



# Air Accident Investigation Sector

## - Aviation Safety Study -

[Nº SRP/0001/2016]

## Fueling Vehicle Fire during Aircraft Fueling



## What is an Aviation Safety Study?

Aviation Safety Studies conducted by the Air Accident Investigation Sector (AAIS) of the United Arab Emirates (UAE) are initiated when a safety trend indicating a specific risk factor is prevalent and that an overview of the existing environment is considered necessary to provide a focus on the current, and relevant operating environment.

The Safety Studies are sometimes extensions to investigations conducted by the AAIS into similar occurrences or into occurrences where the same operations or organisation is involved.

The AAIS Safety Studies cover occurrences classified under the scope of *Annex 13* and occurrences outside the scope if safety lessons are expected to be obtained.

The AAIS Safety Studies cover a wide spectrum and make an effective tool, particularly for:

- analysing a type of given occurrence or trend
- analysing an identified recurring factor in recent events
- analysing a specific risk factor
- reporting on a specific point of interest.

Safety Studies draw on data recorded by the AAIS and/or its foreign counterparts, on the skills of the AAIS's expertise, on joint efforts with research bodies or industrial groups (manufacturers, airlines, operators and ground handling agents), feedback from the aviation industry, and recreational flying organisations.

The AAIS is responsible for the investigation, analysis and conclusions of Safety Studies. The results of these Safety Studies can lead to the AAIS issuing safety recommendations. Implementation of the safety recommendations is the responsibility of the General Civil Aviation Authority (GCAA) of the UAE and/or any other organisation.

## Objective

The objective of this Safety Study is to gain an understanding of the current situation in the UAE regarding the potential for fire during fueling of aircraft, analyse the recent event, and suggest safety recommendations to enhance safety and to prevent a recurrence.

It is not the purpose of Safety Studies to apportion blame or liability.

## Process

Safety Studies are conducted in line with *Annex 13 to the Convention on International Civil Aviation*, and in compliance with the *Civil Aviation Regulations (CAR) Part VI, Chapter 3*. The final product of a Study is to issue a public Research Paper which may contain safety actions taken as well as safety recommendations addressed to the concerned organizations within the time frame stipulated. Research Papers are made public on the GCAA's website.



# Contents

What is an Aviation Safety Study? .....	i
Objective.....	i
Process.....	i
Chapter 1. Introduction.....	1
1.1    Background .....	1
1.2    General Outline of Occurrences .....	1
1.3    Aircraft Fueling Supplier .....	1
1.4    Aircraft Fueling Vehicle.....	2
Chapter 2. Occurrences .....	3
2.1    Aircraft Fueling Fire Event .....	3
2.2    Fueling Incidents in the United Arab Emirates .....	3
Chapter 3. Oversight, Standards and Training .....	4
3.1    Airport Aircraft Fueling Agents .....	4
3.2    Regulatory Fuel Agent Oversight.....	4
3.3    Third Party Service Level Agreements with Fueling Supplier .....	4
3.4    Safety Oversight on Fueling Operations .....	4
3.5    Safety Management Systems .....	4
3.6    Safety Assurance and Risk Assessment.....	5
3.7    IATA Fuel Quality Pool audit 2016.....	5
3.8    Fueling Supplier's Safety Management System.....	5
3.9    Equipment Condition and Standard .....	6
3.10    Action Taken .....	6
With reference to the AAIS investigation AIFN 0001/2015 Final Report, t .....	6
Chapter 5. Conclusions.....	8
5.1    Findings Relevant to the <i>Civil Aviation Regulations</i> of the UAE .....	8
5.2    Findings Relevant to the Air Operator .....	8
5.3    Findings Relevant to the Fueling Supplier.....	8
Chapter 6. Safety Recommendations.....	9
References .....	10



# Chapter 1. Introduction

## 1.1 Background

This Safety Study was initiated following a fueling vehicle fire during aircraft fueling at one of the UAE International Airports.

On 16 February 2016, an Airbus Aircraft, was scheduled to operate a passenger flight from the United Arab Emirates to the United States. The Aircraft was parked at a parking stand for fueling, which commenced at 0110 LT. While the fueling was in progress, the fueling operator observed dark black smoke emanating from the vehicles' engine compartment. The operator immediately released the 'deadmans' control and started to attend to the fire with a fire extinguisher. The airport rescue and firefighting team arrived at the site and extinguished the fire. No injuries were reported and the fire damage was limited to the fueling vehicle.

The AAIS is concerned about the potential for injury to persons, and damage to aircraft and facilities due to a fueling fire.

## 1.2 General Outline of Occurrences

The fueling event at the Airport resulted in a review of other similar international events in which either fire erupted during the fueling process, or the potential for a fire existed.

Apart from the event in UAE, three other international events were identified. The first incident occurred on 1 December 1998 a Boeing 747 was severely damaged when a fueling vehicle parked under the right wing and caught fire. It was suspected that a fuel line was damaged causing aviation fuel to leak near the vehicle's automatic transmission.

The second incident occurred at Denver International Airport on 5 September 2001. It was, during the fueling process of a Boeing 777, the operator lowered the fueling lift platform, which caused one of the refuel hoses to disconnect from the wing. Fuel was spraying onto the vehicle, which caused the fire. The refuel operator was fatally injured and the aircraft was substantially damaged.

The third event occurred on 6 August 2003 at Atlanta International Airport. A Boeing 777 had been fuelled when the refuel operator released the 'deadman' control closing the refuel hydrant. At this time, the fueling vehicle 'lurched' forward causing one of the refuel hoses to disconnect from the wing. Due to the shut-off of the hydrant prior to the movement of the vehicle, only a small amount of fuel had spilled onto the apron. No fire erupted and no injuries were sustained.

## 1.3 Aircraft Fueling Supplier

The fueling supplier is a division of a Group of companies established in 1973 as a government-owned company specialising in the marketing and distribution of petroleum products within the United Arab Emirates.

Since 1982, Aviation Operations Division (AVOD) has been providing petroleum products to over 200 regional and international customers in the civil and military sector.

The fueling supplier advised that this was the first of such serious incident in the history of their operation.



## 1.4 Aircraft Fueling Vehicle

The incident involved a Mercedes Benz hydrant fueling vehicle AMD-17 (Aviation Mobile Dispenser) which had been purchased in 1997. It is fitted with a four-cylinder engine and an Allison automatic transmission gearbox type ATS43.

The fueling supplier operates a fleet of 34 hydrant fueling vehicles. The fueling agent advised that all fueling vehicles of similar design have been taken out of service since the incident.

The fueling supplier advised that the new fueling vehicles are fitted with an interlock or power takeoff (PTO) device that prevents the fueling process when the gear selector is not in the 'Neutral' position.



## Chapter 2. Occurrences

### 2.1 Aircraft Fueling Fire Event

On 16 February 2016 at 0235 LT, an airbus was scheduled to operate a passenger flight from the United Arab Emirates, to United States. The Aircraft was parked at the parking stand and the fueling commenced at 0110 LT by the fueling supplier.

Fueling was in progress and 163,057 liters of fuel had already been pumped to the Aircraft when, at 0212 LT, the fueling operator observed dark black smoke emanating from the vehicles' engine compartment. The operator immediately released the 'deadman' control and started to attend to the fire using a fire extinguisher. Another fueling operator who was awaiting an aircraft arrival on the adjacent stand, noticed the fire and informed his supervisor, who in turn informed the fire service, the Airport authorities and the Operator. The second fueling operator then attended to the fire with his vehicle's fire extinguisher. The Emergency Hydrant Shutdown Switch (ESD), which is positioned 80 meters from the incident site, was activated at 0218 LT. Six fire extinguishers were emptied before the airport rescue and firefighting team arrived and extinguished the fire.

No injuries were reported and fire damage was limited to the hydrant fueling vehicle. The Aircraft was subsequently released to service and fueled with the remaining 81,610 liters by another fueling vehicle.

The fueling service providers' internal investigation identified that the automatic transmission gearbox of the fueling vehicle had been left in 'Drive' mode, while the parking brake was applied. This caused the automatic transmission to overheat and emanate hot oil, which ignited and started a fire under the vehicle's driver cabin.

### 2.2 Fueling Incidents in the United Arab Emirates

Twelve fueling incidents that had occurred in the United Arab Emirates were recorded in the GCAA Reports of Safety Incidents (ROSI) database. Of these 12 events, nine involved fuel leaks during the fueling process. The fuel leaks were caused by aircraft fuel system defects, or fuel system handling issues. The incident described in this Safety Study was the only recorded incident involved a fire during fueling.



## Chapter 3. Oversight, Standards and Training

### 3.1 Airport Aircraft Fueling Agents

The fueling supplier is the sole supplier of aviation fuel at the Airport. The Airport operates a Safety Management System (SMS) that includes inspection and audit programs of the ground handling agents, including the Fueling Supplier.

### 3.2 Regulatory Fuel Agent Oversight

The operations of fueling suppliers are not regulated by the *Civil Aviation Regulations (CAR)* of the United Arab Emirates. While *CAR Part IX- Aerodromes*, regulates the certification and oversight of aerodromes, it does not include the aerodrome operator's responsibilities in relation to fueling agents.

*CAR-OPS 1- Commercial and Private Air Transportation (Aeroplanes)*, regulates the air operators' responsibilities but it is limited to operational requirements such as refueling or defueling with passengers onboard, or with passengers disembarking. The fueling process, or interaction with the fueling agent is not included.

### 3.3 Third Party Service Level Agreements with Fueling Supplier

The Aviation Fuel Supply Agreement between the operator and the Fueling Supplier stated in paragraph 8- *Buyer's Responsibilities (Operation of Aircraft Switches and Valves)*, that the buyer has "Sole responsibilities for operating all appropriate aircraft fueling switches, valves and pre-set quantities gauges." Apart from this statement, no further quality control of the service provided was described in the agreement.

### 3.4 Safety Oversight on Fueling Operations

The Fuel Department of the Air Operator is responsible for auditing contracted fuel suppliers, such as the Fueling Supplier, under the IATA Fuel Quality Pool Control of Fuel Quality & Fueling Safety Standards Program (IFQP). However, the Operator Fuel Department is a non-operational entity and does not have any regulatory accountabilities with respect to fuel related risks.

The Aviation Fuel Supply Agreement between the Operator and Fueling supplier was reviewed and was found to be predominantly commercial in nature. The contract lacks safety aspects such as risk assessments, management of incident investigations, and other key performance indicators to assess the safety performance of the contracted fuel suppliers.

### 3.5 Safety Management Systems

*CAR Part X- Safety Management System*, contains provisions for approved and certified organizations under *CAR Part IV- Operations Regulations and Special Purpose Operations Regulations*, *CAR Part V- Maintenance, Repair and Design Regulations*, *CAR Part VIII- Air Navigations Regulations*, and *CAR Part IX- Aerodrome Regulations*.

While *CAR Part X* states that "The SMS shall correspond to the size of the organization and the nature and complexity of its activities, taking into account the hazards and associated risks inherent in these activities." it does not include any requirements for interaction with and oversight of third party service suppliers such as fueling agents.



IATA describes in the *IFQP Manual* that an SMS "... emphasize safety management as a fundamental business process to be considered in the same manner as other aspects of business management."

It states that "By recognizing the organizations' role in accident prevention, SMSs provide to both certificate holders and fuel service suppliers (into-plane, hydrant system and storage facility operators):

...

A means of demonstrating safety management capability before system failures occur

"

### 3.6 Safety Assurance and Risk Assessment

Guidance Material to paragraph 2.3- *Safety Assurance*, of *CAR Part X*, states that

"Safety assurance consists of processes and activities undertaken by the organisation to determine whether the SMS is operating according to expectations and requirements. The organisation should continually monitor its internal processes as well as its operating environment to detect changes or deviations that may introduce emerging safety risks or the degradation of existing risk controls."

By relying on the IFQP checklist when conducting station audits, air operators may not identify otherwise observable operational hazards relating to their fueling operation.

The AAIS requested copies of risk assessments conducted by the Operator relating to fueling activities. The assessments provided described the process for hazards identified during previous inspections, or audits. Predicted fueling hazards relating to potential events, such as a fueling vehicle fire, were not sufficiently identified.

ICAO describes the three methods of identifying hazards as 'Reactive' through the analysis of past events; 'Proactive' through the analysis of real time situations; and 'Predictive' through data gathering in order to identify possible negative future outcomes, or events.

The provided assessments show that the Operator has not moved past the initial 'Reactive' method, although data for real life events of fueling vehicle fires were commonly available.

### 3.7 IATA Fuel Quality Pool audit 2016

The IFQP comprises airlines who share the workload of fuel agent inspection audits at locations worldwide.

The inspection of the Incident vehicle log in the IFQP checklist, item *R.H.1-Books/Inspection Records*, was annotated as 'Satisfactory' without further remarks or references.

The 2016 IFQP audit assessed the Fueling Supplier's Safety Management System as 'Satisfactory' in item A1.

### 3.8 Fueling Supplier's Safety Management System

The Fueling Supplier provided the investigation with an index of its *SMS manual*. The *manual* is only available on their intranet and is titled 'Health, Safety and Environment Division'. It is divided into 13 sections, each with a number of sub-sections, varying from mobile crane



operations (2.13) to accident and incident investigation and reporting (2.14). While the contents could not be verified, the index showed a focus on occupational health and safety, with some elements of an SMS included.

The Fueling Supplier conducted regular airside fueling procedure audits, which were documented on an *Airside Fueling – Checklist*. The applicable items in the *checklist* were either ticked or crossed to indicate conformance. No additional comments describe the observations.

The Fueling Supplier's *SMS manual* does not include a section on third party interaction, which could explain how the Fueling Supplier's staff contribute to the SMS of their clients.

### 3.9 Equipment Condition and Standard

A review of the IFQP checklist for hydrant fueling vehicles show that the focus is on the condition and serviceability of the fueling device. The vehicle inspection is limited to a check of the vehicle log books and inspection records.

Regular airside fueling procedure audits conducted by the Fueling Supplier, recorded on an 'Airside Fueling – Checklist', documented observations made during the fueling process. This was an opportunity to identify any non-conformances with the Fueling Supplier procedures or the condition of the fueling vehicle.

### 3.10 Action Taken

With reference to the AAIS investigation AIFN 0001/2015 Final Report, there is no regulatory reference that empowers the airports to carry out oversight functions on airport stakeholders, and there are no specific *Conditions of Use*<sup>1</sup> applicable to all stakeholders.

The safety recommendation included in the Final report AIFN 0001/2015, which states that:

**The General Civil Aviation Authority (GCAA) of the United Arab Emirates to:**

**SR43/2016**

Promulgate requirements for the integration of Safety Management Systems operated by the various operators and service suppliers at the airport with the structure of the airport safety management system that is officially recognized by *CAR Part IX- Aerodromes*, and *CAR Part X- Safety Management System*.

**SR44/2016**

Promulgate requirements that empower airport operators to assume safety and quality oversight of airside operators and service suppliers.

These safety recommendations have been implemented and provide a positive input to safety.

<sup>1</sup> *Conditions of Use* is a document that contains terms of reference that govern the relationship between airport and aircraft operators. In addition to the commercial aspects that form its majority, the condition of use contains Terms of Reference related to ramp operations



## Chapter 4. Analysis

The fueling incident at the Airport highlighted the risk associated with aircraft fueling. Although the likelihood of a fueling fire is rare, the four incidents discussed in this safety study show that the potential for a severe consequence is relatively high. The Operator hazard identification and risk analysis system had not been used to risk assess the aircraft fueling process.

The incident involved a Mercedes Benz hydrant fueling vehicle AMD-17 (Aviation Mobile Dispenser) which had been purchased in 1997. Fueling using this vehicle could take place when the gear selector was in the driving mode position. The design of the vehicle did not restrict the ability to refuel to require that the gear selector be in the 'Neutral or parking' position. The fueling agent advised that all fueling vehicles of similar design have been taken out of service since the incident).

The fueling supplier advised that the replacement fueling vehicles are fitted with an interlock, or power takeoff (PTO) device, that prevents the delivery of fuel when the gear selector is not in the 'Neutral' position.

The AAIS is concerned with the quality of safety oversight of fuel agents as third party service suppliers to operators in the United Arab Emirates. Insufficient oversight may result in complacency by the operators when revisiting identified operational risks, in this case, risks associated with the fueling operation.

The current regulation excludes certain third party service suppliers from the requirement to establish and implement an approved safety management system. Furthermore, *CAR Part X-Safety Management System*, omits the requirement for air operators to describe their interaction with third party service suppliers. A solid interaction with third party service suppliers would reduce the likelihood that defenses in the operator's safety management system are weakened by third party staff, or unsuitable equipment standards.

This situation requires from the air operator not only a good understanding of relevant operational risks, but also the initiative to manage the risks sufficiently, while exceeding current regulatory requirements.

According to the GCAA guidance material, safety assurance consists of processes and activities undertaken by the organization to determine whether the safety management system is operating according to expectations and requirements. This requires from the organization a process of continual monitoring, not only of its internal processes, but also its operating environment to detect emerging safety risks, or the degradation of existing risk controls.

The Operator had an agreement with their fuel supplier and the Operator undertakes fuel supplier audits according to their membership in the IATA Fuel Quality Pool (IFQP). While this may satisfy internal requirements, the content of the audit is focused on fuel quality and fuel provision. Operational aspects, including the observations of staff's conformance with documented procedures, or the status and condition of fuel delivery vehicles, were absent. By relying on the IFQP checklist when conducting station audits, operational hazards may remain undetected.

Furthermore, the agreement in place between the Operator and the Fueling supplier was of a commercial nature and did not describe the operator's safety expectation of the Fueling Supplier staff. While no such expectations were included, the Fueling Supplier staff were not actively contributing to the Operator's safety management system.



## Chapter 5. Conclusions

### 5.1 Findings Relevant to the *Civil Aviation Regulations* of the UAE

- (a) The *Civil Aviation Regulations* do not regulate the operation of aircraft fueling agents. While *CAR Part IX* regulates the certification and oversight of aerodromes, it does not include the aerodrome operator's responsibilities towards fueling agents.
- (b) *CAR-OPS 1* regulates the air operator's responsibilities but is limited to operational requirements such as refueling/defueling with passengers onboard or during disembarking. The fueling process or the interaction with the fueling agent is not included.
- (c) *CAR Part X- Safety Management System*, does not include a requirement for a defined interaction between the air operator and third party service suppliers or vendors.

### 5.2 Findings Relevant to the Air Operator

- (a) Insufficient *Service Level Agreement (SLA)* between the Air Operator and the Fueling Supplier. The SLA current at the time of the incident focused on commercial aspects and was lacking in safety aspects.
- (b) Lack of documentation clearly outlining responsibilities for fueling operations, or the provision of third party services in general.
- (c) The risk management system was reactive to identified hazards instead of proactively applying techniques to identify possible hazards.

### 5.3 Findings Relevant to the Fueling Supplier

- (a) The absence of procedures for the Fueling Supplier's staff to be included in their clients' safety management systems, although not required by regulation, tolerates an environment in which operational hazards may remain undetected.



## Chapter 6. Safety Recommendations

In light of the findings above, the Air Accident Investigation Sector recommends that the General Civil Aviation Authority (GCAA) of the United Arab Emirates:

### **SSR09/2017**

Establish a requirement in *CAR Part X—Safety Management System*, that the operator apply their safety management system to fuel suppliers. The extent of application of the operator's SMS to fuel suppliers should be documented in the contract agreed between the operator and the fuel supplier.

### **SSR10/2017**

Establish a requirement for operators to exercise oversight of aircraft fuel suppliers. The extent of oversight should be documented in the contract agreed between the operator and the fuel supplier.

This Safety Study is issued by:

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## References

Data and references were used in this Safety Study from the following sources:

	Organization	Reference	Link
1	FUELING SUPPLIER	Incident Investigation Report – Dispenser on fire under aircraft, 16 February 2016	
2	FUELING SUPPLIER	Aviation Fuel Supply Agreement, between FUELING SUPPLIER and Operator Airways, dated 1 May 2013	
3	Operator	Fuel Department Procedures Manual Section 8 Fuel Quality Procedures & Business Continuity Plan, Revision 4 dated 17 April 2016	
4	Operator	AIRPORT FUEL QUALITY AND SAFETY CHECKLIST 2016/5/8-AUH-ADN-EY, dated 8 May 2016	
5	Operator	AIRPORT FUEL QUALITY AND SAFETY CHECKLIST 2014/3/13-AUH-ADN-EY, dated 13 March 2014	
6	Operator	AIRPORT FUEL QUALITY AND SAFETY CHECKLIST 2012/3/13-AUH-ADN-EY, dated 13 March 2012	
7	IATA	IATA Fuel Quality Pool Control of Fuel Quality & Fueling Safety Standards, 9 <sup>th</sup> Edition April 2016	<a href="http://www.iata.org/publications/Pages/standards-manuals.aspx">http://www.iata.org/publications/Pages/standards-manuals.aspx</a>
8	GCAA	Civil Aviation Regulation (CAR)	<a href="http://www.gcaa.gov.au">GCAA.gov.au</a>
9	AAIB	AAIB Investigation report – Atlanta International Airport	<a href="https://www.gov.uk/aaib-reports/boeing-777-236-g-viil-6-august-2003">https://www.gov.uk/aaib-reports/boeing-777-236-g-viil-6-august-2003</a>
10	NTSB	NTSB Investigation report DEN01FA157 – Denver International Airport	<a href="http://www.ntsb.gov/about/employment/_layouts/ntsb.aviation/brief2.aspx?ev_id=20010918X01956&amp;ntsbno=DEN01FA157&amp;key=1">http://www.ntsb.gov/about/employment/_layouts/ntsb.aviation/brief2.aspx?ev_id=20010918X01956&amp;ntsbno=DEN01FA157&amp;key=1</a>
11	NTSB	NTSB Investigation report MIA99FA038 – Miami International Airport	<a href="http://www.ntsb.gov/_layouts/ntsb.aviation/brief.aspx?ev_id=20001211X11594&amp;key=1">http://www.ntsb.gov/_layouts/ntsb.aviation/brief.aspx?ev_id=20001211X11594&amp;key=1</a>
12	Flight Safety Foundation	In Aircraft Fueling, Fire Prevention Requires Strict Compliance With Routine Procedures, March-June 2001	<a href="http://flightsafety.org/ao/ao_marshall01.pdf">http://flightsafety.org/ao/ao_marshall01.pdf</a>