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ICAO's Overall Plan for the Safe Carriage of Lithium Batteries by Air

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Ninth Triennial International Aircraft Fire and Cabin Safety Research Conference
Atlantic City, 28 to 31 October 2019





Overview

- ICAO — what do we do?
- ICAO and transport of dangerous goods by air
- ICAO and transport of lithium batteries by air
 - What we have done
 - What we are doing



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ICAO — What do we do?



ICAO and its Role

The **International Civil Aviation Organization (ICAO)** is a UN specialized agency, created in 1944 upon the signing of the *Convention on International Civil Aviation* (Chicago Convention).





ICAO — How Does it Work?

Assembly (193 Contracting States)



Council (36 Contracting States)



Commission and Committees



Secretariat

Panels of the ANC
Airworthiness
Flight Operations
Dangerous Goods
Safety Management
...



Nineteen Annexes to Chicago Convention

- *Annex 1 — Personnel Licensing*
- *Annex 2 — Rules of the Air*
- *Annex 3 — Meteorological Service for International Air Navigation*
- *Annex 4 — Aeronautical Charts*
- *Annex 5 — Units of Measurement to be Used in Air and Ground Operations*
- *Annex 6 — Operation of Aircraft*
- *Annex 7 — Aircraft Nationality and Registration Marks*
- *Annex 8 — Airworthiness of Aircraft*
- *Annex 9 — Facilitation*
- *Annex 10 — Aeronautical Telecommunications*
- *Annex 11 — Air Traffic Services*
- *Annex 12 — Search and Rescue*
- *Annex 13 — Aircraft Accident and Incident Investigation*
- *Annex 14 — Aerodromes*
- *Annex 15 — Aeronautical Information Services*
- *Annex 16 — Environmental Protection*
- *Annex 17 — Security — Safeguarding International Civil Aviation against Acts of Unlawful Interference*
- *Annex 18 — The Safe Transport of Dangerous Goods by Air*
- *Annex 19 — Safety Management*





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Safe Transport of Dangerous Goods

International Standards and Recommended Practices



Annex 18
to the Convention on International Civil Aviation

The Safe Transport of Dangerous Goods by Air

This edition incorporates all amendments adopted by the Council prior to 9 March 2014 and superseded, on 17 November 2011, all previous editions of Annex 18.

For information regarding the applicability of the Standards and Recommended Practices, see Foreword and the relevant clauses in each Chapter.

Fourth Edition
July 2011

International Civil Aviation Organization

International Standards and Recommended Practices



Annex 6 to the Convention on International Civil Aviation

Operation of Aircraft

Part I — International Commercial Air Transport — Aeroplanes
Tenth Edition, July 2016



This edition supersedes, on 10 November 2016, all previous editions of Part I of Annex 6.

For information regarding the applicability of the Standards and Recommended Practices, see Foreword.

INTERNATIONAL CIVIL AVIATION ORGANIZATION

International Standards and Recommended Practices



Annex 8 to the Convention on International Civil Aviation

Airworthiness of Aircraft

Twelfth Edition, July 2018



This edition incorporates all amendments and supersedes, on 8 November 2018, all previous editions of Annex 8.

For information regarding the applicability of the Standards and Recommended Practices, see sections 1.1, 2.1, 3.1 and 4.1 of Part 8, and section 1.3 of Parts 8A, 8B, 8A, 8B, 9A, 9B, 9C and 9D, and the Foreword.

INTERNATIONAL CIVIL AVIATION ORGANIZATION

International Standards and Recommended Practices



Annex 19 to the Convention on International Civil Aviation

Safety Management

Second Edition, July 2016



This edition supersedes, on 7 November 2016, all previous editions of Annex 19.

For information regarding the applicability of the Standards and Recommended Practices, see Chapter 2 and the Foreword.

INTERNATIONAL CIVIL AVIATION ORGANIZATION



Amendments to Annexes

- Recommendations
- Preliminary review
- State consultation
- Final review
- Council adoption





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ICAO AND DANGEROUS GOODS



Regulatory Structure

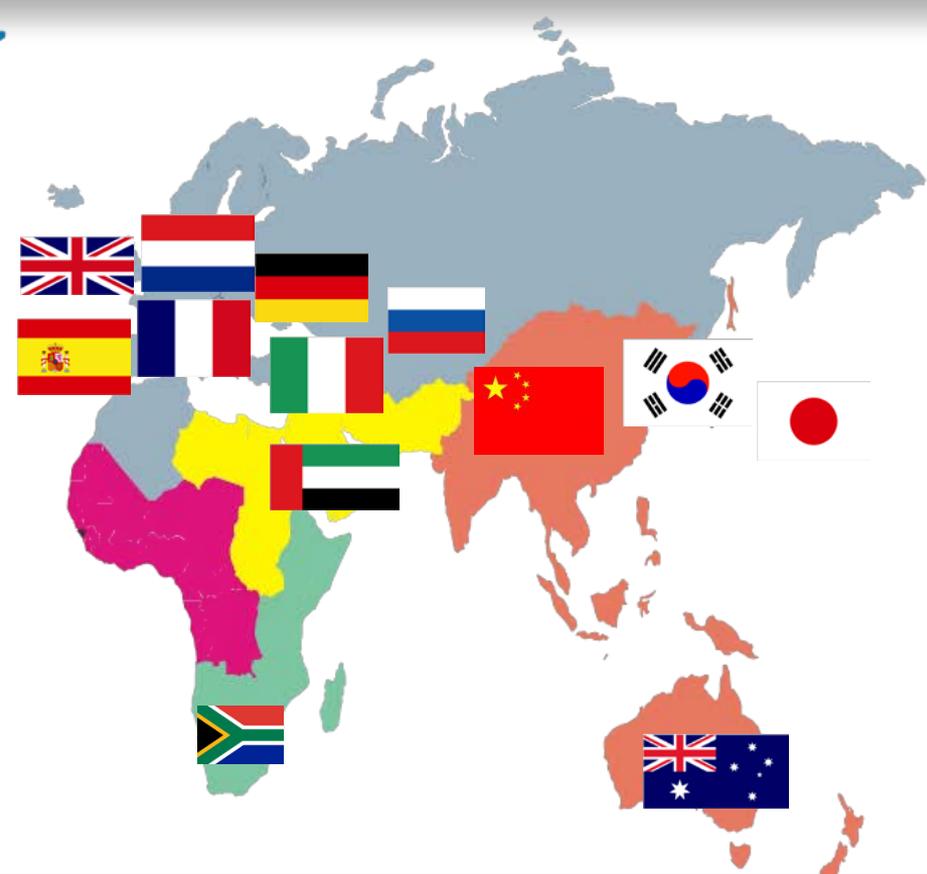
- Annex 18 — The Safe Transport of Dangerous Goods by Air
 - “The Standards and Recommended Practices of this Annex shall be applicable to all international operations of civil aircraft.”
 - “Each Contracting State shall take the necessary measures to achieve compliance with the detailed provisions contained in the Technical Instructions.”

(Annex 18, 2.1.1 and 2.2.1)



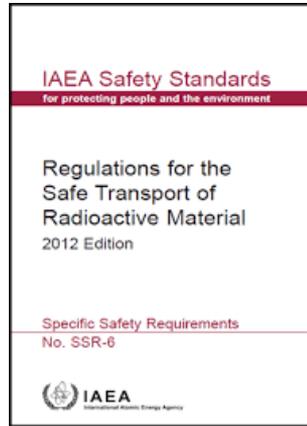
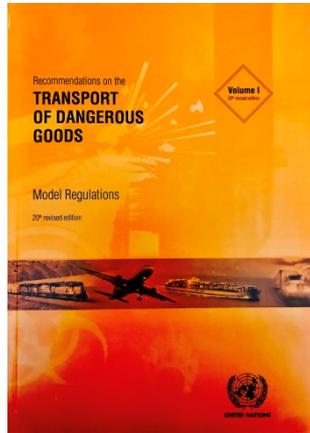


DGP





United Nations and Dangerous Goods





Approving the Technical Instructions



DGP



ANC



COUNCIL

www.icao.int



ICAO and IATA

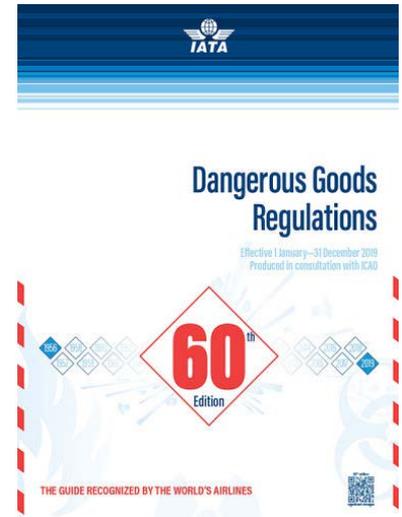
ICAO

- Sole authentic legal source material



IATA

- Based on Annex 18 and Technical Instructions
- Commercial field document
- Practical reference for industry





Risk Mitigation — Package Level

- Hazard identification
- Packing
- Quantity limitations
- Hazard communication
- Certification

SHIPPER

- Acceptance check
- Handling and loading
- NOTOC
- Emergency response
- Passenger provisions

OPERATOR

No
restrictions
on number of
packages that
can be loaded
on aircraft



Classes of Dangerous Goods

- Nine classes
- Class 9 —
Miscellaneous
dangerous goods





Scope and Applicability

- Forbidden under any circumstance on any aircraft
- Forbidden under normal circumstances on passenger
- Forbidden under normal circumstances on passenger and cargo
- Permitted on all aircraft





Cargo Aircraft Only

- When
 - Larger quantities
 - Forbidden on passenger aircraft
- Why
 - Accessibility
 - Greater range of actions in an emergency





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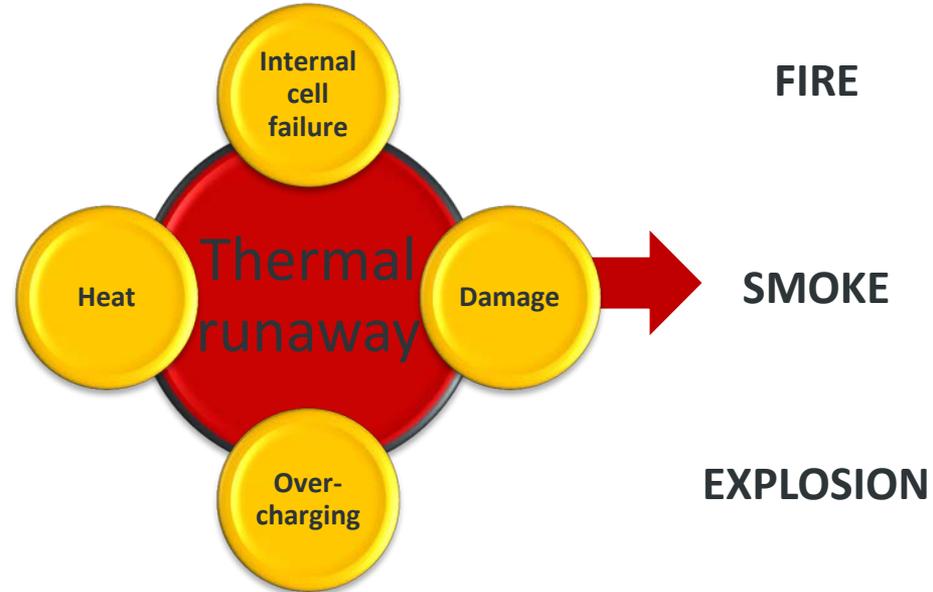


ICAO AND LITHIUM BATTERIES



Lithium Batteries — Hazards

- Source of fuel + Ignition source
 - Flammable electrolytes
 - Thermal runaway
 - Propagation
- Outcome of thermal runaway event
 - Battery size, density, chemistry, design, manufacturer





Are package level limitations still enough?





Air Transport Safety Concerns

A growing body of test data identifies that existing **cargo compartment fire protection systems ... are unable to suppress or extinguish a fire involving significant quantities of lithium batteries**, resulting in reduced time available for safe flight and landing of an aircraft to a diversion airport. Continuing to allow the carriage of lithium batteries within today's transport category aircraft cargo compartments is an **unacceptable risk** to the air transport industry and flying public.

International Coordinating Council of
Aerospace Industries Associations
(ICCAIA)





ANC Panels

- FLTOPSP, AIRP
 - Conduct **safety risk assessment** before continuing to transport lithium batteries as cargo on aircraft
- DGP
 - Ban will increase non-compliance
 - Additional restrictions better approach

Battery chemistry/
hazard

Battery
quantities/density

Aircraft fire
protection features

Location of
batteries in cargo
compartment

Proximity to other
dangerous goods

Shipper
compliance



Lithium Batteries — Where we are Now

- Lithium metal — prohibited on passenger aircraft (January 2015)
- Lithium ion — prohibited on passenger (April 2016)
- Additional restrictions for cargo aircraft from 1 April 2016 including reduced state of charge





Lithium Batteries — Three Safety Measures Needed

- Performance-based package standard
- Appropriate hazard communication
- Provisions for safety risk assessments



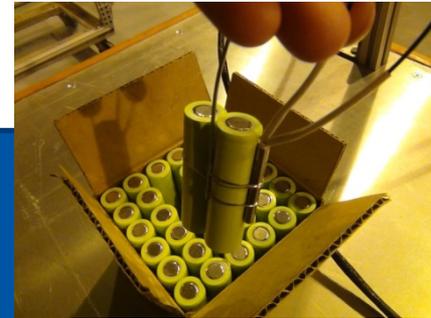


Performance-Based Package Standard

- Battery/packaging combination safe for transport
- Controversial issues
 - Beyond baseline test
 - External fire
- Differing needs



International Lithium Battery
Packaging Committee





Lithium Battery Hazard Communication

- Class 9 — Miscellaneous does not effectively communicate the hazard
- New classification by UN working group





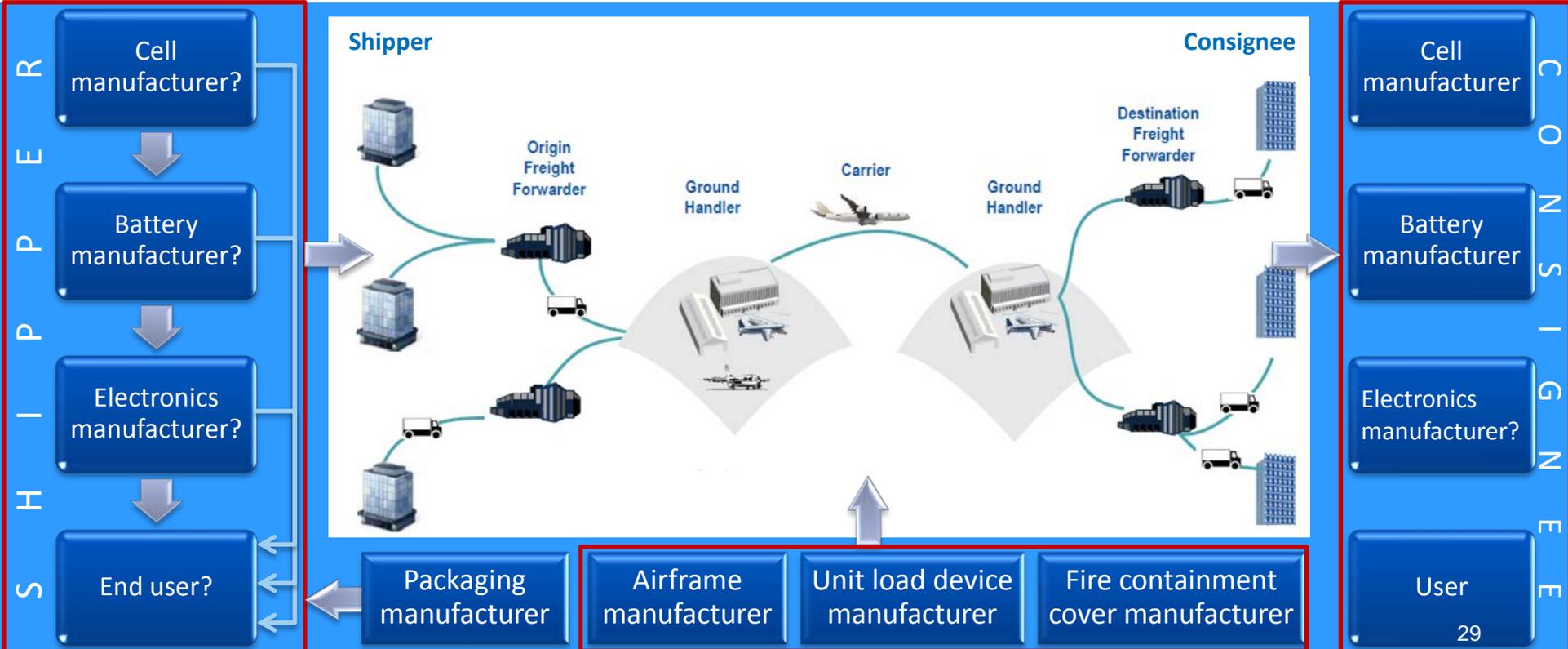
Amendment to Annex 6

- New Chapter 15
 - Cargo compartment safety
 - Specific safety risk assessment
 - Cargo compartment fire protection capabilities in the aeroplane flight manual or other documentation supporting the operation of the aeroplane
 - Policy and procedures that address items to be transported in the cargo compartment





Lithium Battery Air Cargo Transport System





Cargo Transport Safety

- Multidisciplinary Approach
 - Safety management
 - Operations
 - Airworthiness
 - Security
 - Dangerous goods

Safe Carriage of Goods
Specific Working
Group of the Flight
Operations Panel



Are these Measures Enough?

- Rule breakers
 - Undeclared shipments
 - Unintentional
 - Deliberate
- Rule resisters
 - Battery industry versus aviation industry





A Risk-Based Approach

- Prescriptive approach
 - Provisions need to be simplified
 - Ineffective on its own
- Assessment of shipments using safety management principles
- Safety management and dangerous goods in Annex 18
- Safety culture
 - Single most important influence on safety management





Rules? What Rules?





Rule Breakers and Resisters

- Unaware they exist
- Too difficult to follow
- Don't think they are necessary
- “Nobody else is doing it”
- Too costly
- Profit
- Different safety threshold

Why?



Compliance

- Raise awareness
- Explain the consequences
- Lead by example
- Simplify!
- Improve safety culture

Know “why” to
know “how”



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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



THANK YOU