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16. Abstract INTRODUCTION. Cabin air quality onboard commercial aircraft has been a major concern for over 30 years. Advances in aircraft engine technology have resulted in increased engine temperatures and the use of synthetic lubricating oils that may contain organophosphate additives. Synthetic oils heated to high temperatures can contaminate aircraft air supplies due to mechanical failures or design deficiencies. The purpose of this paper is to describe the rate of occurrence of smoke, odor, and fume events related to pyrolyzed oil, hydraulic fluids, or fuel on US commercial airline flights. METHODS. Air supply contamination reports for US commercial airlines were collected from the Federal Aviation Administration Service Difficulty Report System (SDRS) database for a four-year period (January 2016 through December 2019). The event descriptions were then searched for keywords to include odor, fume, fog, aroma, smoke, odor, odour, odour, haze, fire, scent, smell, and smoking. Events, such as baggage area fires and inspections, stating that the aircraft was powered off, were removed. The remaining events were manually reviewed to remove the cases that the automated keyword search included but were inapplicable. These filtered results were then manually reviewed to examine the description in the 'Event Details' column to ensure that the contaminant resulted from pyrolyzed oil, hydraulic fluid, or fuel. Furthermore, maintenance-related columns were reviewed for descriptions of follow-up maintenance activities such as repair or replacement that indicated pyrolyzed oil, hydraulic fluid, or fuel was a possible but not definite cause. This more restricted set of events is called the "contaminant events." RESULTS. Smoke, Odor, Fume (SOF) events were identified in 6,656 SDRS reports, of which 660 were identified as definite contaminant events (i.e., SOF events caused by possible pyrolyzed oil, hydraulic fluids, or fuel.) There were also another 487 reports for which follow-on maintenance activities such as repair or replacement of parts indicated that pyrolyzed oil, fluid, or fuel was a possible, but not definite cause. Therefore, the number of events can reasonably be bounded between 660 and 1147. The rate of events during this period can be expressed as the number of events per day (between 0.45 and 0.77), as the number of events per million departures (between 17.5 and 30.4), or as the number of events per 100,000 block (i.e., gate-to-gate) hours (between 0.72 and 1.26). (The number of block hours flown by aircraft certified to operate under Part 121 rules from 2016 to 2019 and the number of related departures were derived from the Bureau of Transportation Statistics Air Carrier Statistics Table). DISCUSSION. The results of this study are limited by conditions such as the reporting accuracy of SOF events and incomplete symptom data and should be interpreted as preliminary and indicative rather than conclusive. However, these results show that further monitoring and study of airplane cabin air quality are needed.					
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