



Republic of the Philippines
CIVIL AVIATION AUTHORITY OF THE PHILIPPINES

MEMORANDUM CIRCULAR NO. 05-2021

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TO : ALL PHILIPPINE COMMERCIAL AIR OPERATORS

**SUBJECT : GUIDELINES FOR CARRIAGE OF COVID 19 VACCINES
PACKED IN DRY ICE BY AIR**

DATE : 01 FEBRUARY 2021

This Memorandum Circular provides guidance to Philippine Commercial Air Operators for the transport of dry ice in excess of what is permitted in the air operators' Operations Manual or other applicable aircraft manufacturer documents for the transportation of the COVID-19 vaccines. These guidelines are issued to reduce the introduction of additional risk to the safety and health of the aircraft systems and its occupants.

I. BACKGROUND

International vaccine suppliers will start to deliver initial shipments of the COVID-19 vaccine to the Philippines. It is anticipated that the international effort to rapidly distribute vaccines worldwide will lead to an unprecedented demand for this type of cargo. As part of the supply chain for these shipments, Philippine commercial air operators may be requested to transport these vaccines at a temperature of -70°C for proper preservation. It is expected that large quantities of COVID-19 vaccines will be transported by airfreight, which may introduce challenges for the air operators.

Some COVID-19 vaccines may need to be maintained at sub-zero temperatures during transport, and some may even require a temperature-controlled environment of below -70°C . The cooling can reliably be ensured by the use of dry ice (frozen CO_2), the most commonly used, affordable and readily available refrigerant material available in the country. While dry ice is regularly and safely used to transport perishable goods, operators may plan to carry larger-than normal quantities of dry ice during this vaccination effort. The use of dry ice as refrigerant in large quantities on board an aircraft raises technical and operational challenges particularly when transported on the main (passenger/cargo) deck of a large airplane.

Dry ice continually sublimates (transitions directly from a solid to a gas) at temperatures higher than -78°C under standard atmospheric pressure. At reduced pressures, the sublimation rate of dry ice will increase, all other factors being equal. Hence, dry ice is classified as Class 9-Miscellaneous Dangerous Goods. The conversion rate of dry ice to gaseous CO_2 will vary depending on package insulation, dry ice particle/pellets size, surrounding temperature, and cabin pressure.

II. SCOPE

All scheduled operators who are currently authorized to carry dangerous goods are authorized to carry COVID-19 vaccines packed in dry ice within the Philippines after meeting the regulatory requirements of the Authority.

Operators whether Scheduled or Non-scheduled that are required to participate in the carriage of COVID-19 vaccines packed in dry ice shall obtain the approval of the Authority before commencement of such operations and shall operate only within the bounds of the approval granted to them.

The air operator shall be responsible for the compliance of the requirements for the transport of dangerous goods on board the aircraft under Philippine Civil Aviation Regulations (PCAR) Part 18 and the International Civil Aviation Organization Document 9284 ('Technical Instructions for the Safe Transport of Dangerous Goods by Air').

III. SAFETY RISK ASSESSMENT

In transporting COVID-19 vaccines using dry ice in excess of that allowed in Operations' Manual or other applicable aircraft manufacturer documents, the air operator shall perform a specific risk assessment. The risk assessment requires coordination with the Type Certificate (TC) and/or Supplemental Type Certificate (STC) holder and who propose an appropriate operating procedure in order to mitigate the identified risk.

The risk assessment shall at least cover the following:

- (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 Carbon Dioxide (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 the 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. traffic on runway);
- (12) The consequences of diversion and specific airport ground-handling consideration;
- (13) The possible diversion times and the need to use alternative routes where necessary;
- (14) The extended loading time needed in case of transport in the passenger cabin, which may result in excessive CO₂ concentration.

The risk assessment shall ensure that all relevant technical and operational aspects have been strictly taken into account. The necessary documentation on the volume of vaccines and dry ice transported, as well as the risk assessment performed and the mitigations taken shall be included in the post operation report to be submitted to the Authority.

IV. TECHNICAL CONSIDERATIONS- SAFETY OF FLIGHT

Vaccines cooled by dry ice shall preferably be transported in the existing lower-deck cargo compartments. In case vaccines, cooled by dry ice, need to be transported on the main (passenger/cargo) deck, additional technical aspects should be considered.

A. Ventilation and Pressurization System

- (1) Minimum Equipment List (MEL) considerations

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

- (2) Aircraft Flight Manual (AFM) considerations:

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

To mitigate the risk of higher concentrations of CO₂ (above 0.5%), it is recommended that the ventilation and pressurization system is fully operational, i.e. all air-conditioning packs shall 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 Original Equipment Manufacturer (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

(1) MEL considerations

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

(2) 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).

C. Cargo locations (lower and main deck cargo compartments and passenger cabin)

Vaccines cooled with dry ice shall preferably be transported in lower-deck cargo compartments. It is recommended to use the cargo compartment that is located to the next 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.

The air operator shall ensure that a minimum number of occupants shall be onboard for fire detection and fire-fighting purposes. Vaccines cooled with dry ice may only be transported in the passenger cabin when the associated risks are sufficiently mitigated. The mitigations taken by the air operator shall be included in the post operation report to be submitted to the Authority. Details are addressed below in Chapters D and E.

D. Occupants on board (their roles and location, equipment, etc.)

(1) Flight crew:

The operator shall take all necessary steps to avoid that the flight crew is harmed by carbon dioxide incapacitation or intoxication.

Flight crews shall be properly trained prior to the flight on the hazards and risks of transporting dry ice and on the procedures related to the operation.

(2) Other occupants:

Passengers shall strictly not be allowed onboard if dry ice is transported in excess of the limit specified in the Operations Manual or other applicable aircraft manufacturer documents. Any other occupants onboard shall 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).

If occupants not considered flight crew need to be onboard, they shall be protected against a potential CO₂ intoxication through the following means:

- (1) They shall have access during all phases of flight to approved supplemental oxygen equipment ready to be used;
- (2) They shall be properly trained prior to the flight on the use of that oxygen equipment;
- (3) They shall be properly trained prior to the flight on the hazards and risks of transporting dry ice and on the procedures related to the operation; and,
- (4) In addition, CO₂ detectors shall be available in the cabin.

Any seating position identified for a potential occupancy during any phase of the flight shall pose no additional risk to its occupants, in particular in case of a CO₂ incapacitation/intoxication.

Adequate number of CO₂ detectors shall be available in the cabin. Such detectors shall be adequately located and shall timely and reliably detect dangerous concentrations of CO₂ in the aircraft. If the detectors are power supplied by lithium-ion batteries, the additional fire risk shall be assessed and mitigated accordingly.

Note 1: If CO₂ sensors and monitoring systems are used, the operator shall 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.

E. Interaction with Other Cargo

Live animals shall not be transported in cargo compartments together with the dry ice. Any interaction with other cargo should be assessed and mitigated by the operator and the shipper.

V. TECHNICAL CONSIDERATIONS – GROUND HANDLING

When loading and unloading boxes filled with dry ice, awareness shall be raised that there can be carbon dioxide present in concentrations that potentially endanger human health. Staff engaged in the loading and unloading process shall be properly trained and prepared for this. They shall be trained on the specific risks and hazards and the special procedures related to this cargo. The operator and the ground-handling provider shall implement special procedures to ensure that there is no health or safety risk for the staff performing the loading and unloading of dry ice packages.

Operators who are not currently authorized to carry dangerous goods but are required to participate in the carriage of COVID-19 vaccines packed in dry ice, shall, after being granted approval by the Authority, ensure that the staff engaged in the loading and unloading process shall be properly trained.

In doing this, the operator and ground-handling provider shall consider, as a minimum, 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 when opening cargo or cabin doors;
- (b) A second person always outside the cargo bay or cabin to monitor entrance and trigger the alarm in case of an incident;
- (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.

VI. OPERATIONAL CONSIDERATIONS

Operators transporting dry ice shall be required to obtain an authorization for the transport of dangerous goods in accordance with Philippine Civil Aviation Regulations (PCAR) Parts 9 and 18. In accordance with the requirements established in such regulations, operators shall have job-specific training and procedures for the transport of dangerous goods. The trainings and procedures shall be approved by the Authority and shall be in accordance with ICAO Annex 18 and ICAO Doc 9284, Technical Instructions for the Safe Transport of Dangerous Goods. These shall all be reflected in the Operations Manuals and Training Program.

It shall be possible to obtain an approval for the transport of certain dangerous goods. Thus, an operator shall obtain an authorization to transport only dry ice before commencement of its operations. The scope of the approval needs to be taken into consideration before any shipment of the vaccine may be accepted. Details are addressed in Appendix A.

Additionally, operators:

- (1) Shall perform a risk assessment which includes the particularity of dangerous goods transport (as from November 2020, ICAO Annex 6, Chapter 15 also calls for such a risk assessment).
- (2) Shall confirm that the packages containing dry ice are packed, marked, labelled and documented meeting the requirements of ICAO Annex 18 and ICAO Doc 9284, Technical Instructions for the Safe Transport of Dangerous Goods.
- (3) Shall ensure that each package containing COVID-19 vaccines packed in dry ice is clearly marked DRY ICE or CARBON DIOXIDE, SOLID and shall specify the net quantity contained in each package.
- (4) Shall use acceptance checklist for dry ice if the Shipper's Declaration for Dangerous Goods is not required while accepting shipments of COVID-19 vaccines packed in dry ice:
 - a) Follow the general compatibility, loading, securing requirements as detailed in the ICAO Doc 9284, Technical Instructions for the Safe Transport of Dangerous Goods. 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.
 - b) Inform the Pilot-in-Command in writing of the quantity of dry ice loaded including loading locations.
- (5) Shall make the necessary documentation on the volume of vaccines and dry ice transported, as well as the risk assessment performed and the mitigations taken which shall be included in the post operation report to be submitted to the Authority.

Note: The AOC holder shall ensure that the provision pertinent to Shipper's Responsibilities must be complied with.

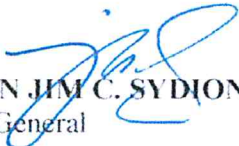
To ensure that the transport is safely conducted, operators transporting quantities of dry ice in excess of that specified in the operations manual or other applicable aircraft manufacturer

documents shall consider additional mitigation actions. The training, procedures and risk assessment mentioned above shall take into consideration the specific conditions of this transport. These shall also include all the technical considerations mentioned before and apply to all the staff involved and all the stages of the operation, from the acceptance to the unloading. The operator may additionally consider the following:

- (1) Lower the temperature in the cargo compartment as much as possible to minimize the sublimation rate;
- (2) Evaluate the potential for cargo containing dry ice to be loaded as late as possible and unloaded as early as possible to minimize the potential exposure of ground staff to elevated levels of CO₂ in the cargo compartment.

To ensure the strict implementation of the aforementioned requirements, relevant activities shall be subject to monitoring and surveillance by our Dangerous Goods Safety Inspectors of the Flight Operations Department.

For strict compliance.


CAPTAIN JIM C. SYDIONGCO
Director General

APPENDIX A.
OPERATORS WITH NO DANGEROUS GOODS AUTHORIZATION BUT INTENDS
TO CARRY COVID-19 VACCINES PACKED IN DRY ICE.

CONDITIONS:

- (1) The Operator shall have a supplemental provision in the Operations Manual to be approved by the CAAP that states that the Operator is limited to transport UN1845 Carbon Dioxide, solid (Dry ice) for COVID-19 Vaccines;
- (2) The Operator shall specify in the Operations Manual the maximum quantity of dry ice per cargo hold of each aircraft type in accordance with the aircraft manufacturer documents;
- (3) The Operator shall have a Dangerous Goods Training Program to be approved by the CAAP and training shall be in accordance with the ICAO Annex 18 and ICAO Doc 9284, Technical Instructions for the Safe Transport of Dangerous Goods in the following categories:
 - a) Category 6- Operator's and ground handling agent's staff accepting dangerous goods
 - b) Category 8- Operator's and ground handling agent's staff involved in the handling, storage and loading of cargo or mail and baggage
 - c) Category 10- Flight crew members, loadmasters, load planners and flight operations officers/flight dispatchers
 - d) Category 11- Crew members (other than flight crew members)
- (4) The Operator shall develop procedures for reporting and addressing damaged/leaking packages;
- (5) The Operator shall develop emergency procedures in case of an incident or accident;
- (6) If issued with a specific approval, the Operator shall submit a post-flight report for every shipment done on the following information but are not limited to:
 - a) Airway bill;
 - b) Details of the operator including aircraft type, flight numbers, flight crew and other occupants onboard, if necessary, of each flight;

ADDITIONAL GUIDANCE:

- *FAA Advisory Circular 91-76A, "Hazard Associated with Sublimation of Solid Carbon Dioxide (Dry Ice) Aboard Aircraft"*
- *IATA Guidance for Vaccine and Pharmaceutical Logistics and Distribution*
- *EASA Guidelines Transportation of Vaccines Using Dry Ice*
- *ICAO Annex 18 and Doc. 9284 – Technical Instructions*