



June 30, 2010

Ms. Kay Gee
Area Director
U.S. Department of Labor, Occupational Safety and Health Administration
Queens District Office of the Manhattan Area Office
45-17 Marathon Parkway
Little Neck, NY 11362

RE: Alleged violations of the OSHA Hazard Communication Standard

Dear Ms. Gee:

The Association of Flight Attendants – Communications Workers of America, AFL-CIO (AFA) represents 50,000 flight attendants at 20 US airlines. As Director of the Department of Air Safety, Health, and Security, I am writing to allege multiple violations of the OSHA Hazard Communication Standard (29CFR1910.1200) by British Petroleum (BP) located in Parsippany, NJ. These alleged violations affect workers at US airlines that use BP2197 or BP2380 and operate in New Jersey and New York including, but not limited to, United Airlines, US Airways, Mesaba Airlines, and Comair. Because these alleged violations affect workers in your area, I am writing to request that your office launch an immediate investigation into this matter.

The 1975 Federal Aviation Administration (FAA) claim of exclusive jurisdiction over the occupational safety and health of flight attendants¹ is applicable to only *aircraft in operation*. In addition, the Hazard Communication Standard, like the OSHA Record Keeping Standard that is adhered to by airlines, is purely administrative in nature, and does not duplicate any FAA standards. In 2000, the FAA-OSHA Aviation Safety and Health Team confirmed that “compliance with OSHA's Hazard Communication Standard would not compromise aviation safety.”² In addition, OSHA standards provide legal protections to airline ground staff and they are exposed to the hazardous products in question when they inspect and clean contaminated air supply systems. As such, AFA trusts and fully expects OSHA to act on this complaint.

In 2004, I wrote to Mr. Robert Kulick (then Director, OSHA Avenel, NJ Area Office) to inform him that ExxonMobil had removed the neurological health hazard warning language from the material safety data sheet (MSDS) of its aviation engine oils without adequate justification. Mr. Kulick's office cited ExxonMobil, although, ultimately, ExxonMobil refused to warn users that exposure to their product may cause neurological symptoms, some of which may be delayed. Sadly, this omission still does a disservice to maintenance workers who must service aircraft lubricated with these oils, and crewmembers who are sometimes exposed to oil fumes in the cabin and flight deck when pyrolyzed oil contaminates the aircraft air supply system.

¹ 40 Fed. Reg. at 29114, 1975

² FAA/OSHA Aviation Safety & Health Team (2000) “First Report: Application of OSHA's requirements to employees on aircraft in operation,” Washington, DC

Description of alleged violations

The issues I wish to bring to your attention today are: (1) BP's failure to report the presence and content of tricresylphosphates (TCPs) and N-phenyl-1-naphthylamine on the Material Safety Data Sheets (MSDSs) of its aviation engine oils, including BP2197 and BP2380; (2) BP's failure to warn users that they may be exposed to a complex mixture of TCPs, hydrocarbons, and carbon monoxide (CO) when pyrolyzed BP2197 or BP2380 contaminates the aircraft air supply system; (3) BP's failure to warn users that they may be exposed to trimethylolpropane phosphate (TMPP) when exposed to pyrolyzed BP2380; and (4) BP's failure to warn users that exposure to pyrolyzed BP2197 and BP2380 can cause neurological and respiratory symptoms, and that the neurological symptoms may be delayed.

OSHA states that its Hazard Communication Standard applies "to any chemical which is known to be present in the workplace in such a manner that employees may be exposed under normal conditions of use or in a foreseeable emergency" (29 CFR 1910.1200(b)(2)). "Foreseeable emergency" is defined as "any potential occurrence such as, but not limited to, equipment failure, rupture of containers, or failure of control equipment which could result in an uncontrolled release of a hazardous chemical into the workplace" (29 CFR 1910.1200(c)).

On commercial flights in the US, there is documentation to demonstrate that oil contamination of the aircraft air supply system occurs almost daily.³ This risk is, in part, a function of the design of the air distribution system which "bleeds" air off either the aircraft engines or the aircraft auxiliary power unit and, in part, a function of maintenance issues, such as a worn engine oil seal or an overfilled oil reservoir. OSHA has explicitly interpreted anticipated or known use during which exposure to hazardous chemicals might occur to downstream employees to include equipment failure. Further, OSHA has said that "[i]f the chemical manufacturer [has] information that overheating via equipment failure or maladjustment, etc., can be expected to occur a percentage of time...then employees have a right to know the hazard information associated with the resultant potential exposure...".⁴

In addition to oil fumes contaminating aircraft air supply systems, airline maintenance workers risk daily dermal exposure (and potentially inhalation exposure) to engine oils because troubleshooting contaminated air supply systems is part of these workers' job description. All US airlines have FAA-approved maintenance manuals, and those that AFA has reviewed include procedures to clean oil-contaminated air supply systems.

As you will know, OSHA's Hazard Communication Standard dictates that manufacturers report hazardous ingredients on an MSDS if those chemicals comprise at least 1% of the product by weight (29 CFR 1910.1200(g)(2)(i)(C)(1)), and meet the "one study rule"; namely that at least one study conducted according to established scientific principles has a positive and statistically significant result (1910.1200(d)(2)). Manufacturers must also report ingredients present at less than 1% by weight if there is evidence that exposure could present a health risk to employees (29 CFR 1910.1200(g)(2)(i)(C)(2)).

³ Murawski, JTL; Supplee, DS (2008) "An attempt to characterize the frequency, health impact, and operational costs of oil in the cabin and flight deck supply air on US commercial aircraft" J of ASTM Intl., Vol. 5(5). Paper ID JAI101640

⁴ OSHA Hazard Communication Standard Interpretation (Dec 21, 1990): "Potential release of hazardous substances from heat shrink products," Occupational Health and Safety Administration, Washington, DC

Evidence that engine oils contain at least 1% of hazardous ingredients

Both BP2197 and BP2380 contain at least 1% TCPs. A recent GC-MS analysis of these oils confirms the TCP content of BP2197 as 2.85% and BP2380 as 5.10%.⁵ A published analysis of the volatile components of BP2380 when heated to 525°C lists three TCP isomers and 15 other organic compounds.⁶ (Similar results have been published for other aviation engine oils.^{7,8}) The volatile constituents of pyrolyzed BP2380 listed in the study cited above did not include PAN, although maintenance workers risk dermal exposure to PAN when servicing aircraft systems with BP2380 and possibly BP2197. (It is not clear from the MSDS if BP2197 contains PAN, as described below.)

On the UK version of the MSDS for BP2197 engine oil, BP reports that the product contains 1-5% TCPs (**Attachment 1**). Similarly, on the New Zealand version of the MSDS for this product, BP reports < 3% TCPs and < 5% mixed aromatic amines (**Attachment 2**). However, on the US version of the MSDS for the same product, BP states that “[t]his product does not contain any hazardous ingredients at or above regulated thresholds” (**Attachment 3**). So, BP does not notify users that if they handle bulk oil samples, they risk exposure to TCPs. Also, BP does not warn users that if they are exposed to pyrolyzed oil, they may inhale a complex mixture of hydrocarbons and TCPs. Regarding the neurological health hazard warnings associated with exposure to these ingredients, BP does describe a study in which hens were orally dosed with the oil for 13 weeks with no clinical or histopathological signs of neurotoxicity, although mechanics, flight attendants, and pilots are not ingesting these oils.

Similarly, on the German version of the MSDS for BP2380 engine oil, BP reports that the product contains 5-10% TCPs and 1-5% N-phenyl-1-naphthylamine (**Attachment 4**). On the South African version of the MSDS for this product, BP reports the same ingredients (**Attachment 5**). But on the US version of the MSDS for the same product, BP reports that the product does not contain “any hazardous ingredients at or above regulated thresholds” (**Attachment 6**). So, the warnings of exposure to TCPs and PAN when handling bulk oil, the risk of exposure to a complex mixture of hydrocarbons and TCPs when inhaling pyrolyzed oil, and appropriate neurological health hazard warnings are all absent, as above.

Evidence of exposure to toxic combustion byproducts

The MSDSs for these products do list CO as a hazardous decomposition product, but “eye and respiratory tract irritation” is an insufficient description of the inhalation hazard. CO is especially toxic during a flight because the ambient oxygen level is reduced.^{9,10} In a laboratory study,

⁵ OHRCA-ACER (2009) “Cabin air quality incidents project report” Occupational Health Research Consortium in Aviation and the Airliner Cabin Environment Research. Preliminary report submitted to the Federal Aviation Administration, Washington, DC

⁶ van Netten, C and Leung, V (2000) “Comparison of the constituents of two jet engine oil lubricating oils and their volatile pyrolytic degradation products,” *Appl Occup and Environ Hyg*, 15(3): 277-283

⁷ van Netten, C. and Leung, V. “Hydraulic fluid and jet engine oil: pyrolysis and aircraft air quality.” *Archives of Environmental Health*, Vol 56(2): 181-186 (March/April 2001).

⁸ van Netten, C. “Analysis of two jet engine lubricating oils and a hydraulic fluid: their pyrolytic breakdown products and their implication on aircraft air quality,” *Air Quality and Comfort in Airliner Cabins*, ASTM STP 1393, NL Nagda, Ed. American Society for Testing and Materials, West Conshohocken, PA (2000).

⁹ USAF MIL-E-87145 (1992) “Environmental Control, Airborne: Appendix B. Respiratory Environmental Thresholds and Physiologic Limitations,” United States Air Force, AFGS-87145A

¹⁰ McFarland, RA. “Human factors in relation to the development of pressurized cabins.” *Aerospace Med*. 12: 1303-1318 (1971).

120ppm of CO was generated by heating a 0.5 ml sample of BP2380 to temperatures typical of an operating aircraft engine.¹¹ Although it is not possible to extend these results directly to the aircraft cabin, airline maintenance records indicate losses on the order of two to three quarts of engine oil that coincide with a “smoke in the cabin event,” suggesting that crewmembers may be exposed to clinically significant levels of CO. Pilots are especially at risk because the flight deck is supplied with a higher outside/bleed air flow rate than the cabin. The NJ Department of Health and Senior Services Hazardous Substance Fact Sheet states that “inhaling carbon monoxide can cause headache, dizziness, lightheadedness and fatigue” (**Attachment 7**). On aircraft, this health issue becomes a safety issue if the pilots' ability to safely fly the plane is impaired, which has been documented (described below). As well, affected flight attendants have reported that they would have been unable to conduct an emergency evacuation had it been necessary, nor would they have been able to react to a security breach.

More than 20 years ago, a US naval research team warned of the risk of exposure to trimethylolpropane phosphate (TMPP; a potent neurotoxin) when BP2380¹² was heated to temperatures at or above 350°C.¹³ TMPP is formed when the trimethylol propane (TMP) base stock reacts with the TCPs. The report formally recommended that US naval ships not be lubricated with BP2380 because of this exposure risk. Later, a research team confirmed that TMPP could form at temperatures as low as 250°C.¹⁴ Despite these findings, BP2380 is widely used on the commercial fleet twenty years later, and BP does not warn users that they may be exposed to TMPP when the oil is heated.

Evidence that “one study rule” criteria is met

Exposure to these oil fumes clearly presents a health risk to airline employees. Many of the on-aircraft investigations described below document acute symptoms consistent with exposure to CO (e.g., dizziness, confusion severe headaches, tunnel vision, and metallic taste) and TCPs (e.g., chills, stomach cramping, muscle aches, fatigue). Some of the investigations summarize cases of chronic neurological symptoms consistent with exposure to TCPs, including peripheral neuropathy, memory deficits, aphasia, tremors, seizures, abnormal gait, and balance problems. Maintenance records often confirm that the source of the smoke, mist, or fumes in the cabin is partly-combusted and aerosolized engine oil. Airlines are not required to monitor the air quality during any phase of flight on any aircraft, so in-flight sampling data from routine operations are not available.

Most controlled studies investigating the health impact of exposure to aviation engine oils have been conducted by major oil companies (or their consultants) and assess the physical manifestations of organophosphate induced delayed neuropathy among test animals made to ingest these oils.¹⁵ However, as stated above, this research does not mimic the exposure pattern of crews and passengers on commercial aircraft, and is therefore of little relevance.

¹¹ van Netten and Leung (2000) 277-283

¹² At the time of publication, the engine oil product was called Exxon 2380. It is now marketed as BP2380.

¹³ Callahan, AB; Tappan, DV; Mooney, LW, et al. “Final report: Analysis of hydraulic fluids and lubricating oils for the possible formation of trimethylolpropane phosphate (TMP-P)” US Naval Submarine Medical Research Laboratory, NSMRL Special Report SP89-5, Biomedical Sciences Department, NSMRL, Croton, CT

¹⁴ Wright, RL (1996) “Formation of the neurotoxin TMPP from TMPE-phosphate formulations” Tribology Transactions, Vol. 39(4): 827-34

¹⁵ Mackerer, C.R., Barth, M.L., Krueger, A.J.; et al. (1999) “Comparison of neurotoxic effects and potential risks from oral administration or ingestion of tricresyl phosphate and jet engine oil containing tricresyl phosphate,” J. Toxicol. Environ. Health, 56A: 293-328

More than 30 years ago, a published case study of a healthy 34-year old flight navigator exposed to oil fumes inflight described “disturbance in [his] mental and neuromuscular function” and noted that “by the time the plane could be landed, he had difficulty standing.”¹⁶ A review of 89 incidents of smoke/fumes in the flight decks on military aircraft from 1970-80 described “incapacitating central nervous system dysfunction and mucous membrane irritation” and concluded that “smoke/fumes in the cockpit is not a rare event and is a clear threat to flying safety because of acute toxic effects.”¹⁷

From 1979-81, 10 turboprop aircraft, all equipped with the same Garrett engine, crashed, leaving 38 fatalities. Oil residues were identified in the engines from one of the aircraft that had been retrieved from the bottom of a lake. An investigative study published by the FAA acknowledged that “with an unfiltered [bleed air] line, a significant toxicity could be associated with breathing the oil mist.”¹⁸

In 1999, the Australian Transport Safety Bureau (ATSB) issued a report of an oil fume event inflight where the pilot “suffered from a loss of situational awareness.”¹⁹ Upon approach, “his control inputs had become jerky and he began suffering vertigo.” The incident was attributed to oil fumes in the flight deck air (based on mechanical records) but the pilot in command had reported that no smoke or fumes were present so he did not use the smoke removal checklist and none of the three pilots donned their oxygen masks.

In 2000, an Australian Senate inquiry into oil contaminated bleed air summarized a series of pilot-reported incapacitation events. Upon exposure to oil fumes, pilots reported “difficulty in concentrating on the operation of the aircraft” and “a feeling like drunkenness [resulting in] difficulty lining up the aircraft for landing.”²⁰

Since 2000, the UK Civil Aviation Authority (CAA) has issued four bulletins to airlines that warn of the risk of pilot incapacitation caused by exposure to toxic oil fumes inflight and recommend procedures to protect against pilot incapacitation.^{21,22,23,24} The agency notes that

¹⁶ Montgomery, MR; Wier, GT; Zieve, FJ; et al. (1977) "Human intoxication following inhalation exposure to synthetic jet lubricating oil," Clin. Toxicol., 11(4): 423-426

¹⁷ Rayman, RB and McNaughton, GB (1983) "Smoke/fumes in the cockpit" Aviat. Space Environ. Med., 54(8): 738-740

¹⁸ Crane, CR; Sanders, DC; Endecott, BR; et al. (1983) "Inhalation Toxicology: III. Evaluation of Thermal Degradation of Products From Aircraft and Automobile Engine Oils, Aircraft Hydraulic Fluid, and Mineral Oil," Aviation Medicine Report FAA AM-83-12, Civil Aeromedical Institute, US Federal Aviation Administration, Oklahoma City, OK

¹⁹ ATSB (1999) "British Aerospace Plc BAe 146-300, VH-NJF. Occurrence brief no. 199702276." Australian Transport Safety Bureau, Canberra, Australia

²⁰ PCA (2000) "Technical report on air safety and cabin air quality in the BAe146 aircraft," Parliament of the Commonwealth of Australia, Senate Rural and Regional Affairs and Transport Legislation Committee, Senate Printing Unit, Canberra, Australia, pp.115-128

²¹ CAA (2008) "Flight operations department communications (FODCOM) 17/2008," UK Civil Aviation Authority, Safety Regulation Group, West Sussex, England

²² CAA (2002) "Flight Operations Department Communications (FODCOM) 21/2002" UK Civil Aviation Authority, Safety Regulation Group, Aviation House, Gatwick, West Sussex, England

²³ CAA (2001) "Flight Operations Department Communication (FODCOM) 14/2001" UK Civil Aviation Authority, Safety Regulation Group, Aviation House, Gatwick, West Sussex, England

²⁴ CAA (2000) "Flight Operations Department Communication (FODCOM) 17/2000" UK Civil Aviation Authority, Safety Regulation Group, Aviation House, Gatwick, West Sussex, England

“reducing occurrences of oil contamination will also reduce the risk of flight crew incapacitation.”²⁵

In 2001, the CAA initiated a research program into aircraft air quality in response to the increase in reported smoke/fume events, including a small number of events where “flight crew have been incapacitated to a greater or lesser degree.”²⁶ The published research report concludes that “engine oil fumes were the most likely cause” for the acute symptoms and found no evidence of other causal factors.²⁷

In 2001, Swedish air safety investigators published a report regarding a smoke/fume event on a commercial aircraft during which the captain was “having difficulty with physiological motor response, simultaneity, and in focusing.”²⁸ The contaminated flight deck air was attributed to an engine oil leak. The investigative report stated that subsequent air sampling by the aircraft engine manufacturer did not identify the cause of either pilot’s symptoms, but the air sampling data released years later cited the presence of a wide range of contaminants, including tricresylphosphates and triphenylphosphate, specific to oil contamination.²⁹

In 2003, a health survey of pilots operating B757, B737, and A320 aircraft at a major airline in the UK identified acute and chronic symptoms associated with 1,674 reported incidents of cockpit air supply contamination, all but seven of them on the B757.³⁰ Although the response rate was low (106 of 600 pilots), the reported symptoms are cause for concern, given the implications for flight safety.

In 2004, the FAA issued an Airworthiness Directive (AD) requiring BAe146 operators to prevent the accumulation of oil residue in the air supply system ductwork.³¹ The FAA stated that these procedures were necessary “to prevent impairment of the operational skills and abilities of the flightcrew caused by the inhalation of agents released from oil or oil breakdown products, which could result in reduced controllability of the airplane.” The FAA had issued this AD in response to a service bulletin published by the aircraft manufacturer which stated that oil leaks and odors “must be regarded as a potential threat to flight safety.”³²

Also in 2004, the UK Air Accidents Investigation Branch (AAIB) reported an incident of oil fumes in the airliner flight deck in which the “first officer’s condition began to decline to an extent that he had difficulty in concentrating...The commander also felt light-headed and had difficulty in judging height and in the ensuing approach and landing.”³³ The report concluded

²⁵ CAA (2002)

²⁶ CAA (2002)

²⁷ CAA (2004) “Cabin air quality” CAA Paper 2004/04, Research Management Department, Safety Regulation Group, UK Civil Aviation Authority, Aviation House, Gatwick Airport South, West Sussex, UK

²⁸ SHK (2001) “Report RL 2001:41e “Accident investigation into incident onboard aircraft SE-DRE during flight between Stockholm and Malmo M County, Sweden,” Statens Haverikommission Board of Accident Investigation, Stockholm, Sweden

²⁹ ACARM (2007) “Appendix 10: Air monitoring research summary” Aviation Contaminated Air Reference Manual, Michaelis, S., ed. ISBN 9780955567209, London, England, pp. 760

³⁰ Michaelis, S (2003) “A survey of health symptoms in BALPA Boeing 757 pilots,” J Occup Health Safety – Aust NZ, 19(3): 253-261

³¹ FAA (2004) “Airworthiness Directive 2004-12-05: BAe Systems (Operations) Limited Model BAe 146 Series Airplanes” Docket No. 2003-NR-94-AD, Federal Aviation Administration, Washington, DC

³² BAe (2001) Inspection Service Bulletin 21-150: “Air conditioning: to inspect engine oil seals, APU and ECS jet pump and air conditioning pack for signs of oil contamination” Issued March 20, 2001; revised Oct 24, 2002. British Aerospace Operations Ltd., Scotland

³³ AAIB (2004) Aircraft accident report no. 1/2004, BAe146, G-JEAK (EW/C2000/11/4), UK Air Accidents Investigation Branch, UK Department for Transport, Aldershot, England

that there was “circumstantial evidence” that the flight crew had been affected by exposure to oil that had contaminated the APU.

In 2006, the Swiss Aircraft Accident Investigation Bureau published its investigation into a report of oil fumes in the flight deck.³⁴ The report concluded that “the serious incident is attributable to the fact that on approach...the cockpit filled with fumes which caused a toxic effect, leading to a limited capability of acting of the copilot. These fumes were caused by an oil leak...”

In 2007, the AAIB reported another incident of oil fumes in the flight deck.³⁵ The report identified 153 other smoke/fume incidents and concluded that 40 of them had involved “adverse physiological effects on one or both pilots, in some cases severe.” The report recommended that the European Aviation Safety Agency and the FAA require flight deck detection and warning systems for oil smoke/mist. The AAIB repeated this recommendation in 2009 because the regulators had not responded.³⁶

Also in 2007, the ATSB reported that the second most common cause of pilot incapacitation was due to toxic smoke/fumes, of which 25% were due to CO.³⁷

Some crewmembers have reported neurological symptoms that resemble multiple sclerosis (MS) following one of these “smoke in the cabin” incidents. The temporal association (exposure – symptoms – diagnosis) suggests a possible occupational connection. Pilots in Australia have reported similar anecdotes. Interestingly, occupation-specific clusters of symptoms that resemble MS have been described in the literature with specific references to exposure to hydraulic and machining fluids that contain the same or similar organophosphates.^{38,39} Three case studies of TCP-associated neurological deficits have also been published for workers in a plant that manufactures tri-aryl phosphates.⁴⁰ As well, significant excess in *mortality* from motor neuron disease has been reported among pilots and machinists.^{41,42} Pilots have also been found to have significant excess *morbidity* from motor neuron disease,⁴³ although such associations have never been formally investigated among flight attendants.

³⁴ SAAIB (2006) “Investigation report concerning the serious incident to aircraft AVRO 146-RJ 100, HB-IXN operated by Swiss International Air Lines Ltd. under flight number LX1103 on 19 April 2005 on approach to Zurich-Kloten airport” Swiss Accident Investigation Bureau, Bern, Switzerland

³⁵ AAIB (2007) Bulletin no. 4/2/07, Bombardier DHC-8-400, G-JECE (EW/C2005/08/10), UK Air Accidents Investigation Branch, UK Department for Transport, Aldershot, England

³⁶ AAIB (2009) Bulletin no. 6/2009, B757, G-BYAO (EW/C2006/10/8), UK Air Accidents Investigation Branch, UK Department for Transport, Aldershot, England

³⁷ ATSB (2007) “Pilot incapacitation: analysis of medical conditions affecting pilots involved in incidents and accidents 1 January 1975 to 31 March 2006: Aviation Research & Analysis Report – B2006/0170,” Australian Transport Safety Bureau, Canberra, Australia

³⁸ Krebs, JM; Park, RM; Boal, WL (1995) “A neurological disease cluster at a manufacturing plant,” Arch Environ Health, 50(3): 190-5

³⁹ Park, RM (2002) Letter to the Editor, Arch Environ Health, 4(4): 383

⁴⁰ Morgan, AA (1981) “Neurological problems arising in a plant manufacturing tri-aryl phosphates,” J Soc Occup Med, 31: 139-143

⁴¹ Nicholas, JS; Lackland, DT; Dosemeci, M et al. (1998) “Mortality among US commercial pilots and navigators,” J Occup Environ Med, 40(11): 980-5

⁴² Schulte, PA; Burnett, CA; Boeniger, MF; and Johnson, J (1996) “Neurodegenerative diseases: occupational occurrence and potential risk factors, 1982 through 1991,” Am J Public Health, 86(9): 1281-8

⁴³ Nicholas, JS; Butler, GC; Lackland, DT; et al. (2001) “Health among commercial airline pilots,” Aviat Space Environ Med: 72(9): 821-6

Possible explanation for inadequate health hazard warnings

As background, there are ten chemical variations (“isomers”) of tricresylphosphates (TCPs), some or all of which are added to commercial aviation engine oils. The isomeric blends of TCPs in commercial aviation engine oils are proprietary, and although the chemical constituents of pyrolyzed oils have been defined, a complete analysis of the TCP isomers has not been possible because chemical standards are not available for all isomers. The tri-ortho isomer (TOCP) has received the most attention because of its role in some mass accidental poisonings.⁴⁴ In the late 1950s, a toxicologist observed that all six “ortho” isomers of TCP (of which TOCP is one) are highly toxic to the peripheral nerves in animal studies.⁴⁵ This finding was reaffirmed 40 years later by the world’s leading aviation engine oil manufacturer.⁴⁶ Some of the neurological complaints reported by crews and passengers exposed to oil fumes suggest peripheral nervous system damage (e.g., paraesthesias, abnormal gait).

One major oil company has claimed that, in reformulating its oils with a very low concentration of the ortho TCPs, neither inhalation nor dermal exposure would damage the nervous system, and so warning labels on product containers are unnecessary.⁴⁷ BP may agree with this line of reasoning for its BP2197 and BP2380 products. However, these claims of low or no toxicity are problematic for the following reasons:

First, the majority of symptoms reported by crew and passengers exposed to oil fumes indicate central nervous system (CNS) damage (e.g., headache, difficulty concentrating, memory problems, slowed mental processing and response time, balance problems, depression, and visual irregularities).^{48,49,50,51,52,53,54,55,56,57} The fact that there are no published animal data on CNS toxicity of inhalation exposure to TCPs (whether the six ortho isomers or the remaining four meta/para isomers that dominate TCPs in engine oils) does not mean that TCPs do not damage the CNS. The more subtle, but significant, symptoms of CNS damage reported by exposed crewmembers are not possible to assess directly in animal studies, and we are not aware of post-mortem brain analyses of structures or regions involved in cognition or emotion. A neurotoxic

⁴⁴ Morgan, JP and Penovich, P (1978) “Jamaica ginger paralysis: forty-seven year follow up,” *Arch. of Neurol.*, 35(8): 530-532

⁴⁵ Henschler, D. (1958) “Tricresyl phosphate poisoning experimental clarification of problems of etiology and pathogenesis,” *Klinische Wochenschrift*, 36(14): 663-674

⁴⁶ Mackerer et al. 293-328

⁴⁷ Mobil (1999) Mobil USA submission by Mackerer, CR and Ladov, EN to the Australian Senate Inquiry into Air Safety – BAe146 Cabin Air Quality. In: *Inquiry Into Air Safety: Volume 3, Submissions*. Mobil USA, Paulsboro, NJ

⁴⁸ Montgomery et al. 423-426

⁴⁹ Rayman and McNaughton 738-740

⁵⁰ PCA 115-128

⁵¹ Michaelis 253-261

⁵² Harrison, R; Murawski, J; McNeely, E; et al. (2008) “Exposure to aircraft bleed air contaminants among airline workers: A guide for health care providers” Report to the US Federal Aviation Administration, Washington, DC

⁵³ Harper, A (2005) “A survey of health effects in aircrew exposed to airborne contaminants,” *J. Occup. Health & Safety, Austr & New Zealand*, Vol. 21(5): 433-439

⁵⁴ Somers, M (2005) “Aircrew exposed to fumes on the BAe146: An assessment of symptoms,” *J Occup Health & Safety, Austr & New Zealand*, Vol. 21(5): 440-449

⁵⁵ Cox, L and Michaelis, S (2002) “A survey of health symptoms in BAe 146 aircrew,” *J Occup Health & Safety, Austr. & New Zealand*, Vol. 18(4): 305-312

⁵⁶ Coxon, L (2002) “Neuropsychological assessment of a group of BAe 146 aircraft crewmembers exposed to jet engine oil emissions,” *J Occup Health & Safety, Austr. & New Zealand*, Vol. 18(4): 313-319

⁵⁷ van Netten, C (1998) “Air quality and health effects associated with the operation of BAe146-200 aircraft,” *Appl Occup Environ Hyg*, 13(10): 733-739

effect of exposure to meta/para TCP isomers has been suggested because the results of experimental studies cannot be explained by the presence of the ortho-isomers alone.⁵⁸ Using neurotoxic esterase enzyme activity as an endpoint, an oil manufacturer identified low, but consistent, neurotoxicity of meta/para isomers that it had expected to be inactive.⁵⁹

Second, even if the ortho isomer content in aviation engine oils is low, an association with reported peripheral nervous system damage cannot be ruled out for the following reasons: there is no defined “safe” exposure level for inhaling mixed TCP isomers; there are defined genetic, endocrine, and environmental factors known to influence an individual’s ability to metabolize organophosphates;^{60,61,62} exposure levels have not been defined; and there is no information on the health impact of chronic exposure to low-levels of pyrolyzed engine oils. One study assessed symptoms of peripheral neuropathy in hens orally dosed with engine oils containing TCPs. The authors reported an “unexpected high neurotoxic potency of the aviation engine oil containing 3% TCPs and less than 0.02% of TOCP.”⁶³ These TCP contents are comparable to aviation oil products used industry-wide today. Administering heated oils to test animals via inhalation (instead of unheated oils orally) would be expected to increase the observed neurotoxic impact^{64,65} and would better reflect exposures on commercial aircraft.

⁵⁸ Abou-Donia, MB (2005) “Organophosphate ester induced chronic neurotoxicity,” J Occup Health & Safety, Australia & New Zealand, Vol 21(5): 408-432

⁵⁹ Mackerer et al. 293-328

⁶⁰ Tang, J; Cao, Y; Rose, RL; et al. (2001) “Metabolism of chlorpyrifos by human cytochrome P450 isoforms and human, mouse, and rat liver microsomes,” Drug Metabolism Disposition, 29: 1201-1204

⁶¹ Gene, S; Gurdol, F; Guvenc, S; et al. (1997) “Variations in serum cholinesterase activity in different age and sex groups,” Eur J Clin Chem Clin Biochem, 35(3): 239-240

⁶² Mutch, E; Blain, PG; Williams, FM (1992) “Interindividual variations in enzymes controlling organophosphate toxicity in man,” Human Experimental Toxicol, 11: 109-116

⁶³ Freudenthal, RI; Rausch, L; Gerhart, JM; et al. (1993) “Subchronic neurotoxicity of oil formulations containing either tricresyl phosphate or tri-orthocresyl phosphate,” J Am College Toxicol, Vol. 12(4): 409-416

⁶⁴ Abou-Donia 408-432

⁶⁵ Lipscomb, J; Walsh, M; Caldwell, D; et al. (1995) “Inhalation toxicity of vapor phase lubricants” AL/OE-TR-1997-0090, US Air Force Armstrong Laboratory, Occupational and Environmental Health Directorate, Toxicology Division, Wright-Patterson AFB, OH

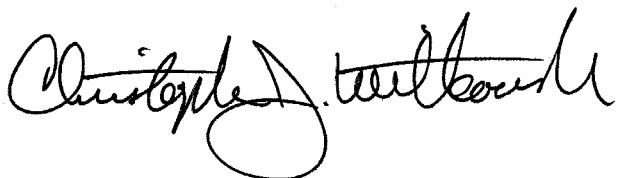
Conclusions

Despite the fact that TCPs constitute greater than 1% of BP2197 and BP2380; despite the evidence that oil fumes contain a complex mixture of hydrocarbons and TCPs, and may contain CO; despite the potential for exposure to TMPP when BP2380 is heated; and despite the widespread evidence of a health hazard, BP does not report either the presence of TCPs or PAN, the potential for exposure to TMPP (for BP2380), or the risk of either acute or chronic neurological symptoms associated with exposure. The product labels and MSDSs for BP2197 and BP2380 must reflect these exposure hazards.

AFA respectfully requests that OSHA investigate this matter and require that the product labels and MSDSs for BP2197, BP2380, and chemically similar engine oils: (1) Report the content of hazardous ingredients, including TCPs and PAN (as applicable); (2) Notify users that they may be exposed to a complex mixture of hydrocarbons, TCPs, and possibly CO if pyrolyzed oil contaminates the aircraft air supply system; (3) Notify users that BP2380 fumes may contain TMPP if the oil is heated to temperatures at or above 250°C; (4) Notify users that exposure to oil fumes may cause acute and chronic respiratory symptoms, as well as acute and chronic neurological symptoms that can impair a person's ability to operate machinery and perform safety-sensitive duties; and (5) Notify users that neurological symptoms may be delayed by days or weeks.

Flight attendants, pilots, and airline ground workers are potentially exposed to these hazards daily. They need OSHA's support. If you have questions about this complaint, please contact me directly at 202-434-0593, or call Judith Murawski, an Industrial Hygienist on my staff, at 206-932-6237.

Sincerely,



Christopher J. Witkowski
Director
Air Safety, Health & Security Department

CC: Dr. David Michaels, Assistant Secretary, OSHA
Mr. Randy Babbitt, Administrator, FAA
Mr. Robert Kulick, Regional Administrator, OSHA, Region II
Mr. Rick Engler, Director, New Jersey Work Environment Council

Attachments:

1. Material Safety Data Sheet for BP2197 engine oil, published in the United Kingdom
2. Material Safety Data Sheet for BP2197 engine oil, published in New Zealand
3. Material Safety Data Sheet for BP2197 engine oil, published in the United States
4. Material Safety Data Sheet for BP2380 engine oil, published in Germany
5. Material Safety Data Sheet for BP2380 engine oil, published in South Africa
6. Material Safety Data Sheet for BP2380 engine oil, published in the United States
7. New Jersey Department of Health & Senior Services Right to Know Hazardous Substance Fact Sheet: Carbon Monoxide

ATTACHMENT 1

**Material Safety Data Sheet for BP2197 engine oil,
published in the United Kingdom**



1. Identification of the substance/preparation and company/undertaking

Product name **BP Turbo Oil 2197**
SDS no. 452218
Historic SDS no. 0000000072
Use of the substance/preparation Turbine Oil
 For specific application advice see appropriate Technical Data Sheet or consult our company representative.
Supplier Air BP Ltd
 Chertsey Road
 Sunbury-on-Thames
 Middlesex
 TW16 7LN
United Kingdom
 For general enquiries please go to <http://www.airbp.com>
EMERGENCY TELEPHONE NUMBER +44 (0) 1865 407333
E-mail address MSDSadvice@bp.com

2. Hazards identification

This preparation is not classified as dangerous according to Directive 1999/45/EC as amended and adapted.
 See sections 11 and 12 for more detailed information on health effects and symptoms and environmental hazards.

3. Composition/information on ingredients

Synthetic base stock. Proprietary performance additives.

Chemical name	CAS no.	%	EINECS / ELINCS.	Classification
Tricresyl phosphate	1330-78-5	1 - 5	215-548-8	Xn; R21/22 N; R51/53

See section 16 for the full text of the R-phrases declared above
 Occupational exposure limits, if available, are listed in section 8.

4. First-aid measures

Eye contact In case of contact, immediately flush eyes with a copious amount of water for at least 15 minutes. Get medical attention if irritation occurs.
Skin contact In case of contact, immediately flush skin with plenty of water. Remove contaminated clothing and shoes. Wash clothing before reuse. Clean shoes thoroughly before reuse. Get medical attention if irritation develops.
Inhalation If inhaled, remove to fresh air. Get medical attention if symptoms appear.
Ingestion Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. If large quantities of this material are swallowed, call a physician immediately.
Notes to physician Treatment should in general be symptomatic and directed to relieving any effects.

5. Fire-fighting measures

Extinguishing media
Suitable In case of fire, use foam, dry chemical or carbon dioxide extinguisher or spray.
Not suitable Do not use water jet.
Hazardous decomposition products Decomposition products may include the following materials:
 carbon oxides
 phosphorus oxides
Special fire-fighting procedures None identified.
Protection of fire-fighters Fire-fighters should wear self-contained positive pressure breathing apparatus (SCBA) and full turnout gear.

Product name	BP Turbo Oil 2197	Product code	452218-US08	Page:	1/4
Version	1	Date of issue	18 September 2007	Format	United Kingdom (UK)
				Language	ENGLISH
		Build	9.1.2	(United Kingdom)	(ENGLISH)

6 . Accidental release measures

Personal precautions	No action shall be taken involving any personal risk or without suitable training. Evacuate surrounding areas. Keep unnecessary and unprotected personnel from entering. Do not touch or walk through spilled material. Avoid breathing vapour or mist. Provide adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Put on appropriate personal protective equipment (see Section 8).
Environmental precautions	Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers. Inform the relevant authorities if the product has caused environmental pollution (sewers, waterways, soil or air).
Large spill	Stop leak if without risk. Move containers from spill area. Approach the release from upwind. Prevent entry into sewers, water courses, basements or confined areas. Wash spillages into an effluent treatment plant or proceed as follows. Contain and collect spillage with non-combustible absorbent materials, e.g. sand, earth, vermiculite, diatomaceous earth and place in container for disposal according to local regulations (see section 13). Dispose of via a licensed waste disposal contractor. Contaminated absorbent material may pose the same hazard as the spilt product. Note: see section 1 for emergency contact information and section 13 for waste disposal.
Small spill	Stop leak if without risk. Move containers from spill area. Absorb with an inert material and place in an appropriate waste disposal container. Dispose of via a licensed waste disposal contractor.

7 . Handling and storage

Handling	Wash thoroughly after handling.
Storage	Keep container tightly closed. Keep container in a cool, well-ventilated area.
Not suitable	Prolonged exposure to elevated temperature.

8 . Exposure controls/personal protection

Occupational exposure limits	This product does not have any assigned OELs.
Exposure controls	
Occupational exposure controls	Provide exhaust ventilation or other engineering controls to keep the relevant airborne concentrations below their respective occupational exposure limits.
Hygiene measures	Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period.
Personal protective equipment	
Respiratory protection	<p>Respiratory protective equipment is not normally required where there is adequate natural or local exhaust ventilation to control exposure.</p> <p>In case of insufficient ventilation, wear suitable respiratory equipment.</p> <p>Respiratory protective equipment must be checked to ensure it fits correctly each time it is worn.</p> <p>Air-filtering respirators, also called air-purifying respirators, will not be adequate under conditions of oxygen deficiency (i.e. low oxygen concentration), and would not be considered suitable where airborne concentrations of chemicals with a significant hazard are present. In these cases air-supplied breathing apparatus will be required.</p> <p>Provided an air-filtering/air-purifying respirator is suitable, a filter for particulates can be used for mist or fume. Use filter type P or comparable standard. A combination filter for particles and organic gases and vapours (boiling point >65°C) may be required if vapour or abnormal odour is also present due to high product temperature. Use filter type AP or comparable standard.</p>
Hand protection	<p>Wear protective gloves if prolonged or repeated contact is likely. Wear chemical resistant gloves.</p> <p>Recommended: nitrile gloves</p> <p>Protective gloves will deteriorate over time due to physical and chemical damage. Inspect and replace gloves on a regular basis. The frequency of replacement will depend upon the circumstances of use.</p>
Eye protection	Safety glasses with side shields.
Skin and body	<p>Use of protective clothing is good industrial practice.</p> <p>Cotton or polyester/cotton overalls will only provide protection against light superficial contamination that will not soak through to the skin. Overalls should be laundered on a regular basis. When the risk of skin exposure is high (e.g. when cleaning up spillages or if there is a risk of splashing) then chemical resistant aprons and/or impervious chemical suits and boots will be required.</p>

9 . Physical and chemical properties

General information

Appearance

Physical state	Liquid.
Colour	Dark Amber.
Odour	Characteristic.

Important health, safety and environmental information

Flash point	Open cup: 262°C (503.6°F) [Cleveland.]
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Product name	BP Turbo Oil 2197	Product code	452218-US08	Page:	2/4
Version	1	Date of issue	18 September 2007	Format	United Kingdom (UK)
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		Build	9.1.2		

Viscosity	Kinematic: 27 mm ² /s (27 cSt) at 40°C Kinematic: 5.28 mm ² /s (5.28 cSt) at 100°C
Pour point	-57 °C
Relative Density	0.997
Density	997 kg/m ³ (0.997 g/cm ³) at 15.6°C
Solubility	Insoluble in water.
Partition coefficient (LogKow)	>3

10 . Stability and reactivity

Stability	The product is stable. Under normal conditions of storage and use, hazardous polymerisation will not occur.
Conditions to avoid	No specific data.
Materials to avoid	Reactive or incompatible with the following materials: oxidizing materials, acids and alkalis.
Hazardous decomposition products	Combustion products may include the following: carbon oxides phosphorus oxides Under normal conditions of storage and use, hazardous decomposition products should not be produced.

11 . Toxicological information

Acute toxicity	Unlikely to cause more than transient stinging or redness if accidental eye contact occurs. Unlikely to cause harm to the skin on brief or occasional contact but prolonged or repeated exposure may lead to dermatitis. Unlikely to cause harm if accidentally swallowed in small doses, though larger quantities may cause nausea and diarrhoea. At normal ambient temperatures this product will be unlikely to present an inhalation hazard because of its low volatility. May be harmful by inhalation if exposure to vapour, mists or fumes resulting from thermal decomposition products occurs.
Chronic toxicity	
Chronic effects	No known significant effects or critical hazards.
Effects and symptoms	
Eyes	No significant health hazards identified.
Skin	No significant health hazards identified.
Inhalation	No significant health hazards identified.
Ingestion	No significant health hazards identified.

12 . Ecological information

Persistence/degradability	Inherently biodegradable.
Mobility	Spillages may penetrate the soil causing ground water contamination.
Bioaccumulative potential	This product is not expected to bioaccumulate through food chains in the environment.
Environmental hazards	Not classified as dangerous.
Other ecological information	Spills may form a film on water surfaces causing physical damage to organisms. Oxygen transfer could also be impaired.

13 . Disposal considerations

Disposal Consideration / Waste information	The generation of waste should be avoided or minimised wherever possible. Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Disposal of this product, solutions and any by-products should at all times comply with the requirements of environmental protection and waste disposal legislation and any regional local authority requirements. Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers.
Unused product	
European waste catalogue (EWC)	13 02 06* synthetic engine, gear and lubricating oils However, deviation from the intended use and/or the presence of any potential contaminants may require an alternative waste disposal code to be assigned by the end user.

Product name	BP Turbo Oil 2197	Product code	452218-US08	Page:	3/4
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		Build	9.1.2	(United Kingdom)	(ENGLISH)

14 . Transport information

Not classified as hazardous for transport (ADR/RID, ADN, IMDG, ICAO/IATA)

15 . Regulatory information

Classification and labelling have been performed according to EU directives 1999/45/EC and 67/548/EEC as amended and adapted.

Label requirements

Risk phrases	This product is not classified according to the EU regulations.
Additional warning phrases	Safety data sheet available for professional user on request.
Other regulations	
Inventories	Europe inventory: All components are listed or exempted. United States inventory (TSCA 8b): All components are listed or exempted. Australia inventory (AICS): At least one component is not listed. Canada inventory: At least one component is not listed. China inventory (IECSC): All components are listed or exempted. Japan inventory (ENCS): At least one component is not listed. Korea inventory (KECI): At least one component is not listed. Philippines inventory (PICCS): At least one component is not listed.


16 . Other information

Full text of R-phrases referred to in sections 2 and 3	R21/22- Harmful in contact with skin and if swallowed. R51/53- Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.
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History

Date of issue	18/09/2007.
Date of previous issue	No Previous Validation.
Prepared by	Product Stewardship Group

Notice to reader

 Indicates information that has changed from previously issued version.

All reasonably practicable steps have been taken to ensure this data sheet and the health, safety and environmental information contained in it is accurate as of the date specified below. No warranty or representation, express or implied is made as to the accuracy or completeness of the data and information in this data sheet.

The data and advice given apply when the product is sold for the stated application or applications. You should not use the product other than for the stated application or applications without seeking advice from us.

It is the user's obligation to evaluate and use this product safely and to comply with all applicable laws and regulations. The BP Group shall not be responsible for any damage or injury resulting from use, other than the stated product use of the material, from any failure to adhere to recommendations, or from any hazards inherent in the nature of the material. Purchasers of the product for supply to a third party for use at work, have a duty to take all necessary steps to ensure that any person handling or using the product is provided with the information in this sheet. Employers have a duty to tell employees and others who may be affected of any hazards described in this sheet and of any precautions that should be taken.

Product name	BP Turbo Oil 2197	Product code	452218-US08	Page:	4/4
Version	1	Date of issue	18 September 2007	Format	United Kingdom (UK)
		Build	9.1.2	Language	ENGLISH (ENGLISH)

ATTACHMENT 2

**Material Safety Data Sheet for BP2197 engine oil,
published in New Zealand**

Date of Issue: 05/03/2001



BP OIL NEW ZEALAND LTD MATERIAL SAFETY DATA SHEET

BP Turbo Oil 25, 2197, 2380, 2389

1. IDENTIFICATION OF THE SUBSTANCE/PREPARATION AND OF THE COMPANY/UNDERTAKING

Identification of substance/preparation

BP Turbo Oil 25, 2197, 2380, 2389

Alternative Names: Issue date: 05/03/2001

Application

Lubricating oil for aviation turbine engines.

This synthetic lubricant should not be mixed with petroleum based oils or used in aircraft or automomobile piston engines.

For specific application advice see appropriate Technical Data Sheet or consult your BP representative

Company Identification

BP Oil New Zealand Limited

20 Customhouse Quay

Wellington 1

New Zealand

Emergency Telephone Number

64 4 495 5000

NZ National Poisons Centre Emergency Number 64 3 474 7000.

2. COMPOSITION/INFORMATION ON INGREDIENTS

Chemical Composition

Synthetic base stock. (90 - 100%)

Tris(methylphenyl) phosphate CAS No. 1330-78-5 EINECS No. 215-548-8 (<3%)
(contains <0.1% ortho isomer)

Mixed aromatic amines (<5%)

↑ This is tricresylphosphates

Hazardous Components

No component is present at sufficient concentration to require a hazardous classification.

3. HAZARDS IDENTIFICATION

This material is not considered to be hazardous but should be handled in accordance with good industrial hygiene and safety practices.

4. FIRST-AID MEASURES

Eyes

Wash eye thoroughly with copious quantities of water ensuring eyelids are held open. Obtain medical advice if any pain or redness develops or persists.

Skin

Wash skin thoroughly with soap and water as soon as reasonably practicable. Remove heavily contaminated clothing and

wash underlying skin.

Ingestion

If contamination of the mouth occurs wash out thoroughly with water.

Except as a deliberate act the ingestion of large amounts of product is unlikely. If it should occur do not induce vomiting obtain medical advice.

Inhalation

If inhalation of mists fumes or vapour causes irritation to the nose or throat or coughing remove to fresh air. If symptoms persist obtain medical advice.

Medical Advice

Treatment should in general be symptomatic and directed to relieving any effects.

5. FIRE-FIGHTING MEASURES

Use foam dry powder or water fog. DO NOT USE water jets.

Fires in confined spaces should be dealt with by trained personnel wearing approved breathing apparatus.

Water may be used to cool nearby heat exposed areas/objects/packages. Avoid spraying directly into storage containers because of the danger of boil-over.

Combustion Products

Toxic fumes may be evolved on burning or exposure to heat.

See Stability and Reactivity Section 10 of this Safety Data Sheet.

6. ACCIDENTAL RELEASE MEASURES

Contain and recover spilled material using sand or other suitable inert absorbent material.

It is advised that stocks of suitable absorbent material should be held in quantities sufficient to deal with any spillage which may be reasonably anticipated.

Spilled material may make surfaces slippery.

Protect drains from potential spills to minimise contamination. Do not wash product into drainage system.

In the case of large spills contact the appropriate authorities.

In the case of spillage on water the product may emulsify when shaken or mixed and recovery may be difficult.

In the case of spillage on water prevent the spread of product by the use of suitable barrier equipment. Recover product from the surface. Protect environmentally sensitive areas and water supplies.

7. HANDLING AND STORAGE

Handling Precautions

Avoid contact with eyes. If splashing is likely to occur wear a full face visor or chemical goggles as appropriate.

Avoid frequent or prolonged skin contact with fresh or used product.

Good working practices high standards of personal hygiene and plant cleanliness must be maintained at all times.

Wash hands thoroughly after contact.

Use disposable cloths and discard when soiled. Do not put soiled cloths into pockets.

Fire Prevention

Product contaminated rags paper or material used to absorb spillages represent a fire hazard and should not be allowed to accumulate. Dispose of safely immediately after use.

Storage Conditions

Store under cover away from heat and sources of ignition.

Avoid temperatures above 60°C

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Exposure Limits

There is no appropriate occupational exposure limit for this material.

Ensure good ventilation.

Avoid as far as reasonably practicable inhalation of vapour mists or fumes generated during use.

If vapour mists or fumes are generated their concentration in the workplace air should be controlled to the lowest reasonably practicable level.

Protective Clothing

Wear face visor or goggles in circumstances where eye contact can accidentally occur.

If skin contact is likely wear impervious protective clothing and/or gloves.

Protective clothing should be regularly dry cleaned. Change heavily contaminated clothing as soon as reasonably practicable dry clean laundry and preferably starch before re-use. Wash any contaminated underlying skin with soap and water.

Respiratory Protection

If operations are such that exposure to vapour mist or fume may be anticipated then suitable approved respiratory equipment should be worn.

The use of respiratory equipment must be strictly in accordance with the manufacturers' instructions and any statutory requirements governing its selection and use.

9. PHYSICAL AND CHEMICAL PROPERTIES

Typical Values

Grades:	Test Method	Units	BPTO 25	BPTO 2197	BPTO 2380	BPTO 2389
Physical state			liquid	liquid	liquid	liquid
Colour			amber	dark amber	amber	amber
Odour			mild fatty odour	mild fatty odour	mild fatty odour	mild fatty odour
Kinematic viscosity @ 40°C	ASTM D 445	mm ² /s	25	27	24	12.5
Flash point (COC)	ASTM D 92	°C	>204	>204	>204	220
Pour point	ASTM D 97	°C	<-60	-57		
Solubility in water		g/l	<1%	<1%	<1%	<1%
Explosion limits		%	1 - 12	1 - 12	1 - 12	1 - 12
Specific Gravity @ 15.6°C (water = 1)			990	995	980	950

10. STABILITY AND REACTIVITY

Products of this type are stable and unlikely to react in a hazardous manner under normal conditions of use.

Hazardous polymerisation reactions will not occur.

This material is combustible.

Materials to Avoid

Avoid contact with strong oxidizing agents.

Hazardous Decomposition Products

Thermal decomposition products will vary with conditions.

Incomplete combustion will generate smoke carbon dioxide and hazardous gases including carbon monoxide and oxides of sulphur nitrogen and phosphorus.

11. TOXICOLOGICAL INFORMATION

Eyes

Unlikely to cause more than transient stinging or redness if accidental eye contact occurs.

Skin

Unlikely to cause harm to the skin on brief or occasional contact but prolonged or repeated exposure may lead to dermatitis.

Ingestion

Unlikely to cause harm if accidentally swallowed in small doses though larger quantities may cause nausea and diarrhoea.

Inhalation

At normal ambient temperatures this product will be unlikely to present an inhalation hazard because of its low volatility. May cause irritation to eyes nose and throat due to exposure to vapour mists or fumes.

May be harmful by inhalation if exposure to vapour mists or fumes resulting from thermal decomposition products occurs.

12. ECOLOGICAL INFORMATION

Mobility

Spillages may penetrate the soil causing ground water contamination.

Persistence and degradability

No data available.

Bioaccumulative potential

There is no evidence to suggest bioaccumulation will occur.

Aquatic toxicity

Spills may form a film on water surfaces causing physical damage to organisms. Oxygen transfer could also be impaired.

13. DISPOSAL CONSIDERATIONS

Dispose of via an authorised person/ licensed waste disposal contractor in accordance with local regulations.

Incineration may be carried out under controlled conditions provided that local regulations for emissions are met.

14. TRANSPORT INFORMATION

Not classified as hazardous for transport (NZ Standard 5433 UN IATA/ICAO IMO).

15. REGULATORY INFORMATION

Not classified using the criteria in the NZ Toxic Substances and Dangerous Goods Regulations.

16. OTHER INFORMATION

Compiled by:

Product Stewardship Group
BP Oil Technology Centre
Chertsey Road
Sunbury-on-Thames
Middlesex TW16 7LN

This data sheet and the health safety and environmental information it contains is considered to be accurate as of the date specified below. We have reviewed any information contained herein which we received from sources outside the BP Amoco Group of Companies. However no warranty or representation express or implied is made as to the accuracy or completeness of the data and information contained in this data sheet.

Health and safety precautions and environmental advice noted in this data sheet may not be accurate for all individuals and/or situations. It is the user's obligation to evaluate and use this product safely and to comply with all applicable laws and regulations. No statement made in this data sheet shall be construed as a permission recommendation or authorization given or implied to practise any patented invention without a valid licence. The BP Amoco Group shall not be responsible for any damage or injury resulting from abnormal use of the material from any failure to adhere to recommendations or from any hazards inherent in the nature of the material.

SHEET REVISIONS DATE SECTIONS REVISED - - SHEET NO: SAV0104 ISSUE DATE: 05/03/2001 REVISION OF SHEET DATED: -

ATTACHMENT 3

**Material Safety Data Sheet for BP2197 engine oil,
published in the United States**

Material Safety Data Sheet



1. Chemical product and company identification

Product name	BP TURBO OIL 2197
MSDS #	452218
Historic MSDS #:	0000000072
Code	452218-US08
Product use	Turbine Oil For specific application advice see appropriate Technical Data Sheet or consult our company representative.
Supplier	Air BP Maple Plaza II - 1N Six Campus Drive Parsippany, NJ 07054 U.S.A.
EMERGENCY HEALTH INFORMATION:	1 (800) 447-8735 Outside the US: +1 703-527-3887 (CHEMTREC)
EMERGENCY SPILL INFORMATION:	1 (800) 424-9300 CHEMTREC (USA)
OTHER PRODUCT INFORMATION	1 (866) 4 BP - MSDS (866-427-6737 Toll Free - North America) email: bpcares@bp.com

2. Composition/information on ingredients

This product does not contain any hazardous ingredients at or above regulated thresholds.

3. Hazards identification

Physical state	Liquid.
Color	Dark Amber.
Emergency overview	CAUTION! MAY CAUSE EYE IRRITATION. MAY CAUSE SKIN IRRITATION. MAY CAUSE RESPIRATORY TRACT IRRITATION. Avoid contact with eyes, skin and clothing. Avoid breathing vapor or mist. Keep container closed. Use with adequate ventilation. Wash thoroughly after handling.
Routes of entry	Dermal contact. Eye contact. Inhalation. Ingestion.
Potential health effects	
Eyes	May cause eye irritation.
Skin	May cause skin irritation.
Inhalation	May cause respiratory tract irritation.
Ingestion	Ingestion may cause gastrointestinal irritation and diarrhea.
Medical conditions aggravated by over-exposure	None identified.

Product name BP TURBO OIL 2197

MSDS # 452218-US08

Page: 1/5

Version 1.01 Date of issue 04/11/2006.

Format US

Language ENGLISH.

Build 4.2.7

(ENGLISH)

4. First aid measures

Eye contact	In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Get medical attention.
Skin contact	Immediately wash exposed skin with soap and water. Remove contaminated clothing and shoes. Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention if irritation develops.
Inhalation	If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.
Ingestion	Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. If large quantities of this material are swallowed, call a physician immediately.

5. Fire-fighting measures

Flammability of the product	May be combustible at high temperature.
Flash point	262 °C (Open cup) Cleveland.
Products of combustion	These products are: carbon oxides (CO, CO ₂), oxides of phosphorus.
Unusual fire/explosion hazards	This material is not explosive as defined by established regulatory criteria.
Fire-fighting media and instructions	In case of fire, use water fog, foam, dry chemicals, or carbon dioxide. Do not use water jet.
Protective clothing (fire)	Fire-fighters should wear positive pressure self-contained breathing apparatus (SCBA) and full turnout gear.

6. Accidental release measures

Personal precautions	Immediately contact emergency personnel. Keep unnecessary personnel away. Use suitable protective equipment (See Section: "Exposure controls/personal protection"). Follow all fire fighting procedures (See Section: "Fire-fighting measures").
Environmental precautions and clean-up methods	If emergency personnel are unavailable, contain spilled material. For small spills add absorbent (soil may be used in the absence of other suitable materials) scoop up material and place in a sealed, liquid-proof container for disposal. For large spills dike spilled material or otherwise contain material to ensure runoff does not reach a waterway. Place spilled material in an appropriate container for disposal. Avoid contact of spilled material with soil and prevent runoff entering surface waterways. See Section 13 for Waste Disposal Information.
Personal protection in case of a large spill	Splash goggles. Full suit. Boots. Gloves. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

7. Handling and storage

Handling	Avoid contact with skin and clothing. Avoid contact with eyes. Use only with adequate ventilation. Avoid breathing vapor or mist. Wash thoroughly after handling.
Storage	Keep container tightly closed. Keep container in a cool, well-ventilated area. Empty containers may contain harmful, flammable/combustible or explosive residue or vapors. Do not cut, grind, drill, weld, reuse or dispose of containers unless adequate precautions are taken against these hazards.

8. Exposure controls/personal protection

Occupational exposure limits

This product does not have any assigned OELs.

Control Measures Provide exhaust ventilation or other engineering controls to keep the relevant airborne concentrations below their respective occupational exposure limits. Ensure that eyewash stations and safety showers are close to the work-station location.

Hygiene measures Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period.

Personal protection

Eyes Avoid contact with eyes. Chemical splash goggles.

Skin and body Avoid contact with skin and clothing. Wear suitable protective clothing.

Respiratory Use only with adequate ventilation. In accordance with good industrial hygiene and safety work practices, airborne exposures should be controlled to the lowest extent practicable.

Hands Wear suitable gloves.
Consult your supervisor or S.O.P. for special handling directions

Consult local authorities for acceptable exposure limits.

9. Physical and chemical properties

Physical state	Liquid.
Odor	Characteristic.
Color	Dark Amber.
Heat of combustion	Not available.
Pour Point	-57 °C
Specific gravity	0.997
Density	997 kg/m ³ (0.997 g/cm ³) at 15.6°C
Viscosity	Kinematic: 27 mm ² /s (27 cSt) at 40°C Kinematic: 5.28 mm ² /s (5.28 cSt) at 100°C

10. Stability and reactivity

Stability and reactivity	The product is stable.
Conditions to avoid	Keep away from heat, sparks and flame.
Incompatibility with various substances	Reactive or incompatible with the following materials: oxidizing materials, acids and alkalis.
Hazardous decomposition products	Products of combustion: carbon oxides (CO, CO ₂), oxides of phosphorus.
Hazardous polymerization	Will not occur.

11. Toxicological information

Chronic toxicity

Carcinogenic effects No component of this product at levels greater than 0.1% is identified as a carcinogen by ACGIH or the International Agency for Research on Cancer (IARC). No component of this product present at levels greater than 0.1% is identified as a carcinogen by the U.S. National Toxicology Program (NTP) or the U.S. Occupational Safety and Health Act (OSHA).

Product name BP TURBO OIL 2197

MSDS #

452218-US08

Page: 3/5

Version 1.01

Date of issue 04/11/2006.

Format US

Language ENGLISH.

Build 4.2.7

(ENGLISH)

Mutagenic effects

No component of this product at levels greater than 0.1% is classified by established regulatory criteria as a mutagen.

Reproductive effects

No component of this product at levels greater than 0.1% is classified by established regulatory criteria as a reproductive toxin.

Teratogenic effects

No component of this product at levels greater than 0.1% is classified by established regulatory criteria as teratogenic or embryotoxic.

Other chronic toxicity data

This product and/or similar products have been evaluated for the potential to cause delayed neurotoxic effects in animals (hens). Groups of hens were administered the product orally at either a single, maximum limit dose of 5 gm/kg, or a repeated maximum limit dose of 1 gm/kg, 5 days per week for 13 weeks. No clinical signs or histopathological evidence of neurotoxicity were observed. Therefore, the use of this product under recommended industrial hygiene practices should not pose a neurotoxic hazard.

12. Ecological information

Ecotoxicity

No testing has been performed by the manufacturer.

13. Disposal considerations

Waste information

Avoid contact of spilled material and runoff with soil and surface waterways. Consult an environmental professional to determine if local, regional or national regulations would classify spilled or contaminated materials as hazardous waste. Use only approved transporters, recyclers, treatment, storage or disposal facilities. Dispose of in accordance with all applicable local and national regulations.

Consult your local or regional authorities.

14. Transport information

Not classified as hazardous for transport (DOT, TDG, IMO/IMDG, IATA/ICAO)

15. Regulatory information

U.S. Federal regulations

US INVENTORY (TSCA): In compliance.

TSCA 12(b) one-time export notification:: Diphenylamine

This product is not regulated under Section 302 of SARA and 40 CFR Part 355.

SARA 311/312 MSDS distribution - chemical inventory - hazard identification: BP TURBO OIL 2197: Immediate (Acute) Health Hazard

SARA 313**Form R - Reporting requirements**

This product does not contain any hazardous ingredients at or above regulated thresholds.

Supplier notification

This product does not contain any hazardous ingredients at or above regulated thresholds.

CERCLA Sections 102a/103 Hazardous Substances (40 CFR Part 302.4):: This material is not regulated under CERCLA Sections 103 and 107.

State regulations

New Jersey:Tricresyl phosphate

California Prop 65: No products were found

Product name BP TURBO OIL 2197

MSDS #

452218-US08

Page: 4/5

Version 1.01

Date of issue 04/11/2006.

Format US

Language ENGLISH.

Build 4.2.7

(ENGLISH)

Inventories

AUSTRALIAN INVENTORY (AICS): Not listed.

CANADA INVENTORY (DSL): Not listed.

CHINA INVENTORY (IECS): In compliance.

EC INVENTORY (EINECS/ELINCS): In compliance.

JAPAN INVENTORY (ENCS): Contact supplier for regulatory information.

KOREA INVENTORY (ECL): Not listed.

PHILIPPINE INVENTORY (PICCS): Not listed.

16. Other information

Label requirements

CAUTION!

MAY CAUSE EYE IRRITATION.
MAY CAUSE SKIN IRRITATION.
MAY CAUSE RESPIRATORY TRACT IRRITATION.

HMIS® Rating :

Health 1 -
Flammability 1
Physical Hazard 0
Personal protection X

**National Fire
Protection
Association
(U.S.A.)**



History

Date of issue

04/11/2006.

Date of previous issue

01/03/2006.

Prepared by

Product Stewardship

Notice to reader

NOTICE : This Material Safety Data Sheet is based upon data considered to be accurate at the time of its preparation. Despite our efforts, it may not be up to date or applicable to the circumstances of any particular case. We are not responsible for any damage or injury resulting from abnormal use, from any failure to follow appropriate practices or from hazards inherent in the nature of the product.

ATTACHMENT 4

Material Safety Data Sheet for BP2380 engine oil,
published in Germany



1. Identification of the substance/preparation and company/undertaking

Product name BP Turbo Oil 2380
SDS no. 452219
Historic SDS no. 000000070
Use of the substance/preparation Turbine Oil
 For specific application advice see appropriate Technical Data Sheet or consult our company representative.
Supplier Deutsche BP Aktiengesellschaft
 Max-Born-Strasse 2
 D-22761 Hamburg
 Germany
 Telefon: (+49) 040-6395-0
EMERGENCY TELEPHONE NUMBER Telephone (+49) 040-6395-2006
 Telephone (+49) 040-6395-2306
E-mail address MSDSadvice@bp.com

2. Hazards identification

This preparation is not classified as dangerous according to Directive 1999/45/EC as amended and adapted.
 See sections 11 and 12 for more detailed information on health effects and symptoms and environmental hazards.

3. Composition/information on ingredients

Synthetic base stock. Proprietary performance additives.

Chemical name	CAS no.	%	EINECS / ELINCS.	Classification
Tricresyl phosphate	1330-78-5	5 - 10	215-548-8	Xn; R21/22 N; R51/53 [1]
n-phenyl-1-naphthylamine	90-30-2	1 - 5	201-983-0	Xn; R22 R43 N; R50/53 [1]

See section 16 for the full text of the R-phrases declared above

[1] Substance classified with a health or environmental hazard

[2] Substance with a workplace exposure limit

[3] PBT-substance

[4] vPvB-substance

Occupational exposure limits, if available, are listed in section 8.

4. First-aid measures

Eye contact In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Get medical attention if irritation occurs.
Skin contact In case of contact, immediately flush skin with plenty of water. Remove contaminated clothing and shoes. Wash clothing before reuse. Clean shoes thoroughly before reuse. Get medical attention if irritation develops.
Inhalation If inhaled, remove to fresh air. Get medical attention if symptoms appear.
Ingestion Do not induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. If potentially dangerous quantities of this material have been swallowed, call a physician immediately.
Notes to physician Treatment should in general be symptomatic and directed to relieving any effects.

5. Fire-fighting measures

Extinguishing media

Suitable

In case of fire, use foam, dry chemical or carbon dioxide extinguisher or spray.

Not suitable

Do not use water jet.

Hazardous decomposition products


Decomposition products may include the following materials:
 carbon dioxide
 carbon monoxide
 nitrogen oxides
 phosphorus oxides

Special fire-fighting procedures


None identified.

6 . Accidental release measures


Personal precautions

 No action shall be taken involving any personal risk or without suitable training. Evacuate surrounding areas. Keep unnecessary and unprotected personnel from entering. Do not touch or walk through spilt material. Put on appropriate personal protective equipment (see section 8).


Environmental precautions

 Avoid dispersal of spilt material and runoff and contact with soil, waterways, drains and sewers. Inform the relevant authorities if the product has caused environmental pollution (sewers, waterways, soil or air).

Large spill

 Stop leak if without risk. Move containers from spill area. Prevent entry into sewers, water courses, basements or confined areas. Contain and collect spillage with non-combustible, absorbent material e.g. sand, earth, vermiculite or diatomaceous earth and place in container for disposal according to local regulations (see section 13). Dispose of via a licensed waste disposal contractor. Note: see section 1 for emergency contact information and section 13 for waste disposal.

Small spill

 Stop leak if without risk. Move containers from spill area. Absorb with an inert material and place in an appropriate waste disposal container. Dispose of via a licensed waste disposal contractor.

7 . Handling and storage

Handling

Wash thoroughly after handling.

Storage

Keep container tightly closed. Keep container in a cool, well-ventilated area.

Not suitable

Prolonged exposure to elevated temperature

8 . Exposure controls/personal protection

Occupational exposure limits

This product does not have any assigned OELs.

Exposure controls

Occupational exposure controls

Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapours below their respective occupational exposure limits.

Hygiene measures

Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period.

Personal protective equipment

Respiratory protection

Respiratory protective equipment is not normally required where there is adequate natural or local exhaust ventilation to control exposure.

In case of insufficient ventilation, wear suitable respiratory equipment.

Respiratory protective equipment must be checked to ensure it fits correctly each time it is worn.

Air-filtering respirators, also called air-purifying respirators, will not be adequate under conditions of oxygen deficiency (i.e. low oxygen concentration), and would not be considered suitable where airborne concentrations of chemicals with a significant hazard are present. In these cases air-supplied breathing apparatus will be required.

Provided an air-filtering/air-purifying respirator is suitable, a filter for particulates can be used for mist or fume. Use filter type P or comparable standard. A combination filter for particles and organic gases and vapours (boiling point >65°C) may be required if vapour or abnormal odour is also present due to high product temperature. Use filter type AP or comparable standard.

Hand protection

Wear protective gloves if prolonged or repeated contact is likely. Wear chemical resistant gloves.

Recommended: nitrile gloves

Protective gloves will deteriorate over time due to physical and chemical damage. Inspect and replace gloves on a regular basis. The frequency of replacement will depend upon the circumstances of use.

Eye protection

Safety glasses with side shields.

Skin and body

Use of protective clothing is good industrial practice.

Cotton or polyester/cotton overalls will only provide protection against light superficial contamination that will not soak through to the skin. Overalls should be laundered on a regular basis. When the risk of skin exposure is high (e.g. when cleaning up spillages or if there is a risk of splashing) then chemical resistant aprons and/or impervious chemical suits and boots will be required.

9 . Physical and chemical properties

General information

Appearance

Physical state

Liquid.

Colour

Amber.

Odour

Characteristic.

Important health, safety and environmental information

Flash point

 Open cup: 265°C (509°F) [Cleveland.]

Viscosity

Kinematic: 24.2 mm²/s (24.2 cSt) at 40°C
Kinematic: 4.97 mm²/s (4.97 cSt) at 100°C

Pour point

-57 °C

Density

980 kg/m³ (0.98 g/cm³) at 15.6°C

Solubility

 Insoluble in water.

10 . Stability and reactivity

Stability	The product is stable.
Possibility of hazardous reactions	Under normal conditions of storage and use, hazardous reactions will not occur.
Conditions to avoid	Avoid all possible sources of ignition (spark or flame).
Materials to avoid	Reactive or incompatible with the following materials: oxidizing materials.
Hazardous decomposition products	Combustion products may include the following: carbon oxides nitrogen oxides phosphorus oxides Under normal conditions of storage and use, hazardous decomposition products should not be produced.

11 . Toxicological information

Acute toxicity	Unlikely to cause more than transient stinging or redness if accidental eye contact occurs. Unlikely to cause harm to the skin on brief or occasional contact but prolonged or repeated exposure may lead to dermatitis. Product not classified for sensitisation. Based on data available for this or related materials. Unlikely to cause harm if accidentally swallowed in small doses, though larger quantities may cause nausea and diarrhoea. At normal ambient temperatures this product will be unlikely to present an inhalation hazard because of its low volatility. May be harmful by inhalation if exposure to vapour, mists or fumes resulting from thermal decomposition products occurs.
Chronic toxicity	
Chronic effects	No known significant effects or critical hazards.
Effects and symptoms	
Eyes	No significant health hazards identified.
Skin	No significant health hazards identified.
Inhalation	No significant health hazards identified.
Ingestion	No significant health hazards identified.

12 . Ecological information

Persistence/degradability	Inherently biodegradable
Mobility	Spillages may penetrate the soil causing ground water contamination.
Bioaccumulative potential	This product is not expected to bioaccumulate through food chains in the environment.
Environmental hazards	Not classified as dangerous.
Other ecological information	Spills may form a film on water surfaces causing physical damage to organisms. Oxygen transfer could also be impaired.

13 . Disposal considerations

Disposal considerations / Waste information	The generation of waste should be avoided or minimised wherever possible. Empty containers or liners may retain some product residues. This material and its container must be disposed of in a safe way. Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Disposal of this product, solutions and any by-products should at all times comply with the requirements of environmental protection and waste disposal legislation and any regional local authority requirements. Avoid dispersal of spilt material and runoff and contact with soil, waterways, drains and sewers.
Unused product	
European waste catalogue (EWC)	3 02 06* synthetic engine, gear and lubricating oils However, deviation from the intended use and/or the presence of any potential contaminants may require an alternative waste disposal code to be assigned by the end user.

14 . Transport information

Not classified as hazardous for transport (ADR/RID, ADN, IMDG, ICAO/IATA)

15 . Regulatory information

Classification and labelling have been performed according to EU directives 1999/45/EC and 67/548/EEC as amended and adapted.

Label requirements

Risk phrases

This product is not classified according to EU legislation.


Additional warning phrases

Contains n-phenyl-1-naphthylamine. May produce an allergic reaction. Safety data sheet available for professional user on request.

Other regulations**Europe inventory**

 All components are listed or exempted.


**United States inventory
(TSCA 8b)**

 All components are listed or exempted.


Australia inventory (AICS)

 At least one component is not listed.

Canada inventory

 All components are listed or exempted.


China inventory (IECSC)

 All components are listed or exempted.


Japan inventory (ENCS)

 At least one component is not listed.

Korea inventory (KECI)

 All components are listed or exempted.

**Philippines inventory
(PICCS)**


 All components are listed or exempted.

**Hazard Class for water
(WGK), according to VwVwS**

 Appendix No. 4

16 . Other information

**Full text of R-phrases referred
to in sections 2 and 3**

 R22- Harmful if swallowed.

R21/22- Harmful in contact with skin and if swallowed.

R43- May cause sensitisation by skin contact.

R50/53- Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.

R51/53- Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.

History**Date of issue/ Date of
revision**

18/11/2008.

Date of previous issue

16/08/2007.

Prepared by

Product Stewardship Group

Notice to reader

 Indicates information that has changed from previously issued version.

All reasonably practicable steps have been taken to ensure this data sheet and the health, safety and environmental information contained in it is accurate as of the date specified below. No warranty or representation, express or implied is made as to the accuracy or completeness of the data and information in this data sheet.

The data and advice given apply when the product is sold for the stated application or applications. You should not use the product other than for the stated application or applications without seeking advice from us.

It is the user's obligation to evaluate and use this product safely and to comply with all applicable laws and regulations. The BP Group shall not be responsible for any damage or injury resulting from use, other than the stated product use of the material, from any failure to adhere to recommendations, or from any hazards inherent in the nature of the material. Purchasers of the product for supply to a third party for use at work, have a duty to take all necessary steps to ensure that any person handling or using the product is provided with the information in this sheet. Employers have a duty to tell employees and others who may be affected of any hazards described in this sheet and of any precautions that should be taken.

ATTACHMENT 5

**Material Safety Data Sheet for BP2380 engine oil,
published in South Africa**



1. Identification of the substance/preparation and company/undertaking

Product name **BP Turbo Oil 2380**
SDS no. 452219
Historic SDS no. 0000000070
Use of the substance/preparation Turbine Oil
 For specific application advice see appropriate Technical Data Sheet or consult our company representative.
Supplier BP Southern Africa(Pty) Ltd
 10 Junction Avenue Parktown
 Johannesburg
South Africa
 2193
 Product Technical Helpdesk: 0800 111 551
EMERGENCY TELEPHONE NUMBER +27 (0)860 222166
 Tygerberg Poison Centre: +27 (0)21 931 6129
E-mail address MSDSadvice@bp.com

2. Hazards identification

This preparation is not classified as dangerous according to Directive 1999/45/EC as amended and adapted.
 See sections 11 and 12 for more detailed information on health effects and symptoms and environmental hazards.

3. Composition/information on ingredients

Synthetic base stock. Proprietary performance additives.

Chemical name	CAS no.	%	EINECS / ELINCS.	Classification
Tricresyl phosphate	1330-78-5	5 - 10	215-548-8	Xn; R21/22 N; R51/53 [1]
n-phenyl-1-naphthylamine	90-30-2	1 - 5	201-983-0	Xn; R22 R43 N; R50/53 [1]

See section 16 for the full text of the R-phrases declared above

- [1] Substance classified with a health or environmental hazard
 [2] Substance with a workplace exposure limit
 [3] PBT-substance
 [4] vPvB-substance

Occupational exposure limits, if available, are listed in section 8.

4. First-aid measures

Eye contact In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Get medical attention if irritation occurs.
Skin contact In case of contact, immediately flush skin with plenty of water. Remove contaminated clothing and shoes. Wash clothing before reuse. Clean shoes thoroughly before reuse. Get medical attention if irritation develops.
Inhalation **If inhaled, remove to fresh air. Get medical attention if symptoms appear.**
Ingestion Do not induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. If potentially dangerous quantities of this material have been swallowed, call a physician immediately.
Notes to physician Treatment should in general be symptomatic and directed to relieving any effects.

5. Fire-fighting measures

Extinguishing media
Suitable In case of fire, use foam, dry chemical or carbon dioxide extinguisher or spray.
Not suitable Do not use water jet.
Hazardous decomposition products **Decomposition products may include the following materials:**
 carbon dioxide
 carbon monoxide
 nitrogen oxides
 phosphorus oxides

Special fire-fighting procedures	None identified.
Protection of fire-fighters	Fire-fighters should wear positive pressure self-contained breathing apparatus (SCBA) and full turnout gear.


6 . Accidental release measures

Personal precautions	No action shall be taken involving any personal risk or without suitable training. Evacuate surrounding areas. Keep unnecessary and unprotected personnel from entering. Do not touch or walk through spilled material. Put on appropriate personal protective equipment (see section 8).
Environmental precautions	Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers. Inform the relevant authorities if the product has caused environmental pollution (sewers, waterways, soil or air).
Large spill	Stop leak if without risk. Move containers from spill area. Prevent entry into sewers, water courses, basements or confined areas. Contain and collect spillage with non-combustible, absorbent material e.g. sand, earth, vermiculite or diatomaceous earth and place in container for disposal according to local regulations (see section 13). Dispose of via a licensed waste disposal contractor. Note: see section 1 for emergency contact information and section 13 for waste disposal.
Small spill	Stop leak if without risk. Move containers from spill area. Absorb with an inert material and place in an appropriate waste disposal container. Dispose of via a licensed waste disposal contractor.

7 . Handling and storage

Handling	Wash thoroughly after handling.
Storage	Keep container tightly closed. Keep container in a cool, well-ventilated area.
Not suitable	Prolonged exposure to elevated temperature

8 . Exposure controls/personal protection

Occupational exposure limits	This product does not have any assigned OELs.
Exposure controls	
Occupational exposure controls	Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapours below their respective occupational exposure limits.
Hygiene measures	Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period.
Personal protective equipment	
Respiratory protection	Respiratory protective equipment is not normally required where there is adequate natural or local exhaust ventilation to control exposure. In case of insufficient ventilation, wear suitable respiratory equipment. Respiratory protective equipment must be checked to ensure it fits correctly each time it is worn. Air-filtering respirators, also called air-purifying respirators, will not be adequate under conditions of oxygen deficiency (i.e. low oxygen concentration), and would not be considered suitable where airborne concentrations of chemicals with a significant hazard are present. In these cases air-supplied breathing apparatus will be required. Provided an air-filtering/air-purifying respirator is suitable, a filter for particulates can be used for mist or fume. Use filter type P or comparable standard. A combination filter for particles and organic gases and vapours (boiling point >65°C) may be required if vapour or abnormal odour is also present due to high product temperature. Use filter type AP or comparable standard.
Hand protection	Wear protective gloves if prolonged or repeated contact is likely. Wear chemical resistant gloves. Recommended: nitrile gloves Protective gloves will deteriorate over time due to physical and chemical damage. Inspect and replace gloves on a regular basis. The frequency of replacement will depend upon the circumstances of use.
Eye protection	Safety glasses with side shields.
Skin and body	Use of protective clothing is good industrial practice. Cotton or polyester/cotton overalls will only provide protection against light superficial contamination that will not soak through to the skin. Overalls should be laundered on a regular basis. When the risk of skin exposure is high (e.g. when cleaning up spillages or if there is a risk of splashing) then chemical resistant aprons and/or impervious chemical suits and boots will be required.
Personal protective equipment (Pictograms)	

9 . Physical and chemical properties

General information

Appearance	
Physical state	Liquid.
Colour	Amber.
Odour	Characteristic.

Important health, safety and environmental information

Flash point	Open cup: 265°C (509°F) [Cleveland.]
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Product name	BP Turbo Oil 2380	Product code	452219-US08	Page:	2/4
Version	1	Date of issue	18 November 2008	Format	South Africa
				(South Africa)	(ENGLISH)

Viscosity	Kinematic: 24.2 mm ² /s (24.2 cSt) at 40°C Kinematic: 4.97 mm ² /s (4.97 cSt) at 100°C
Pour point	-57 °C
Density	980 kg/m ³ (0.98 g/cm ³) at 15.6°C
Solubility	insoluble in water.

10 . Stability and reactivity

Stability	The product is stable.
Possibility of hazardous reactions	Under normal conditions of storage and use, hazardous reactions will not occur.
Conditions to avoid	Avoid all possible sources of ignition (spark or flame).
Materials to avoid	Reactive or incompatible with the following materials: oxidizing materials.
Hazardous decomposition products	Combustion products may include the following: carbon oxides nitrogen oxides phosphorus oxides Under normal conditions of storage and use, hazardous decomposition products should not be produced.

11 . Toxicological information

Acute toxicity	Unlikely to cause more than transient stinging or redness if accidental eye contact occurs. Unlikely to cause harm to the skin on brief or occasional contact but prolonged or repeated exposure may lead to dermatitis. Product not classified for sensitisation. Based on data available for this or related materials. Unlikely to cause harm if accidentally swallowed in small doses, though larger quantities may cause nausea and diarrhoea. At normal ambient temperatures this product will be unlikely to present an inhalation hazard because of its low volatility. May be harmful by inhalation if exposure to vapour, mists or fumes resulting from thermal decomposition products occurs.
Chronic toxicity	
Chronic effects	No known significant effects or critical hazards.
Effects and symptoms	
Eyes	No significant health hazards identified.
Skin	No significant health hazards identified.
Inhalation	No significant health hazards identified.
Ingestion	No significant health hazards identified.

12 . Ecological information

Persistence/degradability	Inherently biodegradable
Mobility	Spillages may penetrate the soil causing ground water contamination.
Bioaccumulative potential	This product is not expected to bioaccumulate through food chains in the environment.
Environmental hazards	Not classified as dangerous.
Other ecological information	Spills may form a film on water surfaces causing physical damage to organisms. Oxygen transfer could also be impaired.

13 . Disposal considerations

Disposal considerations / Waste information	The generation of waste should be avoided or minimised wherever possible. Empty containers or liners may retain some product residues. This material and its container must be disposed of in a safe way. Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Disposal of this product, solutions and any by-products should at all times comply with the requirements of environmental protection and waste disposal legislation and any regional local authority requirements. Avoid dispersal of spilt material and runoff and contact with soil, waterways, drains and sewers.
Unused product	
European waste catalogue (EWC)	13 02 06* synthetic engine, gear and lubricating oils However, deviation from the intended use and/or the presence of any potential contaminants may require an alternative waste disposal code to be assigned by the end user.

Product name	BP Turbo Oil 2380	Product code	452219-US08	Page:	3/4
Version	1	Date of issue	18 November 2008	Format	South Africa
					(South Africa)
				Language	ENGLISH
					(ENGLISH)

14 . Transport information

Not classified as hazardous for transport (ADR/RID, ADN, IMDG, ICAO/IATA)

15 . Regulatory information

Classification and labelling have been performed according to EU directives 1999/45/EC and 67/548/EEC as amended and adapted.

Label requirements

Risk phrases	This product is not classified according to EU legislation.
Additional warning phrases	Contains n-phenyl-1-naphthylamine. May produce an allergic reaction. Safety data sheet available for professional user on request.
Other regulations	
Europe inventory	All components are listed or exempted.
United States inventory (TSCA 8b)	All components are listed or exempted.
Australia inventory (AICS)	At least one component is not listed.
Canada inventory	All components are listed or exempted.
China inventory (IECSC)	All components are listed or exempted.
Japan inventory (ENCS)	At least one component is not listed.
Korea inventory (KECI)	All components are listed or exempted.
Philippines inventory (PICCS)	All components are listed or exempted.
National regulations	National legislation: Occupational Health and Safety Act (Act 85 of 1993).

16 . Other information

Full text of R-phrases referred to in sections 2 and 3	R22- Harmful if swallowed. R21/22- Harmful in contact with skin and if swallowed. R43- May cause sensitisation by skin contact. R50/53- Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment. R51/53- Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.
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History

Date of issue/ Date of revision	18/11/2008.
Date of previous issue	No previous validation.
Prepared by	Product Stewardship Group
Notice to reader	

Indicates information that has changed from previously issued version.

All reasonably practicable steps have been taken to ensure this data sheet and the health, safety and environmental information contained in it is accurate as of the date specified below. No warranty or representation, express or implied is made as to the accuracy or completeness of the data and information in this data sheet.

The data and advice given apply when the product is sold for the stated application or applications. You should not use the product other than for the stated application or applications without seeking advice from us.

It is the user's obligation to evaluate and use this product safely and to comply with all applicable laws and regulations. The BP Group shall not be responsible for any damage or injury resulting from use, other than the stated product use of the material, from any failure to adhere to recommendations, or from any hazards inherent in the nature of the material. Purchasers of the product for supply to a third party for use at work, have a duty to take all necessary steps to ensure that any person handling or using the product is provided with the information in this sheet. Employers have a duty to tell employees and others who may be affected of any hazards described in this sheet and of any precautions that should be taken.

Product name	BP Turbo Oil 2380	Product code	452219-US08	Page:	4/4
Version	1	Date of issue	18 November 2008	Format	South Africa
					(South Africa)
				Language	ENGLISH
					(ENGLISH)

ATTACHMENT 6

**Material Safety Data Sheet for BP2380 engine oil,
published in the United States**



1. Product and company identification

Product name	BP Turbo Oil 2380
MSDS #	452219
Historic MSDS #:	0000000070
Code	452219-US08
Product use	Turbine Oil For specific application advice see appropriate Technical Data Sheet or consult our company representative.
Supplier	Air BP Lubricants Maple Plaza II - 1N Six Campus Drive Parsippany, NJ 07054 U.S.A.
EMERGENCY HEALTH INFORMATION:	1 (800) 447-8735 Outside the US: +1 630-961-6958
EMERGENCY SPILL INFORMATION:	1 (800) 424-9300 CHEMTREC (USA) Outside the US: +1 703-527-3887
OTHER PRODUCT INFORMATION	1 (866) 4 BP - MSDS (866-427-6737 Toll Free - North America) email: bpcares@bp.com

2. Hazards identification

Physical state	Liquid.
Color	Amber.
Emergency overview	CAUTION ! MAY CAUSE RESPIRATORY TRACT, EYE AND SKIN IRRITATION. In accordance with good industrial hygiene and safety work practices, airborne exposures should be controlled to the lowest extent practicable. Avoid contact with eyes, skin and clothing. Use only with adequate ventilation. Keep container tightly closed and sealed until ready for use. Wash thoroughly after handling.
Routes of entry	Dermal contact. Eye contact. Inhalation. Ingestion.
Potential health effects	
Eyes	May cause eye irritation.
Skin	May cause skin irritation.
Inhalation	May cause respiratory tract irritation.
Ingestion	Ingestion may cause gastrointestinal irritation and diarrhea.
See toxicological information (section 11)	

3. Composition/information on ingredients

This product does not contain any hazardous ingredients at or above regulated thresholds.

4. First aid measures

Eye contact	In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Get medical attention if symptoms occur.
Skin contact	Flush contaminated skin with plenty of water. Remove contaminated clothing and shoes. Wash clothing before reuse. Clean shoes thoroughly before reuse. Get medical attention if symptoms occur.
Inhalation	If inhaled, remove to fresh air. Get medical attention if symptoms occur.
Ingestion	Do not induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. If potentially dangerous quantities of this material have been swallowed, call a physician immediately. Get medical attention if symptoms occur.

5. Fire-fighting measures

Flash point	Open cup: 265°C (509°F) [Cleveland.]
Fire/explosion hazards	In a fire or if heated, a pressure increase will occur and the container may burst.
Extinguishing media	
Suitable	Use an extinguishing agent suitable for the surrounding fire.
Not suitable	Do not use water jet.
Fire-fighting procedures	Promptly isolate the scene by removing all persons from the vicinity of the incident if there is a fire. No action shall be taken involving any personal risk or without suitable training.
Hazardous combustion products	Combustion products may include the following: phosphorus oxides carbon oxides (CO, CO ₂) (carbon monoxide, carbon dioxide) nitrogen oxides (NO, NO ₂ etc.)
Protective clothing (fire)	Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode.

6. Accidental release measures

Personal precautions	No action shall be taken involving any personal risk or without suitable training. Keep unnecessary and unprotected personnel from entering. Do not touch or walk through spilled material. In accordance with good industrial hygiene and safety work practices, airborne exposures should be controlled to the lowest extent practicable. Provide adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Put on appropriate personal protective equipment (see section 8).
Environmental precautions	Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers. Inform the relevant authorities if the product has caused environmental pollution (sewers, waterways, soil or air).
Methods for cleaning up	
Large spill	Stop leak if without risk. Move containers from spill area. Approach release from upwind. Prevent entry into sewers, water courses, basements or confined areas. Wash spillages into an effluent treatment plant or proceed as follows. Contain and collect spillage with non-combustible, absorbent material e.g. sand, earth, vermiculite or diatomaceous earth and place in container for disposal according to local regulations (see section 13). Dispose of via a licensed waste disposal contractor. Contaminated absorbent material may pose the same hazard as the spilled product. Note: see section 1 for emergency contact information and section 13 for waste disposal.
Small spill	Stop leak if without risk. Move containers from spill area. Dilute with water and mop up if water-soluble or absorb with an inert dry material and place in an appropriate waste disposal container. Dispose of via a licensed waste disposal contractor.

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7. Handling and storage

Handling	Put on appropriate personal protective equipment (see section 8). Workers should wash hands and face before eating, drinking and smoking. Do not breathe vapor or mist. Do not ingest. Avoid contact with eyes, skin and clothing. Use only with adequate ventilation. Wear appropriate respirator when ventilation is inadequate.
Storage	Store in accordance with local regulations. Store away from direct sunlight in a dry, cool and well-ventilated area, away from incompatible materials (see section 10). Keep container tightly closed and sealed until ready for use. Containers that have been opened must be carefully resealed and kept upright to prevent leakage. Do not store in unlabeled containers. Use appropriate containment to avoid environmental contamination.
Not suitable	Prolonged exposure to elevated temperature

8. Exposure controls/personal protection

Occupational exposure limits

Some states may enforce more stringent exposure limits.

Control Measures	Use only with adequate ventilation. If user operations generate dust, fumes, gas, vapor or mist, use process enclosures, local exhaust ventilation or other engineering controls to keep worker exposure to airborne contaminants below any recommended or statutory limits.
Hygiene measures	Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period. Appropriate techniques should be used to remove potentially contaminated clothing. Wash contaminated clothing before reusing.
Personal protection	
Eyes	Avoid contact with eyes. Safety glasses with side shields or chemical goggles. Recommended: safety glasses with side-shields
Skin and body	Avoid contact with skin and clothing. Wear suitable protective clothing.
Respiratory	Use adequate ventilation. In accordance with good industrial hygiene and safety work practices, airborne exposures should be controlled to the lowest extent practicable.
Hands	The correct choice of protective gloves depends upon the chemicals being handled, the conditions of work and use, and the condition of the gloves (even the best chemically resistant glove will break down after repeated chemical exposures). Most gloves provide only a short time of protection before they must be discarded and replaced. Because specific work environments and material handling practices vary, safety procedures should be developed for each intended application. Gloves should therefore be chosen in consultation with the supplier/manufacturer and with a full assessment of the working conditions. Consult your supervisor or S.O.P. for special handling instructions.

9. Physical and chemical properties

Physical state	Liquid.
Color	Amber.
Odor	Characteristic.
Flash point	Open cup: 265°C (509°F) [Cleveland.]
Density	980 kg/m ³ (0.98 g/cm ³) at 15.6°C
Viscosity	Kinematic: 24.2 mm ² /s (24.2 cSt) at 40°C Kinematic: 4.97 mm ² /s (4.97 cSt) at 100°C
Solubility	Insoluble in water.

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10. Stability and reactivity

Stability and reactivity	The product is stable.
Possibility of hazardous reactions	Under normal conditions of storage and use, hazardous reactions will not occur.
Conditions to avoid	Keep away from heat, sparks and flame.
Incompatibility with various substances	Reactive or incompatible with the following materials: oxidizing materials, acids and alkalis.
Hazardous decomposition products	Under normal conditions of storage and use, hazardous decomposition products should not be produced.
Hazardous polymerization	Under normal conditions of storage and use, hazardous polymerization will not occur.

11. Toxicological information

Other Toxicity Data	This product and/or similar products have been evaluated for the potential to cause delayed neurotoxic effects in animals (hens). Groups of hens were administered the product orally at either a single, maximum limit dose of 5 gm/kg, or a repeated maximum limit dose of 1 gm/kg, 5 days per week for 13 weeks. No clinical signs or histopathological evidence of neurotoxicity were observed. Therefore, the use of this product under recommended industrial hygiene practices should not pose a neurotoxic hazard.
Other information	
Potential chronic health effects	
Carcinogenicity	No known significant effects or critical hazards.

12. Ecological information

No testing has been performed by the manufacturer.

Persistence/degradability	Inherently biodegradable
Mobility	Spillages may penetrate the soil causing ground water contamination.
Bioaccumulative potential	This product is not expected to bioaccumulate through food chains in the environment.
Other ecological information	Spills may form a film on water surfaces causing physical damage to organisms. Oxygen transfer could also be impaired.

13. Disposal considerations

Waste information	The generation of waste should be avoided or minimized wherever possible. Empty containers or liners may retain some product residues. This material and its container must be disposed of in a safe way. Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Disposal of this product, solutions and any by-products should at all times comply with the requirements of environmental protection and waste disposal legislation and any regional local authority requirements. Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers.
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NOTE: The generator of waste has the responsibility for proper waste identification (based on characteristic(s) or listing), transportation and disposal

14. Transport information

Not classified as hazardous for transport (DOT, TDG, IMO/IMDG, IATA/ICAO)

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15. Regulatory information

U.S. Federal Regulations

United States inventory (TSCA 8b)

All components are listed or exempted.

TSCA 12(b) one-time export: Diphenylamine

SARA 302/304/311/312 extremely hazardous substances: No products were found.

SARA 302/304 emergency planning and notification: No products were found.

SARA 302/304/311/312 hazardous chemicals: Tricresyl phosphate

SARA 311/312 MSDS distribution - chemical inventory - hazard identification: BP Turbo Oil 2380: Immediate (acute) health hazard, Delayed (chronic) health hazard

SARA 313

Form R - Reporting requirements

This product does not contain any hazardous ingredients at or above regulated thresholds.

Supplier notification

This product does not contain any hazardous ingredients at or above regulated thresholds.

CERCLA Sections 102a/103 Hazardous Substances (40 CFR Part 302.4):

CERCLA: Hazardous substances.: 1-Naphthylamine: 100 lbs. (45.4 kg); 2-Naphthylamine: 10 lbs. (4.54 kg); Aniline: 5000 lbs. (2270 kg);

State regulations

Massachusetts Substances

None of the components are listed.

New Jersey Hazardous Substances

The following components are listed: TRICRESYLPHOSPHATE

Pennsylvania RTK Hazardous Substances

None of the components are listed.

California Prop. 65

WARNING: This product contains a chemical known to the State of California to cause cancer. 1-Naphthylamine; 2-Naphthylamine; Aniline

Inventories

Canada inventory

All components are listed or exempted.

Europe inventory

All components are listed or exempted.

Australia inventory (AICS)

At least one component is not listed.

China inventory (IECSC)

All components are listed or exempted.

Japan inventory (ENCS)

At least one component is not listed.

Korea inventory (KECI)

All components are listed or exempted.

Philippines inventory (PICCS)

All components are listed or exempted.

16. Other information

Label requirements

CAUTION !

MAY CAUSE RESPIRATORY TRACT, EYE AND SKIN IRRITATION.

HMIS® Rating :

Health 1
Flammability 1
Physical Hazard 0
Personal protection X

National Fire Protection Association (U.S.A.)

Health  Fire hazard
Instability
Specific hazard

History

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Date of previous issue 08/23/2008.
Prepared by Product Stewardship

Notice to reader

NOTICE : This Material Safety Data Sheet is based upon data considered to be accurate at the time of its preparation. Despite our efforts, it may not be up to date or applicable to the circumstances of any particular case. We are not responsible for any damage or injury resulting from abnormal use, from any failure to follow appropriate practices or from hazards inherent in the nature of the product.

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ATTACHMENT 7

New Jersey Department of Health & Senior Services
Right to Know Hazardous Substance Fact Sheet:
Carbon Monoxide



Right to Know Hazardous Substance Fact Sheet

Common Name: **CARBON MONOXIDE**

Synonyms: Carbonic Oxide; Exhaust Gas; Flue Gas

Chemical Name: Carbon Monoxide

Date: May 2006

Revision: January 2010

CAS Number: 630-08-0

RTK Substance Number: 0345

DOT Number: UN 1016

Description and Use

Carbon Monoxide is a colorless and odorless gas. It is mainly found as a product of incomplete combustion from vehicles and oil and gas burners. It is used in metallurgy and plastics, and as a chemical intermediate.

Reasons for Citation

- ▶ **Carbon Monoxide** is on the Right to Know Hazardous Substance List because it is cited by OSHA, ACGIH, DOT, NIOSH and NFPA.
- ▶ This chemical is on the Special Health Hazard Substance List.

SEE GLOSSARY ON PAGE 5.

FIRST AID

Eye Contact

- ▶ Immediately flush with large amounts of water for at least 15 minutes, lifting upper and lower lids. Remove contact lenses, if worn, while rinsing.

Skin Contact

- ▶ In case of contact with *liquid Carbon Monoxide*, immerse affected part in warm water. Seek medical attention.

Inhalation

- ▶ Remove the person from exposure.
- ▶ Begin rescue breathing (using universal precautions) if breathing has stopped and CPR if heart action has stopped.
- ▶ Transfer promptly to a medical facility.
- ▶ Medical observation is recommended for several days after exposure or if symptoms are present, as some symptoms may be delayed.

EMERGENCY NUMBERS

Poison Control: 1-800-222-1222

CHEMTREC: 1-800-424-9300

NJDEP Hotline: 1-877-927-6337

National Response Center: 1-800-424-8802

EMERGENCY RESPONDERS >>>> SEE LAST PAGE

Hazard Summary

Hazard Rating	NJDHSS	NFPA
HEALTH	-	2
FLAMMABILITY	-	4
REACTIVITY	-	0
TERATOGEN FLAMMABLE POISONOUS GASES ARE PRODUCED IN FIRE CONTAINERS MAY EXPLODE IN FIRE		

Hazard Rating Key: 0=minimal; 1=slight; 2=moderate; 3=serious; 4=severe

- ▶ **Carbon Monoxide** can affect you when inhaled.
- ▶ **Carbon Monoxide** may be a TERATOGEN. HANDLE WITH EXTREME CAUTION.
- ▶ Exposure during pregnancy can cause lowered birth weight in offspring.
- ▶ Skin contact with *liquid Carbon Monoxide* can cause frostbite.
- ▶ **Inhaling Carbon Monoxide** can cause headache, dizziness, lightheadedness and fatigue.
- ▶ Higher exposure to **Carbon Monoxide** can cause sleepiness, hallucinations, convulsions, and loss of consciousness.
- ▶ **Carbon Monoxide** can cause personality and memory changes, mental confusion and loss of vision.
- ▶ Extremely high exposure to **Carbon Monoxide** can cause the formation of *Carboxyhemoglobin* and decrease the ability of the blood to carry *Oxygen*. This can cause a bright red color to the skin and mucous membranes causing trouble breathing, collapse, convulsions, coma and death.
- ▶ **Carbon Monoxide** can affect the heart and damage the nervous system.
- ▶ **Carbon Monoxide** is a FLAMMABLE GAS and a DANGEROUS FIRE HAZARD.

Workplace Exposure Limits

OSHA: The legal airborne permissible exposure limit (PEL) is **50 ppm** averaged over an 8-hour workshift.

NIOSH: The recommended airborne exposure limit (REL) is **35 ppm** averaged over a 10-hour workshift and **200 ppm**, not to be exceeded during any 15-minute work period.

ACGIH: The threshold limit value (TLV) is **25 ppm** averaged over an 8-hour workshift.

Determining Your Exposure

- ▶ Read the product manufacturer's Material Safety Data Sheet (MSDS) and the label to determine product ingredients and important safety and health information about the product mixture.
- ▶ For each individual hazardous ingredient, read the New Jersey Department of Health and Senior Services Hazardous Substance Fact Sheet, available on the RTK Program website (www.nj.gov/health/eoh/rtkweb) or in your facility's RTK Central File or Hazard Communication Standard file.
- ▶ You have a right to this information under the New Jersey Worker and Community Right to Know Act and the Public Employees Occupational Safety and Health (PEOSH) Act if you are a public worker in New Jersey, and under the federal Occupational Safety and Health Act (OSHA) if you are a private worker.
- ▶ The New Jersey Right to Know Act requires most employers to label chemicals in the workplace and requires public employers to provide their employees with information concerning chemical hazards and controls. The federal OSHA Hazard Communication Standard (29 CFR 1910.1200) and the PEOSH Hazard Communication Standard (N.J.A.C. 12:100-7) require employers to provide similar information and training to their employees.

This Fact Sheet is a summary of available information regarding the health hazards that may result from exposure. Duration of exposure, concentration of the substance and other factors will affect your susceptibility to any of the potential effects described below.

Health Hazard Information

Acute Health Effects

The following acute (short-term) health effects may occur immediately or shortly after exposure to **Carbon Monoxide**:

- ▶ Skin contact with *liquid Carbon Monoxide* can cause frostbite.
- ▶ **Inhaling Carbon Monoxide can cause headache, dizziness, lightheadedness and fatigue.**
- ▶ Higher exposure to **Carbon Monoxide** can cause sleepiness, hallucinations, convulsions, and loss of consciousness.
- ▶ **Carbon Monoxide** can cause personality and memory changes, mental confusion and loss of vision.
- ▶ Extremely high exposure to **Carbon Monoxide** can cause the formation of *Carboxyhemoglobin* and decrease the ability of the blood to carry *Oxygen*. This can cause a bright red color to the skin and mucous membranes causing trouble breathing, collapse, convulsions, coma and death.

Chronic Health Effects

The following chronic (long-term) health effects can occur at some time after exposure to **Carbon Monoxide** and can last for months or years:

Cancer Hazard

- ▶ There is no evidence that **Carbon Monoxide** causes cancer in animals. This is based on test results presently available to the New Jersey Department of Health and Senior Services from published studies.

Reproductive Hazard

- ▶ **Carbon Monoxide** may be a TERATOGEN in humans since it is a teratogen in animals.
- ▶ There is limited evidence that **Carbon Monoxide** may damage the male reproductive system (including decreasing the sperm count) in animals.

Other Effects

- ▶ **Carbon Monoxide** can affect the heart and damage the nervous system.

Medical

Medical Testing

For frequent or potentially high exposure (half the TLV or greater), the following are recommended before beginning work and at regular times after that:

- ▶ *Carboxyhemoglobin* levels (a combination of **Carbon Monoxide** and hemoglobin) should be tested for within a few hours after exposure to the gas.
- ▶ EKG
- ▶ Exam of the nervous system

Any evaluation should include a careful history of past and present symptoms with an exam. Medical tests that look for damage already done are not a substitute for controlling exposure.

Request copies of your medical testing. You have a legal right to this information under the OSHA Access to Employee Exposure and Medical Records Standard (29 CFR 1910.1020).

Mixed Exposures

- ▶ Smoking increases your exposure to **Carbon Monoxide**. Because smoking can cause heart disease, as well as lung cancer, emphysema, and other respiratory problems, it may worsen respiratory conditions caused by chemical exposure. Even if you have smoked for a long time, stopping now will reduce your risk of developing health problems. Exposure to **30 ppm of Carbon Monoxide** throughout the day is equivalent to smoking 20 cigarettes a day.

Conditions Made Worse By Exposure

- ▶ Individuals who have heart disease should not be exposed to levels of **Carbon Monoxide** above **25 ppm**.

Workplace Controls and Practices

Very toxic chemicals, or those that are reproductive hazards or sensitizers, require expert advice on control measures if a less toxic chemical cannot be substituted. Control measures include: (1) enclosing chemical processes for severely irritating and corrosive chemicals, (2) using local exhaust ventilation for chemicals that may be harmful with a single exposure, and (3) using general ventilation to control exposures to skin and eye irritants. For further information on workplace controls, consult the NIOSH document on Control Banding at www.cdc.gov/niosh/topics/ctrlbanding/.

The following work practices are also recommended:

- ▶ Label process containers.
- ▶ Provide employees with hazard information and training.
- ▶ Monitor airborne chemical concentrations.
- ▶ Use engineering controls if concentrations exceed recommended exposure levels.
- ▶ Provide eye wash fountains and emergency showers.
- ▶ Wash or shower if skin comes in contact with a hazardous material.
- ▶ Always wash at the end of the workshift.
- ▶ Change into clean clothing if clothing becomes contaminated.
- ▶ Do not take contaminated clothing home.
- ▶ Get special training to wash contaminated clothing.
- ▶ Do not eat, smoke, or drink in areas where chemicals are being handled, processed or stored.
- ▶ Wash hands carefully before eating, smoking, drinking, applying cosmetics or using the toilet.

In addition, the following may be useful or required:

- ▶ Specific actions are required for this chemical by OSHA. Refer to the OSHA *Compressed gases* Standard (29 CFR 1910.101).
- ▶ Before entering a confined space where **Carbon Monoxide** may be present, check to make sure that an explosive concentration does not exist.
- ▶ Where possible, transfer **Carbon Monoxide** from cylinders or other containers to process containers in an enclosed system.

Personal Protective Equipment

The OSHA Personal Protective Equipment Standard (29 CFR 1910.132) requires employers to determine the appropriate personal protective equipment for each hazard and to train employees on how and when to use protective equipment.

The following recommendations are only guidelines and may not apply to every situation.

Gloves and Clothing

- ▶ Avoid skin contact with **Carbon Monoxide**. Wear personal protective equipment made from material which can not be permeated or degraded by this substance. Safety equipment suppliers and manufacturers can provide recommendations on the most protective glove and clothing material for your operation.

- ▶ Safety equipment manufacturers recommend work gloves, and Tychem® BR, Responder®, and TK, or the equivalent, as protective materials for clothing.
- ▶ Where exposure to cold equipment, vapors, or liquid may occur, employees should be provided with *insulated* gloves and special clothing designed to prevent the freezing of body tissues.
- ▶ All protective clothing (suits, gloves, footwear, headgear) should be clean, available each day, and put on before work.
- ▶ Wear protective clothing made of material that does not generate static electricity.

Eye Protection

- ▶ Wear non-vented, impact resistant goggles when working with fumes, gases, or vapors.
- ▶ If additional protection is needed for the entire face, use in combination with a face shield. A face shield should not be used without another type of eye protection.

Respiratory Protection

Improper use of respirators is dangerous. Respirators should only be used if the employer has implemented a written program that takes into account workplace conditions, requirements for worker training, respirator fit testing, and medical exams, as described in the OSHA Respiratory Protection Standard (29 CFR 1910.134).

- ▶ DO NOT USE CHEMICAL CARTRIDGE OR CANISTER RESPIRATORS.
- ▶ Where the potential exists for exposure over **25 ppm**, use a NIOSH approved supplied-air respirator with a full facepiece operated in a pressure-demand or other positive-pressure mode. For increased protection use in combination with an auxiliary self-contained breathing apparatus or an emergency escape air cylinder.
- ▶ Exposure to **1,200 ppm** is immediately dangerous to life and health. If the possibility of exposure above **1,200 ppm** exists, use a NIOSH approved self-contained breathing apparatus with a full facepiece operated in a pressure-demand or other positive-pressure mode equipped with an emergency escape air cylinder.

Fire Hazards

If employees are expected to fight fires, they must be trained and equipped as stated in the OSHA Fire Brigades Standard (29 CFR 1910.156).

- ▶ **Carbon Monoxide** is a FLAMMABLE GAS.
- ▶ Stop flow of gas and use water spray to disperse vapors.
- ▶ POISONOUS GASES ARE PRODUCED IN FIRE.
- ▶ Use water spray to keep fire-exposed containers cool.
- ▶ Vapors may travel to a source of ignition and flash back.
- ▶ **Carbon Monoxide** may form an ignitable vapor/air mixture in closed tanks or containers.

Spills and Emergencies

If employees are required to clean-up spills, they must be properly trained and equipped. The OSHA Hazardous Waste Operations and Emergency Response Standard (29 CFR 1910.120) may apply.

If **Carbon Monoxide** is leaked, take the following steps:

- ▶ Evacuate personnel and secure and control entrance to the area.
- ▶ Eliminate ignition sources.
- ▶ Ventilate area of leak to disperse the gas.
- ▶ Stop flow of gas. If source of leak is a cylinder and the leak cannot be stopped in place, remove the leaking cylinder to a safe place in the open air, and repair leak or allow cylinder to empty.
- ▶ Keep **Carbon Monoxide** out of confined spaces, such as sewers, because of the possibility of an explosion.
- ▶ Turn leaking cylinder with leak up to prevent escape of gas in liquid state.
- ▶ Purge with *inert* gas before attempting repairs.
- ▶ It may be necessary to contain and dispose of **Carbon Monoxide** as a HAZARDOUS WASTE. Contact your state Department of Environmental Protection (DEP) or your regional office of the federal Environmental Protection Agency (EPA) for specific recommendations.

Handling and Storage

Prior to working with **Carbon Monoxide** you should be trained on its proper handling and storage.

- ▶ **Carbon Monoxide** is not compatible with OXIDIZING AGENTS (such as PERCHLORATES, PEROXIDES, PERMANGANATES, CHLORATES, NITRATES, CHLORINE, BROMINE and FLUORINE) and ALKALI METALS (such as LITHIUM, SODIUM and POTASSIUM).
- ▶ *Liquified, cold* **Carbon Monoxide** may react vigorously with WATER.
- ▶ **Carbon Monoxide** is mildly corrosive to NICKEL and IRON.
- ▶ Store in tightly closed containers in a cool, well-ventilated area away from HEAT. Do not store above 125°F (52°C).
- ▶ Sources of ignition, such as smoking and open flames, are prohibited where **Carbon Monoxide** is used, handled, or stored.
- ▶ Metal containers involving the transfer of **Carbon Monoxide** should be grounded and bonded.
- ▶ Use explosion-proof electrical equipment and fittings wherever **Carbon Monoxide** is used, handled, manufactured, or stored.
- ▶ Use only non-sparking tools and equipment, especially when opening and closing containers of **Carbon Monoxide**.

Occupational Health Information Resources

The New Jersey Department of Health and Senior Services, Occupational Health Service, offers multiple services in occupational health. These services include providing informational resources, educational materials, public presentations, and industrial hygiene and medical investigations and evaluations.

For more information, please contact:

New Jersey Department of Health & Senior Services
 Right to Know Program
 PO Box 368
 Trenton, NJ 08625-0368
 Phone: 609-984-2202
 Fax: 609-984-7407
 E-mail: rtk@doh.state.nj.us
 Web address: <http://www.nj.gov/health/eoh/rtkweb>

***The Right to Know Hazardous Substance Fact Sheets
 are not intended to be copied and sold
 for commercial purposes.***

GLOSSARY

ACGIH is the American Conference of Governmental Industrial Hygienists. They publish guidelines called Threshold Limit Values (TLVs) for exposure to workplace chemicals.

Acute Exposure Guideline Levels (AEGs) are established by the EPA. They describe the risk to humans resulting from once-in-a lifetime, or rare, exposure to airborne chemicals.

Boiling point is the temperature at which a substance can change its physical state from a liquid to a gas.

A **carcinogen** is a substance that causes cancer.

The **CAS number** is unique, identifying number, assigned by the Chemical Abstracts Service, to a specific chemical.

CFR is the Code of Federal Regulations, which are the regulations of the United States government.

A **combustible** substance is a solid, liquid or gas that will burn.

A **corrosive** substance is a gas, liquid or solid that causes destruction of human skin or severe corrosion of containers.

The **critical temperature** is the temperature above which a gas cannot be liquefied, regardless of the pressure applied.

DEP is the New Jersey Department of Environmental Protection.

DOT is the Department of Transportation, the federal agency that regulates the transportation of chemicals.

EPA is the Environmental Protection Agency, the federal agency responsible for regulating environmental hazards.

ERG is the Emergency Response Guidebook. It is a guide for emergency responders for transportation emergencies involving hazardous substances.

Emergency Response Planning Guideline (ERPG) values provide estimates of concentration ranges where one reasonably might anticipate observing adverse effects.

A **fetus** is an unborn human or animal.

A **flammable** substance is a solid, liquid, vapor or gas that will ignite easily and burn rapidly.

The **flash point** is the temperature at which a liquid or solid gives off vapor that can form a flammable mixture with air.

IARC is the International Agency for Research on Cancer, a scientific group.

Ionization Potential is the amount of energy needed to remove an electron from an atom or molecule. It is measured in electron volts.

IRIS is the Integrated Risk Information System database on human health effects that may result from exposure to various chemicals, maintained by federal EPA.

LEL or Lower Explosive Limit, is the lowest concentration of a combustible substance (gas or vapor) in the air capable of continuing an explosion.

mg/m³ means milligrams of a chemical in a cubic meter of air. It is a measure of concentration (weight/volume).

A **mutagen** is a substance that causes mutations. A **mutation** is a change in the genetic material in a body cell. Mutations can lead to birth defects, miscarriages, or cancer.

NFPA is the National Fire Protection Association. It classifies substances according to their fire and explosion hazard.

NIOSH is the National Institute for Occupational Safety and Health. It tests equipment, evaluates and approves respirators, conducts studies of workplace hazards, and proposes standards to OSHA.

NTP is the National Toxicology Program which tests chemicals and reviews evidence for cancer.

OSHA is the federal Occupational Safety and Health Administration, which adopts and enforces health and safety standards.

PEOSHA is the New Jersey Public Employees Occupational Safety and Health Act, which adopts and enforces health and safety standards in public workplaces.

Permeated is the movement of chemicals through protective materials.

ppm means parts of a substance per million parts of air. It is a measure of concentration by volume in air.

Protective Action Criteria (PAC) are values established by the Department of Energy and are based on AEGs and ERPGs. They are used for emergency planning of chemical release events.

A **reactive** substance is a solid, liquid or gas that releases energy under certain conditions.

STEL is a Short Term Exposure Limit which is usually a 15-minute exposure that should not be exceeded at any time during a work day.

A **teratogen** is a substance that causes birth defects by damaging the fetus.

UEL or Upper Explosive Limit is the highest concentration in air above which there is too much fuel (gas or vapor) to begin a reaction or explosion.

Vapor Density is the ratio of the weight of a given volume of one gas to the weight of another (usually *Air*), at the same temperature and pressure.

The **vapor pressure** is a force exerted by the vapor in equilibrium with the solid or liquid phase of the same substance. The higher the vapor pressure the higher concentration of the substance in air.



Right to Know Hazardous Substance Fact Sheet

**Emergency
Responders
Quick Reference**

Common Name: **CARBON MONOXIDE**

Synonyms: Carbonic Oxide; Exhaust Gas; Flue Gas

CAS No: 630-08-0

Molecular Formula: CO

RTK Substance No: 0345

Description: Colorless, odorless gas

HAZARD DATA

Hazard Rating	Firefighting	Reactivity
2 - Health 4 - Fire 0 - Reactivity DOT#: UN 1016 ERG Guide #: 119 Hazard Class: 2.3 (Poisonous Gas)	Carbon Monoxide is a FLAMMABLE GAS . Stop flow of gas and use water spray to disperse vapors. POISONOUS GASES ARE PRODUCED IN FIRE. Use water spray to keep fire-exposed containers cool. Vapors may travel to a source of ignition and flash back. Carbon Monoxide may form an ignitable vapor/air mixture in closed tanks or containers.	Carbon Monoxide is not compatible with OXIDIZING AGENTS (such as PERCHLORATES , PEROXIDES , PERMANGANATES , CHLORATES , NITRATES , CHLORINE , BROMINE and FLUORINE) and ALKALI METALS (such as LITHIUM , SODIUM and POTASSIUM). <i>Liquified, cold Carbon Monoxide</i> may react vigorously with water.

SPILL/LEAKS

Isolation Distance:

Small Spill: 30 meters (100 feet)

Large Spill: 150 meters (500 feet)

Fire: 800 meters (1/2 mile)

Stop flow of gas. If source of leak is a cylinder and the leak cannot be stopped in place, remove the leaking cylinder to a safe place in the open air, and repair leak or allow cylinder to empty.

Keep **Carbon Monoxide** out of confined spaces, such as sewers, because of the possibility of an explosion.

Turn leaking cylinder with leak up to prevent escape of gas in liquid state.

Purge with *inert gas* before attempting repairs.

Use only non-sparking tools and equipment, especially when opening and closing containers of **Carbon Monoxide**.

Carbon Monoxide is harmful to aquatic life at very low concentrations.

PHYSICAL PROPERTIES

Odor Threshold:	Odorless
Flash Point:	Flammable gas
LEL:	12%
UEL:	75%
Auto Ignition Temp:	1,125°F (607°C)
Vapor Density:	0.97 (air = 1)
Vapor Pressure:	>750 mm Hg at 68°F (20°C)
Specific Gravity:	0.79 (water = 1)
Water Solubility:	Very slightly soluble
Boiling Point:	-313°F (-192°C)
Melting Point:	-337°F (-205°C)
Critical Temp:	-282°F (-139°C)
Ionization Potential:	14 eV
Molecular Weight:	28

EXPOSURE LIMITS

OSHA: 50 ppm, 8-hr TWA

NIOSH: 35 ppm, 10-hr TWA; 200 ppm, 15-min Ceiling

ACGIH: 25 ppm, 8-hr TWA

IDLH: 1,200 ppm

The Protective Action Criteria values are:

PAC-1 = 83 ppm PAC-2 = 83 ppm PAC-3 = 330 ppm

PROTECTIVE EQUIPMENT

Gloves:	Insulated work gloves (double glove for spills)
Coveralls:	Tychem® BR, Responder ® and TK (330-minute breakthrough) >10% LEL wear flash protection or turnout gear
Respirator:	SCBA

HEALTH EFFECTS

Eyes:	No information available
Skin:	Skin contact with <i>liquid Carbon Monoxide</i> can cause frostbite
Inhalation:	Headache, dizziness, lightheadedness and fatigue, convulsions and loss of consciousness

FIRST AID AND DECONTAMINATION

Remove the person from exposure.
Flush eyes with large amounts of water for at least 15 minutes. Remove contact lenses if worn.
In case of contact with <i>liquid Carbon Monoxide</i> , immerse affected part in warm water. Seek medical attention.
Begin artificial respiration if breathing has stopped and CPR if necessary.
Transfer promptly to a medical facility.
Medical observation is recommended as symptoms may be delayed.