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Toxicokinetic Study for Investigation of Sex Differences in Internal Dosumetry of Jet Propulsion Fuel 8 (JP-8) in the Laboratory Rat

Sweeney, Phillips, Gut, Okolica, and Reboulet

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The experiments reported herein were conducted in compliance with the Animal Welfare Act and in accordance with the principles set forth in the "Guide for the Care and Use of Laboratory Animals," Institute of Laboratory Animals Resources, National Research Council, National Academy Press, 1996 and conducted under Animal Use Protocol # F-WA-2010-0118-A, as approved by the Wright-Patterson Air Force Base (WPAFB) Institutional Animal Care and Use Committee.

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14. ABSTRACT

An estimated 2 million people per year are occupationally exposed to jet propulsion fuel 8 (JP-8) or similar fuels during fueling of aircraft, land-based vehicles, equipment, heaters, and lighting sources and through other uses. Aircraft maintenance personnel exposed to jet fuel and noise at a military installation had significantly elevated odds of hearing loss that increased with exposure duration. Determination of the extent to which JP-8 reaches the blood and target tissues under various exposure conditions may permit refinement of the assessment of risk for humans exposed to jet fuel. A toxicokinetic study was conducted where male and female Fischer 344 rats were exposed by inhalation to JP-8 for up to 4 hrs, with blood, liver, cochlea, and fat sample collection during and after exposure. Blood and tissue samples were analyzed for 25 JP-8 components. The amount of data useful for time course determination from this study was limited. Explanations for the paucity of data useable for pharmacokinetic modeling included the likelihood that many analytes were below the level of quantitation, contamination or storage losses, and possible strain and sex differences compared to previous studies. Some apparent sex differences in the frequency of analyte detection were observed. JP-8 components were detected more frequently in the liver of male (vs. female) rats, and more frequently in the fat and cochlea of female rats (as compared to males). While there were analytical and methodological difficulties, these findings are consistent with prior observations suggesting that sex-related differences in JP-8 disposition could be a factor in in JP-8 inducted ototoxicity.

15. SUBJECT TERMS
Jet propulsion fuel 8, JP-8, nose-only, inhalation, rats, toxicokinetics, ototoxicity, sex-related differences

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Table of Contents

List of Tables

LIST OF FIGURES

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SUMMARY

An estimated 2 million people per year are occupationally exposed to jet propulsion fuel 8 (JP-8) or similar fuels during fueling of aircraft, land-based vehicles, equipment, heaters, and lighting sources and through other uses. Aircraft maintenance personnel exposed to jet fuel and noise at a military installation had significantly elevated odds of hearing loss that increased with exposure duration. Determination of the extent to which JP-8 reaches the blood and target tissues under various exposure conditions may permit refinement of the assessment of risk for humans exposed to jet fuel. A toxicokinetic study was conducted where male and female Fischer 344 rats were exposed by inhalation to JP-8 for up to 4 hrs, with blood, liver, cochlea, and fat sample collection during and after exposure. Blood and tissue samples were analyzed for 25 JP-8 components. The amount of data useful for time course determination from this study was limited. Explanations for the paucity of data useable for pharmacokinetic modeling included the likelihood that many analytes were below the level of quantitation, contamination or storage losses, and possible strain and sex differences compared to previous studies. Some apparent sex differences in the frequency of analyte detection were observed. JP-8 components were detected more frequently in the liver of male (vs. female) rats, and more frequently in the fat and cochlea of female rats (as compared to males). While there were analytical and methodological difficulties, these findings are consistent with prior observations suggesting that sex-related differences in JP-8 disposition could be a factor in in JP-8 inducted ototoxicity.

INTRODUCTION

The combined consumption of fuels by the U.S. Armed Forces was approximately 4 billion gallons in fiscal year 2007, of which approximately 2.8 billion gallons were jet propulsion fuel 8 (JP-8) (Department of Defense, 2008). An estimated 2 million people per year are occupationally exposed to JP-8 or similar military and commercial jet fuels during fueling of aircraft, land-based vehicles, equipment, heaters, and lighting sources; dust and sand suppression; vehicle decontamination; and use of jet fuel as a combat obscurant (Ritchie et al., 2003).

Aircraft maintenance personnel exposed to jet fuel and noise at a military installation had significantly elevated odds of persistent hearing loss, which increased with exposure duration (odds ratio [OR] = 1.7, 95 percent confidence interval [CI] = 1.14-2.53 for 3 years of jet fuel exposure, OR = 2.41, CI = 1.04-5.57 for 12 years of jet fuel and noise exposure; n = 90 exposed, 48 unexposed) (Kaufman et al., 2005). Hearing loss and tinnitus were the two most common service-connected disabilities reported by the Veterans Benefits Administration for fiscal year 2006; compensation costs exceeded $1.2 billion that year (Saunders and Griest, 2009). Recognizing that chemical agents present in the workplace may potentiate noise-induced hearing loss, the U.S. Army Hearing Conservation Program requires consideration of ototoxic chemical exposures (including toluene and xylene), particularly when they occur in combination with noise exposures (Department of the Army, 1998).

The hydrocarbons ethylbenzene, toluene, and p-xylene, known to be present in JP-8 (Tremblay et al., 2010a, 2010b), produced ototoxicity via effects on the cochlea when rats were exposed to elevated levels of the individual compounds (Gagnaire et al., 2007; Hoet and Lison, 2008; Maguin et al., 2006; Vyskocil et al., 2008). Subacute exposure to a high concentration of JP-8 (2000 mg/m^3) may have produced transient impairment of rat cochlear outer hair cell function in the absence of noise (Fechter et al., 2010); the addition of noise exposure yielded demonstrable effects on hearing at JP-8 exposure levels that did not produce effects in the absence of noise (Fechter et al., 2010, 2012). Outer hair cell loss was greater in JP-8 and noise exposed male rats than in female rats (Fechter et al., 2012).

Determination of the extent to which JP-8 reaches the blood and target tissues (the inner ear) under various exposure conditions may permit refinement of the assessment of risk for jet fuel-exposed humans. Blood and tissue time course data for JP-8 are required to extend our understanding of how JP-8 is distributed and eliminated in rats and give insights into how JP-8 is distributed and eliminated in humans.

This study was concerned primarily with the pharmacokinetics of JP-8 components in the blood and cochlea. For this experiment, groups of animals were exposed via inhalation to three concentrations of JP-8 with each exposure lasting 4 hours or less. Groups of animals were euthanized at various time points during and after exposure for collection of blood and tissues that were analyzed for the presence and concentration of selected JP-8 components. Preliminary physiologically based pharmacokinetic (PBPK) models have been developed for JP-8 inhalation exposure, but explicit inclusion of the target organ (the cochlea) in the model is lacking (Martin et al., 2012). These data may allow the refinement of the model for use in risk assessment evaluations of JP-8.

OBJECTIVE

The objective of the study was to collect kinetic data to evaluate sex-related differences in internal dosimetry of JP-8 components in rats, especially as they pertain to ototoxicity.

MATERIALS AND METHODS

Study Design and Animal Model

Specific Pathogen Free Fisher-344 (F344) rats (Charles River Laboratories, Inc. Wilmington, MA) were exposed to jet fuel (JP-8, CAS No. 8008-20-6) in high-efficiency particulate air (HEPA)-filtered air for up to 4 hours. The target test concentrations of JP-8 were 200, 750, or 1500 mg/m^3 (low, medium, and high exposures) in air, consistent with a companion JP-8 toxicity study (Fechter et al., 2012). JP-8 was obtained from a stock maintained by the Fuels Branch at Wright-Patterson Air Force Base (WPAFB). It consisted of a blend of jet fuel from various refineries with the addition of the JP-8 fuel additive package of diethylene glycol monomethyl ether (diEGME, to inhibit ice formation) and unspecified static and corrosion inhibitors. The JP-8 used in this study came from the same lot that was used by Fechter et al. (2012), POSF 7562. The JP-8 was administered as a combined vapor and aerosol in the breathing air of the animals via a nose-only exposure system. Technical details of the exposure system are provided below under "Inhalation Exposure System".

F344 rats were used for this work as this species and strain is commonly used in inhalation toxicology research and PBPK modeling, including the companion JP-8 toxicity study (Fechter et al., 2012) and previous jet fuel PBPK modeling (Campbell and Fisher, 2007; Martin et al., 2012). Both male and female rats were used for this study. Both sexes were required to detect or rule out any pharmacokinetic differences of JP-8 between sexes in the blood or tissues; previously, JP-8 kinetics has been studied only in male rats (Campbell and Fisher, 2007; Martin et al., 2012).

Upon arrival at the WPAFB vivarium, a facility accredited by the Association for Assessment and Accreditation of Laboratory Animal Care International, the rats were segregated for a 10-day quarantine and acclimation period. Animals were observed twice daily for signs of distress. Animal rooms were maintained at a temperature and relative humidity in accordance with the recommendations of the National Research Council's *Guide for the Care and Use of Laboratory Animals* (1996), with approximately 15 complete air changes per hour, and a 12hr:12hr electronically controlled light:dark cycle. Animals were housed doubly, separated by sex.

Prior to exposure, all rats were acclimated to the nose-only tubes for 0.5 – 4 hours over four days prior to exposure during the second half of the 10 day quarantine period. The rats were placed into the tubes for 0.5 hours the first day, 1 hour the second day, 2 hours the third day, and 4 hours the fourth day.

Rats (males: age 71-86 days, females: age 74-84 days) were exposed to the JP-8 vapor and aerosol mixture for up to 4 h. Ten to twelve rats (5 or 6 males and 5 or 6 females) per dose group were removed from the exposure system at 2 h and at 4 h following the start of exposure for blood and tissue collection. Additional groups of 5 or 6 male and 5 or 6 female rats per dose group were removed from the exposure system at 4 h following the start of exposure and returned to their home cages with free access to food and water until anesthesia, euthanasia, and

tissue harvest at the 4.25, 4.5, 4.75, and 5 h time points after the start of exposure. Rats were not fasted prior to exposure or necropsy.

Inhalation Exposure System

JP-8 was administered as a combined vapor and aerosol in the breathing air of the animals. The test atmosphere was generated using a liquid nebulizer/fluid metering pump procedure. Total JP-8 concentrations were monitored throughout the exposures via Fourier transform infrared spectroscopy (FTIR) monitoring of HEPA-filtered samples of exposure atmosphere (Nicolet Thermo Scientific, Madison, WI, Model IS10). Aerosol concentrations could not be measured separately during the exposure, but were measured during pre-study operation of the system and can also be estimated based on previous experience in this laboratory with the same generation system (see "Results and Discussion—Exposure Conditions").

For each exposure, the JP-8 was initially generated into a 690 liter toxic hazard research unit (THRU) exposure chamber at desired concentration, using the same generation techniques as for previous jet fuel studies (Fechter et al., 2012; Sweeney et al., 2013). However, for this study, the chamber was operated at a higher pressure (approximately 5 inches of water above ambient) so as to supply JP-8 to the Cannon nose-only exposure system.

Rats were exposed to JP-8 on a 52-position Cannon nose-only exposure system (Lab Products, Maywood, NJ). To facilitate blood and tissue collection, tubes containing individual rats were added to the nose-only tower at approximately 5 minute intervals; when an individual rat completed the scheduled exposure time, that rat could immediately be euthanized and blood and tissues collected rapidly (as described below under "Blood and Tissue Collection"). One nose-only exposure system was used for each concentration. The exposure system is a dynamic, non-rebreathing system. In this system, an exposure atmosphere flow rate of approximately 0.5 L/min per open port was maintained through a central, inner plenum and out through the delivery tubes that direct the test atmosphere past the nose of each animal. The nose-only exposure system was fitted with connections for a differential pressure gauge to monitor static pressure and a temperature-humidity probe to measure the temperature and humidity in the area surrounding the exposure system. A three-way valve was connected to the top of the tower to direct the exposure atmosphere flow to the chamber or the exhaust. The outer plenum of the nose-only exposure system carried the animals' exhaled breath and excess test atmosphere to an exhaust that passed through a charcoal filter and into the house vacuum. The chamber operated as a push-pull system where the HEPA-filtered air supply was positive and the exhaust flow was negative. The air supply was set at the target flow rate and the exhaust was adjusted to maintain a static pressure in the range of -0.05 to -0.25 inches of water during exposure. Closed polycarbonate nose-only tubes with stainless steel backs and a rubber stopper were used for animal containment during the exposures.

Chamber temperature, humidity, airflow rate and static pressure were displayed continuously and checked hourly during the exposure. Chamber temperature and relative humidity were to be maintained, to the maximum extent possible, between 64 to 80°F and 30 to 70 percent, respectively, per the approved protocol, but systems to control these variables were not available, so they could only be monitored.

Blood and Tissue Collection

Rats were anesthetized via inhalation of 70 percent carbon dioxide. The level of anesthesia was determined by testing the toe pinch reflex. When a rat was no longer responsive to toe pinch, it was considered to be adequately anesthetized. Once the rat was adequately anesthetized, the abdomen was opened with scissors, the diaphragm cut (bilateral pneumothorax), the intestines moved to one side, and blood drawn from the caudal vena cava or heart. All needles and syringes were treated with heparin as an anticoagulant. Blood was transferred to 2 ml Nalgene cryogenic tubes (Fisher Scientific, Pittsburgh, PA). Following blood draw, the rat was rapidly decapitated with a rat guillotine. The cochlea (with encapsulating bone), the left lateral lobe of the liver, and a 0.1 to 0.9 g sample of right side abdominal adipose were harvested, placed in aluminum foil wrappers, and blood and tissues were preserved in liquid nitrogen.

In addition to blood and tissue collection from exposed animals, additional tissues were required for gas chromatograph/mass spectrophotometer (GC/MS) calibrations. For these analyses, blood and tissue were collected from 64-77 day old naïve F344 rats of both sexes and preserved as described for blood and tissues collected from exposed animals.

Analysis of Blood and Tissue Samples

Sample preparation

Blood was thawed on ice prior to preparation. One ml of the whole blood from each sample had a known amount of toluene-d_8 surrogate (Restek Corporation, Bellefonte, PA) in methanol (0.05 – 0.06 µg) added. Twenty ml of 0.28 µg/mL of sodium chloride solution (NaCl) was then added to a ~40 ml vial (clear, borosilicate glass volatile organic compound analysis [VOA] vial, Entech Instruments, Simi Valley, CA). The vial was capped with a stainless steel vacuum tight seal fitting with a rubber o-ring (Entech Instruments, Simi Valley, CA) and set aside for sonication. The procedure up to this point was done as quickly as possible to eliminate loss of volatile compounds. Samples were sonicated for one hour at 67 ± 5^{o}C (Sonicor SC-400TH, Sonicor Instrument Corp., Copiague, NY). The sample was allowed to cool to room temperature prior to analysis.

The cochlea samples were weighed individually then pooled together by exposure group and sex for preparation and analysis. After the samples were pooled together, the cochleae were crushed between weigh plates, reweighed, and transferred to a VOA vial for addition of toluene-d_8 surrogate and NaCl solution, followed by sonication, cooling, and analysis, as described for blood.

The left lateral lobe of each liver sample was weighed and minced in a weigh boat with a razor blade and quickly transferred to a VOA vial for the addition of surrogate and NaCl solution, followed by sonication, cooling, and analysis, as described for the blood.

The fat samples were weighed and placed in a 40 ml VOA vial for the addition of toluene-d_8 surrogate. Ten ml of 3 M sodium hydroxide (NaOH) solution was then added to digest the fat along with 10 ml of the NaCl solution. This process was done as quickly as possible to eliminate the loss of volatile compounds. The samples were then sonicated, cooled and analyzed, as described for the blood.

Analytes

Analytes were selected in consultation with the sponsor (with consideration of availability of chemical standards from suppliers) from the approximately 260 known components of JP-8 (Ritchie et al., 2003). The analytes evaluated in this study expanded upon those previously reported for blood and tissue analysis of JP-8 kinetics in exposed rats (Campbell and Fisher, 2007; Martin et al., 2012) (Table 1).

Table 1. Selected JP-8 analytes: content in JP-8, previous inclusion in JP-8 PBPK models, and availability of rat toxicokinetic data

Compound	CAS No.	Level in neat JP-8 (percent)		Included in JP-8 PBPK Models?		Rat blood concentration data identified?[a]
		Campbell and Fisher (2006)	Tremblay et al. (2010a)	Campbell and Fisher (2007)	Martin et al. (2012)	
n-Octane	111-65-9	0.46	0.44	No	Yes	Yes
n-Nonane	111-84-2	1.1	1.0	No	No	Yes
n-Decane	124-18-5	2.7	2.19	No	Yes	Yes
n-Tetradecane	629-59-4	2.33	1.62	No	Yes	Yes
2-Methylhexane	591-76-4	0.032	0.13	No	No	No
2,5-Dimethylhexane	592-13-2	0.015	NA[b]	No	No	No
2-Methylheptane	592-27-8	0.17	0.24	No	No	Yes
2,5-Dimethylheptane	2216-30-0	0.063	0.04	No	No	No
2-Methyloctane	3221-61-2	0.23	0.42	No	No	Yes
2,6-Dimethyloctane	2051-30-1	0.44	NA	No	No	No
4-Methyldecane	2847-72-5	0.57	NA	No	No	No
n-Butylcyclohexane	1678-93-9	0.41	1.11	No	No	No
Methylcyclopentane	96-37-7	0.013	NA	No	No	No
Phenylcyclohexane (Cyclohexylbenzene)	827-52-1	NA	NA	No	No	No
Toluene	108-88-3	0.21	0.30	No	Yes	Yes
o-Xylene	95-47-6	0.27	0.42	No	No	Yes
m-Xylene[c]	108-38-3	0.42	1.0	Yes	Yes	Yes
p-Xylene[c]	106-42-3	0.17	NA	No	No	Yes
1,2,4-Trimethylbenzene (Pseudocumene)	95-63-6	1.18	1.45	No	No	Yes
1,3,5-Trimethylbenzene (Mesitylene)	108-67-8	0.42	0.36	No	No	Yes
Ethylbenzene	100-41-4	0.19	0.23	Yes	Yes	Yes
o-Ethyltoluene	611-14-3	0.45	0.44	No	No	No
4-Ethyltoluene (1-Ethyl-4-methylbenzene)	622-96-8	NA	NA	No	No	No
Isopropylbenzene (Cumene)	98-82-8	0.092	NA	No	No	No
Naphthalene	91-20-3	0.21	0.12	No	No	Yes

[a]Rat blood and tissue concentration data sources included both JP-8 and single-compound exposures and are identified and discussed under "Results—Data Evaluation and Interpretation".
[b]NA = No information available in this reference.
[c]m- and p-Xylene do not separate on the GC and were analyzed together in this study.

A custom mix of target compounds was obtained from Restek Corporation (Bellefonte, PA) with each compound at 2 mg/ml (in methanol) except n-nonane, which was purchased neat from the same supplier and added at the same concentration as the other analytes.

Instrumentation/Analytical Conditions

The concentrations for the JP-8 compounds were measured by GC (Agilent 6890N, Agilent Technologies, Wilmington, DE) with a mass selective detector (MS) (5973N, Agilent Technologies, Wilmington, DE) with introduction of sample using a 7410 autosampling headspace inlet and 7150 headspace preconcentrator (Entech Technologies, Simi Valley, CA).

The analytical conditions were as follows: 10 ml of headspace was taken from the vials containing each prepared sample and concentrated on the Entech 7410. Three traps are associated with this preconcentrator: an active solid phase microextraction (SPME) trap (T1), dehydration trap (T2) and absorbent trap (T3). Cryogenics were performed with liquid carbon dioxide with a siphon tube (Weiler Welding, Moraine, OH). The initial temperatures of T1, T2, and T3 were 50ºC, -55ºC, -50ºC, respectively. The multi-step sample concentration proceeded as follows: 10 ml of the sample was flushed with an additional 100 ml of helium into the concentrator. The autosampler inlet temperature and transfer line were set at 100ºC. Next, T2 was heated to 5ºC, and then 15 ml of helium were flushed through T1 and T2 to T3. T2 was then baked at 90ºC for 4.5 minutes. Next, T1 was cooled down to -52ºC, T2 to 60ºC, and T3 preheated to 100ºC. The sample was next transferred at 0.64 psi back from T3 to T1 over a 3.3 minute period of time with T1 at -52ºC, T2 at 60ºC and T3 at 200ºC. The sample was then injected onto the instrument with T1 at 190ºC, T2 at 160ºC, and T3 at 200ºC for 8 minutes at 0.72 psi. After injection, the autosampler and concentrator were baked out. GC conditions used helium as the carrier gas on an Rxi-624Sil MS 60m × 0.32 mm inner diameter × 1.8 µm column (Restek Corp., Bellefonte, PA) with a pressure of 13.68 psi and an initial flow rate of 45.0 ml/min. The initial oven temperature was 40°C with an initial hold time of 5.00 minutes. The oven temperature program was as follows: 8°C/minute to 114°C, 4°C/minute to 140°C with one minute hold followed by 9°C/minute to 160°C, 15°C/minute to 240°C with a 2 minute hold. The run time was 31.31 minutes. Compounds were identified on the 5973N MS using elution order and 2-4 quant ions (Table 2). The m- and p- isomers of xylene are indistinguishable by quant ions or retention time; therefore, they were analyzed and calibrated together.

Table 2. Identification of compounds via GC/MS

Compound	CAS No.	Retention Time (minutes)	Primary Quant Ion	Additional Quant Ions		
Methylcyclopentane	96-37-7	10.36	56	41	69	84
2-Methylhexane	591-76-4	11.22	43	85	42	41
2,5-Dimethylhexane	592-13-2	13.00	57	43	41	56
2-Methylheptane	592-27-8	13.96	43	57	42	41
Toluene-d_8	2037-26-5	14.61	98	100	-	-
Toluene	108-88-3	14.73	91	92	65	-
n-Octane	111-65-9	14.89	43	41	57	71

Compound	CAS No.	Retention Time (minutes)	Primary Quant Ion	Additional Quant Ions		
2,5-Dimethylheptane	2216-30-0	15.94	57	43	41	56
2-Methyloctane	3221-61-2	16.75	43	57	41	71
Ethylbenzene	100-41-4	17.51	91	106	-	-
m-Xylene	108-38-3	17.78	91	106	-	-
p-Xylene	106-42-3	17.78	91	106	105	-
n-Nonane	111-84-2	17.77	43	57	41	85
o-Xylene	95-47-6	18.61	91	106	105	-
2,6-Dimethyloctane	2051-30-1	18.88	57	71	43	41
Isopropylbenzene	98-82-8	19.44	105	120	-	-
p-Ethyltoluene	622-96-8	20.77	105	120	106	-
1,3,5-Trimethylbenzene	108-67-8	20.93	105	120	-	-
n-Decane	124-18-5	20.98	57	43	41	71
1,2,4-Trimethylbenzene	95-63-6	21.96	105	120	-	-
o-Ethyltoluene	611-14-3	21.42	105	120	-	-
n-Butylcyclohexane	1678-93-9	22.68	83	82	55	41
4-Methyldecane	2847-72-5	23.09	43	57	71	41
Naphthalene	91-20-3	27.80	128	129	127	-
Cyclohexylbenzene	827-52-1	29.63	104	117	160	91
n-Tetradecane	629-59-4	29.81	57	43	71	85

Calibration

A calibration curve was generated for each sample matrix (blood, cochlea, liver, and fat) and verified every 24 hours with continuing calibration verification (CCV). To measure the extraction effectiveness, each sample was spiked with a known amount of toluene-d_8 as a surrogate compound. To rule out matrix effects and contamination, a method blank (MB) was prepared with each batch. Each sample batch required a MB and CCV with the tissue being tested from naïve rats. All of the compound calibration curves met a 35 percent relative standard deviation or r^2 of ≥ 0.98 with three points minimum. The calibration curve for the blood samples ranged from 10 µg/l to 600 µg/l. The calibration curve for the liver ranged from 10 ng/liver sample to 300 ng/liver sample. The calibration curve for the cochleae of the female rats ranged from 4 ng/cochlea set to 400 ng/cochlea set. The calibration curve of the male rats ranged from 10 ng/cochlea set to 400 ng/cochlea set. The calibration curve for the fat was 20 ng/piece of fat to 150 ng/piece of fat. Due to the variability of the fat sample size and the partitioning characteristics of the compounds, acceptable calibration for fat samples was accomplished only for the following compounds: methylcyclopentane, 2-methylhexane, 2,5-dimethylhexane, 2-methylheptane, n-octane, and toluene. Depending on the compound, the low and high end of the curves may vary (Table 3).

Table 3. Limits of calibration

Compound	Blood (ng/ml)[a]	Liver (ng/sample)	Cochlea (ng/pooled set)		Fat (ng per sample)
			Female	Male	
n-Octane	10	<10	4	10	20
n-Nonane	50	<10	4	10	n/a
n-Decane	50	<10	4	10	n/a
n-Tetradecane	50	<20	50	20	n/a
2-Methylhexane	10	<10	4	10	20
2,5-Dimethylhexane	10	<10	4	10	20
2-Methylheptane	10	<10	4	10	20
2,5-Dimethylheptane	10	<10	4	10	n/a
2-Methyloctane	10	<10	4	10	n/a
2,6-Dimethyloctane	50	<10	4	10	n/a
4-Methyldecane	50	<20	4	10	n/a
Methylcyclopentane	10	<10	4	10	20
n-Butylcyclohexane	10	<10	4	10	n/a
Cyclohexylbenzene	10	<10	10	10	n/a
Toluene	10	<10	4	10	20
o-Xylene	10	<10	4	10	n/a
m,p-Xylenes	20	<20	8	20	n/a
1,2,4-Trimethyl-benzene	10	<10	10t	10	n/a
1,3,5-Trimethyl-benzene	10	<10	4	10	n/a
Ethylbenzene	10	<10	4	10	n/a
o-Ethyltoluene	10	<10	10	10	n/a
p-Ethyltoluene	10	<10	4	10	n/a
Isopropylbenzene	10	<10	4	10	n/a
Naphthalene	10	<10	20	10	n/a

[a] Most blood samples were 1 ml (range 0.5 to 1.0 ml). Liver sample weights ranged from 0.71 to 2.4 g. Cochleae were pooled (both cochleae from 5-6 animals, crushed sample weights ranged from 0.34 to 0.74 g for males and 0.60 to 1.0 g for females). Fat sample weights ranged from 0.051 to 0.89 g.

Data Analysis

Potential for False Positives in Blood and Tissue Samples

Some analytes were identified, with varying frequency, during the analysis of blood and tissues of naïve rats not known to have been exposed to JP-8 or any other exogenous compounds. Based on the frequency of detection, the results were used to inform the assessment of the level of confidence that an identified compound was present in the blood or tissue due to JP-8 exposure, rather than contamination or carryover from previous analyses.

Adjustment of Instrument-Reported Tissue Concentrations for Sampled Tissue Volume

Calibration curves were constructed with incubated tissue samples that may have differed in weight from the samples from exposed rats. In order to correct for the effect of varying tissue volumes on headspace concentrations, distribution adjustment factors were calculated as necessary. The total VOA vial volume was determined to be 42 ml, based on the difference in weight of empty vials and vials filled with water. The saline volume was assumed to be 20 ml (20 g) for each analysis. The headspace volume was thus 42 ml minus the tissue sample volume. Tissue:air, blood:air, and saline:air partition coefficients were estimated from the literature (Gargas et al., 1989; Hissink et al., 2007; Smith et al., 2005; Tardif et al., 1997; Zahlsen et al., 1993). Saline:air partition coefficients were assumed equal to blood:air partition coefficients if no saline:air partition coefficient was available and cochlea:air partition coefficients were assumed equal to liver:air partition coefficients. Ethylbenzene, 2-methyloctane, and n-octane partition coefficients were used as surrogates for p-ethyltoluene, 2,6-dimethyloctane, and n-butylcyclohexane partition coefficients based on similarity of logP estimates from EpiSuite (www.chemspider.com). To derive the tissue sample volume adjustment factor, the analyte concentration ratios for the 3 matrices within the vial (tissue, saline, and headspace) were assumed to be at thermodynamic equilibrium based on solubility, as described by the partition coefficients. The reference (calibration) vial headspace concentration was computed using the average tissue sample weight for the samples used to develop the calibration curve. Based on the partition coefficients and sample volumes, the ratios of the headspace concentration to the analyte mass in the reference and sample vials were calculated. These two ratios were used to compute the sample's analyte-specific distribution correction factors.

RESULTS AND DISCUSSION

Exposure Conditions

No temperature or humidity logs from the time the exposures were performed (December 2010) were available for preparation of this report. Logs from a period with roughly comparable outdoor temperatures and humidity (December 2011) were available. The laboratory temperature was steady at 70.6 ºF in December 2011 (within protocol specification), but humidity had major swings within the range of 8 to 58 percent in December 2011. Although no data from the performance period are available, it is possible that humidity was less than called for in the protocol at some point during the exposures. The impact of such a protocol deviation, if it occurred, is unknown, but was deemed unlikely to have any significant impact on disposition of JP-8.

JP-8 concentrations were monitored throughout the exposures via FTIR monitoring of HEPA-filtered samples of exposure atmosphere. The FTIR calibration for total JP-8 exposure was based on measurements of filtered JP-8 vapor in equilibrium with aerosol over a range of atmospheres of known total concentration. Because of the staggered start (~ 5 minute spacing between the start of individual rats' exposures), each rat in a given exposure group experienced slightly different time-weighted average exposure concentrations of JP-8 (group mean exposure concentrations in Table 4; individual animal exposure concentrations in Appendix Table A-1, Table A-2, and Table A-3). Due to the high flow rate requirements of the impactors, aerosol samples could not be collected during exposure. While the actual aerosol concentrations during the animal exposures are unknown, measurements were made for test runs (without rats) at the high

concentration approximately one month prior. In that exposure, the aerosol concentration in the supply chamber was 156.9 mg/m^3, with a mass median aerodynamic diameter (MMAD) of 2.54 µm and geometric standard deviation (GSD) of 1.77, while the aerosol in the nose-only tower was reduced to 117.7 mg/m^3, with a MMAD of 2.34 µm and GSD of 1.82. These aerosol characteristics are consistent with the historical operation of this generating system at similar concentrations (e.g., Sweeney et al., 2013), so the best estimate of the aerosol concentration for the high exposure groups in this was 117.7 mg/m^3. In the 14-day Jet-A studies, when the vapor concentration decreased from 1422 mg/m^3 to 963.6 mg/m^3, the aerosol concentration decreased by a factor of 4 (240.8 to 57.0 mg/m^3) (Sweeney et al., 2013). A similar decrease would be expected going from the high to medium exposures for this study, so we estimate the aerosol exposure for the medium group was not more than 30 mg/m^3. At the lowest tested JP-8 concentrations, aerosol is expected to be minimal. For the medium and high concentrations, these percentages are lower than those reported by Martin et al. (2012) for total JP-8 exposures of ~900 mg/m^3 (37 percent aerosol). It is unclear if the reported differences are due to the use of different generation and exposure systems or under-collection or evaporation of collected aerosols in the WPAFB system as compared to the University of Georgia system (Martin et al., 2010). The reduced aerosolized (as compared to vapor phase) JP-8 components in the nose-only exposure could have resulted in the animals in this study being exposed to a greater percentage of volatile components (enriched in vapor phase) and less of the compounds with lower vapor pressure, as compared to whole-body exposure studies done with the same lot of fuel (Fechter et al., 2012).

Table 4. JP-8 exposure concentrations and animal body weights (mean ± standard deviation) for the toxicokinetic study

	Males			Females		
	Low	Medium	High	Low	Medium	High
Total[a] Concentration (mg/m^3)	202.1 ± 0.8	760.3 ± 2.1 (n = 34)	1523.2 ± 12.1	202.0 ± 0.8	760.8 ± 2.3	1522.8 ± 11.6
Body Weight (g)	212 ± 11 (n = 30)	219 ± 11 (n = 34)	218 ± 12	143 ± 5 (n = 30)	142 ± 5	143 ± 6

See Appendix Tables A-1, A-2, and A-3 for individual animal data. n = 36 unless otherwise noted.

[a]Rats were exposed to a mixture of vapor and aerosol, but only the total concentrations were measured during exposure. See text ("Results and Discussion—Exposure Conditions") for details. Reported as time-weighted average concentration.

Blood and Tissue Collection

Blood and tissue samples were collected promptly after cessation of exposure (Tables 5 and 6).

Table 5. Biosample collection times for JP-8 exposed male rats (mean ± standard deviation)

Exposure group	Exposure duration	Nominal post exposure collection time (min.)	Time to decapitation (min.)	Time from decapitation to liquid nitrogen (min.)	Total collection time (min.)
Low	2 hrs	0	3.2 ± 0.8	4.7 ± 0.8	7.8 ± 1.2
	4 hrs	0	2.3 ± 0.5	4.3 ± 0.8	6.7 ± 1.0
		15	2.8 ± 1.3	4.0 ± 0.6	6.8 ± 1.5
		30	2.5 ± 0.5	4.2 ± 1.0	6.7 ± 0.8
		45	2.2 ± 0.4	3.8 ± 0.8	6.0 ± 0.9
		60	2.7 ± 0.5	3.8 ± 0.8	6.5 ± 1.0
Medium	2 hrs	0	2.8 ± 0.4[a]	3.3 ± 0.4[a]	6.2 ± 0.4[a]
	4 hrs	0	2.8 ± 0.4	3.3 ± 0.5	6.2 ± 0.4
		15	2.2 ± 0.4	2.8 ± 0.8	5.0 ± 0.6
		30	2.2 ± 0.8	3.3 ± 0.5	5.5 ± 1.0
		45	2.2 ± 0.8	3.8 ± 0.4	6.0 ± 0.6
		60	2.2 ± 0.4[a]	3.4 ± 0.5[a]	5.6 ± 0.5[a]
High	2 hrs	0	2.3 ± 0.5	3.3 ± 0.5	5.7 ± 0.5
	4 hrs	0	2.8 ± 0.8	3.0 ± 0.6	5.8 ± 0.8
		15	1.8 ± 0.4	3.2 ± 0.8	5.0 ± 0.6
		30	1.8 ± 0.8	3.7 ± 0.5	5.5 ± 0.8
		45	2.3 ± 1.0	3.5 ± 0.5	5.8 ± 1.2
		60	2.0 ± 0	4.0 ± 0.6	6.0 ± 0.6

See Appendix Tables A-1, A-2, and A-3 for individual animal data; n = 6 unless otherwise noted.
[a]n = 5.

Table 6. Biosample collection times for JP-8 exposed female rats (mean ± standard deviation)

Exposure group	Exposure duration	Nominal post exposure collection time (min.)	Time to decapitation (min.)	Time from decapitation to liquid nitrogen (min.)	Total collection time (min.)
Low	2 hrs	0	3.2 ± 0.4	4.0 ± 0.9	7.2 ± 1.0
	4 hrs	0	2.3 ± 0.5	3.5 ± 0.8	5.8 ± 0.8
		15	1.8 ± 1.5	3.7 ± 0.8	5.5 ± 1.8
		30	2.8 ± 0.4	3.7 ± 0.5	6.5 ± 0.5
		45	2.3 ± 0.5	3.3 ± 1.0	5.7 ± 0.8
		60	2.0 ± 0	3.3 ± 0.8	5.3 ± 0.8
Medium	2 hrs	0	3.5 ± 0.8 [a]	3.0 ± 0.6 [a]	6.5 ± 1.0 [a]
	4 hrs	0	2.7 ± 0.5	2.3 ± 0.5	5 ± 0
		15	2.2 ± 0.4	2.7 ± 0.8	4.8 ± 0.8
		30	2.5 ± 0.5	2.8 ± 0.4	5.3 ± 0.5
		45	2.5 ± 0.5	3.0 ± 0.6	5.5 ± 0.5
		60	2.2 ± 0.4 [a]	2.7 ± 0.5 [a]	4.8 ± 0.8 [a]
High	2 hrs	0	2.2 ± 0.4	3.2 ± 0.8	5.3 ± 0.8
	4 hrs	0	3.0 ± 0.6	2.8 ± 0.8	5.8 ± 0.8
		15	1.8 ± 0.4	2.8 ± 0.8	4.7 ± 0.5

Exposure group	Exposure duration	Nominal post exposure collection time (min.)	Time to decapitation (min.)	Time from decapitation to liquid nitrogen (min.)	Total collection time (min.)
		30	2.2 ± 0.4	2.7 ± 0.5	4.5 ± 0.5
		45	2.2 ± 0.4	2.7 ± 1.0	4.8 ± 1.3
		60	2.0 ± 0	2.8 ± 0.8	4.7 ± 0.8

See Appendix Tables A-1, A-2, and A-3 for individual animal data. n = 6 unless otherwise noted
[a]n = 5.

Cochleae were weighed after being removed from storage in liquid nitrogen. Reference data for cochlea weights were not identified in the literature, so individual-animal paired cochlea weights were determined so that the volume (mass) of this tissue compartment could be estimated for future PBPK model development. The group averaged results are reported in Table 7. Collection of the cochleae was challenging due to their small size. Samples for which the analyst noted that extra (non-cochlea) tissue was collected along with the cochlea were excluded from the weight calculations. While the data appear to indicate significant differences between male and female cochleae, it is unknown to what extent the use of two different scientists for tissue collection (one for all the female rats, one for all the male rats) contributed to the apparent difference, perhaps due to collection of larger amounts of surrounding bony tissue.

Table 7. Post-exposure cochlea weights as a fraction of body weight (mean ± SD [n])

	Low Concentration	Medium Concentration	High Concentration	All
Males	0.000372 ± 0.000173 (26)	0.000313 ± 0.000139(32)	0.000328 ± 0.000175 (33)	0.000335 ± 0.000163 (91)
Females	0.000735 ± 0.000276 (23)	0.000838 ± 0.000298 (33)	0.001038 ± 0.000332(36)	0.000890 ± 0.000328 (92)
All animals				0.000613 ± 0.000380 (183)

See Appendix Table A-4 for individual animal cochlea weights.

Blood and Tissue Analysis

GC Performance

Method Detection Limits

Based on the recoveries measured in seven analyses of the calibration mixture, method detection limits (MDLs) were calculated for each analyte. The MDL was defined as the standard deviation of the results for the 7 analyses multiplied by the t-value for 99 percent confidence for 7 replicates (6 degrees of freedom) of 3.143; the MDL should be less than the spike value for the instrument's analyses to be considered valid. For two analytes (m- and p-xylenes, and 2-methylhexane) the MDLs were within rounding error (third significant figure) of the spike value, and therefore were considered likely valid. Four additional analytes (p-ethyltoluene, o-ethyltoluene, 1,2,4-trimethylbenzene, and 1,3,5-trimethylbenzene) were within a factor of two of the MDL, so the quantification was considered uncertain. The three analytes with the longest

retention times, naphthalene, cyclohexylbenzene, and n-tetradecane, had highly elevated calculated recoveries and failed the MDL criterion; the measured concentrations of these three compounds were thus considered unreliable.

Compounds Detected in "Control" Samples

More than half of the analytes evaluated (13/24) were identified in at least one "control" tissue or blood sample (Table 8). All of the control blood samples had "hits" for 1,2,4-trimethylbenzene, but none of the control tissue samples did, leading us to conclude that 1,2,4-trimethylbenzene or a co-eluting contaminant migrated from the plastic collection syringes or storage tubes into the blood. The other analytes that were detected in more than two control sample analyses were the three compounds that failed the MDL (naphthalene, cyclohexylbenzene, and n-tetradecane), likely due to inconsistent purging/retention. Excluding cyclohexylbenzene and n-tetradecane, all of the compounds that were detected in control cochlea were identified in a single run, suggesting that that particular sample or run was somehow compromised. Given these findings, we concluded that the detection of naphthalene, cyclohexylbenzene or n-tetradecane in a given run is not a reliable indication that the analyte was present in the sample. Because 1,2,4-trimethylbenzene (or a co-eluting compound) was present in all control blood samples, its detection in blood samples collected from JP-8-exposed animals cannot conclusively be attributed to exposure. n-Decane and 4-methyldecane were each identified in 2 out of 38 control samples, which introduces some doubt as to the validity of detection of these analytes in the samples from exposed animals, but not as much doubt as for naphthalene, cyclohexylbenzene, or n-tetradecane. Analytes found only in the single compromised control cochlea sample were likely valid when identified in exposed animal samples. The remaining analytes, which were not detected in any control sample, were interpreted as being valid indicators of systemic exposure when identified in blood or tissue from exposed rats.

Table 8. Detection of analytes in control samples

Compound	Control samples in which analyte was detected					Validity of detection in samples from exposed rats	Validity of quantification in samples from exposed rats
	Blood (n = 16)	Liver (n = 18)	Cochlea (n = 4)	Fat (n = 19)	All control samples[a]		
n-Octane	0	0	1	0	1[b]	Likely valid	Likely valid
n-Nonane	0	0	0	--	0	Valid	Valid
n-Decane	1	0	1	--	2	Uncertain	Uncertain
n-Tetradecane	2	3	3	--	8	Unreliable	Unreliable
2-Methylhexane	0	0	0	0	0[b]	Valid	Likely valid
2,5-Dimethylhexane	0	0	1	0	1[b]	Likely valid	Likely valid
2-Methylheptane	0	0	0	0	0[b]	Valid	Valid
2,5-Dimethylheptane	0	0	1	--	1	Likely valid	Likely valid
2-Methyloctane	0	0	0	--	0	Valid	Valid
2,6-Dimethyloctane	0	0	0	--	0	Valid	Valid
4-Methyldecane	2	0	0	--	2	Uncertain	Uncertain

Compound	Control samples in which analyte was detected					Validity of detection in samples from exposed rats	Validity of quantification in samples from exposed rats
	Blood (n = 16)	Liver (n = 18)	Cochlea (n = 4)	Fat (n = 19)	All control samples[a]		
Methylcyclopentane	0	0	0	0	0 [b]	Valid	Valid
n-Butylcyclohexane	0	0	1	--	1	Likely valid	Uncertain
Cyclohexylbenzene	0	7	3	--	10	Unreliable	Unreliable
Toluene	0	0	0	0	0 [b]	Valid	Valid
o-Xylene	0	0	0	--	0	Valid	Valid
m,p-Xylenes	0	0	0	--	0	Valid	Likely valid
1,2,4-Trimethylbenzene	16	0	0	--	16	Unreliable for blood, valid for all others	Unreliable/ uncertain
1,3,5-Trimethylbenzene	0	0	1	--	1	Likely valid	Uncertain
Ethylbenzene	0	0	0	--	0	Valid	Valid
o-Ethyltoluene	0	0	0	--	0	Valid	Uncertain
p-Ethyltoluene	0	0	1	--	1	Likely valid	Uncertain
Isopropylbenzene	0	0	1	--	1	Likely valid	Likely valid
Naphthalene	3	9	0	--	12	Unreliable	Unreliable

[a] n = 38, unless otherwise indicated
[b] n = 57

Reliability of Compound Quantification in Blood and Tissue Samples from Exposed Rats

The assessment of the reliability of analyte quantification in blood and tissue samples was derived from the results of the MDL determination and the frequency of detection in blank/control samples (Table 8). An analyte's quantification could not be considered more reliable than its MDL evaluation. Likewise, if an analyte was identified in blanks/control sample runs more than once, the quantification was also considered uncertain, even if the MDL evaluation was passed. Based on these criteria, the quantification was considered "valid" for 8 analytes, "likely valid" for 6 analytes, "uncertain" for 7 analytes, and "unreliable" for 3 analytes (Table 8).

Blood and Tissue Analyte Concentrations

Blood

Blood samples from rats exposed to the lowest concentrations of JP-8 were not analyzed due to the infrequency of analyte detection at the medium concentration. Eight of the target analytes were not detected in any analyzed blood sample: methylcyclopentane, 2-methylhexane, 2,5-dimethylhexane, 2-methylheptane, n-octane, 2,5-dimethylheptane, 2-methyloctane, and n-butylcyclohexane. None of the analytes had sufficient quantifiable data to generate a full time course estimate of blood concentrations. Unadjusted measurements from the medium and high exposure groups are reported in the Appendix (Tables A-5 to A-10).

n-Decane concentrations (corrected for sample volume, as necessary) in rats exposed to high concentrations of JP-8 were determined for the 4 hr collection time, when n-decane was quantified in 5/6 male and 5/6 female blood samples (Appendix, Table A-11). All of the n-decane measurements were below the range of calibration. Blood n-decane levels were 9.72 ± 1.8 µg/L in male rats and 16.4 ± 4.7 µg/L in female rats exposed to high concentrations of JP-8 for 4 hrs. Because n-decane was also found in "control" samples (1 blood sample, 1 cochlea sample), the low levels reported here should be interpreted cautiously.

Liver

Few analytes were identified in the livers of female rats exposed to JP-8, and those that were identified were detected with low frequency, and only after exposure to high concentrations of JP-8. While analytes were much more frequently identified in the livers of male rats than female rats (Table 9), the frequency was insufficient to generate useful time course estimates. Unadjusted measurements from the medium and high exposure groups are reported in the Appendix (Tables A-12 to A-17). The use of slightly larger liver samples for males (1.6 g) than for females (0.98 g) enhanced the likelihood of detecting analytes in male livers.

Table 9. Frequency of analyte identification in liver samples[a] of JP-8 exposed rats

		Frequency of finding in rat liver	
Reliability of Detection[b]	Analyte	Male	Female
Valid	2-Methyloctane	3	0
	n-Nonane	2	0
	2,6-Dimethyloctane	3	0
	Toluene	1	0
	Ethylbenzene	1	0
	o-Xylene	2	0
	m,p-Xylenes	2	0
	1,2,4-Trimethylbenzene	9	1
	o-Ethyltoluene	12	2
Likely valid	2,5-Dimethylheptane	1	0
	Isopropylbenzene	2	0
	p-Ethyltoluene	7	2
	1,3,5-Trimethylbenzene	6	1
	n-Butylcyclohexane	9	0
Uncertain	n-Decane	11	0
	4-Methyldecane	8	1

[a]The following analytes were not found in liver samples from any exposed rats: methylcyclopentane, 2-methylhexane, 2,5-dimethylhexane, 2-methylheptane, and n-octane. Naphthalene, cyclohexylbenzene, and n-tetradecane were excluded due to frequent analytical difficulties, likely due to poor purging. N = 70 male liver samples (36 high concentration, 34 medium concentration) and 71 female liver samples (36 high concentration, 35 medium concentration).

[b]Reliability based on frequency of findings in control ("blank") blood and tissues.

Cochlea

All of the analytes were identified in the cochleae of rats exposed to JP-8. In contrast to findings in the liver, where analytes were much more frequently identified in the livers of male rats than female rats (Table 9), the frequency of analyte detection was typically greater in cochleae of female rats than male rats (Table 10). The increased detection frequency may be due, in part, to the collection of larger tissues samples, likely including greater amounts of surrounding tissue with an unknown affinity for JP-8 components. The detection frequency was deemed sufficient to generate time course estimates of six compounds that were detected in a minimum of 4 of the 6 pooled samples collected from female rats exposed to high concentrations of JP-8 (Table 11).

Unadjusted measurements from the medium and high exposure groups are reported in the Appendix (Tables A-18 to A-23).

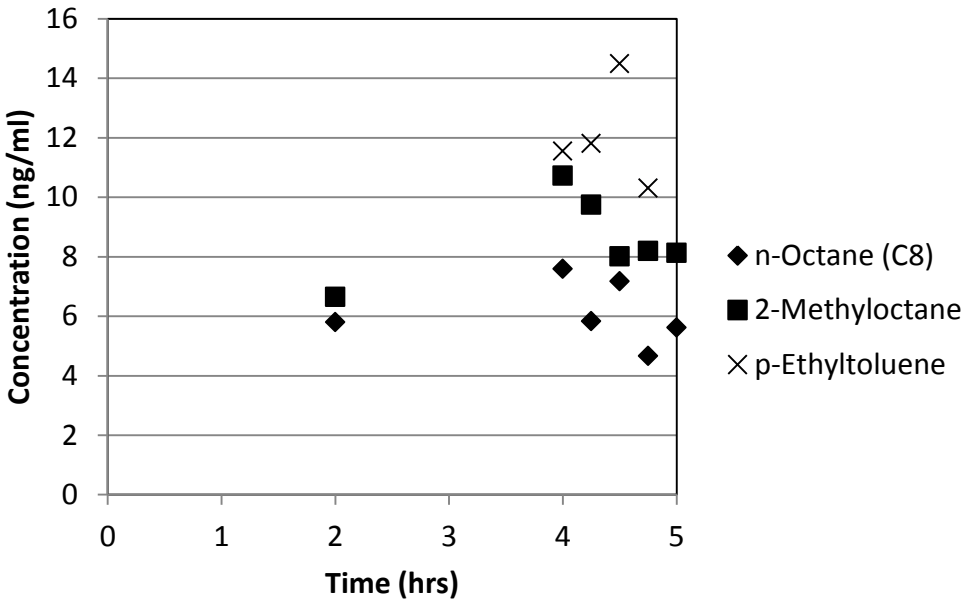
Table 10. Frequency of analyte identification in cochlea samples[a] of JP-8 exposed rats

		Frequency of finding in rat cochlea	
Reliability of Detection[b]	Analyte	Male	Female
Valid	Methylcyclopentane	1	2
	2-Methylhexane	1	2
	2-Methylheptane	1	2
	2-Methyloctane	2	9
	n-Nonane	2	5
	2,6-Dimethyloctane	2	10
	Toluene	2	4
	Ethylbenzene	2	2
	o-Xylene	2	4
	m,p-Xylenes	2	3
	1,2,4-Trimethylbenzene	4	3
	o-Ethyltoluene	4	3
Likely valid	2,5-Dimethylheptane	1	2
	n-Octane	2	9
	2,5-Dimethylheptane	1	2
	Isopropylbenzene	2	3
	p-Ethyltoluene	4	7
	1,3,5-Trimethylbenzene	3	4
	n-Butylcyclohexane	4	10
Uncertain	n-Decane	9	14
	4-Methyldecane	4	6

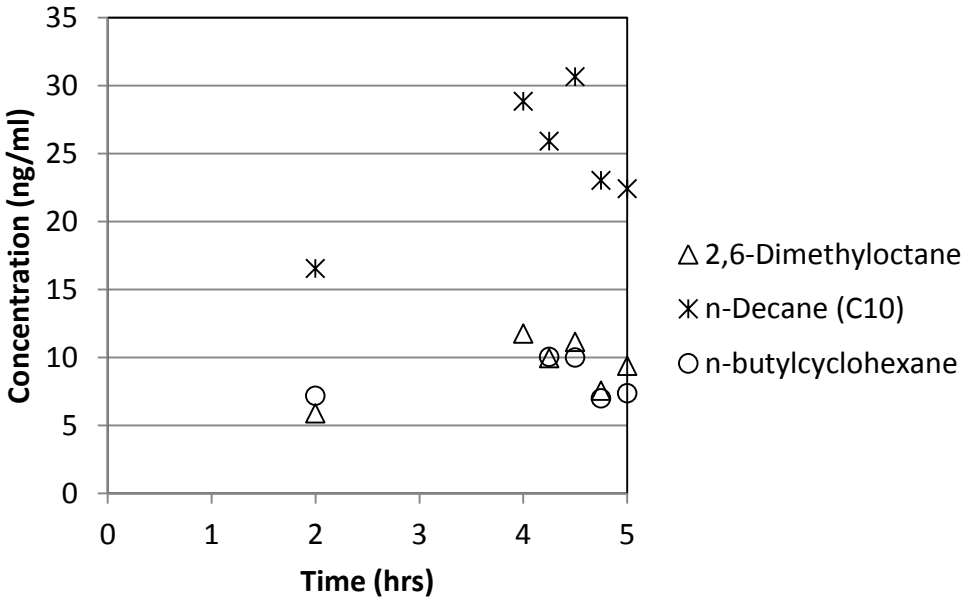
[a]Naphthalene, cyclohexylbenzene, and n-tetradecane were excluded due to frequent analytical difficulties, likely due to poor purging. N = 18 pooled samples per sex (6 per sex per concentration, 3 exposure concentrations).
[b]Reliability based on frequency of findings in control ("blank") blood and tissues.

Table 11. Time course of six analytes in cochleae (composite samples) of female rats exposed to high concentrations of JP-8 for 4 hrs

	Concentration in µg/L (ng/g)					
Time (hr)	n-Octane	2-Methyl-octane	2,6-Dimethyl-octane	n-Decane	p-Ethyl-toluene	n-Butylcyclo-hexane
2	5.80	6.65	5.89	16.5	Not detected	7.18
4	7.59	10.7	11.7	28.8	11.6	Not detected
4.25	5.83	9.75	9.94	25.9	11.8	10.0
4.5	7.18	8.01	11. 2	30.6	14.5	10.0
4.75	4.67	8.19	7.56	23.0	10.3	6.98
5	5.62	8.13	9.38	22.4	Not detected	7.37



(a)



(b)

Figure 1. Time course of six analytes in cochleae (composite samples) of female rats exposed to high concentrations of JP-8 for 4 hrs (a) n-octane, 2-methyloctane and p-ethyltoluene, (b) 2,6-dimethyloctane, n-decane, and n-butylcyclohexane.

Fat (Adipose Tissue)

As noted above (Table 3), acceptable instrument calibration could be achieved for measurement of only six analytes in fat (adipose tissue) samples. Methylcyclopentane, 2-methylhexane, and 2,5-dimethylhexane were not detected in any samples. No analytes were detected in any "blank" (control) sample. Because no analytes were detected in the fat samples from male rats exposed to the medium concentration of JP-8, the samples from the low concentration male rats were not analyzed. No analytes were detected in samples from the low concentration female rats. Detection frequencies for the three analytes detected in any fat sample are summarized in Table 12. Detection occurred much more frequently in samples from female rats than male rats. Time course data for toluene, n-octane, and 2-methylheptane concentration in female rat fat samples are summarized in Table 13 and Figure 2. Male rat data were too sparse to derive meaningful time course data. Individual animal data are reported in the Appendix (Tables A-24 to A-26).

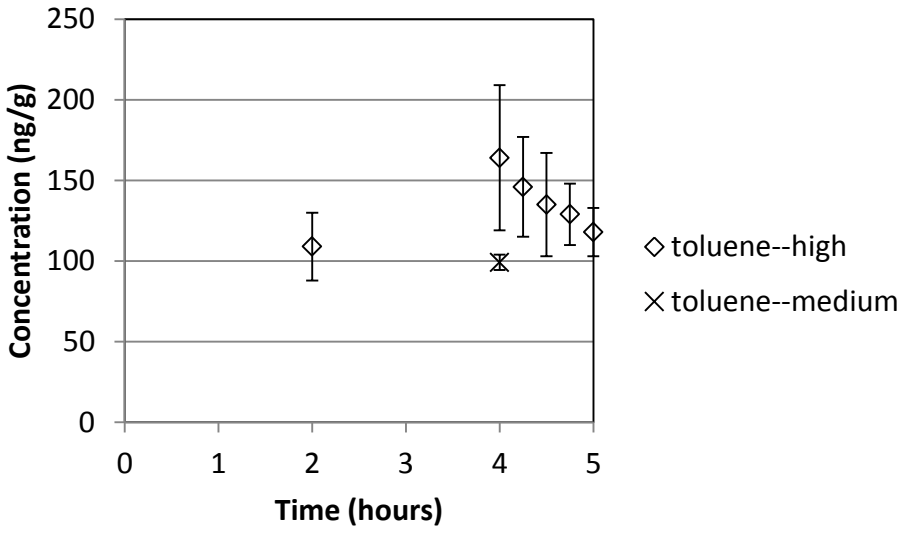
Table 12. Frequency of analyte identification in fat (adipose tissue) samples of JP-8 exposed rats

	Male Rats		Female Rats	
Analyte	Medium Concentration (n = 34)	High Concentration (n = 36)	Medium Concentration (n = 32)	High Concentration (n = 36)
2-Methylheptane	0	0	26	36
n-Octane	0	6	28	36
Toluene	0	2	11	35

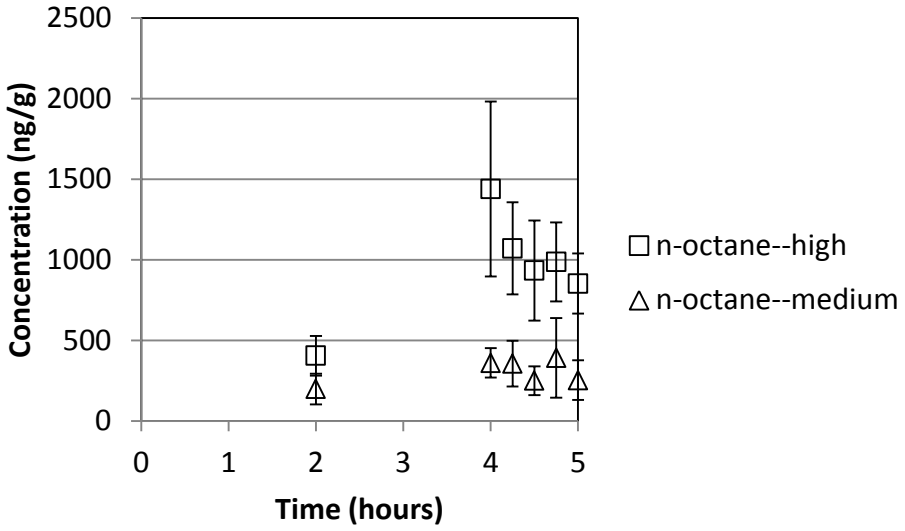
Table 13. Time course of three analytes in fat of female rats exposed to JP-8 for 4 hrs

Exposure Group	Time (hr)	Concentration in µg/L (ng/g)		
		Toluene	n-Octane	2-Methylheptane
Medium	2	--[a]	199 ± 95[b]	71.3 ± 69.1[b]
	4	99.2 ±4.8[b]	361 ± 91	224 ± 32.7
	4.25	--	356 ± 142	167 ± 42.5
	4.5	--	251 ± 89 [b]	120 ± 39.6 [b]
	4.75	--	392 ± 247[c]	203 ± 95.6[c]
	5	--	254 ± 124[c]	170 ± 54.9[c]
High	2	109 ± 21	405 ± 122	169 ± 64
	4	164 ± 45	1439 ± 543[d]	595 ± 249
	4.25	146 ± 31	1071 ± 286[d]	448 ± 114
	4.5	135 ± 32	933 ± 310[d]	383 ± 125
	4.75	129 ± 19	987 ± 245[d]	444 ± 191
	5	118 ± 15	853 ± 187[d]	323 ± 89

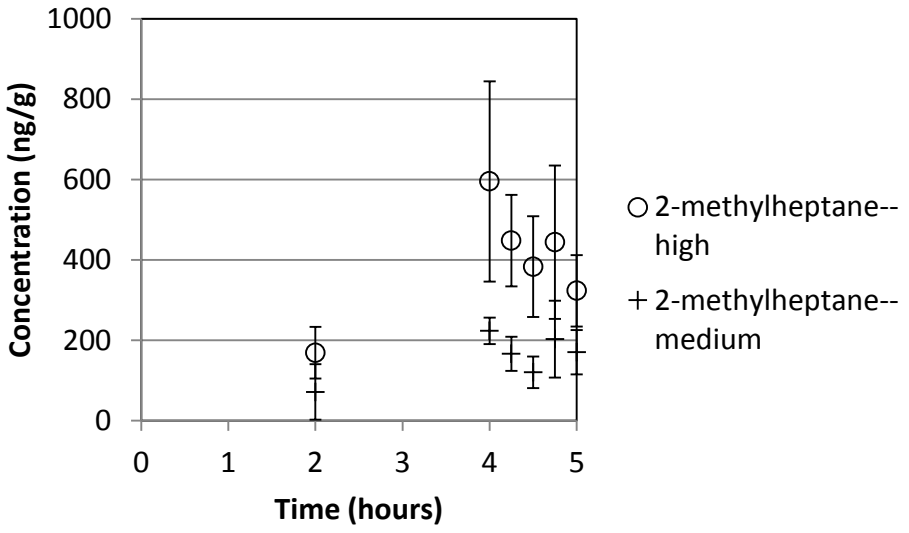
[a]Not computed if more than one sample was a non-detect. n = 6 unless otherwise noted.
[b]n = 5, with one sample below the limit of detection.
[c]n = 3, with one sample below the limit of detection, and 2 samples were lost.
[d]Estimate; n-octane concentration was above the range of the calibration curve.


250
200
150
100
50
0
Concentration (ng/g)
0
1
2
3
4
5
Time (hours)
toluene--high
toluene--medium

(a)


2500
2000
1500
1000
500
0
Concentration (ng/g)
0
1
2
3
4
5
Time (hours)
n-octane--high
n-octane--medium

(b)



(c)

Figure 2. Time course of three analytes in fat of female rats exposed to JP-8 for 4 hrs. (a) Toluene, (b) n-octane, (c) 2-methylheptane.

Data Evaluation and Interpretation

Detection of JP-8 Components in Male vs. Female Rat Blood and Tissues

While the reliably quantifiable data were too sparse to make direct comparisons between male and female rats with regard to concentrations of JP-8 components in blood and tissues, distinct differences were observed regarding the frequency of detection in male and female tissue samples. JP-8 components tended to be identified more frequently in the livers of male rats than female rats (Table 9). In contrast, the cochleae and fat of female rats were more likely to have detectable levels of JP-8 components than cochleae and fat of male rats (Table 10, Table 12).

Comparison of Experimental Data to Literature Data

Blood

As noted above ("Blood and Tissue Analysis—Blood and Tissue Analyte Concentrations"), few analytes were reliably detected and quantified in blood of exposed rats. Possible explanations for the lack of quantifiable levels of the target analytes include inadequate analytical sensitivity (i.e., levels in tissues were below the level of reliable quantitation) or losses due to collection and storage techniques. Each of these hypotheses is addressed below.

Martin et al. (2012) previously reported blood and tissue concentrations (n = 3) of n-octane, n-decane, n-tetradecane, ethylbenzene, m-xylene, and toluene in male F344 rats exposed to 900 mg/m^3 JP-8 by inhalation for 4 hours. As a screening estimate, projected blood and tissue con-

centrations at t = 4 hrs for the high concentration JP-8 exposures in the current study were estimated by assuming the blood and tissue concentrations would be roughly proportional to the exposure concentration in both studies (Table 14). Several researchers have conducted inhalation exposures to other single chemicals which are components of JP-8. By estimating the amounts of the target analytes in JP-8 exposure atmospheres, the single-chemical literature data was used to estimate blood concentrations of these analytes during JP-8 exposures (Table 15). In several cases, the estimated blood concentration of analyte is below or similar to the blood MDL. In three cases, however, the estimated blood analyte concentration is 3-fold higher (or more) than the MDL, but the analyte was not detected at all (n-octane), detected infrequently (toluene) or present at levels much lower than the estimated concentration (n-decane) (Table 14).

Table 14. Estimated and observed blood concentrations of n-octane, n-decane, n-tetradecane, ethylbenzene, m-xylene, and toluene in rats exposed to JP-8 by inhalation for 4 hrs

Analyte	Estimated Blood Concentration (µg/L)[a]	Method Detection Limit (MDL) (µg/L)	Current Observations
n-Octane	30.7	8.9	Detected in 0/12 4 hr samples
n-Decane	47.1	7.4	Detected in 1/16 blood blanks (8.26 µg/L). Detected in 5/6 male (9.72 ± 1.8 µg/L) and 5/6 female (16.4 ± 4.7 µg/L) 4 hr samples.
n-Tetradecane	82.0	No usable MDL due to suspected poor purging	Compound could not be reliably analyzed.
Ethylbenzene	18.5	9.8	Detected in 0/6 male and 1/6 female 4 hr samples.
m-Xylene	15.5	20.7 (m- and p-xylenes, combined)	m- and p-xylene (combined) detected in 1/6 male and 2/6 female 4 hr samples.
Toluene	24.2	7.8	Detected in 0/6 male and 1/6 female 4 hr samples.

[a]Estimated for high concentration JP-8 exposures via extrapolation from 4 hr male rat data of Martin et al. (2012), assuming proportionality between JP-8 exposure concentration and the analyte concentration in the blood.

Table 15. Estimated and observed blood concentrations of naphthalene, xylenes, trimethylbenzenes, 2-methylheptane, 2-methyloctane, and n-nonane in rats exposed to JP-8 by inhalation for 4 hrs.

Analyte	Estimated Blood Concentration (µg/L)[a]	Method Detection Limit (MDL) (µg/L)	Current Observations
Naphthalene	15.5[b]	8.2, however poor purging and/or contamination suspected	Detected in 3 of 16 blood blanks. Detected in 3/6 male and 4/6 female 4 hr samples.
p-Xylene	13.5[c]	20.7 (m- and p-xylenes, combined)	m- and p-xylene (combined) detected in 1/6 male and 2/6 female 4 hr samples.
m- and p-Xylene	29[d]	20.7	Detected in 1/6 male and 2/6 female 4 hr samples.
o-Xylene	9.0[e]	9.8	Detected in 0/6 male and 2/6 female 4 hr samples.
1,2,4-Trimethylbenzene	104[f]	No usable blood MDL due to suspected contamination	Samples from 4 hr JP-8 exposed rats do not differ statistically from blood collected from untreated rats.
1,3,5-Trimethylbenzene	14.2[g]	No usable MDL	Detected in 3/6 male and 5/6 female 4 hr samples.
2-Methylheptane	1.37[h]	9.9	Detected in 0/12 4 hr samples.
2-Methyloctane	2.80[i]	9.8	Detected in 0/12 4 hr samples.
n-Nonane	17.6[j]	7.8	Detected in 0/6 male and 1/6 female 4 hr samples.

[a]Estimated for high concentration JP-8 exposures via extrapolation from experimental data. Concentrations of the analyte in JP-8 were estimated as total JP-8 exposure concentration × lowest measured concentration in neat fuel (see Table 1). The most comparable single-chemical inhalation exposure data were used for comparison. Proportionality between the analyte exposure concentration and the analyte concentration in the blood was assumed for both studies.

[b]Based on average blood concentrations measured in male and female F344 rats at the end of 6 hrs of inhalation exposure to 10 ppm naphthalene (NTP, 2000).

[c]Based on average blood concentrations measured in male Sprague-Dawley rats at the end of 4 hrs of inhalation exposure to 208 mg/m^3 m-xylene (Carlsson, 1981).

[d]Sum of estimates for m-xylene (Table 14) and p-xylene.

[e]Based on average blood concentrations measured in male Sprague-Dawley rats at the end of 12 hrs of inhalation exposure to 100 ppm (434 mg/m^3) o-xylene (Zahlsen et al., 1992).

[f]Based on average blood concentrations measured in male Wistar rats after 4 hrs of inhalation exposure to 25 ppm (123 mg/m^3) 1,2,4-trimethylbenzene (Swiercz et al., 2002).

[g]Based on average blood concentrations measured in male Wistar rats after 6 hrs of inhalation exposure to 25 ppm (123 mg/m^3) 1,3,5-trimethylbenzene (Swiercz et al., 2006).

[h]Based on average blood concentrations measured in male Sprague-Dawley rats at the end of 12 hrs of inhalation exposure to 100 ppm (434 mg/m^3) 2-methylheptane (Zahlsen et al., 1993).

[i]Based on average blood concentrations measured in male Sprague-Dawley rats at the end of 12 hrs of inhalation exposure to 100 ppm (434 mg/m^3) 2-methyloctane (Zahlsen et al., 1993).

[j]Based on average blood n-nonane concentrations measured in male Sprague-Dawley rats at the end of 12 hrs of inhalation exposure to 25 ppm n-nonane, 25 ppm 1,2,4-trimethylbenzene, and 25 ppm 1,2,4-trimethylcyclohexane (Eide and Zahlsen, 1996).

Liver

JP-8 components were more frequently found in the liver tissues from male rats than female rats (Table 9). Estimates of concentrations of the analytes in livers of rats exposed to high concentrations of JP-8 (Table 16, Table 17) were frequently similar to the adjusted MDL. Based on the estimates, one would have expected 1,2,4-trimethylbenzene and n-nonane to have been consistently detected, but they were not.

Table 16. Estimated and observed liver concentrations of n-octane, n-decane, n-tetradecane, ethylbenzene, m-xylene, and toluene in rats exposed to JP-8 by inhalation for 4 hrs

Analyte	Estimated Liver Concentration (µg/L)[a]	Adjusted[b] Method Detection Limit (MDL) (µg/L)	Current Observations
n-Octane	4.49	6.94	Detected in 0/11 4 hr samples.
n-Decane	13.0	6.94	Detected in 4/6 male (one lost) and 0/5 female (1 lost) 4 hr samples.
n-Tetradecane	21.7	No usable MDL due to suspected poor purging	Compound could not be reliably analyzed.
Ethylbenzene	12.2	6.94	Detected in 0/11 4 hr samples.
m-Xylene	15.5	13.9 (m- and p-xylenes, combined)	m- and p-xylene (combined) detected in 1/6 male and 0/5 female 4 hr samples.
Toluene	20.9	6.94	Detected in 1/6 male and 0/5 female 4 hr samples.

[a]Estimated for high concentration JP-8 exposures via extrapolation from 4 hr male rat data of Martin et al. (2012), assuming proportionality between JP-8 exposure concentration and the analyte concentration in the liver.
[b]Adjusted for average liver calibration sample weight.

Table 17. Estimated and observed liver concentrations of xylenes, trimethylbenzenes, 2-methylheptane, 2-methyloctane, and n-nonane in rats exposed to JP-8 by inhalation for 4 hrs

Analyte	Estimated Liver Concentration (µg/L)[a]	Adjusted[b] Method Detection Limit (MDL) (µg/L)	Current Observations
p-Xylene	11.6	13.9 (m- and p-xylenes, combined)	m- and p-xylene (combined) detected in 1/6 male and 0/5 female 4 hr samples.
o-Xylene	13.4	6.94	Detected in 1/6 male and 0/5 female 4 hr samples.
1,2,4-Trimethylbenzene	63.3	6.94	Detected in 4/6 male and 0/5 female 4 hr samples.

Analyte	Estimated Liver Concentration (µg/L)[a]	Adjusted[b] Method Detection Limit (MDL) (µg/L)	Current Observations
1,3,5-Trimethylbenzene	13.2[g]	6.94	Detected in 2/6 male and 0/5 female 4 hr samples.
2-Methylheptane	4.74	6.94	Detected in 0/11 4 hr samples.
2-Methyloctane	15.6	6.94	Detected in 0/11 4 hr samples.
n-Nonane	57.2	6.94	Detected in 0/11 4 hr samples.

[a]Estimated using the same sources and in a manner analogous that described for blood in Table 15.
[b]Adjusted for average liver calibration sample weight.

Cochlea

Concentrations of JP-8 analytes in measured in cochleae were compared to literature values for JP-8 analytes in brain (Table 18, Table 19), on the assumption that partitioning characteristics of the analytes would be similar for these tissues. In general, JP-8 components were not consistently detected in cochleae of male rats (Table 10); a few components were consistently detected in cochleae of female rats, and concentration time courses could be determined (Table 11). In the instances where comparisons between estimated brain concentrations and observed female cochlea concentrations were possible, the values were within a factor of 3 of each other (Table 18, Table 19); however, compounds for which elevated levels might have been expected (e.g., n-nonane) were not consistently detected.

Table 18. Estimated brain and observed cochlea concentrations of n-octane, n-decane, n-tetradecane, ethylbenzene, m-xylene and toluene in rats exposed to JP-8 (high concentration) by inhalation for 4 hrs

Analyte	Estimated Brain Concentration (µg/L)[a]	Current 4-hr Observations in female Rats (µg/L)
n-Octane	16.0	7.59
n-Decane	25.5	28.8
n-Tetradecane	13.9	Analysis not reliable
Ethylbenzene	21.4	Not consistently detected throughout exposure
m-Xylene	52.3	Not consistently detected throughout exposure
Toluene	21.4	Not consistently detected throughout exposure

[a]Estimated for high concentration JP-8 exposures via extrapolation from 4 hr data of Martin et al. (2012), assuming proportionality between JP-8 exposure concentration and the analyte concentration in the brain.

Table 19. Estimated brain and observed cochlea concentrations of o-xylene, 1,2,4-trimethylbenzene, 2-methylheptane, 2-methyloctane, and n-nonane in rats exposed to JP-8 by inhalation for 4 hrs

Analyte	Estimated Brain Concentration (µg/L)[a]	Current 4-hr Observations in female Rats (µg/L)
o-Xylene	22.2	Not consistently detected throughout exposure
1,2,4-Trimethylbenzene	70.5	Not consistently detected throughout exposure
2-Methylheptane	8.87	Not consistently detected throughout exposure
2-Methyloctane	27.2	10.7
n-Nonane	166	Not consistently detected throughout exposure

[a]Estimated using the same sources and in a manner analogous that described for blood in Table 15.

Fat

Fat samples from JP-8 exposed rats were analyzed for only six potential fuel components due to analytical obstacles. Of the three analytes that were detected in fat from JP-8 exposed rats, it was possible to make predictions of all three of these compounds based on experimental data collected in male rats (Table 20, Table 21). The n-octane levels measured in female rats in the current study were similar to the predicted n-octane fat concentrations estimated from a previous study with male rats. Toluene, while consistently quantifiable in samples from female (but not male) rats, was present only at levels well below what would be expected based on the previous findings of Martin et al. (2012). Levels of 2-methylheptane measured in the fat of female rats were substantially higher than the predicted level, but the levels in male rats (detected in 1/6 samples) were likely consistent with the previous data (Zahlsen et al., 1993).

Table 20. Estimated and observed fat (adipose) tissue concentrations of n-octane and toluene in rats exposed to JP-8 by inhalation for 4 hrs

Analyte	Estimated Fat Concentration (µg/L)[a]	Adjusted[b] Method Detection Limit (MDL) (µg/L)	Current Observations
n-Octane	1389	88.9	1439 ± 543 µg/L (female), detected in 1/6 male 4 hr samples
Toluene	1464	88.9	164 ± 45 µg/L (female), detected in 1/6 male 4 hr samples

[a]Estimated for high concentration JP-8 exposures via extrapolation from 4 hr male rat data of Martin et al. (2012), assuming proportionality between JP-8 exposure concentration and the analyte concentration in the fat.
[b]Adjusted for average fat calibration sample weight.

Table 21. Estimated and observed fat (adipose tissue) concentrations of 2-methylheptane in rats exposed to JP-8 by inhalation for 4 hrs

Analyte	Estimated Fat Concentration (µg/L)[a]	Adjusted[b] Method Detection Limit (MDL) (µg/L)	Current Observations
2-Methylheptane	77.6	88.9	595 ±249 µg/L (female), detected in 1/6 male 4 hr samples

[a]Estimated using the same source and in a manner analogous that described for blood in Table 15, footnote h.
[b]Adjusted for average fat calibration sample weight.

Hydrocarbons in the rat blood collected in this study may have been lost during collection, storage, and thawing (migrated into plastics). In this study, blood was collected using plastic syringes, stored for over a year in plastic vials, and thawed in plastic vials prior to analysis. In contrast, for their kinetic studies of 1,2,4-trimethylbenzene, n-nonane, and 1,2,4-trimethylcyclohexane, Zahlsen et al. (1990) used the following procedures: blood was collected (after decapitation) into heparinized glass tubes, through a heparinized glass funnel. The blood was rapidly transferred to a headspace vial and closed by a screw cap with a Teflon-faced neoprene septum. Brain homogenate was also stored in glass headspace vials and perirenal fat was stored in stoppered glass tubes. Samples were stored at -20ºC and analyzed within 14 days. While the authors do not state that these precautions were undertaken to prevent collection and storage losses of these hydrocarbons, such a conclusion follows logically from the extensive detail and use of chemically-resistant materials. Significant retention of pesticides with log Kow ≥ 1.7 by centrifugal ultrafiltration units (filtration membrane and housing) has previously been noted by researchers (Tremblay et al., 2012).

CONCLUSIONS

A toxicokinetic study was conducted where male and female F344 rats were exposed by inhalation to JP-8 for up to 4 hrs, with blood and tissue collection after 2 hrs of exposure; at the conclusion of 4 hrs of exposure; and at 15, 30, 45, and 60 minutes after the conclusion of 4 hrs of exposure. The blood and tissue collection and freezing was completed rapidly upon cessation of exposure, typically within 7 minutes (Table 5, Table 6).

Blood and tissue (liver, adipose, and pooled cochleae) samples were analyzed for 25 JP-8 components using GC/MS with sample introduction via headspace autosampling with SPME preconcentration. Two analytes, m- and p-xylene, could not be distinguished from each other by retention time or quantitation ion and therefore were analyzed and calibrated together (Table 2). The three analytes with the longest retention times exhibited unacceptable variability in recoveries, likely due to inconsistent purging, and thus could not be reliability detected nor quantified on the available equipment. Acceptable calibration for fat samples could only be achieved for six analytes, due to samples size variability and partitioning characteristics. Ten of the remaining 21 analytes were identified in at least one control tissue or blood sample (Table 8). 1,2,4-Trimethylbenzene, or a co-eluting compound, was identified in all 16 analyses of control blood but none of the 22 control tissue samples, suggesting migration of a contaminant from the plastic collection syringe or storage tubes. Therefore detection of 1,2,4-trimethylbenzene could reliably

be attributed to JP-8 exposure when identified in tissues, but not in blood. n-Decane and 4-methyldecane were each identified in 2 of 38 control samples, introducing uncertainty as to the validity of their detection and low-level quantitation in samples from JP-8 exposed rats.

No analytes had sufficient frequency of reliable detection and quantitation in blood of JP-8 exposed rats to generate a full time course estimate of blood concentrations. Comparison to literature data indicated that in several cases, anticipated blood levels of analytes were similar to or less than the limits of detection. Failure to detect analytes expected to be present above the detection limit in blood may be due to loss of analytes into collection and storage materials that were not sufficiently chemical resistant. In general, similar considerations apply to the analysis of the liver, fat, and cochlea. No analytes had sufficient frequency of reliable detection and quantitation in livers of JP-8 exposed rats to yield time course data, but a trend of more frequent detection of several analytes in livers of male (vs. female) rats was noted (Table 9). The reverse situation was identified in cochleae and fat, with more frequent analyte detection in tissues of female rats than male rats (Table 10, Table 12).

Detection frequency was sufficient to allow quantitation of the time course of six analytes in the cochleae and of three analytes in the fat of female rats (Table 11, Table 13). Comparisons to estimates derived from male rat data available in the literature were inconsistent. In some instances, there was agreement between the current data and the literature, but in others, the measured female values were substantially higher or less than the male rat values in the literature. It is unclear whether the discrepancies (between current data and the literature) were due to sex/strain difference, invalid assumptions (e.g., JP-8 composition, linear relationship between exposure concentration and tissue concentration), or differences in sample preparation and analysis. The presence of deicer (diEGME) is unlikely have had an impact on metabolism of JP-8 components; while diEGME administration can induce cytochrome P-450, the induction in male Wistar rats, repeated administration of high doses (2000 mg/kg/day) for 20 days increases hepatic content of cytochrome P-450 by less than 10 percent (Kawamoto et al., 1990). While the identity of the static and corrosion inhibitors is unknown, they are also likely to be present only at low levels that would have a minimal impact on metabolism. Even the foregoing uncertainties, however, cannot explain the observed sex-related differences in detection frequency within the current study.

In conclusion, a study of the inhalation toxicokinetics of JP-8 in male and female F344 rats was conducted, and while tissues and blood were collected and stored rapidly, the amount of data useful for time course determination from this study was limited. Explanations for the paucity of data useable for pharmacokinetic modeling included the likelihood that many analytes were below the level of quantitation, contamination or storage losses, and possible strain and sex differences compared to previous studies. Some apparent sex differences in the frequency with which analytes were detected were observed, but differences in tissue sample size may have contributed to analyte identification just above the limits of detection. Despite analytical and methodological difficulties, these findings are consistent with prior observations by Fechter et al. (2012) suggesting that sex-related differences in JP-8 disposition could be a factor in in JP-8 inducted ototoxicity.

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APPENDIX

Table A-1. Individual animal body weight, exposure, and biosample collection data—Low exposure group

Animal #	Body weight (g)	Exposure conc. (mg/m^3)	Exposure start time (hhmm)	Exposure end time (hhmm)	Decap time (hhmm)	Liquid nitrogen (LN) time (hhmm)	Exposure duration (hr)	Decap time-exposure end (min)	LN time-decap (min)	total LN time-exposure end (min)	Notes
1	235.7	204.9557	805	1005	1009	1015	2	4	6	10	
2	139.2	204.1279	810	1010	1013	1017	2	3	4	7	a
3	209	202.9751	815	1015	1018	1022	2	3	4	7	
4	140	202.0495	820	1020	1023	1028	2	3	5	8	
5	212	202.7026	825	1025	1028	1032	2	3	4	7	
6	140	202.017	830	1030	1033	1038	2	3	5	8	
7	202	202.1515	835	1035	1037	1042	2	2	5	7	b
8	141	201.2176	841	1041	1045	1049	2	4	4	8	c
9	210	201.7179	845	1045	1049	1053	2	4	4	8	
10	141	202.3057	852	1052	1055	1058	2	3	3	6	d
11	246	201.8683	855	1055	1058	1103	2	3	5	8	
12	139	201.2589	900	1100	1103	1106	2	3	3	6	
13	213	204.1284	804	1204	1207	1212	4	3	5	8	
14	144.7	203.1894	819	1219	1221	1224	4	2	3	5	
15	219	203.3251	815	1215	1217	1220	4	2	3	5	
16	149	203.0562	820	1220	1222	1225	4	2	3	5	
17	226	203.1088	825	1225	1227	1231	4	2	4	6	
18	143	202.7447	830	1230	1232	1236	4	2	4	6	
19	225	202.495	835	1235	1237	1242	4	2	5	7	
20	137	202.6697	840	1240	1242	1247	4	2	5	7	
21	225	201.9693	845	1245	1247	1252	4	2	5	7	
22	141	202.3089	850	1250	1253	1256	4	3	3	6	
23	221	201.5801	855	1255	1258	1302	4	3	4	7	
24	149	201.8632	900	1300	1303	1306	4	3	3	6	
25	232	201.3441	905	1305	1324	1328	4	19	4	23	

Animal #	Body weight (g)	Exposure conc. (mg/m^3)	Exposure start time (hhmm)	Exposure end time (hhmm)	Decap time (hhmm)	Liquid nitrogen (LN) time (hhmm)	Exposure duration (hr)	Decap time-exposure end (min)	LN time-decap (min)	total LN time-exposure end (min)	Notes
26	143	201.1782	910	1310	1328	1331	4	18	3	21	
27	222	201.1693	915	1315	1332	1336	4	17	4	21	
28	137	200.8195	920	1320	1337	1342	4	17	5	22	
29	204	201.0132	925	1325	1342	1345	4	17	3	20	
30	151	200.6663	930	1330	1347	1351	4	17	4	21	
31	222	200.5916	935	1335	1352	1356	4	17	4	21	
32	139	200.7811	940	1340	1358	1401	4	18	3	21	
33	221	201.118	945	1345	1402	1407	4	17	5	22	
34	136	201.3407	952	1352	1409	1413	4	17	4	21	
35	236	201.1467	957	1355	1415	1419	4	20	4	24	
36	143	201.7151	1000	1400	1414	1417	4	14	3	17	
37	203	202.2605	1005	1405	1437	1443	4	32	6	38	
38	150	202.0286	1010	1410	1443	1446	4	33	3	36	
39	233	202.3551	1015	1415	1447	1451	4	32	4	36	
40	142	202.8372	1020	1420	1453	1457	4	33	4	37	e
41	206	202.6607	1025	1425	1458	1502	4	33	4	37	
42	153	202.576	1030	1430	1503	1507	4	33	4	37	f
43	223	202.1195	1035	1435	1508	1512	4	33	4	37	
44	142	202.4982	1040	1440	1512	1516	4	32	4	36	
45	213	201.9918	1045	1445	1518	1521	4	33	3	36	
46	143	201.8578	1050	1450	1523	1526	4	33	3	36	
47	207	201.6115	1055	1455	1527	1531	4	32	4	36	
48	142	201.9241	1100	1500	1533	1537	4	33	4	37	g
49	218	201.3735	1105	1505	1552	1556	4	47	4	51	
50	147	201.9184	1110	1510	1557	1602	4	47	5	52	h
51	213	201.4743	1115	1515	1602	1607	4	47	5	52	
52	147	201.5991	1120	1520	1607	1611	4	47	4	51	
53	213	201.8237	1125	1525	1612	1615	4	47	3	50	

Animal #	Body weight (g)	Exposure conc. (mg/m^3)	Exposure start time (hhmm)	Exposure end time (hhmm)	Decap time (hhmm)	Liquid nitrogen (LN) time (hhmm)	Exposure duration (hr)	Decap time-exposure end (min)	LN time-decap (min)	total LN time-exposure end (min)	Notes
54	148	201.7872	1130	1530	1617	1620	4	47	3	50	i
143	213	201.7767	1135	1535	1622	1625	4	47	3	50	
56	146	202.011	1140	1540	1627	1630	4	47	3	50	
57	233	201.7852	1145	1545	1633	1637	4	48	4	52	
58	146	202.0078	1150	1550	1638	1641	4	48	3	51	
59	215	201.9213	1155	1555	1642	1646	4	47	4	51	
60	135	201.6924	1200	1600	1648	1650	4	48	2	50	
61	data missing	201.667	1205	1605	1708	1713	4	63	5	68	
62	data missing	201.766	1210	1610	1712	1716	4	62	4	66	
63	data missing	202.1908	1215	1615	1717	1720	4	62	3	65	
64	data missing	202.0973	1220	1620	1722	1725	4	62	3	65	
65	data missing	202.3275	1225	1625	1728	1732	4	63	4	67	
66	data missing	202.6151	1230	1630	1732	1735	4	62	3	65	
67	data missing	202.8868	1235	1635	1738	1742	4	63	4	67	
68	data missing	202.8615	1240	1640	1742	1746	4	62	4	66	
69	data missing	203.4597	1245	1645	1747	1751	4	62	4	66	
70	data missing	203.3106	1250	1650	1752	1756	4	62	4	66	
71	data missing	203.1698	1255	1655	1758	1801	4	63	3	66	
72	data missing	200.5839	1300	1700	1802	1804	4	62	2	64	

Odd numbered rats were males, even numbered rats were females
[a]Air pulled into syringe during difficult blood draw.
[b]1025-1025, tail pulled out/twisted
[c]1001-1002 tail pulled out/twisted
[d]0940-0942 turned around
[e]Twisted; off at 1053 on 1053
[f]45s late
[g]15s late
[h]Turned around: off 1211 on 1211
[i]Twisted up/tail pulled out: off 1213 on 1213

Table A-2. Individual animal body weight, exposure, and biosample collection data—Medium exposure group

Animal #	Body weight (g)	Exposure conc. (mg/m^3)	Exposure start time (hhmm)	Exposure end time (hhmm)	Decap time (hhmm)	LN time (hhmm)	Exposure duration (hr)	Decap time-exposure end (min)	LN time-decap (min)	total LN time-exposure end (min)
73	231	755.4917	932	1131	1134	1137	2	3	3	6
74	147	757.3485	936	1135	1137	1140	2	2	3	5
75	233	758.6974	939	1139	1142	1145	2	3	3	6
76	141	760.2699	943	1143	1147	1150	2	4	3	7
77	216	760.9857	947	1147	1150	1154	2	3	4	7
78	148	762.1925	951	1151	1155	1158	2	4	3	7
79	240	763.6879	955	1155	1157	1200	2	2	3	5
80	152	764.7045	959	1159	1202	1205	2	3	3	6
81	213	765.4924	1003	1203	1206	1209	2	3	3	6
82	144	765.6608	1007	1207	1211	1213	2	4	2	6
84	145	765.3897	1011	1211	1215	1219	2	4	4	8
85	223	758.5664	932	1332	1335	1338	4	3	3	6
86	136	758.6975	936	1335	1338	1340	4	3	2	5
87	223	758.6637	939	1339	1342	1345	4	3	3	6
88	144	758.602	943	1343	1346	1348	4	3	2	5
89	216	758.4087	947	1347	1349	1353	4	2	4	6
90	137	758.2601	951	1351	1354	1356	4	3	2	5
91	213	758.3145	955	1355	1358	1401	4	3	3	6
92	153	758.5291	959	1359	1401	1404	4	2	3	5
93	237	758.9098	1003	1403	1406	1409	4	3	3	6
94	142	759.5897	1007	1407	1410	1412	4	3	2	5
95	214	760.4252	1011	1411	1414	1418	4	3	4	7
96	138	761.2345	1015	1415	1417	1420	4	2	3	5
97	224	761.9494	1019	1419	1437	1439	4	18	2	20
98	142	762.6083	1023	1423	1440	1444	4	17	4	21
99	207	763.0547	1027	1427	1444	1447	4	17	3	20
100	137	763.3191	1031	1431	1449	1451	4	18	2	20

Animal #	Body weight (g)	Exposure conc. (mg/m^3)	Exposure start time (hhmm)	Exposure end time (hhmm)	Decap time (hhmm)	LN time (hhmm)	Exposure duration (hr)	Decap time-exposure end (min)	LN time-decap (min)	total LN time-exposure end (min)
101	218	763.1348	1035	1435	1452	1455	4	17	3	20
102	141	762.9517	1039	1439	1456	1459	4	17	3	20
103	224	762.3671	1043	1443	1500	1504	4	17	4	21
104	148	761.6682	1047	1447	1504	1506	4	17	2	19
105	211	761.2481	1051	1451	1508	1510	4	17	2	19
106	136	760.8229	1055	1455	1512	1515	4	17	3	20
107	208	760.4469	1059	1459	1516	1519	4	17	3	20
108	146	760.2839	1103	1503	1520	1522	4	17	2	19
109	202	760.2079	1107	1507	1540	1543	4	33	3	36
110	144	760.296	1111	1511	1543	1546	4	32	3	35
111	206	760.331	1115	1515	1547	1551	4	32	4	36
112	141	760.4663	1119	1519	1551	1554	4	32	3	35
113	218	760.4456	1123	1523	1555	1558	4	32	3	35
114	146	760.2128	1127	1527	1600	1602	4	33	2	35
115	201	759.9668	1131	1531	1602	1605	4	31	3	34
116	140	759.7847	1135	1535	1608	1611	4	33	3	36
117	214	759.6781	1139	1539	1611	1614	4	32	3	35
118	145	759.8258	1143	1543	1616	1619	4	33	3	36
119	220	760.1583	1147	1547	1620	1624	4	33	4	37
120	140	760.3994	1151	1551	1623	1626	4	32	3	35
121	228	760.6803	1155	1555	1643	1647	4	48	4	52
122	131	761.0554	1159	1559	1646	1649	4	47	3	50
123	240	761.2344	1203	1603	1650	1654	4	47	4	51
124	140	761.2229	1207	1607	1655	1658	4	48	3	51
125	227	760.9407	1211	1611	1657	1701	4	46	4	50
126	140	760.4807	1215	1615	1702	1705	4	47	3	50
127	213	759.9128	1219	1619	1706	1710	4	47	4	51
128	144	759.3863	1223	1623	1711	1714	4	48	3	51

Animal #	Body weight (g)	Exposure conc. (mg/m^3)	Exposure start time (hhmm)	Exposure end time (hhmm)	Decap time (hhmm)	LN time (hhmm)	Exposure duration (hr)	Decap time-exposure end (min)	LN time-decap (min)	total LN time-exposure end (min)
129	222	758.8439	1227	1627	1714	1718	4	47	4	51
130	153	758.2318	1231	1631	1718	1722	4	47	4	51
131	195	757.6473	1235	1635	1723	1726	4	48	3	51
132	154	757.2961	1239	1639	1727	1729	4	48	2	50
133	227	757.0696	1243	1643	1745	1748	4	62	3	65
134	136	757.0762	1247	1647	1749	1752	4	62	3	65
135	223	757.2694	1251	1651	1753	1757	4	62	4	66
136	141	757.2703	1255	1655	1758	1801	4	63	3	66
137	210.1	761.4812	1333	1733	1836	1839	4	63	3	66
138	143	762.0182	1337	1737	1839	1842	4	62	3	65
139	215	762.4394	1341	1741	1843	1846	4	62	3	65
140	138	762.8213	1345	1745	1847	1849	4	62	2	64
141	223	763.1559	1349	1749	1851	1855	4	62	4	66
142	141	763.3928	1353	1753	1855	1858	4	62	3	65
144	134	763.691	1357	1757	1859	1901	4	62	2	64

Table A-3. Individual animal body weight, exposure, and biosample collection data—High exposure group

Animal #	Body weight (g)	Exposure conc. (mg/m^3)	Exposure start time (hhmm)	Exposure end time (hhmm)	Decap time (hhmm)	LN time (hhmm)	Exposure duration (hr)	Decap time-exposure end (min)	LN time-decap (min)	Total LN-exposure end (min)	Notes
145	210	1556.31	800	1000	1002	1005	2	2	3	5	
146	147	1555.31	805	1005	1007	1011	2	2.00	4	6	
147	224	1554.19	810	1010	1012	1016	2	2	4	6	
148	141	1552.84	815	1015	1017	1021	2	2	4	6	
149	216	1550.52	820	1020	1022	1025	2	2	3	5	
150	149	1547.13	825	1025	1028	1031	2	3	3	6	
151	209	1544.46	830	1030	1033	1036	2	3	3	6	
152	148	1541.74	835	1035	1037	1040	2	2	3	5	
83	230	1539.59	840	1040	1042	1046	2	2	4	6	
154	131	1539.08	845	1045	1047	1049	2	2	2	4	
155	206	1538.75	810	1010	1013	1016	2	3	3	6	a
156	139	1539.09	855	1055	1057	1100	2	2	3	5	
157	213	1529.72	800	1200	1203	1206	4	3	3	6	
158	148	1528.52	805	1205	1207	1210	4	2	3	5	
159	198	1528.07	820	1220	1223	1225	4	3	2	5	a
160	144	1528.04	815	1215	1218	1220	4	3	2	5	a
161	218	1528.11	830	1230	1232	1236	4	2	4	6	a
162	147	1527.93	825	1225	1228	1231	4	3	3	6	a
163	220	1527.54	840	1240	1242	1245	4	2	3	5	a
164	131	1526.55	835	1235	1238	1241	4	3	3	6	a
165	238	1524.74	850	1250	1253	1256	4	3	3	6	a
166	138	1522.79	845	1245	1249	1251	4	4	2	6	a
167	211	1520.63	850	1250	1254	1257	4	4	3	7	a
168	147	1518.49	855	1255	1258	1302	4	3	4	7	
169	215	1519.06	900	1300	1317	1319	4	17	2	19	
170	144	1518.69	905	1308	1325	1327	4	17	2	19	b
171	215	1518.53	910	1310	1327	1330	4	17	3	20	

Animal #	Body weight (g)	Exposure conc. (mg/m^3)	Exposure start time (hhmm)	Exposure end time (hhmm)	Decap time (hhmm)	LN time (hhmm)	Exposure duration (hr)	Decap time-exposure end (min)	LN time-decap (min)	Total LN-exposure end (min)	Notes
172	137	1518.43	915	1315	1332	1336	4	17	4	21	
173	234	1518.13	920	1320	1337	1341	4	17	4	21	
174	134	1517.69	925	1325	1342	1345	4	17	3	20	
175	230	1517.22	930	1330	1347	1350	4	17	3	20	
176	144	1517.04	935	1335	1351	1354	4	16	3	19	
177	222	1516.78	940	1340	1356	1400	4	16	4	20	c
178	146	1516.61	945	1345	1402	1404	4	17	2	19	
179	221	1516.91	950	1350	1407	1410	4	17	3	20	
180	149	1516.90	955	1355	1412	1415	4	17	3	20	
181	226	1516.34	1000	1400	1432	1435	4	32	3	35	
182	151	1515.86	1005	1409	1441	1444	4	32	3	35	d
183	206	1515.16	1010	1410	1443	1447	4	33	4	37	
184	147	1514.49	1015	1415	1447	1450	4	32	3	35	
185	233	1513.40	1020	1420	1452	1455	4	32	3	35	
186	132	1512.12	1025	1425	1457	1500	4	32	3	35	
187	238	1511.22	1030	1430	1501	1505	4	31	4	35	
188	144	1511.03	1035	1435	1507	1509	4	32	2	34	
189	221	1511.65	1040	1440	1512	1516	4	32	4	36	
190	146	1512.64	1045	1445	1517	1519	4	32	2	34	
191	227	1513.84	1050	1450	1521	1525	4	31	4	35	
192	144	1515.60	1055	1455	1526	1529	4	31	3	34	
193	207	1517.21	1100	1500	1549	1553	4	49	4	53	
194	145	1518.40	1105	1505	1553	1557	4	48	4	52	
195	226	1518.55	1110	1510	1556	1600	4	46	4	50	e
196	151	1518.03	1115	1515	1602	1604	4	47	2	49	
197	187	1517.12	1120	1520	1608	1611	4	48	3	51	
198	146	1515.99	1125	1525	1612	1614	4	47	2	49	
199	210	1514.98	1130	1530	1617	1621	4	47	4	51	

Animal #	Body weight (g)	Exposure conc. (mg/m^3)	Exposure start time (hhmm)	Exposure end time (hhmm)	Decap time (hhmm)	LN time (hhmm)	Exposure duration (hr)	Decap time-exposure end (min)	LN time-decap (min)	Total LN-exposure end (min)	Notes
200	147	1514.12	1135	1535	1622	1626	4	47	4	51	
201	192	1513.47	1140	1540	1627	1630	4	47	3	50	
202	144	1513.02	1145	1545	1632	1634	4	47	2	49	
203	227	1513.38	1150	1550	1637	1640	4	47	3	50	
204	148	1514.59	1155	1555	1642	1644	4	47	2	49	
205	236	1515.87	1200	1600	1702	1706	4	62	4	66	
206	138	1517.31	1205	1605	1707	1710	4	62	3	65	
207	233	1519.09	1210	1610	1712	1716	4	62	4	66	
208	139	1520.47	1215	1615	1717	1721	4	62	4	66	
209	213	1520.86	1220	1620	1722	1725	4	62	3	65	
210	140	1520.32	1225	1625	17??	1729	4	Unknown	Unknown	64	f
211	213	1519.51	1230	1630	1732	1736	4	62	4	66	
212	132	1518.68	1235	1635	1737	1739	4	62	2	64	
213	212	1517.99	1240	1640	1742	1746	4	62	4	66	
214	146	1517.65	1245	1645	1747	1749	4	62	2	64	
215	225	1517.36	1250	1650	1752	1757	4	62	5	67	
216	146	1516.72	1255	1655	1757	1800	4	62	3	65	

[a]Out of order
[b]Off at 11:40 back on at 11:43
[c]Air pulled into syringe during difficult blood draw.
[d]Off at 10:28 back on at 10:32
[e]Did not highlight fat
[f]Decap not recorded

Table A-4. Individual animal paired cochlea weights

Animal #	Cochlea Weight (g)	Animal #	Cochlea Weight (g)
Low/2 hour/Immediate			
1	0.0455	2	0.0550
3	0.2085[a]	4	0.0592
5	0.1117	6	0.1333[a]
7	0.0557	8	0.1568[a]
9	0.0261	10	0.0761
11	0.0262	12	0.1402
Group total	0.4737	Group total	0.6206
Group crushed	0.4531	Group crushed	0.6030
Low/4 hour/Immediate			
13	0.1078	14	0.1603
15	0.0426	16	0.0282
17	0.0483	18	0.0989
19	0.1694[a]	20	0.1841[a]
21	0.0626	22	0.1234
23	0.0895	24	0.1078
Group total	0.5202	Group total	0.7027
Group crushed	0.5013	Group crushed	0.6697
Low/4 hour/15 min delay			
25	0.0451	26	0.1251
27	0.0910	28	0.1187
29	0.1229	30	0.0698
31	0.1036	32	0.1181[a]
33	0.0792	34	0.1337
35	0.1052	36	0.0593
Group total	0.547	Group total	0.6247
Group crushed	0.5195	Group crushed	0.6047
Low/4 hour/30 min delay			
37	0.1898[a]	38	0.1589
39	0.0595	40	0.1631[a]
41	0.0394	42	0.098
43	0.1194	44	0.1798[a]
45	0.1096	46	0.0949
47	0.101	48	0.117
Group total	0.6187	Group total	0.8117
Group crushed	0.5867	Group crushed	0.7806
Low/4 hour/45min delay			
49	0.1696	50	0.1108
51	0.2087[a]	52	0.1912
53	0.0328	54	0.1454

Animal #	Cochlea Weight (g)	Animal #	Cochlea Weight (g)
143	0.0870	56	0.2027[a]
57	0.1142	58	0.0595
59	0.1194	60	0.0965
Group total	0.7317	Group total	0.8061
Group crushed	0.7151	Group crushed	0.7911
Low/4 hour/60min delay			
61	0.2207	62	0.1789
63	0.0657	64	0.1657
65	0.0577	66	0.1283
67	0.1548	68	0.1571
69	0.1242	70	0.1772[a]
71	0.1185	72	0.1185
Group total	0.7416	Group total	0.9257
Group crushed	0.7203	Group crushed	0.9119

[a]Extra tissue was present; these individual animal cochlea weights were excluded from computation of group average factional tissue weight (Table 7).

Table A-5. Unadjusted measurements of JP-8 components[a] in blood of rats exposed to JP-8 for 4 hrs: high concentration group, part 1

						Unadjusted analyte concentration in ng/ml (Bottom of curve/MDL in ng/ml)			
Animal #	Dose group	Volume of blood (ml)	Toluene-d_8 Test Value (ng/ml)	Toluene-d_8 Measured Value (ng/ml)	Toluene-d_8 Recovery (%)	n-Nonane 50/7.8	2,6-Di-methyl-octane 50/8.3	Toluene 10/7.8	o-Xylene 10/9.8
145	High/2 hour/Immediate	0.6	83.3	134.28	161.2	--[b]	--	--	--
146	High/2 hour/Immediate	1	50	88.29	176.6	--	--	--	--
147	High/2 hour/Immediate	1	50	66.51	133.0	--	--	--	--
148	High/2 hour/Immediate	1	50	59.44	118.9	--	--	--	--
149	High/2 hour/Immediate	1	50	71.3	142.6	--	--	--	10.12
150	High/2 hour/Immediate	1	50	97.12	194.2	11.47	--	18.76	32.25
151	High/2 hour/Immediate	0.5	100	190.78	190.8	--	--	8.16	14.86
152	High/2 hour/Immediate	1	50	63.49	127.0	--	--	--	--
83	High/2 hour/Immediate	1	50	68.27	136.5	--	--	--	--
154	High/2 hour/Immediate	0.8	62.5	83.35	133.4	--	--	--	--
155	High/2 hour/Immediate	1	50	58.72	117.4	--	--	--	--
156	High/2 hour/Immediate	1	50	76.6	153.2	--	--	--	--
157	High/4 hour/Immediate	1	50	57.58	115.2	--	--	--	--
158	High/4 hour/Immediate	1	50	64.94	129.9	--	--	--	--
159	High/4 hour/Immediate	0.8	62.5	67.86	108.6	--	--	--	--
160	High/4 hour/Immediate	1	50	106.89	213.8	--	--	10.45	18.81
161	High/4 hour/Immediate	1	50	51.65	103.3	--	--	--	--
162	High/4 hour/Immediate	0.8	62.5	62.14	99.4	--	--	--	--
163	High/4 hour/Immediate	1	50	62.32	124.6	--	--	--	--
164	High/4 hour/Immediate	1	50	82.42	164.8	--	--	--	--
165	High/4 hour/Immediate	1	50	117.83	235.7	--	--	--	--
166	High/4 hour/Immediate	0.8	62.5	85.61	137.0	--	11.01	--	9.88
167	High/4 hour/Immediate	0.8	62.5	53.81	86.1	--	--	--	--
168	High/4 hour/Immediate	0.8	62.5	103.65	165.8	12.35	--	--	--
169	High/4 hour/15 min. delay	1	50	71.63	143.3	--	--	--	--
170	High/4 hour/15 min. delay	1	50	41.79	83.6	--	--	--	--
171	High/4 hour/15 min. delay	1	50	54.23	108.5	--	--	--	--
172[c]	High/4 hour/15 min. delay	0.8	62.5	80.8	129.3	--	--	--	--
172	High/4 hour/15 min. delay rerun	0.8	125	104.57	83.7	--	--	--	--
173[c]	High/4 hour/15 min. delay	0.7	71.4	93.39	130.8	--	--	15.24	23.39
173	High/4 hour/15 min. delay rerun	0.8	125	128.83	103.1	--	--	--	--
174[c]	High/4 hour/15 min. delay	1	50	100.86	201.7	--	--	11.66	12.76

Animal #	Dose group	Volume of blood (ml)	Toluene-d_8 Test Value (ng/ml)	Toluene-d_8 Measured Value (ng/ml)	Toluene-d_8 Recovery (%)	Unadjusted analyte concentration in ng/ml (Bottom of curve/MDL in ng/ml)			
						n-Nonane 50/7.8	2,6-Di-methyl-octane 50/8.3	Toluene 10/7.8	o-Xylene 10/9.8
174	High/4 hour/15 min. delay rerun	1	100	150.14	150.1	8.02	8.31	--	--
175 [c]	High/4 hour/15 min. delay	1	50	75.02	150.0	--	--	9.01	--
175	High/4 hour/15 min. delay rerun	0.8	125	220.87	176.7	--	--	--	--
176 [c]	High/4 hour/15 min. delay	0.8	62.5	82.86	132.6	--	--	--	--
176	High/4 hour/15 min. delay rerun	0.8	125	137.49	110.0	--	--	--	--
177 [c]	High/4 hour/15 min. delay	1	50	78.07	156.1	--	--	8.42	--
177	High/4 hour/15 min. delay rerun	1	100	101.72	101.7	--	--	--	--
178 [c]	High/4 hour/15 min. delay	1	50	96.46	192.9	--	--	--	--
178	High/4 hour/15 min. delay rerun	1	100	142.32	142.3	--	--	9.19	11.36
179 [c]	High/4 hour/15 min. delay	0.7	74.4	84.12	113.1	--	--	--	--
180	High/4 hour/15 min. delay	1	50	70.56	141.1	--	--	--	--
181	High/4 hour/30 min. delay	1	50	75.15	150.3	--	--	--	--
182	High/4 hour/30 min. delay	1	50	64.76	129.5	--	--	--	--
183	High/4 hour/30 min. delay	1	50	77.68	155.4	--	--	--	--
184	High/4 hour/30 min. delay	0.8	62.5	134.43	215.1	--	--	--	--
185	High/4 hour/30 min. delay	1	50	62.89	125.8	--	--	--	--
186	High/4 hour/30 min. delay	0.8	62.5	105.81	169.3	--	--	--	--
188	High/4 hour/30 min. delay	1	50	86.77	173.5	--	--	--	--
187	High/4 hour/30 min. delay	1	100	239.3	239.3	--	--	--	--
189	High/4 hour/30 min. delay	0.8	125	157.08	125.7	--	--	--	--
190	High/4 hour/30 min. delay	0.8	125	129.27	103.4	--	--	--	--
191	High/4 hour/30 min. delay	1	100	154.54	154.5	--	--	--	--
192	High/4 hour/30 min. delay	1	100	119.41	119.4	--	--	--	--
193	High/4 hour/45 min. delay	1	100	121.38	121.4	--	--	--	--
194	High/4 hour/45 min. delay	0.8	125	140.34	112.3	--	--	--	--
195	High/4 hour/45 min. delay	1	100	115.21	115.2	--	--	--	--
196	High/4 hour/45 min. delay	1	100	99.87	99.9	--	--	--	--
197	High/4 hour/45 min. delay	0.6	167	309.47	185.3	--	--	--	--
198	High/4 hour/45 min. delay	1	100	153.99	154.0	--	--	--	--
199	High/4 hour/45 min. delay	1	100	120.09	120.1	--	--	12.08	15.51
200	High/4 hour/45 min. delay	1	100	99.8	99.8	--	--	--	--
201	High/4 hour/45 min. delay	0.6	167	338.08	202.4	--	--	--	--
202	High/4 hour/45 min. delay	1	100	138.24	138.2	--	--	--	--
203	High/4 hour/45 min. delay	1	100	78.82	78.8	--	--	--	--

Animal #	Dose group	Volume of blood (ml)	Toluene-d_8 Test Value (ng/ml)	Toluene-d_8 Measured Value (ng/ml)	Toluene-d_8 Recovery (%)	Unadjusted analyte concentration in ng/ml (Bottom of curve/MDL in ng/ml)			
						n-Nonane 50/7.8	2,6-Di-methyl-octane 50/8.3	Toluene 10/7.8	o-Xylene 10/9.8
204	High/4 hour/45 min. delay	1	100	86.48	86.5	--	--	--	--
205	High/4 hour/60 min. delay	0.8	125	310.17	248.1	--	--	--	--
206	High/4 hour/60 min. delay	1	100	115.06	115.1	--	--	--	--
207	High/4 hour/60 min. delay	1	100	161.67	161.7	--	--	--	--
208	High/4 hour/60 min. delay	1	100	164.31	164.3	--	--	--	--
209	High/4 hour/60 min. delay	0.8	125	123.03	98.4	--	--	--	--
210	High/4 hour/60 min. delay	0.8	125	159.27	127.4	--	--	--	--
211	High/4 hour/60 min. delay	1	100	197.03	197.0	--	--	--	--
212	High/4 hour/60 min. delay	1	100	78.03	78.0	--	--	--	--
213	High/4 hour/60 min. delay	1	100	119.21	119.2	--	--	--	--
214	High/4 hour/60 min. delay	0.7	142.8	107.08	75.0	--	--	--	--
215	High/4 hour/60 min. delay	1	100	155	155.0	--	--	--	--
216	High/4 hour/60 min. delay	1	100	97.88	97.9	--	--	--	--

[a]2-Methylheptane, 2-methyloctane, methylcyclopentane, n-octane, 2-methylhexane, 2,5-dimethylhexane, 2,5-dimethylheptane, and n-butylcyclohexane were not detected in any high-dose blood samples. Values in italics indicate measurements below the lowest point on the calibration curve. Analyte concentrations were not adjusted for sample volume. Not all measurements were considered reliable due to instrument/analytical issues (see "Results" for details).
[b]Not detected.
[c]Sample did not run on the day it was prepared due to instrument stoppage.

Table A-6. Unadjusted measurements of JP-8 components[a] in blood of rats exposed to JP-8 for 4 hrs: high concentration group, part 2.

			Unadjusted analyte concentration in ng/ml (Bottom of curve/MDL in ng/ml)						
Animal #	Dose group	Volume of blood (ml)	Ethyl-benzene 10/9.8	m,p-Xylenes 20/20.7	Isopropyl-benzene 10/8.3	4-Methyl-decane 50/4.8	n-Decane 50/7.4	1,2,4-Trimethyl-benzene 10/ND[b]	1,3,5-Trimethyl-benzene 10/ND
145	High/2 hour/Immediate	0.6	--[c]	--	--	--	--	65.77	--
146	High/2 hour/Immediate	1	--	--	--	--	11.87	84.06	--
147	High/2 hour/Immediate	1	--	--	--	--	--	57.82	--
148	High/2 hour/Immediate	1	--	--	--	12.48	7.87	53.27	16.56
149	High/2 hour/Immediate	1	--	21.84	--	--	11.03	80.84	25.7
150	High/2 hour/Immediate	1	26.56	67.22	26.88	14.52	21.03	119.02	58.16
151	High/2 hour/Immediate	0.5	12.13	35.86	--	--	9.27	104.02	34.05
152	High/2 hour/Immediate	1	--	--	--	--	--	24.6	--
83	High/2 hour/Immediate	1	--	--	--	--	11.43	52.86	12
154	High/2 hour/Immediate	0.8	--	--	--	--	8.8	41.38	--
155	High/2 hour/Immediate	1	--	--	--	--	--	82.63	--
156	High/2 hour/Immediate	1	--	--	--	--	9.34	110.71	--
157	High/4 hour/Immediate	1	--	--	--	--	7.96	76.05	--
158	High/4 hour/Immediate	1	--	--	--	--	12.55	62.65	15.46
159	High/4 hour/Immediate	0.8	--	--	--	--	10.63	84.6	18.42
160	High/4 hour/Immediate	1	15.2	41.14	9.59	--	14.42	97.67	38.37
161	High/4 hour/Immediate	1	--	--	--	--	8.7	61.9	--
162	High/4 hour/Immediate	0.8	--	--	--	--	--	56	--
163	High/4 hour/Immediate	1	--	<20	--	--	9.61	57.6	10.02
164	High/4 hour/Immediate	1	--	--	--	--	13.43	99.75	13.69
165	High/4 hour/Immediate	1	--	23.06	--	--	9.54	63.59	19.56
166	High/4 hour/Immediate	0.8	--	23.35	--	--	14.61	107.73	21.03
167	High/4 hour/Immediate	0.8	--	--	--	--	--	25.99	--
168	High/4 hour/Immediate	0.8	--	<20	--	16.72	19.98	42.97	11.69
169	High/4 hour/15 min. delay	1	--	--	--	--	--	79.32	--
170	High/4 hour/15 min. delay	1	--	--	--	--	--	62.29	--
171	High/4 hour/15 min. delay	1	--	--	--	--	--	50.49	--
172[d]	High/4 hour/15 min. delay	0.8	--	24.42		9.42	8.66	74.3	22.9
172	High/4 hour/15 min. delay rerun	0.8	--	--	--	--	--	20.07	--
173[d]	High/4 hour/15 min. delay	0.7	23.35	60.3	20.25	--	15.26	83.22	44.81
173	High/4 hour/15 min. delay rerun	0.8	--	--	--	--	--	61.99	--
174[d]	High/4 hour/15 min. delay	1	14.55	34.88	9.53	9.65	11.17	72.55	26.04
174	High/4 hour/15 min. delay rerun	1	--	--	--	12.77	10.67	37.38	--

Animal #	Dose group	Volume of blood (ml)	Unadjusted analyte concentration in ng/ml (Bottom of curve/MDL in ng/ml) Ethyl-benzene 10/9.8	m,p-Xylenes 20/20.7	Isopropyl-benzene 10/8.3	4-Methyl-decane 50/4.8	n-Decane 50/7.4	1,2,4-Trimethyl-benzene 10/ND[b]	1,3,5-Trimethyl-benzene 10/ND
175 [d]	High/4 hour/15 min. delay	1	--	24.69	--	6.57	9.83	55.95	16.46
175	High/4 hour/15 min. delay rerun	0.8	--	--	--	--	--	86.3	19.26
176 [d]	High/4 hour/15 min. delay	0.8	--	--	--	11.83	13.13	67.73	13.47
176	High/4 hour/15 min. delay rerun	0.8	--	--	--	--	--	36.11	--
177 [d]	High/4 hour/15 min. delay	1	--	24.76	--	--	9.6	67.67	16.67
177	High/4 hour/15 min. delay rerun	1	--	--	--	4.84	--	74.75	12.82
178 [d]	High/4 hour/15 min. delay	1	--	--	--	--	10.86	50.11	--
178	High/4 hour/15 min. delay rerun	1	11.26	28.45	--	--	8.28	63.36	25.69
179	High/4 hour/15 min. delay	0.7	--	--	--	--	--	88.21	--
180	High/4 hour/15 min. delay	1	--	--	--	--	--	56.57	--
181	High/4 hour/30 min. delay	1	--	--	--	--	--	45.73	--
182	High/4 hour/30 min. delay	1	--	--	--	--	--	42.46	10.12
183	High/4 hour/30 min. delay	1	--	--	--	--	--	75.35	11.53
184	High/4 hour/30 min. delay	0.8	--	--	--	--	--	80.38	--
185	High/4 hour/30 min. delay	1	--	--	--	--	--	41.39	--
186	High/4 hour/30 min. delay	0.8	--	--	--	10.82	--	69.23	--
188	High/4 hour/30 min. delay	1	--	--	--	--	--	56.04	--
187	High/4 hour/30 min. delay	1	--	--	--	--	--	77.04	--
189	High/4 hour/30 min. delay	0.8	--	--	--	5.9	--	71.63	10.03
190	High/4 hour/30 min. delay	0.8	--	--	--	--	--	59.09	--
191	High/4 hour/30 min. delay	1	--	--	--	--	--	55.37	14.4
192	High/4 hour/30 min. delay	1	--	--	--	--	--	93.24	16.85
193	High/4 hour/45 min. delay	1	--	--	--	--	--	52.56	--
194	High/4 hour/45 min. delay	0.8	--	--	--	--	--	20.76	--
195	High/4 hour/45 min. delay	1	--	--	--	--	--	50.32	--
196	High/4 hour/45 min. delay	1	--	--	--	--	--	39.62	--
197	High/4 hour/45 min. delay	0.6	--	--	--	--	--	75.71	--
198	High/4 hour/45 min. delay	1	--	--	--	--	--	87.54	--
199	High/4 hour/45 min. delay	1	15.01	33.6	12.83	9.71	8.13	75.91	32.13
200	High/4 hour/45 min. delay	1	--	--	--	--	--	68.73	19.97
201	High/4 hour/45 min. delay	0.6	--	--	--	--	--	49.7	--
202	High/4 hour/45 min. delay	1	--	--	--	--	--	25.84	--
203	High/4 hour/45 min. delay	1	--	--	--	--	--	36.28	--
204	High/4 hour/45 min. delay	1	--	--	--	--	--	42.16	--
205	High/4 hour/60 min. delay	0.8	--	--	--	--	--	66.71	--

Animal #	Dose group	Volume of blood (ml)	Unadjusted analyte concentration in ng/ml (Bottom of curve/MDL in ng/ml)						
			Ethyl-benzene 10/9.8	m,p-Xylenes 20/20.7	Isopropyl-benzene 10/8.3	4-Methyl-decane 50/4.8	n-Decane 50/7.4	1,2,4-Trimethyl-benzene 10/ND[b]	1,3,5-Trimethyl-benzene 10/ND
206	High/4 hour/60 min. delay	1	--	--	--	--	--	69.27	--
207	High/4 hour/60 min. delay	1	--	--	--	--	--	70.3	--
208	High/4 hour/60 min. delay	1	--	--	--	--	--	63.14	13.88
209	High/4 hour/60 min. delay	0.8	--	--	--	--	--	55.37	11.86
210	High/4 hour/60 min. delay	0.8	--	--	--	--	--	66.32	--
211	High/4 hour/60 min. delay	1	--	--	--	--	--	42.47	--
212	High/4 hour/60 min. delay	1	--	--	--	--	--	28.76	--
213	High/4 hour/60 min. delay	1	--	--	--	--	--	43.44	--
214	High/4 hour/60 min. delay	0.7	--	--	--	--	--	61.22	--
215	High/4 hour/60 min. delay	1	--	--	--	--	--	49.58	--
216	High/4 hour/60 min. delay	1	--	--	--	--	--	36.7	--

[a]2-Methylheptane, 2-methyloctane, methylcyclopentane, n-octane, 2-methylhexane, 2,5-dimethylhexane, 2,5-dimethylheptane, and n-butylcyclohexane were not detected in any high-dose blood samples. Values in italics indicate measurements below the lowest point on the calibration curve. Analyte concentrations were not adjusted for sample volume. Not all measurements were considered reliable due to instrument/analytical issues (see "Results" for details).
[b]Could not be determined.
[c]Not detected.
[d]Sample did not run on the day it was prepared due to instrument stoppage.

Table A-7. Unadjusted measurements of JP-8 components[a] in blood of rats exposed to JP-8 for 4 hrs: high concentration group, part 3.

			Unadjusted analyte concentration in ng/ml (Bottom of curve/MDL in ng/ml)				
Animal #	Dose group	Volume of blood (ml)	o-Ethyl-toluene 10/ND	p-Ethyl-toluene 10/ND	Naphthalene 10/8.2	Cyclohexyl-benzene 10/ND[b]	n-Tetradecane 50/ND
145	High/2 hour/Immediate	0.6	--[c]	--	46.68	--	65.86
146	High/2 hour/Immediate	1	--	--	--	--	--
147	High/2 hour/Immediate	1	--	--	--	--	--
148	High/2 hour/Immediate	1	13.74	11.35	103	146.48	193.37
149	High/2 hour/Immediate	1	22.41	20.47	163.96	134.37	123.51
150	High/2 hour/Immediate	1	46.72	53.21	349.21	280.17	219.38
151	High/2 hour/Immediate	0.5	26.9	29.28	260.03	169.89	134.69
152	High/2 hour/Immediate	1	--	--	8.78	--	--
83	High/2 hour/Immediate	1	11.86	10.78	--	--	67.74
154	High/2 hour/Immediate	0.8	--	--	41.79	--	73.4
155	High/2 hour/Immediate	1	--	--	80.79	--	91.2
156	High/2 hour/Immediate	1	--	--	22.67	--	58.95
157	High/4 hour/Immediate	1	--	--	--	--	--
158	High/4 hour/Immediate	1	15.86	15.86	264.6	177	256
159	High/4 hour/Immediate	0.8	16.66	16.03	203.52	89.47	116
160	High/4 hour/Immediate	1	30.94	36.81	333.39	183.51	164.4
161	High/4 hour/Immediate	1	--	--	--	--	--
162	High/4 hour/Immediate	0.8	--	--	--	--	--
163	High/4 hour/Immediate	1	--	--	167.24	99.5	177.22
164	High/4 hour/Immediate	1	12.24	10.3	132	47.97	81.67
165	High/4 hour/Immediate	1	17.56	18.43	260.05	127.08	114.14
166	High/4 hour/Immediate	0.8	19.21	20.42	259.67	93.85	135.53
167	High/4 hour/Immediate	0.8	--	--	--	--	--
168	High/4 hour/Immediate	0.8	13.29	11.06	--	--	71.29
169	High/4 hour/15 min. delay	1	--	--	--	--	--
170	High/4 hour/15 min. delay	1	--	--	--	--	--
171	High/4 hour/15 min. delay	1	--	--	288.6	108.12	202.14
172[d]	High/4 hour/15 min. delay	0.8	18.4	20.44	68.87	--	--
172	High/4 hour/15 min. delay rerun	0.8	--	--	--	--	--
173[d]	High/4 hour/15 min. delay	0.7	34.67	48.48	222.09	88.95	77.46
173	High/4 hour/15 min. delay rerun	0.8	--	--	20.5	--	--
174[d]	High/4 hour/15 min. delay	1	19.85	28.86	148.57	43.12	128.5
174	High/4 hour/15 min. delay rerun	1	--	--	24.29	--	--

Animal #	Dose group	Volume of blood (ml)	Unadjusted analyte concentration in ng/ml (Bottom of curve/MDL in ng/ml) o-Ethyl-toluene 10/ND	p-Ethyl-toluene 10/ND	Naphthalene 10/8.2	Cyclohexyl-benzene 10/ND[b]	n-Tetradecane 50/ND
175 [d]	High/4 hour/15 min. delay	1	12.72	15.04	114.48	--	98.82
175	High/4 hour/15 min. delay rerun	0.8	13.76	13.57	163.96	77.69	68.4
176 [d]	High/4 hour/15 min. delay	0.8	13.26	14.01	--	--	--
176	High/4 hour/15 min. delay rerun	0.8	--	--	106.85	38.32	94.1
177 [d]	High/4 hour/15 min. delay	1	13.4	18.19	--	--	--
177	High/4 hour/15 min. delay rerun	1	10.56	--	88.4	35.94	57.55
178 [d]	High/4 hour/15 min. delay	1	--	--	--	--	--
178	High/4 hour/15 min. delay rerun	1	18.52	19.29	201.42	137.2	85.66
179	High/4 hour/15 min. delay	0.7	--	--	--	--	--
180	High/4 hour/15 min. delay	1	--	--	113.78	68.22	147.05
181	High/4 hour/30 min. delay	1	--	--	81.94	--	--
182	High/4 hour/30 min. delay	1	--	--	168.33	56.68	70.92
183	High/4 hour/30 min. delay	1	--	10.56	188.63	44.16	80.29
184	High/4 hour/30 min. delay	0.8	--	--	--	--	--
185	High/4 hour/30 min. delay	1	--	--	--	--	--
186	High/4 hour/30 min. delay	0.8	--	--	26.15	--	53.22
188	High/4 hour/30 min. delay	1	--	--	--	--	--
187	High/4 hour/30 min. delay	1	--	--	--	--	--
189	High/4 hour/30 min. delay	0.8	--	10.09	212.63	83.32	180.75
190	High/4 hour/30 min. delay	0.8	--	--	112.16	13.3	67.31
191	High/4 hour/30 min. delay	1	11.25	12.93	206.56	73.14	88.47
192	High/4 hour/30 min. delay	1	13.33	15.51	244.31	64.56	96.46
193	High/4 hour/45 min. delay	1	--	--	12.61	--	--
194	High/4 hour/45 min. delay	0.8	--	--	--	--	--
195	High/4 hour/45 min. delay	1	--	--	34.29	--	53.2
196	High/4 hour/45 min. delay	1	--	--	--	--	--
197	High/4 hour/45 min. delay	0.6	--	--	120.71	30.92	111.14
198	High/4 hour/45 min. delay	1	--	--	63.08	--	--
199	High/4 hour/45 min. delay	1	23.11	25.71	233.69	175.28	105.88
200	High/4 hour/45 min. delay	1	14.07	14.66	163.32	88.87	71.48
201	High/4 hour/45 min. delay	0.6	--	--	11.2	--	--
202	High/4 hour/45 min. delay	1	--	--	--	--	--
203	High/4 hour/45 min. delay	1	--	--	28.67	--	--
204	High/4 hour/45 min. delay	1	--	--	--	--	--
205	High/4 hour/60 min. delay	0.8	--	--	--	--	--
206	High/4 hour/60 min. delay	1	--	--	131.29	13.06	100.54

Animal #	Dose group	Volume of blood (ml)	Unadjusted analyte concentration in ng/ml (Bottom of curve/MDL in ng/ml) o-Ethyl-toluene 10/ND	p-Ethyl-toluene 10/ND	Naphthalene 10/8.2	Cyclohexyl-benzene 10/ND[b]	n-Tetradecane 50/ND
207	High/4 hour/60 min. delay	1	--	--	59.55	--	--
208	High/4 hour/60 min. delay	1	10.14	11.47	171.67	83.22	64.76
209	High/4 hour/60 min. delay	0.8	--	10.42	183.01	51.98	57.56
210	High/4 hour/60 min. delay	0.8	--	--	--	--	--
211	High/4 hour/60 min. delay	1	--	--	--	--	--
212	High/4 hour/60 min. delay	1	--	--	17.58	--	--
213	High/4 hour/60 min. delay	1	--	--	--	--	--
214	High/4 hour/60 min. delay	0.7	--	--	--	--	--
215	High/4 hour/60 min. delay	1	--	--	--	--	--
216	High/4 hour/60 min. delay	1	--	--	--	--	--

[a]2-Methylheptane, 2-methyloctane, methylcyclopentane, n-octane, 2-methylhexane, 2,5-dimethylhexane, 2,5-dimethylheptane, and n-butylcyclohexane were not detected in any high-dose blood samples. Values in italics indicate measurements below the lowest point on the calibration curve. Analyte concentrations were not adjusted for sample volume. Not all measurements were considered reliable due to instrument/analytical issues (see "Results" for details).
[b]Could not be determined.
[c]Not detected.
[d]Sample did not run on the day it was prepared due to instrument stoppage.

Table A-8. Unadjusted measurements of JP-8 components[a] in blood of rats exposed to JP-8 for 4 hrs: medium concentration group, part 1.

Animal #	Dose group	Volume of blood (ml)	Toluene-d_8 Test Value (ng/ml)	Toluene-d_8 Measured Value (ng/ml)	Toluene-d_8 Recovery (%)	Unadjusted analyte concentration in ng/ml (Bottom of curve/MDL in ng/ml)		
						m,p-Xylenes 20/20.7	4-Methyl-decane 50/4.8	1,2,4-Trimethyl-benzene 10/ND[b]
73	Medium/2 Hour/Immediate	1	100	110.113	110.1	-- [c]	--	34
74	Medium/2 Hour/Immediate	1	100	109.36	109.4	--	--	66.99
75	Medium/2 Hour/Immediate	1	100	75.63	75.6	--	--	25.26
76	Medium/2 Hour/Immediate	0.7	143	147.03	102.8	--	--	54.36
77	Medium/2 Hour/Immediate	1	100	112.53	112.5	--	--	36
78	Medium/2 Hour/Immediate	1	100	106.54	106.5	23.03	--	45.77
79	Medium/2 Hour/Immediate	1	100	101.04	101.0	--	--	43.52
80	Medium/2 Hour/Immediate	1	100	126.76	126.8	--	--	43.44
81	Medium/2 Hour/Immediate	1	100	115.01	115.0	--	--	54.52
82	Medium/2 Hour/Immediate	1	100	157.81	157.8	--	--	67.89
84	Medium/2 Hour/Immediate	0.2	500	286.69	57.3	--	--	26.94
85	Medium/4 Hour/Immediate	1	100	92.91	92.9	--	--	37.12
86	Medium/4 Hour/Immediate	0.8	125	86.95	69.6	--	--	71.13
87	Medium/4 Hour/Immediate	0.8	125	115.67	92.5	--	--	48.39
88	Medium/4 Hour/Immediate	1	100	90.29	90.3	--	--	43.51
89	Medium/4 Hour/Immediate	1	100	117	117.0	--	--	43.32
90	Medium/4 Hour/Immediate	1	100	123.1	123.1	--	--	63.2
91	Medium/4 Hour/Immediate	0.5	200	234.02	117.0	--	--	41.7
92	Medium/4 Hour/Immediate	1	100	80.76	80.8	--	--	32.99
93	Medium/4 Hour/Immediate	1	100	141.88	141.9	--	--	51.7
94	Medium/4 Hour/Immediate	1	100	97.86	97.9	--	--	35.59
95	Medium/4 Hour/Immediate	0.8	125	124.86	99.9	--	--	62.3
96	Medium/4 Hour/Immediate	1	100	85.18	85.2	--	--	22.8
97	Medium/4 Hour/5 Min. delay	1	100	125.56	125.6	--	--	43.71
98	Medium/4 Hour/15 Min. delay	1	100	96.9	96.9	--	--	38.89
99	Medium/4 Hour/15 Min. delay	1	100	116.85	116.9	--	--	43.31
100	Medium/4 Hour/15 Min. delay	0.9	111	201.22	181.3	--	--	65.08
101	Medium/4 Hour/15 Min. delay	1	100	94.35	94.4	--	--	54.04
102	Medium/4 Hour/15 Min. delay	1	100	147.81	147.8	--	--	57.86
103	Medium/4 Hour/15 Min. delay	1	100	125.75	125.8	--	--	40.77
104	Medium/4 Hour/15 Min. delay	0.8	125	132.04	105.6	--	--	40.65
105	Medium/4 Hour/15 Min. delay	1	100	92.16	92.2	--	--	44.86
106	Medium/4 Hour/15 Min. delay	1	100	87.45	87.5	--	--	62.21

Animal #	Dose group	Volume of blood (ml)	Toluene-d_8 Test Value (ng/ml)	Toluene-d_8 Measured Value (ng/ml)	Toluene-d_8 Recovery (%)	Unadjusted analyte concentration in ng/ml (Bottom of curve/MDL in ng/ml)		
						m,p-Xylenes 20/20.7	4-Methyl-decane 50/4.8	1,2,4-Trimethyl-benzene 10/ND[b]
107	Medium/4 Hour/15 Min. delay	1	100	93.17	93.2	--	--	47.2
108	Medium/4 Hour/15 Min. delay	1	100	89.07	89.1	--	--	31.57
109	Medium/4 Hour/30 Min. delay	0.8	125	127.19	101.8	--	--	63.58
110	Medium/4 Hour/30 Min. delay	1	100	124.07	124.1	--	--	55.72
111	Medium/4 Hour/30 Min. delay	1	100	93.91	93.9	--	--	25.72
112	Medium/4 Hour/30 Min. delay	1	100	90.84	90.8	--	11.7	45.42
113	Medium/4 Hour/30 Min. delay	1	100	126.18	126.2	--	--	20.29
114	Medium/4 Hour/30 Min. delay	1	100	82.46	82.5	--	--	42.59
115	Medium/4 Hour/30 Min. delay	1	100	67.66	67.7	--	--	33.18
116	Medium/4 Hour/30 Min. delay	1	100	85.09	85.1	--	--	45.82
117	Medium/4 Hour/30 Min. delay	1	100	83.3	83.3	--	--	34.12
118	Medium/4 Hour/30 Min. delay	0.8	125	166.66	133.3	--	--	39.76
119	Medium/4 Hour/30 Min. delay	1	100	61.39	61.4	--	--	37.23
120	Medium/4 Hour/30 Min. delay	1	100	84.69	84.7	--	--	50.33
121	Medium/4 Hour/45 Min. delay	1	100	76.01	76.0	--	--	38.64
122	Medium/4 Hour/45 Min. delay	1	100	65.15	65.2	--	--	47.82
123	Medium/4 Hour/45 Min. delay	1	100	55.24	55.2	--	--	32.02
124	Medium/4 Hour/45 Min. delay	0.8	125	165.76	132.6	--	--	17.54
125	Medium/4 Hour/45 Min. delay	1	100	73.29	73.3	--	--	30.79
126	Medium/4 Hour/45 Min. delay	1	100	140.88	140.9	--	--	22.01
127	Medium/4 Hour/45 Min. delay	1	100	84	84.0	--	--	23.35
128	Medium/4 Hour/45 Min. delay	0.7	143	166.96	116.8	--	--	67.71
129	Medium/4 Hour/45 Min. delay	1	100	111.98	112.0	--	--	40.74
130	Medium/4 Hour/45 Min. delay	1	100	115.55	115.6	--	--	36.32
131	Medium/4 Hour/45 Min. delay	1	100	111.61	111.6	--	--	36.22
132	Medium/4 Hour/45 Min. delay	1	100	103.35	103.4	--	--	32.27
133	Medium/4 Hour/60 Min. delay	1	100	127.01	127.0	--	--	46.21
134	Medium/4 Hour/60 Min. delay	0.7	143	155.66	108.9	--	--	33.49
135	Medium/4 Hour/60 Min. delay	1	100	95.93	95.9	--	--	40.08
136	Medium/4 Hour/60 Min. delay	1	100	127.52	127.5	--	--	--
137	Medium/4 Hour/60 Min. delay	1	100	75.8	75.8	--	--	41.27
138	Medium/4 Hour/60 Min. delay	0.7	143	113.44	79.3	--	--	24.91
139	Medium/4 Hour/60 Min. delay	1	100	108.26	108.3	--	--	51.53
140	Medium/4 Hour/60 Min. delay	1	100	66.68	66.7	--	--	62.7
141	Medium/4 Hour/60 Min. delay	1	100	97.1	97.1	--	--	31.59

Animal #	Dose group	Volume of blood (ml)	Toluene-d_8 Test Value (ng/ml)	Toluene-d_8 Measured Value (ng/ml)	Toluene-d_8 Recovery (%)	Unadjusted analyte concentration in ng/ml (Bottom of curve/MDL in ng/ml)		
						m,p-Xylenes 20/20.7	4-Methyl-decane 50/4.8	1,2,4-Trimethyl-benzene 10/ND[b]
142	Medium/4 Hour/60 Min. delay	1	100	95.1	95.1	--	--	40.5
144	Medium/4 Hour/60 Min. delay	1	100	129.28	129.3	--	--	53.19

[a]2-Methylheptane 2-methyloctane, methylcyclopentane, n-octane, 2-methylhexane, 2,5-dimethylhexane, 2,5-dimethylheptane, n-nonane, 2,6-dimethyloctane, n-decane, toluene, ethylbenzene, o-xylene, isopropylbenzene, and n-butylcyclohexane were not detected in any medium-dose blood samples. Analyte concentrations were not adjusted for sample volume. Not all measurements were considered reliable due to instrument/analytical issues (see "Results" for details).
[b]Could not be determined.
[c]Not detected.

Table A-9. Unadjusted measurements of JP-8 components[a] in blood of rats exposed to JP-8 for 4 hrs: medium concentration group, part 2.

			Unadjusted analyte concentration in ng/ml (Bottom of curve/MDL in ng/ml)			
Animal #	Dose group	Volume of blood (ml)	1,3,5-Trimethyl-benzene 10/ND	o-Ethyltoluene 10/ND[b]	p-Ethyltoluene 10/ND	Naphthalene 10/8.2
73	Medium/2 Hour/Immediate	1	--	-- [c]	--	--
74	Medium/2 Hour/Immediate	1	--	--	--	--
75	Medium/2 Hour/Immediate	1	--	--	--	--
76	Medium/2 Hour/Immediate	0.7	--	--	--	84.82
77	Medium/2 Hour/Immediate	1	--	--	--	37.53
78	Medium/2 Hour/Immediate	1	17.7	11.74	14.4	103.25
79	Medium/2 Hour/Immediate	1	13.96	--	12.17	114.82
80	Medium/2 Hour/Immediate	1	--	--	--	--
81	Medium/2 Hour/Immediate	1	--	--	--	58.92
82	Medium/2 Hour/Immediate	1	--	--	--	35.94
84	Medium/2 Hour/Immediate	0.2	--	--	--	--
85	Medium/4 Hour/Immediate	1	--	--	--	74.86
86	Medium/4 Hour/Immediate	0.8	--	--	--	88.46
87	Medium/4 Hour/Immediate	0.8	--	--	--	--
88	Medium/4 Hour/Immediate	1	--	--	--	--
89	Medium/4 Hour/Immediate	1	--	--	--	--
90	Medium/4 Hour/Immediate	1	--	--	--	--
91	Medium/4 Hour/Immediate	0.5	--	--	--	--
92	Medium/4 Hour/Immediate	1	--	--	--	58.79
93	Medium/4 Hour/Immediate	1	--	--	--	34.76
94	Medium/4 Hour/Immediate	1	--	--	--	75.03
95	Medium/4 Hour/Immediate	0.8	--	--	--	98.58
96	Medium/4 Hour/Immediate	1	--	--	--	--
97	Medium/4 Hour/15 Min. delay	1	--	--	--	--
98	Medium/4 Hour/15 Min. delay	1	--	--	--	34.58
99	Medium/4 Hour/15 Min. delay	1	--	--	--	63.03
100	Medium/4 Hour/15 Min. delay	0.9	17.35	12.2	13.37	164.54
101	Medium/4 Hour/15 Min. delay	1	12.93	--	--	148.7
102	Medium/4 Hour/15 Min. delay	1	--	--	--	13.81
103	Medium/4 Hour/15 Min. delay	1	--	--	--	--
104	Medium/4 Hour/15 Min. delay	0.8	--	--	--	10.75
105	Medium/4 Hour/15 Min. delay	1	--	--	--	--
106	Medium/4 Hour/15 Min. delay	1	--	--	--	75.28
107	Medium/4 Hour/15 Min. delay	1	--	--	--	61.52

Animal #	Dose group	Volume of blood (ml)	Unadjusted analyte concentration in ng/ml (Bottom of curve/MDL in ng/ml) 1,3,5-Trimethyl-benzene 10/ND	o-Ethyltoluene 10/ND[b]	p-Ethyltoluene 10/ND	Naphthalene 10/8.2
108	Medium/4 Hour/15 Min. delay	1	18.66	11.92	14.08	163.2
109	Medium/4 Hour/30 Min. delay	0.8	13.25	--	10.02	146.48
110	Medium/4 Hour/30 Min. delay	1	--	--	--	20.24
111	Medium/4 Hour/30 Min. delay	1	--	--	--	--
112	Medium/4 Hour/30 Min. delay	1	--	--	--	14.95
113	Medium/4 Hour/30 Min. delay	1	--	--	--	--
114	Medium/4 Hour/30 Min. delay	1	--	--	--	--
115	Medium/4 Hour/30 Min. delay	1	--	--	--	--
116	Medium/4 Hour/30 Min. delay	1	--	--	--	--
117	Medium/4 Hour/30 Min. delay	1	--	--	--	80.11
118	Medium/4 Hour/30 Min. delay	0.8	--	--	--	42.8
119	Medium/4 Hour/30 Min. delay	1	--	--	--	124.14
120	Medium/4 Hour/30 Min. delay	1	--	--	--	130.06
121	Medium/4 Hour/45 Min. Delay	1	--	--	--	--
122	Medium/4 Hour/45 Min. Delay	1	--	--	--	--
123	Medium/4 Hour/45 Min. Delay	1	--	--	--	--
124	Medium/4 Hour/45 Min. Delay	0.8	--	--	--	--
125	Medium/4 Hour/45 Min. Delay	1	--	--	--	--
126	Medium/4 Hour/45 Min. Delay	1	--	--	--	89.95
127	Medium/4 Hour/45 Min. Delay	1	--	--	--	70.59
128	Medium/4 Hour/45 Min. Delay	0.7	--	--	--	--
129	Medium/4 Hour/45 Min. Delay	1	--	--	--	--
130	Medium/4 Hour/45 Min. Delay	1	--	--	--	78.49
131	Medium/4 Hour/45 Min. Delay	1	--	--	--	--
132	Medium/4 Hour/45 Min. Delay	1	--	--	--	46.6
133	Medium/4 Hour/60 Min. Delay	1	--	--	--	99.56
134	Medium/4 Hour/60 Min. Delay	0.7	--	--	--	106.84
135	Medium/4 Hour/60 Min. Delay	1	--	--	--	--
136	Medium/4 Hour/60 Min. Delay	1	--	--	--	--
137	Medium/4 Hour/60 Min. Delay	1	--	--	--	105.62
138	Medium/4 Hour/60 Min. Delay	0.7	--	--	--	54.76
139	Medium/4 Hour/60 Min. Delay	1	--	--	11.45	118.43
140	Medium/4 Hour/60 Min. Delay	1	--	--	--	121.64
141	Medium/4 Hour/60 Min. Delay	1	--	--	--	--
142	Medium/4 Hour/60 Min. Delay	1	--	--	--	--
144	Medium/4 Hour/60 Min. Delay	1	--	--	--	--

[a]2-Methylheptane 2-methyloctane, methylcyclopentane, n-octane, 2-methylhexane, 2,5-dimethylhexane, 2,5-dimethylheptane, n-nonane, 2,6-dimethyloctane, n-decane, toluene, ethylbenzene, o-xylene, isopropylbenzene, and n-butylcyclohexane were not detected in any medium-dose blood samples. Analyte concentrations were not adjusted for sample volume. Not all measurements were considered reliable due to instrument/analytical issues (see "Results" for details).
[b]Could not be determined.
[c]Not detected.

Table A-10. Unadjusted measurements of JP-8 components[a] in blood of rats exposed to JP-8 for 4 hrs: medium concentration group, part 3.

Animal #	Dose group	Volume of blood (ml)	Unadjusted analyte concentration in ng/ml (Bottom of curve/MDL in ng/ml) Cyclohexylbenzene 10/ND[b]	n-Tetradecane 50/ND
73	Medium/2 Hour/Immediate	1	--[c]	--
74	Medium/2 Hour/Immediate	1	--	--
75	Medium/2 Hour/Immediate	1	--	--
76	Medium/2 Hour/Immediate	0.7	--	54.01
77	Medium/2 Hour/Immediate	1	--	--
78	Medium/2 Hour/Immediate	1	--	--
79	Medium/2 Hour/Immediate	1	--	--
80	Medium/2 Hour/Immediate	1	--	--
81	Medium/2 Hour/Immediate	1	--	--
82	Medium/2 Hour/Immediate	1	--	--
84	Medium/2 Hour/Immediate	0.2	--	--
85	Medium/4 Hour/Immediate	1	--	--
86	Medium/4 Hour/Immediate	0.8	--	--
87	Medium/4 Hour/Immediate	0.8	--	--
88	Medium/4 Hour/Immediate	1	--	--
89	Medium/4 Hour/Immediate	1	--	--
90	Medium/4 Hour/Immediate	1	--	--
91	Medium/4 Hour/Immediate	0.5	--	--
92	Medium/4 Hour/Immediate	1	--	--
93	Medium/4 Hour/Immediate	1	--	--
94	Medium/4 Hour/Immediate	1	--	--
95	Medium/4 Hour/Immediate	0.8	--	--
96	Medium/4 Hour/Immediate	1	--	--
97	Medium/4 Hour/15 Min. delay	1	--	--
98	Medium/4 Hour/15 Min. delay	1	--	74.33
99	Medium/4 Hour/15 Min. delay	1	--	
100	Medium/4 Hour/15 Min. delay	0.9	82.29	61.47
101	Medium/4 Hour/15 Min. delay	1	44.5	53.86
102	Medium/4 Hour/15 Min. delay	1	--	--
103	Medium/4 Hour/15 Min. delay	1	--	--
104	Medium/4 Hour/15 Min. delay	0.8	--	--
105	Medium/4 Hour/15 Min. delay	1	--	--
106	Medium/4 Hour/15 Min. delay	1	11.06	71.39

Animal #	Dose group	Volume of blood (ml)	Unadjusted analyte concentration in ng/ml (Bottom of curve/MDL in ng/ml) Cyclohexylbenzene 10/ND[b]	n-Tetradecane 50/ND
107	Medium/4 Hour/15 Min. delay	1	13.5	--
108	Medium/4 Hour/15 Min. delay	1	99.74	63.82
109	Medium/4 Hour/30 Min. delay	0.8	56.87	58.18
110	Medium/4 Hour/30 Min. delay	1	--	--
111	Medium/4 Hour/30 Min. delay	1	--	--
112	Medium/4 Hour/30 Min. delay	1	--	--
113	Medium/4 Hour/30 Min. delay	1	--	--
114	Medium/4 Hour/30 Min. delay	1	--	--
115	Medium/4 Hour/30 Min. delay	1	--	--
116	Medium/4 Hour/30 Min. delay	1	--	--
117	Medium/4 Hour/30 Min. delay	1		60.39
118	Medium/4 Hour/30 Min. delay	0.8		--
119	Medium/4 Hour/30 Min. delay	1	35.8	--
120	Medium/4 Hour/30 Min. delay	1	18.93	--
121	Medium/4 Hour/45 Min. Delay	1	--	--
122	Medium/4 Hour/45 Min. Delay	1	--	--
123	Medium/4 Hour/45 Min. Delay	1	--	--
124	Medium/4 Hour/45 Min. Delay	0.8	--	--
125	Medium/4 Hour/45 Min. Delay	1	--	--
126	Medium/4 Hour/45 Min. Delay	1	--	--
127	Medium/4 Hour/45 Min. Delay	1	--	62.7
128	Medium/4 Hour/45 Min. Delay	0.7	--	--
129	Medium/4 Hour/45 Min. Delay	1	--	--
130	Medium/4 Hour/45 Min. Delay	1	--	57.36
131	Medium/4 Hour/45 Min. Delay	1	--	--
132	Medium/4 Hour/45 Min. Delay	1	--	--
133	Medium/4 Hour/60 Min. Delay	1	--	--
134	Medium/4 Hour/60 Min. Delay	0.7	--	--
135	Medium/4 Hour/60 Min. Delay	1	--	--
136	Medium/4 Hour/60 Min. Delay	1	--	--
137	Medium/4 Hour/60 Min. Delay	1	--	52.18
138	Medium/4 Hour/60 Min. Delay	0.7	--	--
139	Medium/4 Hour/60 Min. Delay	1	29.36	--
140	Medium/4 Hour/60 Min. Delay	1	13.12	--
141	Medium/4 Hour/60 Min. Delay	1	--	--
142	Medium/4 Hour/60 Min. Delay	1	--	--

Animal #	Dose group	Volume of blood (ml)	Unadjusted analyte concentration in ng/ml (Bottom of curve/MDL in ng/ml) Cyclohexylbenzene 10/ND[b]	n-Tetradecane 50/ND
144	Medium/4 Hour/60 Min. Delay	1	--	--

[a]2-Methylheptane 2-methyloctane, methylcyclopentane, n-octane, 2-methylhexane, 2,5-dimethylhexane, 2,5-dimethylheptane, n-nonane, 2,6-dimethyloctane, n-decane, toluene, ethylbenzene, o-xylene, isopropylbenzene, and n-butylcyclohexane were not detected in any medium-dose blood samples. Analyte concentrations were not adjusted for sample volume. Not all measurements were considered reliable due to instrument/analytical issues (see "Results" for details).
[b]ND = Could not be determined.
[c]Not detected.

Table A-11. n-Decane concentration in blood of rats exposed to JP-8 for 4 hrs: high concentration group, 2 and 4 hr samples.

Animal #	Volume of blood (ml)	Unadjusted concentration (ng/ml)[a]	Distribution correction factor	Adjusted concentration (ng/ml)
157	1	7.96	1	7.96
158	1	12.55	1	12.6
159	0.8	10.63	0.961	12.8
160	1	14.42	1	14.4
161	1	8.70	1	8.70
162	0.8	--[b]	0.961	--
163	1	9.61	1	9.61
164	1	13.43	1	13.4
165	1	9.54	1	9.54
166	0.8	14.61	0.961	17.5
167	0.8	--	0.961	--
168	0.8	19.98	0.961	24.0

[a]All measurements were below the range of calibration.
[b]Below the limit of detection.

Table A-12. Unadjusted measurements of JP-8 components[a] in liver samples of rats exposed to JP-8 for 4 hrs: high concentration group, part 1

Animal #	Dose group	Weight of liver sample (g)	Toluene-d_8 Test Value (ng/sample)	Toluene-d_8 Measured Value (ng/sample)	Toluene-d_8 Recovery (%)	Unadjusted analyte level in ng/sample				
						Toluene	m,p-Xylenes	o-Xylene	2,6-Dimethyl-octane	Isopropyl-benzene
145	High/2 hour/Immediate	1.532	68.78	60	114.6	--[b]	--	--	--	--
146	High/2 hour/Immediate	1.06	44.2	50	88.4	--	--	--	--	--
147	High/2 hour/Immediate	1.648	13.12	60	21.9	--	--	--	--	--
148	High/2 hour/Immediate	0.76	39.1	50	78.2	--	--	--	--	--
149	High/2 hour/Immediate	1.342	29.05	60	48.4	--	--	--	--	--
150	High/2 hour/Immediate	1.46	39.64	50	79.3	--	--	--	--	--
151	High/2 hour/Immediate	2.148	27.49	60	45.8	--	--	--	--	--
152	High/2 hour/Immediate	0.93	74.93	50	149.9	--	--	--	--	--
83[c]	High/2 hour/Immediate	1.901	54.28	60	90.5	--	--	--	--	--
154	High/2 hour/Immediate	1.11	50.92	50	101.8	--	--	--	--	--
155	High/2 hour/Immediate	1.496	25.95	60	43.3	--	--	--	--	--
156	High/2 hour/Immediate	0.86	33.84	50	67.7	--	--	--	--	--
157	High/4 hour/Immediate	1.734	47.99	60	80.0	--	--	--	11.76	--
158	High/4 hour/Immediate	0.76	135.22	50	270.4	--	--	--	--	--
159	High/4 hour/Immediate	1.489	120.08	60	200.1	10.34	21.91	12.85	10.98	10.32
160	High/4 hour/Immediate	1.15	86.73	50	173.5	--	--	--	--	--
161	High/4 hour/Immediate	1.684	40.41	60	67.4	--	--	--	--	--
162	High/4 hour/Immediate	1.14	39.95	50	79.9	--	--	--	--	--
163	High/4 hour/Immediate	1.835	24.93	60	41.6	--	--	--	24.73	--
164	High/4 hour/Immediate	0.87	31.28	50	62.6	--	--	--	--	--
165[c]	High/4 hour/Immediate	1.595	49.75	60	82.9	--	--	--	--	--
166	High/4 hour/Immediate	0.86	66.79	50	133.6	--	--	--	--	--
167[c]	High/4 hour/Immediate	1.511	12.86	60	21.4	--	--	--	--	--
168	High/4 hour/Immediate	sample lost	no sample	no sample	no sample	--	--	--	--	--
169	High/4 hour/15 min. delay	1.665	64.14	60	106.9	--	--	--	--	--
170	High/4 hour/15 min. delay	1.08	43.9	50	87.8	--	--	--	--	--
171	High/4 hour/15 min. delay	1.564	55.91	60	93.2	--	--	--	--	--
172	High/4 hour/15 min. delay	0.88	53.75	50	107.5	--	--	--	--	--
173	High/4 hour/15 min. delay	1.462	89.6	60	149.3	--	--	--	--	--
174	High/4 hour/15 min. delay	0.94	77.74	50	155.5	--	--	--	--	--
175	High/4 hour/15 min. delay	1.701	19.5	60	32.5	--	--	--	--	--
176	High/4 hour/15 min. delay	1.14	59.81	50	119.6	--	--	--	--	--
177	High/4 hour/15 min. delay	2.067	35.74	60	59.6	--	--	--	--	--

Animal #	Dose group	Weight of liver sample (g)	Toluene-d_8 Test Value (ng/sample)	Toluene-d_8 Measured Value (ng/sample)	Toluene-d_8 Recovery (%)	Unadjusted analyte level in ng/sample				
						Toluene	m,p-Xylenes	o-Xylene	2,6-Dimethyl-octane	Isopropyl-benzene
178	High/4 hour/15 min. delay	0.84	74.18	50	148.4	--	--	--	--	--
179	High/4 hour/15 min. delay	1.758	11.55	60	19.3	--	--	--	--	--
180	High/4 hour/15 min. delay	1.2	71.17	50	142.3	--	--	--	--	--
181	High/4 hour/30 min. delay	2.028	30.72	60	51.2	--	--	--	--	--
182	High/4 hour/30 min. delay	1.1	59.05	50	118.1	--	--	--	--	--
183	High/4 hour/30 min. delay	1.923	30.54	60	50.9	--	--	--	--	--
184	High/4 hour/30 min. delay	1.18	71.98	50	144.0	--	--	--	--	--
185	High/4 hour/30 min. delay	1.385	56.41	60	94.0	--	--	--	--	--
186	High/4 hour/30 min. delay	0.881	87.37	60	145.6	--	--	--	--	--
188	High/4 hour/30 min. delay	0.852	68.86	60	114.8	--	--	--	--	--
187	High/4 hour/30 min. delay	1.353	14.37	60	24.0	--	--	--	--	--
189	High/4 hour/30 min. delay	2.111	24.42	60	40.7	--	--	--	--	--
190	High/4 hour/30 min. delay	1.131	4.63	60	7.7	--	--	--	--	--
191	High/4 hour/30 min. delay	1.546	7.77	60	13.0	--	--	--	--	--
192	High/4 hour/30 min. delay	0.76	49.82	50	99.6	--	--	--	--	--
193	High/4 Hour/45 min. delay	1.783	101.93	60	169.9	--	--	--	--	--
194	High/4 Hour/45 min. delay	0.97	68.5	50	137.0	--	--	--	--	--
195	High/4 Hour/45 min. delay	1.419	30.8	60	51.3	--	--	--	--	--
196	High/4 Hour/45 min. delay	1.05	45.9	50	91.8	--	--	--	--	--
197	High/4 Hour/45 min. delay	1.243	50.8	60	84.7	--	--	--	--	--
198	High/4 Hour/45 min. delay	1.12	58.52	50	117.0	--	--	--	--	--
199	High/4 Hour/45 min. delay	1.448	24.71	60	41.2	--	--	--	--	--
200	High/4 Hour/45 min. delay	1.1277	69.51	60	115.9	--	--	--	--	--
201	High/4 Hour/45 min. delay	1.359	8.23	60	13.7	--	--	--	--	--
202	High/4 Hour/45 min. delay	0.8543	92.86	60	154.8	--	--	--	--	--
203	High/4 Hour/45 min. delay	1.406	7.99	60	13.3	--	--	--	--	--
204	High/4 Hour/45 min. delay	1.097	65.62	60	109.4	--	--	--	--	--
205	High/4 hour/60 min. delay	2.203	6.9	60	11.5	--	--	--	--	--
206	High/4 hour/60 min. delay	0.97	98.15	50	196.3	--	--	--	--	--
207	High/4 hour/60 min. delay	1.346	66.95	60	111.6	--	--	--	--	--
208	High/4 hour/60 min. delay	0.88	88.23	50	176.5	--	--	--	--	--
209	High/4 hour/60 min. delay	1.319	90.92	60	151.5	--	--	--	--	--
210	High/4 hour/60 min. delay	0.82	74.06	50	148.1	--	--	--	--	--
211[c]	High/4 hour/60 min. delay	1.455	44.77	60	74.6	--	--	--	--	--
212	High/4 hour/60 min. delay	0.809	113.43	60	189.1	--	--	--	--	--
213[c]	High/4 hour/60 min. delay	1.752	29.15	60	48.6	--	--	--	--	--

Animal #	Dose group	Weight of liver sample (g)	Toluene-d_8 Test Value (ng/sample)	Toluene-d_8 Measured Value (ng/sample)	Toluene-d_8 Recovery (%)	Unadjusted analyte level in ng/sample				
						Toluene	m,p-Xylenes	o-Xylene	2,6-Dimethyl-octane	Isopropyl-benzene
214	High/4 hour/60 min. delay	0.8945	49.4	60	82.3	--	--	--	--	--
215	High/4 hour/60 min. delay	1.653	24.4	60	40.7	--	--	--	--	--
216	High/4 hour/60 min. delay	0.9924	33.33	60	55.6	--	--	--	--	--

[a]The following analytes were not found in liver samples from rats exposed to high concentrations of JP-8: methylcyclopentane, 2-methylhexane, 2,5-dimethylhexane, 2,5-dimethylheptane, 2-methylheptane, n-octane, 2-methyloctane, n-nonane, and ethylbenzene. MDL <10 ng per liver sample for all analytes except m,p-xylenes, 4-methyldecane, and n-tetradecane (<20 ng/liver sample). Average calibration sample weight: batch 1, 1.3588 g; batch 2, 2.0656 g, batch 3: 0.539 g.

[b]Not detected.

[c]Sample did not run on the day it was prepared due to instrument stoppage.

Table A-13. Unadjusted measurements of JP-8 components[a] in liver samples of rats exposed to JP-8 for 4 hrs: high concentration group, part 2.

Animal #	Dose group	Weight of liver sample (g)	Unadjusted analyte level in ng/sample						
			p-Ethyl-toluene	1,3,5-Trimethyl-benzene	n-Decane	1,2,4-Trimethyl-benzene	o-Ethyl-toluene	n-Butyl-cyclohexane	4-Methyl-decane
145	High/2 hour/Immediate	1.532	--[b]	--	--	--	11.37	--	--
146	High/2 hour/Immediate	1.06	--	--	--	--	--	--	--
147	High/2 hour/Immediate	1.648	--	--	--	--	--	--	--
148	High/2 hour/Immediate	0.76	--	--	--	--	--	--	--
149	High/2 hour/Immediate	1.342	--	--	--	--	--	--	--
150	High/2 hour/Immediate	1.46	--	--	--	--	--	--	--
151	High/2 hour/Immediate	2.148	--	--	10.29	--	11.57	--	--
152	High/2 hour/Immediate	0.93	11.6	12.18		13.41	14.54	--	--
83[c]	High/2 hour/Immediate	1.901	--	--	12.45	--	10.76	--	--
154	High/2 hour/Immediate	1.11	10.59	--	--	--	13.47	--	--
155	High/2 hour/Immediate	1.496	--	--	--	--	--	--	--
156	High/2 hour/Immediate	0.86	--	--	--	--	--	--	--
157	High/4 hour/Immediate	1.734	10.15	11.38	18.68	15.36	19.87	16.53	21.96
158	High/4 hour/Immediate	0.76	--	--	--	--	--	--	--
159	High/4 hour/Immediate	1.489	18.32	18.26	20.37	21.71	23.38	20.18	24.13
160	High/4 hour/Immediate	1.15	--	--	--	--	--	--	--
161	High/4 hour/Immediate	1.684	--	--	--	--	--	--	--
162	High/4 hour/Immediate	1.14	--	--	--	--	--	--	--
163	High/4 hour/Immediate	1.835	10	--	73.98	20.02	34.64	40.66	53.47
164	High/4 hour/Immediate	0.87	--	--	--	--	--	--	--
165[c]	High/4 hour/Immediate	1.595	--	--	17.26	10.57	15.22	10.87	--
166	High/4 hour/Immediate	0.86	--	--	--	--	--	--	--
167[c]	High/4 hour/Immediate	1.511	--	--	--	--	--	--	--
168	High/4 hour/Immediate	sample lost	--	--	--	--	--	--	--
169	High/4 hour/15 min. delay	1.665	--	--	--	--	--	--	--
170	High/4 hour/15 min. delay	1.08	--	--	--	--	--	--	--
171	High/4 hour/15 min. delay	1.564	--	--	--	--	--	--	--
172	High/4 hour/15 min. delay	0.88	--	--	--	--	--	--	--
173	High/4 hour/15 min. delay	1.462	--	--	--	--	--	--	--
174	High/4 hour/15 min. delay	0.94	--	--	--	--	--	--	--
175	High/4 hour/15 min. delay	1.701	--	--	--	--	--	--	--
176	High/4 hour/15 min. delay	1.14	--	--	--	--	--	--	--
177	High/4 hour/15 min. delay	2.067	--	--	--	--	--	--	--
178	High/4 hour/15 min. delay	0.84	--	--	--	--	--	--	--
179	High/4 hour/15 min. delay	1.758	--	--	--	--	--	--	--

Animal #	Dose group	Weight of liver sample (g)	Unadjusted analyte level in ng/sample						
			p-Ethyl-toluene	1,3,5-Trimethyl-benzene	n-Decane	1,2,4-Trimethyl-benzene	o-Ethyl-toluene	n-Butyl-cyclohexane	4-Methyl-decane
180	High/4 hour/15 min. delay	1.2	--	--	--	--	--	--	--
181	High/4 hour/30 min. delay	2.028	--	--	--	--	--	--	--
182	High/4 hour/30 min. delay	1.1	--	--	--	--	--	--	--
183	High/4 hour/30 min. delay	1.923	--	--	--	--	--	--	--
184	High/4 hour/30 min. delay	1.18	--	--	--	--	--	--	--
185	High/4 hour/30 min. delay	1.385	--	--	--	--	--	--	--
186	High/4 hour/30 min. delay	0.881	--	--	--	--	--	--	--
188	High/4 hour/30 min. delay	0.852	--	--	--	--	--	--	--
187	High/4 hour/30 min. delay	1.353	--	--	--	--	--	--	--
189	High/4 hour/30 min. delay	2.111	--	--	--	--	--	--	--
190	High/4 hour/30 min. delay	1.131	--	--	--	--	--	--	--
191	High/4 hour/30 min. delay	1.546	--	--	--	--	--	--	--
192	High/4 hour/30 min. delay	0.76	--	--	--	--	--	--	--
193	High/4 Hour/45 min. delay	1.783	--	--	--	--	--	--	--
194	High/4 Hour/45 min. delay	0.97	--	--	--	--	--	--	--
195	High/4 Hour/45 min. delay	1.419	--	--	--	--	--	--	--
196	High/4 Hour/45 min. delay	1.05	--	--	--	--	--	--	--
197	High/4 Hour/45 min. delay	1.243	--	--	--	--	--	--	--
198	High/4 Hour/45 min. delay	1.12	--	--	--	--	--	--	--
199	High/4 Hour/45 min. delay	1.448	--	--	--	--	--	--	--
200	High/4 Hour/45 min. delay	1.1277	--	--	--	--	--	--	--
201	High/4 Hour/45 min. delay	1.359	--	--	--	--	--	--	--
202	High/4 Hour/45 min. delay	0.8543	--	--	--	--	--	--	--
203	High/4 Hour/45 min. delay	1.406	--	--	--	--	--	--	--
204	High/4 Hour/45 min. delay	1.097	--	--	--	--	--	--	--
205	High/4 hour/60 min. delay	2.203	--	--	--	--	--	--	--
206	High/4 hour/60 min. delay	0.97	--	--	--	--	--	--	--
207	High/4 hour/60 min. delay	1.346	--	--	--	--	--	--	--
208	High/4 hour/60 min. delay	0.88	--	--	--	--	--	--	--
209	High/4 hour/60 min. delay	1.319	--	--	--	--	--	--	--
210	High/4 hour/60 min. delay	0.82	--	--	--	--	--	--	--
211[c]	High/4 hour/60 min. delay	1.455	--	--	--	--	--	--	--
212	High/4 hour/60 min. delay	0.809	--	--	--	--	--	--	--
213[c]	High/4 hour/60 min. delay	1.752	--	--	--	--	--	--	--
214	High/4 hour/60 min. delay	0.8945	--	--	--	--	--	--	--
215	High/4 hour/60 min. delay	1.653	--	--	--	--	--	--	--
216	High/4 hour/60 min. delay	0.9924	--	--	--	--	--	--	--

[a]The following analytes were not found in liver samples from rats exposed to high concentrations of JP-8: methylcyclopentane, 2-methylhexane, 2,5-dimethylhexane, 2,5-dimethylheptane, 2-methylheptane, n-octane, 2-methyloctane, n-nonane, and ethylbenzene. MDL <10 ng per liver sample for all analytes except m,p-xylenes, 4-methyldecane, and n-tetradecane (<20 ng/liver sample). Average calibration sample weight: batch 1, 1.3588 g; batch 2, 2.0656 g, batch 3: 0.539 g.
[b]Not detected.
[c]Sample did not run on the day it was prepared due to instrument stoppage.

Table A-14. Unadjusted measurements of JP-8 components[a] in liver samples of rats exposed to JP-8 for 4 hrs: high concentration group, part 3.

Animal #	Dose group	Weight of liver sample (g)	Unadjusted analyte level in ng/sample		
			Naphthalene	Cyclohexylbenzene	n-Tetradecane
145	High/2 hour/Immediate	1.532	102.43	171.8	70.42
146	High/2 hour/Immediate	1.06	--[b]	--	--
147	High/2 hour/Immediate	1.648	--	--	--
148	High/2 hour/Immediate	0.76	--	--	--
149	High/2 hour/Immediate	1.342	--	--	--
150	High/2 hour/Immediate	1.46	72.74	738.31	24.21
151	High/2 hour/Immediate	2.148	52.74	84.48	39.92
152	High/2 hour/Immediate	0.93	61.45	541.25	--
83[c]	High/2 hour/Immediate	1.901	14.03	--	27.68
154	High/2 hour/Immediate	1.11	25.29	187.69	36.4
155	High/2 hour/Immediate	1.496	--	--	--
156	High/2 hour/Immediate	0.86	14.18	22.98	--
157	High/4 hour/Immediate	1.734	73.56	135.79	149.48
158	High/4 hour/Immediate	0.76	293.12	--	--
159	High/4 hour/Immediate	1.489	110.78	245.33	90.9
160	High/4 hour/Immediate	1.15	295.67	--	--
161	High/4 hour/Immediate	1.684	--	35.38	29.37
162	High/4 hour/Immediate	1.14	--	--	--
163	High/4 hour/Immediate	1.835	57.25	93.4	44.38
164	High/4 hour/Immediate	0.87	--	--	--
165[c]	High/4 hour/Immediate	1.595	--	--	21.06
166	High/4 hour/Immediate	0.86	--	--	--
167[c]	High/4 hour/Immediate	1.511	--	--	--
168	High/4 hour/Immediate	sample lost	--	--	--
169	High/4 hour/15 min. delay	1.665	35.03	185.82	63.09
170	High/4 hour/15 min. delay	1.08	16.41	--	--
171	High/4 hour/15 min. delay	1.564	--	--	23.4
172	High/4 hour/15 min. delay	0.88	293.72	--	80.61
173	High/4 hour/15 min. delay	1.462	25.61	54.39	--
174	High/4 hour/15 min. delay	0.94	294.85	--	--
175	High/4 hour/15 min. delay	1.701	--	--	--
176	High/4 hour/15 min. delay	1.14	293.34	--	--
177	High/4 hour/15 min. delay	2.067	--	--	20.82
178	High/4 hour/15 min. delay	0.84	--	--	--
179	High/4 hour/15 min. delay	1.758	--	--	--
180	High/4 hour/15 min. delay	1.2	--	--	--

Animal #	Dose group	Weight of liver sample (g)	Unadjusted analyte level in ng/sample		
			Naphthalene	Cyclohexylbenzene	n-Tetradecane
181	High/4 hour/30 min. delay	2.028	--	--	31.04
182	High/4 hour/30 min. delay	1.1	27.59	269.78	15.05
183	High/4 hour/30 min. delay	1.923	--	--	--
184	High/4 hour/30 min. delay	1.18	29.06	23.95	--
185	High/4 hour/30 min. delay	1.385	--	--	--
186	High/4 hour/30 min. delay	0.881	369.43	--	--
188	High/4 hour/30 min. delay	0.852	366.37	331.6	--
187	High/4 hour/30 min. delay	1.353	--	--	--
189	High/4 hour/30 min. delay	2.111	--	--	--
190	High/4 hour/30 min. delay	1.131	370	--	--
191	High/4 hour/30 min. delay	1.546	--	--	--
192	High/4 hour/30 min. delay	0.76	293.11	--	--
193	High/4 hour/45 min. delay	1.783	--	--	--
194	High/4 Hour/45 min. delay	0.97	--	--	--
195	High/4 Hour/45 min. delay	1.419	--	--	--
196	High/4 Hour/45 min. delay	1.05	29.72	156.97	13.57
197	High/4 Hour/45 min. delay	1.243	--	--	--
198	High/4 Hour/45 min. delay	1.12	23.25	19.29	--
199	High/4 Hour/45 min. delay	1.448	--	--	--
200	High/4 Hour/45 min. delay	1.1277	--	317.84	--
201	High/4 Hour/45 min. delay	1.359	--	--	--
202	High/4 Hour/45 min. delay	0.8543	--	--	--
203	High/4 Hour/45 min. delay	1.406	--	--	--
204	High/4 Hour/45 min. delay	1.097	--	--	--
205	High/4 hour/60 min. delay	2.203	--	--	22.29
206	High/4 hour/60 min. delay	0.97	16.39	--	--
207	High/4 hour/60 min. delay	1.346	--	--	--
208	High/4 hour/60 min. delay	0.88	11.55	--	--
209	High/4 hour/60 min. delay	1.319	--	--	--
210	High/4 hour/60 min. delay	0.82	294.68	--	--
211[c]	High/4 hour/60 min. delay	1.455	--	--	--
212	High/4 hour/60 min. delay	0.809	364.96	328.02	--
213[c]	High/4 hour/60 min. delay	1.752	--	--	--
214	High/4 hour/60 min. delay	0.8945	370.46	--	--
215	High/4 hour/60 min. delay	1.653	--	--	--
216	High/4 hour/60 min. delay	0.9924	363.16	324.02	--

[a]The following analytes were not found in liver samples from rats exposed to high concentrations of JP-8: methylcyclopentane, 2-methylhexane, 2,5-dimethylhexane, 2,5-dimethylheptane, 2-methylheptane, n-octane, 2-methyloctane, n-nonane, and ethylbenzene. MDL <10 ng per liver sample for all analytes

except m,p-xylenes, 4-methyldecane, and n-tetradecane (<20 ng/liver sample). Average calibration sample weight: batch 1, 1.3588 g; batch 2, 2.0656 g, batch 3: 0.539 g.
[b]Not detected.
[c]Sample did not run on the day it was prepared due to instrument stoppage.

Table A-15. Unadjusted measurements of JP-8 components[a] in liver samples of rats exposed to JP-8 for 4 hrs: medium concentration group, part 1.

Animal #	Dose group	Weight of liver (g)	Toluene-d_8 Test Value (ng/sample)	Toluene-d_8 Measured Value (ng/sample)	Toluene-d_8 Recovery (%)	Unadjusted analyte level in ng/sample: 2,5-Dimethyl-heptane	2-Methyl-octane	Ethyl-benzene	m,p-Xylenes	n-Nonane	o-Xylene
73	Medium/2 Hour/Immediate	2.424	22.55	60	37.6	--[b]	--	--	--	--	--
74	Medium/2 Hour/Immediate	1.16	36.05	50	72.1	--	--	--	--	--	--
75	Medium/2 Hour/Immediate	2.164	9.26	60	15.4	--	--	--	--	--	--
76	Medium/2 Hour/Immediate	0.9	24.89	50	49.8	--	--	--	--	--	--
77	Medium/2 Hour/Immediate	1.547	45.74	60	76.2	--	--	--	--	--	--
78	Medium/2 Hour/Immediate	1.125	104.67	60	174.5	--	--	--	--	--	--
79	Medium/2 Hour/Immediate	1.681	50.86	60	84.8	--	--	--	--	--	--
80 [c]	Medium/2 Hour/Immediate	0.7934	37.87	60	63.1	--	--	--	--	--	--
81	Medium/2 Hour/Immediate	1.589	142.98	60	238.3	--	--	--	--	--	--
82	Medium/2 Hour/Immediate	0.958	74.32	60	123.9	--	--	--	--	--	--
84	Medium/2 Hour/Immediate	1.27	65.58	60	109.3	--	--	--	--	--	--
85	Medium/4 Hour/Immediate	1.061	55.61	60	92.7	--	--	--	--	--	--
86	Medium/4 Hour/Immediate	1	32	50	64.0	--	--	--	--	--	--
87	Medium/4 Hour/Immediate	1.631	112.51	60	187.5	--	--	--	--	--	--
88	Medium/4 Hour/Immediate	0.86	39.4	50	78.8	--	--	--	--	--	--
89	Medium/4 Hour/Immediate	1.532	21.73	60	36.2	--	--	--	--	--	--
90[c]	Medium/4 Hour/Immediate	0.9781	41.25	60	68.8	--	--	--	--	--	--
91	Medium/4 Hour/Immediate	1.713	12.68	60	21.1	--	--	--	--	--	--
92 [c]	Medium/4 Hour/Immediate	0.9827	33.45	60	55.8	--	--	--	--	--	--
93	Medium/4 Hour/Immediate	1.577	25.87	60	43.1	--	--	--	--	--	--
94	Medium/4 Hour/Immediate	1.221	199.18	60	332.0	--	--	--	--	--	--
95	Medium/4 Hour/Immediate	1.406	15.68	60	26.1	--	--	--	--	--	--
96	Medium/4 Hour/Immediate	0.711	209.89	60	349.8	--	--	--	--	--	--
97	Medium/4 Hour/15 Min. delay	1.707	46.65	60	77.8	--	--	--	--	--	--
98	Medium/4 Hour/15 Min. delay	0.95	54.04	50	108.1	--	--	--	--	--	--
99	Medium/4 Hour/15 Min. delay	1.689	65.62	60	109.4	--	--	--	--	--	--
100	Medium/4 Hour/15 Min. delay	1.18	18.55	50	37.1	--	--	--	--	--	--
101 [c]	Medium/4 Hour/15 Min. delay	1.489	18.58	60	31.0	--	--	--	--	--	--
102 [c]	Medium/4 Hour/15 Min. delay	0.9174	28.18	60	47.0	--	--	--	--	--	--
103 [c]	Medium/4 Hour/15 Min. delay	1.237	26.58	60	44.3	--	--	--	--	--	--
104 [c]	Medium/4 Hour/15 Min. delay	1.069	18.37	60	30.6	--	--	--	--	--	--
105	Medium/4 Hour/15 Min. delay	1.663	63.04	60	105.1	--	--	--	--	--	--

Animal #	Dose group	Weight of liver (g)	Toluene-d_8 Test Value (ng/sample)	Toluene-d_8 Measured Value (ng/sample)	Toluene-d_8 Recovery (%)	Unadjusted analyte level in ng/sample					
						2,5-Dimethyl-heptane	2-Methyl-octane	Ethyl-benzene	m,p-Xylenes	n-Nonane	o-Xylene
106	Medium/4 Hour/15 Min. delay	0.82	55.56	60	92.6	--	--	--	--	--	--
107	Medium/4 Hour/15 Min. delay	1.77	56.33	60	93.9	--	10.76	12.85	20.05	12.15	14.55
108	Medium/4 Hour/15 Min. delay	1.019	43.97	60	73.3	--	--	--	--	--	--
109	Medium/4 Hour/30 Min. delay	1.379	53.66	60	89.4	--	--	--	--	--	--
110	Medium/4 Hour/30 Min. delay	0.91	63.78	50	127. 6	--	--	--	--	--	--
111	Medium/4 Hour/30 Min. delay	1.814	27.92	60	46.5	--	--	--	--	--	--
112	Medium/4 Hour/30 Min. delay	1.18	29.07	50	58.1	--	--	--	--	--	--
113	Medium/4 Hour/30 Min. delay	1.862	16.12	60	26.9	--	--	--	--	--	--
114 [c]	Medium/4 Hour/30 Min. delay	0.8125	93.19	60	155.3	--	--	--	--	--	--
115	Medium/4 Hour/30 Min. delay	1.343	11.78	60	19.6	--	--	--	--	--	--
116 [c]	Medium/4 Hour/30 Min. delay	1.1872	25.2	60	42.0	--	--	--	--	--	--
117	Medium/4 Hour/30 Min. delay	1.884	52.63	60	87.7	10.53	11.54	--	--	11.35	--
118	Medium/4 Hour/30 Min. delay	1.049	87.63	60	146.1	--	--	--	--	--	--
119	Medium/4 Hour/30 Min. delay	1.869	103.31	60	172.2	--	10.05	--	--	--	--
120	Medium/4 Hour/30 Min. delay	0.963	189.05	60	315.1	--	--	--	--	--	--
121	Medium/4 Hour/45 Min. delay	1.39	77.91	60	129.9	--	--	--	--	--	--
122	Medium/4 Hour/45 Min. delay	0.84	84.25	50	168.5	--	--	--	--	--	--
123	Medium/4 Hour/45 Min. delay	1.7779	5.82	60	9.7	--	--	--	--	--	--
124	Medium/4 Hour/45 Min. delay	1.18	65.65	50	131.3	--	--	--	--	--	--
125	Medium/4 Hour/45 Min. delay	1.231	22.19	60	37.0	--	--	--	--	--	--
126 [c]	Medium/4 Hour/45 Min. delay	1.04	71.97	60	120.0	--	--	--	--	--	--
127	Medium/4 Hour/45 Min. delay	1.492	21.1	60	35.2	--	--	--	--	--	--
128	Medium/4 Hour/45 Min. delay	0.915	95.31	60	158.9	--	--	--	--	--	--
129	Medium/4 Hour/45 Min. delay	1.299	75.66	60	126.1	--	--	--	--	--	--
130	Medium/4 Hour/45 Min. delay	0.852	180.22	60	300.4	--	--	--	--	--	--
131	Medium/4 Hour/45 Min. delay	1.277	63.25	60	105.4	--	--	--	--	--	--
132	Medium/4 Hour/45 Min. delay	1.182	80.56	60	134.3	--	--	--	--	--	--
133	Medium/4 Hour/60 Min. delay	1.38	22.52	60	37.5	--	--	--	--	--	--
134	Medium/4 Hour/60 Min. delay	1.309	88.32	60	147.2	--	--	--	--	--	--
135	Medium/4 Hour/60 Min. delay	1.502	20.68	60	34.5	--	--	--	--	--	--
136	Medium/4 Hour/60 Min. delay	0.987	90.95	60	151.6	--	--	--	--	--	--
137 [c]	Medium/4 Hour/60 Min. delay	1.501	23.81	60	39.7	--	--	--	--	--	--
138	Medium/4 Hour/60 Min. delay	1.111	71.42	60	119.0	--	--	--	--	--	--
139	Medium/4 Hour/60 Min. delay	1.425	65.44	60	109.1	--	--	--	--	--	--
140	Medium/4 Hour/60 Min. delay	0.9364	65.59	60	109.3	--	--	--	--	--	--
141	Medium/4 Hour/60 Min. delay	1.87	86.53	60	144.2	--	--	--	--	--	--

Animal #	Dose group	Weight of liver (g)	Toluene-d_8 Test Value (ng/sample)	Toluene-d_8 Measured Value (ng/sample)	Toluene-d_8 Recovery (%)	Unadjusted analyte level in ng/sample					
						2,5-Dimethyl-heptane	2-Methyl-octane	Ethyl-benzene	m,p-Xylenes	n-Nonane	o-Xylene
142	Medium/4 Hour/60 Min. delay	1.022	152.79	60	254.7	--	--	--	--	--	--
144	Medium/4 Hour/60 Min. delay	1.0235	33.7	60	56.2	--	--	--	--	--	--

[a]The following analytes were not found in liver samples from rats exposed to medium concentrations of JP-8: methylcyclopentane, 2-methylhexane, 2,5-dimethylhexane, 2-methylheptane, n-octane, 2,6-dimethyloctane, toluene, and ethylbenzene. MDL <10 ng per liver sample for all analytes except m,p-xylenes, 4-methyldecane, and n-tetradecane (<20 ng/liver sample). Average calibration sample weight: batch 1, 1.3588 g; batch 2, 2.0656 g, batch 3: 0.539 g.
[b]Not detected.
[c]Sample did not run on the day it was prepared due to instrument stoppage.

Table A-16. Unadjusted measurements of JP-8 components[a] in liver samples of rats exposed to JP-8 for 4 hrs: medium concentration group, part 2.

			Unadjusted analyte level in ng/sample							
Animal #	Dose group	Weight of liver (g)	Isopropyl-benzene	p-Ethyl-toluene	1,3,5-Trimethyl-benzene	n-Decane	1,2,4-Tri-methyl-benzene	o-Ethyl-toluene	n-Butyl-cyclo-hexane	4-Methyl-decane
73	Medium/2 Hour/Immediate	2.424	--[b]	--	--	--	--	--	--	--
74	Medium/2 Hour/Immediate	1.16	--	--	--	--	--	--	--	--
75	Medium/2 Hour/Immediate	2.164	--	--	--	--	--	--	--	--
76	Medium/2 Hour/Immediate	0.9	--	--	--	--	--	--	--	--
77	Medium/2 Hour/Immediate	1.547	--	--	--	--	--	--	--	--
78	Medium/2 Hour/Immediate	1.125	--	--	--	--	--	--	--	--
79	Medium/2 Hour/Immediate	1.681	--	--	--	--	--	--	--	--
80 [c]	Medium/2 Hour/Immediate	0.7934	--	--	--	--	--	--	--	--
81	Medium/2 Hour/Immediate	1.589	--	--	--	--	--	--	--	--
82	Medium/2 Hour/Immediate	0.958	--	--	--	--	--	--	--	--
84	Medium/2 Hour/Immediate	1.27	--	--	--	--	--	--	--	--
85	Medium/4 Hour/Immediate	1.061	--	--	--	--	--	--	--	--
86	Medium/4 Hour/Immediate	1	--	--	--	--	--	--	--	--
87	Medium/4 Hour/Immediate	1.631	--	--	--	--	--	--	--	--
88	Medium/4 Hour/Immediate	0.86	--	--	--	--	--	--	--	--
89	Medium/4 Hour/Immediate	1.532	--	--	--	--	--	--	--	--
90[c]	Medium/4 Hour/Immediate	0.9781	--	--	--	--	--	--	--	--
91	Medium/4 Hour/Immediate	1.713	--	--	--	--	--	--	--	--
92 [c]	Medium/4 Hour/Immediate	0.9827	--	--	--	--	--	--	--	--
93	Medium/4 Hour/Immediate	1.577	--	--	--	--	--	--	--	--
94	Medium/4 Hour/Immediate	1.221	--	--	--	--	--	--	--	--
95	Medium/4 Hour/Immediate	1.406	--	--	--	--	--	--	--	--
96	Medium/4 Hour/Immediate	0.711	--	--	--	--	--	--	--	--
97	Medium/4 Hour/15 Min. delay	1.707	--	--	--	--	--	--	--	--
98	Medium/4 Hour/15 Min. delay	0.95	--	--	--	--	--	--	--	--
99	Medium/4 Hour/15 Min. delay	1.689	--	--	--	--	--	--	--	--
100	Medium/4 Hour/15 Min. delay	1.18	--	--	--	--	--	--	--	--
101 [c]	Medium/4 Hour/15 Min. delay	1.489	--	--	--	--	--	--	--	--
102 [c]	Medium/4 Hour/15 Min. delay	0.9174	--	--	--	--	--	--	--	--
103 [c]	Medium/4 Hour/15 Min. delay	1.237	--	--	--	--	--	--	--	--
104 [c]	Medium/4 Hour/15 Min. delay	1.069	--	--	--	--	--	--	--	--
105	Medium/4 Hour/15 Min. delay	1.663	--	--	--	--	--	--	--	--

Animal #	Dose group	Weight of liver (g)	Unadjusted analyte level in ng/sample: Isopropyl-benzene	p-Ethyl-toluene	1,3,5-Trimethyl-benzene	n-Decane	1,2,4-Tri-methyl-benzene	o-Ethyl-toluene	n-Butyl-cyclo-hexane	4-Methyl-decane
106	Medium/4 Hour/15 Min. delay	0.82	--	--	--	--	--	--	--	--
107	Medium/4 Hour/15 Min. delay	1.77	18	27.25	34.47	19.51	38.98	33.55	35.6	27.98
108	Medium/4 Hour/15 Min. delay	1.019	--	--	--	--	--	--	--	--
109	Medium/4 Hour/30 Min. delay	1.379	--	--	--	--	--	--	--	--
110	Medium/4 Hour/30 Min. delay	0.91	--	--	--	--	--	--	--	--
111	Medium/4 Hour/30 Min. delay	1.814	--	--	--	--	--	--	--	--
112	Medium/4 Hour/30 Min. delay	1.18	--	--	--	--	--	--	--	--
113	Medium/4 Hour/30 Min. delay	1.862	--	--	--	--	--	--	--	--
114 [c]	Medium/4 Hour/30 Min. delay	0.8125	--	--	--	--	--	--	--	--
115	Medium/4 Hour/30 Min. delay	1.343	--	--	--	--	--	--	--	--
116 [c]	Medium/4 Hour/30 Min. delay	1.1872	--	--	--	--	--	--	--	--
117	Medium/4 Hour/30 Min. delay	1.884	--	10.53	11.26	12.24	12.85	12.4	17.01	15.95
118	Medium/4 Hour/30 Min. delay	1.049	--	--	--	--	--	--	--	--
119	Medium/4 Hour/30 Min. delay	1.869	--	--	--	10.07	10.4	10.25	10.65	10.6
120	Medium/4 Hour/30 Min. delay	0.963	--	--	--	--	--	--	--	--
121	Medium/4 Hour/45 Min. delay	1.39	--	--	--	--	--	--	--	--
122	Medium/4 Hour/45 Min. delay	0.84	--	--	--	--	--	--	--	--
123	Medium/4 Hour/45 Min. delay	1.7779	--	--	--	--	--	--	--	--
124	Medium/4 Hour/45 Min. delay	1.18	--	--	--	--	--	--	--	--
125	Medium/4 Hour/45 Min. delay	1.231	--	--	--	--	--	--	--	--
126 [c]	Medium/4 Hour/45 Min. delay	1.04	--	--	--	--	--	--	--	--
127	Medium/4 Hour/45 Min. delay	1.492	--	--	--	--	--	--	--	--
128	Medium/4 Hour/45 Min. delay	0.915	--	--	--	--	--	--	--	--
129	Medium/4 Hour/45 Min. delay	1.299	--	13.41	15.7	12.03	18.69	15.5	12.57	14.52
130	Medium/4 Hour/45 Min. delay	0.852	--	--	--	--	--	--	--	--
131	Medium/4 Hour/45 Min. delay	1.277	--	12.46	15.15	14.04	17.7	14.34	13.19	12.63
132	Medium/4 Hour/45 Min. delay	1.182	--	--	--	--	--	--	--	--
133	Medium/4 Hour/60 Min. delay	1.38	--	--	--	--	--	--	--	--
134	Medium/4 Hour/60 Min. delay	1.309	--	--	--	--	--	--	--	--
135	Medium/4 Hour/60 Min. delay	1.502	--	--	--	--	--	--	--	--
136	Medium/4 Hour/60 Min. delay	0.987	--	--	--	--	--	--	--	--
137 [c]	Medium/4 Hour/60 Min. delay	1.501	--	--	--	--	--	--	--	--
138	Medium/4 Hour/60 Min. delay	1.111	--	--	--	--	--	--	--	--
139	Medium/4 Hour/60 Min. delay	1.425	--	--	--	--	--	--	--	--
140	Medium/4 Hour/60 Min. delay	0.9364	--	--	--	--	--	--	--	--
141	Medium/4 Hour/60 Min. delay	1.87	--	--	--	--	--	--	--	--

Animal #	Dose group	Weight of liver (g)	Unadjusted analyte level in ng/sample: Isopropyl-benzene	p-Ethyl-toluene	1,3,5-Trimethyl-benzene	n-Decane	1,2,4-Tri-methyl-benzene	o-Ethyl-toluene	n-Butyl-cyclo-hexane	4-Methyl-decane
142	Medium/4 Hour/60 Min. delay	1.022	--	--	--	--	--	--	--	--
144	Medium/4 Hour/60 Min. delay	1.0235	--	--	--	--	--	--	--	--

[a]The following analytes were not found in liver samples from rats exposed to medium concentrations of JP-8: methylcyclopentane, 2-methylhexane, 2,5-dimethylhexane, 2-methylheptane, n-octane, 2,6-dimethyloctane, toluene, and ethylbenzene. MDL <10 ng per liver sample for all analytes except m,p-xylenes, 4-methyldecane, and n-tetradecane (<20 ng/liver sample). Average calibration sample weight: batch 1, 1.3588 g; batch 2, 2.0656 g, batch 3: 0.539 g.
[b]Not detected.
[c]Sample did not run on the day it was prepared due to instrument stoppage.

Table A-17. Unadjusted measurements of JP-8 components[a] in liver samples of rats exposed to JP-8 for 4 hrs: medium concentration group, part 3.

			Unadjusted analyte level in ng/sample		
Animal #	Dose group	Weight of liver (g)	Naphthalene	Cyclohexylbenzene	n-Tetradecane
73	Medium/2 Hour/Immediate	2.424	--[b]	--	--
74	Medium/2 Hour/Immediate	1.16	19.7	47.8	--
75	Medium/2 Hour/Immediate	2.164	--	--	--
76	Medium/2 Hour/Immediate	0.9	14.05	--	--
77	Medium/2 Hour/Immediate	1.547	--	--	--
78	Medium/2 Hour/Immediate	1.125	366.91	331.13	ND[c]
79	Medium/2 Hour/Immediate	1.681	--	--	--
80 [d]	Medium/2 Hour/Immediate	0.7934	367.12	332.04	ND
81	Medium/2 Hour/Immediate	1.589	--	--	ND
82	Medium/2 Hour/Immediate	0.958	366.72	331.41	ND
84	Medium/2 Hour/Immediate	1.27	367.89	331.662	ND
85	Medium/4 Hour/Immediate	1.061	--	--	--
86	Medium/4 Hour/Immediate	1	19.03	--	--
87	Medium/4 Hour/Immediate	1.631	43.59	42.5	32.9
88	Medium/4 Hour/Immediate	0.86	14.91	--	--
89	Medium/4 Hour/Immediate	1.532	--	--	--
90 [d]	Medium/4 Hour/Immediate	0.9781	--	321.79	ND
91	Medium/4 Hour/Immediate	1.713	--	--	--
92 [d]	Medium/4 Hour/Immediate	0.9827	362.84	324.73	ND
93	Medium/4 Hour/Immediate	1.577	--	--	--
94	Medium/4 Hour/Immediate	1.221	11.52	24.49	ND
95	Medium/4 Hour/Immediate	1.406	--	--	--
96	Medium/4 Hour/Immediate	0.711	--	--	ND
97	Medium/4 Hour/15 Min. delay	1.707	17.55	41.17	--
98	Medium/4 Hour/15 Min. delay	0.95	296.02	--	79.94
99	Medium/4 Hour/15 Min. delay	1.689	--	--	--
100	Medium/4 Hour/15 Min. delay	1.18	295.55	--	--
101 [d]	Medium/4 Hour/15 Min. delay	1.489	42.16	31.91	35.55
102 [d]	Medium/4 Hour/15 Min. delay	0.9174	19.24	38.99	ND
103 [d]	Medium/4 Hour/15 Min. delay	1.237	--	--	--
104 [d]	Medium/4 Hour/15 Min. delay	1.069	--	--	ND
105	Medium/4 Hour/15 Min. delay	1.663	--	--	--
106	Medium/4 Hour/15 Min. delay	0.82	--	--	ND
107	Medium/4 Hour/15 Min. delay	1.77	145.69	--	ND
108	Medium/4 Hour/15 Min. delay	1.019	10.17	14.9	ND
109	Medium/4 Hour/30 Min. delay	1.379	30.82	69.94	30.22

Animal #	Dose group	Weight of liver (g)	Unadjusted analyte level in ng/sample		
			Naphthalene	Cyclohexylbenzene	n-Tetradecane
110	Medium/4 Hour/30 Min. delay	0.91	--	--	--
111	Medium/4 Hour/30 Min. delay	1.814	--	--	--
112	Medium/4 Hour/30 Min. delay	1.18	--	--	79.79
113	Medium/4 Hour/30 Min. delay	1.862	--	--	--
114 [d]	Medium/4 Hour/30 Min. delay	0.8125	--	12.97	ND
115	Medium/4 Hour/30 Min. delay	1.343	--	--	--
116 [d]	Medium/4 Hour/30 Min. delay	1.1872	10.5	21	ND
117	Medium/4 Hour/30 Min. delay	1.884	27.36	--	ND
118	Medium/4 Hour/30 Min. delay	1.049	363.21	322.9	ND
119	Medium/4 Hour/30 Min. delay	1.869	24.15	--	ND
120	Medium/4 Hour/30 Min. delay	0.963	369.67	--	ND
121	Medium/4 Hour/45 Min. delay	1.39	42.01	102.76	60.53
122	Medium/4 Hour/45 Min. delay	0.84	13.69	--	--
123	Medium/4 Hour/45 Min. delay	1.7779	--	--	--
124	Medium/4 Hour/45 Min. delay	1.18	13.27	--	--
125	Medium/4 Hour/45 Min. delay	1.231	--	--	--
126 [d]	Medium/4 Hour/45 Min. delay	1.04	--	316.49	ND
127	Medium/4 Hour/45 Min. delay	1.492	--	--	--
128	Medium/4 Hour/45 Min. delay	0.915	367.94	336.58	ND
129	Medium/4 Hour/45 Min. delay	1.299	46.37	--	ND
130	Medium/4 Hour/45 Min. delay	0.852	10.86	13.62	ND
131	Medium/4 Hour/45 Min. delay	1.277	45.46	--	ND
132	Medium/4 Hour/45 Min. delay	1.182	--	317.47	ND
133	Medium/4 Hour/60 Min. delay	1.38	34.48	38.79	58.95
134	Medium/4 Hour/60 Min. delay	1.309	--	--	ND
135	Medium/4 Hour/60 Min. delay	1.502	--	--	--
136	Medium/4 Hour/60 Min. delay	0.987	--	--	ND
137 [d]	Medium/4 Hour/60 Min. delay	1.501		19.78	54.59
138	Medium/4 Hour/60 Min. delay	1.111	363.94	327.35	ND
139	Medium/4 Hour/60 Min. delay	1.425	369.98	--	ND
140	Medium/4 Hour/60 Min. delay	0.9364	366.4	330.96	ND
141	Medium/4 Hour/60 Min. delay	1.87	366.36	333.58	ND
142	Medium/4 Hour/60 Min. delay	1.022	367.88	331.74	ND
144	Medium/4 Hour/60 Min. delay	1.0235	14.29	19.15	ND

[a]The following analytes were not found in liver samples from rats exposed to medium concentrations of JP-8: methylcyclopentane, 2-methylhexane, 2,5-dimethylhexane, 2-methylheptane, n-octane, 2,6-dimethyloctane, toluene, and ethylbenzene. MDL <10 ng per liver sample for all analytes except m,p-xylenes, 4-methyldecane, and n-tetradecane (<20 ng/liver sample). Average calibration sample weight: batch 1, 1.3588 g; batch 2, 2.0656 g, batch 3: 0.539 g.

[b]Not detected.
[c]Could not be determined due to calibration failure.
[d]Sample did not run on the day it was prepared due to instrument stoppage.

Table A-18. Unadjusted measurements[a] of JP-8 components in cochlea samples of male rats exposed to JP-8 for 4 hrs: part 1.

				Unadjusted analyte level in ng/sample					
Animal #	Dose group	Weight (g)	Toluene-d_8 Recovery (%)	Methyl-cyclo-pentane	2-Methyl-hexane	2,5-Dimethyl-hexane	2-Methyl-heptane	Toluene	n-Octane
1, 3, 5, 7, 9, 11	Low/2 hour/Immediate	0.4531	125	--[b]	--	--	--	--	--
13, 15, 17, 19, 21, 23	Low/4 hour/Immediate	0.5013	177	--	--	--	--	--	--
25, 27, 29, 31, 33, 35	Low/4 hour/15 min delay	0.5195	162	--	--	--	--	--	--
37, 39, 41, 43, 45, 47	Low/4 hour/30 min delay	0.5867	73.26	--	--	--	--	--	--
49, 51, 53, 143, 57, 59	Low/4 hour/45 min delay	0.7151	46	--	--	--	--	--	--
61, 63, 65, 67, 69, 71	Low/4 hour/60 min delay	0.7203	79	--	--	--	--	--	10.62
73, 75, 77, 79, 81,	Medium/2 hour/Immediate	0.331	153	12.51	13.92	15.55	15.54	15.71	15.17
85, 87, 89, 91, 93, 95	Medium/4 hour/Immediate	0.3858	146	--	--	--	--	19.1	--
97, 99, 101, 103, 105, 107[c]	Medium/4 hour/15 min delay	0.3466	171	--	--	--	--	--	--
109, 111, 113, 115, 117, 119	Medium/4 hour/30 min delay	0.4211	130	--	--	--	--	--	--
121, 123, 125, 127, 129, 131	Medium/4 hour/45 min delay	0.3448	109	--	--	--	--	--	--
133, 135, 137, 139, 141,	Medium/4 hour/60 min delay	0.3738	147	--	--	--	--	--	--
145, 147, 149, 151, 83, 155	High/2 hour/Immediate	0.4123	154	--	--	--	--	--	--
157, 159, 161, 163, 165, 167	High/4 hour/Immediate	0.5562	127	--	--	--	--	--	--
169, 171, 173, 175, 177, 179	High/4 hour/15 Min delay	0.4577	135	--	--	--	--	--	--
181, 183, 185, 187, 189, 191[d]	High/4 hour/30 Min delay	0.4211	86	--	--	--	--	--	--
193, 195, 197, 199, 201, 203	High/4 hour/45 Min delay	0.4318	99	--	--	--	--	--	--
205, 207, 209, 211, 213, 215	High/4 hour/60 Min delay	0.4641	116	--	--	--	--	--	--

[a]Calibration sample weights: average 0.121 g (range: 0.0314-0.399 g)
[b]Not detected.
[c]Did not run on day prepared, due to instrument stoppage.
[d]Vial had a tiny hole in the bottom, and some sodium chloride solution leaked out during sonication. Sample was wrapped in parafilm prior to analysis.

Table A-19. Unadjusted measurements[a] of JP-8 components in cochlea samples of male rats exposed to JP-8 for 4 hrs: part 2.

		Unadjusted analyte level in ng/sample							
Dose group	Weight (g)	2,5-Dimethyl-heptane	2-Methyl-octane	Ethyl-benzene	m,p-Xylenes	n-Nonane	o-Xylene	2,6-Dimethyl-octane	Isopropyl-benzene
Low/2 hour/Immediate	0.4531	--[b]	--	--	--	--	--	--	--
Low/4 hour/Immediate	0.5013	--	--	--	--	--	--	--	--
Low/4 hour/15 min delay	0.5195	--	--	--	--	--	--	--	--
Low/4 hour/30 min delay	0.5867	--	--	--	--	--	--	--	--
Low/4 hour/45 min delay	0.7151	--	--	--	--	--	--	--	--
Low/4 hour/60 min delay	0.7203	--	10.89	--	--	10.74	--	10.42	--
Medium/2 hour/Immediate	0.331	13.07	14.53	16.12	37.94	16.45	17.29	12.3	17.64
Medium/4 hour/Immediate	0.3858	--	--	16.96	40.2	--	18.2	--	14.95
Medium/4 hour/15 min delay[c]	0.3466	--	--	--	--	--	--	--	--
Medium/4 hour/30 min delay	0.4211	--	--	--	--	--	--	--	--
Medium/4 hour/45 min delay	0.3448	--	--	--	--	--	--	--	--
Medium/4 hour/60 min delay	0.3738	--	--	--	--	--	--	--	--
High/2 hour/Immediate	0.4123	--	--	--	--	--	--	--	--
High/4 hour/Immediate	0.5562	--	--	--	--	--	--	--	--
High/4 hour/15 Min delay	0.4577	--	--	--	--	--	--	--	--
High/4 hour/30 Min delay[d]	0.4211	--	--	--	--	--	--	--	--
High/4 hour/45 Min delay	0.4318	--	--	--	--	--	--	--	--
High/4 hour/60 Min delay	0.4641	--	--	--	--	--	--	--	--

[a]Calibration sample weights: average 0.0723 g (range: 0.0305-0.1377 g)
[b]Not detected.
[c]Did not run on day prepared, due to instrument stoppage.
[d]Vial had a tiny hole in the bottom, and some sodium chloride solution leaked out during sonication. Sample was wrapped in parafilm prior to analysis.

Table A-20. Unadjusted measurements[a] of JP-8 components in cochlea samples of male rats exposed to JP-8 for 4 hrs: part 3.

		Unadjusted analyte level in ng/sample									
Dose group	Weight (g)	p-Ethyl-toluene	1,3,5-Trimethyl-benzene	n-Decane	1,2,4-Trimethyl-benzene	o-Ethyl-toluene	n-Butyl-cyclo-hexane	4-Methyl-decane	Naphtha-lene	Cyclohexyl-benzene	n-Tetradecane
Low/2 hour/Immediate	0.4531	--[b]	--	--	--	--	--	--	--	--[b]	--
Low/4 hour/Immediate	0.5013	--	--	--	--	--	--	--	17.4	35.77	139.68
Low/4 hour/15 min delay	0.5195	--	--	--	--	--	--	--	--	--	--
Low/4 hour/30 min delay	0.5867	--	--	--	--	--	--	--	--	15.17	69.23
Low/4 hour/45 min delay	0.7151	14.46	18.91	16.68	23.41	17.09	26.04	36.54	68.61	105.68	229.63
Low/4 hour/60 min delay	0.7203	10.32	--	13.02	11.27	10.05	11.77	18.2	44.48	116.45	--
Medium/2 hour/Immediate	0.331	24.39	22.57	20.25	24.66	21.79	22.17	18.15	50.08	225.33	--
Medium/4 hour/Immediate	0.3858	22.61	19.49	16.73	21.8	18.99	11.82	--	40.88	86.3	400.97
Medium/4 hour/15 min delay[c]	0.3466	--	--	--	--	--	--	--	--	--	68
Medium/4 hour/30 min delay	0.4211	--	--	12.51	--	--	--	10.62	--	13.52	154.59
Medium/4 hour/45 min delay	0.3448	--	--	--	--	--	--	--	--	10.6	71.08
Medium/4 hour/60 min delay	0.3738	--	--	--	--	--	--	--	--	--	--
High/2 hour/Immediate	0.4123	--	--	--	--	--	--	--	--	--	63.23
High/4 hour/Immediate	0.5562	--	--	10.75	--	--	--	--	30.12	72.96	300.23
High/4 hour/15 Min delay	0.4577	--	--	15.74	--	--	--	--	20.97	38.36	--
High/4 hour/30 Min delay[d]	0.4211	--	--	23.1	--	--	--	--	--	--	56.65
High/4 hour/45 Min delay	0.4318	--	--	15.56	--	--	--	--	26.58	75.16	364.44
High/4 hour/60 Min delay	0.4641	--	--	--	--	--	--	--	24.69	44.18	232.75

[a]Calibration sample weights: average 0.0723 g (range: 0.0305-0.1377 g)
[b]Not detected.
[c]Did not run on day prepared, due to instrument stoppage.
[d]Vial had a tiny hole in the bottom, and some sodium chloride solution leaked out during sonication. Sample was wrapped in parafilm prior to analysis.

Table A-21. Unadjusted measurements[a] of JP-8 components in cochlea samples of female rats exposed to JP-8 for 4 hrs: part 1.

				Unadjusted analyte level in ng/sample						
Animal #	Dose group	Weight (g)	Toluene-d_8 Recovery (%)	Methyl-cyclo-pentane	2-Methyl-hexane	2,5-Dime-thyl-hexane	2-Methyl-heptane	Toluene	n-Octane	2,5-Dimethyl-heptane
2, 4, 6, 8, 10, 12	Low/2 hour/Immediate	0.603	108	--[b]	--	--	--	--	--	--
14, 16, 18, 20, 22, 24	Low/4 hour/Immediate	0.6697	71.64	--	--	--	--	--	--	--
26, 28, 30, 32, 34, 36	Low/4 hour/15 min delay	0.6047	91.33	--	--	--	--	--	--	--
38, 40, 42, 44, 46, 48	Low/4 hour/30 min delay	0.7806	94	--	--	--	--	--	--	--
50, 52, 54, 56, 58, 60	Low/4 hour/45 min delay	0.7911	97	--	--	--	--	--	--	--
62, 64, 66, 68, 70, 72	Low/4 hour/60 min delay	0.9119	132	8.97	10.22	9.51	9.04	8.55	10.24	7.68
74, 76, 78, 80, 82, 84	Medium/2 hour/Immediate	0.7325	134	10.54	10.08	9.14	10.25	13.44	10.47	6.99
86, 88, 90, 92, 94, 96	Medium/4 hour/Immediate	0.65	103	--	--	--	--	--	--	--
98, 100, 102, 104, 106, 108[c]	Medium/4 hour/15 min delay	0.7126	76	--	--	--	--	4.4	--	--
110, 112, 114, 116, 118, 120	Medium/4 hour/30 min delay		147	--	--	--	--	--	--	--
122, 124, 126, 128, 130, 132	Medium/4 hour/45 min delay	0.6693	97	--	--	--	--	--	4.56	--
134, 136, 138, 140, 142, 144	Medium/4 hour/60 min delay	0.7855	122	--	--	--	--	--	--	--
146, 148, 150, 152, 154, 156	High/2 hour/Immediate	0.9494	94	--	--	--	--	--	5.24	--
158, 160, 162, 164, 166, 168	High/4 hour/Immediate	0.6075	108	--	--	--	--	--	4.47	--
170, 172, 174, 176, 178, 180	High/4 hour/15 Min delay	0.922	115	--	--	--	--	--	5.12	--
182, 184, 186, 188, 190, 192	High/4 hour/30 Min delay	0.8911	106	--	--	--	--	5.93	6.1	--
194, 196, 198, 200, 202, 204	High/4 hour/45 Min delay	0.9986	110	--	--	--	--	--	4.42	--
206, 208, 210, 212, 214, 216	High/4 hour/60 Min delay	0.8354	98	--	--	--	--	--	4.49	--

[a]Calibration sample weights: average 0.0723 g (range: 0.0305-0.1377 g)
[b]Not detected.
[c]Did not run on day prepared, due to instrument stoppage.

Table A-22. Unadjusted measurements[a] of JP-8 components in cochlea samples of female rats exposed to JP-8 for 4 hrs: part 2.

		Unadjusted analyte level in ng/sample									
Dose group	Weight (g)	2-Methyl-octane	Ethyl-benzene	m,p-Xylenes	n-Nonane	o-Xylene	2,6-Dimethyl-octane	Isopropyl-benzene	p-Ethyl-toluene	1,3,5-Trimethyl-benzene	n-Decane
Low/2 hour/Immediate	0.603	--	--	--	--	--	--	--	--	--	--
Low/4 hour/Immediate	0.6697	--	--	--	--	--	--	--	--	--	--
Low/4 hour/15 min delay	0.6047	--	--	--	--	--	--	--	--	--	--
Low/4 hour/30 min delay	0.7806	--	--	--	--	--	--	--	--	--	--
Low/4 hour/45 min delay	0.7911	--	--	8.04	5.26	4.79	6.44	6.23	10.58	15.51	18.03
Low/4 hour/60 min delay	0.9119	8.23	8	18.28	9.06	8.45	7.65	8.85	9.19	10.09	10.13
Medium/2 hour/Immediate	0.7325	9.25	11.04	24.48	9.17	10.47	10.38	9.15	11.35	9.82	19.68
Medium/4 hour/Immediate	0.65	--	--	--	--	--	--	--	--	--	12.43
Medium/4 hour/15 min delay[c]	0.7126	--	--	--	--	--	--	--	--	--	9.21
Medium/4 hour/30 min delay		--	--	--	--	--	--	--	--	--	6.59
Medium/4 hour/45 min delay	0.6693	5.19	--	--	--	--	6.14	--	--	--	16.83
Medium/4 hour/60 min delay	0.7855	--	--	--	--	--	--	--	--	--	9.36
High/2 hour/Immediate	0.9494	5.81	--	--	--	--	5.15	--	--	--	13.55
High/4 hour/Immediate	0.6075	6.19	--	--	--	--	6.78	--	4.1	--	15.97
High/4 hour/15 Min delay	0.922	8.3	--	--	4.4	--	8.46	--	5.11	--	20.7
High/4 hour/30 Min delay	0.8911	6.61	--	--	6.11	4.07	9.2	--	6.18	4.76	23.79
High/4 hour/45 Min delay	0.9986	7.5	--	--	--	--	6.92	--	4.61	--	19.7
High/4 hour/60 Min delay	0.8354	6.32	--	--	--	--	7.29	--	--	--	16.45

[a]Calibration sample weights: average 0.0723 g (range: 0.0305-0.1377 g)
[b]Not detected.
[c]Did not run on day prepared, due to instrument stoppage.

Table A-23. Unadjusted measurements[a] of JP-8 components in cochlea samples of female rats exposed to JP-8 for 4 hrs: part 3.

		Unadjusted analyte level in ng/sample						
Dose group	Weight (g)	1,2,4-Trimethyl-benzene	o-Ethyl-toluene	n-Butyl-cyclohexane	4-Methyl-decane	Naphtha-lene	Cyclohexyl-benzene	n-Tetradecane
Low/2 hour/Immediate	0.603	--[b]	--	--	--	--		62.84
Low/4 hour/Immediate	0.6697	--	--	--	--	--	10.72	85.91
Low/4 hour/15 min delay	0.6047	--	--	--	--	--	11.48	92.18
Low/4 hour/30 min delay	0.7806	--	--	--	--	--	11.58	74.8
Low/4 hour/45 min delay	0.7911	21.26	15.44	27.1	28.25	72.24	139.31	163.95
Low/4 hour/60 min delay	0.9119	12.6	10.85	8.81	10.75	49.54	139.47	449.31
Medium/2 hour/Immediate	0.7325	13.57	12.26	10.8	9.99	40.67	123.03	184.79
Medium/4 hour/Immediate	0.65	--	--	4.17		25.57	53.85	138.39
Medium/4 hour/15 min delay[c]	0.7126	--	--	--	--	--	--	59.66
Medium/4 hour/30 min delay		--	--	--	--	--	--	80.35
Medium/4 hour/45 min delay	0.6693	--	--	5.83	4.8	18.98	25.21	129.51
Medium/4 hour/60 min delay	0.7855	--	--	--	--	--	--	82.49
High/2 hour/Immediate	0.9494	--	--	6.48	--	--	27.74	163.98
High/4 hour/Immediate	0.6075	--	--	--	--	23.61	116.65	142.1
High/4 hour/15 Min delay	0.922	--	--	8.82	5.15	24.21	100.06	235.85
High/4 hour/30 Min delay	0.8911	--	--	8.5	5.56	23.26	119.1	156.12
High/4 hour/45 Min delay	0.9986	--	--	6.61	--	21.02	91.96	151.03
High/4 hour/60 Min delay	0.8354	--	--	5.89	--	--	--	66.47

[a]Calibration sample weights: average 0.0723 g (range: 0.0305-0.1377 g)
[b]Not detected.
[c]Did not run on day prepared, due to instrument stoppage.

Table A-24. Unadjusted measurements[a] of JP-8 components in fat (adipose tissue) samples of male rats exposed to JP-8 for 4 hrs

Animal #	Dose group	Calibration group	Weight (g)	Unadjusted Toluene-d_8 Recovery (%)	Unadjusted analyte level in ng/sample	
					Toluene	n-Octane
73	Medium/2 hour/Immediate	2	0.326	52.1	--[b]	--
75	Medium/2 hour/Immediate	2	0.462	31.0	--	--
77	Medium/2 hour/Immediate	2	0.41	37.5	--	--
79	Medium/2 hour/Immediate	2	0.531	24.3	--	--
81	Medium/2 hour/Immediate	2	0.417	28.5	--	--
85	Medium/4 hour/Immediate	2	0.442	21.4	--	--
87	Medium/4 hour/Immediate	2	0.304	43.0	--	--
89	Medium/4 hour/Immediate	2	0.313	47.4	--	--
91	Medium/4 hour/Immediate	2	0.493	34.4	--	--
93	Medium/4 hour/Immediate	2	0.563	28.4	--	--
95	Medium/4 hour/Immediate	2	0.39	27.2	--	--
97	Medium/4 hour/15 Min. delay	2	0.359	42.5	--	--
99	Medium/4 hour/15 Min. delay	2	0.385	42.4	--	--
101	Medium/4 hour/15 Min. delay	2	0.404	33.7	--	--
103	Medium/4 hour/15 Min. delay	2	0.331	38.5	--	--
105	Medium/4 hour/15 Min. delay	2	0.501	25.2	--	--
107	Medium/4 hour/15 Min. delay	2	0.285	47.8	--	--
109	Medium/4 hour/30 Min. delay	2	0.357	44.5	--	--
111	Medium/4 hour/30 Min. delay	2	0.424	38.5	--	--
113	Medium/4 hour/30 Min. delay	2	0.319	93.4	--	--
115	Medium/4 hour/30 Min. delay	2	0.302	49.5	--	--
117	Medium/4 hour/30 Min. delay	2	0.591	25.6	--	--
119	Medium/4 hour/30 Min. delay	2	0.446	41.1	--	--
121	Medium/4 hour/45 Min. delay	2	0.856	12.4	--	--
123[c]	Medium/4 hour/45 Min. delay	2	0.89	20.3	--	--
125[c]	Medium/4 hour/45 Min. delay	2	0.438	31.0	--	--
127	Medium/4 hour/45 Min. delay	2	0.235	50.3	--	--
129	Medium/4 hour/45 Min. delay	2	0.425	35.5	--	--
131	Medium/4 hour/45 Min. delay	2	0.36	40.5	--	--
133	Medium/4 hour/60 Min. delay	2	0.464	35.7	--	--
135[c]	Medium/4 hour/60 Min. delay	2	0.482	35.8	--	--
137	Medium/4 hour/60 Min. delay	2	0.468	29.6	--	--
139	Medium/4 hour/60 Min. delay	2	0.263	46.4	--	--
141	Medium/4 hour/60 Min. delay	2	0.416	34.9	--	--
83	High/2 hour/Immediate	2	0.467	30.1	--	--
145	High/2 hour/Immediate	2	0.41	40.4	--	--
147	High/2 hour/Immediate	2	0.429	41.7	--	--
149[c]	High/2 hour/Immediate	2	0.563	33.6	--	--
151	High/2 hour/Immediate	2	0.41	41.8	--	--
155	High/2 hour/Immediate	2	0.313	141.9	26.69	27.04
157	High/4 hour/Immediate	2	0.415	41.1	--	--
159[c]	High/4 hour/Immediate	2	0.391	44.1	--	--
161[c]	High/4 hour/Immediate	2	0.346	54.7	--	--
163	High/4 hour/Immediate	2	0.51	30.6	--	--
165	High/4 hour/Immediate	2	0.48	46.0	21.99	32.77
167	High/4 hour/Immediate	2	0.519	32.4	--	--
169	High/4 hour/15 min. delay	2	0.525	26.1	--	--
171[c]	High/4 hour/15 min. delay	2	0.553	39.1	--	23.05
173[c]	High/4 hour/15 min. delay	2	0.343	59.3	--	--

Animal #	Dose group	Calibration group	Weight (g)	Unadjusted Toluene-d_8 Recovery (%)	Unadjusted analyte level in ng/sample	
					Toluene	n-Octane
175	High/4 hour/15 min. delay	2	0.461	34.8	--	25.6
177	High/4 hour/15 min. delay	2	0.488	29.6	--	--
179	High/4 hour/15 min. delay	2	0.565	26.9	--	--
181	High/4 hour/30 min. delay	2	0.513	53.2	--	--
183 [c]	High/4 hour/30 min. delay	2	0.458	41.8	--	--
185	High/4 hour/30 min. delay	2	0.615	19.4	--	21.31
187	High/4 hour/30 min. delay	2	0.641	29.8	--	--
189	High/4 hour/30 min. delay	2	0.507	32.0	--	--
191	High/4 hour/30 min. delay	2	0.594	26.3	--	--
193	High/4 hour/45 min. delay	2	0.409	42.9	--	--
195 [c]	High/4 hour/45 min. delay	2	0.289	64.5	--	--
197	High/4 hour/45 min. delay	2	0.371	47.7	--	--
199	High/4 hour/45 min. delay	2	0.431	38.6	--	--
201	High/4 hour/45 min. delay	2	0.354	43.1	--	--
203	High/4 hour/45 min. delay	2	0.459	32.9	--	--
205 [c]	High/4 hour/60 min. delay	2	0.424	41.6	--	--
207	High/4 hour/60 min. delay	2	0.547	26.5	--	--
209 [c]	High/4 hour/60 min. delay	2	0.386	47.9	--	20.07
211	High/4 hour/60 min. delay	2	0.406	38.5	--	--
213	High/4 hour/60 min. delay	2	0.508	34.6	--	--
215	High/4 hour/60 min. delay	2	0.527	25.6	--	--

[a]Calibration sample weights: calibration 1 average 0.24265 g (range: 0.0986-0.4715 g); calibration 2 average 0.225357 (0.149-0.235, one sample with no weight reported. Methylcyclohexane, 2,5-dimethylhexane, and 2-methylhexane and 2-methylheptane were not detected in in any fat sample from male rats.
[b]Not detected.
[c]Did not run on day prepared, due to instrument stoppage.

Table A-25. Unadjusted measurements[a] of JP-8 components in fat (adipose tissue) samples of female rats exposed to JP-8 for 4 hrs

Animal #	Dose group	Calibration group	Weight (g)	Unadjusted Toluene-d_8 Recovery (%)	Unadjusted level (ng/sample)			Distribution correction factor		
					Toluene	n-Octane[b]	2-Methyl-heptane	Toluene	n-Octane	2-Methyl-heptane
74	Medium/2 hour/Immediate	1	0.1413	not spiked	--[c]	--	--	n/a[d]	n/a	n/a
76	Medium/2 hour/Immediate	1	0.2615	98.6	--	39.3	21.42	1.0632	1.0536	1.0262
78	Medium/2 hour/Immediate	1	0.1482	148.6	--	41.39	25.51	0.6837	0.7320	0.8688
80	Medium/2 hour/Immediate	1	0.182	127.4	--	24.38	--	0.7969	0.8280	0.9157
82	Medium/2 hour/Immediate	1	0.191	167.7	--	36.34	25.26	0.8271	0.8535	0.9282
84	Medium/2 hour/Immediate	1	0.179	150.6	20.18	78.46	--	0.7869	0.8194	0.9116
86	Medium/4 hour/Immediate	1	0.22	133.1	25.41	92.81	51.82	0.9242	0.9358	0.9686
88	Medium/4 hour/Immediate	1	0.1807	112.6	22.75	50.12	36.4	0.7926	0.8243	0.9139
90	Medium/4 hour/Immediate	1	0.184	119.0	21.45	69.35	37.03	0.8036	0.8336	0.9185
92	Medium/4 hour/Immediate	1	0.201	not spiked	22.86	113.69	49.62	0.8606	0.8819	0.9421
94	Medium/4 hour/Immediate	1	0.164	92.4	--	70.59	48.18	0.7366	0.7769	0.8907
96	Medium/4 hour/Immediate	1	0.208	134.9	23.06	90.65	54.75	0.8840	0.9017	0.9519
98	Medium/4 hour/15 Min. delay	1	0.2303	81.3	--	77.63	40.2	0.9587	0.9650	0.9829
100	Medium/4 hour/15 Min. delay	1	0.1944	88.5	--	84.32	40.05	0.8384	0.8631	0.9330
102	Medium/4 hour/15 Min. delay	1	0.127	220.7	23.13	107.95	34.66	0.6127	0.6719	0.8393
104	Medium/4 hour/15 Min. delay	1	0.216	112.7	--	58.79	28.11	0.9108	0.9244	0.9630
106	Medium/4 hour/15 Min. delay	1	0.214	55.4	23.35	103.13	37.19	0.9041	0.9188	0.9602
108	Medium/4 hour/15 Min. delay	1	0.199	69.1	--	38.56	24.19	0.8539	0.8762	0.9394
110	Medium/4 hour/15 Min. delay	1	0.2595	149.6	--	62.61	33.41	1.0565	1.0479	1.0235
112	Medium/4 hour/30 Min. delay	1	0.1991	99.5	22.98	91.47	38.67	0.8542	0.8765	0.9395
114	Medium/4 hour/30 Min. delay	1	0.25	80.7	--	45.16	24.73	1.0247	1.0209	1.0103
116	Medium/4 hour/30 Min. delay	1	0.358	66.3	--	50.87	24.31	1.3865	1.3274	1.1604
118	Medium/4 hour/30 Min. delay	1	0.272	48.7	--	56.92	28.48	1.0984	1.0834	1.0408
120	Medium/4 hour/30 Min. delay	2	0.135	108.3	--	--	--	n/a	n/a	n/a
122	Medium/4 hour/45 Min. delay	1	0.1284	177.6	22.71	128.3	46.4	0.6173	0.6758	0.8412
124	Medium/4 hour/45 Min. delay	1	0.242	102.6	20.48	53.49	27.6	0.9979	0.9982	0.9991
126	Medium/4 hour/45 Min. delay	1	0.181	208.3	--	61.71	37.85	0.7936	0.8251	0.9143
128	Medium/4 hour/45 Min. delay	n/a	Lost	--	--	--	--	n/a	n/a	n/a
130	Medium/4 hour/45 Min. delay	n/a	Lost	--	--	--	--	n/a[c]	n/a	n/a
132	Medium/4 hour/45 Min. delay	2	0.235	79.1	--	--	--	n/a[c]	n/a	n/a
134	Medium/4 hour/60 Min. delay	1	0.1801	98.7	--	28.02	29.96	0.7905	0.8226	0.9131
136	Medium/4 hour/60 Min. delay	1	0.185	166.0	--	57.57	25.53	0.8070	0.8365	0.9199
138	Medium/4 hour/60 Min. delay	1	0.12	197.3	--	69.05	33.56	0.5892	0.6520	0.8296
140	Medium/4 hour/60 Min. delay	n/a	Lost	--	--	--	--	n/a	n/a	n/a
142	Medium/4 hour/60 Min. delay	n/a	Lost	--	--	--	--	n/a	n/a	n/a

Animal #	Dose group	Calibration group	Weight (g)	Unadjusted Toluene-d_8 Recovery (%)	Unadjusted level (ng/sample)			Distribution correction factor		
					Toluene	n-Octane[b]	2-Methyl-heptane	Toluene	n-Octane	2-Methyl-heptane
144	Medium/4 hour/60 Min. delay	2	0.211	62.7	--	--	--	n/a	n/a	n/a
146	High/2 hour/Immediate	1	0.1687	306.5	22.81	78.89	37.16	0.7524	0.7902	0.8972
148	High/2 hour/Immediate	1	0.411	25.0	22.55	124.42	33.41	1.5641	1.4778	1.2340
150	High/2 hour/Immediate	1	0.387	57.7	--	56.22	28.68	1.4837	1.4097	1.2007
152	High/2 hour/Immediate	1	0.1892	206.2	22.19	80.43	33.16	0.8210	0.8484	0.9257
154	High/2 hour/Immediate	1	0.2127	74.1	31.8	121.1	48.6	0.8998	0.9151	0.9584
156	High/2 hour/Immediate	1	0.1665	262.5	28.66	112.46	45.93	0.7450	0.7840	0.8942
158	High/4 hour/Immediate	1	0.1575	133.3	33.93	250.06	89.25	0.7148	0.7584	0.8817
160	High/4 hour/Immediate	1	0.1827	152.1	30.73	244.38	83.04	0.7993	0.8299	0.9167
162	High/4 hour/Immediate	1	0.185	209.2	37.16	293.17	105.08	0.8070	0.8365	0.9199
164	High/4 hour/Immediate	1	0.2043	174.6	26.68	202.79	75.69	0.8716	0.8912	0.9467
166	High/4 hour/Immediate	1	0.113	269.3	49.03	427.93	139.54	0.5658	0.6321	0.8198
168	High/4 hour/Immediate	1	0.1348	352.0	37.17	333.39	122.19	0.6388	0.6940	0.8501
170	High/4 hour/15 min. delay	1	0.2358	90.1	29.08	181.94	67.4	0.9771	0.9806	0.9905
172	High/4 hour/15 min. delay	1	0.1636	81.4	30.41	208.31	69.08	0.7353	0.7757	0.8902
174	High/4 hour/15 min. delay	1	0.1296	256.7	39.92	253.36	91.01	0.6214	0.6792	0.8429
176	High/4 hour/15 min. delay	1	0.184	--	36.97	264.61	102.26	0.8036	0.8336	0.9185
178	High/4 hour/15 min. delay	1	0.1708	164.4	36.54	302.21	99.61	0.7594	0.7962	0.9002
180	High/4 hour/15 min. delay	1	0.2056	85.0	24.81	171.37	86.79	0.8760	0.8949	0.9485
182	High/4 hour/30 min. delay	1	0.1787	86.4	31.81	165.48	74.92	0.7859	0.8186	0.9111
184	High/4 hour/30 min. delay	1	0.2411	13.2	25.2	141.59	54.58	0.9949	0.9957	0.9979
186	High/4 hour/30 min. delay	1	0.2461	147.1	28.28	181.69	61.65	1.0116	1.0099	1.0048
188	High/4 hour/30 min. delay	1	0.1671	93.2	22.94	206.23	77.14	0.7470	0.7857	0.8950
190	High/4 hour/30 min. delay	1	0.233	175.7	42.9	347.11	116.86	0.9678	0.9727	0.9866
192	High/4 hour/30 min. delay	1	0.154	178.3	36.54	224.11	93.44	0.7031	0.7485	0.8768
194	High/4 hour/45 min. delay	1	0.2488	95.6	30.57	192.55	76.44	1.0207	1.0175	1.0086
196	High/4 hour/45 min. delay	1	0.1796	97.7	23.84	138.59	50.71	0.7889	0.8211	0.9124
198	High/4 hour/45 min. delay	1	0.111	327.8	32.17	203.85	83.87	0.5591	0.6265	0.8170
200	High/4 hour/45 min. delay	1	0.1969	124.7	28.41	242.85	89.65	0.8468	0.8702	0.9364
202	High/4 hour/45 min. delay	1	0.2334	93.1	29.87	232.66	75.37	0.9691	0.9738	0.9872
204	High/4 hour/45 min. delay	1	0.0912	233.2	25.53	208.72	84.88	0.4927	0.5703	0.7895
206	High/4 hour/60 min. delay	1	0.1721	161.7	30.94	256.93	87.52	0.7637	0.7999	0.9020
208	High/4 hour/60 min. delay	1	0.2515	135.1	25.97	174.67	66.67	1.0297	1.0252	1.0123
210	High/4 hour/60 min. delay	1	0.2513	127.9	25.3	173	57.14	1.0291	1.0246	1.0121
212	High/4 hour/60 min. delay	1	0.205	102.9	30.71	181.01	80.99	0.8740	0.8932	0.9477
214	High/4 hour/60 min. delay	1	0.1814	184.4	24.03	206.56	71.56	0.7949	0.8262	0.9149
216	High/4 hour/60 min. delay	1	0.284	103.7	30.45	197.65	66.11	1.1386	1.1174	1.0575

[a]Calibration sample weights: calibration 1 average 0.24265 g (range: 0.0986-0.4715 g); calibration 2 average 0.225357 (0.149-0.235, one sample with no weight reported. Methylcyclohexane, 2,5-dimethylhexane, 2-methylhexane, and 2-methylheptane were not detected in in any fat sample from male rats.
[b]All samples above 150 ng/sample (unadjusted) are estimates above the range of the calibration curve.
[c]Not detected.
[d]n/a = Not applicable

Table A-26. Adjusted measurements[a] of JP-8 components in fat (adipose tissue) samples of female rats exposed to JP-8 for 4 hrs

Animal #	Dose group	Corrected toluene-d_8 recovery (Percent)	Concentration in ng/g		
			Toluene	n-Octane	2-Methyl-heptane
74	Medium/2 hour/Immediate	n/a[b]	--[c]	--	--
76	Medium/2 hour/Immediate	104.9	--	158.3	84.1
78	Medium/2 hour/Immediate	101.6	--	204.4	149.5
80	Medium/2 hour/Immediate	101.5	--	110.9	--
82	Medium/2 hour/Immediate	138.7	--	162.4	122.8
84	Medium/2 hour/Immediate	118.5	88.7	359.2	--
86	Medium/4 hour/Immediate	123.0	106.7	394.8	228.1
88	Medium/4 hour/Immediate	89.2	99.8	228.6	184.1
90	Medium/4 hour/Immediate	95.6	93.7	314.2	184.9
92	Medium/4 hour/Immediate	n/a	97.9	498.8	232.6
94	Medium/4 hour/Immediate	68.1	--	334.4	261.7
96	Medium/4 hour/Immediate	119.2	98.0	393.0	250.6
98	Medium/4 hour/15 Min. delay	77.9	--	325.3	171.6
100	Medium/4 hour/15 Min. delay	74.2	--	374.4	192.2
102	Medium/4 hour/15 Min. delay	135.2	111.6	571.1	229.1
104	Medium/4 hour/15 Min. delay	102.6	--	251.6	125.3
106	Medium/4 hour/15 Min. delay	50.1	98.6	442.8	166.9
108	Medium/4 hour/15 Min. delay	59.0	--	169.8	114.2
110	Medium/4 hour/30 Min. delay	158.0	--	252.8	131.8
112	Medium/4 hour/30 Min. delay	85.0	98.6	402.7	182.5
114	Medium/4 hour/30 Min. delay	82.7	--	184.4	99.9
116	Medium/4 hour/30 Min. delay	91.9	--	188.6	78.8
118	Medium/4 hour/30 Min. delay	53.4	--	226.7	109.0
120	Medium/4 hour/30 Min. delay	n/a	--	--	--
122	Medium/4 hour/45 Min. delay	109.7	109.2	675.3	304.0
124	Medium/4 hour/45 Min. delay	102.4	84.5	220.6	114.0
126	Medium/4 hour/45 Min. delay	165.3		281.3	191.2
128	Medium/4 hour/45 Min. delay	n/a	n/a	n/a	n/a
130	Medium/4 hour/45 Min. delay	n/a	n/a	n/a	n/a
132	Medium/4 hour/45 Min. delay	--	--	--	--
134	Medium/4 hour/60 Min. delay	78.0	--	128.0	151.9
136	Medium/4 hour/60 Min. delay	133.9	--	260.3	126.9
138	Medium/4 hour/60 Min. delay	116.3	--	375.2	232.0
140	Medium/4 hour/60 Min. delay	n/a	n/a	n/a	n/a
142	Medium/4 hour/60 Min. delay	n/a	n/a	n/a	n/a

Animal #	Dose group	Corrected toluene-d_8 recovery (Percent)	Concentration in ng/g		
			Toluene	n-Octane	2-Methyl-heptane
144	Medium/4 hour/60 Min. delay	--	--	--	--
146	High/2 hour/Immediate	230.6	101.7	369.5	197.6
148	High/2 hour/Immediate	39.0	85.8	447.4	100.3
150	High/2 hour/Immediate	85.6	--	204.8	89.0
152	High/2 hour/Immediate	169.3	96.3	360.7	162.2
154	High/2 hour/Immediate	66.7	134.5	521.0	219.0
156	High/2 hour/Immediate	195.6	128.2	529.5	246.7
158	High/4 hour/Immediate	95.3	154.0	1204.1 [d]	499.6
160	High/4 hour/Immediate	121.6	134.4	1110.1 [d]	416.7
162	High/4 hour/Immediate	168.8	162.1	1325.5 [d]	522.5
164	High/4 hour/Immediate	152.2	113.8	884.7 [d]	350.7
166	High/4 hour/Immediate	152.4	245.5	2393.9 [d]	1012.4
168	High/4 hour/Immediate	224.9	176.1	1716.4 [d]	770.6
170	High/4 hour/15 min. delay	88.1	120.5	756.6 [d]	283.1
172	High/4 hour/15 min. delay	59.8	136.7	987.7 [d]	375.9
174	High/4 hour/15 min. delay	159.5	191.4	1327.9 [d]	591.9
176	High/4 hour/15 min. delay	No spike	161.5	1198.8 [d]	510.5
178	High/4 hour/15 min. delay	124.9	162.5	1408.7 [d]	525.0
180	High/4 hour/15 min. delay	74.4	105.7	745.9 [d]	400.4
182	High/4 hour/30 min. delay	67.9	139.9	758.0 [d]	382.0
184	High/4 hour/30 min. delay	13.1	104.0	584.7	225.9
186	High/4 hour/30 min. delay	148.8	116.3	745.6 [d]	251.7
188	High/4 hour/30 min. delay	69.6	102.5	969.6 [d]	413.2
190	High/4 hour/30 min. delay	170.0	178.2	1449.1 [d]	494.8
192	High/4 hour/30 min. delay	125.4	166.8	1089.2 [d]	532.0
194	High/4 hour/45 min. delay	97.6	125.4	787.5 [d]	309.9
196	High/4 hour/45 min. delay	77.0	104.7	633.6	257.6
198	High/4 hour/45 min. delay	183.2	162.0	1150.5 [d]	617.3
200	High/4 hour/45 min. delay	105.6	122.2	1073.3 [d]	426.4
202	High/4 hour/45 min. delay	90.3	124.0	970.7 [d]	318.8
204	High/4 hour/45 min. delay	114.9	137.9	1305.1 [d]	734.8
206	High/4 hour/60 min. delay	123.5	137.3	1194.1 [d]	458.7
208	High/4 hour/60 min. delay	139.1	106.3	712.0 [d]	268.4
210	High/4 hour/60 min. delay	131.6	103.6	705.4 [d]	230.1
212	High/4 hour/60 min. delay	89.9	130.9	788.7 [d]	374.4
214	High/4 hour/60 min. delay	146.6	105.3	940.8 [d]	360.9
216	High/4 hour/60 min. delay	118.1	122.1	777.7 [d]	246.2

[a]Calibration sample weights: calibration 1 average 0.24265 g (range: 0.0986-0.4715 g); calibration 2 average 0.225357 (0.149-0.235, one sample with no weight reported. Methylcyclohexane, 2,5-dimethylhexane, and 2-methylhexane were not detected in in any fat sample from female rats.
[b]n/a = Not applicable
[c]Not detected.
[d]Estimate (above range of calibration curve)

LIST OF SYMBOLS, ABBREVIATIONS, AND ACRONYMS

CCV	continuing calibration verification
CI	confidence interval
diEGME	diethylene glycol monomethyl ether
F344	Fischer 344
FTIR	Fourier transform infrared
GC	gas chromatograph
GSD	Geometric standard deviation
HEPA	high-efficiency particulate air
JP-8	jet propulsion fuel 8
LN	liquid nitrogen
MB	method blank
MDL	method detection limit
MMAD	mass median aerodynamic diameter
MS	mass spectrophotometer
NaCl	sodium chloride
NaOH	sodium hydroxide
NA	not available
ND	not determined
OR	odds ratio
PBPK	physiologically based pharmacokinetic
SPME	solid phase microextraction
T1	trap 1
T2	trap 2
T3	trap 3
THRU	toxic hazards research unit
VOA	volatile organic compound analysis
WPAFB	Wright-Patterson Air Force Base