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AIRCRAFT FUELLING AND DEFUELLING

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Director General of Civil Aviation

1.0 GENERAL

Nigeria Civil Aviation Authority Advisory Circulars from Aerodrome Standards Department contain information about standards, practices and procedures that the Authority has found to be an Acceptable Means of Compliance (AMC) with the associated Regulations.

An AMC is not intended to be the only means of compliance with a regulation, and consideration will be given to other methods of compliance that may be presented to the Authority.

2.0 PURPOSE

This Advisory Circular provides methods, acceptable to the Authority, for showing compliance with Aircraft Fuelling and Defuelling requirements of Nig. CARs Part 12 Vol I, as well as explanatory and interpretative material to assist in showing compliance.

3.0 APPLICABILITY

The material contained in this Advisory Circular applies to Aerodrome Operators and fueling companies involved in the provision of Aircraft fuelling and defuelling services at Aerodromes.

4.0 REFERENCE

The Advisory Circular relates specifically to Nig. CARs. Part 12 Vol I, 12.1.4.19(a)(8).

5.0 STATUS OF THIS AC

This is an amendment on the first issue of the AC on this subject.

AMENDMENT PROCEDURES

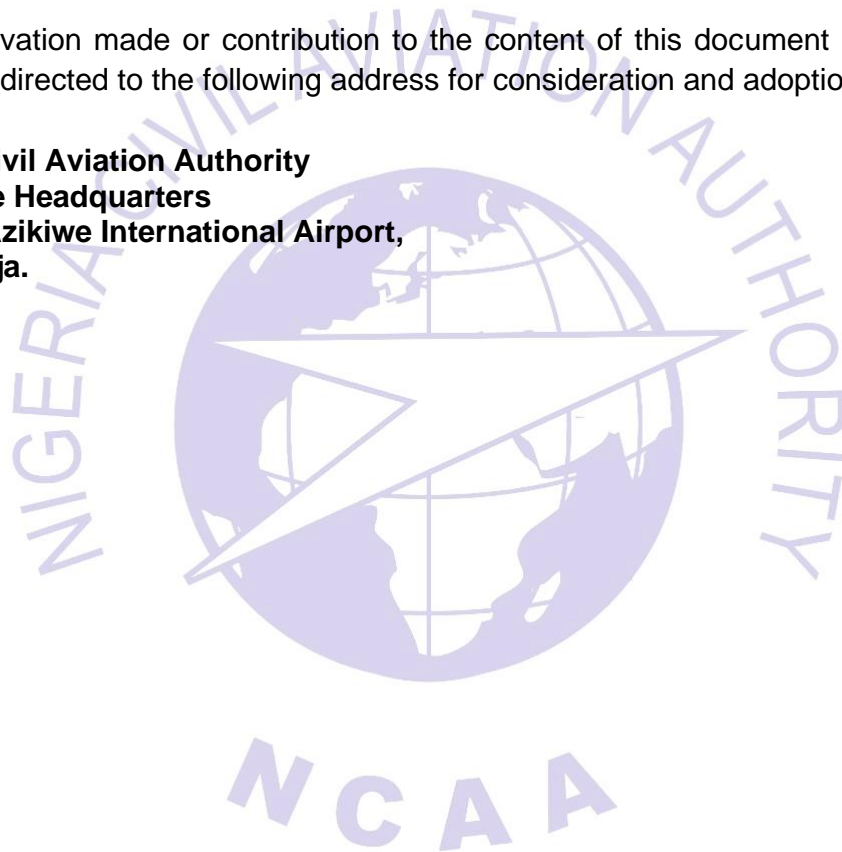
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Each page will show the document number, issue/amendment number, issue date and page number at the base of the page.

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Any observation made or contribution to the content of this document by the user should be directed to the following address for consideration and adoption

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RECORD OF AMENDMENTS

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NCAA

CHAPTER 1

AIRCRAFT FUELING PRACTICES

1.1 INTRODUCTION

- (a) The term fuelling requirements encompasses refuelling and defuelling.
- (b) The aerodrome operator, the aircraft operator and the fuel supplier each has responsibilities in respect of the safety measures to be taken during fuelling operations. Guidance on these safety measures is given below. It is important to note that this material is not intended to replace the fuel supplier and the operator's procedures (which are usually developed to meet requirements imposed by special equipment), or National Regulations, etc. This guidance material includes the following subjects:
 - (i) Safety and design requirements related to the fuelling system
 - (ii) Storage and handling of Jet fuel
 - (iii) general precautionary measures to be taken during fuelling operations; and
 - (iv) Additional precautionary measures to be taken when passengers remain on board or embark / disembark during refuelling operations.
- (c) This technical guidance material should be supplemented by suitable additional local instructions agreed and promulgated by the Airport, aircraft operator and fuelling company to cover such specialized activities as:
 - (i) Fuelling and defueling in hanger,
 - (ii) Fuelling of any aircraft on water,
 - (iii) Draining and filling aircraft tanks during fuel system maintenance operations.

Note - Further information on internationally accepted petroleum and aviation industry fuel practices, including fuel quality control and operations, can be found in the Manual on Civil Aviation Jet Fuel Supply (ICAO Doc 9977).

For the purpose of these recommended fuelling practices, fuelling is regarded as:

- (a) Fuelling of aircraft on the ground;
- (b) Defueling of aircraft tanks;

1.2 FUELLING PLACE

- (a) The fuelling of aircraft at an aerodrome by mobile equipment should only be carried out at a place approved by the aerodrome operator.
- (b) As a general guide, fuelling areas should be sited to avoid bringing fuelling equipment or aircraft fuel tank to within 15 meters (50feet) of any building other than those parts constructed for the purpose of direct loading or unloading of aircraft, such as nose loader, Aerobridges etc.

1.3 SUPERVISION OF FUELLING

Aircraft operating companies should appoint a competent person (referred to as the fuelling overseer to ensure the observance of correct fuelling procedures and to liaise with the fuel companies 'service supervisors. The fuelling overseer should also ensure that there is adequate restraint of the aircraft by proper checking to ensure that the brakes are applied and the wheels are checked both before and after.

1.4 CLEAR EXIT PATHS

The fuelling overseer should ensure that a clear path is maintained from the aircraft to allow quick removal of fuelling equipment in case of an emergency. Fuelling equipment should be positioned such that there is no requirement for vehicles to reverse before departing. All vehicles and equipment should be strategically positioned to ease quick exit of passengers from the aircraft in case of an emergency.

Aircraft fuelling vehicle should be positioned such that, accessibility to aircraft by rescue and fire fighting vehicles is NOT interrupted.

All vehicles performing aircraft servicing functions other than fuel servicing (e.g. baggage truck etc) should not be driven or be parked under aircraft wings while fuelling is in progress.

The exhaust systems of all operational vehicles required to operate in the fuelling zone must be subjected to the most stringent and regular maintenance to eliminate defects which may result in the emission of sparks or flames capable of igniting fuel or fuel vapour.

CHAPTER 2

FUELLING OPERATIONS AND FACILITIES

For the purpose of this guidance material, “**aviation fuel**” means fuel intended for use in aircraft; “**aviation fuel installation**” means 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.

2.1 Fuel Storage Areas and Unloading / Loading Stations

- (a) Storage areas should be located as close to the aircraft fuelling area as practical, with due recognition given to established clearances of flight patterns from obstacles.
- (b) Storage areas should be located such that adverse effects on the environment due to spills, leaks, sample and water drain disposal and the like, are minimized.
- (c) The vapour densities of aviation fuels are such that released vapours, particular under calm wind conditions, may travel considerable distances along the ground and collect in depressions where they may not readily dissipate, investigation of inhabited areas around the airport and wind directions is necessary.
- (d) Fuel storage areas will be fenced, locked when unattended and posted with signs to reduce chance of unauthorized entry and / or tampering.
- (e) Fuel storage areas and unloading / loading stations will be posted with "**NO SMOKING**" signs.
- (f) Fuel storage areas and unloading / loading stations will be free of materials, equipment, functions, and activities that could be ignition sources.
- (g) Piping will be underground or reasonably protected from damage by surface vehicles.
- (h) Fuel storage areas and unloading / loading stations will be equipped with a minimum of two accessible fire extinguishers, at least 9kg ABC rated.
- (i) Electrical equipment, switches, and wiring in fuel storage areas and unloading / loading stations will be explosion proof and reasonably protected from heat, abrasion, or impact which could cause an ignition source.
- (j) Piping, filters, tanks, and electrical components will be electrically bonded together and interconnected to an adequate ground.
- (k) Unloading / loading stations will be equipped with bond / ground wire with appropriate clip for grounding tankers and mobile fuelers.
- (l) Loading stations will be equipped with a dead-man control feature.

- (m) Loading stations will be equipped with a boldly marked emergency cut-off capable of stopping all fuel flow with one physical movement. The emergency cut-off must be located outside the probable areas and near the route that normally is used to leave the probable spill areas or to reach the fire extinguishers provided for protection of the area.

2.2 Storage Capacity

- (a) Storage capacity requirements should be estimated based on a forecast, taking into consideration;
 - (i) Types of operating aircraft;
 - (ii) Frequency of operations;
 - (iii) Fuel uplift per aircraft;
 - (iv) Different types of fuel required

for a period of time determined by the reserve policy in accordance with the distance to source of delivery and the risks of disruption in the fuel transportation system.

- (b) The delivery of fuel is made from refineries or other associated main storage facilities. Its transportation to airports may vary and dependent on several factors, it can be made by ship, barge, railway, trucks or pipeline; the system to be used has a significant bearing on the capital cost, location and topography of the airport. Thus the options considered are largely a question of economy, and requires a careful cost/benefit and safety analysis.

2.3 Mobile Fuelers

- (a) Mobile fuelers will be marked with letters at least 3 inches high on all sides to show flammability, and display standard hazardous material placards. A **"NO SMOKING"** sign will be posted in the cab. Smoking equipment such as cigarette lighters and ashtrays shall not be provided, and shall be rendered inoperable if procured.
- (b) Mobile fuelers will be equipped with a minimum of two fire extinguishers, at least 9kg-ABC rated, each accessible from a different side.
- (c) Mobile fuelers will be equipped with a system capable of overriding all other controls and stopping all fuel flow with one physical movement. Emergency fuel cut-off should be boldly marked. Mobile fuelers will also be equipped with a tank bottom outflow cut-off valve that can block fuel flow in the event of piping rupture or valve failure.
- (d) Fuel tanks on mobile fuelers will be equipped with gasket dome covers that contain an emergency vapor pressure relief valve and are adequate to prevent fuel spillage during vehicle movement.

- (e) Electrical equipment, switches, and wiring in mobile fuelers, will be explosion proof and be reasonably protected from heat, abrasion, or impact, which could be an ignition source.
- (f) Mobile fuelers will be equipped with bonding wires / clamps to facilitate prompt, definite electrical bond connection to aircraft during fueling operations.
- (g) Fuel systems on mobile fuelers will have electrical continuity between all metallic or conductive components.
- (h) Fuel system piping on mobile fuelers and cabinets will be reasonably protected from impact / stress that could cause fuel spillage.
- (i) All nozzles on mobile fuelers will be controlled by a dead-man flow cut-off feature.
- (j) Mobile fuelers will be equipped with a spark arrestor and leak-free exhaust system terminating in a standard baffled muffler. The exhaust system on mobile fuelers will be routed under the front of the cab or be shielded if under the fuel storage tank to prevent concentrated fumes from contacting the exhaust system if overfilled or leaking.

2.4 Responsibilities of Fuelling Personnel & Management Staff

Fueling personnel and management staff will ensure that:

- (a) Appropriate clothing is worn. Garments shall be made of fabric other than silk, polyesters, nylon with wool, or other static generating fabrics. Shoes shall not contain taps, hobnails, or other material that could generate sparks.
- (b) Matches or cigarette lighters are not carried, that could become an ignition source if operated, bumped, hit, or dropped.
- (c) Fueling is performed only outside, never in a building.
- (d) Mobile fuelers should not park closer than 10 feet from each other or closer than 50 feet from a building, except for fuel truck maintenance facilities approved by the NCAA.

(Note: These distances can be reduced with approval by the fire authority due to space limitations and apron layout. At some airports, fuel truck parking may be more of a hazard to taxiing aircraft if located 50 feet from all buildings).

- (e) All fuel systems and mobile fuelers are grounded, or at least bonded between aircraft, tankers, or fuelers, before commencing fuel transfer operations.
- (f) Before opening any aircraft or mobile fueling tank or commencing any fueling operation, and at all times during fuel transfer, at least a bonding wire is

connected between mobile fueller and loading station or between fueller and the aircraft being fueled.

- (g) All fueling equipment is in good operating condition and free of fuel leaks prior to use.
- (h) All fuel storage areas and equipment is kept neat and free of trash or debris that could contribute to the spread of fire.
- (i) All fire extinguishers are sealed and charged, and that they are inspected at least every six (6) months.
- (j) Fuel service operations are suspended when there are lightning discharges in the immediate vicinity of the airport.



CHAPTER 3

FUELLING OF AIRCRAFT

- (a) Aircraft are fueled at their parking positions either in stands close to terminal buildings or at remote ones, by fuel servicing tank vehicles, fuelling pits, or hydrant systems. The system chosen should be determined by the forecast rate of aircraft movements. Generally, tankers are most suitable; where plenty of space is available, the rate of aircraft movement is not too high and the fuel requirements of aircraft are not too great. At busy airports, especially those where the aircraft operators' route structures make it necessary for very large quantities of fuel to be provided, problems arise due to both the number of tankers on the aprons and their very large size, which makes them slow and difficult to manoeuvre. In consequence, they may obstruct other servicing vehicles on the apron and around the aircraft, and stands have to be especially large to accommodate them. In these circumstances, it is often desirable to install pipelines under the apron from the fuel storage area to the stands. Outlets are provided at stands and only a small road vehicle is then required to connect the hydrant outlets to the aircraft.
- (b) Considerable care should be exercised in locating hydrant outlets at the stands to ensure that they provide optimum flexibility and capacity, or provisions made for increasing the capacity through future provision of more outlets, to meet possible future aircraft requirements. However, it is seldom possible to provide flexibility comparable with that of fuel servicing tank vehicles. Sometimes combinations of hydrants and tankers can be used with advantage. Hydrants to refuel tankers near the edge of aprons can also be useful.
- (c) There are, however, disadvantages associated with the use of trucks. Large jet aircraft require considerable amount of fuel nearly 70 000 litres for the Boeing 707-120 and DC-S domestic to almost 115 000 litres for the Boeing 747. Two trucks are normally required, one under each wing. For the large jets, standby units are sometimes required if the fuel requirements are in excess of two units. Thus means that there are a large number of vehicles on the apron during peak periods, creating a potential hazard of collision with personnel, other vehicles, and aircraft. When a truck is empty, it must return to the storage area for refuelling before it can be used again. Thus extra trucks must be provided for use during the time when other trucks are being reloaded. When refuelling trucks are not in use, parking space must be provided for these vehicles.
- (d) The capacity of fuel servicing tank vehicles varies from 10000 to 60000 litres and modern tankers for DC-10, L-1011 and B-747 aircrafts can reach a capacity of 75000 litres. For the larger fuel servicing tank vehicles, axel loads are sometimes in excess of the bearing limits on highways; the airport designer

consequently must provide adequate pavement strengths to support these vehicles.

- (e) Another method of fuelling is to install pipelines running from a central fuel storage area located adjacent to the landing area, to pits located at the aircraft stands on the apron. Fuel is transferred to the pits by pumps located at the storage tanks. The pits must be located relatively near the fuel intakes in the wings of the aircraft.
- (f) The advantages of fuel pits are that;
 - (i) a continuous supply of fuel is available at all times;
 - (ii) it is carried safely underground; and
 - (iii) trucks are eliminated from the apron
- (g) The disadvantages of fuel pits are that;
 - (i) For each pit separate meters, filters, hose reels, etc., are required causing duplication in equipment
 - (ii) A change in future operations at the airport may require a major change in installation
 - (iii) Because a concrete or steel pit is required, maintenance costs can be high due to intrusion of moisture
- (h) The trend at large airports is definitely towards the hydrant system, which requires a simpler installation than the pit while providing similar advantages. Essentially, the hydrant system consists of the same elements as the fuel pits, except that the pit is replaced by a special valve mounted in a box in the pavement and flush with the surface. The hose reel, meter, filter and air eliminator are contained in a mobile self-propelled or towed hydrant dispenser.
- (i) The principal advantages of the hydrant system are elimination of the need for duplicating the hose reel, meter, and filter which are required in each pit. The principal disadvantage is that vehicles are not entirely removed from the apron. However, because of their small size, hydrant dispensers reduce possible collision damage to a minimum.
- (j) It is desirable that the hose line from the hydrant dispenser or pit to the intakes in the wings be from 6m to 9m long. If a variety of aircraft are to be serviced at an aircraft stand, the precise spacing of the hydrant valves should be established in consultation with the airlines, as the number of hydrants required per gate position will depend not only on the type of aircraft but also on the number of grades of fuel required (each grade of fuel requires a separate hydrant).

CHAPTER 4

INSPECTION OF FUELLING OPERATIONS

4.1 Daily Inspections of Fuelling Operations

- (a) The daily inspection on aircraft fueling operations should concentrate on a quick inspection for the most common problems concerning compliance with fire safety codes at fuel storage areas and with mobile fuelers.
- (b) The inspection should also include security, fire protection, general housekeeping, and fuel dispensing facilities and procedures.

*A more detailed fueling operation inspection should be scheduled quarterly (see Quarterly Fueling Operations, under Periodic Condition Inspection; **paragraph 4.2**).*

- (c) Determine if the fueling operator is permitting any unsafe fueling practices or is in violation of local fire codes, such as:
 - (i) Failure to bond aircraft with the mobile fuelers during fueling operations
 - (ii) Fueling personnel smoking while fueling aircraft.
- (d) Check to ensure that the appropriate signs for the fuel farm are installed and that all gates are locked except when the facility is occupied by an authorized user.
- (e) Monitor and report any unsafe fueling practices and violation of fire codes. Report any non-compliances with fuel fire safety procedures as specified in the approved Aerodrome Operations Manual.

4.2 Quarterly inspections of fuelling operations

Certificated airport are required to establish fire safety standards for safe fuelling operations and conduct quarterly inspections of the fuelling facilities. The fire safety standards for fuelling operations should be listed in the Aerodrome Operations Manual (AOM) and quarterly inspections should be conducted for compliance to the fuelling fire safety standards specified in the AOM.

- (a) Inspection of Fuel Storage Areas And Loading / Unloading Stations
 - (i) Check fuel storage areas for adequate fencing and security to prevent unauthorized access or tampering.
 - (ii) Check for “**NO SMOKING**” signs that are clearly visible.
 - (iii) Check fuel storage areas for materials such as trash or vegetation that could contribute to the spread of fire.

- (iv) Check for equipment, functions or activities that could be ignition sources.
- (v) Note if fueling equipment appears to be in good operating condition and free of fuel leaks.
- (vi) Check piping for reasonable protection from damage by vehicles if piping is above ground.
- (vii) Check fuel storage areas for at least two accessible and serviceable fire extinguishers. Where the open hose discharge capacity of the equipment is more than 750 litres per minute. At least one wheeled extinguisher with at least 55kg of agent is also required.
- (viii) Check for explosion proof equipment, switches and wiring that is reasonably protected from heat, abrasion or impact, which could cause an ignition source.
- (ix) Check for piping, filters, tanks and pumps being electrically bonded together and interconnected to an adequate grounding rod.
- (x) Check for a serviceable bond / ground wire with clip at each loading /unloading facility for grounding tankers and mobile fuelers.
- (xi) Check loading stations for dead-man control features.
- (xii) Look for a boldly marked emergency cutoff capable of stopping all fuel flow with one physical movement. The emergency cutoff should be located outside the probable fuel spill area near the route that normally is used to leave the spill area or to reach the fire extinguishers.

(b) Inspection of Mobile Fuelers

At least once every 3 months, inspect all fuel trucks to ensure they meet fire safety standards.

The Aerodrome Operator should:

- (i) Note if mobile fuelers appear to be in good operating conditions and free of fuel leaks.
- (ii) Check mobile fuelers for parking at least 50 feet from a building and at least 10 feet from each other.

Note: Some airports may have a mobile fueller maintenance building that is approved by the fire service.

- (iii) Check for flammability decals on all sides. Lettering should be at least 3 inches high. Also check for hazardous materials placards on all sides. (The

Hazmat number for Jet A trucks should be #1863 and #1203 for 100LL trucks).

- (iv) Check the cab for a “**NO SMOKING**” sign and the presence of smoking equipment.
- (v) Ashtrays and cigarette lighters are not to be provided.
- (vi) Check for two fire extinguishers, accessible from each side of the mobile fueler. Fire extinguishers should be charged, sealed and tagged from the last fire extinguisher inspection.
- (vii) Check dry chemical extinguishers to ensure they are only B-C rated. ABC rated multi-purpose dry chemical extinguishers are not to be used on mobile fuelers as they are highly corrosive to aircraft and can cause significant damage to aircraft engines.
- (viii) Check emergency fuel cutoffs to ensure they are boldly marked and operable. There should be an emergency fuel cutoff accessible from each side.
- (ix) Check electrical equipment, switches, wiring and tail light lens covers for explosion proof construction and reasonable protection from heat, abrasion or impact which could be an ignition source.
- (x) Check for serviceable bonding wires and clamps.
- (xi) Check nozzles for dead man control feature.
- (xii) Check the vehicle exhaust system for exhaust leaks and for adequate shielding if it extends under the fuel tank portion of the vehicle.

CHAPTER 5

BONDING AND EARTHING

- (a) During fuelling, safety depends upon the efficient bonding between the aircraft and the supply source earthing, except through properly designed apron earthing points. This is difficult and sometimes not fully effective. In practice, almost “any ground” will be found satisfactory for static electricity dissipation purposes, although there are exceptions when operations are conducted on sandy or desert terrains. Drag chain or conductive tyres are seldom effective under all climatic condition.
- (b) The aircraft fueller, nozzle hose coupling, filters; funnels or any other appliance through which fuel passes should be effectively bonded to the ground and to each other throughout the fuelling operation. Connection should be made to the designated loading points or on clean unpainted surfaces of the aircraft and fuelling vehicles.
- (c) Before the transfer of fuel commences, the following procedure should be carried out.
- (i) The aircraft should be connected to an approved earthing point.
 - (ii) The aircraft should be effectively bonded to the fuelling equipment
 - (iii) During over wing fuelling, the nozzle or the hose should be bonded to the aircraft structure before the tank filler cap is removed. In the absence of any suitable bonding point, the nozzle should be brought into contact with the skin of the aircraft before the filler cap is removed and this contact maintained until fuelling ceases.
 - (iv) In the case of pressure fuelling, metal to metal contact between the aircraft fitting and the coupling is not a sufficient protection; therefore separate bonding is still required.
 - (v) When fuelling from hand operated equipment including pumping from cans or drums, similar precautions should be taken to bond the pumping equipment, hose nozzle and containers. If funnels are used, they should also be bonded both to the nozzle of the hose or can and to the aircraft. If a chamois leather is used, the metal ring around the leather should be bonded to the can funnel, or can. This action will ensure that the funnel, nozzle, can and aircraft are brought to the same electrical potential before removing the aircraft filler cap.
 - (vi) Any cables, clips and plugs for bonding or earthing should be maintained in good condition and regularly tested for electrical continuity.

- (vii) When fuelling is completed, bonding wire(s) must not be disconnected until the filler cap is replaced.
- (viii) Fuelling hydrant pit must not be used for earthing purposes.



CHAPTER 6

6.1 FIRE PROTECTION

- (a) The aerodrome operator should provide portable fire extinguishing equipment of 50kg minimum capacity on standby suitable for at least initial intervention in the event of fuel fire. Personnel trained in its use shall be readily available and there shall be means of quickly summoning the rescue and fighting service in the event of fire or major fuel spill. But where provision is not made for the portable fire extinguishing equipment, the service of airport fire service shall be engaged to provide the fire coverage, most importantly when passengers are on board the aircraft during fuelling.
- (b) The fuelling operator should provide suitable portable fire extinguishing agent for the protection of the bowser that operate at the airport.
- (c) The Airport Operators Rescue and Fire Fighting vehicles should be on standby during fuelling and defuelling of aircraft.

6.2 FUELLING ZONE

- (a) Fuelling zone should be established before fuelling commences. These zones should be regarded as extending not less than 6 meters (20 feet) radially from the filling and venting points on the aircraft and the fuelling equipment.

Note: When establishing fuelling zones it should be noted that the engine efflux of modern jet aircraft taxiing under the maximum probable engine thrust conditions, has been assessed as having a speed of up to 65 knots; and a temperature of approximately 52°C (125°F at a distance of 30 meters (100 feet) from the jet pipe. This temperature is not dangerous from a fire point of view but the blast, however, could be dangerous to aircraft, personnel and equipment.

- (b) Within this zone, smoking, the use of naked lights and the operation of switches on lighting systems other than the approved patterns shall be forbidden.
- (c) Unless fuelling takes place in a designated no smoking area, “**NO SMOKING**” signs should be displayed not less than 15 meters (50 feet) from the fuelling equipment and aircraft tank vents. Fuelling vehicles should permanently bear “**NO SMOKING**” signs or notices.
- (d) Personnel engaged in the fuelling process should not carry matches or other means of ignition or put on footwear with exposed iron or studs, nails or tips.
- (e) Aircraft borne Auxiliary power units (APU"s), which have an exhaust efflux discharging into the zone should be started before filler caps are removed or fuelling connections made.

- (f) If an A.P.U. is stopped for any reason during a fuelling operation it should not be restarted until the flow of fuel has ceased and there is no risk of igniting fuel vapours.
- (g) Ground power units (G.P.U"S) may be operated provided they are positioned not less than 6 meters (20 feet) from an aircraft filling and/or venting point and the fuelling unit's pumping compartments.
- (h) It is against fuelling procedures to be driving operational vehicles around the fuelling zone(s).



CHAPTER 7

GENERAL PRECAUTIONARY MEASURES TO BE TAKEN DURING AIRCRAFT FUELLING OPERATIONS

The following general precautionary measures shall be taken during aircraft fuelling operations:

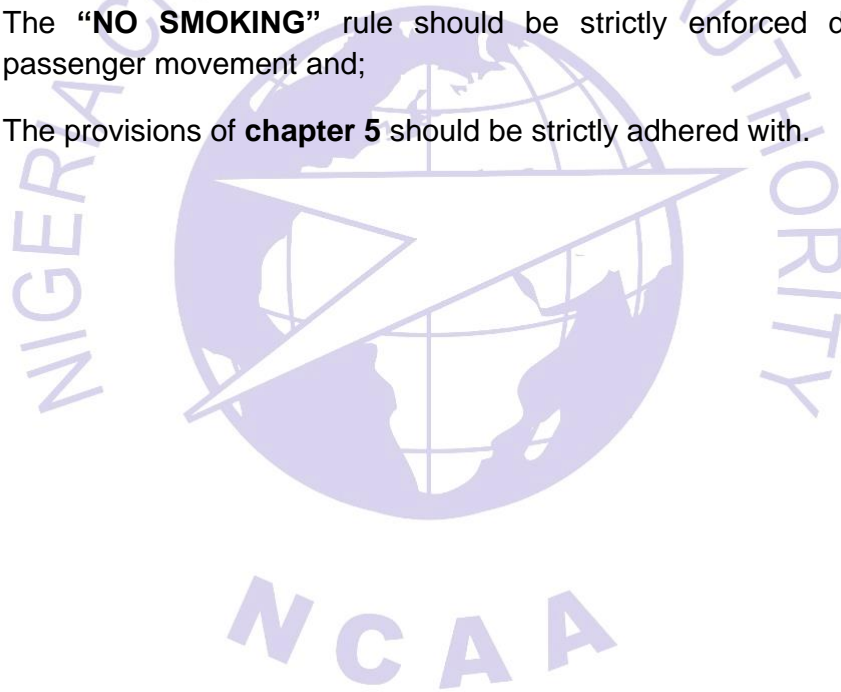
- (a) aircraft fuelling operations shall be done outdoors;
- (b) bonding and / or grounding, shall be done as appropriate,
- (c) aircraft fuelling vehicles shall be positioned so that:
 - (i) accessibility to aircraft by RFF vehicles is not interrupted;
 - (ii) a cleared path is maintained to permit rapid removal of fuelling vehicles from an aircraft in an emergency;
 - (iii) they do not obstruct evacuation from occupied portions of the aircraft in the event of a fire; and
 - (iv) the vehicle engines are not under the wing;
- (d) all vehicles performing aircraft servicing functions other than fuel servicing (e.g. baggage trucks, etc.) shall not be driven or be parked under aircraft wings while fuelling is in progress;
- (e) Open flames and lighted open flame devices shall be prohibited on the apron and in other locations within 15 m of any aircraft fuelling operation. Included in the category of open flames and lighted open flame devices are the following:
 - (i) lighted cigarettes, cigars, pipes;
 - (ii) exposed flame heaters;
 - (iii) welding or cutting torches, etc.; and
 - (iv) flare pots or other open flame lights;
- (f) cigarette lighters or matches shall not be carried or used by anyone while engaged in aircraft fuelling operations;
- (g) Extreme caution shall be used when fuelling during lightning and electrical storms. The fuelling operations shall be suspended during severe lightning disturbances in the immediate vicinity of the aerodrome;
- (h) when any part of an aircraft undercarriage is abnormally heated, the aerodrome RFF service shall be called and fuelling shall not take place until the heat has dissipated; and

- (i) Portable fire extinguishing equipment suitable for at least initial intervention in the event of fuel fire and personnel trained in its use shall be readily available, and there shall be a means of quickly summoning the rescue and firefighting service in the event of a fire or major fuel spill. It shall be ensured by regular inspection and maintenance that this equipment is maintained in a fully serviceable condition.

7.1 ADDITIONAL PRECAUTIONARY MEASURES TO BE TAKEN WHEN PASSENGERS REMAIN ONBOARD OR EMBARK / DISEMBARK DURING REFUELLING OPERATIONS

- (a) To enable a reduction in transit time and for security reasons some operators of fixed wing aircraft with a seating capacity exceeding 20 passengers allow passengers to remain on board during refuelling operations, while others allow passengers to embark and disembark. However, an aircraft shall not be refuelled when passengers are embarking, on board or disembarking unless it is properly staffed by qualified personnel ready to initiate and direct an evacuation of the aeroplane by the most practical and expeditious means available.
- (b) When aircraft refuelling operations take place while passengers are embarking, on board or disembarking, ground equipment shall be positioned so as to allow:
 - (i) the use of a sufficient number of exits for expeditious evacuation; and
 - (ii) a ready escape route from each of the exits to be used in an emergency.
 - (iii) However, in these circumstances the following precautions must be observed during refuelling operations while passengers remain on board or embarking / disembarking:
 - (iv) Passengers shall be informed and warned that fuelling will take place and that they must not smoke. Mobile phones, electronic gadgets, operate switches or other source of ignition shall not be operated.
 - (v) The illuminated “**NO SMOKING**” signs and exit lighting shall be switched on, together with sufficient interior lighting to enable emergency exits to be identified. Such lighting should not be allowed to go off until fuelling operations have been completed.
 - (vi) Stairways should be positioned at the normal passenger exits except when built-in “air stair” is fitted. Doors should be opened or ajar and free from obstructions, except a situation where it is absolutely necessary to close them for climatic or operational reasons. Cabin attendants trained in emergency evacuation procedures should remain at all times in the aircraft to initiate and direct evacuation if need arises.

- (vii) If during refuelling, the presence of fuel vapour is detected in the aircraft interior, or any other hazard arises, the fuelling overseer (who must have adequate means of communication) should be informed. Fuelling and all cleaning activities using electrical equipment within the aircraft shall be stopped, until conditions permit resumption / unless the fuelling overseer directs otherwise.
- (viii) Ground servicing activities and other work within an aircraft should be conducted in such a manner that they do not create hazard or obstruct exits. Access to and from the areas where the aircraft escape chutes may be deployed should be kept clear.
- (ix) Where passengers are embarking or disembarking during fuelling, their route should avoid areas where fuel vapours are likely to be present and this movement should be under the supervision of an airline official / responsible person(s).
- (x) The “**NO SMOKING**” rule should be strictly enforced during such passenger movement and;
- (xi) The provisions of **chapter 5** should be strictly adhered with.



CHAPTER 8

HELICOPTERS

- (a) Due to the design features of helicopters, such as the close proximity of fuel intakes and tanks to the passenger compartments, passengers should not be allowed to remain in aircraft or within the fuelling zone during a fuelling operation. Normally the engines should not be operated whilst fuelling is in progress; under exceptional circumstances, it may be necessary to keep the engine(s) running. In this event, extreme caution should be exercised and the provisions of section 9 of this document where applicable should be applied.
- (b) In the severe weather and wind conditions experienced on off-shore oil rig platforms, it is frequently necessary to keep helicopter engine(s) running after landing on the helipad to achieve a “quick turn-around”. Adverse weather conditions may also make it necessary to refuel the helicopter. In such circumstances, the captain of the helicopter should be responsible for the overall direction of the operation and the owner of the oilrig should be aware of the possible hazards, and they, in turn, should cooperate to ensure that their Staff fully observes necessary safety precautions when the aircraft passengers are embarking or disembarking whilst the engine(s) are running.
- (c) In the case of fuelling with jet A1 (AVTUR), it should only be permitted with engine(s) running if the exhaust system is higher than the filling point or on the opposite side of the aircraft.
- (d) Fuelling should be carried out using approved installation such as the portable fuel tanks, which are encased in a frame having a separate compartment for the pump and filters.
- (e) No other relaxation of this guidance should be permitted during off–shore fuelling operations.

CHAPTER 9

9.1 FUEL SPILLAGE

- (a) In the event of fuel spillage the following action may be appropriate although each spillage will need to be treated as an individual case because of such variables as the size and location of spillage, type of fuel involved, prevailing wind and weather conditions, equipment arrangement, aircraft occupancy, emergency equipment and personnel available etc.
- (b) In the case of a spillage covering an area more than 2 meters (6 feet) in any dimension, the fuelling overseer should:-
- (i) Initiate action to stop the flow of fuel. Evacuate all persons from the affected area to a place at least 15 meters (50 feet) from the spillage.
 - (ii) Immediately notify the Aerodrome Fire Services.
 - (iii) Prevent the movement of personnel or vehicles into the area and ensure that all activities in the vicinity are restricted to reduce the risk of ignition.
 - (iv) Vehicles in the spillage area whose engines are not running should not be started. The engine of stationary vehicles within 6 meters (20 feet) of a spillage should not be restarted until the area is declared safe.
 - (v) If large scale spillage occurs, fuel should not be washed into drains or culverts. In the event of this occurring accidentally, large scale water flushing should be carried out once and the local authorities notified. Absorbent clearing agents, emulsion compounds or rags may be used to absorb the spilled fuel. Contaminated absorbents should be placed in suitable containers and removed to a safe location for disposal. The selection of tools and equipment to be used in removing spillage and the disposal of contaminated materials should have regard to minimizing the risk of ignition.

9.2 SAFEGUARDS AGAINST SPECIAL HAZARDS

9.2.1 Operation of Radar

A minimum of 30 meters safety gap must be allowed between an aircraft and radar equipment under test or in use in aircraft or ground installation during fuelling process.

9.2.2 Over Heated Undercarriage Assemblies

When any part of an aircraft undercarriage like the wheels, tyres or brakes, is abnormally heated, the Airport fire service should be called and fuelling should not take place until the heat is completely dissipated. Fuelling equipment should not be positioned on aircraft until the fuelling overseer certifies the environment hazard free.

Note: - In checking for high temperatures, care should be taken in approaching the wheels. The best approach is only fore and aft, never from the sides.

9.2.3 Hazards from Adjacent Aircraft Operations

Before or during fuelling, the fuelling overseer should ensure that no personnel or equipment is under hazard from the efflux of other aircraft or APUs. If the fuelling overseer observes hazards, he should stop refuelling immediately until condition permits resumption.

9.2.4 Electric Storms

Extreme caution should be exercised when fuelling during electrical storms. Fuelling should be suspended during severe lightning disturbances in the immediate vicinity of the aerodrome, and precaution should be taken to prevent rain water entering fuel tanks.

9.2.5 Photographic Flash Equipment

The use of photographic flash, electronic flash equipment within 6 meters (20 feet) of the filling or venting points or aircraft or fuelling equipment should not be permitted.

9.3 HYDRANT FUELLING SYSTEMS

- (a) The service pressure to which the system and its components may be subjected should not exceed the design pressure rating. Surge pressure should be controlled by the use of pressure-reducing equipment, slow closing valves, surge suppressors or other devices placed in the system. System components should be designed and installed in accordance with industrial safe practices and should permit safe operation without placing an abnormal demand on the abilities of operating personnel.
- (b) Emergency shut off mechanisms should be installed as an integral part of the system. They should be so located as to be readily accessible in the event of an accident or spillage and should not be obstructed by vehicles or equipment. All major fuel dispensing equipment systems capable of delivering Jet B or 100L should have operating controls, which will be automatically cut off on release of the control by the operator or failure of the operating energy. The operator of the control should have a clear view of refueling operations.

CHAPTER 10

10.1 THE SERVICING, MAINTENANCE, TESTING OR REPAIR OF AIRCRAFT DURING FUELLING.

Whilst fuelling is in progress, servicing, maintenance, test and repair activities within the fuelling zone should be subject to the following recommendations:-

- (a) All ground equipment such as rostrums steps should be clear of aircraft during fuelling. This is to prevent damage to the aircraft setting on to the ground equipment as a result of extra weight of fuel being lifted up.
- (b) The main aircraft engine(s) should not be operated (except for helicopter engines under exceptional circumstance, **(see chapter 8)** APUs may be operated as specified in **sections 6.2(e)** and **6.2(f)**.
- (c) Only aircraft switches essential to either the fuelling operation or aircraft servicing should be operated when fuelling is taking place.
- (d) The engines of vehicles including those on electrically powered vehicles, normally employed for servicing aircraft should not be run within the fuelling zone unless they have been designed for the purpose. All vehicles, their engines and equipment should be subjected to regular inspection and maintenance to preserve their safety characteristics.
- (e) All connections between ground equipment and the aircraft should be made before filler caps are removed and should not be broken until fuelling ceases.
- (f) Battery trolleys may be used within the fuelling zone provided that connection is made to the aircraft and any switch operated before the filler caps are removed. The circuit is to remain unbroken until fuelling has ceased.
- (g) Vehicle operating in the fuelling zone should not pass under, or park beneath, the main plane or taint plane unless specifically required to do so for fuelling or maintenance purposes.
- (h) Aircraft combustion heaters should not be used.
- (i) Only checking and limited maintenance work such as the exchange or units should be allowed on radio, radar and electrical equipment. Any testing of such equipment should be deferred until fuelling is completed.
- (j) Radio equipment of approved types, installed on fuelling and servicing equipment, may be operated.
- (k) Maintenance work, which may create a source of ignition, should not be carried out in the vicinity of the tanks or fuelling equipment.

- (l) Hand torches and inspection lamps on their cable connection used within the fuelling zone should be of approved “flameproof” or “Intrinsically safe” design.
- (m) Only authorized persons and vehicles should be permitted within the fuelling zone and the numbers of these should be kept to the minimum; and
- (n) The use of GSM and other cell phone and electrical devices shall not be allowed within the fuelling zone.

10.2 VEHICLE EXHAUST SYSTEMS AND ELECTRICAL SYSTEMS

It is essential that the exhaust systems of all vehicles required to operate in the fuelling zone should be subjected to the most stringent and regular maintenance to eliminate defects which may result in the emission of sparks or flames capable of igniting fuel vapours.

A vehicle required to operate in or near the fuelling zone should have their ignition and electrical system properly maintained to reserve their safety characteristics.

10.3 ACTIONS TO BE TAKEN IN THE EVENT OF FIRE OCCURRENCE DURING FUELLING OR DEFUELLING OF AIRCRAFT

- (a) The fuel supply valves are to be shut off.
- (b) The aircraft fuelers, hose or nozzle coupling, filters, funnels or any other appliance through which fuel passes and all other connections are to be disconnected and removed from the area.
- (c) Replace aircraft filler cap.
- (d) Notify the Aerodrome fire service immediately.
- (e) Evacuate the aircraft if passengers are on-board and switch off all electrical switches in the aircraft.
- (f) Fight the fire with any available fire media before the arrival of the Aerodrome fire service personnel.

CHAPTER 11

TRAINING

- (a) The Aerodrome Operator, fuel companies and Aircraft operators should have a documented training programme for their personnel. The programme should cover product quality, safe operations of equipment, emergency procedures and occupational health, as well as management systems for operational safety, environment and security.
- (b) In particular, the programme should include in its scope a systematic way to identify hazards and effectively control risks to fuel quality, personnel, facility and equipment or aircraft safety.
- (c) It should be ensured that:
 - (i) Personnel engaged on fuel servicing operations are aware of, and practice effective safety procedure during fuel servicing operations. Before delivery commences such personnel should also establish that the correct grade of fuel is dispensed.
 - (ii) Personnel are fully conversant with the operation of mobile fire protection equipment provided to cover such operations and be conversant with the initiation of emergency procedures.

CHAPTER 12

SAFETY AND SPECIAL DESIGN REQUIREMENTS RELATED TO FUELLING SYSTEMS

Consideration should be given to the need for accessibility by emergency fire equipment, when establishing aircraft fuel servicing locations and laying out airport fixed fuelling systems. Other important considerations include:

- (a) Standards are prescribed by the competent authorities or stipulated by specialized institutes or associations. Codes, regulations and specifications are available from several agencies and different countries. Nevertheless, the consultation with airlines, as users, and oil companies, as providers of the product, is advisable when planning fuelling supply systems at airports.
- (b) Tanks located near or under aircraft movement areas such as aprons should be of the underground type or mounded over with earth with depth and type of cover determined by consideration of aircraft wheel and/or impact loads.
- (c) Fuel piping should not run under buildings or passenger loading fingers excluding movable loading bridges except when run in buried steel casings enclosing only the fuel piping.
- (d) Fuelling hydrants, cabinet and pits having a flow rate in excess of 23L/min should be located at least 15m from any terminal building, hanger, service building or fixed enclosed walkways.
- (e) The apron surfacing material should be graded to form a gradual slope away from the rim or edge of fuelling hydrants or fuelling pits to prevent flooding.
- (f) At aircraft stands where aircraft are fuelled, to prevent errors in measurement of fuel in the aircraft's tanks caused by parking with one wing low, the slope should not exceed 0.5 per cent in the transverse direction and 1 per cent in the longitudinal direction.
- (g) The surface should slope away from the face of the terminal building for proper drainage and safety in case of fuel spillage.
- (h) Fuel-resistant pavements should be used on aprons wherever refuelling operations or engine shut-downs are likely to take place regularly.