

UK FAME RELATED JET FUEL PRODUCT QUALITY INCIDENT ON 14th May 2008 – BRIEFING NOTE

Proactive testing of jet fuel coming from multiproduct pipelines for FAME carryover in accordance with the JIG bulletin 15 revealed a problem in the fuel supply to Birmingham airport in the UK.

As a result, a number of tanks at Kingsbury supply terminal and Birmingham airport were quarantined. Once it was confirmed that the level of FAME in product was above the current 5ppm limit (concentrations up to 20ppm were measured in samples), companies concerned advised the affected airports to cease fuelling. This caused only a minor disruption to fuelling activities at Birmingham airport thanks to the availability of unaffected product from a different supply route. The quarantine severely disrupted supplies to other airports normally supplied from Kingsbury and significant volumes of jet fuel were downgraded.

The investigation of what happened at the Kingsbury supply terminal is complete and has shown the potential for problems arising from the co-transport of biodiesel and jet fuel in multiproduct pipelines. A summary of the investigation is attached to this bulletin.

JIG Bulletin 15 highlighted potential problems with bulk transport of jet fuel in multiproduct pipelines that also transport biodiesel. The particular concern was carryover of the FAME component through adsorption onto and desorption from pipe walls.

It should be stressed that the pipeline operator for the Kingsbury terminal had completed a successful verification trial in accordance with the protocol in JIG 15. However, the Kingsbury incident was caused by bulk contamination of biodiesel into jet fuel at extremely low levels (~1.7m³ in 6000m³) in the receipt manifold system and highlights the need to verify that operating procedures are compatible with the design of the facility.

The JIG PQ Committee therefore recommends that operators of multiproduct systems should:

- 1) examine their facilities to identify any potential sources of low level cross contamination. Areas to inspect should include but not be limited to: ingress and egress manifolds, pump stations, valve integrity, deadlegs, meter bays.
- 2) review operating procedures associated with these facilities to ensure they are effective at preventing low level contamination (note that 1m³ B5 in 10,000m³ jet fuel is equivalent to 5ppm FAME in jet fuel).

One of the problems with controlling cross contamination with biodiesel is the lack of suitable and widely available test methods to measure low level FAME content. The UK Energy Institute has initiated a fast track programme to develop standard laboratory and field test methods with a target date of end of 2008.

JIG Bulletin 15 also noted the need for an approval of 100ppm FAME in jet fuel and the UK Energy Institute has recently created a Joint Industry Project to pursue this goal.

Summary of report of visit to BP Kingsbury and BPA Kingsbury as a part of Midlands Airport IncidentIntroduction

It has been identified that the JET A-1 in BP Kingsbury tanks 3 and 5 contains approximately 20ppm FAME. The aim of the visit was to identify the possible cause of the presence of FAME in the fuel. The delivery of fuel to BP Kingsbury is the responsibility of British Pipeline Agency as operators of the UKOP pipeline. A meeting was held between BP and BPA at BPA Kingsbury on the 18th May.

Pipeline Operation Procedures

Running on a 3-day cycle, a typical pipeline sequence into UKOP South from Shell Haven and Petroplus Coryton is DIESEL{}GASOLINE{}JETA-1{}KERO{}. Two thirds of the JET A-1 is heart-cut from the parcel at Bovingdon junction for delivery to London Heathrow. Shell products received from Stanlow Refinery via UKOP North also follow a similar sequence and are transferred into co-mingled storage at the BP terminal.

From April 15th 2008 all DIESEL in UKOP South contains approx 5% FAME as B5 grade BIODIESEL. From April 22nd 2008 all DIESEL in UKOP North contains approx 5% FAME as B5 grade BIODIESEL.

In this configuration, the preceding parcel to any JET A-1 is GASOLINE and is therefore free of FAME. There has not been a need identified to have a preceding KEROSENE buffer to JET A-1 parcels. The GASOLINE/JET A1 interface is handled according to standard multiproduct pipeline procedures.

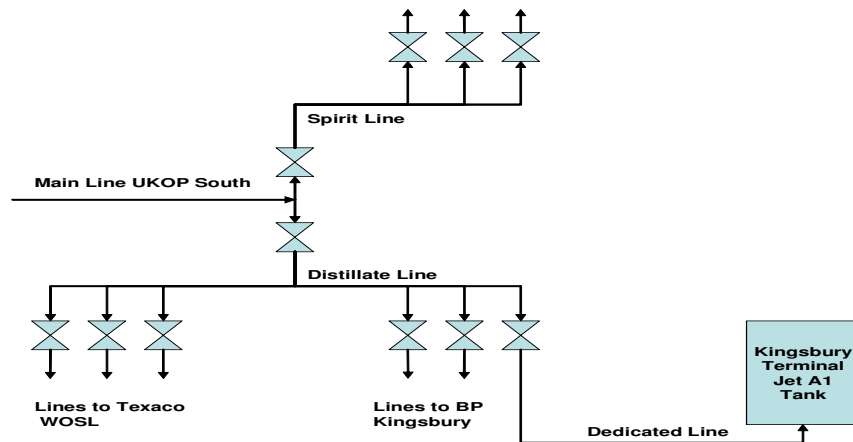
In this configuration DIESEL follows JET A-1 in the pipeline and due to turbulence, flow rates and stoppages the DIESEL may leach forward into the JET A-1. There is a requirement to have a KEROSENE buffer trailing the JET A-1 to prevent any transfer of the FAME into JET A-1. The buffer size at the tail end of the JET A-1 is 500m³. This buffer is always downgraded and transferred to kerosene storage at BP Kingsbury terminal.

Pipeline trial samples and verification samples from London Heathrow have been tested for FAME content and verify

- Leading gasoline buffers prevent contamination of JET A-1 from leading DIESEL.
- Trailing kerosene buffers prevent contamination of JET A-1 from trailing DIESEL

Receipt Procedures

On arrival at BPA Kingsbury fuel is transferred through a network of manifolds and lines to the WOSL and BP Terminals (see layout below)



N.B. This layout is the same for UKOP North from Stanlow

When DIESEL, KEROSENE or JET A-1 parcels arrive at BPA Kingsbury, they can be transferred into the BP or WOSL tanks via the distillate line and manifold.

When GASOLINE parcels arrive at BPA Kingsbury they are transferred to the relevant BP or WOSL tanks via the spirit line and manifold.

The 12" diameter pipe work length of the distillate manifold is approx 22 meters in length containing approx 77 litres per meter, which equates to approx 1.7m³ of product. This manifold is shared between BP and WOSL (see picture below)

Following a DIESEL parcel, this entire line is left filled with DIESEL – 1.7m³.

Following a JET A-1 parcel, this entire line is left filled with JET A-1 – 1.7m³.

Distillate Manifold



JET A-1 parcels following GASOLINE are transferred into BP Kingsbury via the distillate manifold. If there have been no KEROSENE parcels or buffers since the previous DIESEL parcel receipt, this manifold contains approx 1.7m³ DIESEL. Of this DIESEL, 1m³ is displaced directly into the BP Kingsbury JET A-1 tanks by the incoming JET A1 parcel.

When a BP JET A-1 parcel is directed to BP storage the WOSL portion of the distillate manifold still contains approx 0.7m³ DIESEL. Depending on flushing efficiency, this volume may leach in to the JET A-1 continuously during the receipt as product turbulence flushes the manifold.

Conclusions

It is believed that the practice described above is the immediate cause that has allowed the mixing of DIESEL containing FAME with JET A-1 in the distillate manifold. The end result was unacceptably high levels of FAME in JET A-1 in BP storage.

If a JET A-1 parcel receipt of 6000m³ is contaminated by 1.7m³ of DIESEL containing 4.8% FAME (typical B5 grade) then the mixture will contain 14ppm FAME. The exact volume of cross contaminating DIESEL is not known. This calculated result is consistent with the FAME content of the JET A-1 tested in BP JET A-1 tanks 5 (22ppm) and 3 (19ppm).

Recommendations**Short Term**

- BP requested BPA to introduce the following procedures to eliminate the immediate cause:
 1. Drain the distillate manifold before ingress of ALL JET A-1 parcels
 2. Use a 250m³ buffer to proceed the receipt of ALL JET A-1 parcels
 3. Use a 250m³ buffer to trail the receipt of ALL JET A-1 parcels

Medium Term

- BP requested BPA to conduct a root-cause analysis of this incident.
- BP requested a review of all UK multi product operations in co-operation with pipeline operators, terminal operators and shipping.

Long term

- BP have requested BPA to identify modifications (procedural and engineering) to the system to prevent the problem recurring.

Lessons learned will be shared with the wider aviation community.

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