Jet Fuel

Jet fuels are particular forms of no. 1 fuel oil. JP-1 is kerosene, while JP-5 is specially refined high flash point kerosene. The specific gravity for these oils range from 0.75 to 0.80. At room temperature, jet fuel has a viscosity similar to water. Jet fuels are highly volatile and have high evaporation rates. Although these evaporation rates tend to be less than that of gasoline. JP-5 is a combustible liquid, and will ignite easily particularly in the early stages of spills. Specifically, if a spill is kept from spreading freely by natural or man-made structures the resulting oil slick might be thick enough to support ignition. In addition, vapor concentrations near the source of spill or vapors collected in sheltered areas can present an explosion hazard.

When spilled in open water, the oil typically spreads into thin, rainbow or silver colored films. Because these films are so thin (< 3 microns) and jet fuels have high evaporation rates, sheens from smaller spills (< 100 barrels) often break-up and dissipate within 8 to 12-hours if there is sufficient mixing (i.e., strong tidal currents, breaking waves). Jet fuel is a light refined product and is not expected to form a stable emulsion. If the sheens reach the shoreline in a few hours, a slight staining or greasy film is common. Normally, this type of release does not become an involved cleanup problem.

If jet fuel is spilled in quiescent, sheltered environments, the oil may persist for a much longer period (a few days to a week). For spills occurring in a stream or river where there is sufficient mixing due to rapids or passage over a weir, the enhanced dispersion would increase the amount of product in the water column.

Notes: See if applicable to your incident

The military is the primary user for JP-5 but they are slowly switching to JP-8. JP-8 is similar to Jet A-1, except for the addition of a fuel system icing inhibitor, a corrosion inhibitor, and a lubricity additive. While additives are important components, they represent only a small fraction of the fuel oil mixture.

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## Longer Version

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Chemistry Report: IES/RCAT96-48

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To: Steve Lehmann -- NOAA SSC

From: Charlie Henry -- Research Associate

Re: General Information on Jet Fuels

In response to your request on JP-8, I have condensed a lot of aviation/jet fuel information into a short primer on the subject. I hope you find the information useful.

General Characterization of Jet Fuel:

In general, jet fuels are highly refined kerosene products. Jet fuels are blended from low sulfur or desulfurized kerosene and various light distillates generated from hydrocracking partially refined petroleum feedstocks. The end product must meet critical specifications including a very low freeze point (or pour point), smoke point, and aromatic hydrocarbon content (generally <20%). The smoke point characteristic of a fuel oil can be improved by a process called hydrotreating. Hydrotreating jet fuel results in converting unsaturated aromatic hydrocarbon compounds to saturated hydrocarbons such as alkylated naphthenes which have a lower carbon to hydrogen ratio and burn cleaner. Special additives are used in all jet fuels to meet users specifications such as

storage stability. Additives are important components but represent only a very small fraction of the fuel oil mixture.

User specifications vary, and, as a result, a wide range in flash points (-10 to 60°C) exist within the general jet fuel classification. Jet fuels are often subdivided into two basic types: wide-cut gasoline-type and basic kerosene-type. Wide-cut gasoline-type jet fuels such as USAF JP-4 contain gasoline and kerosene distillates; the resultant blend is highly flammable. Basic kerosene-type fuels such a commercial Jet A and military JP-5 have a narrow boiling point range and a higher flash point similar to generic kerosene (reduced flammability, reduced fire and explosive hazard). Safety considerations limit commercial and naval aircraft fuels to the later type. Civil Jet A and military JP-5 contain essentially the same petroleum distillates and differ only in the additives used.

Table 1 provides generic physical property data for a variety of fuel oils. The values shown are the median values collected and each value has been reduced to a single significant figure (a degree of precision which is more than accurate for response and hazard assessment). Table 1 clearly indicates that aviation gasoline (avgas not jet fuel) and automobile gasoline have the greatest fire and explosive hazard (lowest flash points) followed closely by wide-cut gasoline-type jet fuels (JP-4 and Jet B).

Table 1. Generic Physical Property Data for a Variety of Fuel Oils

| Fuel | FP (1) (°C) | PP(2) (°C) | Gravity(3) (API) | Color |
|---|---|---|---|---|
| Aviation Gasoline (Avgas) | -50 | -60 | 70 | dyed green (4) |
| Gasoline Unleaded | -30 | no data | no data | no data |
| JP-4 | -10 | -50 | 50 | no data |
| Jet Fuel B | -10 | -50 | 50 | no data |
| Diesel, Grade 1-D (5) | 40 | -30 | 40 | light brown |
| Kerosene, #1 Fuel Oil | 40 | no data | 40 | colorless to light brown |
| JP-6 | 40 | no data | no data | no data |
| Jet Fuel A-1 | 40 | -50 | 40 | no data |
| JP-8 | 40 | -50 | 40 | no data |
| Gas Turb. Fuel, 1-GT | 40 | -20 | 40 | no data |
| Jet Fuel A | 50 | -40 | 40 | no data |
| JP-5 | 50 | -50 | 40 | colorless to light brown |
| Diesel, Grade 2-D (6) | 60 | -20 | 40 | light brown |
| JP-7 | 60 | -30 | 50 | no data |

(1) Flash point reported as median with only one significant figure accuracy.
(2) Pour point reported as median with only one significant figure accuracy.
(3) Gravity reported in degrees API with only one significant figure accuracy..
(4) Avgas 80-red, Avgas 115-purple, Avgas 100LL-blue, and Avgas 100-green. The values s
(5) Light diesel formulated for automobiles, etc.
(6) Heavier diesel formulation similar to #2 fuel oil.

General information on Selected Jet Fuels:

Jet A. A petroleum distillate blended from kerosene fractions and used in civil aviation. Standard operational fuel for commercial turboprop and turbojet aircraft in the US.

Jet A-1 (Turbo Fuel A-1). A petroleum distillate blended from kerosene fractions and is the standard operational fuel for civilian aviation requiring a low freezing point product. Jet A-1 is similar to Jet A except for a lower freezing point. Standard commercial fuel used on commercial international flights.

Jet B. A wide boiling-range petroleum distillate blended from gasoline and kerosene fractions. Operational fuel for US and NATO military aircraft and for many commercial turboprop and turbojet aircraft. Similar to JP-4 but with different additives.

JP-1, JP-2, and JP-3. Early US military jet fuels developed in the 1940's. Primarily wide-cut formulations and all are obsolete.

JP-4. The standard USAF wide-cut aviation turbine fuel. The general formulation is 65% gasoline-type and 35% kerosene-type hydrocarbons.

JP-5. Specially refined kerosene. Similar to Jet A but with additional additives to meet military specifications. Standard Navy and USCG jet fuel. This fuel was designed specifically to reduce safety and combat hazards on naval aircraft carriers.

JP-6. A higher kerosene fraction than JP-4 and with fewer impurities. The fuel was designed to have improved thermal stability properties and was used for certain supersonic aircraft such as high altitude, supersonic bombers. JP-6 is obsolete.

JP-7. A high flash point, special kerosene-refined fuel used in advanced supersonic aircraft. This fuel has enhanced combustion and thermal stability properties and developed specifically for use in very high performance, Mach 3 plus, aircraft.

JP-8. A kerosene modeled on Jet A-1. The fuel was formulated to address safety and combat concerns relative to the highly flammable USAF standard jet fuel, JP-4 (I'm not sure to what existent JP-8 has replaced JP-4 within the USAF).

References:

Allinson, J.P. 1973. Criteria for Quality of Petroleum Products. John Wiley and Sons, New York. 286 pp.

Environment Canada. 1994. Catalogue of Crude Oil and Oil Product Properties. Emergencies Science Division, Environmental Technology Centre, 3439 River Road, Ottawa, Ontario. (ASCII data Files)

Hughes, J.R. and N.S. Swindells. 1987. The Storage and Handling of Petroleum Liquids. Charles Griffin & Company Ltd., London. 332 pp.

Leffler. W.L. 1979 Petroleum Refining for the Non-Technical Person. PennWell Books, Tulsa, Oklahoma. 159 pp.

Disclaimer:

Please note, this report was generated by the Response and Chemical Assessment Team at Louisiana State University at the request of the Science Support Coordinator. The information contained in this report has not undergone extensive review and is intended to provide real-time data to answer response questions. Please keep this in mind if you intend to use this information outside its original purpose.

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