**IN THE CIRCUIT COURT OF COOK COUNTY ILLINOIS**
**COUNTY DEPARTMENT, LAW DIVISION**

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|---|---|---|
| VANESSA WOODS, a single woman; FAYE OSKARDOTTIR, a single woman; DARLENE RAMIREZ, a single woman; and KAREN NEBEN and NATHAN NEBEN, husband and wife, | ) | |
| Plaintiffs, | ) | NO. _____ |
| v. | ) | |
| THE BOEING COMPANY, | ) | *Plaintiffs Demand Trial by Jury* |
| Defendant. | ) | |

## COMPLAINT

Plaintiffs VANESSA WOODS ("Ms. Woods"), FAYE OSKARDOTTIR ("Ms. Oskardottir"), DARLENE RAMIREZ ("Ms. Ramirez"), KAREN NEBEN ("Mrs. Neben") and NATHAN NEBEN ("Mr. Neben"), by and through their attorneys, POWER ROGERS & SMITH, P.C., FRIEDMAN RUBIN, LITTLEPAGE BOOTH, and BRODKOWITZ LAW, file this Complaint against the above-named Defendant (hereinafter referred to as "Boeing") and state as follows:

## PARTIES

1. Ms. Woods is a citizen of the United States of America, domiciled in Newport Beach, California.

2. Ms. Oskardottir is a citizen of the United States of America, domiciled in Rancho Santa Margarita, California.

3. Ms. Ramirez is a citizen of the United States of America, domiciled in San Diego, California.

4. Mr. and Mrs. Neben are a married couple, citizens of the United States of America and domiciled in Lemon Grove, California.

5. Defendant Boeing Company is a Delaware corporation with its principal place of business and corporate headquarters in Chicago, Illinois.

6. Jurisdiction and venue is proper in this Court because Illinois is Defendant The Boeing Company's home state, the event at issue occurred at least in part in Chicago and the Plaintiffs received initial medical treatment for their personal injuries in Chicago.

7. At all times relevant to this complaint, Defendant Boeing Company was engaged in the business of designing, manufacturing, assembling, testing, servicing, marketing, promoting, leasing and selling commercial aircraft as well as providing information and warnings about such aircraft, including the aircraft at issue.

## FACTS

8. The facts of this case highlight a previously hidden and "dirty little secret" of the commercial airline industry: Cabin air in Boeing's commercial aircraft (with the exception of the Boeing 787 Dreamliner) comes in through the aircraft's engines before entering the cabin.

9. This is known as a "bleed air" system because the cabin air is in effect "bled" off the airplane's engines and can thus become contaminated with heated jet engine oil and its toxic by-products.

10. Air contamination can occur during normal operation of the airplane but is particularly high during "fume events" or events where additional toxins enter the air system.

11. Fume events can sometimes produce distinctive odors, often described as a chemical, oily or a “dirty socks” smell.

12. Inhaling toxic cabin air can cause short-term or transient symptoms as well as permanent and serious personal injury.

13. The chemical constituents of burning or heated jet engine oil and its byproducts, include, but are not limited to, neurotoxins such as organophosphates.

14. Organophosphates are chemical compounds used in insecticides, herbicides, pesticides, nerve agents, and nerve gases.

15. In 2001 the Environmental Protection Agency banned most residential uses of organophosphates in part because of their risk to human health.

16. When inhaled, contaminated bleed air can cause serious injury, such as occurred in this case.

17. On July 12, 2013, Ms. Woods, Ms. Oskardottir, Ms. Ramirez, and Ms. Neben (“the flight attendant crew”) were flight attendants working onboard a model 737-890 aircraft, Federal Aviation Administration registration number N538AS, serial number 41188, (“the aircraft” A/K/A “the subject aircraft”) operated by Alaska Airlines, Inc., as Flight 769 (“the flight”) which departed Logan Airport in Boston, Massachusetts, and was destined for San Diego International Airport.

18. The subject aircraft was designed and manufactured by defendant Boeing in 2012.

19. On the flight, Ms. Neben and Ms. Ramirez were working the forward cabin, and Ms. Woods and Ms. Oskardottir were assigned to the aft cabin.

20. The flight deck crew included Captain Joe Blunt and First Officer Christopher Hutton.

21. The flight attendant crew had flown in from San Diego to Boston on the evening of July 11, 2013, and had a layover in Boston until the afternoon of July 12, 2013.

22. On July 12, 2013, the subject aircraft flew from San Diego to Maui, back to San Diego and then on to Boston where it arrived behind schedule in the early evening.

23. When the flight attendant crew boarded Flight 769 on July 12, 2013, they smelled an unpleasant odor in the cabin, described as “burnt oil,” “oily”, “a chemical smell” or “dirty socks.”

24. The smell was even more prominent in the back of the aircraft, starting just aft of the wings.

25. Following take-off, the smell intensified and Ms. Woods started to feel unwell and fatigued. Ms. Neben and Ms. Woods checked the overhead bins but found nothing that would explain the smell.

26. Ms. Neben informed Captain Blunt that oily smelling fumes were coming from the vents and that her throat was burning and that she was not feeling well.

27. Soon after, Ms. Oskardottir told Ms. Ramirez that she did not feel well and Ms. Ramirez helped her strap into a jump seat.

28. Shortly thereafter Ms. Oskardottir fainted or lost consciousness.

29. Ms. Ramirez immediately notified Captain Blunt that a flight attendant had passed out and she was going to put Ms. Oskardottir on oxygen.

30. Ms. Woods and Ms. Ramirez also paged for medical assistance, asking if there was a doctor onboard.

31. Ms. Woods and Ms. Ramirez placed Ms. Oskardottir on the floor of the aircraft on a blanket.

32. Two passengers, an emergency room physician and a nurse, volunteered to help the flight attendants.

33. The doctor communicated with Med Link, a service that provides onboard medical advice to airline crews.

34. Ms. Oskardottir began to vomit.

35. Ms. Woods became nauseated and she went into the bathroom and began to dry heave.

36. Ms. Ramirez helped Ms. Woods into a passenger seat and administered oxygen to her.

37. Ms. Ramirez cleared the last row of passengers, moving them further up the aircraft.

38. Ms. Ramirez also began to feel dizzy and unwell and she informed Captain Blunt of this fact.

39. Ms. Neben began to feel unwell as she was dizzy, lightheaded, her heart felt like it was beating rapidly, and her throat was burning.

40. Ms. Ramirez put Ms. Neben in a seat and on oxygen.

41. Ms. Ramirez informed the Captain that multiple flight attendants were now sick.

42. The Captain decided to divert the plane and land in Chicago.

43. Ms. Oskardottir, when conscious, had impaired speech.

44. Ms. Neben remained unwell and was not fully conscious or alert.

45. Shortly before landing, Ms. Oskardottir paged the doctor again because Ms. Woods had passed out.

46. The physician passenger returned to the galley and assisted Ms. Woods.

47. Upon landing, emergency personnel and firemen entered the plane.

48. The fire department staff told Ms. Ramirez that the fire department's air quality monitor showed bad air quality in the plane.

49. Paramedics removed Ms. Oskardottir, Ms. Neben, and Ms. Woods from the plane and all four flight attendants were taken to the hospital.

50. At Resurrection Medical Center, Ms. Oskardottir had trouble speaking and Ms. Woods complained of headache and dizziness.

51. Resurrection Hospital physicians concluded that the flight attendants' symptoms were consistent with hydrocarbon exposure.

52. The next morning, July 13, 2013, the flight attendants were still sick, disoriented and had trouble thinking or retaining information.

53. The subject aircraft was grounded and did not return to service until July 15, 2013.

54. The ozone converters were removed from the aircraft and they failed performance tests (15-19% efficiency, compared to the necessary >70% efficiency).

55. Plaintiffs experienced short-term and long term health effects from this experience.

56. Due to their exposure to contaminated cabin air, plaintiffs suffered – and continue to suffer from - personal injuries including nausea, pain, a metallic taste in their mouths, gastrointestinal difficulties, extreme fatigue and exhaustion, rashes, excess sweating, balance problems, decreased motor skills, numbness and tingling in their arms, hands and feet, joint and muscle pain, tremors, dizziness, vertigo, shortness of breath, blurred vision, problems sleeping, severe headaches, problematic sleeping patterns, memory loss, trouble concentrating, difficulty

with reading, writing or finding words when speaking, cognitive defects, emotional distress, depression, anxiety and can no longer live the normal life heretofore enjoyed.

57. As a result of this event, Plaintiffs have suffered loss of wages and wage earning capacity in the past and in the future, as well as an inability to work.

58. Two of the four plaintiffs were unable to continue working as flight attendants.

59. Because of her injuries, Plaintiff Vanessa Woods lives permanently with her mother.

## BACKGROUND FACTS

60. For at least sixty years, Boeing, and its predecessors, knew (or should have known) that bleed air can become contaminated with engine oil toxins, presenting a serious danger to the health and welfare of crew members and passengers.

61. Boeing was put on notice more than **40 times** that its aircraft was unreasonably dangerous but failed to rectify the flawed design, failed to provide adequate sensors, warnings or alarms, failed to install, design or retrofit its aircraft with adequate filters or sensors and failed to provide adequate warnings or training about the dangers. For example:

62. ***Red Flag or Safety Signal # 1:*** **February 1953**: As early as 1953, Boeing was aware of an air contamination problem on its aircraft if heated engine oil entered the air conditioning system.

63. Indeed, Boeing employees "repeatedly reported presence of smoke and odor in the occupied compartments of the airplane" and Boeing admitted that "the possible toxic effect of the contamination is still unknown." See **Exhibit 1**, by Boeing Airplane Company, entitled "Decontamination Program."

64. Boeing's testing confirmed a "definite association" between contaminants and engine oil and the defendants acknowledged that they needed a decontamination or filter unit that could "purify engine bleed air to the point where it is suitable for cabin air conditioning."

65. From its initial study of the oil used and its oxidation, Boeing concluded that the contaminants included particulate matter, aerosols of unchanged oil, aerosols of the decomposition products of the oil, aerosols of oxidation products of the oil, condensable vapors and non-condensable vapors, including carbon monoxide.

66. Boeing created simulators with air sampling and test equipment to reproduce, test and study the possible contaminants ("Engine Test Program" or "Engine Test Simulator").

67. These simulators were used to replicate oil fume events and test decontamination devices.

68. Boeing found that increasing the temperature (for instance to 640°F) rapidly increased carbonyl production.

69. Boeing demonstrated a critical relationship between temperature and oil breakdown; the hotter the oil the more contaminants and by-products produced.

70. Alarmingly, to this day, Boeing has never met its 1953 objective to fully identify the contaminants present in cabin air after a fume event and Boeing still cannot list or categorize or define the actual chemical composition of aviation jet engine oil, including its base stock, or all of the particulates present in contaminated cabin air.

71. Boeing wholly failed to do adequate testing to understand, appreciate, warn about, and counteract the hazardous effects of fume events.

72. ***Red Flag or Safety Signal # 2:*** February to **December 1953**: Boeing began an oil filter development program in 1953 with a goal to protect cabin air from engine oil contamination. *See* **Exhibit 1.**

73. Boeing noted that "the possible toxic effect of the contamination is still unknown" and "in most instances, the worst contamination was noted immediately after the air conditioning system was turned 'on.'"

74. Boeing proposed designing a "decontamination unit which will purify engine bleed air to the point where it is suitable for cabin air conditioning."

75. But Boeing's goals were never implemented and, despite being aware of the need for a filter decades ago, Boeing has never designed, created, implemented, or added a filter to the air circulation system of the aircrafts that can safely and effectively protect crew members and passengers from contaminated air.

76. ***Red Flag or Safety Signal # 3:*** **January 1954**: McDonnell Douglas, Inc., which was acquired by Boeing in 1997, was aware of the problem of bleed air contamination since 1954. See **Exhibit 2**, entitled "*Engine Compressor Bleed Air Contamination Study, XC-132 Project*."

77. In April of 1953, Dr. George Kitzes from the United States Aero Medical Laboratory visited McDonnell Douglas and provided a verbal summary of the testing underway to determine the physical, chemical and physiological properties of cabin air contamination. Dr. Kitzes was Chief of the Biochemistry Section of the Physiology Branch of the Wright-Patterson Air Force Base in Ohio.

78. Aero Medical Laboratory testing confirmed that aviation jet engine oil could become atomized and decomposed at high temperatures, breaking down into aldehydes, acrylic esters and carbon monoxide, peroxides, formaldehyde, carbonyl and numerous contaminants.

79. The testing showed that only a small quantity of oil, as low as three parts per billion, was sufficient to cause intense eye irritation and nausea in a matter of a few minutes.

80. Air cabin contamination did not appear to affect everyone to the same degree, indeed some people appeared to be physiologically more susceptible to even trace amounts of contaminants.

82. ***Red Flag or Safety Signal # 4:*** **February 1955**: In early 1955, Dr. George Kitzes published an article "*Cabin Air Contamination Problems in Jet Aircraft*" confirming that the aircraft industry was aware of cabin air contamination problems "in newly developed high speed aircraft." **See Exhibit 3**, attached. On March 22, 1955, Dr. Kitzes also presented these findings at the 26th annual meeting of the Aero Medical Association in Washington, D.C.

83. Dr. Kitzes highlighted pilot complaints of obnoxious odors, eye and nasal irritations, dizziness, nausea, headache, and respiratory distress associated with the presence of smoke or odors in the cabin during flight operations.

84. Dr. Kitzes described how engine oil, which can leak through the bearing seal when heated, becomes pyrolized and creates toxic chemical substances, including aldehydes, keto-acids, peroxides, and carbon monoxide.

85. Dr. Kitzes' testing concluded that decomposition products from the engine oil were toxic to laboratory animals. Indeed, animal studies showed fatalities when rabbits and rats inhaled heated oil.

86. Dr. Kitzes described how the toxicity of the oil was directly related to the temperature to which it was heated, with the oil becoming more toxic at higher temperatures.

87. As Dr. Kitzes noted, "[s]moke, fumes and physiologically active chemical materials cannot be tolerated in the cabin air of high speed aircraft and may constitute a flight hazard."

88. ***Red Flag or Safety Signal # 5:*** **April 1955**: The 1955 results of Aero Medical Laboratory's testing, under the direction of Dr. George Kitzes, should have raised serious concerns for Boeing. See **Exhibit 4,** *The Toxicity of Certain Lubricants, Engine Oil and Certain of Their Constituents, With Particular Reference to the Products of Their Thermal Decomposition*, Treon, Joseph F., Cleveland, Frank P., and Cappel, John. The testing assessed the toxicity of aviation jet engine lubricating oil and its breakdown products when given orally to animals, applied to their skin or administered through breathing a heated fog of engine oil.

89. These researchers found that when these substances were ingested or applied to the skin of rabbits, rats, guinea pigs, and cats they were practically nontoxic. But when the aviation jet engine oil was heated and inhaled by the animals, the toxicity increased considerably along with the fatality rates of the test animals.

90. Inhaled toxic effects included degeneration of the brain, liver, and kidneys of these animals as well as pulmonary irritation, pneumonitis, respiratory distress, and weakness.

91. In one test, upon exposure to aviation jet engine lubricating oil heated to 700°F, one of three (3) cats died, nineteen (19) of thirty-two (32) rabbits died, and nineteen (19) of forty-two (42) rats died.

92. The affected animals suffered degeneration of the brain, liver, kidneys, heart and adrenal glands, and focal pneumonia, pulmonary irritation, acute bronchitis, pulmonary edema, and hyper anemia.

93. Despite this clear safety signal, Boeing never did adequate studies to determine, quantify, or warn about the health dangers of breathing contaminated cabin air.

94. ***Red Flag or Safety Signal # 6:*** **October 1955**: In the fall of 1955 Henry Reddall, an employee of North American Aviation, Inc. (which became part of Boeing in 1996), presented at the Society of Automotive Engineers Golden Anniversary Aeronautic Meeting in Los Angeles, California on the problem of engine bleed air contamination. See **Exhibit 5**, *Elimination of Engine Bleed Air Contamination*, by Henry A. Reddall.

95. Mr. Reddall explained that on a modern turbojet aircraft the compressor bleed air used for air conditioning was "increasingly subject to unacceptable contamination."

96. Mr. Reddall described symptoms of eye watering, nausea and loss of sense of direction.

97. Mr. Reddall also highlighted engineering efforts underway to eliminate such contamination, including filtration and a non-bleed system and confirmed that "one of the methods tested eliminates the fumes entirely."

98. Mr. Reddall explained that, during the compression process the engine oil and air are heated to temperatures on the order of 700°F to 800°F. This high level of heat can cause decomposition of the oil and discharge of contaminants into the air conditioning system.

99. Mr. Reddall acknowledged that the compressor bearing seals are the main source of oil leakage.

100. Even as of today, Boeing has wholly failed to design, manufacture, or implement engine seals that would adequately reduce or eliminate the described oil leakage.

101. Reddall also noted that on a multi-engine aircraft, since the engine bleed air can be selected from one or more engines, if a large oil leak occurred in one engine, this engine could be shut down and the bleed air for cabin ventilation selected from another engine, without aborting the "airplane mission."

102. Obviously a monitor, alarm or sensor was needed to detect which engine was producing contaminated air so counter-measures could be implemented.

103. Boeing has failed to design, manufacture, or implement any such warning devices.

104 The optimum solution to the bleed air contamination problem according to Mr. Reddall was designing aircraft with a separate compressor which would pump fresh air into the aircraft instead of relying upon bleed air coming off the engines.

105. Even by 1955, there were several different turbocompressor designs available with a turbocompressor for a bomber weighing only ninety (90) lbs. and occupying two and one half (2 ½) feet of space.

106. Despite this knowledge, and the availability of safer options decades ago, Boeing only eliminated the bleed air supply system from one of its commercial aircraft: the Dreamliner, launched in 2004.

107. Mr. Reddall concluded that every effort should be made to minimize or eliminate leakage of engine oil into the compressor air. He posited that catalytic filters could stop engine oil contamination of the cabin and cockpit air.

108. Boeing has never designed, installed, or implemented adequate filters to protect crew and passengers from contaminated air.

109. ***Red Flag or Safety Signal # 7:*** **March 1967:** The Medical Research Division of Esso Research and Engineering Company tested synthetic lubricants to evaluate the toxic hazards associated with the inhalation of air contaminated with heated synthetic engine oils. See **Exhibit 6**, attached.

110. In this study, rabbits, rats, and guinea pigs were exposed to heated synthetic engine oils. In one animal chamber, the animals were exposed for two hours to oil heated to 500°F.

111. At concentrations of 0.54 mg/l, half of the rabbits died, at concentrations of 1.10 mg/l all of the rabbits died.

112. The researchers found that rabbits exposed to high dosage levels also manifested a paralysis of the hind quarters.

113. In general the animals responded to the stress of exposure by labored gasping during exposure.

114. Autopsies of the dead animals revealed gross changes suggesting severe irritation of the respiratory tract.

115. The researchers concluded that products thermally derived from the synthetic engine oils at 500°F were less toxic than those derived at 700°F.

116. ***Red Flag or Safety Signal # 8:*** **1969**: In 1969, a McDonnell Douglas employee submitted a $35,000 budget request (see **Exhibit 7**, attached), with these stated objectives:

> Obtain data on toxicity and nuisance level in cabin in event of engine oil leak
>
> - Maximum oil leak rate
> - How much gets into bleed air

- Toxicity as a function of bleed temperature
- Detection and removal methods

117. The goal was to lead the industry in establishing standards for air systems. But, decades later, Boeing still does not have detection and removal methods in place to protect flight crew and passengers.

118. ***Red Flag or Safety Signal # 9:*** **August 1969**: Later that year, McDonnell Douglas conducted bleed air contamination studies at its engine test facility.

119. As part of this testing, McDonnell Douglas recognized it would be advantageous to use a continuous contaminant analyzer to indicate the buildup rates of bleed air contamination because "[t]his data when compared to engine shutdown procedures (i.e. the amount of oil leakage) would indicate the time and contaminant levels to which the flight crew and passengers would be subjected." See **Exhibit 8**, attached.

120. To this day, Boeing does not have monitors or analyzers in its planes to accurately record the amount or type of contamination present in cabin air.

121. ***Red Flag or Safety Signal # 10:*** **February 1973**: Dr. J. G. Gaume, from the Aviation Medical and Safety Research division of Douglas Aircraft Company (later known as McDonnell Douglas and merged with Boeing in 1997), authored a paper in 1973 entitled "*Analytical Considerations Concerned with Cephalagia on the DC-10*" about the physical problems associated with cabin air contamination. See **Exhibit 9**, attached.

122. Dr. Gaume noted that airline flight attendants complained of "disagreeable, sour, irritating, acrid, and pungent" odors in the cabins and lower galleys and temporally related symptoms of headaches as well as irritation of the eyes, nose and throat.

123. Dr. Gaume concluded that the probable source of the headaches was contaminants derived from engine bleed air source for cabin pressurization.

124. Dr. Gaume asserted that analysis was needed on the physiological effects and toxicity of the contaminants and the work load of the flight attendants.

125. Dr. Gaume posited that the physical workload of the flight attendants, imposed in the presence of such contaminants, could explain why there are more reported health complaints in flight attendants than among passengers.

126. Dr. Gaume also recommended that the industry sample the cabin air and analyze it for contaminants to identify and quantify the chemicals present in the air.

127. Dr. Gaume concluded that, since the odors and headaches sometimes began shortly after engine start, the seals may be leaking even when the aircraft engines are not running.

128. Boeing never appropriately acted on these suggestions and, to this day, has not designed, implemented, or incorporated any cabin air quality sensors in its aircraft.

129. ***Red Flag or Safety Signal # 11:*** **1983**: Dr. Russell Rayman, Commander of the Hospital at England Air Force Base in Florida, reviewed eighty-nine (89) incidents of smoke/fumes in the cockpit during United States Air Force flights occurring from 1970-1980. *Smoke/Fumes in the Cockpit*, Rayman & McNaughton, Aviat Space Environ Med, 1983 Aug. 54(8):738-40. *See* **Exhibit 10**.

130. The flight crews experienced dizziness, lightheadedness, irritated eyes, nausea/vomiting, confusion, headache, visual problems, paresthesia, chest pain, respiratory distress, loss of consciousness, and cough.

131. The presence of engine oil fumes was identified in many of the smoke/fume incidents supporting Dr. Rayman's conclusion that "Smoke/fumes in the cockpit is not a rare event and is a clear threat to flying safety because of acute toxic effects."

132. ***Red Flag or Safety Signal # 12:*** **1990**: In 1990, the International Program on Chemical Safety, a division of the World Health Organization, published a review of Tricresyl Phosphate. *See* **Exhibit 11**.

133. This international group of experts concluded that mixtures containing tri-ortho-cresyl phosphate (ToCP, one of the TCP isomers) are "major hazards to human health" and "there is no safe level for ingestion."

134. The group warned that exposure to ToCP through dermal contact or inhalation should be minimized.

135. ***Red Flag or Safety Signal # 13:*** **1997**: Since at least 1997, the Civil Aviation Authority (CAA) in the United Kingdom began receiving reports of bleed air contamination on Boeing planes. *See* **Exhibit 12.**

136. The CAA investigated such reports and advised Boeing of these complaints.

137. Pilots complained of strong pungent oily smells on the flight deck during departure and cruise.

138. In at least one instance the smell was described as "burning rotten socks."

139. The flight crew experienced nausea, incapacitation, headaches, dizziness, inability to concentrate, light headedness, feeling shaky, sore eyes, and throats.

140. Various root causes for these symptoms were identified, including small quantities of engine oil entering the compressor system, oil fumes coming in through the

Auxiliary Power Unit with a slight coating of oil found at various points in the APU, and air cycle machine failures.

141. In one incident, described as a "Serious Incident," an oily metallic smell was reported. Then the flight crew missed numerous calls from Air Traffic Control (ATC), prompting ATC to ask if everything was all right. The pilot then forgot to slow the aircraft during approach until reminded to do so. The crew was unaware they were partially incapacitated.

142. ***Red Flag or Safety Signal # 14:*** **1998:** In response to increased passenger concern about the spread of contagious diseases through re-circulated air in cabins, Boeing started offering an optional retrofit for its existing planes of HEPA filters.

143. Even though Boeing recognized that additional filters could also be installed in the bleed airstream to protect crew and passengers from air contaminated with oil fumes, Boeing never offered such a retrofit, or re-designed its planes, to include such filters to protect against oil contaminants or fume events.

144. ***Red Flag or Safety Signal # 15:*** **1998:** In 1998, Professor van Netten, a Professor at the University of British Columbia, in the Department of Health and Epidemiology, published a paper describing poor air quality and health complaints from flight crews, with some requiring admission to emergency departments. *See* **Exhibit 13**, *Air Quality and Health Effects Associated with the Operation of Bae146-200 Aircraft*, van Netten, Appl Occup Environ Hyg, Vol. 13, Issue 10 (1998).

145. The health complaints were consistent with exposure to carbon monoxide, respiratory irritants, and possible neurological agents.

146. According Dr. van Netten, excessive oil leakage from oil seals allowed smoke and lubricating oil components to enter the cabin.

147. Professor van Netten recommended equipping aircraft with further detectors.

148. ***Red Flag or Safety Signal # 16:*** **2000:** In 2000, Boeing advised at least one airline that it was developing a sensor to detect various air quality issues in the cabin. *See* **Exhibit 14.**

149. On August 16, 2000, Boeing wrote to Monarch Airlines:

> "Boeing is currently working with several suppliers to develop an on-board system that would be able to detect various air quality parameters and for the system to also be able to react to these condition [sic] to remedy the condition. At this time the concepts and feasibility of such a system are being explored. We will continue to monitor this effort and will advise MON accordingly.
>
> We will continue to investigate development of a simple checklist to troubleshoot smoke/smell conditions during flight."

150. To date, Boeing has yet to include cabin air quality sensors in its aircraft.

151. ***Red Flag or Safety Signal # 17:*** **2000**: In 2000, Congress tasked the National Research Council ("NRC") with identifying contaminants in the aircraft air and developing recommendations for means of reducing such contaminants.

152. In its resulting report, issued in 2002, the NRC recognized that problems arise when engine lubricating oils enter the cabin through the air-supply system through bleed air. *See* **Exhibit 15**, *The Airliner Cabin Environment and the Health of Passengers and Crew*, Nat'l Research Council (2002).

153. The report acknowledged that many cabin crew members and passengers had reported incidents of smoke or odors in the cabin, see below.

154. ***Red Flag or Safety Signal # 18:*** **February 2001**: In early 2001, representatives from the aviation industry gathered in Phoenix, Arizona to develop a strategic plan to deal with cabin air quality. The meeting included representatives from

Boeing, Rolls-Royce, Hamilton-Sunstrand, Honeywell, BAE Systems, United Technologies, Pratt & Whitney, and GE Aircraft Engines. See **Exhibit 16.**

155. Elements of the plan considered by the air quality meeting participants included:

- "A response for the airlines
- A response for the flight crews
- A response for the cabin crews
- A response for the passengers
- A response for legislators"

156. The industry representatives recognized a need to develop a common and consistent collection system for toxic cabin air incident complaints especially since there was an increase in the number of cabin and flight crews reporting such events.

157. Importantly, the representatives acknowledged a lack of definitive information on "[w]hat chemical changes occur" with engine oil in a fume event?, "How much oil is lost during normal flight?" and "What are the various pathways by which oil leaves the engine?"

158. One question raised was: "How proactive should we be as manufacturers?"

159. The representatives were concerned about "Confronting litigation from opposition, for example anti-tobacco industry."

160. Industry representatives asked themselves "What would you like to do to address Air Quality concern?", "What do you think WE, as a group, should do?" and "Should we form an alliance?"

161. One of the solutions considered was "[s]ensors for low level leakage-Predictive and Diagnostic" as well as a "[p]rocedure to identify location of smoke in minutes."

162. Participants also discussed whether it was best to "[p]revent leak or deal with it, or both?"

163. To date, none of these issues have been adequately answered or addressed by Boeing.

164. ***Red Flag or Safety Signal # 19:*** **2001**: In 2001, Boeing sent a Request for Information to a number of its suppliers in order to develop an air purification system and air quality monitor for aircraft. *See* **Exhibit 17.**

165. Boeing acknowledged that events of irritable odors and complaints of compromised health due to air quality had been reported, often with no fault found and no means to measure air quality during such an event.

166. Boeing, seeking information about air quality monitors or sensors, stated:

> "Air quality monitor should be capable of signaling crew and /or provide air purification system activation and potential ventilation control. Notification should occur within 1 minute of identifying compromised air quality conditions. Duct mounted systems that are integral with the air purification system or offer opportunities for early detection of smoke or fume events are of particular interest for source isolation or mitigation."

167. Even though Boeing recognized in 2001 that signals or alarms were important for flight crew and passenger safety, Boeing never installed such alarms or provided flight crews with any ability to isolate the location of contaminated cabin air so counter-measures could be implemented.

168. ***Red Flag or Safety Signal # 20:*** **2001:** In 2001, Sweden's Board of Accident Investigations published a report describing an incident aboard a flight where both pilots were affected by contaminated bleed air, see below

169. The captain of that aircraft, Neils Gomer, described the incident to reporter Charles Starmer-Smith, "I felt confused and five seconds later I, too, was close to vomiting. I just managed to put on my mask, after which I could hardly move. We were sitting there flying at 600 miles an hour, late at night, both of us more or less incapacitated. I could not even raise my hand; I could not talk; it was like I was paralyzed." *See* **Exhibit 18**. *"Is cabin air making us sick?" February 21, 2008.*

170. Mr. Gomer went on to describe that "many of the 73 passengers on the flight were so deeply asleep that it was difficult to wake them up" — a fact confirmed by the accident investigator, who noted that passengers were in a "zombie-like condition."

171. Captain Gomer managed to land the plane, but said later that if he had delayed going on to oxygen even by seconds, the aircraft may have crashed.

172. The Swedish Board of Accident Investigation identified an oil leak in one of the engines as well as oil residue on different carbon seals. *See* **Exhibit 19**.

173. The accident board concluded that "The risk that crews can, without warning, be subjected to poisonous cabin air that can substantially reduce their capabilities, or that can temporarily disable an individual crewmember, constitutes a serious threat to flight safety."

174. ***Red Flag or Safety Signal # 21:*** **February 2002**: As noted above, in 2002, the Federal Aviation Administration (FAA) issued a report to the Administrator

about the National Research Council (NRC) review of air contamination issues. *See* **Exhibit 15**, "*The Airliner Cabin Environment and the Health of Passengers and Crew*."

175. The FAA explained that the Department of Defense (DOD) had invested heavily over the past decade in new sensor technology and preliminary inquiries to the scientific community suggested that adaptation of those sensors for cabin environment monitoring was possible and feasible.

176. The FAA discussed the need for sensors on commercial aircraft so flight crew could be quickly made aware of an "air contaminant" event and identify its source.

177. But the FAA acknowledged that the aircraft industry was "naturally resistant to making significant new investments in cabin air monitoring equipment."

178. The FAA noted that "viewed as a whole, NRC's report should be seen as evidence that passengers and crewmembers on commercial aircraft have a continuing concern about a variety of health and comfort problems that they ascribe to poor air quality in airliner cabins. Such concerns are not a new phenomenon."

179. At that time, both the NRC and FAA acknowledged a lack of sufficient data to assess objectively passenger and crewmembers' complaints, design effective interventions, or determine whether rulemaking or guidance would be the most effective tactic for making changes.

180. In 1999, the FAA reviewed its event database between January 1978 and December 1999 involving "air quality" in the aviation Accidents and Incident Data Systems (AIDS).

181. Of 240 events identified in the search, about 60 were "airplane ventilation toxic contaminant events."

182. Of the 60 events, 24 times crewmembers reported their performance was impacted.

183. There were also a number of reports of foreign airline crew members having their performance impaired to the point that they had to be assisted in performing their flight duties or had to relinquish their flying duties during the flight.

184. The National Research Council (NRC)'s study concluded that "Under certain failure conditions, toxicants such as pyrolized engine oils and hydraulic fluids may leak into the aircraft cabin and flight deck air supply systems, and that these toxicants may be associated with health effects."

185. The NRC also highlighted the need to define the toxicity of these airborne contaminants and concluded it was a high priority to investigate the relationship between exposure and reported ill health.

186. The agency noted, "This is a matter of great concern to FAA."

187. ***Red Flag or Safety Signal #22*: <u>2002</u>:** In 2002, researcher Dr. Leonie Coxon performed neuropsychological assessments on two pilots and six flight attendants who reported symptoms after exposure to air contaminated by jet engine oil in commercial aircraft. *See* **Exhibit 20**, *Neuropsychological Assessment of a Group of Bae146 Aircraft Crew Members Exposed to Jet Engine Oil Emissions*, Coxon, L., J. Occup Health Safety- Austr NZ. Vol. 18(4):313-319 (2002).

188. The neuropsychological testing revealed significant impairments of reaction time, information processing speed, and fine motor skills.

189. Dr. Coxon described symptoms reported by airline pilots, cabin crew and passengers exposed to engine oil emissions as breathing difficulties, chest pain, nausea,

fatigue, chronic headache, dizziness, light-headedness, confusion, concentration problems, and memory difficulties.

190. Dr. Coxon explained that oil can escape through faulty engine seals into the compressor bleed air.

191. The engine oil contains tri-cresyl phosphates including tri-ortho-cresyl phosphate (ToCP) as well as other ortho-cresyl phosphates at even higher concentrations and which are known to be more neurotoxic than ToCP.

192. Dr, Coxon noted that the remaining and dominant TCPs are also toxic.

193. Dr. Coxon recommended a wider study so that the data gathered could initiate better working conditions for aviation industry employees.

194. ***Red Flag or Safety Signal # 23*: <u>2003:</u>** The aviation jet engine oil used at the relevant times by Alaska Airlines is Mobil Jet Oil II, supplied by Exxon Mobil.

195. The Material Safety Data Sheet (MSDS) for Mobil Jet Oil II confirms that this product contains synthetic hydrocarbons and additives and "is considered hazardous." *See* **Exhibit 21**, 2003 Mobile Jet Oil II MSDS.

196. The MSDS states that prolonged or repeated breathing of this oil mist can "cause nervous system effects" and may produce "nervous system disorders including gastrointestinal disturbances, numbness, muscular cramps, weakness and paralysis."

197. The Plaintiff flight attendants were never adequately warned of this danger.

198. ***Red Flag or Safety Signal # 24*: <u>February 2003</u>:** In 2003 researchers in the Toxicology detachment at Wright Patterson Air Force Base wrote a paper describing the *Known Harmful Effects of Constituents of Jet Oil Cabin Smoke*, Bobb, Andrew J., Still, Kenneth R. *See* **Exhibit 22**.

199. In this paper, the authors described how the construction of cabin pressurization systems of certain commercial aircraft allow pyrolyzed jet oil to leak into the cabin air.

200. Toxic constituents of this smoke from the oil were identified as including tricresyl phosphate, and carbon monoxide.

201. The researchers posited that neurological effects alleged by airline workers could be due to tricresyl phosphate and/or carbon monoxide exposure from the heated jet engine oil.

202. ***Red Flag or Safety Signal # 25:*** **August 2003**: Dr. Abou-Donia, a professor at Duke University, described the long-term, persistent neurodegenerative health problems caused by exposure to organophosphorus compounds in 2003. *See* **Exhibit 23**.

203. Dr. Abou-Donia defined this effect as "organophosphorus ester-induced chronic neurotoxicity, or OPICN."

204. Dr. Abou-Donia noted that "OPICN induced by low-level inhalation of organophosphates present in jet engine lubricating oils and the hydraulic fluids of aircraft could explain the long-term neurologic deficits consistently reported by crewmembers and passengers."

205. ***Red Flag or Safety Signal # 26:*** **September 2003**: On September 3, 2003, Honeywell responded to Boeing's Request for Information regarding sensors with an Air Quality Engineering Coordination Memo. *See* **Exhibit 24**.

206. Honeywell proposed a "Bleed Air Monitor" or "BAM," a highly sensitive apparatus capable of detecting and monitoring real-time levels of synthetic lubricants and other hydrocarbons in the aircraft air.

207. Honeywell stated that oil fumes are one source of hydrocarbons in the aircraft air and recognized that:

> "Smoke- and odor in cabin complaints can be difficult and costly to repair. If the airline or operator can pinpoint the source of contamination quickly and efficiently and the air handling system can act appropriately, the odor- or smoke in cabin events could be avoided. This will not only reduce the cost of potential repairs and system cleaning but also avoid health complaints and associated compensation claims filed by flight attendants and crew members."

208. Honeywell's proposed BAM would provide signals to the environmental control system in the case of a fume event to redirect air flow so that uncontaminated air would be provided to the cabin.

209. Honeywell confirmed that the BAM had been tested and validated in in-flight tests on a number of Boeing commercial airlines.

210. Honeywell also described other existing sensors and technologies that could be integrated into a packaged system for monitoring and controlling cabin air quality to meet Boeing's needs.

211. ***Red Flag or Safety Signal # 27:*** **2004**: In 2004, Boeing launched the Boeing 787 Dreamliner, a commercial aircraft that does not use a bleed air system.

212. The Dreamliner air system eliminates the risk of engine oil decomposition products being introduced in the cabin air supply.

213. One of the reasons Boeing developed the bleed free air supply system on the Dreamliner was to eliminate "engine contaminants potentially entering cabin air supply- Improved Air Quality." *See* **Exhibit 25**.

214. ***Red Flag or Safety Signal # 28:*** **June 2004**: On June 9, 2004, an air safety Airworthiness Directive applicable to the British Aerospace BAE-146 Aircraft was published in the Federal Register. *See* **Exhibit 26**.

215. This directive required inspections of the inside of specific air conditioning ducts to identify oil contamination and then recommended corrective action to "prevent impairment of the operational skills and abilities of the flight crew caused by the inhalation of agents released from oil or oil breakdown products, which could result in reduced controllability of the airplane…"

216. ***Red Flag or Safety Signal # 29:*** **August 2004**: In the fall of 2004, General Electric (GE) proposed a sensor system to Boeing for cabin air quality monitoring.

217. Boeing has never adopted or implemented such a sensor system.

218. ***Red Flag or Safety Signal # 30:*** **August 2004**: On August 12, 2004, a Boeing employee in the Cabin Environment Comfort and Air Quality department wrote that "…the cabin environment group (where I work) is interested in teaming with General Electric research staff to develop a MEMS sensor package to sense a variety of contaminants onboard the aircraft, circulating in the cabin air and/or associated ducting." *See* **Exhibit 27**.

219. Boeing executive Timothy Arnaud noted that the Air Quality department intended to request funding for the project "soon."

220. That same day, Mr. Arnaud told GE, "Yes I agree we have made significant progress in getting our arms around a sensor concept. Our next step is submitting it back through the funding process." *See* **Exhibit 28**.

221. But Boeing never funded or implemented such a filter to protect passengers and flight crew.

222. ***Red Flag or Safety Signal # 31:*** **April 2005**: On April 20 and 21 of 2005, there was an International Aero Industry Conference regarding Contaminated Air Protection, Air Safety & Cabin Air Quality at Imperial College in London, England.

223. At the end of the conference, Jim McAuslan, Secretary for British Airline Pilots Association (BALPA) read the following closing statement:

> "We wish to bring to the urgent attention of Government, Aviation Regulators and the Airline and Aerospace industry the following conclusions, distilled from the conference: There is a workplace problem resulting in chronic and acute illness amongst flight crew (both pilots and cabin crew). The workplace in which those illnesses are being induced is the aircraft cabin environment. This, we conclude, is resulting in significant flight safety issues, in addition to unacceptable flight crew personnel health implications. Further, we are concerned the passengers may also be suffering from similar symptoms to those exhibited by flight crew. We urgently call upon Government, Industry and Regulators to work in partnership with cabin environment medical and analyst specialists and representatives from flight crew unions to analyse, quantify and remedy the cabin air quality problems that we have identified exist." *See* **Exhibit 29.**

224. ***Red Flag or Safety Signal # 32:*** **2006**: Dr. Sarah Mackenzie Ross, a clinical neuropsychologist at University College London, published an article in 2006 chronicling the short and long term health effects of breathing heated jet engine oil. *See* **Exhibit 30**, *Ill Health Following Exposure to Contaminated Aircraft Air: Psychosomatic Disorder or Neurological Injury?*, MacKenzie Ross, J Occup Health Safety- Aust NZ, 22(6): 521-528 (2006).

225. Dr. MacKenzie Ross' paper included a case study of a commercial aircraft pilot who smelled oily fumes during a flight and then suffered a marked deterioration in cognitive function.

226. The fume event caused short term symptoms of light headedness, stinging eyes and sore throat, in both the pilot and co-pilot.

227. The pilots filed an air safety report on landing.

228. Although the pilot resumed flying within a few days, he later developed insomnia, fatigue, coordination problems, joint weakness, excessive sweating, poor memory, and concentration.

229. Neurological examination of the pilot found evidence of nervous system dysfunction consistent with exposure to organophosphate compounds.

230. Serum auto antibody testing of the pilot showed increased auto antibodies against nervous system proteins, suggestive of neuronal injury as a result of chemical injury.

231. Neuropsychological assessment of the pilot demonstrated problems with information-processing speed, auditory working memory span, verbal learning, and mental flexibility.

232. It was concluded that exposure to engine oil fumes was the most likely factor involved in the etiology of the pilot's cognitive impairment.

233. Dr. Mackenzie-Ross identified an urgent need to increase awareness of ill health following contaminated air events.

234. Despite this call to action, Boeing did nothing to increase such awareness, warn flight crew or passengers or otherwise address this significant safety problem.

235. ***Red Flag or Safety Signal # 33:*** **August 2007**: On August 9, 2007, Boeing revised its internal Material Data Safety Sheet for synthetic aviation jet engine lubricating oil. *See* **Exhibit 31**.

236. In terms of acute effects, Boeing warned that, if inhaled, the oil is a respiratory irritant, "particularly if vapors are from heated or burning liquid."

237. Boeing also admitted that exposure to the oil "[m]ay cause delayed neurotoxic reaction."

238. Signs and symptoms of exposure were described by Boeing as "dizziness, headache, confusion and 'intoxication.'"

239. If exposed to inhalants, Boeing's First Aid Measure required "Immediately move subject to fresh air."

240. Boeing warned that "[p]rolonged or repeated exposures may cause absorption of tricresyl phosphate through the skin. Tricresyl phosphate has been reported to cause delayed neurotoxicity."

241. Boeing described the target organ of the engine oil as the "[c]entral nervous system."

242. ***Red Flag or Safety Signal # 34:*** **October 2007**: George Bates, an engineer employed in the Boeing Environmental Control department, wrote an internal email on October 26, 2007, describing the problem of bleed air contamination in the aircraft cabin. *See* **Exhibit 32**.

243. Boeing's engineer complained that the propulsion folks did not "account …for the bleed air quality they feed us…Pratt & Whitney has some guarantees in their spec but GE and Rolls Royce engine specs do not mention bleed air quality when it comes to CO/CO2 or Hydrocarbon by-products…"

244. Mr. Bates described reports of oil by-products in the bleed ducts which caused flight diversions due to haze in the cabin.

245. Mr. Bates perceptively acknowledged, "Who knows what the by-products are in hot synthetic Turbine Oil" but noted that the Material Data Sheet warned "about skin contact and breathing the fumes of the oil."

246. Mr. Bates sought answers to his concerns, but he was also realistic. Mr. Bates knew it would take something catastrophic to get the attention of management, as best shown by his concluding statement: "Bottom line is I think we are looking for a tombstone before anyone with any horsepower is going to take interest."

247. Mr. Bates was correct: it is apparently going to take deaths for Defendants' management to correct this serious health problem. To date, Boeing has taken no steps to rectify this unreasonable dangerous design flaw in its aircraft or to provide adequate instructions, warnings, sensors, alarms or detection devices.

248. ***Red Flag or Safety Signal # 35*: <u>May 2008</u>:** In 2008, two researchers published a paper describing the frequency of air contamination problems on the US aircraft fleet. *See* **Exhibit 33,** *An Attempt to Characterize the Frequency, Health Impact, and Operational costs of Oil in the Cabin and Flight Deck Supply Air on US Commercial Aircraft*, Murawski, J., Supplee, D., J. of ASTM International, Vol. 5(5), Paper ID JA101640 (2008).

249. The researchers, an industrial hygienist with the Association of Flight Attendants as well as a mechanic and the Director of Flight Safety for the International Association of Machinists, found four hundred and seventy (470) reports of air supply contamination over an eighteen (18) month period and concluded that this represents almost one contaminated air event occurring per day in the United States alone.

250. These researchers further noted that fume events are underreported.

251. Monitors or sensors in the cabin would be needed for an accurate count of fume events.

252. Boeing has never added, retrofitted or included such detectors in its aircraft even though such devices were (and are) available and technologically feasible.

253. ***Red Flag or Safety Signal # 36:*** **August 2008**: In August 2008, the Federal Aviation Administration helped fund a document entitled "*Exposure to Aircraft Bleed Air Contaminants Among Airline Workers*." *See* **Exhibit 34**.

254. The FAA document was designed to assist medical personnel treating crew and passengers who have inhaled oil fumes onboard aircraft.

255. The report authors thus document symptoms and health issues related to contaminated bleed air inhalation including: shortness of breath, chest tightness, eye, nose or throat irritation, headache, dizziness, lightheadedness, memory impairment, concentration difficulty, visual changes, tremor, gait problems, paresthesia (tingling sensation), balance problems, slowed mental processing, difficulty-multi-tasking, nausea, vomiting, fatigue, muscle weakness, palpitations, diarrhea, anxiety, sleep disturbance, depression, PTSD, and rash.

256. ***Red Flag or Safety Signal # 37:*** **December 2010**: At the end of 2010, a group of researchers published an article about the potential for occupational exposure to organophosphates (OPs) from turbine and hydraulic oils among flying personnel in the aviation industry. *See* **Exhibit 35**, *Organophosphates in aircraft cabin and cockpit air—method development and measurements of contaminants*, Solbu *et al*, J. of Environmental Monitoring, Vol. 13: 1393 (2011).

257. The researchers' long-term sampling revealed organophosphates in the cabin air of the investigated aircrafts and that there was "potential for substantially higher TCP contamination in cabin air" if there was a fume event or leakage of turbine oil into the cabin air.

258. The researchers recommended further assessment of OP contamination in relation to fume events, including the thermal degradation products.

259. **Red Flag or Safety Signal # 38: <u>2010</u>:** Pall Corporation, a company that manufactures filters, certified a filter for the cockpit of the Boeing 757 in 2010.

260. The Pall filter uses carbon to remove oil droplets and volatile organic compounds from contaminated air.

261. In 2012, Pall Corporation reported that a European cargo air carrier had retrofitted its Boeing 757s with Pall's filter, leading to a marked reduction in pilot complaints about smoke/fume events.

262. ***Red Flag or Safety Signal # 39:*** **<u>December 2012 to February 2013</u>:** In December of 2012, pilot Richard Westgate, aged 43, died after complaining of long-term health problems. In February of 2013, the coroner in the inquest into his death opined that examination of Mr. Westgate's body disclosed symptoms consistent with exposure to organophosphate compounds in aircraft cabin air. The coroner requested that urgent action be taken to prevent future deaths.

*263.* ***Red Flag or Safety Signal # 40:*** **<u>March 2013</u>**: In 2013 University of Washington researchers studied the health effects of oral exposure of mice to a commercial blend of tricresyl phosphate (a component of jet engine oil). *See* **Exhibit 36**.

264. The researchers demonstrated that the para isomers of tricresyl phosphate are also neurotoxic. Specifically they found that when mice ingested tri-para-cresyl-phosphate an enzyme implicated in cognition was significantly impaired as well as an enzyme that regulates the central nervous system.

**FACTS ABOUT BOEING**

265. Boeing markets itself as "the world's largest aerospace company and leading manufacturer of commercial jetliners" and claims "a long tradition of aerospace leadership and innovation" including "creating advanced technology solutions."

266. With corporate headquarters in Chicago, Boeing employs more than 165,000 people across the United States and in more than 65 countries.

267. Boeing claims it has "one of the most diverse, talented and innovative workforces anywhere."

268. In Boeing's 2013 Annual Report, its reported annual revenue was $86.6 billion.

269. Despite these resources, the aircraft at issue was not equipped with appropriate filters to remove contaminants, or alarms, sensors or detectors to warn or protect the flight crew, cabin crew or passengers from contaminated cabin air.

270. Further, the flight crew had no training on how to mitigate or prevent a fume incident and had no ability to isolate the source of the air contamination so such contamination could be avoided or stopped.

271. Boeing knew that cabin air could become contaminated, knew that such contamination could cause health problems and knew that safer alternatives were available that were technologically available and economically feasible.

272. Yet Boeing did not redesign or retrofit the subject aircraft to remove or reduce these hazardous events.

273. Rather than admit the truth about air cabin contamination, Boeing instead deliberately misrepresented the safety of its aircraft.

274. In 1995, for example, Boeing represented at the Aeromedical Medical Association annual meeting that the ECS or Environmental Control System of "today's jetliner is carefully engineered to provide superior cabin air quality." *See* **Exhibit 37**, *Commercial Airliner Environmental Control System, Engineering Aspects of Cabin Air Quality*, Hunt, ED, Reid, DH, Space, DR, Tilton, FE (1995).

275. Boeing executives have affirmatively represented that Boeing aircraft, including the cabin air specifically, are safe.

276. For example, in 2011, Boeing engineer David Space discussed cabin air quality with various airlines, including Alaska Airlines, as well as the media. *See* **Exhibit 38**, "*Airplanes 201, The Airplane Cabin Environment, The Air That you Breathe.*"

277. Mr. Space stated that Boeing was committed to providing a "safe, healthy, flying environment."

278. Boeing compared the air on its aircraft to that found in hospitals, reassuring attendees that its filters are even more efficient than hospital air filtration systems.

279. Boeing further stated that Boeing's air delivery "system is carefully engineered to provide superior cabin air quality."

280. As early as 2011 Boeing represented that it planned to "[c]ontinue to seek a comprehensive understanding of air quality components through research and analysis" and planned to "continually look at product improvements."

281. Yet to date Boeing has failed to perform air quality studies or improve the air quality on its products.

282. In 2014, the German Federal Bureau of Aircraft Accident Investigation issued a study based upon information gathered from "an increased number of reports of so-called fume events," *i.e.* events involving smoke, smell or vapor inside the aircraft and health impairment of occupants of transport aircraft. *See* **Exhibit 39**, "*Study of Reported Occurrences in Conjunction with Cabin Air Quality in Transport Aircraft*."

283. The Bureau found "[c]lear indication of health impairments in terms of occupational health for flight and cabin crew" as well as passengers.

284. Impairments described by one hundred and five (105) cabin crew were: eye irritation, light headedness, headaches, dizziness, and nausea.

285. The German agency recommended "improved identification and avoidance of cabin air contamination" as well as follow up studies to evaluate and assess the "conjunction between long-term health impairments and fume events."

286. By reason of Boeing's design decisions, flight crews, including the subject flight attendant crew, are exposed to contaminated bleed air, specifically air contaminated with toxic chemicals in the form of heated aviation jet engine oil and the chemicals resulting from its thermal breakdown.

287. By reason of Boeing's design decisions, the environmental control system on the subject aircraft lacked filters which would have purified the cabin air and prevented the subject flight attendant crew from being exposed to toxic fumes.

288. By reason of Boeing's willful and negligent decisions, the subject flight attendants were unaware of the health dangers of contaminated cabin air and ill equipped to respond to this incident.

289. As described in further detail herein, Boeing knew of the defects in the subject aircraft, knew that because of such defects the cabin air was not free from harmful or hazardous concentrations of contaminants, was on notice that the defects were likely to cause injury yet failed to adequately warn or instruct on the aircraft defects, failed to remedy the known defect in the subject aircraft, failed to discover the dangerous conditions when such could have been discovered and / or failed to take affirmative action to avoid injury to Plaintiffs and others.

## COUNT I

## Strict Liability: Design Defect

290. Defendants manufactured, designed, promoted, marketed and sold the subject aircraft. At the time the subject aircraft left Boeing's custody and control, it was defective and unreasonably dangerous because:

a. Its design rendered the aircraft unreasonably dangerous.

b. The danger of this design was beyond that contemplated by the ordinary consumer with ordinary knowledge common to the community as to its characteristics.

c. The benefits of this design are outweighed by the design's inherent risk of danger.

291. Boeing's design of the subject aircraft made such aircraft unreasonably dangerous in one of more of the following respects:

a. The subject aircraft's ventilation system allows bleed air, which can become contaminated with dangerous toxins, to enter the breathing zone of the aircraft.

c. The subject aircraft lacked adequate air quality monitors, sensors or alarms.

d. The subject aircraft provides no safeguards or systems so the flight crew could identify the source of the contaminated air or mitigate or prevent contamination of the cabin air.

e. The subject aircraft lacked adequate or appropriate filters which would have purified the cabin air and prevented or mitigated bleed air contamination.

292. By reason of the foregoing, the subject aircraft was unreasonably dangerous and defective and Boeing is strictly liable for the damages sustained by the Plaintiffs.

**COUNT II**

**Strict Liability: Defect in Warnings / Instructions**

293. Plaintiffs re-allege all previous paragraphs as if set forth verbatim herein.

294. Boeing failed to adequately warn of the danger of toxic cabin air and / or failed to adequately instruct on the proper use of its aircraft to avoid cabin air contamination in one of more of the following respects:

a. The subject aircraft lacked proper warnings regarding the potential of the air supply system to become contaminated.

b. The subject aircraft lacked proper warnings regarding the identification or detection of contaminated air.

c. The subject aircraft lacked proper warnings regarding the health dangers of exposure to contaminated air.

d. Defendants failed to adequately warn or instruct on how to respond, contain or reduce the danger of fume events.

295. By reason of the foregoing, the subject aircraft was unreasonably dangerous and defective and Boeing is strictly liable for the damages sustained by the Plaintiffs.

**COUNT III**

**Negligence**

296. Plaintiffs re-allege all previous paragraphs as if set forth verbatim herein.

297. At all times relevant hereto, Boeing owed a duty to the Plaintiffs to use reasonable care in designing, manufacturing, assembling, testing, maintaining, servicing, selling, marketing, promoting and providing warnings or instructions about the subject aircraft so as not to cause Plaintiffs severe personal injuries and pain and suffering.

298. Defendant Boeing negligently breached its duty of care owed to the Plaintiffs though one or more of the following negligent acts and omissions, when Boeing:

a. negligently designed, manufactured, assembled and sold the subject aircraft such that its ventilation system allowed contaminated bleed air to enter the breathing zone of the aircraft;

b. negligently designed, manufactured, assembled and sold the subject aircraft without an adequate or appropriate air quality monitor, sensor or alarm to detect bleed air contamination, allow the flight to identify the source of such contamination and / or permit the flight crew to mitigate or prevent fume events;

c. negligently designed, manufactured, assembled and sold the subject aircraft without adequate or appropriate filters to protect cabin air from contamination;

d. negligently designed, manufactured, assembled and sold the subject aircraft without proper warnings or instructions regarding the potential of the air supply system to become contaminated or the danger of exposure to such contaminated air;

e. negligently designed, manufactured, assembled and sold the subject aircraft without knowing the actual chemical composition of the aviation jet engine lubricating oil, required for use on its aircraft;

f. negligently designed, manufactured, assembled and sold the subject aircraft without knowing what chemicals or byproducts are created when aviation jet engine lubricating oil is heated to temperatures consistent with those experienced in the engines, required for use on its aircraft;

g. negligently designed, manufactured, assembled and sold the subject aircraft without properly testing heated aviation jet engine lubricating oil;

h. negligently designed, manufactured, assembled and sold the subject aircraft without knowing the quality of the bleed cabin air;

i. negligently failed to incorporate a proper and effective environmental control system on the subject aircraft;

j. negligently failed to incorporate a proper and effective air supply system on the subject aircraft;

k. negligently failed to properly test the subject aircraft before distributing it;

l. negligently failed to adequately maintain, service, retrofit and/or inspect the subject aircraft;

m. negligently represented, promoted and marketed its aircraft as being safe and failed to provide adequate warnings and instructions about its aircraft; and

m. was otherwise negligent and careless.

299. Boeing owed a duty to adequately warn and instruct about the dangers of its aircraft of which it knew, or, in the exercise of ordinary care, should have known, at the time the product left Boeing's control.

300. Boeing negligently failed to warn of the defective and unreasonably dangerous conditions of the subject aircraft.

301. Boeing negligent and willfully misrepresented the safety of its aircraft and the dangers of air cabin contamination.

302. As a direct and proximate result of one or more of the aforesaid negligent acts and omissions of Boeing, Boeing caused Plaintiffs to suffer personal injuries and damages.

**COUNT IV.**

**Fraud**

303. Plaintiffs re-allege all previous paragraphs as if set forth verbatim herein.

304. Boeing, having undertaken to design, create, research, develop, manufacture, market, promote, lease and sell its aircraft, owed a duty to provide a safe and appropriate air system as well as accurate and complete information regarding its aircraft.

305. Instead, Boeing provided affirmative misrepresentations or omissions and falsely and deceptively sought to create the image and impression that the air cabin in its aircraft was safe.

306. As described in some detail above, Boeing purposefully concealed, failed to disclose, misstated, downplayed, and understated the health hazards and risks associated with cabin air contamination on its aircraft.

307. Boeing deceived flight crew, flight attendants and passengers by concealing, misstating, and downplaying the incidence rate, seriousness and health effects of fume events.

308. Boeing falsely and deceptively kept relevant and material information from flight crew, flight attendants and passengers and minimized concerns regarding the safety of its aircraft air system.

309. Boeing did not properly study nor report accurately the results of its analysis of cabin air contamination.

310. As a direct and proximate result of one or more of the aforesaid fraudulent acts of Boeing, Boeing caused Plaintiffs to suffer severe personal injuries and damages.

**COUNT V.**

**Damages**

311. Boeing's conduct caused Plaintiffs short term and long term health problems and injuries including pain, suffering, mental anguish, emotional distress, physical impairment, loss of normal enjoyment of life, medical bills and expenses as well as loss of wage earning capacity, in the past as well as reasonably anticipated in the future.

**DEMAND FOR JURY TRIAL**

312. The Plaintiffs hereby demand a jury trial on all claims so triable in this action.

313. WHEREFORE, Plaintiffs pray for the entry of a judgment in their favor and against Defendant Boeing, together with costs, attorney fees and such other damages as may be allowed by law.

DATED this _____ day of June, 2015.

_____
Attorneys for Plaintiffs

Joe Powers
POWER ROGERS AND SMITH, PC
Three First National Plaza
70 West Madison Street, 55th Floor
Chicago, IL 60602
Tel: (312) 236-9381

Zoe Littlepage
Rainey Booth
LITTLEPAGE BOOTH
2043A W. Main St.
Houston, TX 77098
Tel: (713) 529-8000
Email: zoe@littlepagebooth.com
Email: rainey@littlepagebooth.com

Rick Friedman
Sean Gamble
FRIEDMAN RUBIN
1126 Highland Ave.
Bremerton, WA 98337
Tel: (360) 782-4300

Alisa Brodkowitz
BRODKOWITZ LAW
81 Vine St. Suite 202
Seattle, WA 98121
Tel: (206) 838-7531