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OFFICE OF THE DIRECTOR GENERAL OF CIVIL AVIATION
OPPOSITE SAFDARJUNG AIRPORT, NEW DELHI-110003

No. 4/1/2020-IR
Dated: 08-01-2021

CIRCULAR

Sub: Guidelines for Carriage of COVID19 Vaccines packed in Dry Ice by Air– Reg.

1. INTRODUCTION

- 1.1 Carriage of COVID 19 vaccines from the manufacturing units to the place of administration gains significant importance especially in the light of the high expectations of the government(s), health care personnel and the general public. It is needless to say that amongst the various modes of transport, air transport is the most efficient option. Hence, it is imperative that air logistics provide a well-defined procedure that meets the global safety standards and requirements based on local conditions.
- 1.2 This circular provides guidance to the operators for the transportation of dry ice in excess of that already permitted in the operators' Operations Manual or other applicable aircraft manufacturer documents in order to reduce the introduction of additional risks (safety and health) to the aircraft systems and its occupants.
- 1.3 All scheduled operators who have been currently authorized to carry dangerous goods may carry COVID 19 vaccines packed in dry ice, meeting the regulatory requirements. Non-scheduled operators including aircraft engaged in general aviation that are required to participate in the carriage of COVID 19 vaccines packed in dry ice shall seek specific approval before commencing such operations. Compliance with ICAO Doc 9284 (Technical Instructions for the Safe Transport of Dangerous Goods by Air) is the responsibility of each operator.

2. DRY ICE AS A REFRIGERANT MATERIAL

The temperature maintenance requirement for COVID19 vaccines is reported to be varying from -8° C to -70° C and hence, the use of refrigerant material during the transportation becomes essential. Though there may be different refrigerant options, use of dry ice (Carbon Dioxide Solid) is the most commonly used, affordable and readily available refrigerant material available in the country for transportation of perishables by air.

Dry ice continually sublimates (Dry ice that is solid, transforms into Carbon Dioxide gas (CO₂)) at temperatures higher than -78°C (-108.4°F) under normal atmospheric pressure. At reduced pressures, the sublimation rate of dry ice will increase while all other factors being the same. Hence, ICAO under Annex 18 and Doc 9284 - Technical Instructions that governs safe transportation of

dangerous goods by air has classified dry ice as Class 9 – Miscellaneous dangerous goods.

3. OPERATOR'S RESPONSIBILITY

All operators while engaging in transportation of COVID 19 Vaccines packed with dry ice shall establish the maximum quantity of dry ice that can be loaded in a given cargo hold and/ or compartment or in the main deck (passenger cabin) when a passenger version aircraft is deployed for all cargo operations. This maximum quantity shall be based on the aircraft manufacturers' information on maximum recommended dry ice quantities that the aircraft ventilation can support, depending on the sublimation rate and also the requirements of the operators' Safety Management Systems.

3.1 Carriage of Dry ice in cargo compartment:

- 3.1.1 For the transport of vaccines in dry ice in excess of the limit specified in the Operations Manual or other applicable aircraft manufacturer documents, the operator should perform a specific risk assessment. Such risk assessment may require getting in contact with the TC and/or STC holder and should propose appropriate operating procedures in order to adequately mitigate the identified risks. This risk assessment should at least cover:
- (1) The vaccine and its characteristics for transport as cargo (i.e. packaging, handling, etc.);
 - (2) The amount and effects of dry ice to be carried (including weight and balance considerations) and the associated sublimation rate with validation of the assumed rates vs. all operational scenarios.
 - (3) The possible need for CO₂ detectors to mitigate the identified risks;
 - (4) The aircraft ventilation system's operational characteristics, performance, controls, selections-settings in all operational procedures for normal/abnormal/emergency operational scenarios and phases of operation (including applicable MEL provisions);
 - (5) All other relevant aircraft and systems configurations (including applicable MEL provisions);
 - (6) The location of the cargo on board and the interaction with other cargo;
 - (7) The aircraft occupancy (whether occupants are allowed on board or not);
 - (8) The procedures and training of on-board occupants, ground handling and other relevant staff;
 - (9) The analysis of ambient temperatures on ground (at departure and arrival), which may lead to a higher sublimation rate (particularly when flying to warm areas);
 - (10) The potential pressure build-up as a result of gas released from the packaging;

- (11) The impact of potential departure delays, extended taxi-in/out and additional time needed on the ground (e.g. for de-icing);
- (12) The consequences of diversion and specific airport ground-handling consideration;
- (13) The possible diversion times and the need to use alternate routes where necessary; and
- (14) The extended loading time needed in case of transport in the passenger cabin, which may result in excessive CO₂ concentration.

The risk assessment should ensure that all relevant technical and operational aspects have been taken into account.

3.2 Carriage of Dry ice in passenger cabin:

Vaccines packed in dry ice should preferably be transported in lower-deck cargo compartments. However, in case Operators desires to carry vaccines packed in dry ice in the passenger cabin, in addition to para 3.1, the following shall be complied with:

3.2.1 Occupants on board:

(1) Flight crew:

- (a) The operator should take all necessary steps to ensure that the flight crew is not harmed by carbon dioxide incapacitation or intoxication.
- (b) Flight crew should be properly trained on the hazards and risks of transporting dry ice and on the procedures related to the operation.

(2) Other occupants:

- (a) Passengers shall not be allowed on-board.
- (b) Any other occupants on-board should only be allowed if required under demonstrated urgent operational needs (e.g., additional flight crew for the return flight or additional persons needed for the cargo handling).
- (c) Occupants, that are not considered flight crew, should be protected against a potential CO₂ intoxication by the following means:
 - (i) Have access during all phases of flight to approved supplemental oxygen equipment ready to be used.
 - (ii) Have been properly trained on the use of oxygen equipment.
 - (iii) Have been properly trained on the hazards and risks of transporting dry ice and on the procedures related to the operation.
- (d) Any seating position identified for a potential occupancy during any phase of the flight should pose no additional risk to its occupants, in particular in case of a CO₂ incapacitation/intoxication.

- (3) Adequate number of CO₂ detectors should be available in the cabin. Such detectors should be located at locations for timely and reliable detection of

dangerous concentrations of CO₂ in the aircraft. If the detectors are power supplied by lithium ion batteries, the additional fire risk must be assessed and mitigated accordingly.

Note 1: If CO₂ sensors and monitoring systems are used, the operator should ensure that these devices do not interfere with the aircraft systems and do not affect the safe operation of the aircraft. Portable CO₂ detectors are considered Portable Electronic Devices (PED). Recent/ frequent calibration of CO₂ detectors must be ensured.

3.3 Technical Considerations

(A) Ventilation and Pressurisation System

MEL considerations:

For aircraft dispatch, the air conditioning, air supply and the distribution/ventilation system should use configurations recommended by the manufacturer.

AFM considerations:

The AFM procedures for ventilation should be reviewed and adapted in the operator's standard operating procedures to consider carriage of dry ice under normal and failure cases.

The operator's standard operating procedures should also include lowering of temperature in the cargo compartment as much as possible to minimise the sublimation rate of dry ice.

To mitigate the risk of higher concentrations of CO₂, the ventilation and pressurisation system shall be fully operational, i.e. all air-conditioning packs should be running at all times.

In case of partial failure of the ventilation system in flight, the situation has to be carefully evaluated in order to decide if the flight may continue to destination. The OEM guidance should account for a single next critical failure to enable continuation of the flight, while total failure of the ventilation system in flight should lead to an immediate diversion to the nearest suitable airport.

Note 1: Running the air-conditioning systems at maximum volume may lead to an additional risk when opening the doors due to potential residual overpressure. The operator should consider this hazard when drafting the operational procedures for the transportation of vaccines.

Note 2: The operator should consider the case of build-up of CO₂ concentration in the cabin as a possible emergency situation and should develop a procedure to require the donning of oxygen masks for the remaining duration of the flight.

(B) Oxygen System

MEL considerations

For aircraft dispatch the crew oxygen systems should be fully operative.

AFM considerations

The AFM procedures for the use of oxygen should be reviewed and adapted in the Operator Standard Operating Procedures to consider carriage of dry ice under normal and failure cases (e.g. failure of the ventilation systems), including the case of detection of dangerous concentration of CO₂ (if applicable).

- 3.4 It is recommended to use the cargo compartment that is located next to the outflow valve, in order to effectively ensure that even in the case of partial or complete failure of the ventilation and pressurization system during flight, the CO₂ will be ventilated overboard.

4. PACKAGING AND HANDLING

- 4.1 Ensure that the shipments containing COVID 19 vaccines packed in dry ice shall be accepted and handled by appropriately trained personnel only.
- 4.2 Prepare a 'Dos & Don't' guidance and circulate among those handling personnel the specific requirements that may be applicable for handling shipments containing COVID 19 vaccines packed in dry ice considering the sensitivity of the shipments and also possibility of large quantities of dry ice required to be handled.

Adequate precautions need to be taken at the end of a flight, as compartments or ULDs containing dry ice will tend to have high concentration of CO₂ and also the area immediately outside the door experiences high concentration of CO₂ for several minutes.

The 'Dos & Don't' should cover at least the following:

- (1) Loading:
 - (a) Methods to ensure that only packaging compliant with the applicable regulations is loaded on board;
 - (b) Procedures for reporting and addressing damaged/ leaking packages.
- (2) Unloading:
 - (a) Instructions on precautions to be taken while opening of cargo or cabin doors;
 - (b) A second person shall always be available outside the cargo bay or cabin to trigger the alarm in case of any unforeseen event;
 - (c) Procedures for reporting and addressing damaged/leaking packages.
- (3) Ensure proper ventilation before entering a cargo compartment containing dry ice.
- (4) Minimize ground time without ventilation.
- (5) Carry a CO₂ detector when entering cargo compartments.
- (6) Develop emergency procedures in case of an incident or accident.

- (7) Evaluate the potential for cargo containing dry ice to be loaded as late as possible and unloaded as early as possible.
- 4.3 Confirm that the packages containing dry ice are packed, marked, labelled and documented meeting the requirements of ICAO Annex 18 and Doc 9284 - Technical Instructions for Safe Transportation of Dangerous Goods.
- 4.4 Ensure that each package containing COVID 19 vaccines packed in dry ice is clearly marked – *DRY ICE* or *CARBON DIOXIDE SOLID* and specifies the net quantity contained in each package.
- 4.5 Ensure that the Shipper provides a packing list clearing indicating-
- Package Identification Number,
 - Gross Weight of the package
 - Net Quantity of dry ice contained in the package
 - Total Gross Weight and total Net Quantity of dry ice of the consignment
- 4.6 Ensure that the ULDs (Pallets / Containers) that are loaded with COVID 19 vaccines packed in dry ice are provided with placard clearly indicating - *DRY ICE* or *CARBON DIOXIDE SOLID* and net quantity contained in each ULD;
- 4.7 Use Acceptance Checklist of dry ice when Shippers Declaration for Dangerous Goods (DGD) is not required while accepting shipments of COVID 19 vaccines packed in dry ice:
- Follow the general compatibility, loading and securing requirements as detailed in the ICAO Annex 18 and Doc 9284 - Technical Instructions.
- However, considering the high volume of dry ice and sensitivity of the contents, as a matter of extraordinary precaution and with a view to avoid possible contaminations of the external surfaces of the packages and or the contents therein, no other goods such as foods, meat, fish, flowers, vegetables, fruits, live animals, etc. shall be loaded adjacent to these packages in the same compartment or cargo hold of the aircraft.
- Inform the Pilot-in-command in writing of the quantity of dry ice loaded including loading locations.
5. Please acknowledge the receipt and ensure strict compliance.



(Sunil Kumar)

Joint Director General

To

- All Domestic Scheduled Airlines/ NSOP Operators;
- All Airport Operators and other stakeholders.