Sixth joint IATA–UPU webinar

MAIL TRANSPORT CHALLENGES

15 May 2024, 13.00–15.00 CEST (UTC+2)

Online via Zoom – *in English only*

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Senior Manager, E-Commerce & Cargo Operations, International Air Transport Association

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Coordinator, Postal Supply Chain, Universal Postal Union

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VP and Executive Director, Electrochemical Safety Research Institute (ESRI), UL Research Institutes

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Programme

1 *Introduction*

– ***Matthew Tang**, Senior Manager, E-Commerce & Cargo Operations, International Air Transport Association*

– ***Ján Bojnanský**, Coordinator, Postal Supply Chain, Universal Postal Union*

2 *EU ICS2 R2: transit/transhipment update*

– ICS2 filing for transit and transhipment mail – the IPC COMETS experience
***Jörgen Van Mook**, Head, Network Management & Innovation, International Post Corporation*

– Lessons learned from ICS2 Release 2 implementation from a Post's perspective
***Carlos Eduardo Gomes Lontra Pires**, Analyst X, CS/DINEG/SUPRO/DEINT/GDPI and UPU Regional Postal Security Manager, Empresa Brasileira de Correios e Telégrafos*

– Airmail reporting status and open challenges from a carrier's perspective
***Rani Joseph George**, Senior Manager, Customs & Authorities, Lufthansa Cargo*

Programme (cont.)

3 *Batteries in airmail*

– USPIS best practices for transport of equipment containing lithium-ion batteries
***Gerald Gales**, Program Specialist, Aviation Security/ Hazardous Materials, United States Postal Inspection Service*

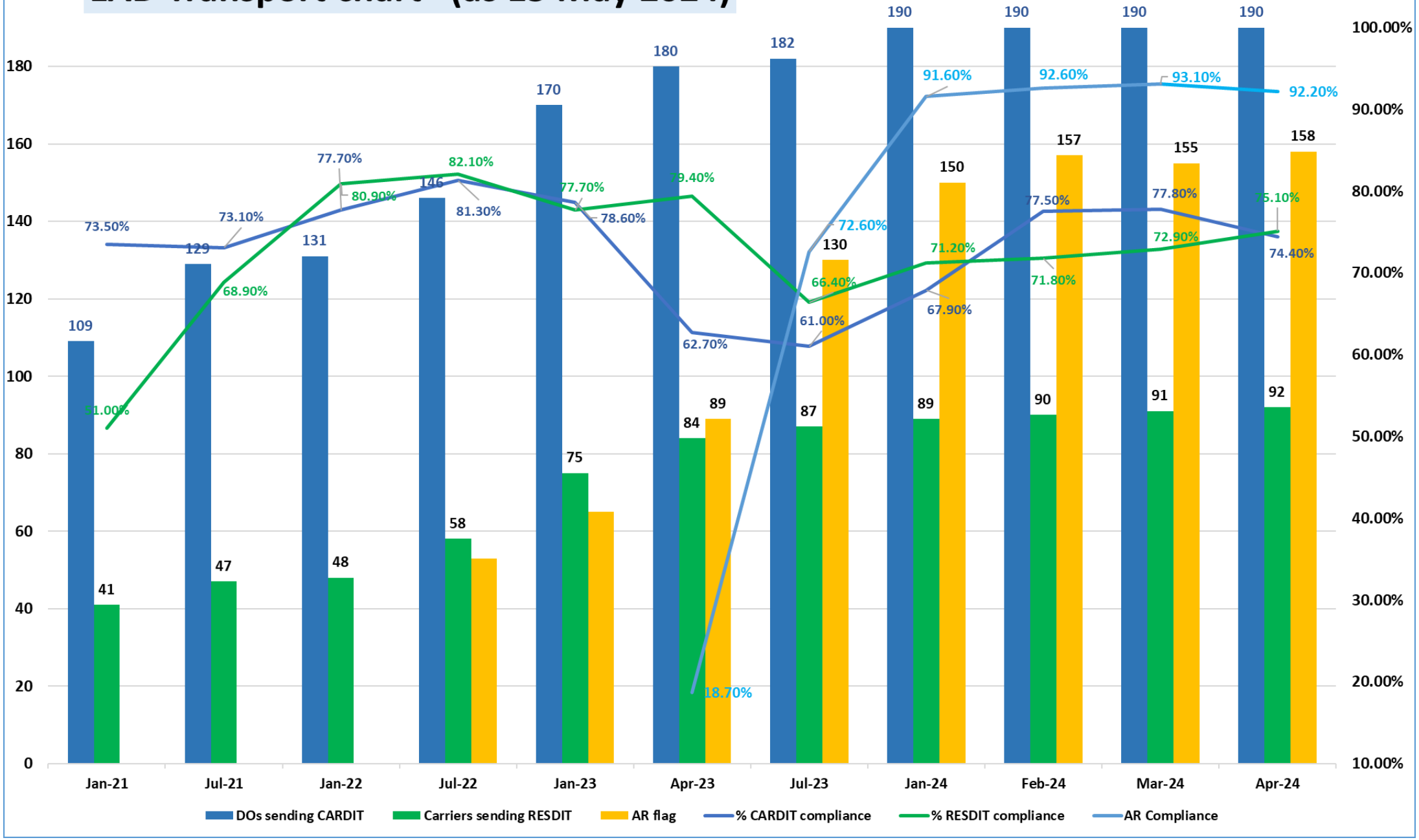
– Batteries in airmail: permitted vs prohibited
***Ben Firkins**, Head, Cargo Safety and Dangerous Goods, International Air Transport Association*

– Safety challenges of lithium-ion cells and batteries
***Dr Judy Jeevarajan**, VP and Executive Director, Electrochemical Safety Research Institute (ESRI), UL Research Institutes*

4 *Closing*

– Brief summary

EAD Transport chart (as 15 May 2024)



April 2024

EAD-readiness KPI Dashboard

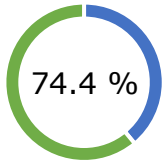
CARDIT/RESDIT

190
Number of DOs sending CARDIT

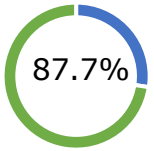
158
Number of DOs sending CARDIT AR flag

92
Number of carriers sending RESDIT

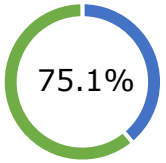
CARDIT compliance

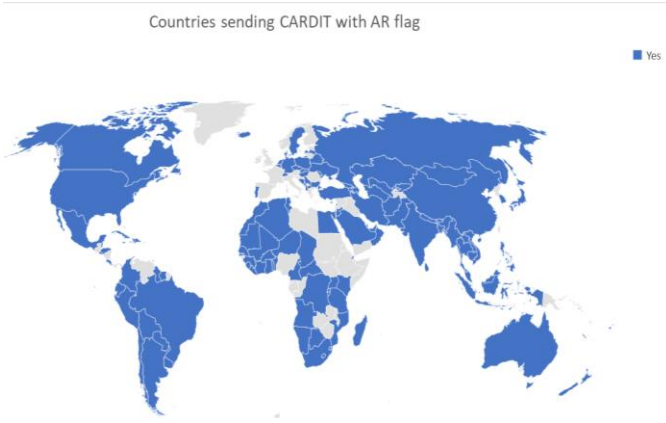


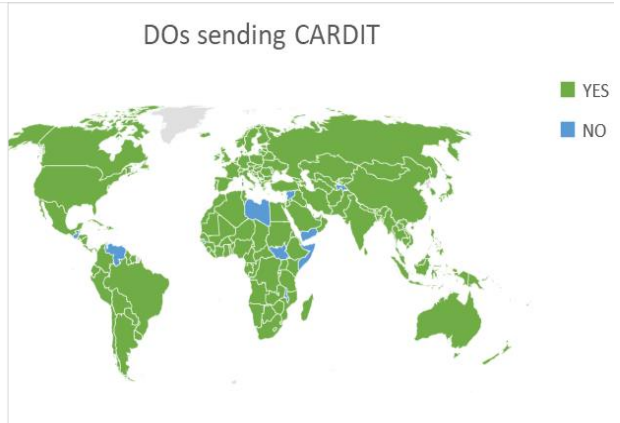
CARDIT AR flag compliance



RESDIT compliance





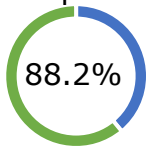


ITMATT

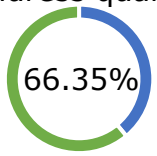
204
Number of DOs sending ITMATT

ITMATT over PREDES

ITMATT compliance



ITMATT address quality



ITMATT with no response from ITMREF destination

ITMREF

29
Number of DOs sending ITMREF

134
Number of DOs receiving ITMREF

General

98*
Mandatory EAD countries

60
Number of DOs signatories to MDSA

***98 countries, 100 DOs**

Response time – time between ITMATT and ASC	
0–2 hrs.	97.83%
2–4 hrs.	1.96%
4–6 hrs.	0.03%
6–12 hrs.	0.01%
12–24 hrs.	0.04%
24–48 hrs.	0.00%
48-72 hrs.	0.00%
+72 hrs.	0.13%
No ASC	0.00%

Percentage last ITMREF responses	**April (1st - 30th) total items 7,370,242**
EXEMPT	3.11%
PENDING	0.13%
ERR	3.60%
ASC	93.17%
RFI (unresolved)	0.01%
RFS (unresolved)	0.00%
DNL	0.00%

Sources: UPU and IPC

COMETS

ICS2 filing for transit and transhipment mail

Presented by IPC

Classification: Confidential

8 pages

15/05/2024

CORPORATE

OPEN/CLOSED TRANSIT

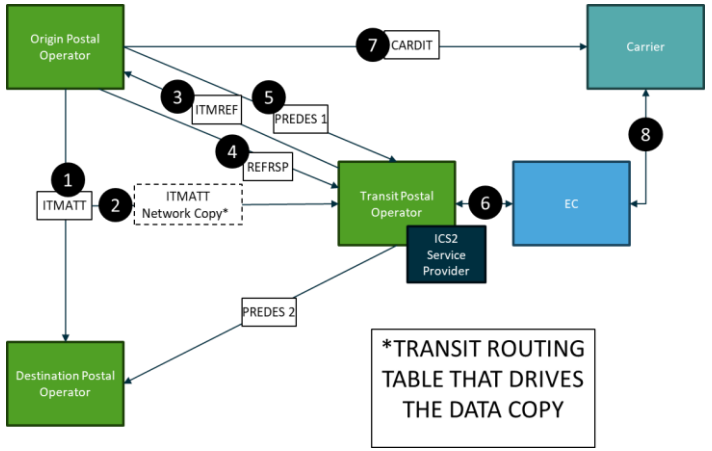
Recap ICS2 Requirements

- **Open/Closed Transit**
  - Transit Operator is responsible to do an ICS2 Filing in the transit country on item level and receptacle level
  - Filing needs to be done **pre-loading** but in case this is not done transit operator need to do the filing when the item is in transit
  - Transit Operator can issue referrals to origin postal operator
  - Origin Postal Operator cannot dispatch items with open referrals

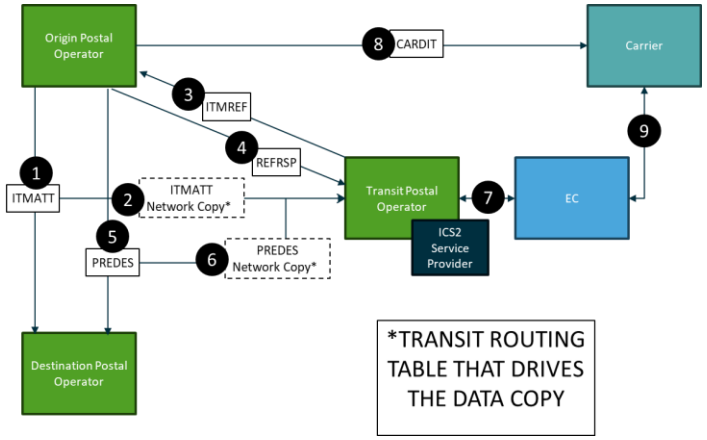
- **Challenges**
  - Transit Operator does not have all required data
  - The actual route of items can be different from the planned route

- **Solution**
  - Work with **a configuration table with planned transit routes**
  - All **data will be copied on network level to the transit DO** via the UPU and IPC (GXS) networks
  - The **ICS2 Service provider will use the data to do the required ICS2 filings**

Recap Data Flow Open Transit



Recap Data Flow Closed Transit



OPEN/CLOSED TRANSIT

IPC COMETS Status Open/Closed Transit Solution (OCTA)

- **From approval to deployment**
  - 11th of January 2024 the COMETS UG approved funding to develop the Open and Closed Transit solution modules (OCTA)
  - OCTA went into **UAT 28 March 2024**
  - OCTA went into **production 16 April 2024**
  - A procedure described in the "Prerequisites and Checklist for Open and Closed Transit mail filing" is being designed between UPU and IPC for postal operators to activate transit filings
  - The roll out and deployment will proceed in line with this procedure

- **Current status**
  - The technical solution is **working as designed**
  - The first transit lanes for **about 4 postal operators are in production** and doing filings for transit items
  - The tool to do manual filings in case there is no planned routes are defined will be deployed in production in the 2nd half of May 2024

- **Solution limitations**
  - **Only one given route (origin to destination) for a given service indicator or item range, only one transit operator can be defined**
  - Solution will offer the possibility to cancel filings in one country to manually refile in another country if the actual route is going over another country
  - If an actual route is not going of EU/ICS2 region at the end, EU indicated that this is not an issue. These filings will never have an IE3F44 or IE3F42 filing and will be discarded after 200 days.

OPEN/CLOSED TRANSIT

First Test Routes Active

- **UPU is actively working with non-EU and EU/ICS2 operators to test transit routes**

- **The following lanes are active in test**
  - BRA -> PLA -> UAA
  - GEA -> PLA -> UAA

- **There are additional routes in the pipeline, e.g.**
  - BRA -> NLA -> AMA – pending confirmation from NL
  - Greenland
  - Faeroe Islands
  - Some African countries

- **To setup transit routes**
  - Reach out to the UPU or IPC
  - Check the prerequisites and follow the checklist

- **Technical impact for non-EU Operators**
  - The technical impact is limited to none for non-EU operators to setup these routes

- **Technical impact for EU/ICS2 Operators**
  - EU/ICS2 Operators work with their ICS2 Service Provider to setup the ICS2 filings

OPEN/CLOSED TRANSIT

International Post Corporation

Pre-requisites and Checklist readiness compliance ICS2 release 2 - Open and Closed transit postal items

- Step 1: there needs to be in place an agreement between transit DO and origin DO to process Open and Closed transit mail on transit routes for which ICS2 ENS filing is required
- Step 2: **Data Sharing Agreement:** the transit DO to check if a **data sharing agreement** needs to be in place with the origin DO in line with respective national legislation, before the transit DO can receive the required data for ICS2 ENS Filing on the agreed transit routes from the Origin DO
- Step 3: **Data use authorization for ENS filing purpose between Transit and Origin DO**:
  - The Transit DO shall obtain authorization to use ITMATT and PREDES data received for the purpose of ENS filing
- Step 4: **Data Copy Agreement between UPU and IPC**:
  - If either Origin DO or Destination DO have the mailboxes to exchange ITMATT and PREDES on IPMX (OpenText/GXS) no further data copy agreement is required for the Transit DO to obtain the data
  - If both Origin DO and Destination DO have the mailboxes to exchange ITMATT and PREDES on UPU POST*Net, the origin DO needs to contact UPU PTC/DOP to receive and sign an authorization form to copy the ITMATT and PREDES on network level to IPC for ICS2 ENS filing. See Appendix 1.
- Step 5: **ENS Filings:** transit DO to contact their ICS2 Service Provider to organise the actual ENS Filing setup. See appendix 2.
- Step 6: If origin DO is currently creating and sending new ITMATT interchanges to the transit DO for the purpose of ICS2 filing the origin DO is expected to discontinue this for transit DO's that use the solution described in this guideline

Important note: With this solution, the origin DO does NOT need to create new ITMATT interchanges towards Transit DO's using this guideline for ENS Filing.

TRANSSHIPMENT

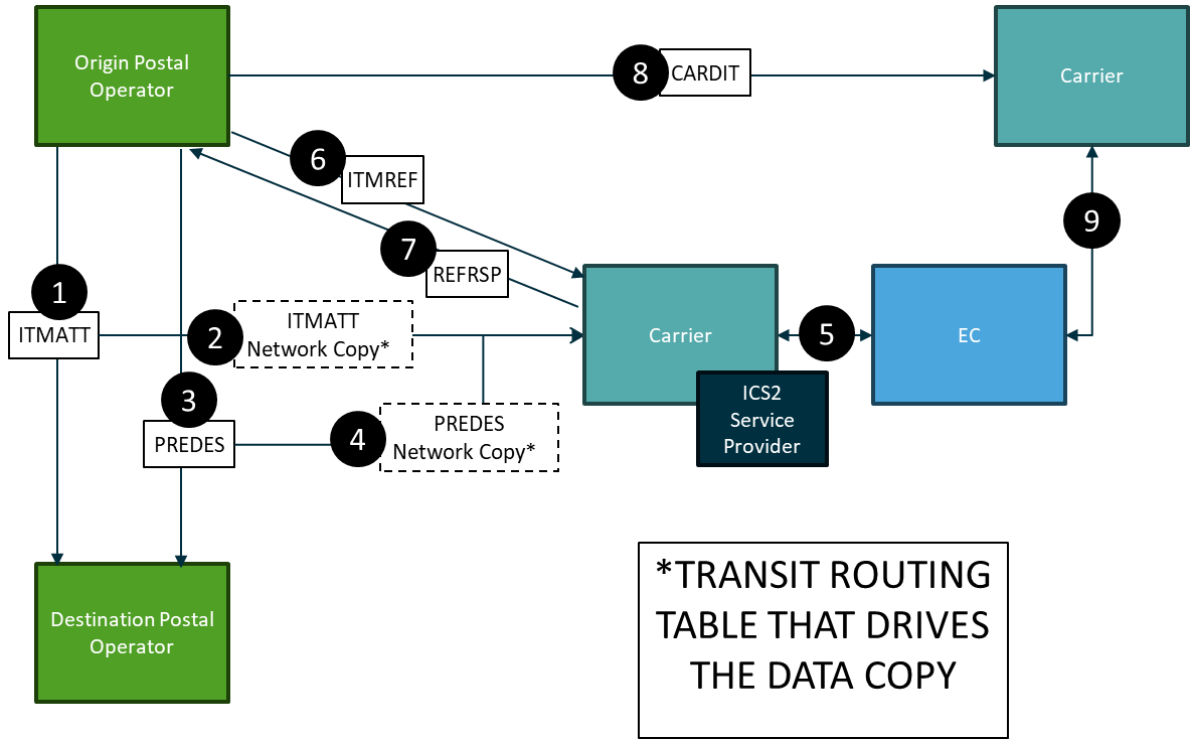
Recap ICS2 Requirements

- **Transshipment**
  - EU is expecting **the party that brings the items into the EU/ICS2 region to do an ICS2 Filing in the transit country** on item level and receptacle level
  - Filing needs to be done **pre-loading** but in case this is not done the filing when the item is in transit
  - The party that did the filing can issue referrals to origin postal operator
  - Origin Postal Operator cannot dispatch items with open referrals

- **Challenges**
  - There is no transit postal operator in the flow, **the airline is the only party with a legal representation in the EU/ICS2 region**
  - **The airlines don't have item nor receptacle level data**

- **Proof of Concept**
  - UPU, IATA, A4E and IPC agreed to do a proof of concept to proof airlines can do technical ICS2 filings

Recap Data Flow Closed Transshipment



- **POC (Proof Of Concept)**
  - IPC executed a **POC in March 2024**
  - ITMATT and PREDES files were obfuscated and translated to IE3F43 and IE3F44 filings
  - Lufthansa was taken has the DECLARANT of the filings, using its EORI number
  - German was the filing member state
  - German customs were involved in the message flow
  - IPC was the IT service provider and the SENDER of the messages
  - Both happy path scenarios as unhappy path scenarios were tested
    - Happy path: Filing – MRN number received – Assessment Complete Received
    - Unhappy path: Filing – MRN number received – RFI or RFS received – Response sent – Assessment Complete Received
- **Conclusions**
  - The solution was concluded **technically successful**
  - No issues were detected
  - German customs confirmed they received the data of the filings
  - European Commission TAXUD confirmed the technical solution works and is feasible

Next steps

- **Possible solution**
  - Based on the successful technical POC, a similar solution as transit can be designed
  - This solution will be based on a **configuration table** where the data is on network level copied to the IT Service Provider that handles the ICS2 filings on behalf of the airlines
  - The airlines will act as DECLARANT of the filings which can be send by an IT Service Provider that can act as the SENDER of the messages
  - The airlines will issue Acknowledgement (ACK) messages, Assessment Complete (ASC) messages and referrals to origin postal operators (via airline mailboxes) which are translated by an IT Service Provider into the UPU postal message format
  - The origin operator responds to these referrals to the airline mailboxes
  - The IT Service Provider is responsible to translate the responses and send it back to the European Commission using the airline as the DECLARANT
- **Limitations**
  - Same limitations as the transit solution – mainly that it assumes pre-planned routes and only one airline can be on a certain route (can be finetuned on service indicator/item range level)
  - Options to tackle these limitations are being evaluated
- **IPC Next Steps**
  - IPC is evaluating if it can act as the IT Service Provider for airlines

6th IATA-UPU Webinar "Lessons learned from ICS2 Release 2 implementation"

EU ICS2 from a non-EU ICS2 Postal Operator's perspective

Presentation by a Postal member

BRAZIL

Carlos **Lontra**

IATA-UPU Webinar, 15 May 2024

Correios

Contents

Introduction – Current Situation

Our objective today is to give a presentation about some lessons learned from ICS2 Release 2 implementation and next steps for 2Q 2024.

General: Goods destined to the EU

Closed Transit and Transhipment

Measures introduced

2023

Jan
AR Flag CARDIT (EU)

Feb
ITMREF-REFRESP Piloting

May
Update IPS and CDS 2022 PNG2.3

Aug
Increase in the number of partners (EU)

Sep
European Commission (EC) Announcement ICS2 R2 - postponement for closed transit and transshipment (2Q 2024)

Oct
IC2 R2 Full

2024

Feb
Revised Agreement (Transit Countries) And CDS Configuration (ITMATT copy)

Apr
Preparation: Signature PTC Authorization to copy POST*Net EDI exchanges for ICS2 Closed Transit And Transhipment

May
Pilot

Correios

Preparation – Summary (Closed Transit and Transhipment)

- **Review Closed Transit Agreement;**
- Advanced Data: Generate/Transmit ITMATT when is posted (CDS) **Copy**;
- **Signature PTC Authorization to copy POST*Net EDI exchanges for ICS2**
- Configure - EDI exchanges (M53 ITMREF and M54 REFRSP) (CDS);
- Manage Pending Referrals (CDS);
- Carry out pilot tests and analyse the outcomes to optimize processes;
- Plan to move to production.

Lessons learned (1 - General)

- Use EAD Status Check (IPS) - Effective
- Noted: Updated UPU systems: (PNG/CDS/IPS)
- Noted: ⬆ CARDIT/RESDIT with the Carriers
- Continue improving data quality: ⬆ ITMATT and CARDIT/ ⬇ ITMREF ≠ ASC
- Promote improvements in data capture and operational flow
- Agility to deal with the referrals (RFI/RFS/DNL/ERR)
- Operational plan: generation of the CARDIT at least 4-6 hours in advance to the RESDIT 74

Lessons learned (2 - Transit)

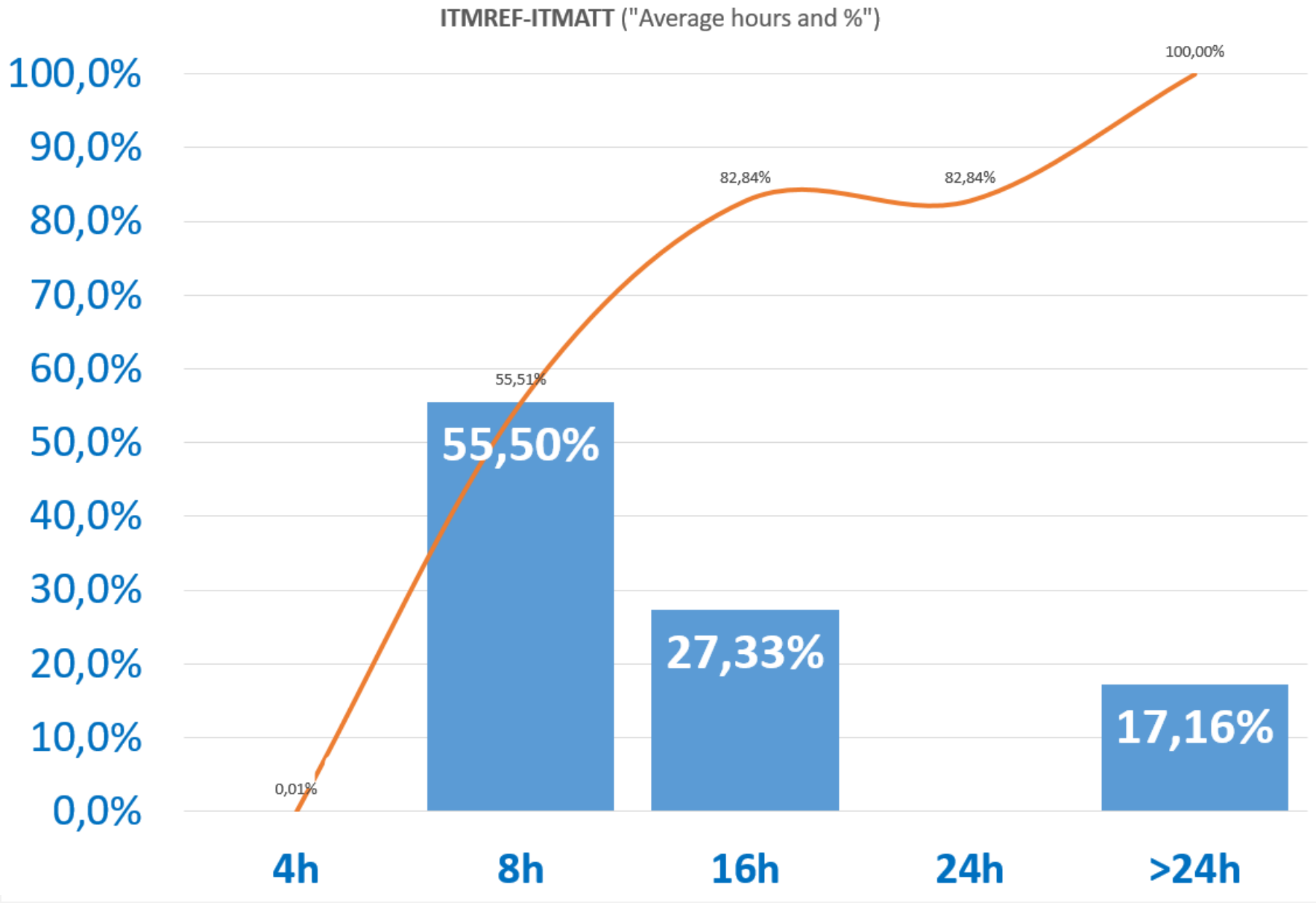
- Review Closed Transit Agreement (Technical cooperation);
- Signature PTC Authorization to copy POST*Net EDI exchanges for ICS2 (“Cover DSA issue”)
- Prevent operational impacts by monitoring/Target:

1) Generate/Transmit ITMATT when is posted - copy
    2) 100% ITMATT (“Goods”)
        3) 100% EMC with ASC
            4) ITMREF-ITMATT keep the shortest times possible
                5) 100% CARDIT

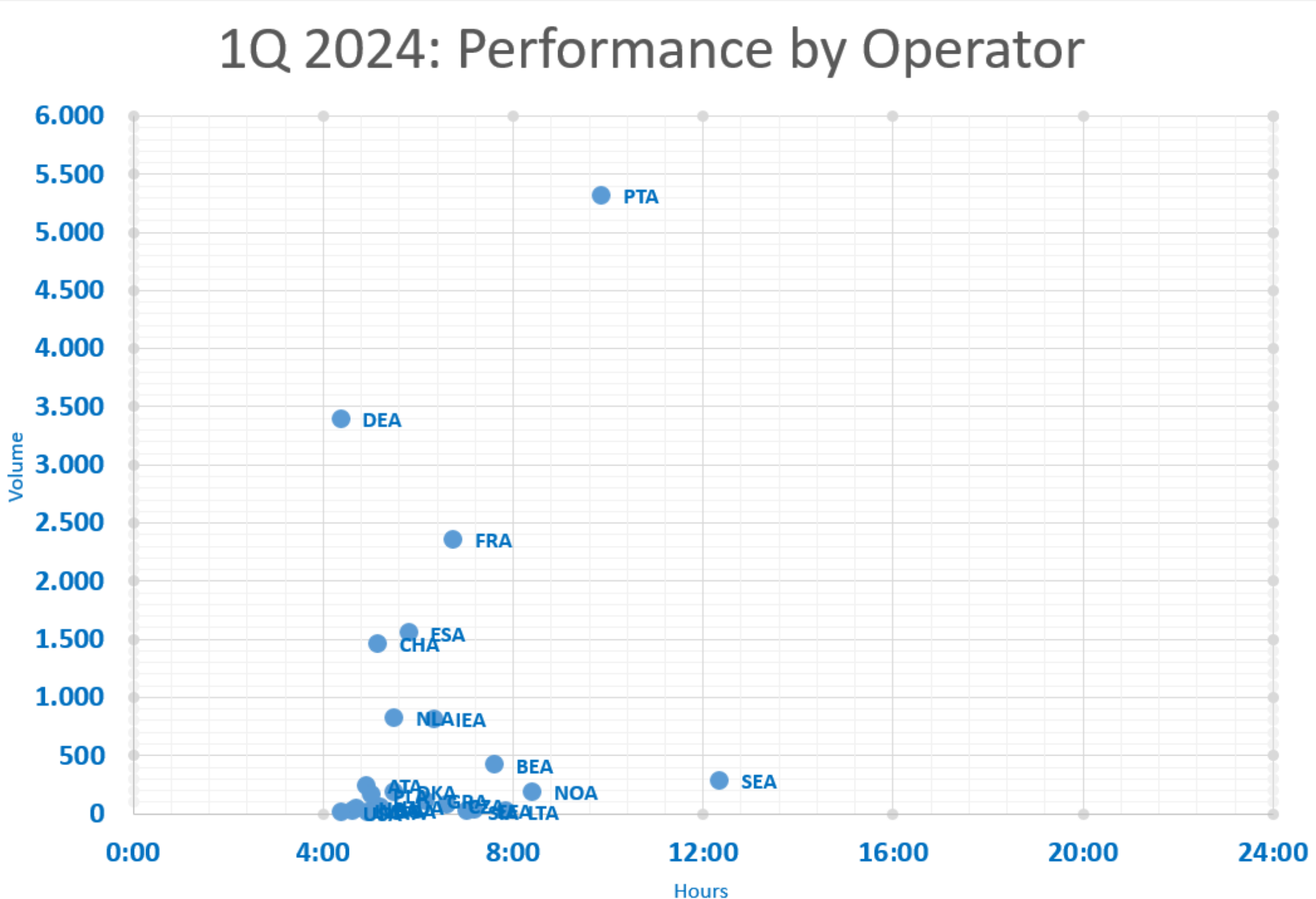
- Sharing experiences with UPU

KPI

ITMATT-ITMREF: 83% <16h (“Global”)



KPI


1Q 2024: Performance by Operator
6.000
5.500
5.000
4.500
4.000
3.500
3.000
2.500
2.000
1.500
1.000
500
0
Volume
PTA
DEA
FRA
ESA
CHA
NLA
IEA
BEA
SEA
ATA
NOA
ALTA
0:00
4:00
8:00
12:00
16:00
20:00
24:00
Hours

Challenges & Observations

1. Continuous improvement of data quality
2. Operational training “Continuously”
3. Operational Planning in the AMU: CARDIT X R74 (Transport)
4. Be prepared for the ITMREF messages: RFS/RFI/DNL
5. Deal with ITMREF messages: ERR
6. Closed Transit (Monitoring the Pilot)
7. Transhipment: Technical cooperation with Carriers – it will be necessary

Correios

Next Steps (2Q 2024)

Closed Transit

- No development was needed to participate
- The pilot was initiated (May 2024) (Monitoring)
- Provide outcomes and lessons learned as soon as possible

Transhipment

- Develop Technical cooperation with the Carriers (in progress) (Carriers)

THANK YOU

UPU / IATA Webinar
Airmail reporting status and open challenges from carrier POV

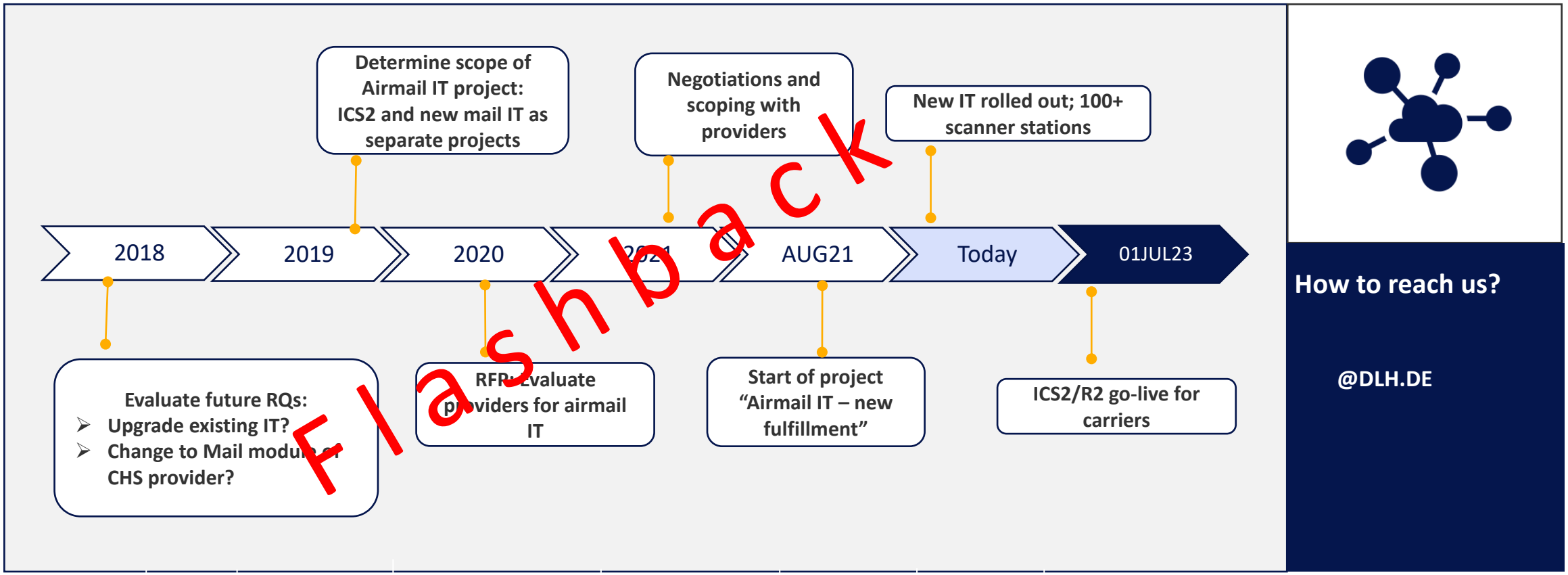
15.05.2024

Rani J. George

Lufthansa Cargo

Timeline of project history to achieve ICS2 readiness (Airmail)

Due to many time constraints and interdependencies in large companies



Status and learnings after 10 months of ICS2

Industry and customs learning curve still ongoing; some challenges remain same

- LH carrier go Live on 3rd July 2023
- Technically smooth; operationally steep learning curve
- Still trying to keep up process compliance; system support is in place, but instable central system performance makes it hard to establish
- Compliance enforcement: no EU destination mail accepted without a CARDIT incl. AR flag and all conditional data elements linked to it since OCT23
- CARDIT rate is good; however not every CARDIT is formally solid

- Customs slowly showing their learning by investigating, exchanging with airlines; compliance slowly monitored for both cargo and mail

Technical challenges

Industry and customs learning curve still ongoing; some challenges remain same

- Carriers receiving CARDITs that do not comply with M48 specification
- Some elements are conditionally mandatory when using AR flag and are **prerequisite** to carrier being able to generate PAWB (needed for ICS2 filing)
    - Shipper/consignee (RFF+ABO/RFF+ACF) plus ORG/DST (RFF+ERN/ RFF+AWN)
- When that happens, even though CARDIT is available carrier cannot ensure filing
- Carriers have had to implement solutions to accommodate this
- Standards are there to make collaboration for stakeholders easy, because everyone speaks the same “language”

    → Please ensure your CARDITs are technically compliant with M48 spec!

Open challenge I:

PN for airmail - communication between carrier and DPOs lacking

Presentation needs to be done referring to pre-arrival filing

- Part of the ICS2 process is the presentation notification, for both cargo and mail
- Not all EU countries have adopted this fully
- Mail will have to be presented to EU customs at point of entry, with a reference to the ENS
- This reference is to the prearrival filing (F42) done by the carrier
- Therefore, a process/channel of communication will have to be established between carriers and postal operators, for carrier to share prearrival MRN with postal operator
- Carriers being approached by EU DPOs about MRN numbers already

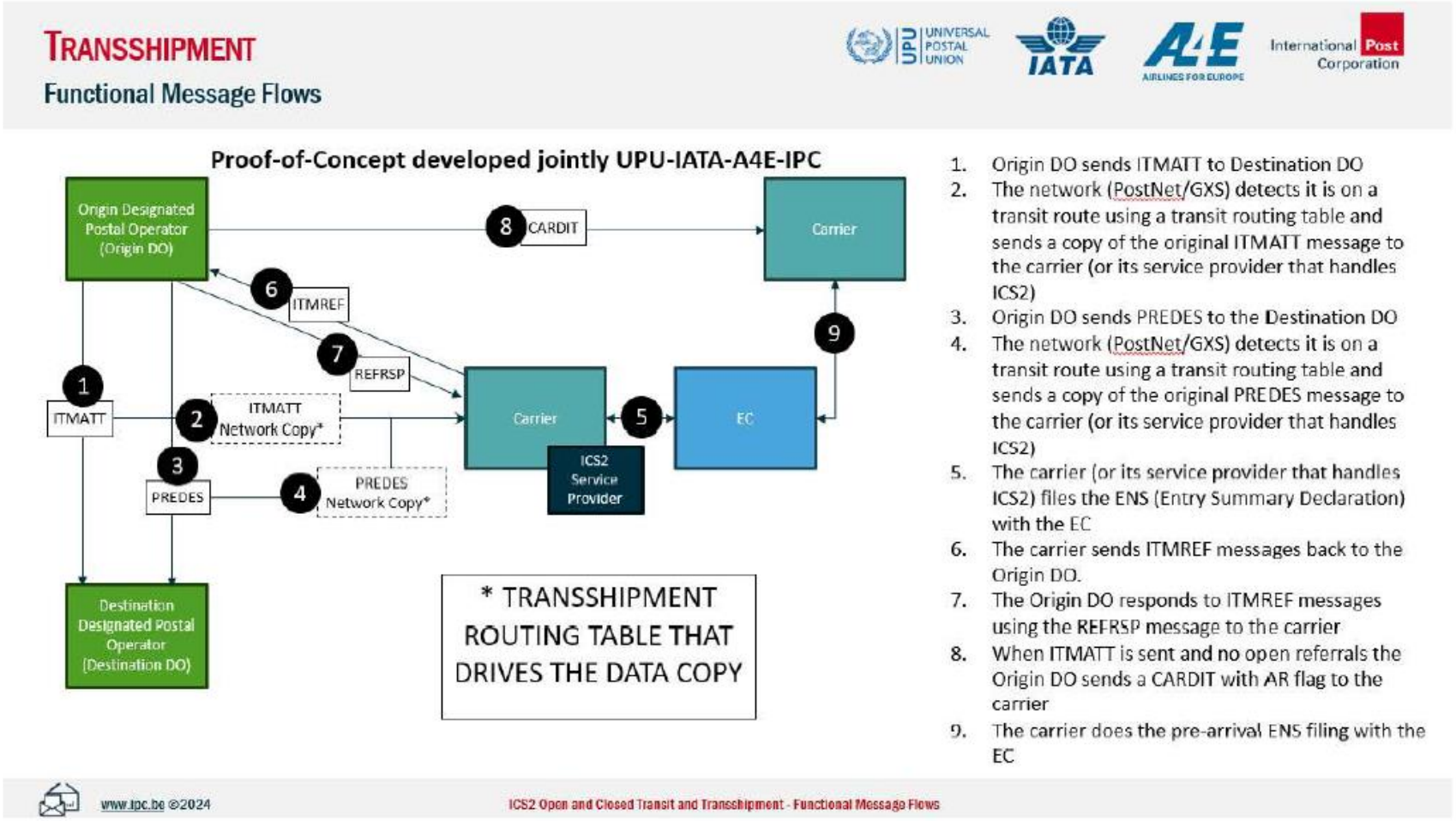
Open challenge II: transshipment reporting mandatory as of April 2024

Enforcement up to MemberStates; POC conducted successfully and hope for solution in sight

- Technical Proof of concept successfully conducted with A4E, IATA, IPC and UPU involvement
- Possible solution involves using ITMATT data already available to UPU/IPC systems to create F44/43 filing for transshipment mail
- ITSP (e.g. IPC) maps ITMATT into ICS2 preloading messages; carrier acts as declarant, origin DPO involvement needed for handling referrals, ensuring only cleared items get handed over to carrier
- DPOs consent required for using the ITMATT data for transshipment filing purpose
- Filings done on a most used lane-carrier principle: e.g. Post from Country A to country C most commonly transported by carrier X via EU country Y
- Next steps:
  - Presenting solution at EU COM TES meeting 22nd MAY
  - Finalize data sharing agreement
  - Clarify commercials

Open challenge II: transshipment reporting mandatory as of April 2024

Schematic summary of possible solution



Appeal to Postal Authorities as valued airline customers

Comprehensive data and support for carrier compliance in transshipment flows

- **Follow** CARDIT **specification**
- If and where possible provide **all data needed for PAWB** creation even if not AR flag set (as currently the case for transshipment):
    - Having Shipper/consignee (RFF+ABO/RFF+ACF) plus ORG/DST (RFF+ERN/ RFF+AWN) available means carrier can at least comply with F42 for transshipment mail flows
- ICS2 Airmail reporting is a **regulatory requirement**
- Not being able to fulfill it means that carriers **might not be able accept** your consignment
- **Let us work together as an industry to keep the wide global postal network as diversified as it exists today!**

Lufthansa Cargo AG
Rani Joseph George
Senior Manager Customs & Authorities

Lufthansa Cargo
Networking the world.

USPIS HAZMAT / DG Update – Lithium Battery Mitigation

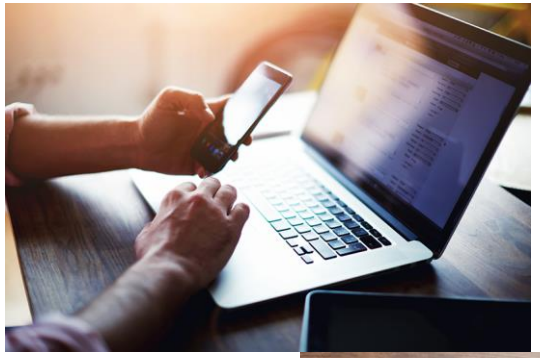
USPIS NHQ HAZMAT Program Specialist - Gerald Gales

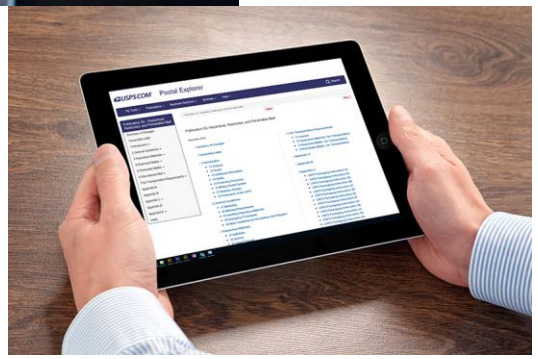
USPIS HAZMAT PROGRAM

“To protect the U.S. Postal Service and its employees, customers, business partners, and infrastructure from threats posed by undeclared and improperly prepared dangerous goods in the mail.”

Lithium Batteries (LB) in the Mail

- Lithium Battery USPS Regulation
- Industry Growth Trends
- Challenges
  - Customer education
  - eCommerce related concerns
  - UN3481/UN3091 Marking International
- HAZMAT LB Control Measures





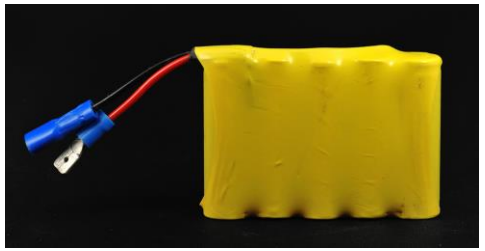
Lithium Battery USPS Regulation

- Section II and Section 1B
- Lithium-ion battery not to exceed 100 Wh.
- Lithium metal battery not to exceed 2.0 grams aggregate lithium content
- International shipments, acceptable only when installed in equipment, no marking allowed.

Lithium Battery Product Growth Trends

Devices / Equipment operated by lithium batteries are:

- Smaller design
- More energy dense, for longer lasting power
- Expansion to more types of materials (i.e., clothing)
- Custom made batteries, not following UN 38.3 test requirements.



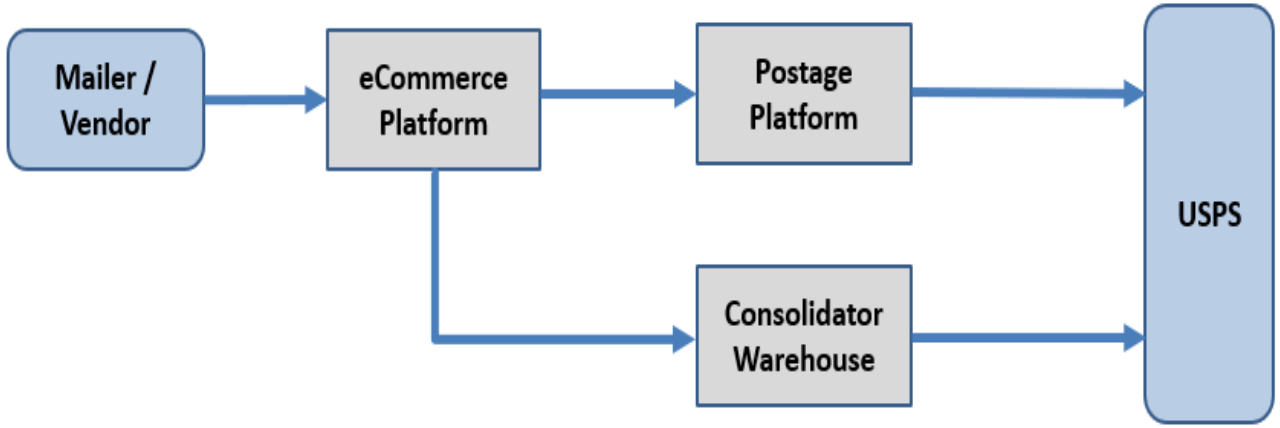
Lithium Battery Challenges – Industry Trends
Trends - Nonmailable (Prohibited)

The Lithium Batteries that power up these types of equipment exceeds the 100 Wh. (Watt Hours) restriction per Pub 52 policy. (i.e., Scooters, Hoover boards, electric skateboards and ebikes)

HAZMAT/ DG Customer Education and eCommerce Challenges

eCommerce Challenges:

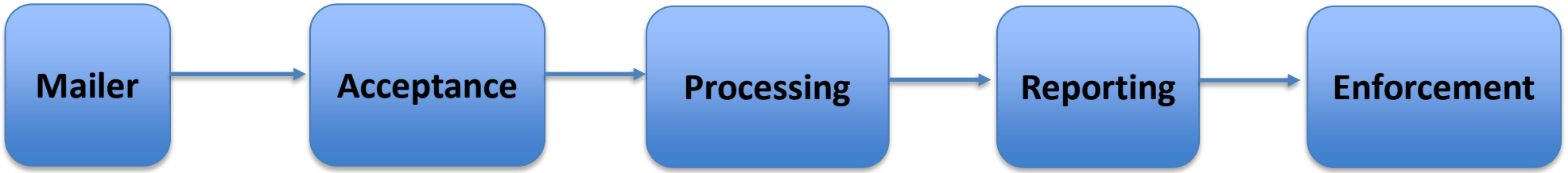
- Improper declaration of HAZMAT (undeclared)
- Improper preparation
- International nexus – Mailer/Vendor located overseas



HAZMAT/DG UN3481 & UN3091 Marking Challenges – International, including APO/DPO/FPO destinations

- Manufacturer Packaging integrated marking
- Applied to all conditions
- APO/DPO/FPO shipments

Enterprise HAZMAT/DG (Lithium Battery) Control Measures



- PSA
- Platform engagement
- EHRS

- Technical updates
- RACG
- Posters
- Training

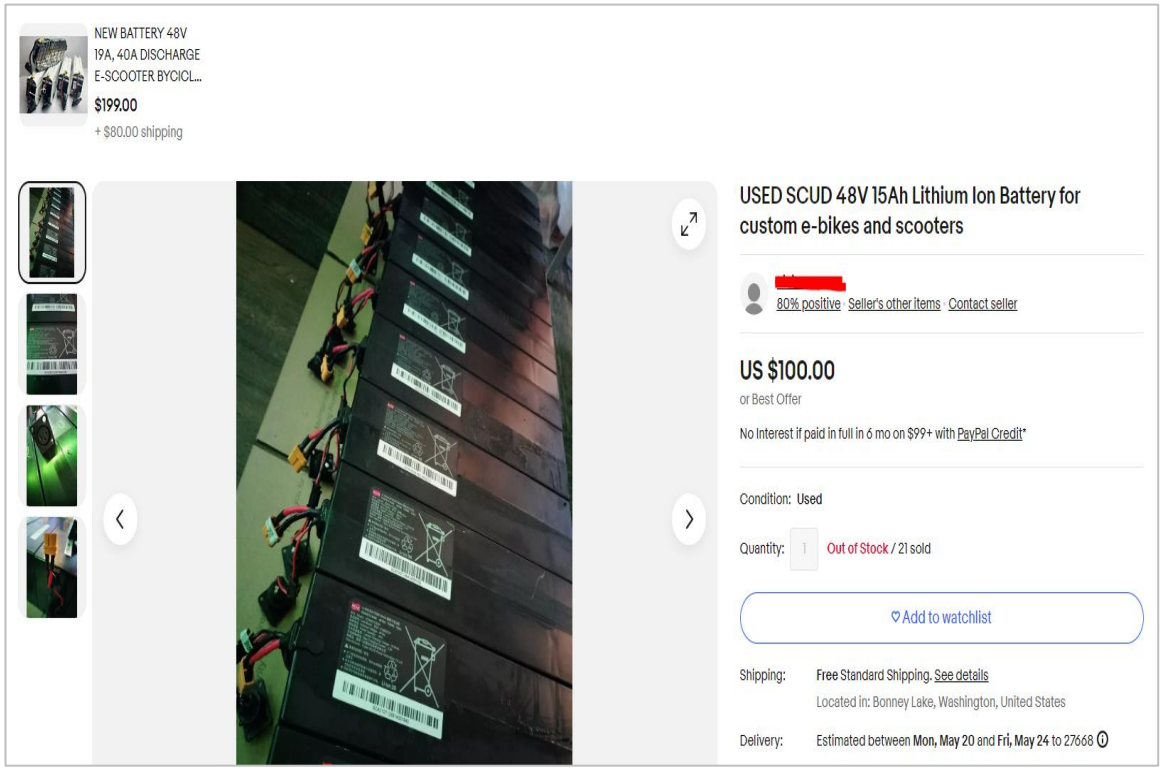
- Automation Label Recognition
- Training
- Visual Aids

- Internal Database
- Doc Portal (external)
- USPS Stakeholder engagement

- Civil Penalty
- HSC engagements

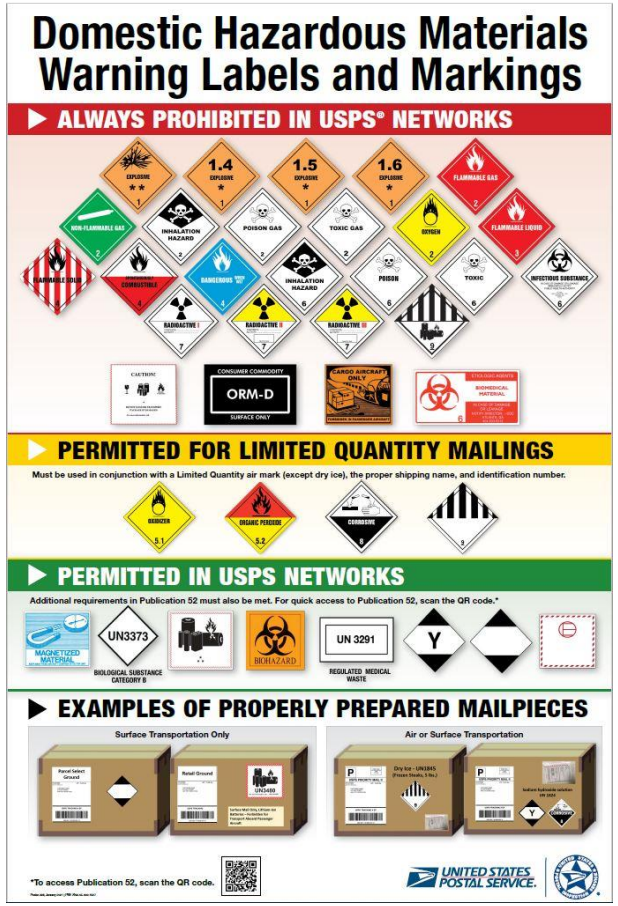
PSA USPIS YouTube Channel - Lithium Battery

eHRS
eCommerce HAZMAT Reporting System



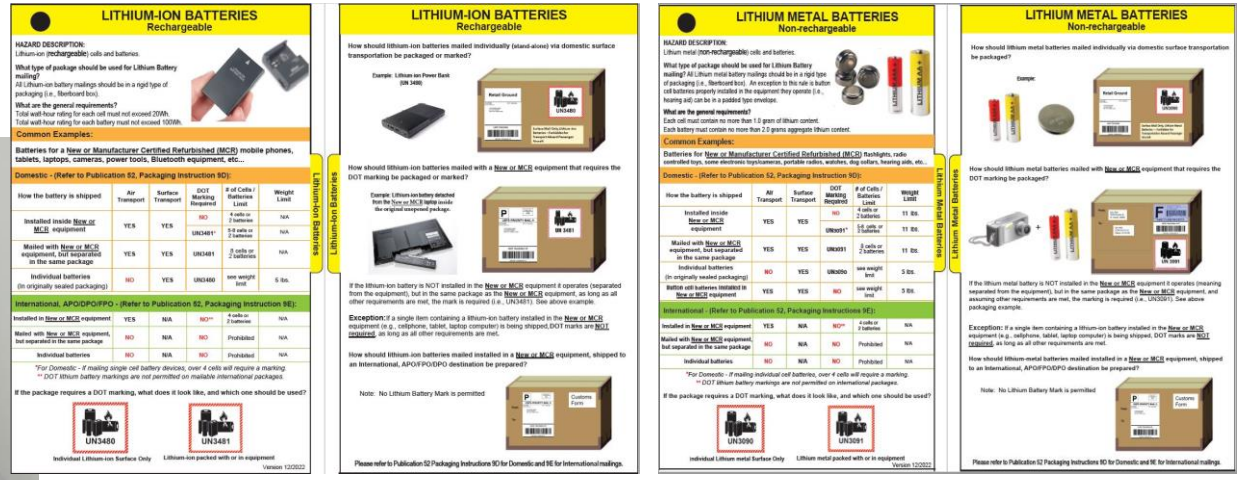
Acceptance and Processing Enhancements

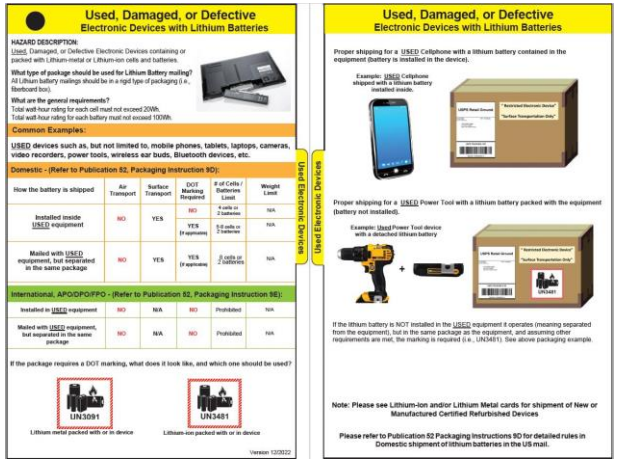
HAZMAT Posters and Labels

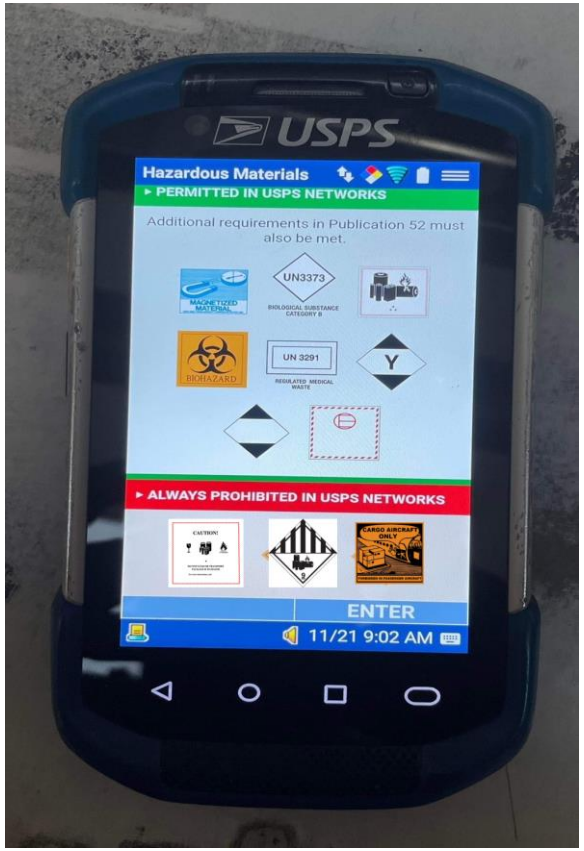


Acceptance and Processing Enhancements

Retail Acceptance Counter Guide and Delivery Scanners

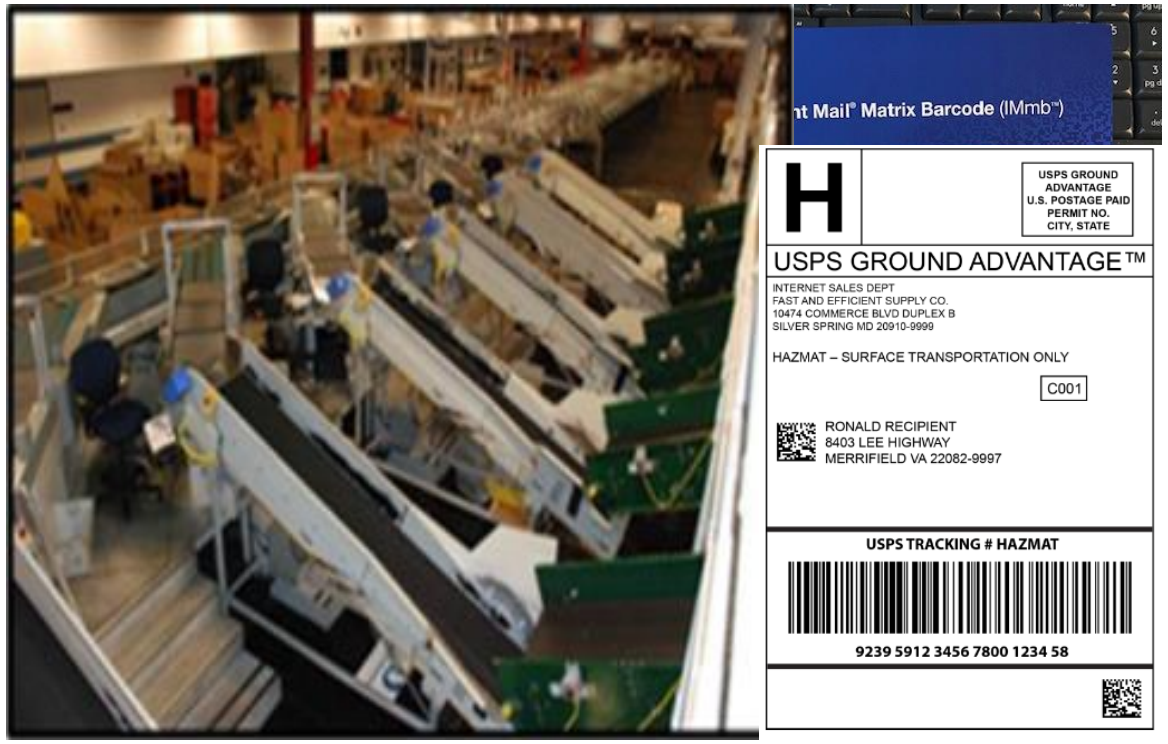






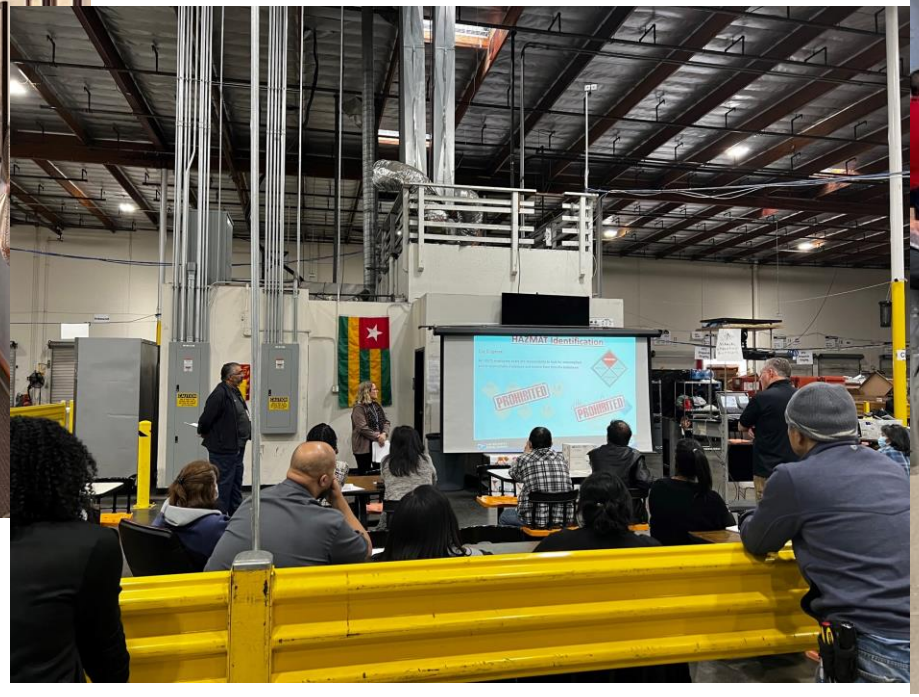
Acceptance and Processing Enhancements

Label Recognition System and HAZMAT indicators (STC)



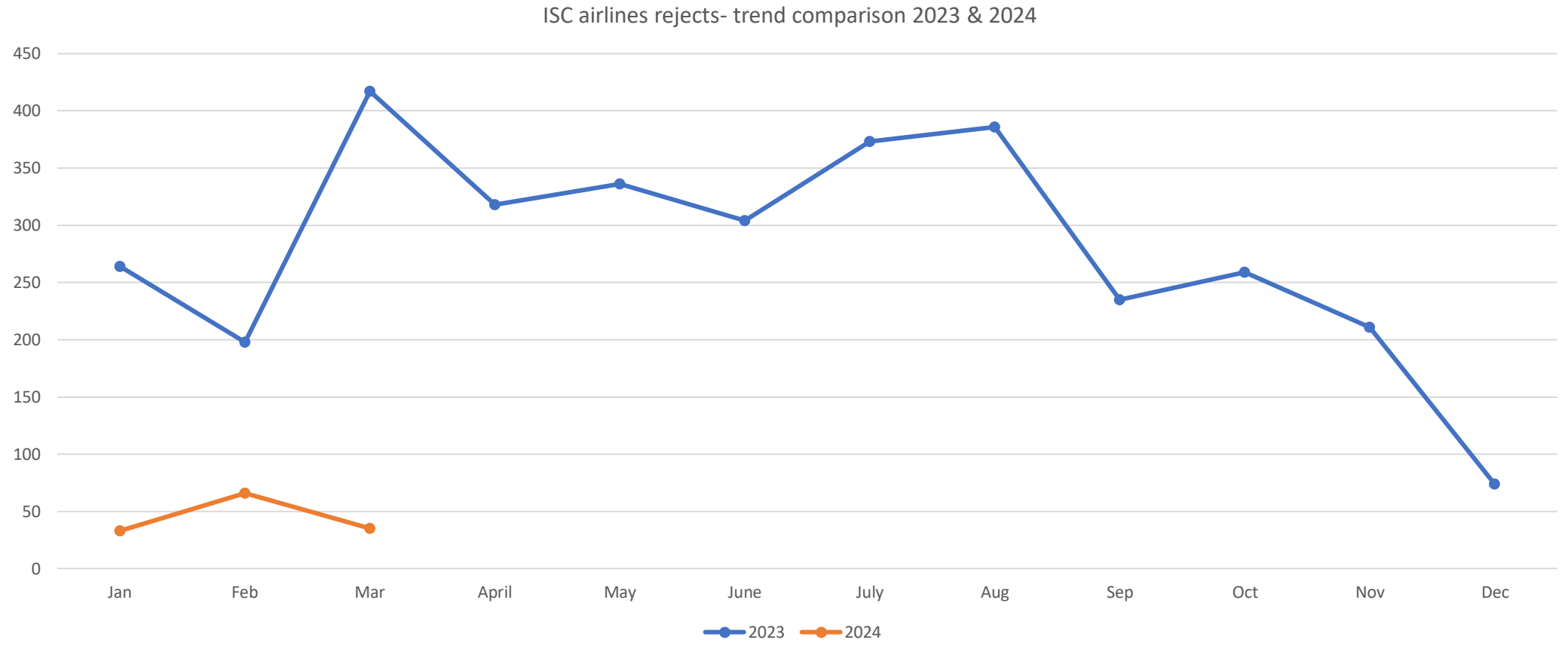
HAZMAT MIRT In-Person Training Initiative

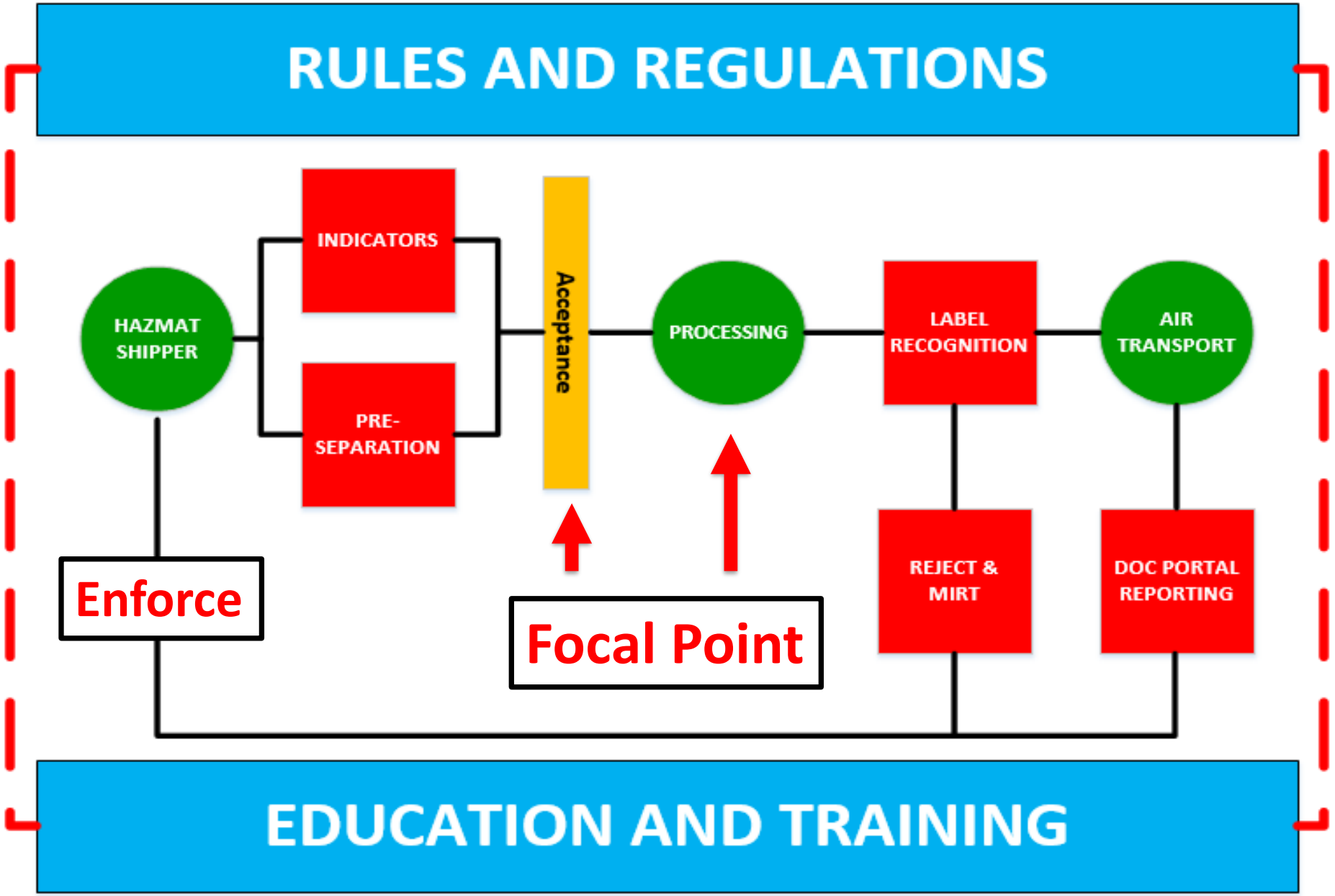
ISC – International Service Center, BMEU, and feeder plants.



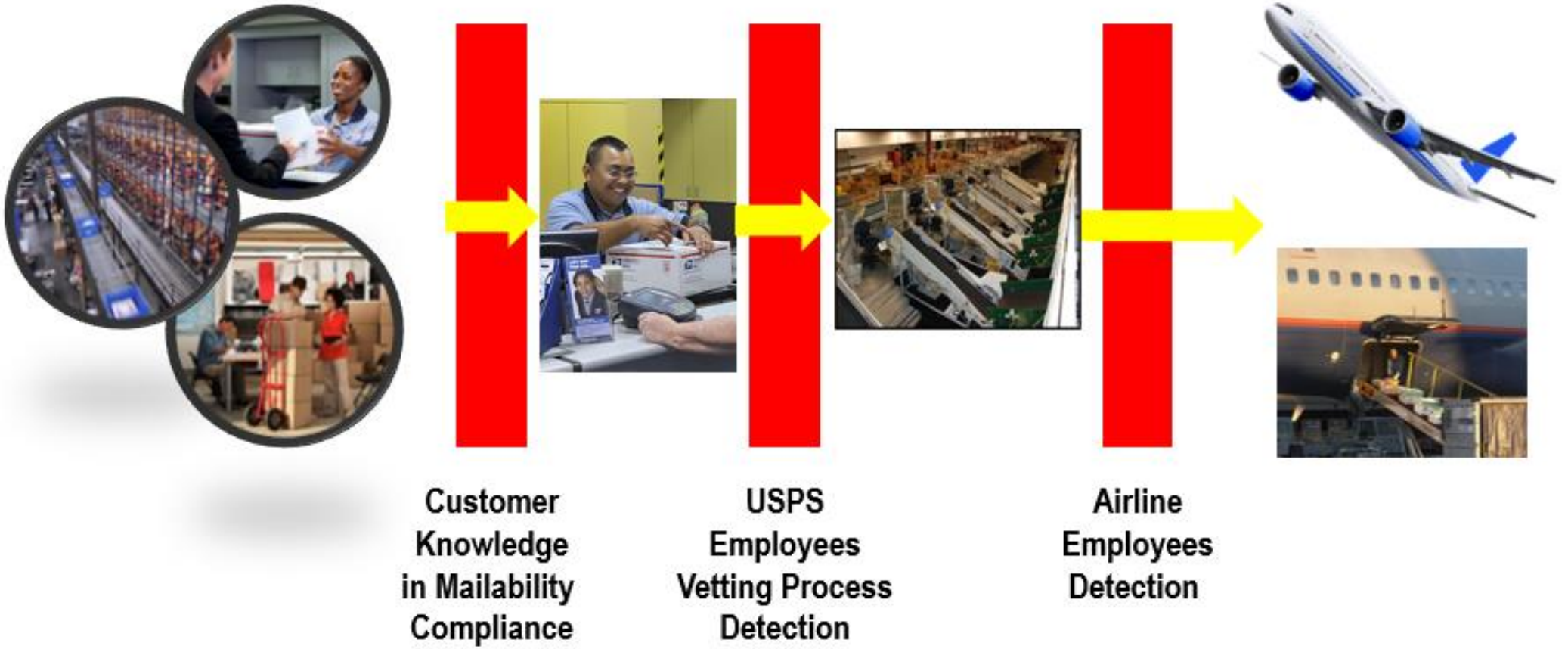
HAZMAT MIRT In-Person Training Initiative

ISC – International Service Center, BMEU, and feeder plants.




RULES AND REGULATIONS
HAZMAT SHIPPER
INDICATORS
PRE-SEPARATION
Acceptance
PROCESSING
LABEL RECOGNITION
AIR TRANSPORT
REJECT & MIRT
DOC PORTAL REPORTING
Enforce
Focal Point
EDUCATION AND TRAINING

Risk Prevention – A Shared Responsibility



THANK YOU!

Gerald Gales
NHQ HAZMAT Program Specialist
U.S. Postal Inspection Service
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Batteries in the Airmail

Prohibited vs Permitted

Agenda

Legal basis

Lithium Batteries

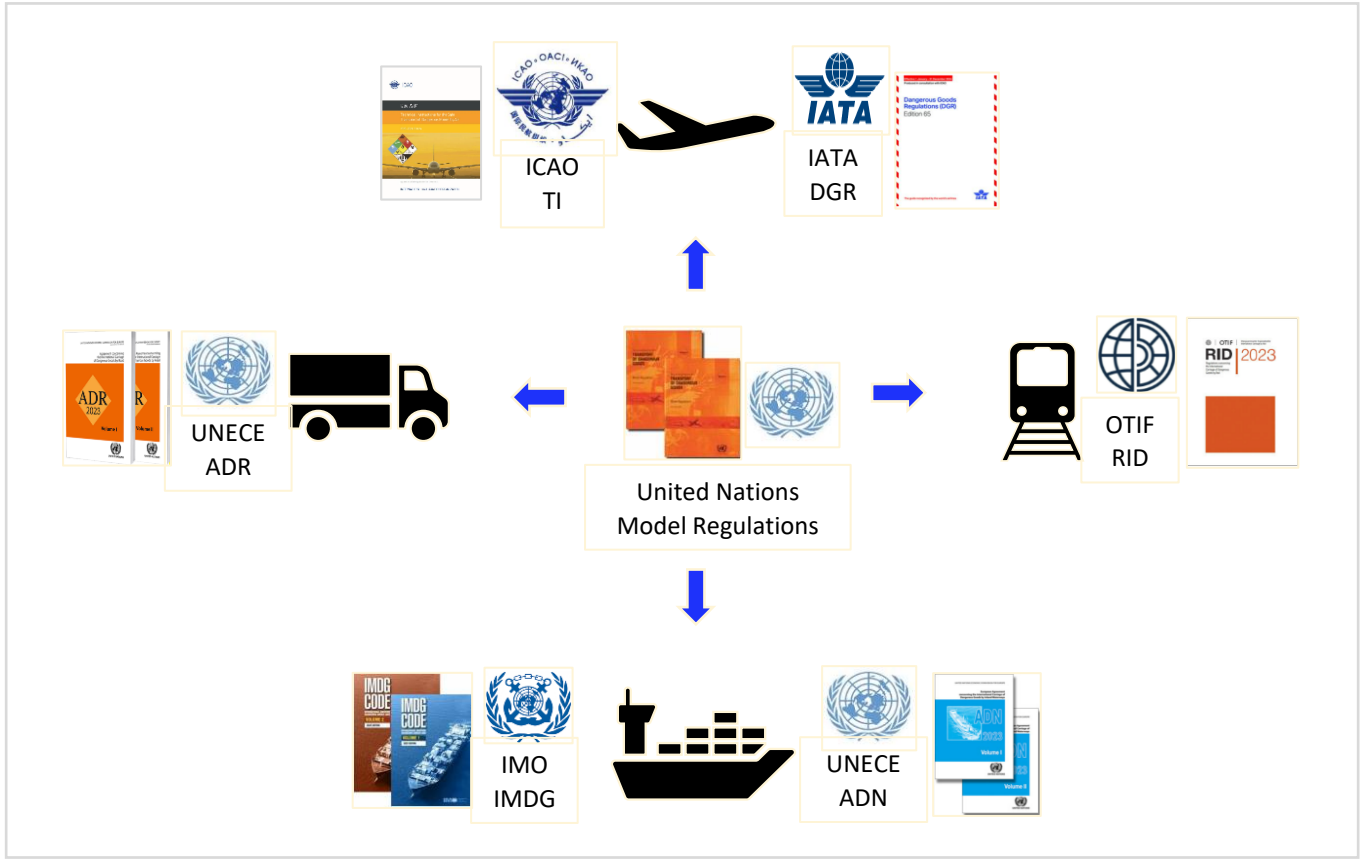
Permitted vs

Prohibited

“Authorized” DPOs

What’s next?

Developing Safety in the Transport of Dangerous Goods



Lithium Ion Batteries

- Subject to a set of test criteria (UN 38.3 series tests).
- Classified as UN 3480 (Lithium Ion) or UN 3090 (Lithium Metal)
- Primary concern with lithium batteries entering thermal runaway.
- **Prohibited as cargo on a passenger aircraft**

UN 3481 – Lithium ion batteries PACKED with equipment - PI 966
UN 3481 – Lithium ion batteries CONTAINED IN equipment – PI 967
UN 3091 – Lithium metal batteries PACKED with equipment - PI 969
UN 3091 – Lithium metal batteries CONTAINED IN equipment - PI 966

ICAO Technical Instructions

for the

Safe Transport of Dangerous Goods by Air

ICAO Technical Instructions Part 1; Chapter 2 – Limitation of Dangerous Goods on Aircraft

Section 2.3 Transport of Dangerous Goods by Post

2.3.2 (a) – Patient Specimens

2.3.2 (b) – Infectious Substances Category B

2.3.2 (c) – Radioactive Material – Excepted Package

2.3.2 (d) – Lithium ion batteries contained in equipment

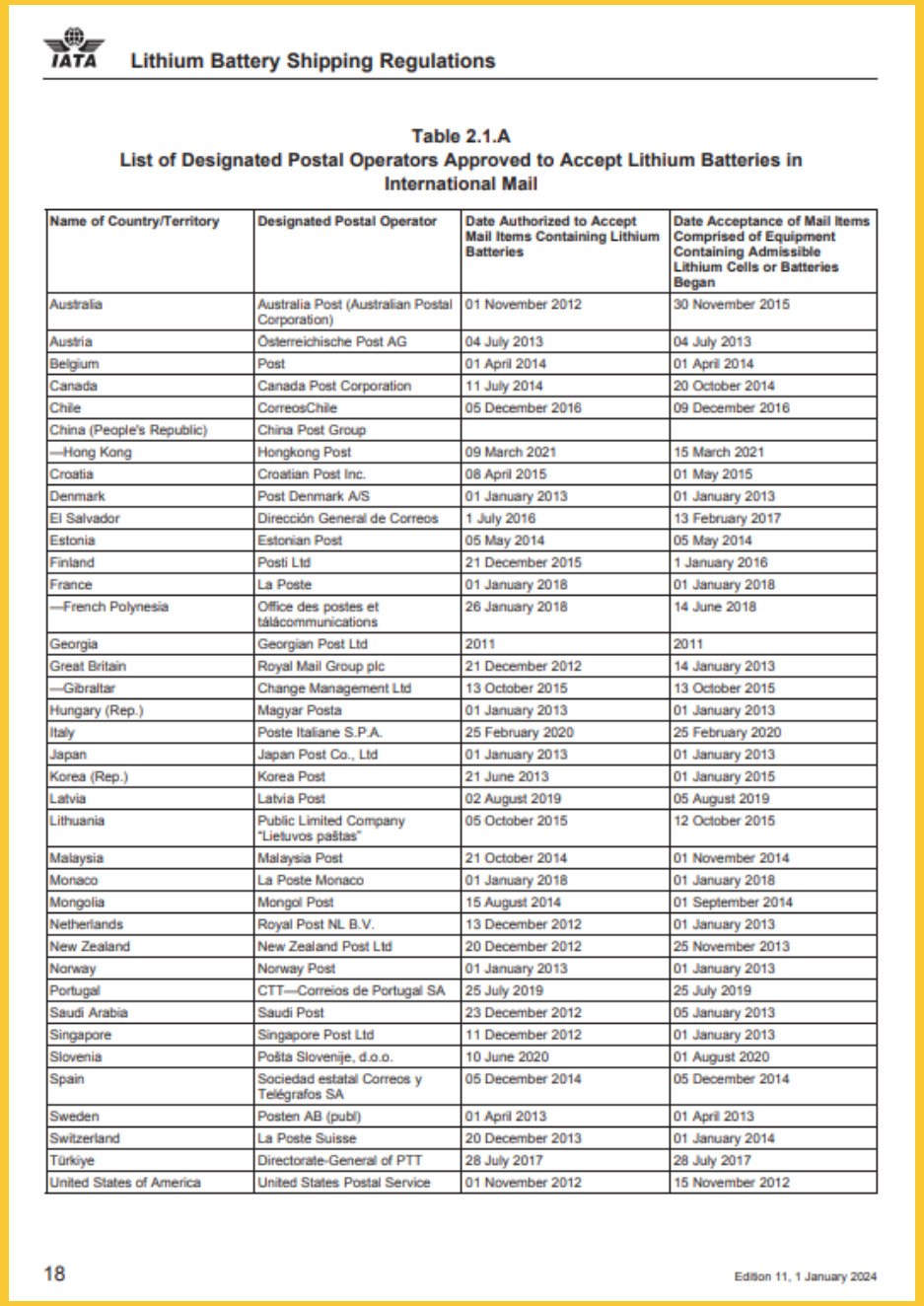
2.3.2 (e) – Lithium metal batteries contained in equipment

2.3.2 (d) Lithium ion batteries contained in equipment (UN 3481) meeting the provisions of Section II of Packing Instruction 967. No more than four cells or two batteries may be mailed in any single package; and

2.3.2 (e) Lithium metal batteries contained in equipment (UN 3091) meeting the provisions of Section II of Packing Instruction 970. No more than four cells or two batteries may be mailed in any single package.

2.3.3 The procedures of designated postal operators for controlling the introduction of dangerous goods in mail into air transport are subject to review and approval by the civil aviation authority of the State where the mail is accepted.

2.3.4 A designated postal operator must have received specific approval from the civil aviation authority before the designated postal operator can introduce the acceptance of lithium batteries as identified in 2.3.2(d) and (e).



IATA Lithium Battery Shipping Regulations

Table 2.1.A
List of Designated Postal Operators Approved to Accept Lithium Batteries in International Mail

Name of Country/Territory	Designated Postal Operator	Date Authorized to Accept Mail Items Containing Lithium Batteries	Date Acceptance of Mail Items Comprised of Equipment Containing Admissible Lithium Cells or Batteries Began
Australia	Australia Post (Australian Postal Corporation)	01 November 2012	30 November 2015
Austria	Österreichische Post AG	04 July 2013	04 July 2013
Belgium	Post	01 April 2014	01 April 2014
Canada	Canada Post Corporation	11 July 2014	20 October 2014
Chile	CorreosChile	05 December 2016	09 December 2016
China (People's Republic)	China Post Group		
—Hong Kong	Hongkong Post	09 March 2021	15 March 2021
Croatia	Croatian Post Inc.	08 April 2015	01 May 2015
Denmark	Post Denmark A/S	01 January 2013	01 January 2013
El Salvador	Dirección General de Correos	1 July 2016	13 February 2017
Estonia	Estonian Post	05 May 2014	05 May 2014
Finland	Posti Ltd	21 December 2015	1 January 2016
France	La Poste	01 January 2018	01 January 2018
—French Polynesia	Office des postes et télécommunications	26 January 2018	14 June 2018
Georgia	Georgian Post Ltd	2011	2011
Great Britain	Royal Mail Group plc	21 December 2012	14 January 2013
—Gibraltar	Change Management Ltd	13 October 2015	13 October 2015
Hungary (Rep.)	Magyar Posta	01 January 2013	01 January 2013
Italy	Poste Italiane S.P.A.	25 February 2020	25 February 2020
Japan	Japan Post Co., Ltd	01 January 2013	01 January 2013
Korea (Rep.)	Korea Post	21 June 2013	01 January 2015
Latvia	Latvia Post	02 August 2019	05 August 2019
Lithuania	Public Limited Company "Lietuvos paštas"	05 October 2015	12 October 2015
Malaysia	Malaysia Post	21 October 2014	01 November 2014
Monaco	La Poste Monaco	01 January 2018	01 January 2018
Mongolia	Mongol Post	15 August 2014	01 September 2014
Netherlands	Royal Post NL B.V.	13 December 2012	01 January 2013
New Zealand	New Zealand Post Ltd	20 December 2012	25 November 2013
Norway	Norway Post	01 January 2013	01 January 2013
Portugal	CTT—Correios de Portugal SA	25 July 2019	25 July 2019
Saudi Arabia	Saudi Post	23 December 2012	05 January 2013
Singapore	Singapore Post Ltd	11 December 2012	01 January 2013
Slovenia	Pošta Slovenije, d.o.o.	10 June 2020	01 August 2020
Spain	Sociedad estatal Correos y Telégrafos SA	05 December 2014	05 December 2014
Sweden	Posten AB (publ)	01 April 2013	01 April 2013
Switzerland	La Poste Suisse	20 December 2013	01 January 2014
Türkiye	Directorate-General of PTT	28 July 2017	28 July 2017
United States of America	United States Postal Service	01 November 2012	15 November 2012

There are currently 38 Designated Postal Operators Approved to Accept Lithium Batteries in International Airmail

The full list is maintained by the UPU:

1-6-2023__CAA-Approval-for-Lithium-Batteries.pdf (upu.int)

https://www.upu.int/UPU/media/upu/files/postalSolutions/programmesAndServices/postalSupplyChain/Security/1-6-2023__CAA-Approval-for-Lithium-Batteries.pdf

IATA

UN Recommendations

Development of:

- UN numbers
- Proper Shipping Names
- Testing Criteria
- Classification
- General packing instructions
- Special Provisions
- Marking
- Labelling

Changes in 2023

UN 3551 Sodium Ion Batteries with organic electrolyte

UN3552 Sodium Ion Batteries contained in equipment with organic electrolyte

UN3552 Sodium Ion Batteries packed with equipment with organic electrolyte

Sodium Ion Batteries

- Will be subject to the same test criteria (UN 38.3 series tests) as Lithium batteries.
- Generally adopting the same packing instructions, marking and labelling.
- But will have a different Proper Shipping Name

  Sodium Ion Batteries…. with organic electrolyte.
- and a different UN number **(UN 3551** or **UN 3552).**

Sodium Ion batteries in international (air) post?

DPOs can currently only be approved for UN 3481 & UN 3091 contained in equipment.

No provision for UN 3552 **Sodium Ion Batteries contained in equipment**

The unknown unknowns….:

Will Sodium ion batteries become as ubiquitous as Lithium batteries?

Will e-Commerce drive a demand for sodium ion batteries (with organic electrolyte) in equipment in the post?

Will DPOs need to consider the impact on business operations, employee training, customer education and talking with their CAA?

Any Questions?…

Ben Firkins

E: firkinsb@iata.org

Safety challenges of lithium-ion cells and batteries

Judy Jeevarajan, Ph.D.
VP & Exec. Director

Electrochemical Safety Research Institute (ESRI), UL Research Institutes

Sixth Joint IATA-UPU Webinar
Mail Transport Challenges
May 15, 2024

Electrochemical Safety Research Institute (ESRI)

Advancing safer energy storage through science

Introduction and Background

- Lithium-ion battery chemistry, first commercialized in the 1990s, has the highest energy density of rechargeable battery chemistries, no memory effect, long cycle and calendar life and good rate capability.
- It is used in a myriad of applications from consumer electronics to electric vehicles, stationary grid energy storage, marine and space applications.
- It is known for its propensity to experience fire and thermal runaway if not designed or used correctly.
- Numerous cell designs utilizing numerous electrochemical combinations exist; components inside a single cell can vary significantly; components constituting a battery can also vary significantly.
- Challenge is to screen and match every individual cell.
  - Typical commercial-off-the-shelf (COTS) and some custom battery manufacturing processes do not include cell screening and matching (govt.-aerospace may be a small exception)
  - Cells are assembled into batteries in the 'as received" condition at lower SOC (typically 40%)
- Assembled batteries are traditionally not tested under relevant stringent conditions before they are sent out into the field.
- Globally, several fires and catastrophic events due to a variety of reasons, have been observed in the past few years. The end result is fire and smoke that are accompanied by catastrophic incidents such as loss of life and/or property.

Growth in Energy Storage

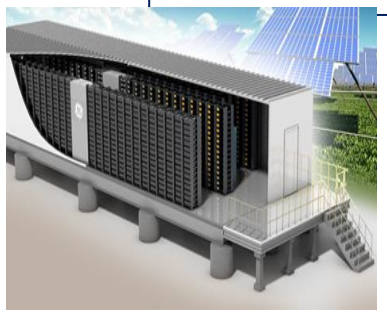
~30 Wh 1990s ~ 22 Wh

Today

~ 25 to 30 kWh

Today

~ MWh to GWh



Incidents of Li-ion Fires

Fire Incidents in Portable Applications

Lithium polymer fire burns down shop

Fire Incidents in Cell Manufacturing Facilities

Fire in Battery Recycling Facility

Fire Incidents in Storage Facilities or In-Transit

China, Xiangzhou District, Zuhai City	Warehouse	19 August 2023	Warehouse		OFweek
Scotland, Kilwinning	Recycling	8 April 2024		A fire broke out at the Fenix battery recycling plant. The cause of fire is under investigation.	BBC
Australia, Maryborough	On highway during transport	22 March 2024	In transit	A semi-trailer truck carrying lithium ion batteries was involved in a multi-vehicle highway crash, resulting in a fire. The level of contribution from the batteries to the fire is unknown.	ABC News
France, Viviez	Recycling	17 February 2024	Storage	A fire broke out in a warehouse owned by battery recycling group SNAM. The warehouse stored 900 metric tons of lithium ion batteries. The cause of the fire is unknown.	Reuters
US, AK, Dutch Harbor	Maritime	29 December 2023	In transit	The ship was transporting lithium-ion batteries from Vietnam to San Diego. The fire began in a hold, which was pumped with carbon dioxide and sealed. The cause of the fire is unknown.	AP News
Netherlands, Ameland	Maritime	26 July 2023	Storage	A cargo ship fire burned for over a week. The crew was evacuated, after 1 death, and the ship was monitored for potential capsizing that could have damaged the nearby UNESCO World Heritage - listed wildlife habitat. The ship was carrying over 3700 new vehicles, with ~500 reported to be EVs. The cause of the fire is unknown.	AP
France, Rouen	Warehouse	16 Jan 2023	Storage	A fire spread through a warehouse containing thousands of lithium ion batteries.	the deep dive

Fire Incidents – contd.

US, CA, Palo Alto	EV Dealership	7 August 2022	Storage	Failure within a stack of uninstalled EV batteries led to thermal runaway and damage to all batteries and some nearby property.	Palo Alto Fire Dept.
Netherlands, Amsterdam	Maritime	25 July 2022	In transit / operation	Battery fire on Diesel-Electric hybrid river boat	The Maritime Executive
US, WI, Milwaukee	Hospital parking garage	21 June 2022	recycling bin	Container holding recycled batteries exploded in parking garage	WISN
Sweden, Karlskoga	Warehouse	10 April 2022	warehouse	A fire outside of a warehouse where a large number of batteries were being stored.	SVT Nyheter

Energy and Toxicity

Two main factors that categorize safety:

Energy : MWh to GWh in Stationary ESS

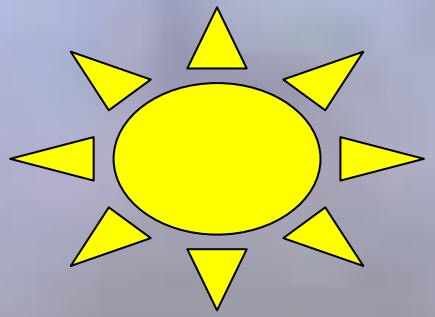
Toxicity: Toxicity – based on electrolyte (vapors, decomposition products, etc.)

- KOH: alkaline, NiCd, NiMH, AgZn – caustic and corrosive- will burn skin and eyes.
- H_2SO_4: Lead acid- acidic and corrosive, will create acid fumes that can damage throat and lungs.
- $SOCl_2$: $LiSOCl_2$ and BCX- burn skin, eyes, damage throat and lungs to a higher degree than above and can be lethal.
- $Li(CF)_x$ and $LiMnO_2$, Li-ion: affects skin and eyes on contact; (electrolyte is flammable and can cause fire in the presence of an ignition source and may give out toxic fumes).

Sources of Toxicity Hazards:

- **Lithium-ion:** Metals such as Cobalt are considered to be possibly toxic (International Agency for Research on Cancer); Nickel may lead to cancer (NIOSH) – exposure of high amount of Ni can harm skin, lungs, stomach, kidneys, liver; Manganese exposure concerns are related to neurotoxicity although considered to be rare; organic carbonates – shown later; hydrogen fluoride or hydrofluoric acid – TLV is 0.5 ppm (not to exceed 2 ppm in an 8-hour shift); toxicity due to particulate emissions discussed later.

Li-ion Cell Hazards

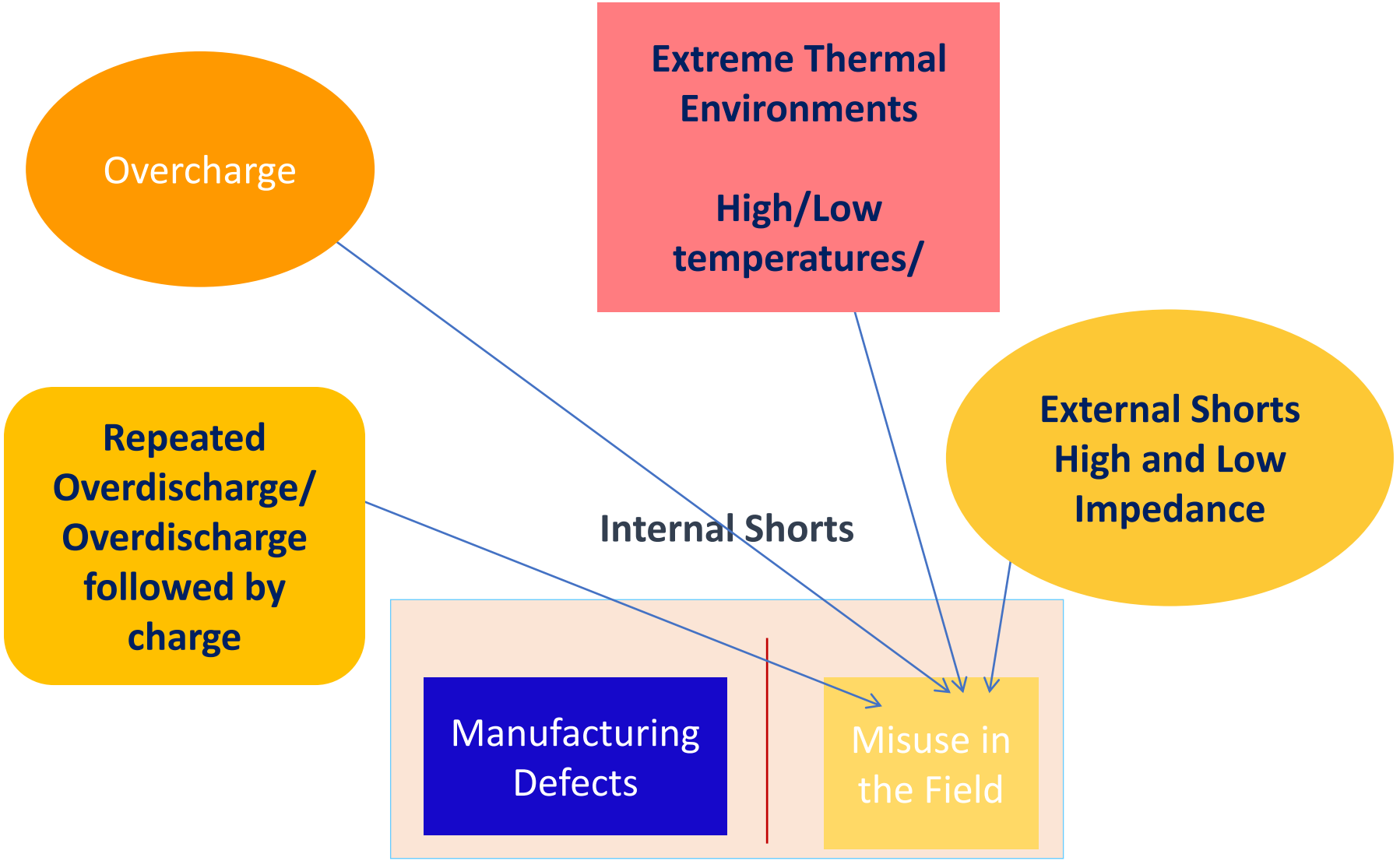


Thermal

Mechanical

Electrical

Lithium-ion Batteries: Hazards



Hazard Causes - Electrical

Overcharge

Over-voltage / High-rate Charge

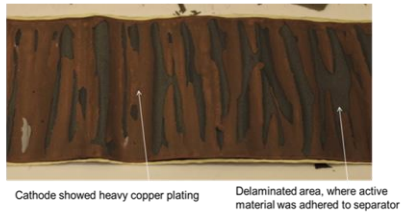
- Electrolyte Decomposition (formation of gases such as H_2, CO and CO_2)
- Cathode destabilization and release of Oxygen

Lithium metal dendrites (can pierce the separator causing short circuit)

→ High Temperatures, Venting, Fire, Thermal Runaway

Overdischarge

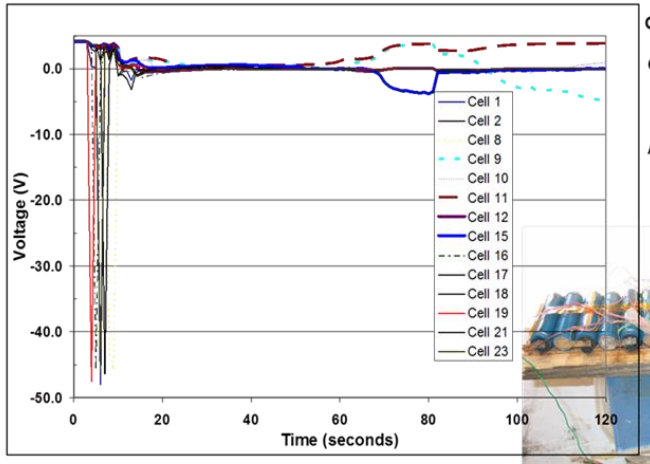
Undervoltage / High Rate Discharge → Dissolution of Copper Current Collector → Benign Internal Shorts



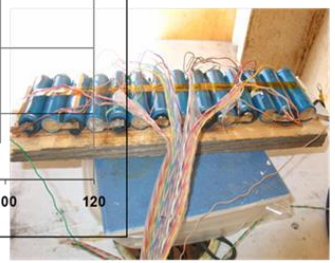
Cathode showed heavy copper plating. Delaminated area, where active material was adhered to separator

J. Nemanick *et al.*, International Batt Seminar, March 2016

External Short – High and Low Impedance



Only venting observed, no fire
Cell Voltages in bold – No visible signs of Venting or damage, but no voltage;
All others vented with Obvious leakage or discoloration



Rapid cell venting within the first 10 seconds

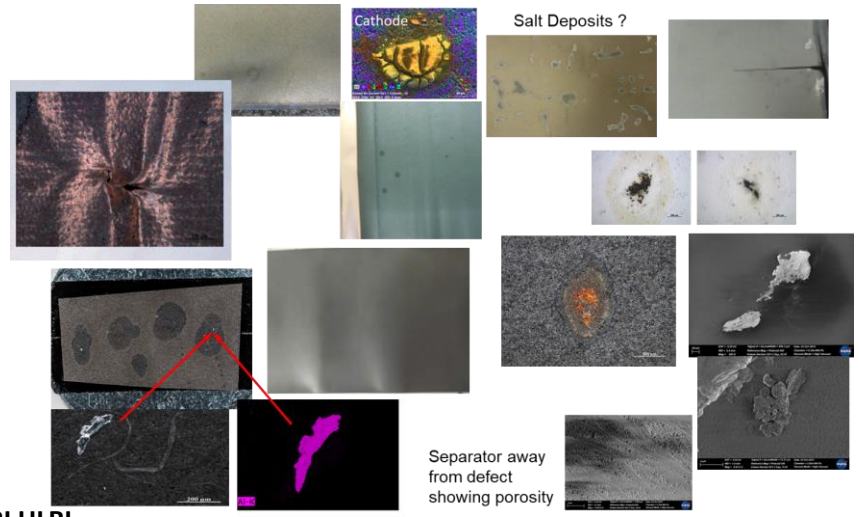
Internal Short

Internal Short

- **Manufacturing Defect**
- **Field Failures**

Manufacturing Defect
Major defects can be screened by manufacturers **Subtle defects** need to be identified and screened out during acceptance testing. Defects include poor manufacturing (creases, tears, delamination, etc.), introduction of foreign or native object debris,

Field Failures
Avoided by **use within manufacturer's specification** (I, V, T); **stringent cell and battery selection and screening criteria**; **stringent monitoring and control (I, V, T)**; **cell balancing**, **health checks** (with issue-recognizable tests); **good thermal design.**



Counterfeit Cell and Battery Challenges

Overcharge Test (results contrary to authentic 18650 cell designs

Original

Counterfeit

Cell Gas Composition and Particulate Emissions

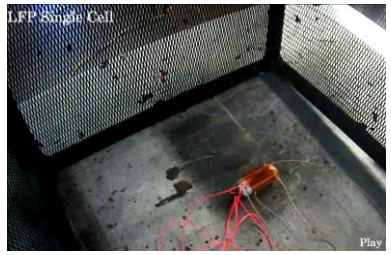
Hydrogen

Carbon Monoxide

Gases above Lower Flammability Limit (LFL)

Methane

Other hydrocarbons



Concern with HF toxicity – more difficult to detect in lab tests

Emissions exceed toxicity limits

Metal/ Other contaminants

Carbon/Soot

Storage of Lithium-Ion Batteries

Judy Jeevarajan, Ph.D. / ESRI ULRI

Battery Storage – General Considerations

- Storing batteries involves the risk of thermal runaway and the spread of a fire to surrounding batteries, other combustible materials (fire loads) and ultimately the entire building.
- Batteries should be stored in a cool, dry, well-ventilated area away from combustible materials and other hazardous materials.
- Batteries should not be allowed to come into contact with water. Do not let water penetrate packaging boxes during storage and transportation. Batteries should not be exposed to rain or condensation.
- Batteries should be packaged in a manner that prevents inadvertent terminal contact.
- Battery terminals should be protected to avoid inadvertent contact and short circuit.
- Heavy objects should never be stacked on top of containers/boxes containing batteries to prevent puncturing or crushing the cell cases.
- Shock and vibration should be avoided by making sure that any containers containing batteries are handled and stacked gently, and properly secured from movement during transportation.
- Batteries should be stored in their original containers whenever possible.
- Different battery types (for example, lead acid, nickel-metal hydride, nickel-cadmium, lithium-ion) should be stored separated from each other.
    - Lead acid, nickel-metal hydride, nickel-cadmium batteries may vent flammable hydrogen gas which poses a significant safety hazard in the presence of lithium-ion batteries.
- Visually inspect battery storage areas regularly. Any batteries with damaged casings or swelling should be separated from other batteries and combustible materials. Battery containers that show visible electrolyte leakage should be separated from other battery storage containers.

Battery Storage – Damaged, Defective or Recalled Batteries

- **Damaged, defective, or recalled (DDR) batteries and batteries that are of questionable quality** should be stored in an isolated storage area separated from all other batteries, and away from flammable or combustible materials.
- DDR and suspect batteries should be stored at low temperatures (4 °C to -18 °C), as it can prevent cells from going into an inadvertent thermal runaway during storage periods.
- DDR and suspect batteries should be placed in a heavy (sturdy) metal cage with small lattice structure (no large holes) to prevent any large shrapnel of hot cell materials from escaping the cage and igniting surrounding materials or causing physical injury to individuals, if a fire or thermal runaway occurs.
    - The batteries should be stored in their original shipping containers to prevent external short circuits caused by contact to the metal cage.
    - The batteries in their shipping containers should not be stacked on top of each other to prevent puncturing, crushing or applying excessive pressure on the cell cases.
    - Preferably, the batteries in the metal cage should be in a controlled temperature environment (refrigerator or freezer storage 4 °C to -18 °C).
    - This is a low-cost option that does not require large resources.
- If batteries/cells are stored at low temperature, **caution should be exercised when removing them from the cold temperature storage**. Condensation on the battery/cell will cause short circuits in the batteries/cells and should be avoided. Use of refrigerator or freezer storage bags and materials will help to avoid condensation when they are brought back to room temperature.
    - If the cells are shipped again, the DOT regulations on damaged, defective or recalled batteries should be followed for shipping and transportation: The batteries should be individually packaged in e.g. a plastic bag inner packaging, surrounded by non-combustible, non-conductive and absorbent cushioning material, such as vermiculite, and placed in a larger rigid outer packaging.

Battery Storage – Thermal Environment

- Batteries should be stored in a cool, dry, well-ventilated area.
- Batteries should not be stored in places with high temperatures or exposure to direct sunlight.
- Typical operating temperatures of batteries are 0 to 40 °C (32 °F to 104 °F). Exposure to temperatures greater than 80 °C (176 °F) leads to decomposition reactions and eventually leads to thermal runaway. Optimal storage temperature is 5 to 20 °C (41 °F to 68 °F)
- Batteries can also be stored at low temperatures, e.g. in the refrigerator or freezer, especially for long-term storage. The relevant cold temperature storage bags should be used for such storage.
- Batteries that are of a questionable quality such as counterfeit or undeclared shipments are best stored at low temperatures (refrigerator or freezer) as cold temperatures prevent cells from going into an inadvertent thermal runaway during storage periods. Caution should be exercised when these are removed from cold temperature storage if they are to be shipped again. Condensation will cause short circuits in the batteries that should be avoided.
- High ambient temperatures or adiabatic insulation will increase the likelihood that any given internal fault can drive a cell to thermal runaway and increase the energy available to heat the cell.

What to do in an emergency?

- In extreme cases, there may be hazardous liquid spill, smoke, fire, venting and deflagration (energetic expulsion of battery content).
- Once ignited, lithium-ion battery fires can be difficult to extinguish.
- Use appropriate personal protective equipment (PPE), and fire extinguisher (LITH-X, ABC) depending on the type of cell and the extent of the hazard. Copious amounts of water can also effectively put out a Li-ion battery fire but should not be used with a Li metal (non-rechargeable or rechargeable) battery fires
- Call the fire service if the battery fire is larger than a camcorder or laptop battery fire and cannot be extinguished with a fire extinguisher.
- Approach the battery only after confirming with an IR thermal sensor that the battery is at room temperature.
- Liquid electrolyte spills can be washed down with copious amounts of water. Small spills can be neutralized with the relevant neutralizing agent and then wiped up with proper chemical disposal methods for the wipes. Lithium-ion electrolyte can be neutralized with sodium carbonate or sodium bicarbonate and Ni-MH and NiCd battery electrolyte spills can be neutralized with citric acid.
- In the event of a catastrophic failure that causes physical injury to individuals, it is advisable to go to the ER to take care of any burn or toxic fume ingestions.

Fire Suppression

- It is recommended that batteries be stored in an isolated storage area or in a controlled area in a storage space (e.g. in a separate vented fireproof cabinet, separate from fire loads). Other combustible materials should not be stored in the same area.
- In a shelf storage, an overhead sprinkler system might not be sufficient to cool a large number of batteries, which is why shelf-specific sprinklers are recommended.
- The National Fire Protection Association has published guidelines and a standard on the sprinkler systems for large energy storage systems using lithium-ion batteries (NFPA: Sprinkler Protection Guidance for Lithium-Ion Based Energy Storage Systems, https://www.nfpa.org/News-and-Research/Data-research-and-tools/Suppression/Sprinkler-Protection-Guidance-for-Lithium-Ion-Based-Energy-Storage-Systems).
- When a lithium-ion battery burns, the ensuing fire is hard to extinguish because lithium-ion cells generate oxygen which sustains the fire. Thus, a lithium-ion battery fire has all the three conditions required for a fire: flammable material, heat, and oxygen. If the battery is in an enclosed container or box, the battery will display a fire only until all the oxygen internal to the cell, battery and container is used up. However, heat can fester and can cause propagation of thermal runaway which includes excessive venting, high temperatures and smoke.
- In other words, extinguishing visible flames does not necessarily stop the reactions occurring inside the battery. The reactions should be stopped by preventing heat from transferring inside the battery from one cell to another for example by using large amounts of water to cool the battery internally.
- Due to the electrical nature of battery packs, particularly the high voltages associated with large format battery packs, conductive suppression agents may be problematic.

Fire Detection

- The earlier a malfunctioning battery is detected, the sooner fire suppression systems can be activated.
- Specific methods to detect lithium-ion battery fires have been developed especially for large battery energy storage systems (BESS) but these can be applied to suspect batteries that are being shipped also. A combination of two or more of the following detection methods should be used:
    - Conventional heat detectors – detect thermal runaway although the detection process is dependent on the location of the heat detector from the source of the discrepant battery or fire.
    - Smoke detectors – detect smoke release from a burning battery and provide an audible alarm.
    - Combined smoke-heat detectors are recommended as they can be faster than heat detectors and again the detection capability is dependent on the location from the source of the discrepant battery or fire.
    - Flame detectors can detect fires during a thermal runaway event.
    - Gas detectors to detect battery off-gassing/electrolyte vapors during cell venting and can give early warning of a thermal runaway if located in proximity to the discrepant battery.

Factors to Consider for Li-ion Storage Inside Buildings

- Ventilation
- Toxic gas sensors
- Oxygen sensors

Currently available commercial sensors installed inside ESS containers are overwhelmed; first responders are recommended to carry their own gas sensors when entering such enclosed areas that can trap toxic and combustible gases

- Physical access for first responders and fire fighters
- Proper PPE/ respirators (acid gas for Li-ion battery fires)
- Relevant fire extinguishers

PPE

PPE	When to wear
Electrical insulating gloves	When working with high voltage / high energy systems
Disposable lab nitril gloves	When electrolyte leaks are observed
Mask and respirator (P95, 3M 2076HF)	When entering locations that have battery fire and excessive smoke; masks are critical in manufacturing areas to prevent breathing in of nanomaterials used in electrode manufacturing, that are toxic. And in areas where electrolyte is dealt with in cell manufacturing.
Protective Suit	When entering high temperature environments as well as areas where there is a battery fire and excessive smoke is also observed

Use of IR camera to record temperatures before entering a restricted space is highly recommended. Smoke rich environments can mask fires, so this is important.

Conclusions

- Thermal runaway in lithium-ion batteries occurs due to hazard causes that can be electrical, mechanical or thermal in nature.
  - Fully characterizing a battery system under all credible off-nominal conditions will help with safer designs and usage limits
  - Carrying out a high-fidelity thermal analysis provides the data needed to design appropriate heat dissipation paths that lead to safer battery systems
- The events accompanying thermal runaway can vary quite a bit – venting or fire or smoke or combinations of these can be observed.
- Toxic and flammable gases are released from lithium-ion batteries and battery systems.
  - Data obtained on the gases evolved should be analyzed for the volume of the chamber (room) or confined space that the battery system is located in, to understand worst case flammability and explosive as well as toxicity levels and help with the design of appropriate vent and extinguishing systems.
- Battery thermal runaway events can result in significant release of particulate emissions

  Peak PN levels were 6 orders of magnitude higher than ambient concentrations

  Peak black carbon levels were also much higher than safe human exposure limits
- First responders and fire fighters require appropriate PPE when dealing with Li-ion battery fires to protect them from harmful materials and emissions.
- Water or other suppressant runoff may be toxic and should not be allowed to leach into the ground.
- Certification to safety standards and regulations should be carried out and verified to be carried out by shippers.

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Thank you!

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Thank you for taking the time to complete this survey.
Your feedback is valuable.

https://fr.surveymonkey.com/r/5RQPLMD

Any question regarding the workshop?
Please contact Transport@upu.int and/or tangm@iata.org