

## Determination of tricresyl phosphate air contamination in aircraft type BAe 146/AVRO RJ

*D. Breuer<sup>1</sup>, C. Friedrich<sup>1</sup>, U. Metzdorf<sup>2</sup> and W. Rosenberger<sup>3</sup>*

<sup>1</sup>Institute for Occupational Safety and Health of the German Social Accident Insurance (IFA),  
53757 Sankt Augustin, Germany,

<sup>2</sup>German Social Accident Insurance Institution for Transport and Traffic (BG Verkehr),

<sup>3</sup>Hannover Medical School, Institute of Occupational Medicine, Carl-Neuberg-Straße 1,  
30625 Hannover, Germany

For many years, the exposition to tricresyl phosphates (TCP) and tri-*o*-cresyl phosphate (ToCP) in particular of cabin crews in commercial aircrafts is described as a cause of occupational diseases. The Aircraft BAe 146/Avro RJ was identified as a particularly striking. This small short-haul aircraft with four jet engines was reported more frequently than other aircrafts by so-called fume events. Tricresyl phosphates are components of aircraft engine oils, such as those used for many years. The *o*-cresyl phosphates (*o*CPs) are known neurotoxins. From studies of engine oils it is known that the critical *o*CPs are minor contaminants with less than 0.1 % of ToCP in total.

In 2012, the BG Verkehr and the IFA had the opportunity to perform extensive measurements in five aircrafts of type BAe 146/Avro RJ. In addition to the samples on organo phosphates, samples were also drawn to other volatile organic compounds in the air on the plane. The samples were analysed in two independent laboratories.

The investigations showed that the main target compound ToCP was not present in the air of the aircraft cabins. However, other phosphates such as tri-*n*-butyl phosphate and tri-phenyl phosphate are detected which could have their origin in the hydraulic oil. The load of volatile organic compounds (VOC) in the aircraft was in a range, such as occurs in offices. Only on a flight where the plane had to be de-iced before take-off significant some components of de-icing fluid could be detected. However, these substances were no longer detectable after about 30 minutes of flight time.

In another study, a moisture trap from the ventilation system of a retired BAe 146 aircraft was examined for deposits. The inside surface was extracted with methyl tertiary-butyl ether (MtBE) and analysed for organophosphates. The inside surfaces of the filter are reflecting several years of operation and non-volatile organophosphates such as TCP can be accumulated. Also here, the critical ToCP is detectable only in traces, while the other phosphates were very well detectable (Figure 1).

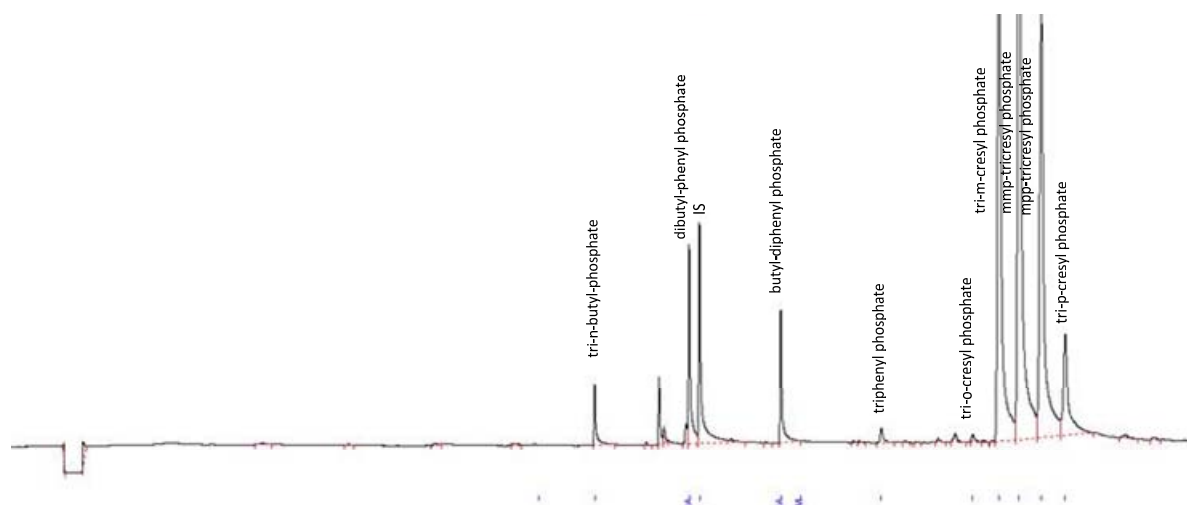


Figure 1: Chromatogram of an MtBE extract from a moisture trap of an BAe 146 aircraft