

This is a background paper for discussion. It does not reflect the views of the Committee and should not be quoted, cited or reproduced.

TOX/2013/32 Annex 7

COMMITTEE ON TOXICITY OF CHEMICALS IN FOOD CONSUMER PRODUCTS AND THE ENVIRONMENT

DISCUSSION PAPER ON EXPOSURE MONITORING OF THE AIRCRAFT CABIN ENVIRONMENT

LITERATURE CONSIDERED AS PART OF REVIEW

1. Abou-Donia, M. B., M. M. Abou-Donia, et al. (2013). Autoantibodies to nervous system-specific proteins are elevated in sera of flight crew members: biomarkers for nervous system injury. *J Toxicol Environ Health A* **76**(6): 363-380.
2. Adar, S. D., M. Davey, et al. (2008). Predicting Airborne Particle Levels Aboard Washington State School Buses. *Atmos Environ (1994)* **42**(33): 7590-7599.
3. Allen, J. G., H. M. Stapleton, et al. (2013). Exposure to flame retardant chemicals on commercial airplanes. *Environ Health* **12**: 17.
4. Allen, J. G., A. L. Sumner, et al. (2012). Air concentrations of PBDEs on in-flight airplanes and assessment of flight crew inhalation exposure. *J Expo Sci Environ Epidemiol*.
5. Amato, F., T. Moreno, et al. (2010). Concentrations, sources and geochemistry of airborne particulate matter at a major European airport. *J Environ Monit* **12**(4): 854-862.
6. Asmi, E., M. Antola, et al. (2009). Driver and passenger exposure to aerosol particles in buses and trams in Helsinki, Finland. *Sci Total Environ* **407**(8): 2860-2867.
7. Baker, P. E., T. B. Cole, et al. (2013). Identifying safer anti-wear triaryl phosphate additives for jet engine lubricants. *Chem Biol Interact* **203**(1): 257-264.
8. Bakke, B., P. A. Stewart, et al. (2007). Uses of and exposure to trichloroethylene in U.S. industry: a systematic literature review. *J Occup Environ Hyg* **4**(5): 375-390.
9. Borak, J. and G. Sirianni (2007). Studies of self-pollution in diesel school buses: methodological issues. *J Occup Environ Hyg* **4**(9): 660-668.
10. Brommer, S., S. Harrad, et al. (2012). Concentrations of organophosphate esters and brominated flame retardants in German indoor dust samples. *J Environ Monit* **14**(9): 2482-2487.
11. Bull, K. (2008). Cabin air filtration: helping to protect occupants from infectious diseases. *Travel Med Infect Dis* **6**(3): 142-144.
12. Buonanno, G., M. Bernabei, et al. (2012). Occupational exposure to airborne particles and other pollutants in an aviation base. *Environmental Pollution* **170**: 78-87.
13. Chaturvedi, A. K. (2011). Aerospace toxicology overview: aerial application and cabin air quality. *Rev Environ Contam Toxicol* **214**: 15-40.

This is a background paper for discussion. It does not reflect the views of the Committee and should not be quoted, cited or reproduced.

14. Chien, Y. C. (2007). Variations in amounts and potential sources of volatile organic chemicals in new cars. *Sci Total Environ* **382**(2-3): 228-239.
15. Christiansson, A., L. Hovander, et al. (2008). Polybrominated diphenyl ethers in aircraft cabins--a source of human exposure? *Chemosphere* **73**(10): 1654-1660.
16. Coleman, B. K., J. R. Wells, et al. (2010). Investigating ozone-induced decomposition of surface-bound permethrin for conditions in aircraft cabins. *Indoor Air* **20**(1): 61-71.
17. De Nola, G., J. Kirby, et al. (2008). Determination of ortho-cresyl phosphate isomers of tricresyl phosphate used in aircraft turbine engine oils by gas chromatography and mass spectrometry. *J Chromatogr A* **1200**(2): 211-216.
18. Denola, G., P. J. Hanhela, et al. (2011). Determination of tricresyl phosphate air contamination in aircraft. *Ann Occup Hyg* **55**(7): 710-722.
19. Geiss, O., S. Tirendi, et al. (2009). Investigation of volatile organic compounds and phthalates present in the cabin air of used private cars. *Environ Int* **35**(8): 1188-1195.
20. Guimaraes, C. S., D. Custodio, et al. (2010). Comparative study of automotive, aircraft and biogenic emissions of aldehydes and aromatic compounds. *Bull Environ Contam Toxicol* **84**(2): 180-184.
21. Guimaraes, C. S., L. S. Varandas, et al. (2010). Formaldehyde and Acetaldehyde Concentrations in the Idle and Taxiway Areas of an Urban Airport. *Journal of the Brazilian Chemical Society* **21**(3): 481-488.
22. Hsu, H. H., G. Adamkiewicz, et al. (2012). The relationship between aviation activities and ultrafine particulate matter concentrations near a mid-sized airport. *Atmospheric Environment* **50**: 328-337.
23. Hsu, H. H., G. Adamkiewicz, et al. (2013). Contributions of aircraft arrivals and departures to ultrafine particle counts near Los Angeles International Airport. *Science of the Total Environment* **444**: 347-355.
24. Hu, S., S. Fruin, et al. (2009). Aircraft Emission Impacts in a Neighborhood Adjacent to a General Aviation Airport in Southern California. *Environmental Science & Technology* **43**(21): 8039-8045.
25. Huang, H. L. and D. J. Hsu (2009). Exposure levels of particulate matter in long-distance buses in Taiwan. *Indoor Air* **19**(3): 234-242.
26. Ionel, I., G. Apostol, et al. (2010). AIR QUALITY MONITORING IN AN INTERNATIONAL ROMANIAN AIRPORT. *Journal of Environmental Protection and Ecology* **11**(3): 815-821.
27. Ionel, I., D. Nicolae, et al. (2011). MEASURING AIR POLLUTANTS IN AN INTERNATIONAL ROMANIA AIRPORT WITH POINT AND OPEN PATH INSTRUMENTS. *Romanian Journal of Physics* **56**(3-4): 507-519.
28. Ireson, R. G., J. M. Ondov, et al. (2011). Measuring in-cabin school bus tailpipe and crankcase PM_{2.5}: a new dual tracer method. *J Air Waste Manag Assoc* **61**(5): 494-503.
29. Jung, K. H., F. Artigas, et al. (2011). Personal, indoor, and outdoor exposure to VOCs in the immediate vicinity of a local airport. *Environ Monit Assess* **173**(1-4): 555-567.
30. Lai, C. H., K. Y. Chuang, et al. (2013). Source Apportionment of Volatile Organic

This is a background paper for discussion. It does not reflect the views of the Committee and should not be quoted, cited or reproduced.

- Compounds at an International Airport. *Aerosol and Air Quality Research* **13**(2): 689-698.
- 31. Lindgren, T., D. Norback, et al. (2007). Perception of cabin air quality in airline crew related to air humidification, on intercontinental flights. *Indoor Air* **17**(3): 204-210.
 - 32. Liyasova, M., B. Li, et al. (2011). Exposure to tri-o-cresyl phosphate detected in jet airplane passengers. *Toxicol Appl Pharmacol* **256**(3): 337-347.
 - 33. Makinen, M. S., M. R. Makinen, et al. (2009). Respiratory and dermal exposure to organophosphorus flame retardants and tetrabromobisphenol A at five work environments. *Environ Sci Technol* **43**(3): 941-947.
 - 34. Mazaheri, M., G. R. Johnson, et al. (2011). An inventory of particle and gaseous emissions from large aircraft thrust engine operations at an airport. *Atmospheric Environment* **45**(20): 3500-3507.
 - 35. Merchant-Borna, K., E. G. Rodrigues, et al. (2012). Characterization of inhalation exposure to jet fuel among U.S. Air Force personnel. *Ann Occup Hyg* **56**(6): 736-745.
 - 36. Rosenberger, W., S. Netz-Piepenbrink, et al. (2013). Determination of mono- and diortho tricresyl phosphates in indoor air of aircraft. *Gefahrstoffe Reinhaltung Der Luft* **73**(4): 138-143.
 - 37. Schafer, K., G. Schurmann, et al. (2007). Budapest airport air quality long-term studies by remote sensing with DOAS and FTIR with focus upon runway emissions - art. no. 67451P. *Remote Sensing of Clouds and the Atmosphere XII*. A. Comeron, R. H. Picard, K. S. Schafer, J. R. Slusser and A. Amodeo. **6745**: P7451-P7451.
 - 38. Schindler, B. K., S. Koslitz, et al. (2013). Exposure of aircraft maintenance technicians to organophosphates from hydraulic fluids and turbine oils: A pilot study. *Int J Hyg Environ Health*.
 - 39. Schindler, B. K., T. Weiss, et al. (2013). Occupational exposure of air crews to tricresyl phosphate isomers and organophosphate flame retardants after fume events. *Arch Toxicol* **87**(4): 645-648.
 - 40. Schopfer, L. M., C. E. Furlong, et al. (2010). Development of diagnostics in the search for an explanation of aerotoxic syndrome. *Anal Biochem* **404**(1): 64-74.
 - 41. Smith, K. W., S. P. Proctor, et al. (2010). Inhalation exposure to jet fuel (JP8) among U.S. Air Force personnel. *J Occup Environ Hyg* **7**(10): 563-572.
 - 42. Solbu, K., H. L. Daae, et al. (2011). Organophosphates in aircraft cabin and cockpit air--method development and measurements of contaminants. *J Environ Monit* **13**(5): 1393-1403.
 - 43. Solbu, K., H. L. Daae, et al. (2010). Exposure to airborne organophosphates originating from hydraulic and turbine oils among aviation technicians and loaders. *J Environ Monit* **12**(12): 2259-2268.
 - 44. Solbu, K., S. Thorud, et al. (2007). Determination of airborne trialkyl and triaryl organophosphates originating from hydraulic fluids by gas chromatography-mass spectrometry. Development of methodology for combined aerosol and vapor sampling. *J Chromatogr A* **1161**(1-2): 275-283.
 - 45. Turgut, E. T. and M. A. Rosen (2010). Assessment of emissions at busy airports.

This is a background paper for discussion. It does not reflect the views of the Committee and should not be quoted, cited or reproduced.

- International Journal of Energy Research **34**(9): 800-814.
- 46. van Netten, C. (2009). Design of a small personal air monitor and its application in aircraft. Sci Total Environ **407**(3): 1206-1210.
 - 47. Yu, Z., D. S. Liscinsky, et al. (2010). Characterization of lubrication oil emissions from aircraft engines. Environ Sci Technol **44**(24): 9530-9534.
 - 48. Zhu, Y., A. Eiguren-Fernandez, et al. (2007). In-cabin commuter exposure to ultrafine particles on Los Angeles freeways. Environ Sci Technol **41**(7): 2138-2145.
 - 49. Zhu, Y. F., E. Fanning, et al. (2011). Aircraft emissions and local air quality impacts from takeoff activities at a large International Airport. Atmospheric Environment **45**(36): 6526-6533.