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Aircraft Fuelling

Guidance Material for Aircraft Fuel Supply

Foreword:

This publication is intended to provide guidance to certified aerodrome operators whose aerodromes have facilities for fuel storage however complex or simple these facilities may be and to the organizations involved in storing and dispensing of fuel to aircraft. This guidance is intended to assist them in the production of procedures for fuel storage, management, handling and distribution and for the safe delivery of fuel to an aircraft in a condition that is fit for use. In addition the purpose of the publication is to inform the aviation industry globally about the existence of internationally accepted petroleum and aviation industry fuel practices, and to reinforce the need for compliance with those requirements and operating procedures.
CAA requires that all involved parties are familiar with the contents and procedures described herein.

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Director General
Civil Aviation Authority December 2012

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Terms and Definitions

For the purposes of this publication the terms below shall have the following associated meanings.

Term	Definition
Fuel equipment	Any device or apparatus or part thereof through which fuel passes when being transferred into or from an aircraft, or between fuel installations.
Fuel installation	Any container or vessel used for the storage of fuel, including a vehicle, designed, manufactured or adapted for this purpose or for the delivery of such fuel to an aircraft or another installation.
Fuel installation manager	The aerodrome operator, organization or a person designated by the operator or organization as being responsible for ensuring and maintaining the quality of fuel received and stored at the aerodrome, and of fuel subsequently delivered to aircraft.
Fuel	Fuel intended for use in aircraft Fuelling embraces both fuelling and de-fuelling unless otherwise specified.
Incident	Any occurrence that could put personnel or equipment at risk, whether directly or indirectly.
Organization	Organizations involved in storing and dispensing of fuel to aircraft.
Wide-cut fuel	A hydrocarbon mixture that spans the gasoline and kerosene boiling ranges, sometimes known as Jet B or JP-4, and is particularly suited to cold climates, also a mixture of gasoline with kerosene where misfuelling has occurred.

CHAPTER 1 – General

1.1 Introduction

1.1.1 Negligence or errors made in the receipt, storage and handling of fuel can endanger an aircraft and the lives of all on board. It is essential that the correct grade and quantity of fuel is supplied and that it is in a condition fit for use in aircraft.

1.1.2 Certified aerodromes that have facilities for the storage of fuel are required, to include within the Aerodrome Service and Operations Manual, procedures to ensure that, throughout the processes of receiving, storing, managing, and distributing fuel, it is at all stages fit for use in aircraft.

1.1.3 Organizations involved in the distribution, testing, monitoring and supply of aviation fuel should develop and implement an "Operations Manual" describing the manner in which the company operates. The content of manual is further described in article 2.1.4

1.1.4 Approved aerodromes where there is a facility for the storage of fuel, are not required to have Aerodrome Service and Operations Manual.

The CAA recommends that managers of those aerodromes, and those responsible for the reception, storage, distribution and handling of aviation fuel there, consider the guidance offered in this TP and similarly produce procedures to ensure that aviation fuel used at the aerodrome is in, and remains in, a state fit for use by aircraft.

1.1.5 Aerodrome operators, organizations involved in the fuel handling and fuel installation managers should ensure they are familiar with the internationally recognized standards and requirements by the petroleum industry, where they relate to the contents of the aerodrome manual, operations manual and the preparation of procedures for the operation of fuel installations. In this context they should note:

a) That there is no difference between single or multiple installations at the aerodrome;

b) That meaning of the term "aviation fuel installation" is any apparatus or container, including a vehicle, designed, manufactured or adapted for the storage of aviation fuel or for the delivery of such fuel to an aircraft; and

c) That the aerodrome manual, operations manual or the appropriate parts of it should be made available to those whose work involves processes contained within it.

1.1.6 Fuel installation managers shall ensure that:

a) fuel received at an installation is fit for use in aircraft;
b) the installation and the storage and dispensing processes will not render it unfit;
c) the fuel storage and delivery system is appropriately labelled;
d) the fuel should be sampled on delivery into the installation; and
e) the fuel should be of the correct grade for the installation.

1.1.7 CAA Inspectors may seek confirmation of compliance with the internationally recognized standards and may carry out inspections with or without prior warning.

1.2 Scope

1.2.1 This TP is intended to provide guidance to the aerodrome operators whose aerodromes have facilities for fuel storage and to assist them in the production of procedures for fuel storage, management, handling, and for the safe delivery of fuel to an aircraft in a condition that is fit for use.
Other organizations that have a responsibility towards any part of the safe storage, management, handling or distribution of aviation fuel shall develop similar appropriate procedures.

1.2.2 Where an aerodrome fuel installation is managed by other organizations involved in fuel handling and the appropriate published procedures of that organization meet the requirements of the internationally recognized standards and the guidance included in this document, those procedures can be used for that purpose and reference to this is made in the Aerodrome Services and Operations Manual.

1.2.3 The technical aspects of fuel installation construction lie outside the scope of this document, but are covered by codes of practice supported by the petroleum industry including:

a) installation and vehicle manufacturers;
b) Joint Inspection Group (JIG)2;

c) International Air Transport Association (IATA); and
d) the Aviation Fuel Working Group.

1.2.4 Fuel installation managers should seek the advice of the groups listed in paragraph 1.2.3 on the technical aspects of installing a fuel installation, and the procedures to be followed for maintaining it, and any associated fuel equipment, in a manner that will ensure compliance with internationally recognised standards.

1.2.5 Guidance material agreed between the major supply companies and endorsed by IATA, entitled "Guidelines for Aviation Fuel Quality Control and Operating Procedures", may be useful to managers of fuel installations. For further information on this document, and on the codes of best practice of the JIG, aerodrome operators/organizations may wish to contact the addressees referred to in paragraph 1.2.3 above.

1.2.6 Aerodrome operators/organizations should be aware that in addition to aviation-oriented regulation, the management, storage, distribution and handling of aviation fuel is subject to statutory legislation required of other state regulatory bodies.

CHAPTER 2 – Fuel Storage, Management, Handling and Distribution

2.1 General

2.1.1 Certified aerodromes operators/organizations should consider:

a) the fire risk associated with the handling of fuel, e.g. fuel leaks, sprays, or vapour emissions;

b) the possibility of fuel quality deterioration, e.g. contamination by; other liquids or solid particles; the passage of time; poorly maintained fuel installations and storage equipment and inappropriate handling procedures; and

c) the risks associated with delivery to the aircraft and apron safety.

NOTE: *Operators should note that fuel vapour will be released from aircraft vents during fuelling, and from fuelling vehicle vents during de-fuelling.*

2.1.2 Certified aerodromes operators and organizations should also consider the risks associated with those stages of the fuel handling and distribution process that relate in particular to personnel e.g. passengers and crew, apron staff, and fuelling operatives; to fuel installations and fuel equipment; and in so doing should:

a) identify the key responsibilities of individuals involved in the management and distribution of fuel;

b) ensure that all personnel involved in the processes of receiving, storing, and dispensing of fuel are suitably trained or experienced to carry out the associated tasks; and

c) perform periodic audits of all fuel installations on the aerodrome to ensure compliance with the Aerodrome Service and Operations Manual and procedures/operations manual. The aerodrome inspector may wish to see records of these audits.

2.1.3 The aerodrome operator shall verify that organizations involved in storing and dispensing of fuel to aircraft have procedures to ensure that aircraft are provided with uncontaminated fuel and of the correct specification.

2.1.4 The aerodrome operator should verify, either by itself or through arrangements with third parties, that organizations involved in storing and dispensing of fuel to aircraft, implement procedures to:

(a) maintain the installations and equipment for storing and dispensing the fuel in such condition so as not to render unfit for use in aircraft;
b) mark such installations and equipment in a manner appropriate to the grade of the fuel;
(c) take fuel samples at appropriate stages during the storing and dispensing of fuel to aircraft, and maintain records of such samples; and
(d) use adequately qualified and trained staff in storing, dispensing, and otherwise handling fuel on the aerodrome.

2.1.5 The aerodrome operator, in order to ensure compliance, could use:

(a) audit reports to organisations involved in storing and dispensing of fuel to aircraft, or
(b) relevant national procedures providing for the assurance of fuel quality.

2.1.6 Organizations involved in the distribution, testing, monitoring and supply of aviation fuel should develop and implement an "'Operations Manual" describing the manner in which the company operates.

The scope of such a manual should be appropriate to the part or parts of the provision chain in which the company operates, taking account of interface issues, as well as reflecting the application of the petroleum industry standards referenced in this manual. In order to meet this expectation each company operations manual should include the appropriate level of detail. Content should include:

a) The organization structure.

b) Names, roles and accountabilities/responsibilities of key personnel, appropriately qualified, knowledgeable and experienced. This will include:
   i. An "accountable" executive, who has overall accountability and authority for the organization's policies, objectives, procedures, implementation and products.
   ii. Accountable managers with the authority to establish and modify processes.
   iii. A process to ensure the continuity of tasks and safety or quality programmes during the absence of a post-holder who is specified as having the primary responsibility for that task or programme.

c) Health, safety, security, environmental and quality policies and objectives, including that covering management commitment and organizational competence.

d) Health, safety, security, environmental and quality management systems, including assurance elements.

e) Product quality performance criteria, targets, and indicators.

f) Self-audit conducted by competent individuals independent of the management of daily operations, including arrangements for assessing process and process controls for effectiveness, such as:
   i. identifying non compliances from company operating procedures;
   ii. correcting reported discrepancies; and
   iii. determining organizational competence.

g) Standard Operating and Control Procedures; these will cover arrangements for working at the interfaces with other parts of the system, including end user safety requirements, as appropriate.

h) Emergency planning, including asset integrity, and business continuity planning, taking into account of customers' business continuity plans and needs.

i) Training and safety promotions programme.

j) Document management.

k) Independent audits.

2.1.7 Fuel management procedures should include, but not be limited to, the following elements:

a) fuel reception, storage, and quality maintenance;
b) the assessment of fuel quality;
c) the safe delivery into an aircraft of fuel fit for the purpose;
d) the taking and storing of fuel samples;
e) the onward distribution of fuel;
f) 'Incident' prevention;
g) 'Incident' management;
h) preventing or minimising electrostatic discharge during the handling of fuel;
i) handling fuel during extremes of weather e.g. electric storms in the aerodrome vicinity or in high ambient temperatures;
j) the actions to be taken should fuel be found to be contaminated; and
k) regular and periodic maintenance and cleaning of fuel installations and equipment.

2.1.8 Documentation is an integral part of robust quality assurance. Documentation is used throughout the supply and distribution system for a variety of purposes, e.g. to certify fuel quality, confirm fuel quality after distribution, record

quality control and maintenance checks and demonstrate fuel traceability. Certain documentation is mandatory, such as the refinery certificate of quality or certificate of analysis, as evidence that the fuel conforms to the relevant specification.
Common quality documentation used with aviation fuel includes, but is not limited to:

a) Refinery Certificate of Quality (RCQ);
b) Certificate of Analysis (COA);
c) Recertification Test Certificate (RTC);
d) Periodic Test Certificate (PTC);
e) Release Certificate (RC);
f) Batch Make-up and Clearance Record;
g)Filter Inspection Report;
h) Tank Inspection Report;

Detailed definitions for these and other types of quality documentation can be found in JIG 1, 2 and 3

2.1.9 Any organization that manufactures supplies or handles aviation fuel should have a documented training program for their personnel. The programme should cover product quality, safe operation of equipment, emergency procedures and occupational health, as well as management systems for operational safety. In particular, the programme should include in its scope a systematic way to identify hazards and effectively control risks to fuel quality, personnel, and facility and equipment or aircraft safety. For more information refer to:

a) JIG 1, JIG 2, JIG 3 and SAE AS 6401 for detailed Health, Safety, Security; Environment, Training and Emergency Procedures;
b) ICAO Doc 9589, Safety Management Manual;
c) IATA Doc ref No8402-01;
d)JIG Bulletin 32 for Risk Management and Safety Promotion;
e) ACI Airside Safety Handbook;
f) ATA Airport Fuel Facility and Operations Maintenance Guidance Manual;
g) Regulation 17/2017 on requirements and administrative procedures related to aerodromes.

There should be a process to:
- monitor implementation of the programme;
- assess the effectiveness of the trainers and the training given, including retention of knowledge and adherence to procedures over time; and
- identify requirements for recurrent training and updating of knowledge.

2.2 Apron Safety Management

2.2.1 The ultimate responsibility for the acceptance of the product or service provided by the airport fuel storage lies with the aircraft operator. However, a primary accountability of the contracted supplier of the fuel is to demonstrate at the time of transfer that the fuel delivered was clean, uncontaminated and on-specification. A written contractual agreement should exist between the aircraft

operator and providers/deliverers of the fuel defining the individual responsibilities, safety related services and quality to be provided. The airport fuel storage and operator's safety related activities relevant to the written agreement should be included in the aircraft operator's quality and safety assurance programs. Aircraft operating companies should appoint a competent person to supervise the observance of correct aircraft fuelling procedures, and to liaise with the fuel supplier's operatives. The Fuelling Supervisor should be instructed in the requirements, the responsibilities and the safety measures of the fuelling supervisory task, and should remain in the apron area while fuelling is taking place.

2.2.2 Aerodrome operator should ensure that all personnel who work in the vicinity of aircraft are aware:

a) of their responsibilities following an accident or incident in the Safety Area and of the appropriate actions to be taken;

b) that should the need arise when fuelling is taking place with passengers boarding, disembarking, or remaining on the aircraft, escape slides may be used to evacuate those on board; and

c) that the areas into which escape slides would deploy and the immediate surrounding area should be kept clear to enable rapid way out of passengers from the aircraft vicinity.

2.2.3 Vehicles (including fuelling vehicles) and equipment should be positioned so that:

a) they do not obstruct access by RFFS vehicles;
b) they do not inhibit the rapid removal of the fuelling vehicle from the apron, or aircraft fuelling or parking areas should this become necessary;
c) they can easily and rapidly be removed;
d) the deployment of escape slides and the way out of passengers from the area into which these slides would deploy are not obstructed; and
e) the settling of the aircraft as its weight increases with the uplift of fuel and payload does not impose on them.

2.2.4 In general, passengers should be disembarked prior to the commencement of fuelling, however circumstances might prevail where this is deemed to be impractical. In such cases, operator should determine the risks associated with passengers embarking, disembarking or remaining on board the aircraft during fuelling, and should establish procedures to mitigate those risks. These procedures should:

a) be designed to enable the most rapid evacuation of passengers from the aircraft should the need arise;

b) ensure the ground area into which passengers would evacuate is kept clear of equipment and obstacles;
c) ensure vehicles attending the aircraft do not impede access to the site by Rescue and Fire Fighting Service (RFFS) vehicles and personnel, or the way out of passengers evacuating the aircraft;
d) include appropriate attendance of RFFS;
e) in the case of medical flights, take into account the ability, or inability, of the patient and attendant staff to effect a rapid evacuation from the aircraft;
f) take into account the ability of those whose mobility is impaired to effect a rapid evacuation from the aircraft; and
g) comply with the requirements of the European Aviation Safety Agency.

2.2.5 Some aircraft have the facility to be fuelled through more than one fuelling point simultaneously, which may require fuel equipment to be positioned on both sides of the aircraft. Aerodrome operator/organization should consider the risks associated with this practice, and should establish procedures to mitigate them. This practice may have an impact on familiar procedures established for single point fuelling in that it may affect the:

a) ability of any passengers, staff and crew, that have remained on board during fuelling, to effect a safe, rapid evacuation;
b) safety of passengers boarding or disembarking the aircraft;
c) safety of apron staff attending the aircraft;
d) ability of the Fuelling Supervisor to oversee the whole fuelling operation;
e) number and extent of the Fuelling Zones; and
f) fire risk.

2.3 Helicopters

2.3.1 Passengers should not remain on the helicopter whilst fuelling is in progress:

a) except under exceptional circumstances, in which case all main exits should be available for immediate use and the external area adjacent to the exits should be kept clear; or

b) with engines or rotors running if the only normal exit is on the same side as the fuelling points.

2.3.2 The fuelling of helicopters with engines or rotors running should be prohibited when fuelling with:

a) gasoline or with wide-cut turbine fuels not containing an antistatic additive; or

b) kerosene or wide-cut turbine fuels containing an antistatic additive if the fuel inlet is positioned so that the exhaust system is at the same height or lower, or if it is on the same side of the helicopter.

2.3.3 Additional information relating specifically to the safe fuelling of helicopters is included ICAO Annex 6 Part III, as amended and ICAO Heliport Manual – Doc. 9261 –AN/903/2

2.4 De-fuelling

2.4.1 Before de-fuelling is commenced, samples should be taken from the drain cocks of each aircraft tank involved in the de-fuelling operation. Unsatisfactory samples do not preclude de-fuelling, but will call for particular attention and thoroughness in the cleaning of vehicles and tank installation after disposal of the fuel.

2.4.2 Until satisfactory quality checks have been completed, fuel removed from an aircraft should be segregated from uncontaminated fuel, preferably by de-fuelling into an empty fuelling vehicle or storage tank. This potentially contaminated fuel should be checked for water, sediment and compatibility, in order to ensure that any resultant blend with existing contents of the next receiving installation meets the appropriate product specification.

2.4.3 Chapter 4 paragraph 4.3.2 below lists details of the records relating to de-fuelling that should be kept.

CHAPTER 3 – Risk Evaluation

3.1 Fire Risks

3.1.1 The aerodrome operator and providers/deliverers of the fuel shall establish procedures to prohibit:
(a) smoking within the movement area, other operational areas of the aerodrome, or areas of the aerodrome where fuel or other flammable material is stored;
(b) display of an open flame or undertaking of an activity that would create a fire hazard within:
(1) areas of the aerodrome where fuel or other flammable material is stored;
(2) the movement area or other operational areas of the aerodrome, unless authorised by the aerodrome operator.

3.1.2 The aerodrome operator and providers/deliverers of the fuel should develop procedures and assign responsibilities for the control of smoking or activities that involve the use of fire hazard, as appropriate.

In addition, these procedures should address the adoption and use of mitigating measures when necessary activities (e.g. maintenance, etc.) which might involve fire hazard.

Such authorised activities may not include smoking within the movement area, other operational areas of the aerodrome, or areas of the aerodrome where fuel or other flammable materials are stored.

3.1.3 Aerodrome operator /organization should address the fire risk associated with the processes involved in the handling of fuel, taking into account the volatility of the fuels involved, the method of delivery and the potential for a hazardous fuel/air mixture and a heat/ ignition source to be present at the same time.

3.1.4 Fuel storage, management, handling and distribution procedures should also be developed in accordance with Health and Safety at Work Regulations and fuelling industry codes of best practice.

3.1.5 The use of any equipment with the potential to create or induce a source of ignition should be identified and excluded from any Fuelling Zone. Equipment maintenance, repairs, and testing procedures, including the operation of switches, radios and other devices, with the potential to create a source of ignition within the Fuelling Zone, should be deferred until fuelling has finished.

3.1.6 Procedures should be established to prevent fuel ignition from other heat sources e.g. aircraft Auxiliary Power Unit exhausts, overheated wheel brakes, jet efflux from other aircraft etc.

3.1.7 Aerodrome operator/organization should be aware that a spark of sufficient intensity to ignite fuel vapour may be produced by the discharge of electrostatic energy (static) created either from the movement of the fuel in the aircraft tank during the fuelling process, or its accumulation on the surface of aircraft or vehicles. A description of each type together with the practices used to prevent its occurrence is given below.

a) **Surface accumulation:** A static charge may be accumulated on the surface of the aircraft or fuelling vehicle, when conditions are favourable. Bonding can eliminate this hazard (see paragraph 3.1.6 below).

b) **Fuel movement accumulation:** A static charge may build up in the fuel during the fuelling operation, and if of sufficiently high potential, it can cause sparking within the aircraft or storage tank. The charge density in the fuel and the possibility of sparks inside the tanks are not affected by bonding. However, the use of static dissipater additives in fuel can contribute materially to reducing the risk involved (see paragraphs 3.1.8 and 3.1.9 below).

3.1.8 Bonding connections should be made to designated points or to clean unpainted metal surfaces, and should connect the installation delivering the fuel, with the aircraft or installation receiving the fuel. All connections should be made before filler caps are removed i.e. prior to the start of fuelling, and not broken until fuelling is complete and the filler caps have been replaced where applicable. On no account should either the fuelling vehicle (including hydrant dispenser) or the aircraft be bonded to a fuel hydrant pit.

3.1.9 Hoses (including so called "conductive" hoses) are not considered to be suitable substitutes for dedicated clips and wires designed to provide effective bonding.

3.1.10 Fuel suppliers should be consulted on whether the fuel being supplied contains a static dissipater additive, and on the adoption of operating procedures and engineering safeguards to minimise the hazards associated with the accumulation of static.

3.1.11 When fuelling with turbine fuels not containing a static dissipater, or where wide-cut fuels are involved, a substantial reduction in fuel flow rate is advisable to avoid fuel ignition in the tank due to electrostatic discharge. Wide-cut fuel is considered to be 'involved' when it is being supplied or when it is already present in the aircraft tanks. It is recommended that when wide-cut fuel has been used the next two uplifts of fuel should be treated as though they too were wide-cut.

3.1.12 When initially filling a filter separator vessel the fuel flow should be regulated to prevent an excessive build-up of static electricity.

3.1.13 Mixtures of wide-cut and kerosene turbine fuels can result in the air-fuel mixture in the tank being in the combustible range at common ambient temperatures during fuelling.

3.1.14 The means for alerting the aerodrome RFFS should be readily available. Aerodrome operators should ensure that the circumstances under which the RFFS would be required e.g. fuel fire, fuel spill, over-heated wheel brakes, and the means by which it can be alerted are fully understood by those who work on the apron, or in aircraft fuelling or parking areas.

3.2 Portable Electronic Devices (PEDs)

3.2.1 There are three primary risks associated with the use of PEDs in the vicinity of aircraft: Fire, Distraction, and Aircraft System Interference.

3.2.1.1 Fire

The risk of a PED creating or inducing a spark of sufficient intensity to ignite fuel vapour released during fuelling is extremely remote under normal circumstances. However, aerodrome operators/organizations should be aware of the proliferation of below-specification mobile telephone batteries that have the potential to fail dangerously. It is not known whether such a failure would be of sufficient magnitude to ignite a fuel/ air mixture, but aerodrome operators/organizations should be aware that such a possibility exists. It is recommended that they consider the circumstances under which such an event might occur on the apron, and mitigate the associated risks accordingly.

3.2.1.2 Distraction

The known potential for a PED user to be distracted presents three associated risks:

a) physical contact with the aircraft by the distracted PED user could cause damage or injury;

b) equipment being operated by a distracted PED user could cause damage to an aircraft; and

c) PED users, distracted while performing essential safety related tasks, could leave those tasks incomplete or unattended.

NOTE: *Operators should be aware that the hazards at 3.2.1.2b) and 3.2.1.2c) above are associated with actions or inactions by apron staff, and carry the potential for the effect to be concealed until a stage of flight where the safety of the aircraft could be compromised.*

3.2.1.3 Aircraft System Interference

Reports have been received that the use of PEDs close to modern aircraft can interfere with fuel gauges, some navigation equipment, and can cause spurious fire warnings in cargo/baggage holds. Such interference could contribute to the risks associated with any of the following:

a) an overweight take-off due to excessive fuel;
b) a flight with insufficient fuel;
c) navigational errors; and
d) a degradation of confidence in the aircraft fire warning system.

3.2.2 Aerodrome operators/organizations should prohibit the use of PEDs on the apron area, or should restrict their use to clearly defined and promulgated circumstances that mitigate the risks associated with their use. These mitigations should be considered against the volatility of the fuel type involved, the proximity of vehicle and aircraft vents, the circumstances under which they may be operated, the category of the hazard, and the provision of an alternative non-interfering communication system. Passengers boarding or disembarking the aircraft should be discouraged from using PEDs when outside, but in the vicinity of, the aircraft.

CHAPTER 4 – Detection and Prevention of Fuel Contamination

4.1 Samples/Sampling Checks

4.1.1 Sampling checks should be made throughout the fuel handling, storage and distribution process to ensure that the fuel is free from water and solid particle contamination, is of the appropriate grade, and is in a state fit for use by aircraft.

4.1.2 When fuel has been delivered into a fuel installation a settling period should be allowed before a sample is taken. If a fuel sample proves to be unsatisfactory then the sampling procedure should be repeated. If a third sample is necessary and proves to be unsatisfactory, then action should be taken to identify the cause of contamination and no fuel should be dispensed to aircraft from the installation concerned. It would, in this case, be advisable to inform and seek advice from the fuel supplier concerned.

4.1.3 Sampling standards and procedures appropriate to the test and in compliance with petroleum industry standards referenced in this manual should be applied.

4.1.4 In addition to when they are required by other processes, fuel samples should be taken at the following times:

a) immediately before receipt into the fuel installation;
b) after receipt of fuel into the fuel installation (after settling time);
c) each day before the first delivery from the fuel installation;
d) after prolonged heavy rainfall or snow;
e) after de-fuelling;
f) after vehicle washing;
g) immediately prior to fuelling an aircraft.

4.1.5 Fuel samples from above ground storage tanks and aircraft fuelling vehicles should be drawn from sampling or drain cocks. A thief pump should be used for obtaining samples from buried tanks and barrelled supplies.

4.1.6 All sampling equipment should be kept in a scrupulously clean condition. Clear glass jars with necks and screw caps should be used for sample examination and retention. Prior to a sample being taken, the pipeline should be "flushed" to an

extent that will remove residual fuel from within it. Operators should seek the advice of the fuel supplier on the quantity required to achieve a satisfactory check. Fuel that is not to be retained and is found to be free of contamination can be returned to the tank.

4.1.7 Samples of fuel taken should be clearly labelled, and retained as evidence that the fuel stored in the installation is fit for use in aircraft. They will be of particular value in demonstrating compliance with requirements following an accident occurring to an aircraft that had received fuel from the installation.

4.1.8 If samples are taken on occasions other than that shown in paragraph 4.1.3 above they should be drawn into similar containers. Where fuel is drawn into buckets or other metal containers e.g. for flushing, they should be manufactured from stainless steel, and they should be bonded to the fuel line by cable and clip prior to and during the process.

4.1.9 All retained samples should be kept cool and stored out of daylight and be labelled with the following information:

a) grade of fuel;
b) reason for sample;
c) date and time of sample;
d) place taken;
e) name of sampling person.

4.1.10 It should be noted that the use of equipment e.g. tanks, drums, filter systems and hoses intended for substances other than aviation fuels may increase the risk of contamination by water, solid particles or chemical deterioration. Where necessary the advice of the organisations referred to in Chapter 1 paragraph 1.2.3 should be required.

4.1.11 All fuel equipment and fuel installations should be fully segregated from other products. Different grades of fuels should also be segregated and ideally installations should have separate delivery and suction lines.

4.1.12 To identify the grade of fuel they contain, all tanks and pipelines should be labelled and colour coded in accordance with codes of practice promulgated by those organisations referred to in Chapter 1 paragraph 1.2.3.

4.1.13 As an additional measure to avoid fuelling errors at delivery, hoses or pipes should be marked with the appropriate grade markings or painted with a band of the appropriate primary grade indicator colour as close as practicable to the delivery nozzle, but not on the nozzle itself. Only a material that will not flake or separate from the nozzle whilst in general use, e.g. a securely attached plastic sleeve or ring should be applied to the delivery nozzle.

4.1.14 A change of fuel grade in storage tanks can pose a risk of contamination of the new grade by residues of the previous fuel stored and therefore, where possible, such changes should be avoided. If this is not practicable, it is recommended that guidance information should be obtained from the fuel supplier concerned or from the organisations referred to in Chapter 1 paragraph 1.2.3.

4.2 Visual Examination and Testing for Contamination

4.2.1 Fuel should be considered unfit for use in aircraft if a visual examination shows any of the following:

a) more than a trace of sediment;
b) globules of water;
c) cloudiness;
d) a positive reaction to water-finding paste, paper or a chemical detector.

4.2.2 The following should serve as a guide to the visual assessment of fuels:

a) Colour. AVGAS is available in red, blue and green, while Jet A-1 turbine fuel is undyed and can vary in appearance between the colour of clear water to straw yellow. The terms 'clear' and 'bright' are independent of the natural colour of the fuel. 'Clear' refers to the absence of sediment or emulsion. 'Bright' refers to the sparkling appearance of fuel free from cloud or haze.

b) Turbine fuels should be checked using a chemical water detector. The presence of free or suspended water is indicated by a distinct change in the colour of the paste, paper or detector element. When a single, clear, apparently colourless liquid is drawn from a container believed to contain aviation gasoline, visual testing alone is inadequate to determine whether it is pure fuel or pure water. Testing by hydrometer or water detecting paste, paper or detector element is required.

c) Undissolved water (free water) will appear as droplets on the sides or as bulk water on the bottom of the sample vessel. Free water will separate

quickly from AVGAS. When the fuel has water in suspension the sample will appear hazy or cloudy.

4.2.3 Solid particle contamination generally consists of small amounts of rust, sand, dust, scale etc. suspended in the fuel or settled out on the bottom of the sample vessel.

4.2.4 Water-finding paste applied to the end of a dipstick or dip tape should be used for direct checking of turbine fuel in bulk storage, or barrels, and may be used similarly for AVGAS. Fresh paste should be used for each check and the dipstick should be allowed to rest on the bottom of the container for up to but no longer than 10 seconds.

4.3 Record Keeping

4.3.1 Written records should be kept of:

a) all deliveries into fuel installations. These records should include the grade and quantity of the fuel, the delivery date, and should include copies of release notes or certificates of conformity.

b) the particulars of the maintenance, including any associated rectification, and cleaning of the fuel installation. These should include details of:

i) inspections and tests;
ii) pressure, purging, equipment, and filter checks; and
iii) hose inspections.

c) the particulars of fuel samples taken and the results of tests of those samples.

d) all barrel deliveries, and of the associated decanting and dispensing of fuel, and of sampling checks.

4.3.2 Written records of de-fuelling operations should include details of:

a) the aircraft registration;
b) the date of de-fuelling;
c) the results of sampling checks;
d) the quantity and grade of fuel drawn; and
e) the disposal of the fuel drawn.

4.3.3 The records referred to above should be preserved for twelve months, or more as the CAA may in a particular case direct. They should include details of consequential action where a defect or deficiency has been revealed and, on request, such records should be produced to an authorised person within a reasonable time.

Appendix 1– Bibliography

- ICAO Doc 9977 AN/489 Manual on civil aviation jet fuel supplies;
- CAP 748 Aircraft fuelling and fuel installation management;
- ICAO Annex 14 Volume I Aerodrome design and operations;
- ICAO Annex 14 Volume II Helicopters;
- ICAO Airport Planning Manual Parts 1 and 2;
- ICAO Airport Services Manual Parts 1, 8 and 9;
- ICAO Annex 6 Part III;
- Regulation No 3/2012 on approved aerodromes;
- Regulation 17-2017 on requirements and administrative procedures related to aerodromes.
- Easy Access Rules for Aerodromes