

## Introduction

This reports of the results of an investigation constituting one half of the body of work suggested in the 2000 House of Lords Select Committee on Science and Technology report on “Air Travel and Health” and independently by the Committee on Toxicity of Chemicals in Food, Consumer Products and the Environment (COT).

It is important to stress that its results have little bearing on the exposure to VOCs and SVOCs in reportable fume events, the basis of the suggested 2<sup>nd</sup> component. The absence of any such reportable events in the 100 flights investigated may tell us something about the frequency of such events but with the small number of flights sampled and the lack of information about the selection of the flights used for investigation and whether this is representative of the airline industry as a whole the interpretation of this is difficult.

Although it was suggested by the COT that the B757s investigated be those fitted with the RR535C engine there is no confirmation that this was the case. Indeed there is no indication that data about engine type were collected. This is unfortunate given that the engine type could be an important determinant of the type and amount of pollutants released.

It is not clear why the investigators chose the complex and possibly wasteful technique of dividing collection and analysis between the two organisations rather than simply designating one as the sampler and the other as the analyser for all flight schedules. This necessitated substantial work assessing agreement between the two analytical laboratories both in techniques and outcome of standard analyses rather than a simple consideration of agreement with spiked standards.

It is of some concern that in the analysis of agreement between the two laboratories there were tubes which were outliers for many of the analytes (page 77). The authors invoke the possibility of contamination either before spiking or during transport or storage. The proportion of tubes so affected is not given but it does give rise to some uncertainty in the interpretation of the high values discovered in the observational parts of the study.

The discussion of the choice of analytes (page 7) is inadequate. It was not clear whether the range of analytes was driven by the agreed scope of the project, according to the practicalities of analysis, likely pollutants and breakdown products of fuels and oils (if so why no discussion about the other possible sources of chemicals in an aircraft), consideration of VOCs and SVOCs of greatest toxicity, or those for which there are pre-existing standards/ data. At Page 3.3 mention is made that

the tubes were selected to retain a wide range of sorbents yet no mention is made as to whether this capability was explored or not. Given one of the suggestions of the COT was that the initial phase should involve the determination of the identity and concentration of chemical compounds and any particulates and that this should cover the widest possible range of potential contaminants that could be analysed it is perhaps unfortunate that a relatively small number be studies and reported.

The issue of blanks is of some concern to me. On page 10 it is stated that values “have not been corrected for any amount of background contamination found on blank tubes”. This makes a nonsense of having blanks. The fact that the number of positive results is altered should not influence the use of measured values in blanks in interpreting values from all other samples.

Presentation of results is somewhat unhelpful. The comparison of means and percentiles of both VOC and SVOC concentrations show that for the majority these are highly skewed if not very highly skewed. Presentation of the data as some estimate of central tendency and variation about this is therefore unhelpful. Even the box-plots in the appendix do not give justice to the results when the mean may be driven by a couple of very high values. Although not standard practice it might be more helpful to provide the proportion of sample results below the limit of quantification and the median and interquartile range for those samples providing deterministic values.

The confounding of the apparent CO monitor failure with one of the aircraft types is unfortunate as it leads to impossibility. There should be some discussion as to why there was thought malfunction other than by interpretation of the results.

In terms of the triggering of further sampling there perhaps should be some breakdown of those that were triggered by reports from flight deck staff where the sampling equipment was situated and those triggered by cabin crew elsewhere in the aircraft. Specifically there is no analysis or comment on any possible relationship between the site of the reported fume incident and measured sample values even though these data were collected.

When it is said that any noticeable rise in VOC or ultra-fine particle count (page 4) would trigger further sampling it would be helpful to know whether such a rise was predetermined or was left up to the researcher on the day.

I fundamentally disagree with the suggestion that the mean concentration weighted as it is by more intensive sampling during early and late phases of the flight “”give an indication of the longer term

mean concentration and therefore the exposure of the crew through the duration of the flight” (page 10).

Under Table 7 a new flight phase is introduced that of “Taxi in”. It is not clear that this is a new concept introduced to cover both Taxi -back and time parked (page 19) or whether it is simply a typographical error should be clarified.

In several cases it is suggested that a high PID reading is due to vapour from the p-Trak device without any indication as to why the researcher should believe this. As they were aware of the PID readings (as this was used as a trigger for further sampling) it is difficult to see how they could produce an unbiased assessment as to whether or not contamination from the p-Trak was responsible or not.

Another source of bias is discussion of the relation between fume incidents identified by the researcher and VOC peaks (Fig 5 page 26)

## **Conclusion**

The study reports suggest that it was carried out to a high standard although the design may have been unnecessarily complex and the range of potential pollutants investigated was relatively small. The results suggest that concentrations of those pollutants measured in flights with no fume incidents worthy of formal reporting are generally low and within either long-term regulatory guidelines or concentrations previously observed in indoor domestic environments. Although there are minor criticisms to be made about the methodology and the presentation of the results these are not of a magnitude to lead me to doubt the conclusions drawn.