amine isomer concentrations in the sample types would have been attributed to stereoselective metabolic and other pharmacokinetic processes. Findings of this study supported the conclusion of the National Transportation Safety Board that, in addition to the visibilityassociated adverse meteorological conditions, the use of the controlled substance played a contributory role in the causation of the aircraft accident.

**Forensic Toxicology, Methamphetamine, Stereochemical Analyses**

 ** Presenting Author*