

Jet Fuel

Introduction

Large international airports are fuelling about 500 aircraft per day with four million litres of jet fuel. Jet fuel is usually stored at the rim of the airport or even in a remote location in order to minimise the associated risk. With trucks or via pipeline systems it is transferred into the aircraft. The transportation in trucks is ruled by strict guidelines and pipeline systems are subject to frequent inspections.

Especially fuelling activities generate a considerable amount of vapour. When fuel is transferred into an aircraft tank, the incoming fuel forces fuel vapours out through tank vents, with an explosive vapour-air mixture formed in the vicinity of the operation. At some point, the escaping fuel vapours will be within explosive limits, depending upon atmospheric conditions and the type of fuel involved. Because fuel vapours are heavier than air, they will settle to the ground and accumulate in ditches, pits, or other depressions and may travel great distances before coming into contact with an ignition source.



Market Segment

- Oil & Gas, storage and distribution of fuels
- Industry, aviation



ETA Associates

119 Foster Street, Bldg #6 • Peabody, MA 01960

Tel: (978) 532-1330 • Fax: (978) 532-7325 • www.ETAassociates.com • eta@ETAassociates.com

Description of the Challenge

1. Fuel types and how to calibrate

The question “How to calibrate?” is essential in this application, since various fuel types are used in the aviation industry. Aircraft with reciprocating engines are fuelled with aviation gasoline (AVGAS). This mixture is more or less comparable to petrol which is used in cars.

Aircraft powered by jet engines are fuelled with a different type of fuel. These jet or turbine fuels fall broadly into three main types:

- Kerosine type: it consists predominantly of hydrocarbons in the C9 to C16 carbon number range. **Jet A, Jet A1, JP 8, JetA50**
- “Wide cut” type: kerosine components are blended with low flash point naphthas to give more volatile fuels covering the C4 to C16 carbon number range. **Jet B, JP 4**
- High flash point kerosine type, blends of kerosine components having a minimum closed cup flash point of 60°C.

Kerosine type jet fuels are the most commonly used ones. Civil aircraft are fuelled with Jet A1 (Jet A in USA / Canada) and Jet A50, whereas military jets use JP8. Wide cut fuel types are as well used for military aircraft (JP4), but constitute less than 1% of the total consumption of kerosines. JP 5 is used in naval aircraft.

2. Where to place the detectors?

Jet fuel detection can be implemented in three different areas:

Storage area: Fuel leak monitoring at pumps and tanks
Transportation: Monitoring of pipelines and pump chambers
Fuelling: Detection of escaping fuel vapours



ETA Associates

119 Foster Street, Bldg #6 • Peabody, MA 01960

Tel: (978) 532-1330 • Fax: (978) 532-7325 • www.ETAassociates.com • eta@ETAassociates.com

Solution from Dräger

1. The composition of jet fuels varies from country to country and even from one production batch to another. However, in most cases it is not necessary to detect substances with flashpoints higher than 35°C to 40°C. Decane (C10) or Hexadecane (C16) exhibit flashpoints of 46°C and 135°C respectively. A calibration towards **Nonane** is the most suitable approximation, since it has a flashpoint of 31°C, which is close to the 38°C flashpoint of jet fuel.

A **Nonane** calibration can be utilised for wide cut fuels and aviation gasoline as well. Within these mixtures, starting from C4, it is detected with the least sensitivity (adjustment of sensitivity to be on the safe side).

Polytron IR is the first choice for this application. It eliminates the necessity of a vapour calibration. A common calibration gas like Propane can be used for calibration. During normal operation Nonane can be selected as target gas from the internal gas library. **Polytron IR** requires no recalibration to the target substance.

Polytron IR Ex provides lower measuring ranges. Therefore it suits well for any leak detection application.

2. All flammable vapours are heavier than air and so the gas detectors should be placed very close to the floor (e.g. 5 cm, 2" above ground, but still accessible for maintenance). Due to its rugged design and superior stability in adverse conditions the **Polytron IR** can also be placed directly into pump chambers, ditches, etc.

Advantages of the Dräger Solution

Gas detectors are advantageous in this application, since they are directly measuring the hazardous vapours. They are more sensitive and reliable for leak detection than conventional level or pressure methods which estimate the potential hazard indirectly. For fuelling operations gas detectors are the only choice for safety monitoring.

Pellistors: - economical solution

Poytron IR :

- robust design
- hermetically sealed housing
- easy calibration
- constant sensitivity over lifetime of the instrument
- long maintenance intervals
- fail-safe

Polytron IR Ex: - low measuring ranges

Polytron Pulsar:

- all Polytron IR USP's
- area monitoring

Restrictions



ETA Associates

119 Foster Street, Bldg #6 • Peabody, MA 01960

Tel: (978) 532-1330 • Fax: (978) 532-7325 • www.ETAassociates.com • eta@ETAassociates.com

(anti-icing, corrosion inhibitors, anti-static)

- Polytron IR:** - Although the Polytron IR is very robust, stress from excessive vibrations should be minimised. The use of dampers is recommended in applications with permanent strong vibrations (e.g. on trucks, at pumps, etc.).
- Polytron IR Ex:** - Polytron IR Ex is not hermetically sealed.
- Polytron Pulsar:** - Installation of open path systems might be restricted to certain areas, e.g. not near the runway. Airport specific guidelines need consideration.

References (internal, external)

- BFSC and HRS: reference via *Paul van den Steene*, Dräger Belgium
Detection of jet fuel vapours in underground pump chambers
- US Air Force, FL: reference via *Russ Kinsey*, Dräger SC Houston
Monitoring Jet Fuel Leaks in a Hanger that is used for the Air Force "In Air"
Refueling Plane

Responsible PM: Hr. Winkler



ETA Associates

119 Foster Street, Bldg #6 • Peabody, MA 01960

Tel: (978) 532-1330 • Fax: (978) 532-7325 • www.ETAassociates.com • eta@ETAassociates.com