



ICAO

ENVIRONMENT

Session 2: CORSIA MRV System: Monitoring of CO₂ Emissions

ICAO Secretariat

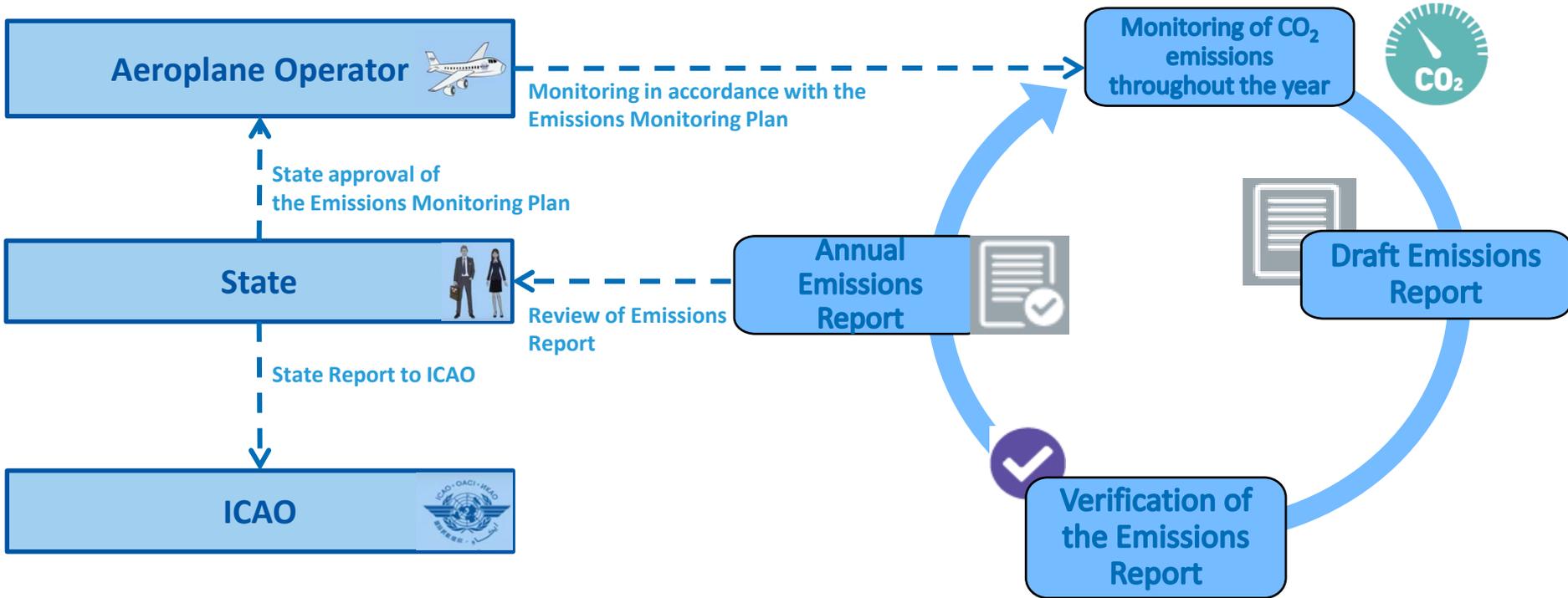




- A monitoring, reporting and verification (MRV) system is a key component of CORSIA implementation
 - Implementation of the MRV system from 1 January 2019 for all international flights is essential to establish CORSIA's baseline (2019-2020)
 - Purpose of MRV is to collect information on international aviation CO₂ emissions on an annual basis and compare emissions against the baseline emissions
- Components of the MRV system:
 - **Monitoring** of fuel use on each flight and calculation of CO₂ emissions
 - **Reporting** of CO₂ emissions information between aeroplane operators, States and ICAO
 - **Verification** of reported emissions data to ensure completeness and to avoid misstatements



Monitoring, Reporting and Verification (MRV) of CO₂ Emissions – Annual MRV Cycle





- Monitoring, reporting and verification of aeroplane operator's annual CO₂ emissions Annex 16, Volume IV, Chapter 2

- 2.1 Applicability of MRV Requirements
- 2.2 Monitoring of CO₂ Emissions
- 2.3 Reporting of CO₂ Emissions
- 2.4 Verification of CO₂ Emissions
- 2.5 Data Gaps
- 2.6 Error Correction to Emissions Reports

Reference: Annex 16, Volume IV, Part II, Chapter 2

CHAPTER 2. — MONITORING, REPORTING AND VERIFICATION (MRV) OF AEROPLANE OPERATOR ANNUAL CO₂ EMISSIONS

2.1 Applicability of MRV requirements

Note. — See also Chapter 1 for administration requirements of the State and aeroplane operator.

2.1.1 The Standards and Recommended Practices of this Chapter shall be applicable to an aeroplane operator that produces annual CO₂ emissions greater than 10 000 tonnes from the use of an aeroplane(s) with a maximum certificated take-off mass greater than 5 700 kg conducting international flights, as defined in 1.1.2, on or after 1 January 2019, with the exception of humanitarian, medical and firefighting flights.

2.1.2 Recommendation — *When considering whether a flight is international or domestic, an aeroplane operator and a State should use, for the purpose of this Volume, the ICAO Manual on Location Indicators (Doc 7910) which contains a list of aerodromes and the State they are attributed to. Further guidance material is also provided in the Environmental Technical Manual (Doc 9501), Volume IV – Procedures for demonstrating compliance with the Carbon Offsetting and Reduction Scheme for International Aviation (CORSLA).*

2.1.3 The Standards and Recommended Practices of this Chapter shall not be applicable to international flights, as defined in 1.1.2, preceding or following a humanitarian, medical or firefighting flight provided such flights were conducted with the same aeroplane, and were required to accomplish the related humanitarian, medical or firefighting activities or to reposition thereafter the aeroplane for its next activity. The aeroplane operator shall provide supporting evidence of such activities to the verification body or, upon request, to the State.

2.1.4 The Standards and Recommended Practices of this Chapter shall be applicable to a new entrant aeroplane operator from the year after it meets the requirements in 2.1.1 and 2.1.3.

2.1.5 Recommendation — *If the aeroplane operator is close to the threshold of annual CO₂ emissions, as defined in 2.1.1 and 2.1.3, from international flights, as defined in 1.1.2, it should consider engaging with the State to which it is attributed for guidance. Likewise, the State should carry out oversight of the aeroplane operators attributed to it, and engage with any that it considers may be close to or above the threshold. The aeroplane operator with annual CO₂ emissions below the threshold may choose to voluntarily engage with the State to which it is attributed.*

Note. — See Attachment B Figure B-1 for a process flowchart on the determination of the applicability of Chapter 2 to international flights, as defined in 1.1.2.

2.2 Monitoring of CO₂ emissions

2.2.1 Eligibility of monitoring methods

2.2.1.1 The aeroplane operator shall monitor and record its fuel use from international flights, as defined in 1.1.2 and 2.1, in accordance with an eligible monitoring method as defined in 2.2.1.2 and 2.2.1.3, and approved by the State to which it is attributed. Following approval of the Emissions Monitoring Plan, the aeroplane operator shall use the same eligible monitoring method for the entire compliance period.

Note. — Further guidance material on eligibility of monitoring methods, as well as on associated thresholds and related metrics, is provided in the Environmental Technical Manual (Doc 9501), Volume IV – Procedures for demonstrating compliance with the Carbon Offsetting and Reduction Scheme for International Aviation (CORSLA).



- Monitoring, reporting and verification of aeroplane operator's annual CO₂ emissions – Annex 16, Volume IV, Chapter 2

2.1 Applicability of MRV Requirements

2.2 Monitoring of CO₂ Emissions

2.3 Reporting of CO₂ Emissions

2.4 Verification of CO₂ Emissions

2.5 Data Gaps

2.6 Error Correction to Emissions Reports

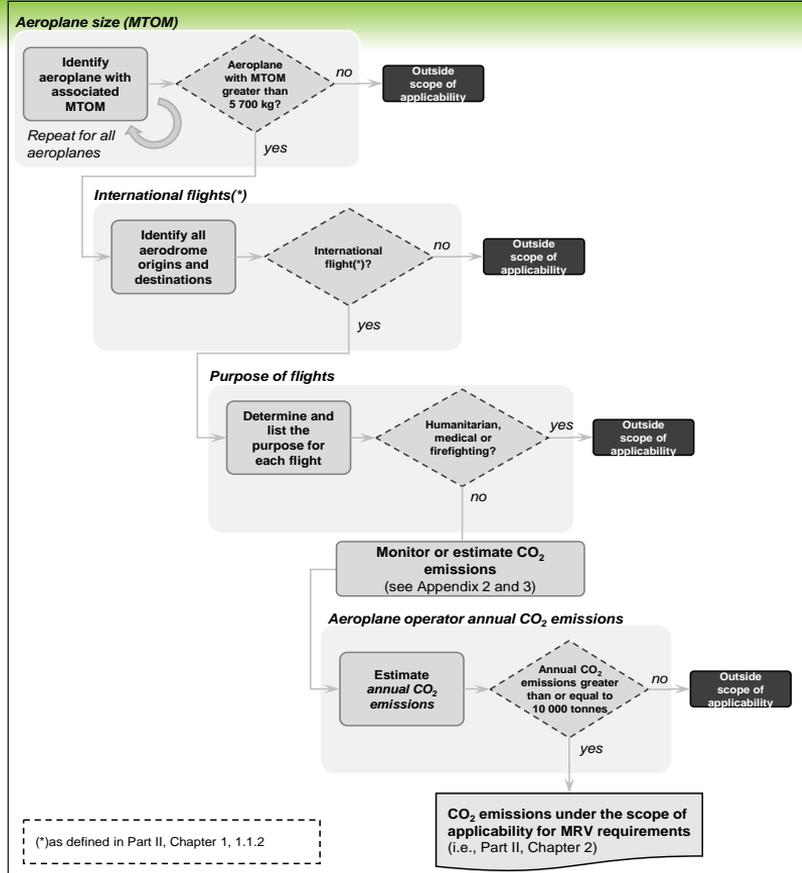
Covered in this session

Covered in session #4:

*CORSIA MRV System:
Reporting and verification of
CO₂ emissions*



- From the use of an aeroplane with a maximum certificated take-off mass of greater than 5,700 kg
- Conducting international operations on or after 1 January 2019
- With the exception of humanitarian, medical and firefighting operations
- An operator that produces annual CO₂ emissions greater than 10,000 tonnes

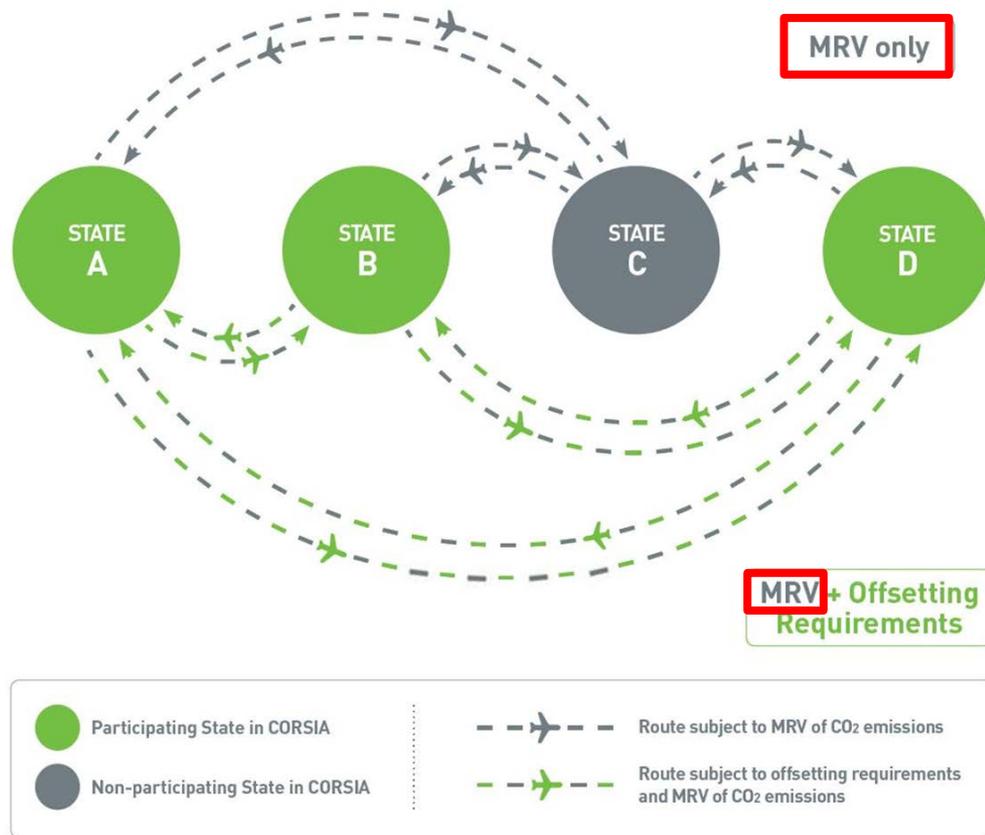


Reference: Annex 16, Volume IV, Part II, Chapter 2, 2.1



- All aeroplane operators conducting international flights are required to monitor, report and verify CO₂ emissions from these flights every year starting on 1 January 2019
- Requirement for the MRV of CO₂ emissions is independent from participation in CORSIA offsetting

Reference: Annex 16, Volume IV, Part II, Chapter 2, 2.1





Monitoring of CO₂ Emissions – Emissions Monitoring Plan



- An Emissions Monitoring Plan (EMP) is a collaborative tool between the State and the aeroplane operator. The EMP:
 - Identifies the most appropriate means and methods for CO₂ emissions monitoring on an operator-specific basis; and
 - Facilitates the reporting of required information to the State.
- An aeroplane operator shall submit an EMP to the State to which it is attributed for approval.
- The State and aeroplane operator should maintain clear and open communication during development and review of an EMP.

Reference: Annex 16, Volume IV, Part II, Chapter 2, 2.2.2

**1**

PREPARATION AND SUBMISSION

An aeroplane operator submits an Emissions Monitoring Plan for review and consultation by the State to which it is attributed.

- **Recommended timeframe:** submit by 30 September 2018.
- **Mandatory timeframe:** submit by 28 February 2019.

2

REVIEW AND APPROVAL

The State reviews and approves the Emissions Monitoring Plan.

- **Recommended timeframe:** approve by 30 November 2018.
- **Mandatory timeframe:** approve by 30 April 2019.

Note: If the aeroplane operator's Emissions Monitoring Plan is not fully aligned with the Emissions Monitoring Plan requirements in the CORSIA SARPs, the State shall collaborate with the aeroplane operator to resolve the outstanding issues.

3

REVISIONS AND UPDATES

An aeroplane operator resubmits the Emissions Monitoring Plan for review and approval by the State if a material change is made to the information contained within the Emissions Monitoring Plan.

For example, a change to the information that would affect:

- The status or eligibility for an option under the emissions monitoring requirements;
- The approach to monitoring; or
- The State's oversight (e.g., change in corporate name / address).

Reference: Annex 16, Volume IV, Part II,
Chapter 2, 2.2.2, and Appendix 1



CORSIA

EMISSIONS MONITORING PLAN (EMP)

CONTENTS

- 1 [EMP-Versions](#)
- 2 [Identification](#)
- 3 [Fleet and Operations Data](#)
- 4 [Fuel Use Monitoring Methods](#)
 - 4.1 [Method A](#)
 - 4.2 [Method B](#)
 - 4.3 [Block-Off/Block-On](#)
 - 4.4 [Fuel Uplift](#)
 - 4.5 [Fuel Allocation with Block Hour](#)
- 4.6 [ICAO CORSIA CO₂ Estimation and Reporting Tool \(CERT\)](#)
- 5 [Data Management](#)

Template Information

Template provided by:	
Version (publication date):	

Note: For the purpose of this template, "international flight" is defined as in Annex 16, Volume IV, Part II, Chapter 1, 1.1.2, and Chapter 2, 2.1."

- EMP contents are included in the Annex 16, Volume IV, Appendix 4
- Main components of an EMP are:

- | |
|--|
| 1. Aeroplane operator identification |
| 2. Fleet and operations data |
| 3. Methods and means of calculating emissions from international flights |
| 4. Data management, data flow and control |

Reference: Annex 16, Volume IV, Part II, Chapter 2, 2.2.2, and Appendix 4



EMP Contents

1. Aeroplane operator identification

2. Fleet and operations data

3. Methods and means of calculating emissions from international flights

4. Data management, data flow and control

- Name of the operator
- Information for attributing the operator to a State:
 - ICAO Designator;
 - Air operator certificate; or
 - Place of juridical registration
- Operator’s ownership structure, including parent-subsidiary relationships
- Contact information, including operator’s CORSIA Focal Point
- Description of the operator’s activities

AIR OPERATOR CERTIFICATE		
STATE OF THE OPERATOR ¹		
ISSUING AUTHORITY ²		
AOC # ⁴ Expiry date ⁵	OPERATOR NAME ⁶ Dba trading name ⁷ Operator address ³ Telephone ³ Fax Email	OPERATIONAL POINTS OF CONTACT ¹¹ Contact details, at which operational management can be contacted without undue delay, are listed in _____ ¹¹
This certificate certifies that _____ ¹² is authorized to perform commercial air operations, as defined in the attached operations specifications, in accordance with the operations manual and the _____ ¹³ .		
Date of issue ¹⁴	Name and signature ¹⁵ Title:	

- Notes—
1. For use of the State of the Operator.
 2. Replace by the name of the State of the Operator.
 3. Replace by the identification of the issuing authority of the State of the Operator.
 4. Unique AOC number, as issued by the State of the Operator.
 5. Date after which the AOC ceases to be valid (dd/mm/yyyy).
 6. Replace by the operator's registered name.
 7. Operator's trading name, if different. Insert "dba" before the trading name (for "doing business as").

ANNEX 6—PART I

APP 6-1

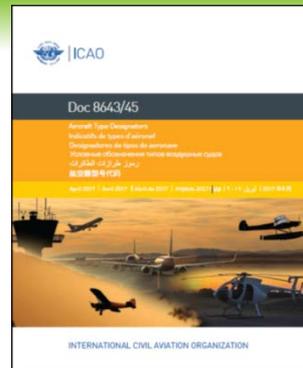
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EMP Contents

1. Aeroplane operator identification
2. Fleet and operations data
3. Methods and means of calculating emissions from international flights
4. Data management, data flow and control



Fleet declaration			
No	ICAO type designator	Fuel type	Number of aeroplanes
1	A320	Jet-A	10
2	B737	Jet-A	10
3	E190	Jet-A	15
4	BCS3	Jet-A	15
5
6

- Information on the operator's aeroplane types and types of fuel
- Flight attribution to the operator
- Procedures to track changes in the fleet
- List of State pairs operated at the time of the EMP submission
- Procedures to identify international flights and exempted flights

ICAO model flight plan form

The image shows a portion of the ICAO model flight plan form. Field 7, 'AIRCRAFT IDENTIFICATION', is circled in red. A red arrow points from this field to a red-bordered box containing the following text:

- ICAO Designator
- Registration mark
- Aircraft owner

 Other fields visible include:

- 1. PRIORITY: FF
- 2. FILING TIME: Heure de dépôt
- 3. MESSAGE TYPE: (FPL)
- 4. NUMBER: Nombre
- 5. DEPARTURE AERODROME
- 6. TIME
- 8. FLIGHT RULES: Règles de vol
- 9. EQUIPMENT: Équipement

Reference: Annex 16, Volume IV, Appendix 4



EMP Contents

1. Aeroplane operator identification
2. Fleet and operations data
3. Methods and means of calculating emissions from international flights
4. Data management, data flow and control

*CO₂ Emissions = Mass of fuel * Fuel Conversion Factor of given fuel type*



- An aeroplane operator shall monitor and record its fuel use from international flights in accordance with an eligible monitoring method
- Monitoring method shall be approved by the State as a part of aeroplane operator's Emissions Monitoring Plan
- The aeroplane operator shall use the same eligible monitoring method for the entire compliance period

Reference: Annex 16, Volume IV, Part II, Chapter 2, 2.2.1



EMP – 3. Emissions Monitoring Options (Decision Tree for 2019 & 2020)



**Information on all
international flights**
(per aeroplane operator per year)



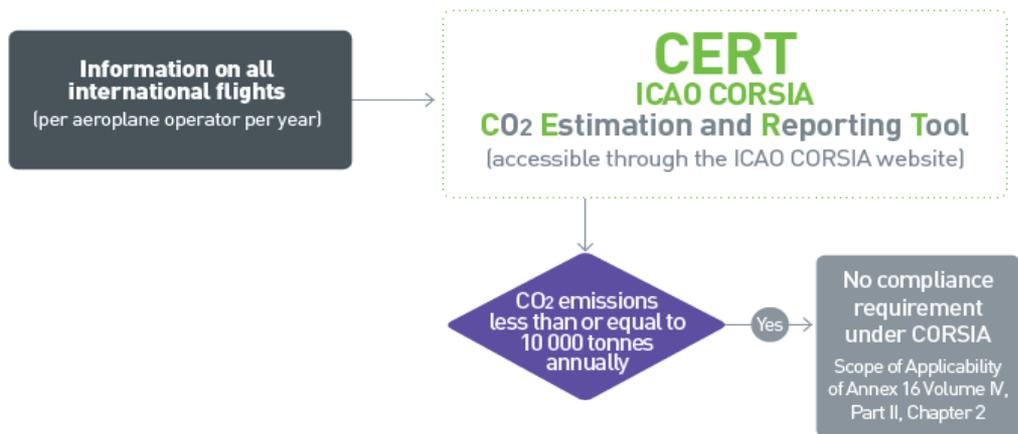
EMP – 3. Emissions Monitoring Options (Decision Tree for 2019 & 2020)



Reference: Annex 16, Volume IV, Part II, Chapter 2, 2.2.1



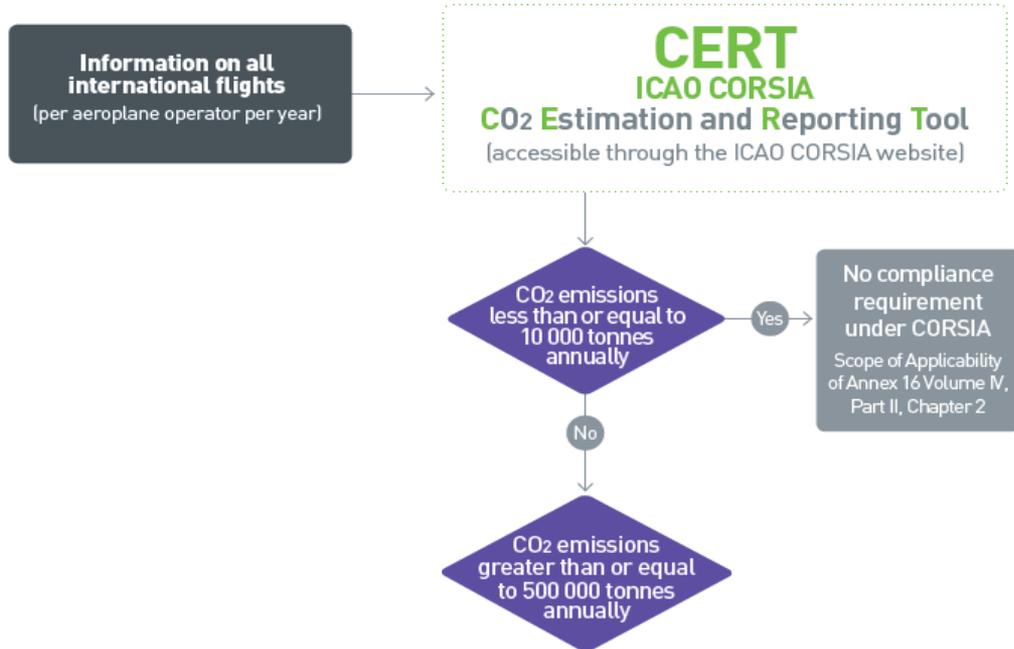
EMP – 3. Emissions Monitoring Options (Decision Tree for 2019 & 2020)



Reference: Annex 16, Volume IV, Part II, Chapter 2, 2.2.1



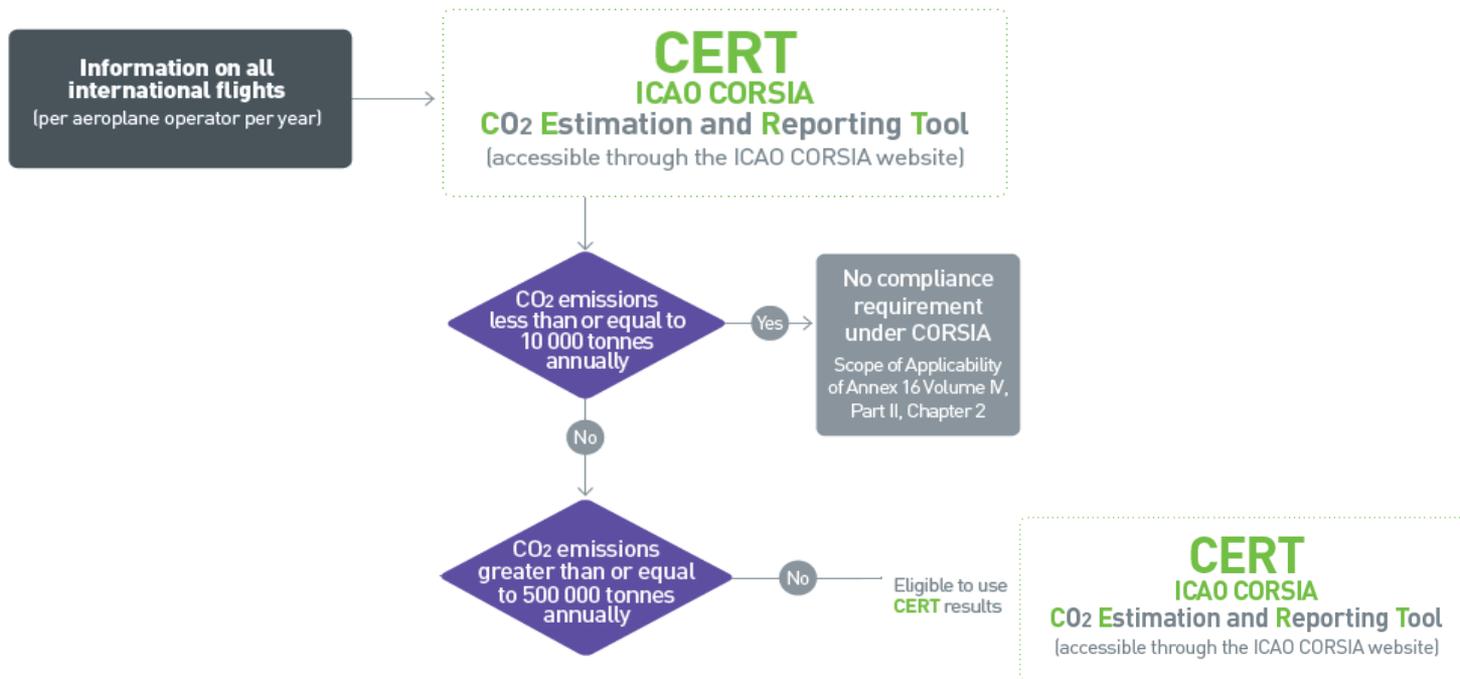
EMP – 3. Emissions Monitoring Options (Decision Tree for 2019 & 2020)



Reference: Annex 16, Volume IV, Part II, Chapter 2, 2.2.1



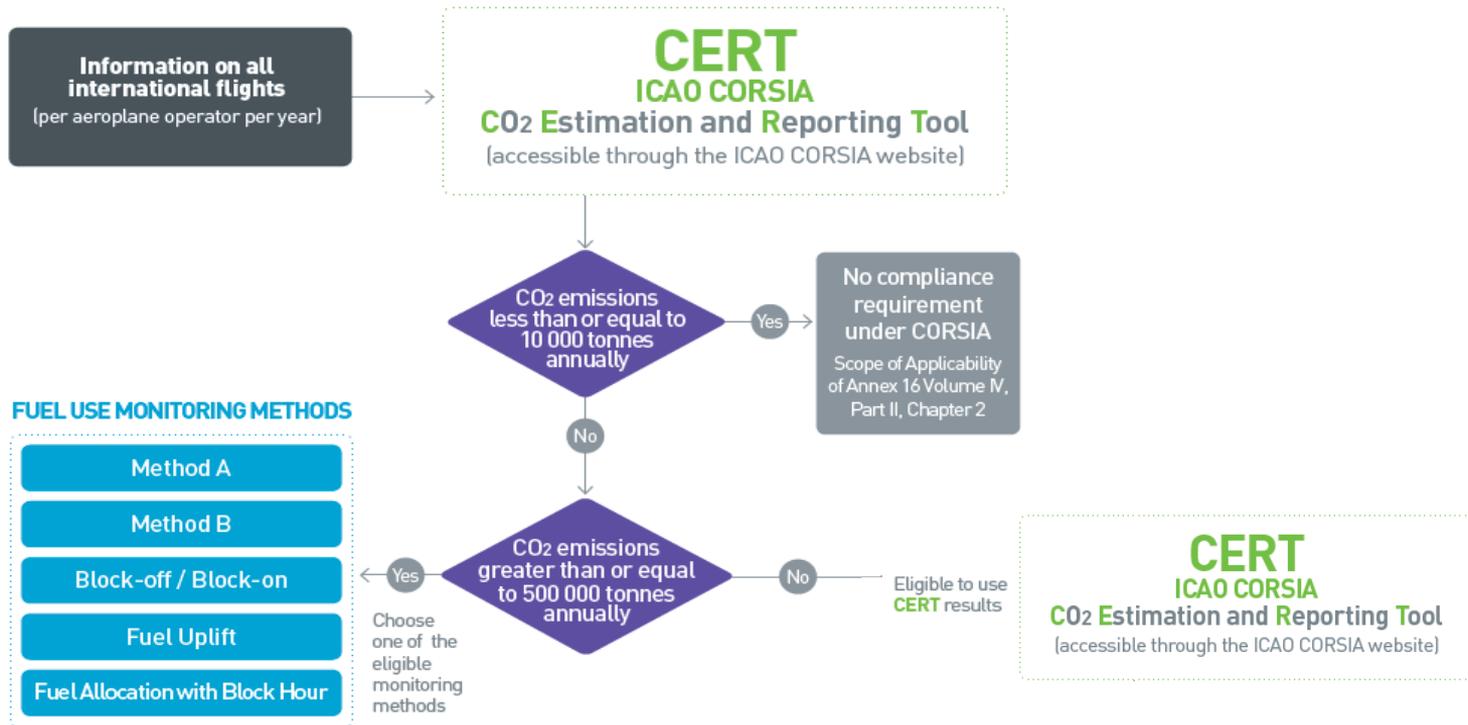
EMP – 3. Emissions Monitoring Options (Decision Tree for 2019 & 2020)



Reference: Annex 16, Volume IV, Part II, Chapter 2, 2.2.1



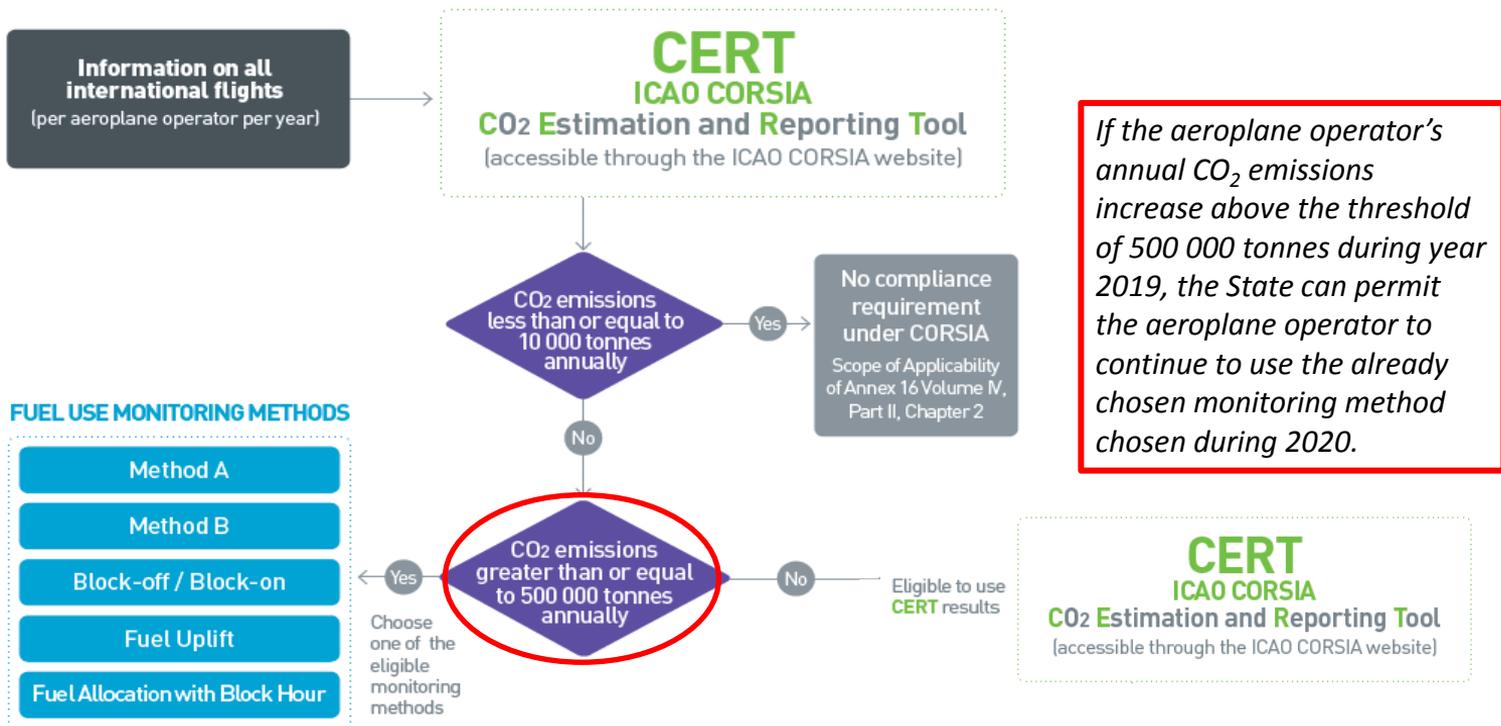
EMP – 3. Emissions Monitoring Options (Decision Tree for 2019 & 2020)



Reference: Annex 16, Volume IV, Part II, Chapter 2, 2.2.1



EMP – 3. Emissions Monitoring Options (Decision Tree for 2019 & 2020)



Reference: Annex 16, Volume IV, Part II, Chapter 2, 2.2.1

**CERT**

ICAO CORSIA

CO₂ Estimation and Reporting Tool

(accessible through the ICAO CORSIA website)

- CORSIA CERT is an ICAO tool to help aeroplane operators estimate and report their international aviation emissions (Annex 16, Volume IV, Appendix 3)

- All operators can use the ICAO CORSIA CERT for a preliminary CO₂ assessment, and for filling in possible data gaps
- Eligible operators can use the ICAO CORSIA CERT for:
 - Estimating CO₂ emissions; and
 - Populating the Emissions Monitoring Plan and Emissions Report templates
- Expected release of the ICAO CORSIA CERT is in July 2018

Practical demonstration of the ICAO CORSIA CERT: later in this seminar

Reference: Annex 16, Volume IV, Part II, Chapter 2, 2.2.1, and Appendix 3



FUEL USE MONITORING METHODS

Method A

Method B

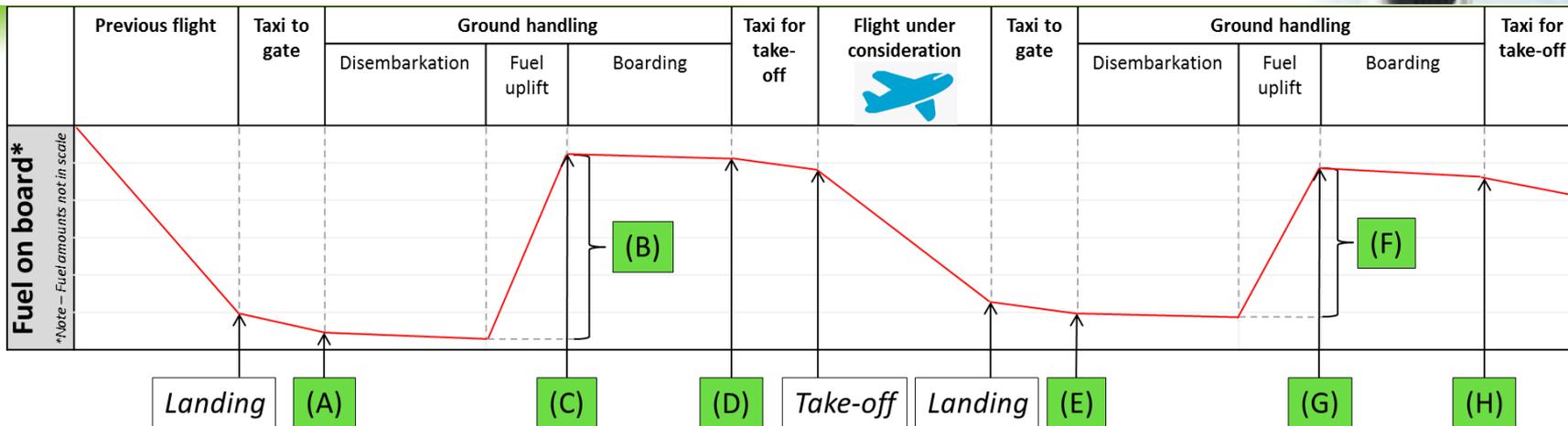
Block-off / Block-on

Fuel Uplift

Fuel Allocation with Block Hour

- Those operators that are not eligible to use ICAO CORSIA CERT, have five Fuel Use Monitoring Methods to choose from
- An operator shall choose one of the five methods
- Methods represent the most accurate established practices, and are equivalent; there is no hierarchy for selecting a method
- Each method uses different fuel measurement points. Specifications of the methods are included in the Annex 16, Volume IV, Appendix 2.

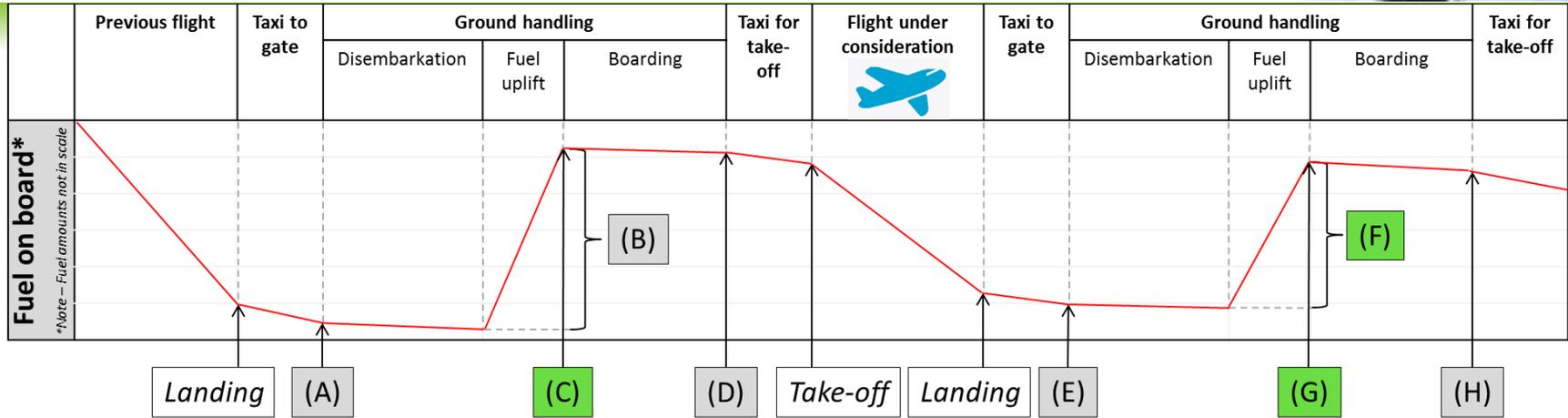
EMP – 3. Emissions Monitoring Options (Fuel Measurement Points)



Fuel Measurement Points		Definition of the measurement point
Before the flight under consideration	After the flight under consideration	
(A) Block-on	(E) Block-on	The time when an aeroplane finally stops at the end of the flight
(B) Fuel uplift	(F) Fuel uplift	Measurement of fuel provided by the fuel supplier, as documented in the fuel delivery notes or invoices for each flight (in litre)
(C) Fuel in tanks after fuel uplift	(G) Fuel in tanks after fuel uplift	Amount of fuel contained in aeroplane tanks once fuel uplifts for the flight under consideration are complete (in tonnes)
(D) Block-off	(H) Block-off	The time when an aeroplane first moves for the purpose of taking off



EMP – 3. Emissions Monitoring Options (5 Monitoring Methods – Method A)



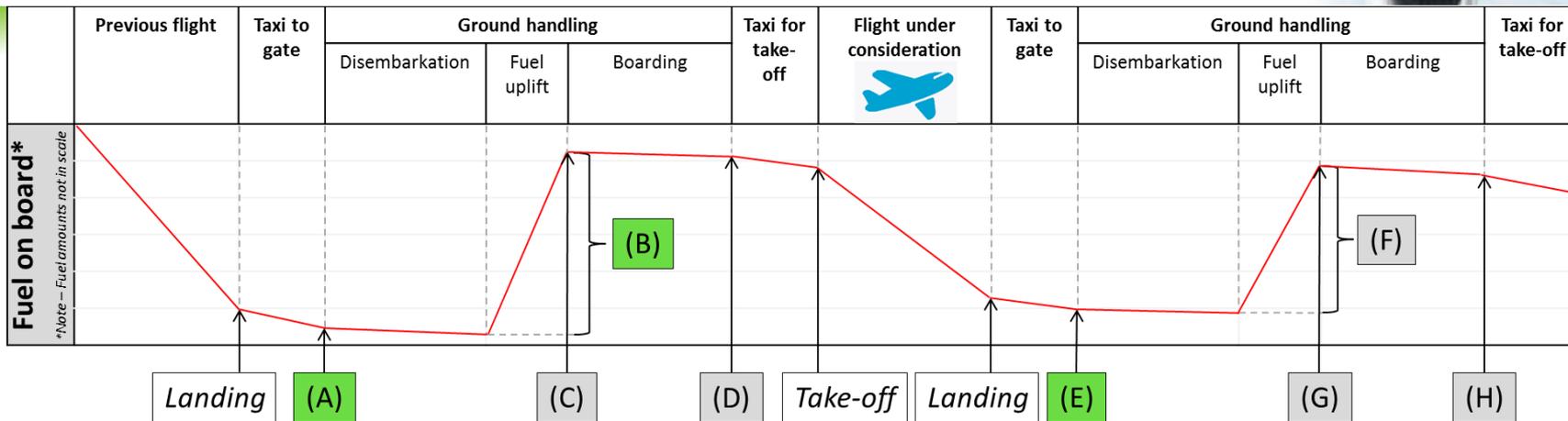
Fuel Measurement Points	
Before the flight under consideration	After the flight under consideration
(A) Fuel at block-on	(E) Fuel at block-on
(B) Fuel uplift	(F) Fuel uplift
(C) Fuel in tanks after fuel uplift	(G) Fuel in tanks after fuel uplift
(D) Fuel at block-off	(H) Fuel at block-off
Fuel Use Monitoring Method: METHOD A	
Fuel used = C-G+F	

FUEL USE MONITORING METHODS

- Method A
- Method B
- Block-off / Block-on
- Fuel Uplift
- Fuel Allocation with Block Hour



EMP – 3. Emissions Monitoring Options (5 Monitoring Methods – Method B)



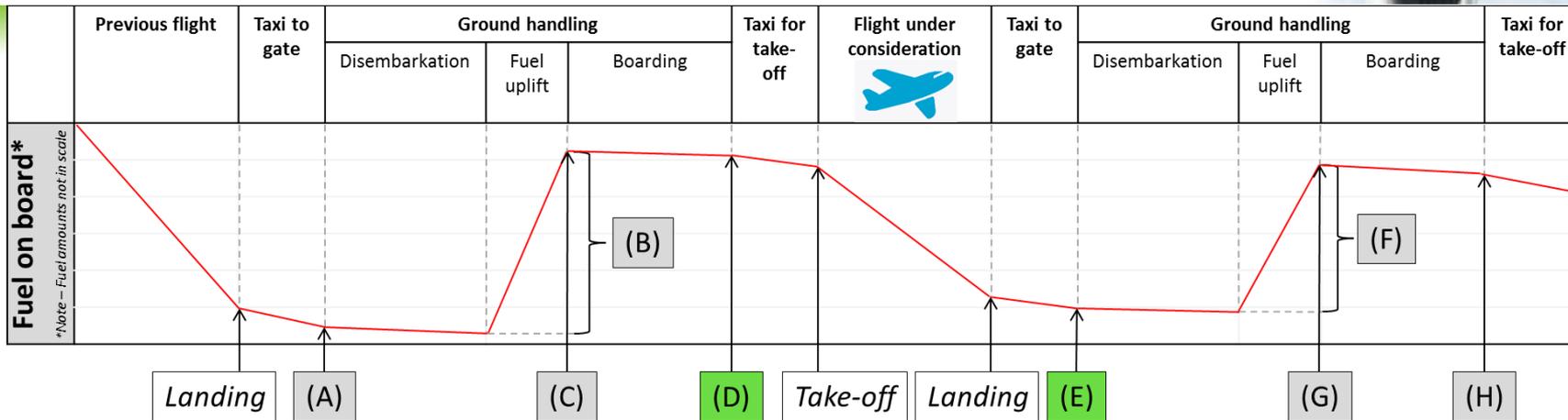
Fuel Measurement Points	
Before the flight under consideration	After the flight under consideration
(A) Fuel at block-on	(E) Fuel at block-on
(B) Fuel uplift	(F) Fuel uplift
(C) Fuel in tanks after fuel uplift	(G) Fuel in tanks after fuel uplift
(D) Fuel at block-off	(H) Fuel at block-off
Fuel Use Monitoring Method: METHOD B	
Fuel used = A-E+B	

FUEL USE MONITORING METHODS

- Method A
- Method B**
- Block-off / Block-on
- Fuel Uplift
- Fuel Allocation with Block Hour



EMP – 3. Emissions Monitoring Options (5 Monitoring Methods – Block-off/Block-on)



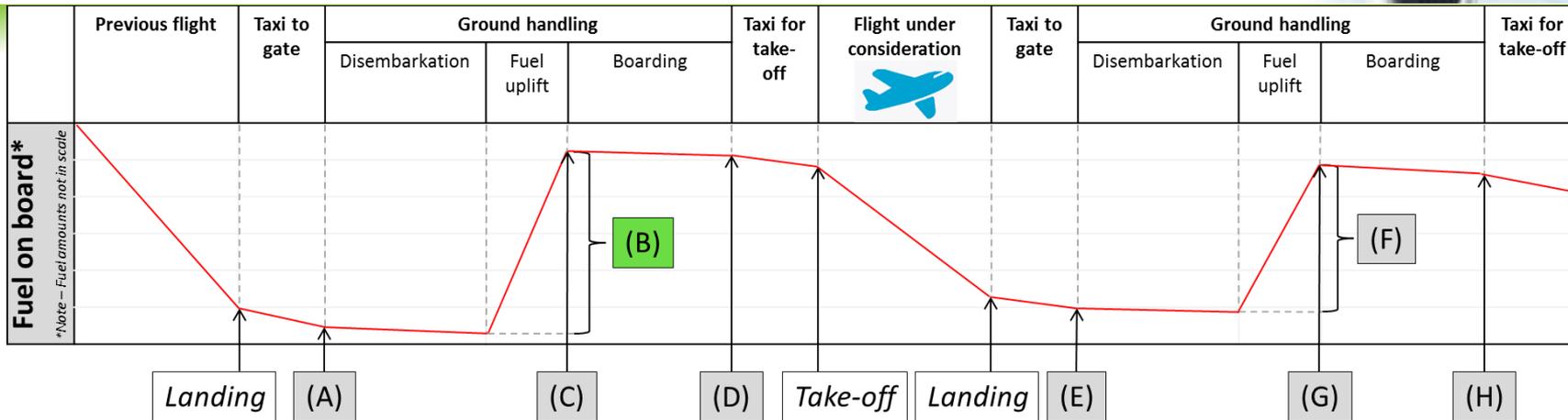
Fuel Measurement Points	
Before the flight under consideration	After the flight under consideration
(A) Fuel at block-on	(E) Fuel at block-on
(B) Fuel uplift	(F) Fuel uplift
(C) Fuel in tanks after fuel uplift	(G) Fuel in tanks after fuel uplift
(D) Fuel at block-off	(H) Fuel at block-off
Fuel Use Monitoring Method: Block-off / Block-on	
Fuel used = D-E	

FUEL USE MONITORING METHODS

- Method A
- Method B
- Block-off / Block-on**
- Fuel Uplift
- Fuel Allocation with Block Hour



EMP – 3. Emissions Monitoring Options (5 Monitoring Methods – Fuel Uplift)

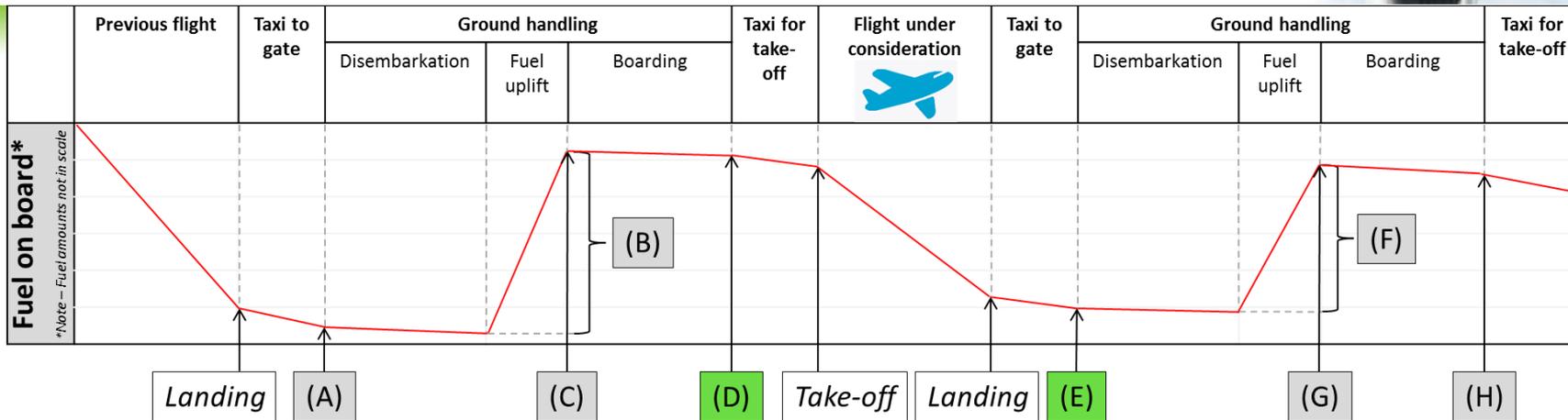


Fuel Measurement Points	
Before the flight under consideration	After the flight under consideration
(A) Fuel at block-on	(E) Fuel at block-on
(B) Fuel uplift	(F) Fuel uplift
(C) Fuel in tanks after fuel uplift	(G) Fuel in tanks after fuel uplift
(D) Fuel at block-off	(H) Fuel at block-off
Fuel Use Monitoring Method: Fuel Uplift	
Fuel used = B	

FUEL USE MONITORING METHODS

- Method A
- Method B
- Block-off / Block-on
- Fuel Uplift**
- Fuel Allocation with Block Hour

EMP – 3. Emissions Monitoring Options (5 Monitoring Methods – Block Hour)



Fuel Measurement Points	
Before the flight under consideration	After the flight under consideration
(A) Fuel at block-on	(E) Block-on time
(B) Fuel uplift	(F) Fuel uplift
(C) Fuel in tanks after fuel uplift	(G) Fuel in tanks after fuel uplift
(D) Block-off time	(H) Fuel at block-off
Fuel Use Monitoring Method: Fuel Allocation with Block Hour	
Fuel used = Block hour * Average fuel burn ratio	

FUEL USE MONITORING METHODS

- Method A
- Method B
- Block-off / Block-on
- Fuel Uplift
- Fuel Allocation with Block Hour



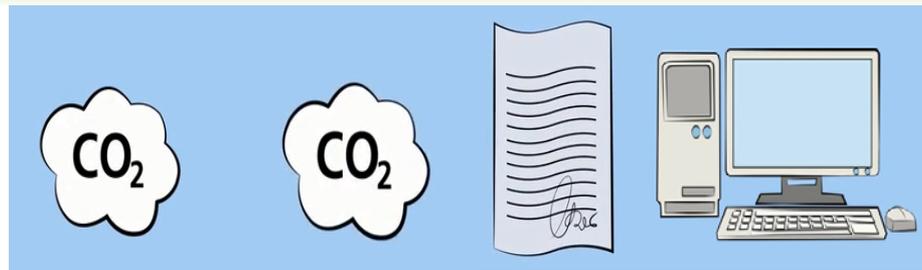
- If the amount of fuel is determined in units of volume, an aeroplane operator shall apply a fuel density value to calculate fuel mass
 - This is the case in, e.g., when fuel uplift is measured in volume
- The operator shall record the fuel density that is used for operational and safety reasons
 - Density is usually recorded e.g., in an operational, flight or technical log
 - Fuel density value may be:
 - An actual fuel density value; or
 - A standard value of 0.8 kg per litre
- The operator shall detail the procedure for informing the use of fuel density in the EMP, along with a reference to the relevant documentation

Reference: Annex 16, Volume IV, Part II, Chapter 2, 2.2.3



EMP Contents

1. Aeroplane operator identification
2. Fleet and operations data
3. Methods and means of calculating emissions from international flights
4. Data management, data flow and control



- Aeroplane operator’s internal roles, responsibilities and procedures on data management, and related risks
- Procedures to handle possible data gaps and errors
- Documentation and record keeping plan
- Procedures for communicating the changes in the EMP to the State

Reference: Annex 16, Volume IV, Appendix 4



Monitoring of CO₂ Emissions – Review of the Emissions Monitoring Plan



- The State and aeroplane operator should maintain clear and open communication during the development and review of an EMP
 - The State shall engage with the aeroplane operator to resolve any outstanding issues in the EMP
- The State shall review and approve aeroplane operator's Emissions Monitoring Plan
- Guidance material on Emissions Monitoring Plans is included in the Environmental Technical Manual (ETM), Volume IV

Reference: Annex 16, Volume IV, Part II, Chapter 2, 2.2.2, and Appendix 4

Development of an Emissions Monitoring Plan – Recap of Actions and Dates

2018

2019



Reference: Annex 16, Volume IV, Part II, Chapter 2, 2.2.2, and Appendix 1

- **Recommendation:**
 - By 30 September 2018: an aeroplane operator to submit an EMP for approval
 - By 30 November 2018: State to approve the EMP
- **Mandatory submission on an EMP by 28 February 2019. Approval by 30 April 2019.**
- **New entrants to submit an EMP to their State within three months of falling under the applicability of MRV requirements**



- If an aeroplane operator does not have an approved EMP as of 1 January 2019:
 - The operator shall monitor CO₂ emissions in accordance with the EMP that it will submit, or has already submitted, to the State.
- If an aeroplane operator does not have sufficient information to use a Fuel Use Monitoring Method:
 - The State can approve the use of the ICAO CORSIA CERT for a period lasting no later than 30 June 2019.



- The aeroplane operator shall resubmit the Emissions Monitoring Plan to the State for approval if “a material change” is made to the Plan
- A material change would affect e.g.:
 - The status or eligibility for an option under the emissions monitoring requirements; or
 - Operator’s approach to monitoring.
- The aeroplane operator shall also inform the State of changes that would affect the State’s oversight, even if the changes do not fall within the definition of a material change, e.g.:
 - Change in corporate name / address.

Reference: Annex 16, Volume IV, Part II, Chapter 2, 2.2.2



Calculation of CO₂ Emissions and Monitoring of CORSIA eligible fuels



- After an aeroplane operator monitors its fuel use in accordance with an approved EMP, it shall calculate CO₂ emissions from the fuel burn
- ICAO CORSIA CERT automatically estimates the CO₂ emissions for aeroplane operators who have been approved to use the CERT
- An operator using a Fuel Use Monitoring Method shall determine the CO₂ emissions by using the following equation:

$$CO_2 \text{ Emissions} = \text{Mass of fuel} * \text{Fuel Conversion Factor of given fuel type}$$

Reference: Annex 16, Volume IV, Part II, Chapter 2, 2.2.3



Fuel Use

Calculate CO₂ emissions

Fuel Conversion Factor

= 3.16 kg CO₂/kg fuel (Jet-A fuel)

and

= 3.10 kg CO₂/kg fuel (AvGas or Jet-B fuel)

Monitored and reported
CO₂ emissions from
international flights

Note – For the purpose of calculating CO₂ emissions the mass of fuel used includes all aviation fuels.

- Information on CO₂ emissions will be reported as a part of an aeroplane operator's Emissions Report

Covered in session #4:
CORSIA MRV System:
Reporting and verification of
CO₂ emissions



- Purchasing and blending records will form the basis for monitoring of the use of CORSIA eligible fuels
- For the purpose of calculating the CO₂ emissions, the mass of fuel used includes all aviation fuel
- The emissions reductions from the use of CORSIA eligible fuels are calculated as part of the CO₂ offsetting requirements



Covered in:

*Session 4: CORSIA MRV System: Reporting and verification of CO₂ emissions; and
Session 6: CORSIA Calculation of CO₂ offsetting requirements*



Timeline	Responsible Party	Activity
30 September 2018	Operator	Submit Emissions Monitoring Plan to State of attribution <i>(recommended)</i>
30 November 2018	State	Approve Emissions Monitoring Plans of operators attributed to the State <i>(recommended)</i>
30 November 2018	State	Submit to ICAO a list of operators attributed to the State
31 December 2018	ICAO	Make available the ICAO document entitled “ CORSIA Aeroplane Operator to State Attributions ”
1 January to 31 December 2019	Operator	Monitor 2019 CO₂ emissions from international flights
28 February 2019	Operator	Submit Emissions Monitoring Plan to State of attribution
30 April 2019	State	Approve Emissions Monitoring Plans of operators attributed to the State
30 April 2019	State	Submit to ICAO: <ul style="list-style-type: none">- List of operators attributed to the State- List of verification bodies accredited in the State
31 May 2019	ICAO	Make available the ICAO document entitled “ CORSIA Aeroplane Operator to State Attributions ”



Questions?



ICAO

ENVIRONMENT



ICAO

North American
Central American
and Caribbean
(NACC) Office
Mexico City

South American
(SAM) Office
Lima

ICAO
Headquarters
Montréal

Western and
Central African
(WACAF) Office
Dakar

European and
North Atlantic
(EUR/NAT) Office
Paris

Middle East
(MID) Office
Cairo

Eastern and
Southern African
(ESAF) Office
Nairobi

Asia and Pacific
(APAC) Sub-office
Beijing

Asia and Pacific
(APAC) Office
Bangkok



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THANK YOU

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