Bulletin No. 26 **June 2009**

PREVENTING FAME CONTAMINATION IN JET FUEL AT AIRPORTS

Purpose

The purpose of this bulletin is to explain actions taken by JIG Limited ("JIG"), in association with its guarantor members, regarding prevention of the potential for FAME carryover into jet fuel supplies to airports and aircraft. FAME, or fatty acid methyl ester, is a bio-component in biodiesel and jet fuel 'free from FAME' is currently defined as <5ppm FAME.

Background

Leading up to the introduction of biodiesel, the JIG aviation fuel suppliers recognised a potential risk of carryover of FAME from biodiesel into jet fuel because FAME is a surface-active material and can adhere to metal surfaces. Multi-product pipelines were identified as a potential source of FAME carryover and a ***large pipeline trial*** was conducted in France on the Trapil pipeline. ***Lessons learnt*** from this trial and ***guidance*** to pipeline operators, were included in Joint Inspection Group ("JIG") Bulletin 15 (available from www.jointinspectiongroup.org).

A subsequent FAME related jet fuel product quality incident at Kingsbury Terminal in the UK, that impacted the supply to Birmingham Airport, highlighted that besides the potential for carryover from metal surfaces, ***bulk contamination even at very low levels*** could also be a potential source of FAME and ***lessons and recommendations*** from that incident were included in JIG Bulletin 16. Additional information to facilitate avoidance of contamination in bulk shipping (Marine) has also now been incorporated into the recently published Energy Institute guidance document HM-50.

Given a lack of thorough study or testing of the effects of FAME content on aircraft engines (now underway), the major engine and airframe manufacturers agreed in mid-2007 that jet fuel must contain less than ***5ppm FAME***, and this requirement was ***incorporated into the DEF STAN 91-91 specification*** in August 2008. This maximum FAME concentration level represents the detection limits of the most advanced analytical methods available for detecting FAME in aviation fuel.

Current Status

While this work is ongoing, JIG recommends that all Member Companies (Guarantor and Associate) and other fuel suppliers follow the guidelines set out in JIG Bulletins 16 and 21. Essentially, these bulletins recommend a risk review to assess the potential risk of FAME carryover in all supply chains. Where such assessments

suggest that there could be a potential risk of FAME carryover in jet fuel supplies, JIG recommends that ***additional quality assurance procedures*** should be introduced to increase control. Where the risks of FAME carryover are assessed to be high and difficult to control with additional quality assurance procedures, JIG further recommends that routine testing of every batch is instigated.

Technical Challenges

The challenges for fuel suppliers in establishing that jet fuel is free from potential FAME carryover include both the lack of widely available testing facilities (using sophisticated methods to measure low level FAME content) and the time taken for each analysis. The ***UK Energy Institute*** is addressing this issue with a fast track programme to ***develop reliable but more easily conducted test methods*** and this is detailed in JIG Bulletin 20. Unfortunately, the easier test methods will not operate at the 5ppm level and until the approval for 100ppm is agreed (if it ever is), testing for FAME will be limited to a few laboratories.

It is important to note that the <5ppm FAME requirement means limiting intergrade contamination between jet fuel and biodiesel (B5) to less than 1 part in 10,000, whereas supply chain systems will only limit intergrade contamination to approximately 1 part in 200. For complete assurance that all fuel supplied meets the <5ppm limit, it would be necessary to test every batch before release into grade dedicated distribution systems. Given the limited availability of test facilities and time required for testing, it must be recognised by all stakeholders that ***confirming all batches are <5ppm is simply not feasible at the present time for all locations worldwide*** (this limitation is acknowledged explicitly in the DEF STAN 91-91 specification).

It is therefore impossible to provide an absolute guarantee by testing that fuel in airport will contain less than 5ppm FAME, hence the risk assessment strategies that are in place. In the longer term, if the 100ppm approval is agreed and there are more testing resources, the type and frequency of testing in the supply chain will need to be reviewed and agreed.

Emergency Protocols

The above risk assessment and testing programme is intended to prevent off-specification fuel reaching airports. However, because of the lack of comprehensive testing facilities, it is conceivable that test results will become available after the facts and fuel will have been delivered to an airport with >5ppm FAME content. To help manage such an incident, the aircraft engine and airframe manufacturers (OEMs) are working on an ***Emergency Protocol*** that will advise what to do in the event of aircraft already fuelled or actually flying with fuel containing FAME in the range 5-30ppm. The ***upper limit of 30ppm*** has been chosen to cover the expected maximum level based on the very few airport incidents that have occurred so far. At the time of writing this bulletin, there is no universally agreed emergency protocol, so the 5ppm limit must be seen as the current limit for airport operations.

Summary

The situation is dynamic and JIG Member Companies are working actively with other industry stakeholders (e.g. infrastructure owners; airport operators; OEMs; airlines; governments; and regulators such as the Civil Aviation Authority) in response to this issue. An active contribution is being made to an ***industry programme*** involving JIG members that is seeking ***approval*** from the aero engine and airframe manufacturers for the continuous use of ***up to 100ppm of FAME*** in jet fuel. Based on existing test results, 100ppm represents a realistic and achievable approval level but the approval process could take another 12 months at the current rate of progress.

Therefore, it is essential that all parties involved in fuel supply to airport adopt the prudent measures outlined above to help maintain the integrity of fuel quality supplied to aircraft.