



### K31 A Case of Fatal Difluoroethane Intoxication

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Attending this presentation will enable the participant to learn about the analysis of difluoroethane and its tissue distribution in a post-mortem case.

1,1-Difluoroethane (DFE, halocarbon 152A, Freon 152) is a colorless, odorless gas that is used as a cooling agent, in aerosols and in the manufacture of other chemicals. Inhalation of DFE can produce coughing, shortness of breath, pulmonary edema, headache, dizziness and loss of consciousness. The intentional abuse of DFE for its intoxicating effect has been reported.

A case was received at the State of Delaware Office of the Chief Medical Examiner involving the intentional abuse of DFE. The decedent was a 34-year-old white male found in a prone position in a concrete drainage culvert with a head injury and his face partially submerged in water. An empty can of dust-off was found under the decedent's leg. Further investigation of the scene revealed a Walkman, cigarettes and 13 empty cans of cleaning duster spray. At autopsy, multiple specimens were collected including heart blood, brain, liver, bile, urine, gastric contents and vitreous humor. Specimens were stored in sealed polypropylene specimen cups at 4°C until analysis. In addition, a 10-mL aliquot of heart blood was sealed in a 20-mL headspace vial and frozen until analysis for DFE. Routine toxicological screening of heart blood and urine for alcohol and drugs of abuse yielded negative results.

It was learned from the decedent's father that the decedent had a long history of drug and alcohol abuse and for about the past year he had been abusing inhalants. Two different brands of cleaning duster spray were found at the scene, one containing DFE and the other containing 1,1,1,2-tetrafluoroethane (TFE). Analysis of DFE and TFE standards and the decedent's heart blood by gas chromatography-mass spectrometry indicated only the presence of DFE in the decedent's heart blood. Multiple postmortem specimens were analyzed for DFE by dual column (Restek BAC1 & BAC2) headspace gas chromatography with flame ionization detection. Quantitation was performed with a 9-point calibration curve ranging from 0.8 mg/L up to 204 mg/L DFE using npropanol as an internal standard. A stock DFE standard was prepared by weighing DFE into 5 mL of methanol in a sealed 20 mL headspace vial. After determination of the methanol-air partition coefficient for the DFE in the vial, the concentration of the stock standard was calculated. Calibrators were prepared by spiking blank blood with the stock standard. Quality controls at concentrations of approximately 4, 40 and 400 mg/L were included with each batch. Blood, vitreous, urine, bile and gastric contents (0.1 mL) were diluted with internal standard solution (1.0 mL) and sealed in a 20-mL headspace vial. Tissue specimens were homogenized with internal standard solution and added to a 20-mL headspace vial. The concentration of DFE in the various specimens analyzed are summarized in the table below:

Specimen	DFE (mg/L or mg/kg)
Heart Blood	413
Vitreous Humor	342
Brain	133
Liver	91
Bile	256
Urine	104
Gastric Contents	272

Interpretation of the quantitative results for DFE is made difficult by the lack of published clinical or postmortem data for DFE. In a single published case report, blood concentrations of 78 mg/L and 35 mg/L DFE were reported in a driver and a passenger involved in a fatal automobile accident<sup>(1)</sup>. The presence of high concentrations of DFE in the decedent's heart blood and tissues and the evidence collected at the scene in this case suggest that the decedent was inhaling DFE from the cleaning duster spray close to the time of his death. It is suspected that he lost consciousness due to his intoxication with DFE, causing him to fall and strike his head, ultimately landing with his face submerged in water. The cause of his death was ruled inhalation of difluoroethane complicated by blunt force head injury and drowning. The manner was ruled undetermined due to the unknown cause of the head injury.

1. Broussard LA, Brustowicz T, Pittman T, Atkins K, Presley L. Two traffic fatalities related to the use of difluoroethane. *J Forensic Sci* 1997;42(6):1186-1187.

#### Difluoroethane, Analytical Toxicology, Postmortem