5th Lithium Battery Workshop

29-30 September, Montreal, Canada

Chairman Opening Remarks

Geoff Leach

Director, DG Office UK

Keynote Address

Steven Creamer

Director, Air Navigation Bureau, ICAO

5th IATA Lithium Battery Workshop

Outreach to enhance safety

Montreal, Canada, 29–30 September 2015

Regulatory Update

What's Happening in 2016 and Beyond?

David Brennan

Assistant Director,

Cargo Safety & Standards, IATA

5th IATA Lithium Battery Workshop

Outreach to enhance safety

Montreal, Canada, 29–30 September 2015

DGR Changes 2016

- Packing Instructions 965 – 970, Sections IB and II will now require “rigid” outer packagings:
  - To provide protection from damage or compression to the batteries, the inner packagings must be placed in a strong **rigid** outer packaging of one of the packaging types shown below.

DGR Changes 2016

OUTER PACKAGINGS																	
Type	Drums						Jerricans			Boxes							
Desc.	Steel	Alu-minium	Ply-wood	Fibre	Plastic	Other metal	Steel	Alu-minium	Plastic	Steel	Alu-minium	Wood	Ply-wood	Recon-stituted wood	Fibre-board	Plastic	Other metal

WHY?

Packing Instructions

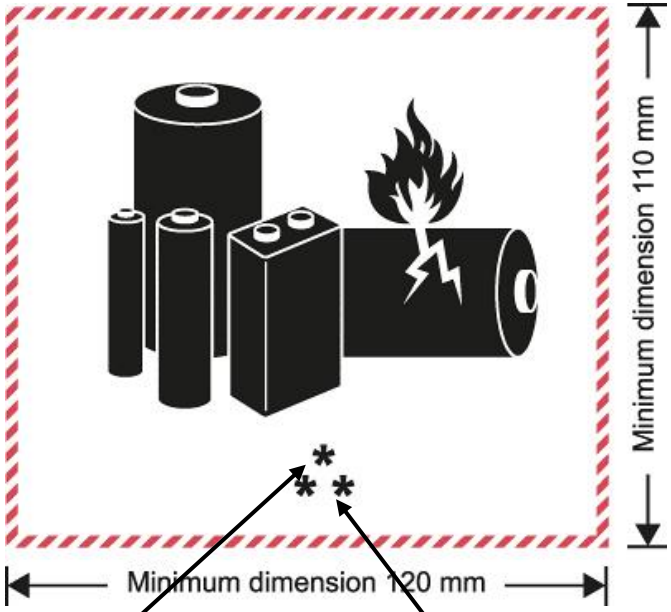
- Definition of what constitutes “equipment” for packed with and contained in:
  - For the purposes of this packing instruction “equipment” means the device or apparatus for which the lithium cells or batteries will provide electrical power for its operation.
  - Also proposed for ICAO Technical Instructions and UN Model Regulations.

Packing Instructions

- Lithium ion batteries – PI 967 / Lithium metal batteries – PI 970 “contained in equipment”
  - Revision to Section II to adopt change from UN Model Regulations to limit the exception from the application of the lithium battery handling label.
  - Adopted 12 months early, but with a 12-month transition period.

ICAO TI Changes – 2017

- Lithium battery handling label replaced by a lithium battery “mark”.
  - May still be reduced in size where package size requires.
  - From the 19th ed. UN Model Regulations; transitional period until 31 December 2018.
  - Proposal to reduce the transitional period for air transport to 31 December 2017.

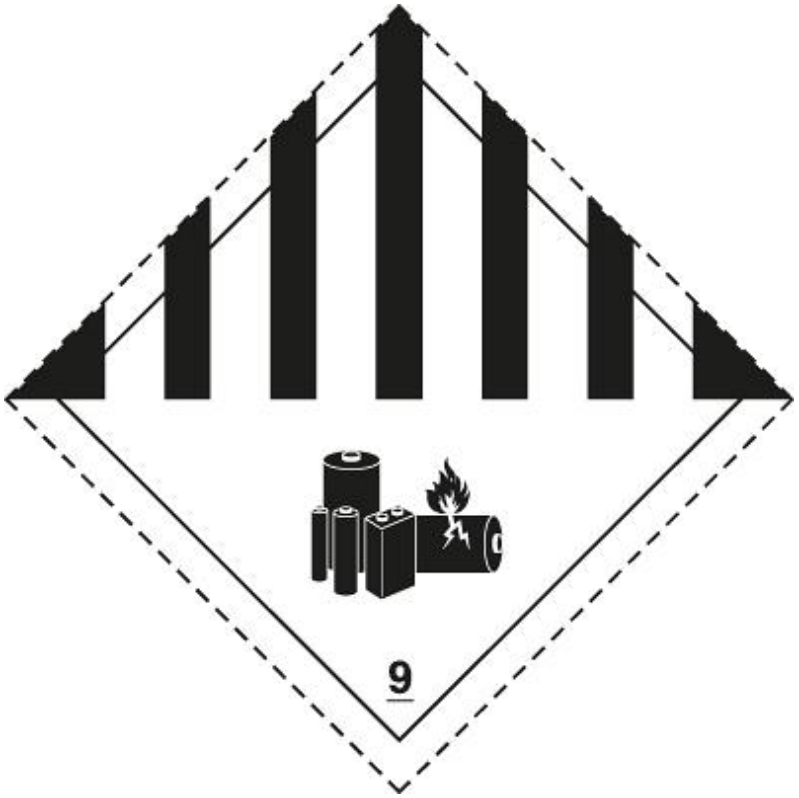


UN Number

Phone number

ICAO TI Changes – 2017

- Introduction of a new Class 9 lithium battery hazard label
  - From the 19th ed. UN Model Regulations; transitional period until 31 December 2018



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ICAO TI Changes – 2017

- Packing Instructions – Section II
  - Clarification that lithium battery mark must fit onto one side of the package, i.e. must not be folded.
  - Requirement for the additional accompanying document has been removed. No longer required from 1 January 2107.
  - Multimodal application arising from changes to the 19th revised ed. UN Model Regulations.

ICAO TI Changes – 2017

- Packing Instruction 965 – Section II
  - Provisions of Part 5;1.1 g) & j) will also apply:
  - Shipper loaded units no longer permitted; and
  - Packages in a consolidation must be presented to the operator separately from other cargo.
  - This aligns to existing requirement for PI 968 – Section II.

ICAO TI Changes – 2017

- Packing Instruction 965 / 968 – Section II
  - Remaining in “square” brackets, removal or restriction on the ability to overpack Section II packages.

    [Not more than [four (4)] packages may be placed into an overpack and the overpack must not contain other packages containing dangerous goods].

Questions?

Networking Break

10:30 – 11:00

Outreach, Awareness, Communication Strategies

Brian Banks

Product Manager, CHEMTREC/American Chemistry Council

5th IATA Lithium Battery Workshop

Outreach to enhance safety

Montreal, Canada, 29–30 September 2015

Outreach, Awareness, Communication Strategies: Dangerous Goods & Lithium Batteries

Presented at :

5th Lithium Battery Workshop

Montreal, Canada

29 September 2015

Brian Banks, Product Manager

CHEMTREC®

Agenda

- Introduction
- What is an Emergency Response Information Provider (ERIP)
- Role of the Emergency Response Information Provider (ERIP) during an incident
- Importance of Lithium Battery information
- Why communication and correct information is critical

CHEMTREC

Who is CHEMTREC

- Established by the Chemical Manufacturers Association (CMA) in 1971
- A division of the American Chemistry Council (ACC)
- 24x7x365 operations center specializing in Level 1 Emergency Response Support
- 32,000+ registered shippers
- 80,000+ contacts in our database

CHEMTREC is a world leader in Level 1 Emergency Response

Overview of Emergency Response Information Provider (ERIP)

- **In the U.S., per the United States Department of Transportation Regulation 49 CFR § 172.604 any organization that places hazardous materials into commerce must have an ERIP**

- **An ERIP is a 24/7 operations center providing emergency information to a caller**
  - **The US DOT allows for companies to provide the information themselves**
  - **Many companies in the U.S. choose to contract this activity to a company dedicated to being an ERIP**

Types of Calls Received by an ERIP

- Spills, Leaks, Fires
- Exposures (Human/Animal)
- Transportation (all modes) and fixed facility
- All Hazard Classes
- Regulated / Non-regulated materials
- Active, cleaned and contained, and potential incidents

Why Call an ERIP?

- **To identify an unknown product**
- **To determine/confirm response actions to be taken during an incident**
- **To obtain product specific information**
- **To obtain expert information on mixed products**

Why Call an ERIP?

- **Facilitation of discussions between incident scene and relevant experts**
- **To gain immediate access to medical personnel**
- **Reporting/Notification to Shipper and/or carrier**

Who Calls an ERIP?

- First Responders
- Shippers & Carriers
- Terminals , Warehouses & Plant Sites
- Product Consumers & Concerned Citizens
- Medical Personnel
- Local, State & Federal Regulators

Concentrated Areas of Expertise

Emergency Response Information Providers should integrate multiple areas of expertise in order to be prepared for the many possible dimensions of mitigating an incident:

1. **Dangerous goods incident management assistance including response, containment, stabilization and notification**
2. **Situational chemical analysis and guidance**
3. **Medical and toxicological advice**

Wide Network of Resources

- **Product Specific Information: Large Database of SDS's, Basic Producers List**
- **Interpreter services: Able to provide interpretation assistance for over 200 different languages**
- **Telecommunications: Redundant systems, high capacity teleconferencing system. For international service, access to "In-Country Dial" phone numbers**

Wide Network of Resources

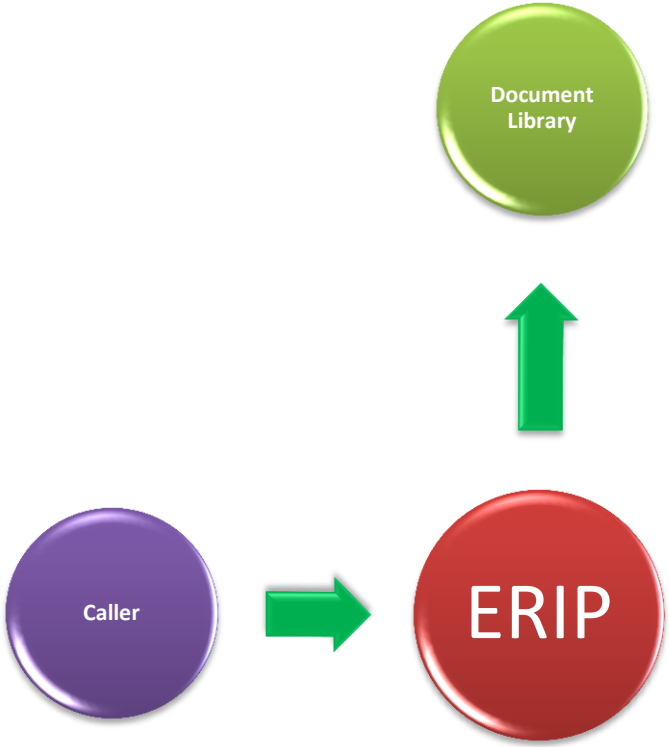
- **Systems: Redundant power, web-enabled data systems to support continuity of operations**
- **Personnel resources: Operators, physicians, toxicologists, chemists all available 24x7x365**
- **Mutual Assistance Network: Product Specific, Foreign Call Centers**

ERIP's Role In Emergency Response

CHEMTREC®
The right information at the right time

What Happens When You Call An ERIP?

What Happens When You Call An ERIP?



Carrier

Shipper

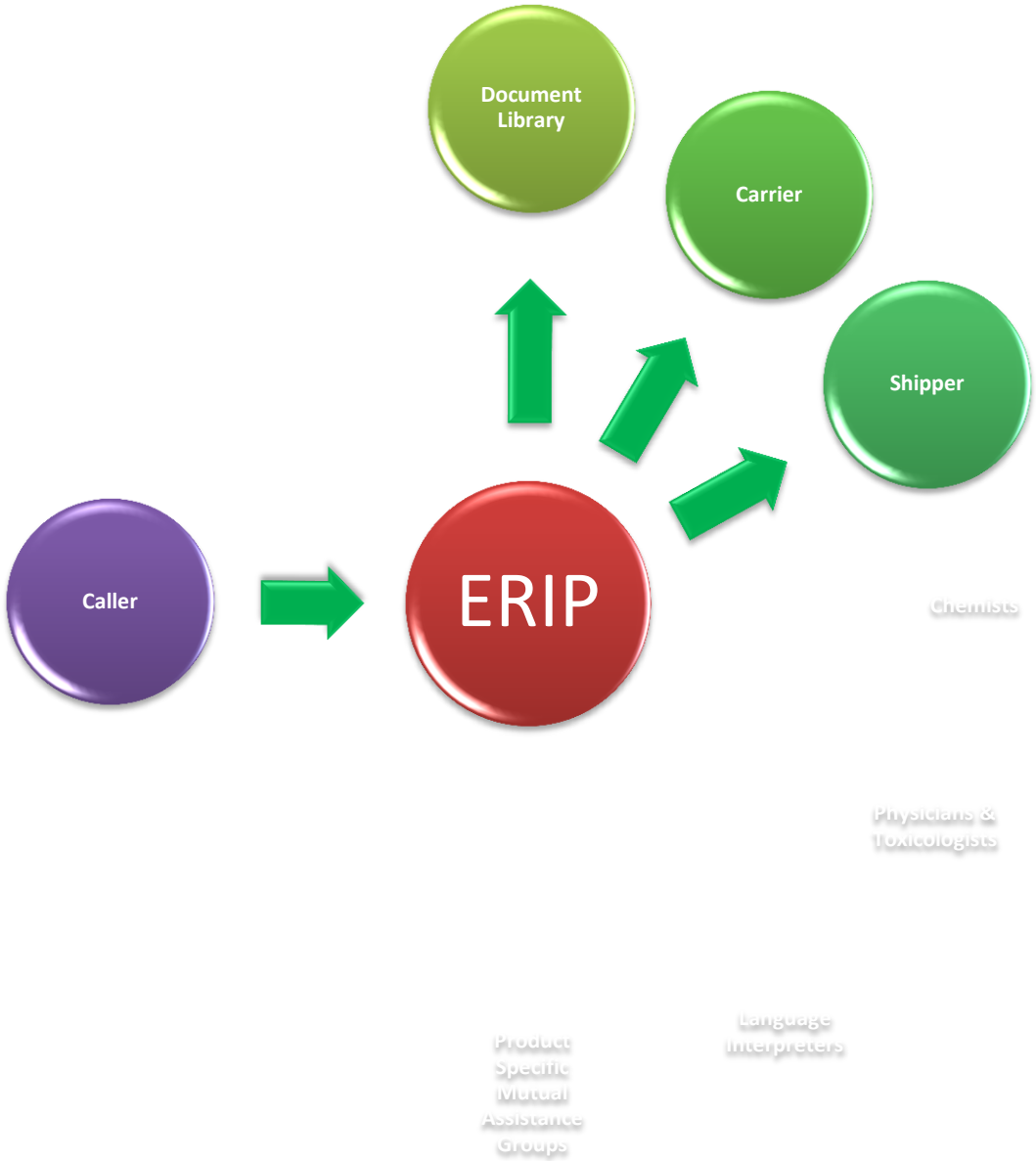
Chemists

Physicians & Toxicologists

Language Interpreters

Product Specific Mutual Assistance Groups

What Happens When You Call An ERIP?



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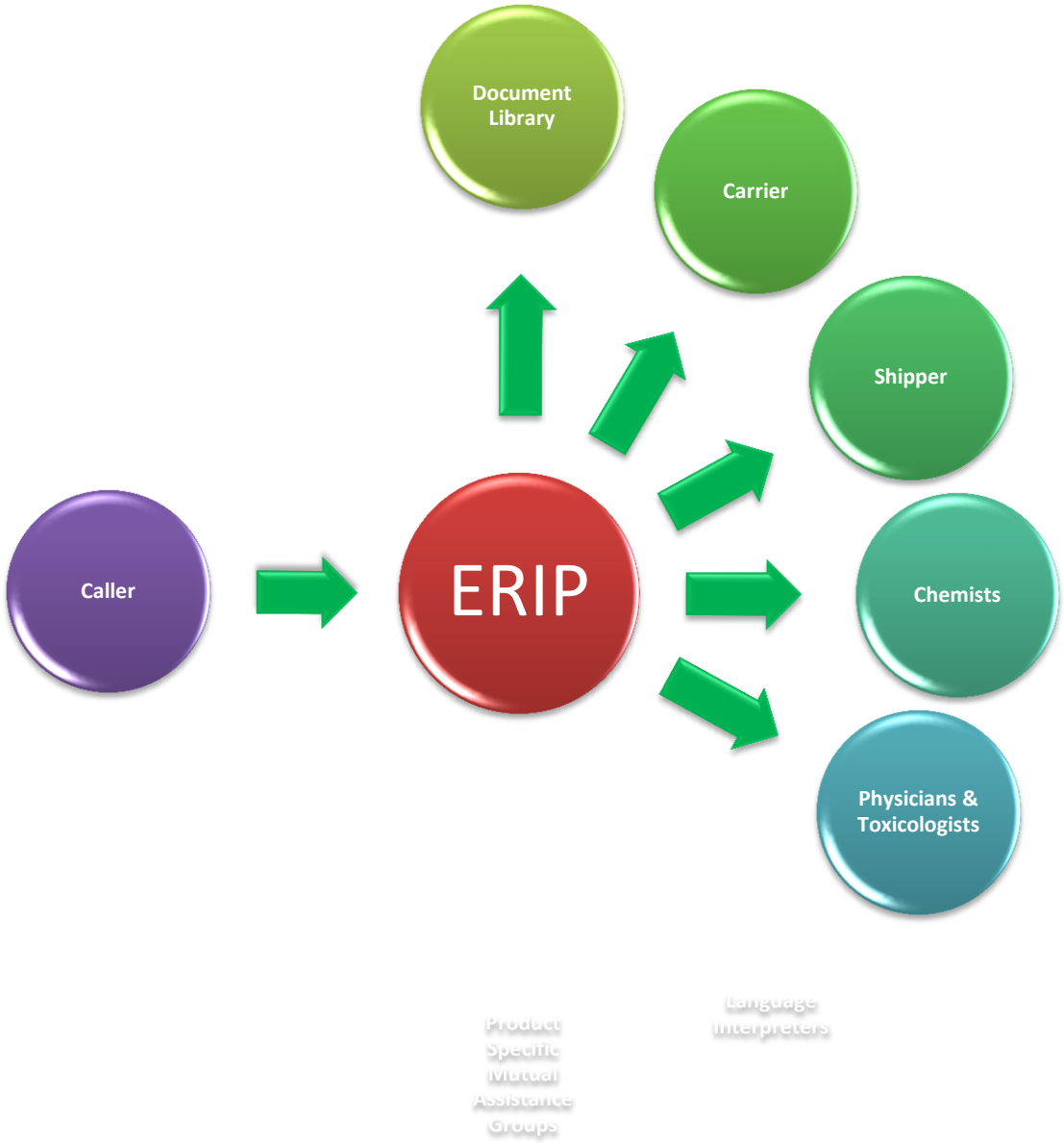

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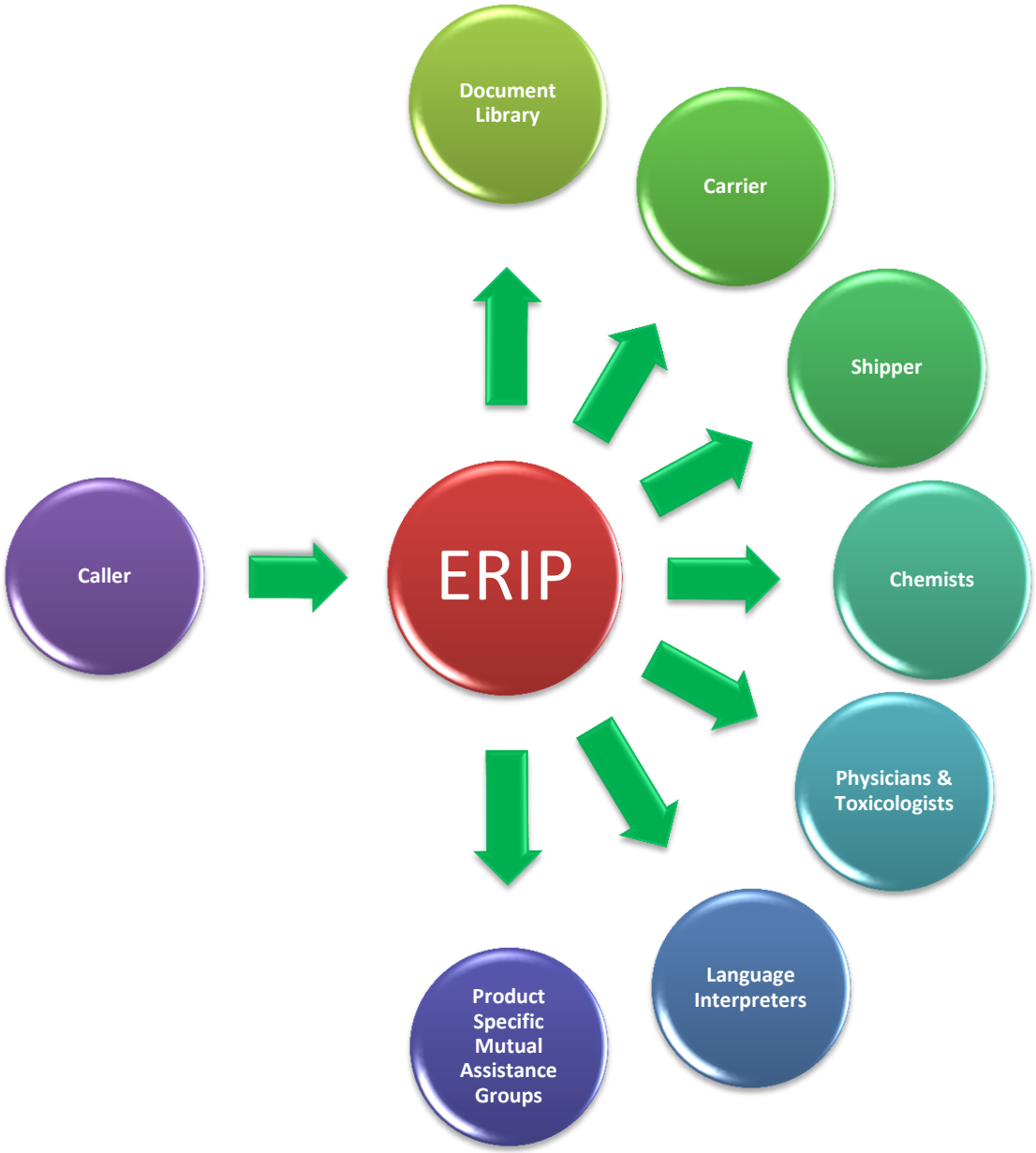

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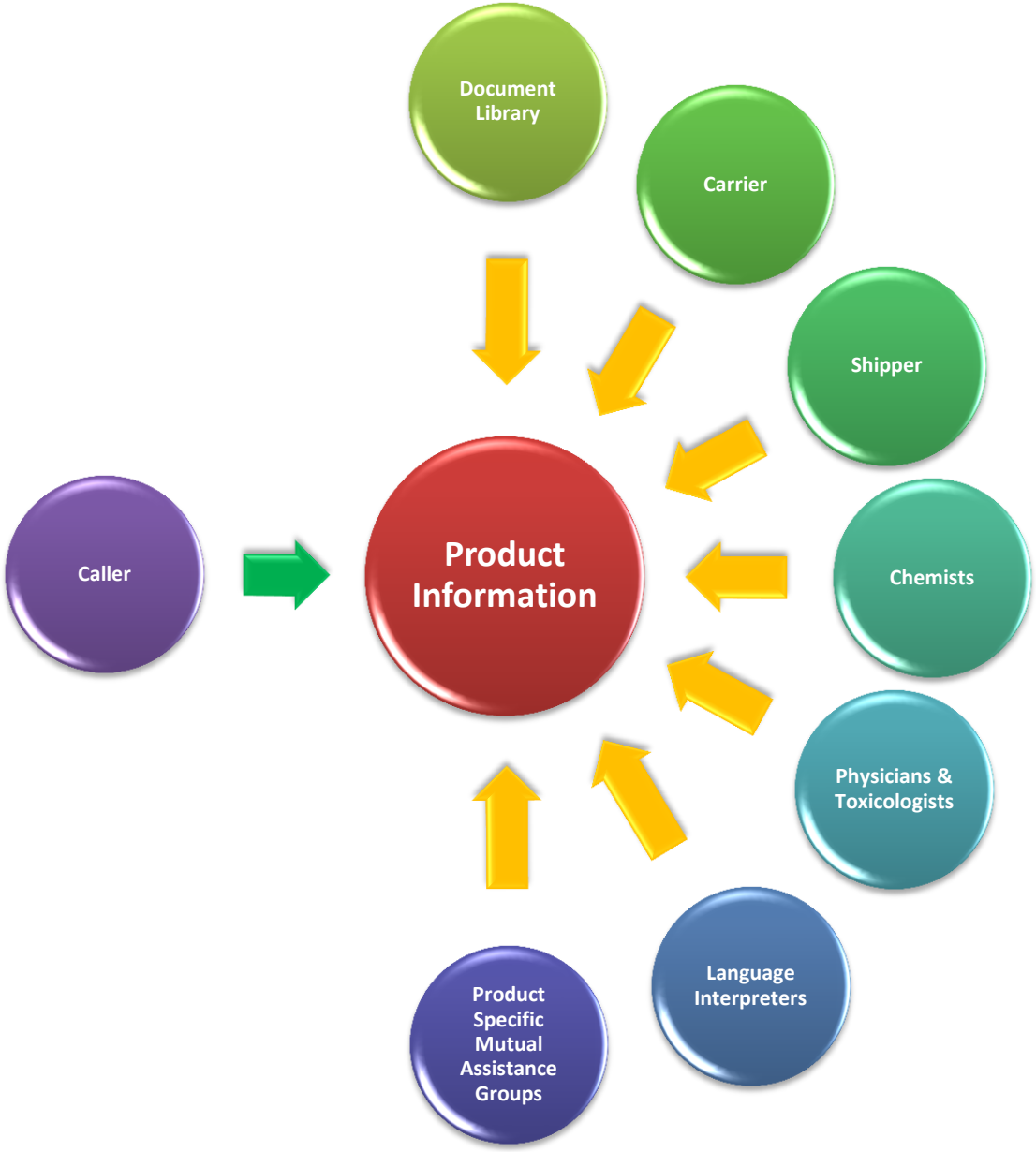


What Happens When You Call An ERIP?

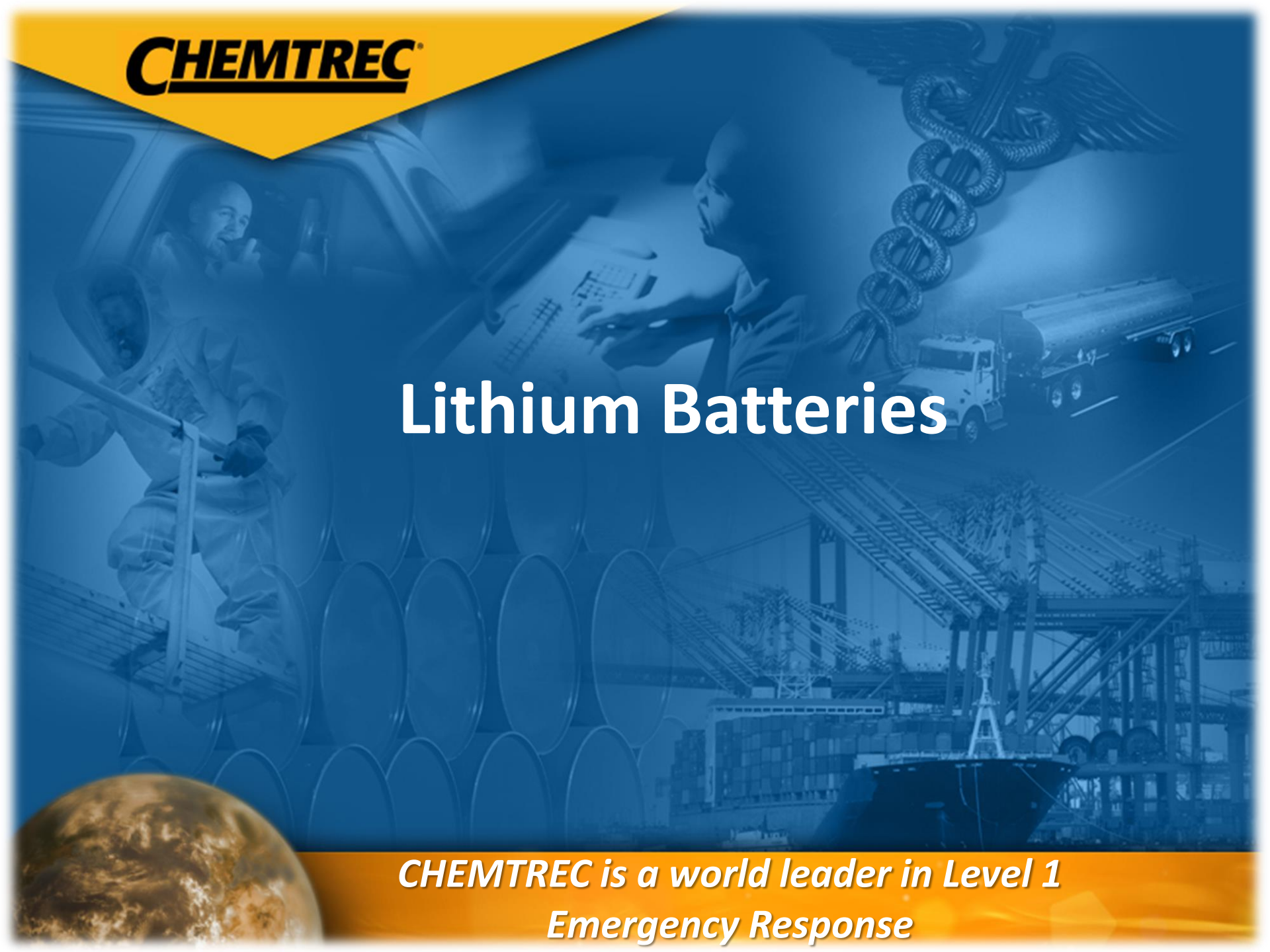

CHEMTREC
Medical Exposures
CHEMTREC is a world leader in Level 1
Emergency Response

How are medical exposure calls handled?

- Medical Exposure calls may be conferenced in with medical experts
- Calls may be handled by Poison Control Specialists available 24 hours a day that provide expert medical advice and can be escalated to Physicians or Toxicologist if necessary

Can we use our own Medical Service?

- **An ERIP may require shippers to either enlist their own medical service/medical professional or medical exposure calls will be handled by 3rd party medical experts**
- **If you have your own medical contact CHEMTREC can connect callers with your designated medical information provider**


CHEMTREC
Lithium Batteries
CHEMTREC is a world leader in Level 1
Emergency Response

For More Information Call…

What do ERIP's need to know about Lithium Batteries?

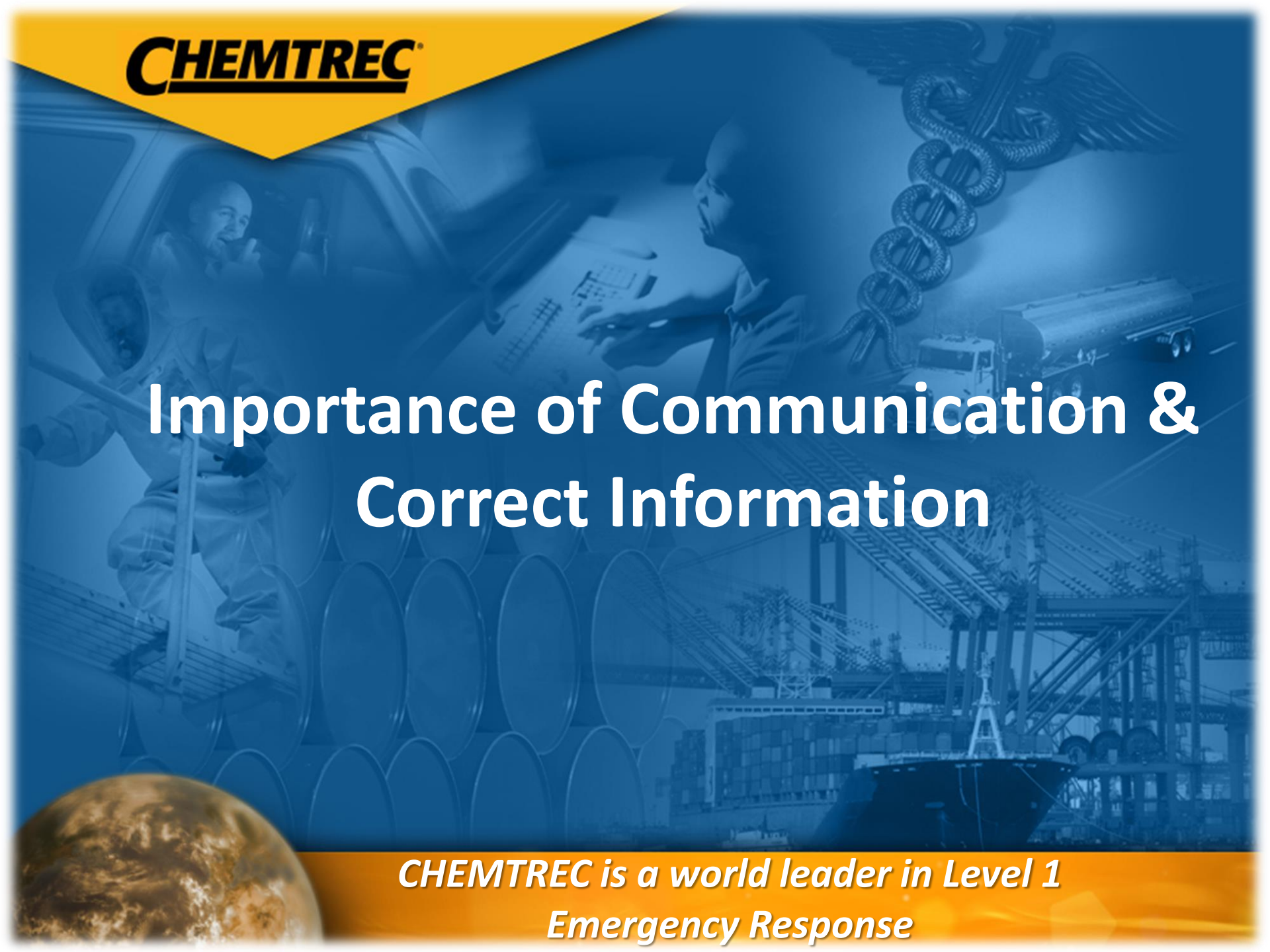
As Much As Possible…

- Transport Incident Details
- Medical Exposure Incident Details
- Technical & Safety Information
- What Action Should The Caller Take If The Packaging Is Damaged?
- Who Should Be Notified If There Is An Incident?

Lithium Battery Incident Calls We Have Handled This Year

Multiple Cases Of:

- Human Exposure
- Leak/Spill
- Severe Damage
- Explosion
- Animal Exposure


CHEMTREC
Importance of Communication & Correct Information
CHEMTREC is a world leader in Level 1 Emergency Response

Why communication and correct information is critical

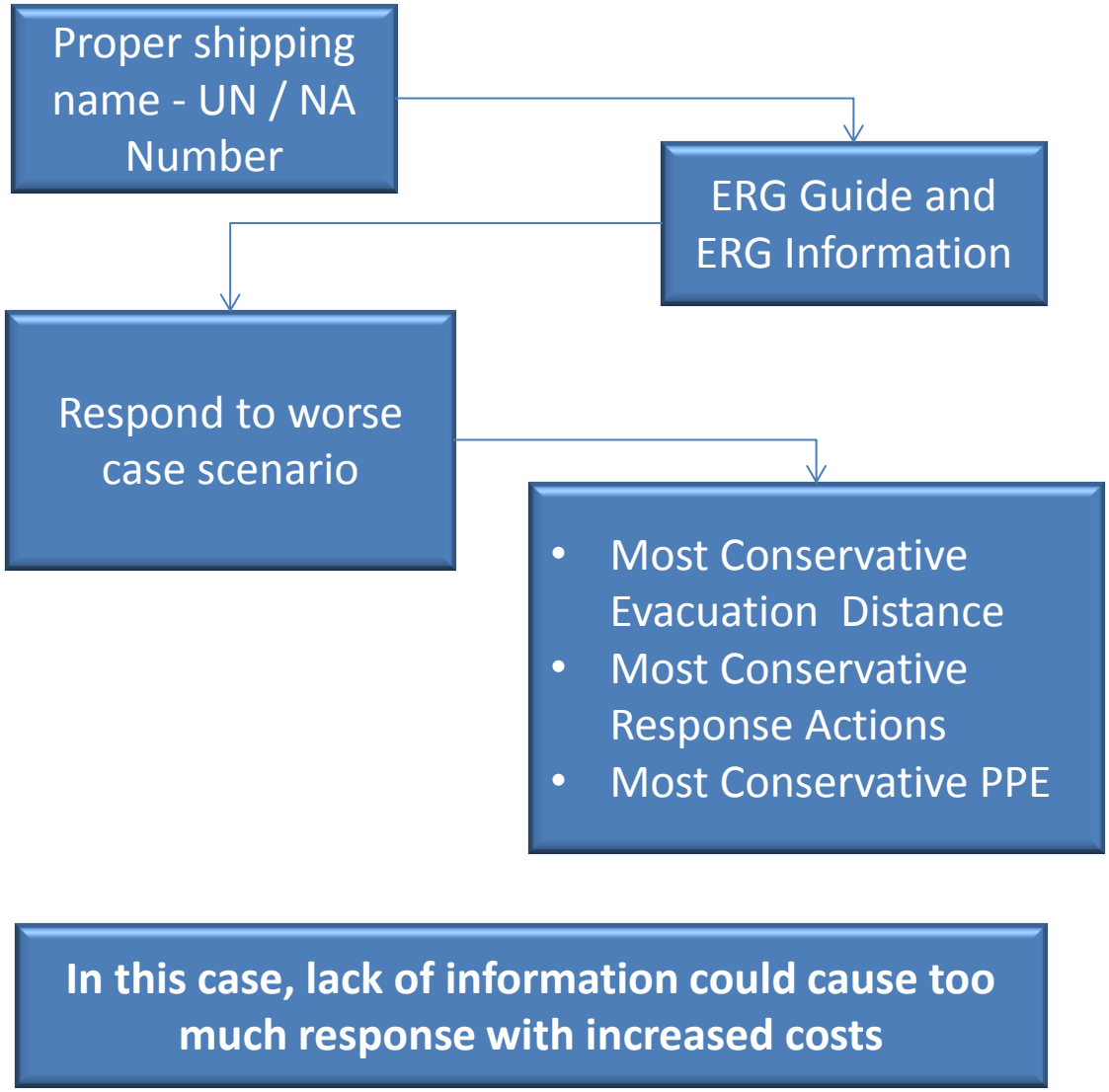
During an incident, all parties are fighting against time. More time causes:

- **For human exposure – longer contact time equals more severe affects**
- **Increased environmental damage / longer time required for remediation from environmental exposure**
- **Higher cost of property damage for property exposure**

Time = Money (in the worst way)

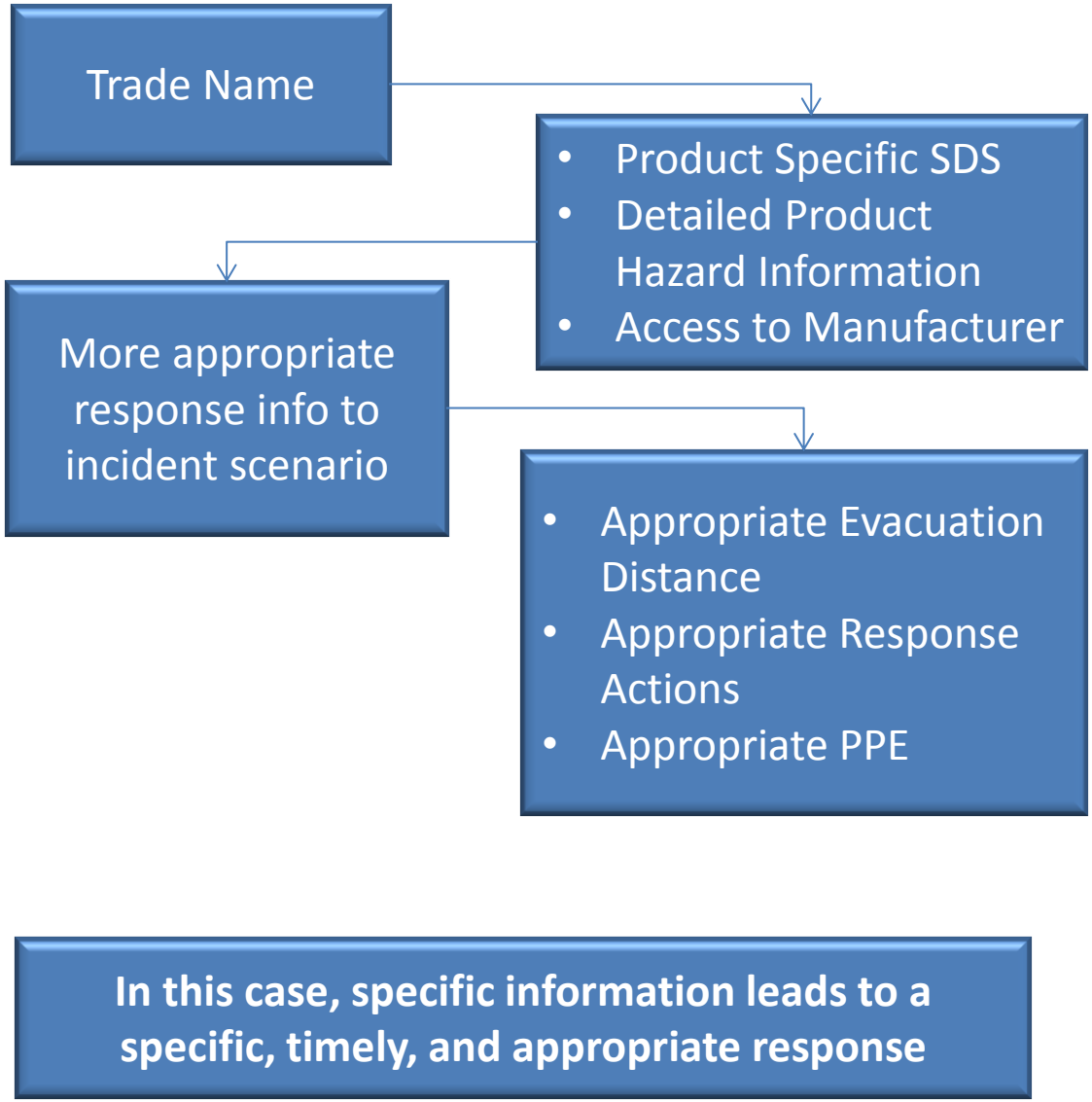
Why communication and correct information is critical

DOT Proper Shipping Name



Why communication and correct information is critical

Product Specific Trade Name



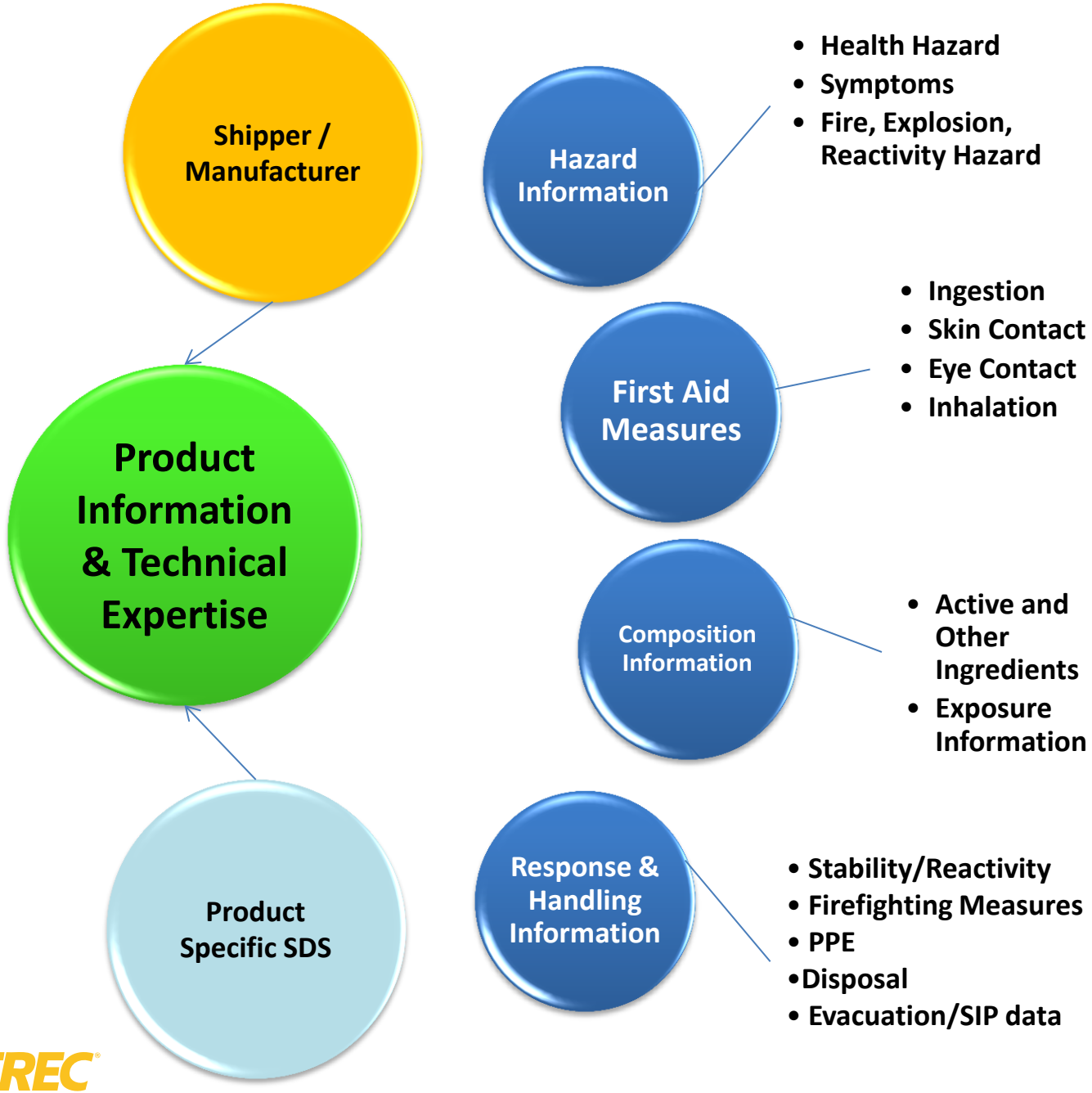
In this case, specific information leads to a specific, timely, and appropriate response

Why communication and correct information is critical

Challenges in Identifying Trade Name

- **Finding Product specific information can be hard for a responder**
  - **SDS data is no titled by proper shipping name or technical name**
  - **Trade name information may not be transferred in EDI data from one system to another**
  - **Trade name information may not be readily apparent to responder (or caller) even if it is shown on shipping documents**

Matching shipper to trade name is quickest path to good information for the responder


Shipper / Manufacturer
Product Information & Technical Expertise
Product Specific SDS
Hazard Information
• Health Hazard
• Symptoms
• Fire, Explosion, Reactivity Hazard
First Aid Measures
• Ingestion
• Skin Contact
• Eye Contact
• Inhalation
Composition Information
• Active and Other Ingredients
• Exposure Information
Response & Handling Information
• Stability/Reactivity
• Firefighting Measures
• PPE
• Disposal
• Evacuation/SIP data

An Important Piece of the Emergency Response Puzzle…

- **Your Emergency Response Information Provider (ERIP) should have immediate access to product specific emergency information**
- **Your ERIP is at the very center of a vast network of resources such as First Responders, Shippers, Carriers, Chemists, Toxicologists and Mutual Assistance Networks**

An Important Piece of the Emergency Response Puzzle…

- **Your ERIP can be the activation point for your internal Emergency Response Plan for any Lithium Battery or Dangerous Goods incident**
- **Your ERIP can provide valuable incident data that can be used for process improvement, lithium battery packaging improvements and internal auditing efforts**

Questions?

Thank You

For more information visit our website
www.chemtrec.com

Brian Banks, Product Manager
CHEMTREC
bbanks@chemtrec.com

Raising Awareness in the Postal Sector

Danny Cortez

Security Specialist, UPU

5th IATA Lithium Battery Workshop

Outreach to enhance safety

Montreal, Canada, 29–30 September 2015

Bringing Awareness to the Postal Sector

Montreal, Canada

5th IATA Lithium Battery Workshop – 29 – 30 September 2015

Daniel Cortez – Global Security, U. S. Postal Inspection Service

UPU UNIVERSAL POSTAL UNION

Introduction

- UPU Background
- Dangerous Goods in International Mail
- UPU Dangerous Goods Efforts
- Hongkong Post Best Practice
- Moving Forward

UNIVERSAL POSTAL UNION

UPU Background

- Founded in 1874
- United Nations specialized agency since 1948
- 192 member countries
- 640,000 postal outlets
- 350 billion letter-post items
- 6 billion parcels

UNIVERSAL POSTAL UNION

Dangerous Goods in International Mail

- UPU rules and regulations allow 4 in international mail
  - Radioactive materials – Very low activity limits
  - Infectious substances – Category B only
  - Solid carbon dioxide (Dry ice) when used as a refrigerant
  - Lithium cells and batteries contained in equipment

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UPU Awareness

- Dangerous goods training developed in cooperation with ICAO and IATA

Universal Postal Union – Training material

- UPU maintains a list of operators who are approved to carry equipment containing lithium batteries

http://www.upu.int/fileadmin/documentsFiles/activities/postalSecurity/listAuthorizedDOsLithiumBatteriesEn.pdf

- UPU collects data on dangerous goods incidents

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UPU Communications Campaign

Campaign primary focus:

- Dangerous goods in mail
- Counterfeit and pirated goods
- Specific reference to lithium batteries in printed flyer
- Overall awareness about what can and cannot be mailed

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UPU Communications Campaign

Broad objectives:

- Raise awareness and inform key publics about what cannot travel in the international mail stream
- Customers: safe packages will reach destination more easily
- Reduce the number of packages delayed at Customs or prevented from moving on to their international destination
- Promote a positive image of the Post as a caring service provider concerned with the safety of customers, postal staff and all stakeholders in the mail supply chain

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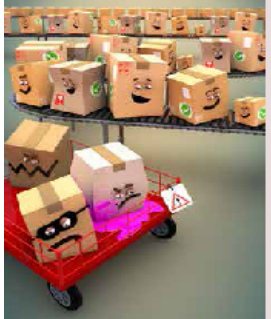
UPU UNIVERSAL POSTAL UNION

Keep me safe to get me there faster



Did you know that dangerous and prohibited goods cannot be sent in packages travelling through the international mail network?

These include explosives such as fireworks and gunpowder, aerosol spray cans and other compressed gasses, lighter fuels, perfumes, matches and other flammable products, and corrosives such as mercury. Counterfeit and pirated items are also forbidden.

Check before sending.

For more information, visit: www.upu.int/keepmesafe or contact your Post or Customs.

Keep me safe to get me there faster

Your Post is committed to providing quality service and delivering your packages and parcels as expeditiously as possible. But it can only do so with your help.

If you are sending a package abroad, be aware that some items, materials and substances are prohibited from travelling in the international mail stream.

Some products* are considered dangerous and present a safety hazard if travelling on aircraft. That's why international airline rules prohibit their inclusion in postal packages. These include ammunition, lighters, oil paints, perfumes, matches or mercury compounds, for example.

Other products, such as counterfeit or pirated goods, coins and valuable goods and live animals, are also prohibited from being sent through the post.

You are responsible for the content of packages you give to the Post for delivery. A package containing something it shouldn't will be handled in accordance with the relevant national legislation and likely be destroyed. Failure to comply with prohibitions and restrictions will also affect your ability to claim compensation.

Refer to this flyer for information and contact your Post's customer service for advice and guidance.

www.upu.int/keepmesafe

*Conditions may differ if these items, materials or substances are travelling domestically only; check with your Post.

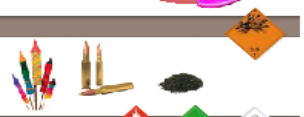
Dangerous goods prohibited in international mail 1

Lithium batteries 2

Prohibited items 3

Dangerous goods prohibited in international mail 1

Class 1 Explosives
- Fireworks
- Firecrackers
- Ammunition
- Gunpowder
- Flares



Class 2 Compressed Gases
- Propane tanks
- Diving tanks
- Aerosol spray cans
- Butane gas
- Fire extinguishers

Class 3 Flammable Liquids
- Lighters
- Lighter fuels
- Oil paints, wood varnishes and enamels – solvent-based
- Adhesives
- Perfumes and aftershaves
- Nail varnish, polish and gel

Class 4 Flammable Substances
- Matches
- Charcoals

Class 5 Oxidizing Substances
- Pool chemicals
- Hydrogen Peroxide
- Bleach

Class 6 Toxic and Infectious Substances*
- Pesticides
- Agricultural chemicals
- Mercury compounds
- Racharis
- Viruses

Class 7 Radioactive materials*
- Radioactive wastes
- Radioactive sources
- Smoke detectors

Class 8 Corrosives
- Wet batteries
- Mercury
- Hydrochloric acid

Class 9 Miscellaneous Dangerous Goods*
- Magnetised goods
- Dry ice
- Lithium batteries

*The Post can carry some of the substances in these categories in very limited quantities. Check with your Post for details.

Mail items may be returned if content description on the customs form does not make it clear that no dangerous goods are enclosed.

	unacceptable	acceptable
Household goods	May contain pressurized aerosol cans, flammable paints, or adhesives	Chocolate, Candles, Shirts, Dresses
Sporting goods	May contain ammunition or compressed gases	Racket, Ball, Shoes
Camping goods	May contain compressed gas, cooking fuel or matches	Tent, Sleeping bags
Diving goods	May contain compressed gasses	Wet suits, Diving masks, Fins, Snorkels
Medicine, drugs	May contain alcohol or be packed in dry ice	Ibuprofen, Aranoid tablets
Cosmetics	May contain flammable perfume, manicure goods, or nail polish remover	Soap, Lip gloss
Automobile components	May contain flammable fuel additives, aerosols or compressed gas	Mirror, Seat cover
Medical devices	May contain blood pressure measurement devices or thermometers that contain mercury	Stethoscopes

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UNIVERSAL POSTAL UNION

Tool kit

- Posters
- Postcards
- Animated videos
- Web banners
- Flyer
- Campaign web pages

UPU UNIVERSAL POSTAL UNION

Hongkong Post Best Practice

- Identified a surge in outgoing mail volume in 2013
- Observed there was a big increase of items with batteries
- Meetings with aviation security and safety to discuss options
- Decision was taken in early September 2013 to immediately stop acceptance of all postal items containing lithium batteries
- Post requested Aviation Security Company (AVSECO) screen items at Air Mail Center

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Actions Taken

- Increased effort by counter staff to inform customers to properly declare contents of postal articles on CN 22/23
- Increased customer education and awareness
- Items declared to contain lithium batteries were refused
- Mailbags or mail items required to pass through x-ray machines

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Actions Taken

- Items which failed screening are forwarded to Item Opening and Inspection (IOI) Team for open inspection
- Item opening inspection is conducted by AVESCO in cooperation with postal staff
- Identified items are used as examples to educate the public
- Majority of customers adjust their mailings and cooperate to avoid having their items delayed

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Results

- Hongkong Post is well known by internet traders for having strict control over lithium batteries
- Sellers will not take the risk of sending items with lithium batteries through Hongkong Post for fear of return without postage refund
- Hongkong Post has developed a solid reputation of accepting safe and secure items with industry partners and transporters

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A price to pay for doing the right thing

- The initial impact on outgoing mail volume was a 50% drop upon introduction of stringent measures
- The volumes are recovering slowly as customers become more familiar with the regulations

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Moving forward

- Continued education and awareness with UPU member countries and partners
- Awareness campaign focused on the staff of postal operators
- Working with other international organizations to understand the risks and how that impacts mail

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Thank You

Networking Lunch

12:30 – 14:00

SAFRAN Morpho

DESCARTES™

dupré Minerals

VIKING PACKING SPECIALIST

PROCYON ALPHA SQUARED PA2 Innovation for logistics & supply chains

5th IATA Lithium Battery Workshop

Outreach to enhance safety

Montreal, Canada, 29–30 September 2015

Testing, How to apply changes to the UN Manual of Tests and Criteria

5th IATA Lithium Battery Workshop

Outreach to enhance safety

Montreal, Canada, 29–30 September 2015

REVISED PRESENTATION

Lithium Battery Testing

– *When to test and how to apply changes to the UN Manual of Test and Criteria.*

John "JC" Copeland
VP/COO, Energy Assurance LLC

ENERGY ASSURANCE

Presentation Revision Explanation

- This presentation was revised based on input received from attendees of the IATA conference (Montreal, 29-30 Sept 2015) who had first-hand knowledge of the decision making that led to the lithium battery verbiage found in the UN Model Regulations that is replicated in the associated ICAO technical instructions and the IATA DGR.
- The verbiage in question specifies the appropriate revision of the UN manual of tests and criteria (section 38.3; covers required cell and battery testing):

  "… Cells and batteries manufactured according to a type meeting the requirements of subsection 38.3 of the UN Manual of Tests and Criteria, Revision 3, Amendment 1 or any subsequent revision and amendment applicable at the date of the type testing may continue to be transported, …"

- Although it states that Revision 3, Amendment 1 **OR** any subsequent applicable revision may be used, parties that participated in the process where this verbiage was generated have advised that this was not the intent, rather the **intent** was that the latest version of the UN manual in effect at the time of testing would be used, and provided there were no product changes sufficient to require retest, retesting would not be mandated solely because a new revision to UN 38.3 was released.
- As a practical matter, this is not a significant concern as most test labs offer testing of only the current revision as this represents the most mature form of the testing. We fully concur that this is the appropriate approach, but further feel that a clarification to the referenced verbiage is needed to prevent future misunderstanding.

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Scope of discussion

- What is the current revision of the UN Manual of Tests and Criteria?
- What does the IATA DGR require?
- What revision should be used when testing a new product?
- What changes really require retest?
- What revision should be used when retesting a product that was previously tested?
- A new revision was released – I haven't changed my product – should I retest?

- *Bonus: UN 38.3 testing - A view from the test lab*

ENERGY ASSURANCE

What is the current revision of the UN Manual?

- January 2015 - 5th revised Edition, Amendment 2
  - Based on amendments adopted by the committee in December 2012
  - Amended testing under T6 for lithium cells
    - Changed the diameter for performing crush versus impact testing

ENERGY ASSURANCE

What does IATA DGR require?

Lithium batteries must comply with the appropriate packing instructions, which require compliance with 3.9.2.6 Lithium Batteries

- (a) each cell or battery is of the type proved to meet the requirements of each test of the UN Manual of Tests and Criteria, Part III, subsection 38.3. Cells and batteries manufactured according to a type meeting the requirements of ***subsection 38.3 of the UN Manual of Tests and Criteria, Revision 3, Amendment 1 or any subsequent revision and amendment applicable at the date of the type testing*** may continue to be transported, unless otherwise provided in these Regulations. Cell and battery types only meeting the requirements of the UN Manual of Tests and Criteria, Revision 3, are no longer valid. **However, cells and batteries manufactured in conformity with such types before 1 July 2003 may continue to be transported if all other applicable requirements are fulfilled**.

- Note: Batteries, including those which have been refurbished or otherwise altered, must be of a type proved to meet the testing requirements of the Manual of Tests and Criteria, Part III, subsection 38.3, irrespective of whether the cells of which they are composed are of a tested type.

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REVISED

Which Revision – New Products?

- Latest revision should be used
  - Test labs will run unless advised otherwise
- Exception – cells and batteries manufactured in conformity with Revision 3 before 1 July 2003
  - ***Interpretation is manufacturing started before 1 July 2003 and no changes***
- Battery cannot claim compliance with a newer revision than the cell
  - Exception – if the cell is not affected by changes made in newer revisions
  - Option – GAP test the cells

What changes really require retest

- UN 38.3 states:
  - Primary cells and batteries – 0.1g or 20% by mass change to cathode, anode, or electrolyte
  - Rechargeable cells and batteries – 20% change in Wh or 20% increase in nominal voltage
  - All types – Any change that could lead to failure of any of the tests
    - Cells - Anode/cathode/electrolyte/separator material change
    - All – change in protective devices, including software changes
    - All – Changes in safety design – venting valve
    - Batteries – change in the number of component cells or the connection means of the cells

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Examples of Common Changes

Change	Retest	No retest
New FET or safety IC that is a drop in replacement. Verified to be the same or better response time and thresholds		XX
Change in method of closure of the battery enclosure, including changes to adhesives, welding methods etc.	XX	
Change in the method used to secure the cells within a battery enclosure (adhesives type, adhesive volume, spacers added or removed)	XX	
Cell – CID or PTC changes	XX	
Cell – Shape and/or size	XX	
Cell – Additives or other chemical changes	XX	

ENERGY ASSURANCE

REVISED

Which Revision – Retesting?

- Latest revision should be used
- There are no exceptions permitted
- Battery cannot claim compliance with a newer revision than the cell
  - Exception – if the cell is not affected by changes made in newer revisions
  - Option – GAP test the cells

ENERGY ASSURANCE

A new revision was released – do I need to retest?

- Newest revision is always best, but not required unless:
  - Regulatory standard adopts new revision (transition period)
  - Design changes

- In some cases you can update a report with no testing to the newest revision:
  - Latest revision only affected cells in a certain diameter range. No retest needed if the cells are not in the affected range.
  - Updated cell certificate provided to newest revision – no battery level test changes, can update battery level certificate to latest.

ENERGY ASSURANCE℠

A view from the Test Lab: UN38.3 Testing

- Intent: Holistic “feel” for the test regime
- Not going to focus on test parameters/execution
- “Test Risk”
  - Where do we typically see failures?
  - What do they look like?
- Example to review: T1-T5 & T7 (Rechargeable Batteries)

ENERGY ASSURANCE

A view from the Test Lab: UN38.3 Testing

	Description	Notes	Risk
T.1	Altitude	50,000 ft simulation	Very Low
T.2	Thermal	Temps outside battery storage temp range. Ages cells; thermally cycles connections.	Medium
T.3	Vibration	3 planes x 3 hours = 9 hours	High
T.4	Mech Shock	18 impacts at 150G's	High
T.5	Short Circuit	Elevated temperature – Hard short. Does the safety circuit still work?	Low, but…
T7	Overcharge	Simulates a bad 24 hour charge and then put in shipping channel for 1 week	Low if good OC Prot.

ENERGY ASSURANCE

Typical Failures

- Mass Loss (a.k.a “Leakage”)
  - Loss of 0.1% (0.001) of pre-test weight = failure
  - Attributable = cell vents
  - Non-Attributable = Moisture loss (non-cell parts)
- Voltage Loss
  - 10% loss permissible (pretty wide tolerance)
  - Cell develops internal shorts
  - Electrical connections mechanically break
  - Loss of insulation or spacing = shorting between components
  - Lossy circuit (ensure in shipping configuration)
- Catastrophic Failures (Rare)

ENERGY ASSURANCE

REVISED

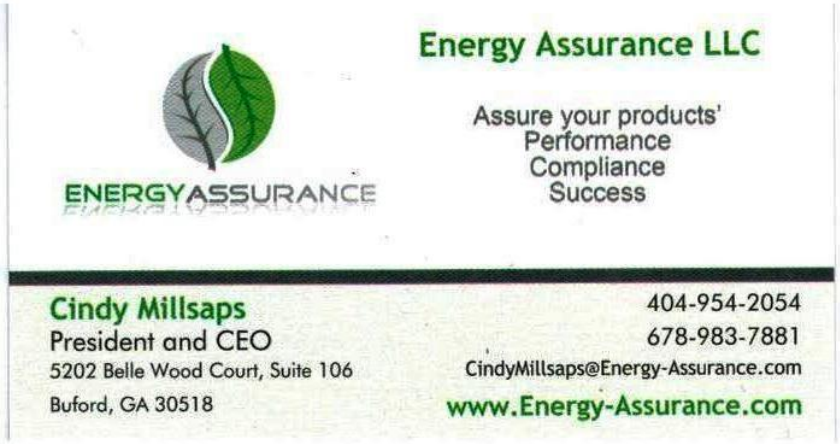
Recap

- Pace of change for UN is very slow
- Incremental changes vs. overall test approach
- Current UN: Revision 5, Amendment 2
- IATA DGR: Current revision (with 1 exception)
- Gap testing is an option for cells qualified to earlier rev.
- Standard specified what constitutes retesting/new model
  - Chemistry, Safety, Wh/Mass, Impact test results

- UN is a mechanically robust test profile
- Likely failures: 1) Leakage; 2) Voltage Loss

ENERGY ASSURANCE℠

Questions…?



ilac-MRA

ANAB
ACCREDITED
ISO/IEC 17025
TESTING LABORATORY
AT-1601

Questions Answered: Interactive Session

Classification

- Will there be some regulation about aluminium ion battery?

- We manufacture and ship data loggers powered by small primary lithium cells in standby mode. Do you foresee any further regulations that might threaten our ability to do so and therefore our business?

- how is the industry planning to confront the unsolved issue of all items sent back and forth via e-bay and similar channels?

- Now, there are Section I/IA , IB, II for lithium battery handling and also have the exceptions for the lithium battery which are not more than 4 cells or 2 batteries in equipment. Is it possible to have a single rule for transport of lithium battery (not so many sections)?
- and if it is so dangerous , all of the lithium battery shall be declared on DGD without any exception?

- everyone know lithium battery are dangerous but why some provision do not require UN specification package, e.g. Section IB ?

- So Lithium Battery in Section II can be treated as non-dangerous goods?

- What will happen with the transport of lithium-ion batteries alone, PI 965 all section? A lot of airlines refuse them right now.

- There is clearly the potential for all energy storage devices to produce dangerous evolutions of heat, would it not make sense to develop the packing instructions to meet a fire-proof specification

- How will the IATA proposal to limit the use of overpacks impact shippers of palletized loads. Palletized loads meet the definition of an overpack.

- As we know there need to be requirements for the safe transport of lithium batteries but, in addition to the packaging requirements should there also be additional emergency equipment requirements made in case of an event during transport.

- Is there a report that outlines the number of shipments that are transported for both bulk and non bulk battery shipments aboard cargo and non cargo aircrafts?

- Would like to know:

1) Regulation clarification plan on lithium batteries

- As a shipper, lithium related consignments are difficult to handle as regulations are understood differently by airlines.
- For example, LBH Labelling Position on packages is not defined so that some airlines decline acceptance as the cannot see LBH from distance, seeing other faces of packages.

- For us, simplification of regulations is truly requested.
- How can we define a limit for the transportation of bulk lithium batteries UN3480
- Many parties are discussing that a bulk of lithium battery should not be transported by air. How does ICAO/IATA think about this? Is it possible to determine/define the meaning of "bulk"? How many batteries are defined as "bulk"?

More Questions?

More information available at:
www.iata.org/lithiumbatteries

Networking Break

15:30-16:00

ULDs and ULD Equipment as a risk mitigation strategy

Bob Rogers Nordisk

Andy Davies AmsafeBridport
Jean-Jacques Machon ULD Consultant
Bob McClelland UPS
Candy Chan Cathay Pacific

5th IATA Lithium Battery Workshop
Outreach to enhance safety
Montreal, Canada, 29–30 September 2015

ULD's as a Risk Mitigation Strategy

5th Lithium Battery Workshop
Montreal Canada
29-30 September 2015

Point 1: ULD are Multi Functional Devices

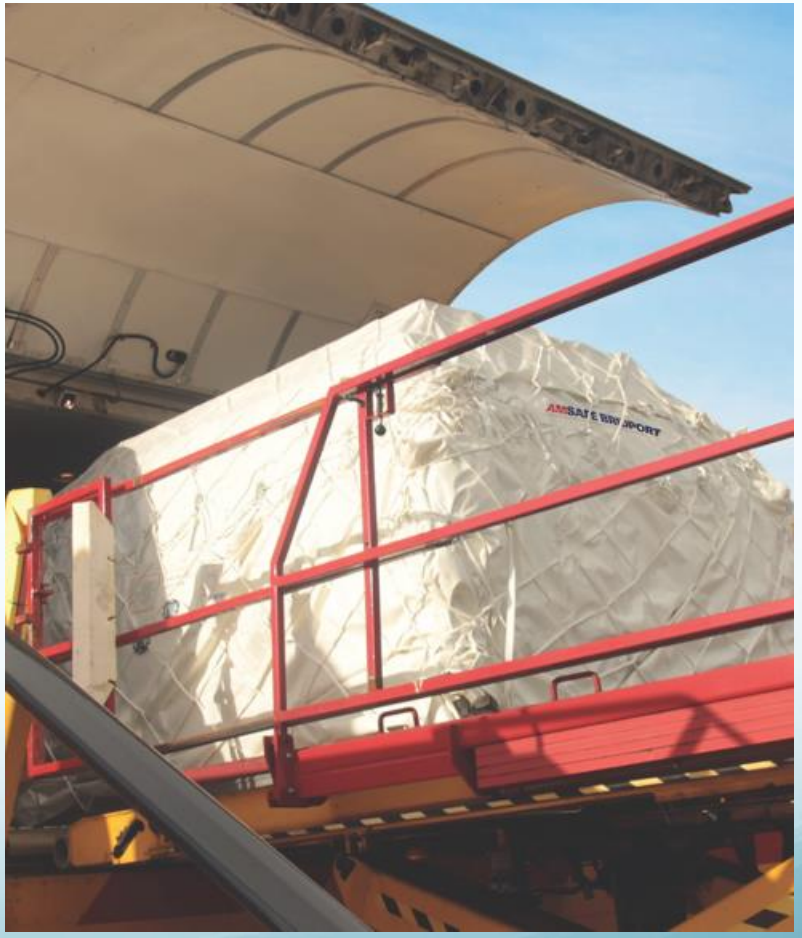
Standard restraint

Special Cargo Restraint

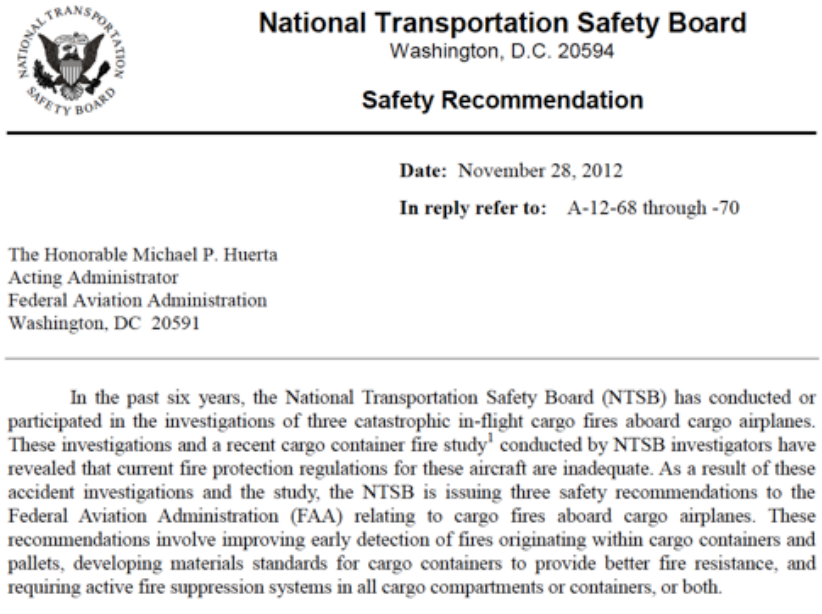
Temperature Control

Explosive device containment

And as Fire Containment Covers & Fire Resistant Containers



Point 2: Regulators see ULD as part of the solution



National Transportation Safety Board
Washington, D.C. 20594

Safety Recommendation

Date: November 28, 2012

In reply refer to: A-12-68 through -70

The Honorable Michael P. Huerta
Acting Administrator
Federal Aviation Administration
Washington, DC 20591

In the past six years, the National Transportation Safety Board (NTSB) has conducted or participated in the investigations of three catastrophic in-flight cargo fires aboard cargo airplanes. These investigations and a recent cargo container fire study[1] conducted by NTSB investigators have revealed that current fire protection regulations for these aircraft are inadequate. As a result of these accident investigations and the study, the NTSB is issuing three safety recommendations to the Federal Aviation Administration (FAA) relating to cargo fires aboard cargo airplanes. These recommendations involve improving early detection of fires originating within cargo containers and pallets, developing materials standards for cargo containers to provide better fire resistance, and requiring active fire suppression systems in all cargo compartments or containers, or both.

4.6 SR 30/2013:
The FAA in co-operation or in coordination with EASA to develop standards for containers with suppression systems, superior heat and fire resistance and resiliency to withstand a suppression-198 caused pressure pulse and still contain a suppression agent in accordance with NTSB recommendations contained in NTSB A-12-68,69,7098.
4.7 SR 31/2013

The FAA in co-operation or in coordination with EASA to implement certification rule changes to require containers or Unit Load Devices (ULDs) which meet the standards in recommendation 4.6, develop a design standard that enables the container or ULD to be capable of internally containing or suppressing a fire agent in accordance with NTSB recommendations contained in NTSB A-12-68,69,70.
4.8 SR 32/2013:

The FAA to develop an Advisory Circular [AC] addressing the use of fire containment covers for cargo stored on pallets that could be used to cover palletized cargo or cargo containers.

Point 3:But others are not so sure

ICAO Multidisciplinary Lithium Battery Transport Coordination Meeting

4. Fire Hardened Cargo Containers

a. Cargo operators and others are developing cargo containers that are fire resistant

b. These containers have been shown to be effective against normal combustibles.

c. Tests with lithium ion cells have resulted in explosions due to gas build-up.

d. Tests with lithium metal cells have been largely unsuccessful.

e. These containers may prevent Halon 1301 from penetrating into the container when used in a Class C compartment.

f. These containers may extend the time from fire ignition to detection by containing the smoke within the container for a period of time.

5. Fire Containment Covers

a. These are covers designed to be installed over palletized cargo.

b. These covers have been shown to be effective against fires involving normal combustibles.

c. Tests have shown that these covers are not successful at containing a lithium metal cell fire.

d. Tests have shown that the covers have mixed success at containing lithium ion cell fires.

Point 3a:No ULD SME at these meetings

2. ATTENDANCE

2.1 The meeting was attended by experts in the fields of dangerous goods, operations, airworthiness, safety management systems, aircraft cargo fire safety research and development and representatives of the airframe manufacturer and lithium battery industries. A list of participants is provided in Appendix C.

Point 4: RISK MITIGATION CHOICES

- DG Regulations?
  - Requires compliance
  - Behavioural issues

- Aircraft design?
  - Life of current fleet
  - Future designs a long way off

- **ULD ?**
  - **Relatively easy to implement**
  - **Relatively inexpensive**
  - **Removes the human factor**

Point 4a:DG regulations can define the right way, ULD can protect against the wrong way !

However:

FCC/FRC not yet mainstream

Lack of clarity of the containment requirements

Poor operating environment

Point 5: Lot of discussion- but is the ULD option getting the recognition it deserves?

ICAO

NAA's

Industry Associations

Airlines

Air Cargo Industry

Battery manufacturers

A role here for IATA to bring the ULD solution into the forefront?

Ask yourself?

Do you consider FCC/FRC a practical defence against on board fires?

If so why is FCC/FRC use not already widespread?

Will 100% FCC/FRC use be mandated in the event of another accident?

If FCC/FRC are mandated is the industry ready?

Where does IATA come into this discussion?

Speakers:

Jean-Jacques Machon

ULD Consultant

Andy Davies

Director of Engineering Amsafe- Bridport

Bob McClelland

Air Dangerous Goods Manager UPS Airlines

UPS Airlines Fire Safety Enhancements

September, 2015

UPS Fleet

Boeing MD-11

Boeing 757

Boeing 767

Boeing 747-400

Airbus A-300


1700 Flight Legs
700 Destinations
220 Countries and Territories
ups
WE LOGISTICS™

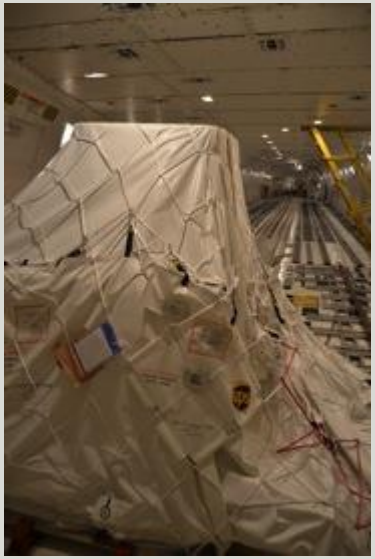
Fire resistant unit load devices

- Fiber-reinforced plastic
- Withstand fires for at least four hours
- Less fuel burn
- More durable

ULD fire test

Fire Containment Covers

- Withstand fires for at least four hours
- Palletized cargo
- Implemented on routes with significant electronics, lithium battery shipments
- Inventory levels to ensure availability in targeted lanes



FCC fire test

Flight deck improvements

Multi-layered approach to cargo fire safety

- Cargo deck
  - FRCs
  - Fire containment covers for cargo pallets
  - Prototype in container fire-suppression units
- Flight deck
  - Quick donning, full-face oxygen masks
  - Emergency Vision Assurance System (EVAS)
  - Enhanced crewmember training and emergency checklists
- Training
  - Enhanced customer and employee training, audits
- Regulatory
  - ICAO, PHMSA, IATA

3rd ULD Regulatory Forum &
Lithium battery workshop joint session
Montreal, Sep.29, 2015

FCC & FRC standards

Contribution to higher flight safety

Presented by: Jean-Jacques Machon, ULD Consultant

A worrying series of accidents due to fire

- 05 Sep. **1996** FedEx DC10F, Newsburgh (hull loss)
- 07 Feb. **2006** UPS DC8F, Philadelphia (hull loss)
- 03 Sep. **2010** UPS B747F, Dubai (fatal crash)
- 28 Jul. **2011** Asiana B747F, at sea (fatal crash)

All involved freighter main deck class **E** compartments

Last three likely involved Lithium batteries

SOURCE: NTSB aviation accidents data base

Hull loss example after emergency landing

Hull loss example after emergency landing

FCC and FRC standards

Prompted by the first accidents, ISO TC20/SC9 decided in **2008** to develop international standards for then non existing:

- Fire Containment Covers for pallets (FCC).
- Fire Resistant Containers (FRC).

These were respectively published in:

- 2013 for **ISO 14186** on FCCs,
- 2015 for **ISO 19281** on FRCs,

FCC and FRC standards (contd)

These standards' development incorporated the results of full scale **fire tests** conducted by airlines, manufacturers, and in parallel the FAA (Atlantic City Technical Center).

International Standards were followed by SAE standards:

- **AS 6453** for Fire Containment Covers (published 2013),
- **AS 6278** for Fire Resistant Containers (in preparation),

and the FAA issued in 2014 **TSO C-203** for FCCs approval.

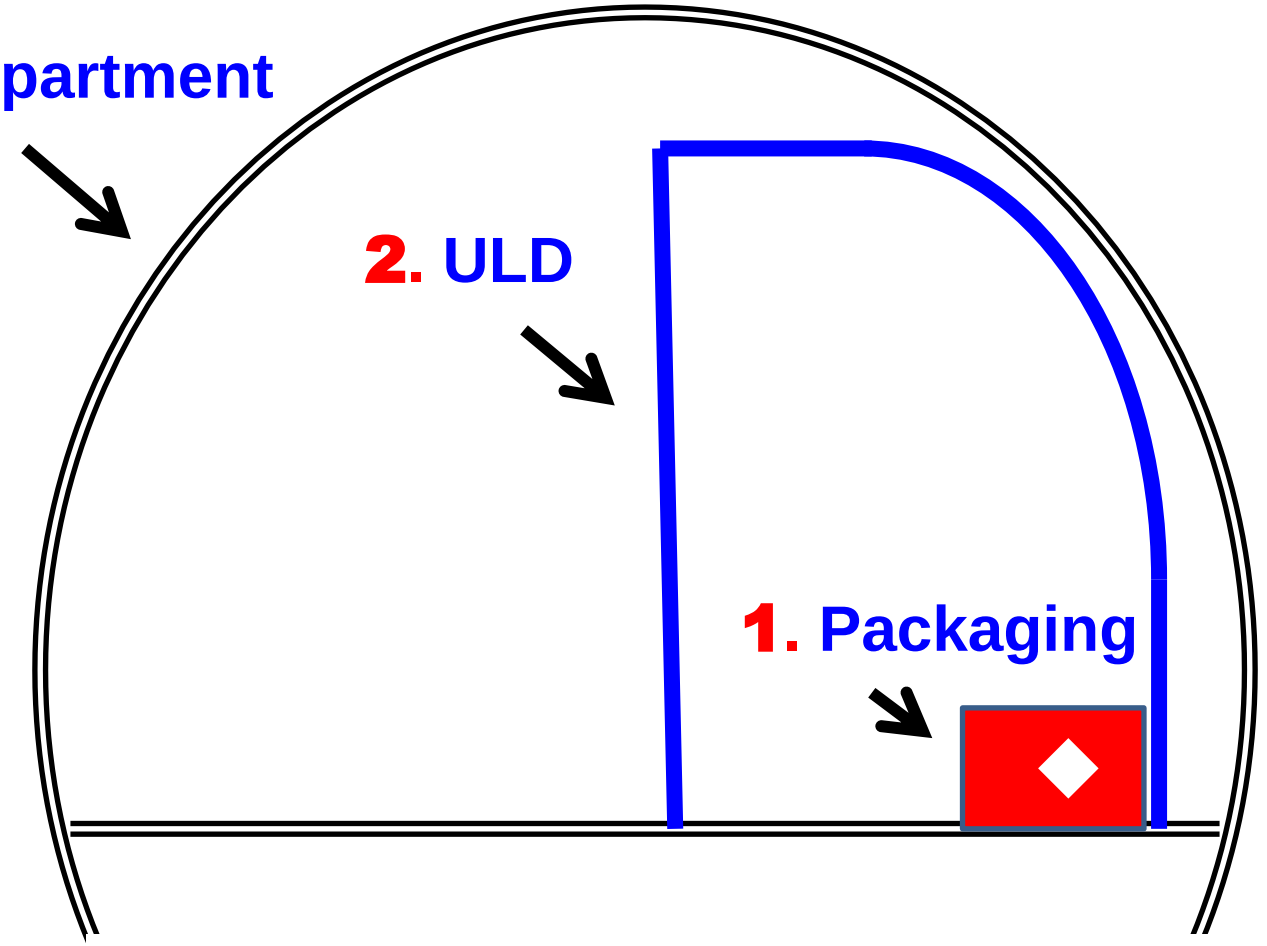
A TSO for FRCs is under consideration, pending AS 6278 publication.

Test findings

- FCC and FRC testing is based on **class A fires** (AC 20-42C: ordinary combustible materials), which Lithium batteries – the main identified hazard – are not.
- Recent testing evidence strongly suggests the Li batteries case must be addressed considering **all** protection elements:
  - ► Batteries **packaging** (Dangerous Goods),
  - ► **ULD** (FCC or FRC, but also regular containers),
  - ► Cargo **compartment** fire detection and control

together, and their interactions.

Saving precious minutes: 3 tiers fire protection



Test findings (contd)

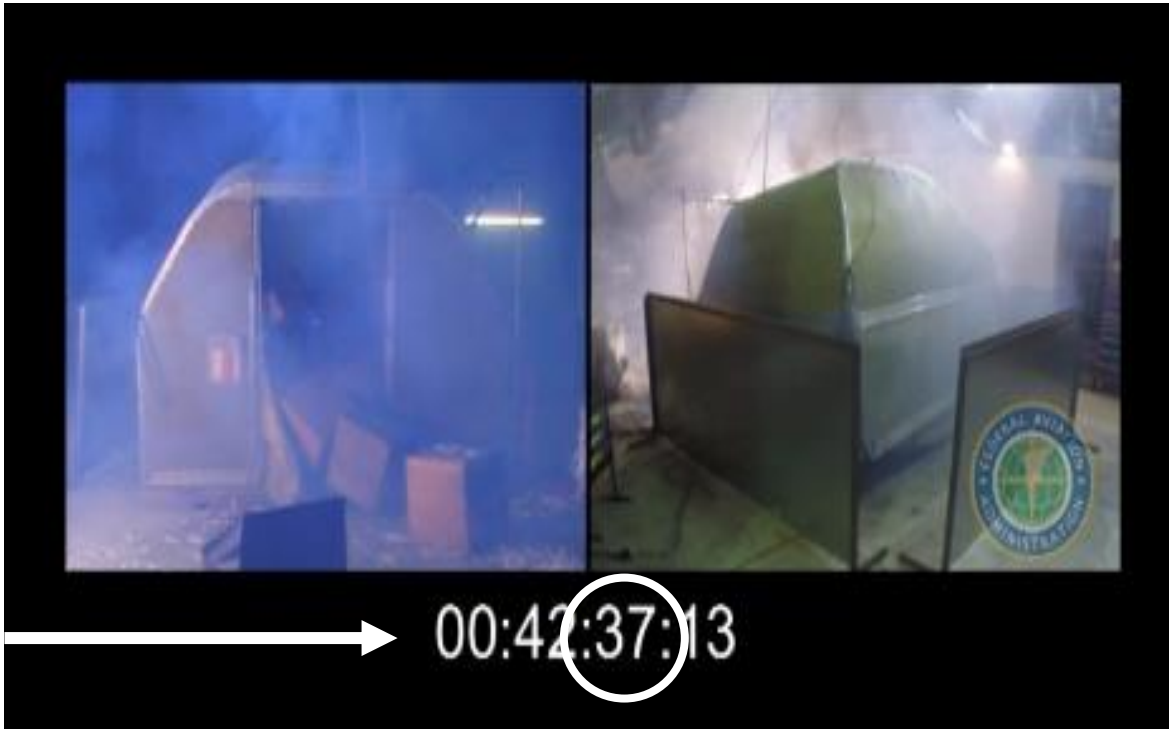
This was emphasized by tests conducted in 2014 by the FAA Tech Center: an FRC, when fire tested with a load of approx. 5,000 **Li-ion** batteries, exploded:

Minutes after ignition

Courtesy FAA Tech Center

Test findings (contd)

Even though the explosions occurred relatively late (42 min after ignition), fire was not contained anymore after explosion:



4 seconds after the explosion

Courtesy FAA Tech Center

Test findings (contd)

- the explosion resulted from propagation of **thermal runaway** of an estimated one to a few hundred batteries
- their combustion vented inside the container flammable **hydrocarbon gases**, resulting in explosion.
- the FAA plans additional tests to develop mitigating strategies for gas build-up due to venting Li-ion batteries.

ICAO recommendations

These test results were considered by a 2nd **ICAO Multidisciplinary Meeting** in Cologne on 9-11 Sep 2014, which agreed **recommendations** on all three prevention factors:

1. Li batteries packaging [ICAO DGP, IATA DGB],
2. ULD contribution [IATA ULDB],
3. Cargo compartments [airframers, airlines].

☞ These recommendations are a road map for all sides of the industry to consider and implement.

ICAO recommendations (contd)

The recommendations concerning **ULDs** are:

Recommendation 6 – Fire Detection and Suppression Agent Accessibility in Class C Compartments:

That a lithium battery fire be detected rapidly and suppression agent reach the fire rapidly regardless of the use of containers or pallets. This will require **re-assessment of current ULD** and fire detection/suppression technologies.

Recommendation 7 (Near-term) – Use of Enhanced Containers and Fire Containment Covers in Class C Cargo Compartments:

That, given recent tests, the carriage of lithium-ion batteries in enhanced containers or on pallets fitted with fire containment covers that inhibit the ability of the Class C fire suppression agent from reaching the fire be **curtailed**, pending further testing. . . . .

ICAO recommendations (contd)

Recommendation 11 (Longer-term) – Research and Sharing Information Concerning the Management of Risks Associated with the Carriage of Lithium Batteries:

That States and industry be encouraged to conduct research and share their results in respect of future methods to mitigate the risks associated with the carriage of lithium batteries on aircraft **including** performance based packaging; **use of existing ULD**s and any appropriate modifications to these devices**; use of fire resistant covers and containers**; and enhancements to fire/smoke detection devices.

A year later, where do we stand ?

- **FCCs** are in service:

  ISO 14186 standard [IATA ULDR: **SS 50/7** and **OS 6/10**]

- some **FRCs** are in service, more are coming:

  ISO 19281 standard [ULDR 4th edition **SS 50/8** & **OS 6/15**]

☞ **But** there remain key outstanding issues . . .

❶ Critical: emergency descent phase

- In freighters class **E** main deck compartments, most fires are controlled (smothering) in cruise flight by depressurization.
- This protection ceases during emergency descent & landing (25-30 min), where fire restarts, eventually fiercely: survival is then a matter of **minutes**.
- Though highly critical, this phase of the flight is **not** simulated by testing to the present standards – even though tests are at ground pressure.

☞ Further research may be needed ?

❷ Lower deck carriage ?

- ICAO recommendation N° 7 is to curtail the use of FCC and FRC in Part 25 **class C** (lower deck) cargo compartments.
- This is intended not to inhibit action of the fire suppression agent, but recent testing to be confirmed seems to indicate that Halon does **not** control a **Lithium battery** class D fire.
- Halon would still control a fire of other origin to avoid setting fire to intact batteries carried in the same ULD ?
- Halon would still enter an **FCC**, if maybe not all FRCs ?

☞ Need for further research and discussions ?

❸ FRC construction

- The high **cost** of all composite FRCs could be reduced by using existing container designs, just replacing the panels and door materials.
- This does not comply with the present ISO 19281, which requires the toughest (Part 25 App. F Part III) fire tests on **all** materials.
- Discussions are on-going to determine if – possibly with other protections and tests – standard container aluminium structure can be kept. If so, the standard would be revised.

❹ Class D fire test needed !

- As outlined, the current class **A** full scale fire test needs to be complemented by a – not yet existing - **class D** fire test.
- Class D fire definition is " *Fires which involve combustible metals*", but no defined example or test method is known.
- A test setup should be defined and FAA approved involving Lithium batteries (at least Li-ion), sizes, quantities and packagings TBD. This can be established **only** by **joint work** of Li batteries and ULD fire test experts. Cooperation is requested.

Conclusion

- **FCCs** are available, and **FRCs** should be shortly, to mitigate up to 6 hours flight the risks due to a Li batteries fire, under the “3 tiers” protection philosophy. But a lot remains to be achieved as far as first generation standards are concerned:
- Better accounting for the critical emergency **descent** phase,
- Testing ULDs to a **class D fire** involving Li batteries.

☞ Cooperation of experts in different areas is the only way.

Thank you for your attention.

.

Questions ?

DISPELLING THE MYTHS - FCCs

ANDY DAVIES

Director of Engineering

AmSafe Bridport

30th September 2015

1. Threat established & increasing
2. Options for fire containment are limited – no magic solution
3. '3 Tier' system being developed – some way off
4. Fire Containment Covers (FCCs) are 'Phase 1'

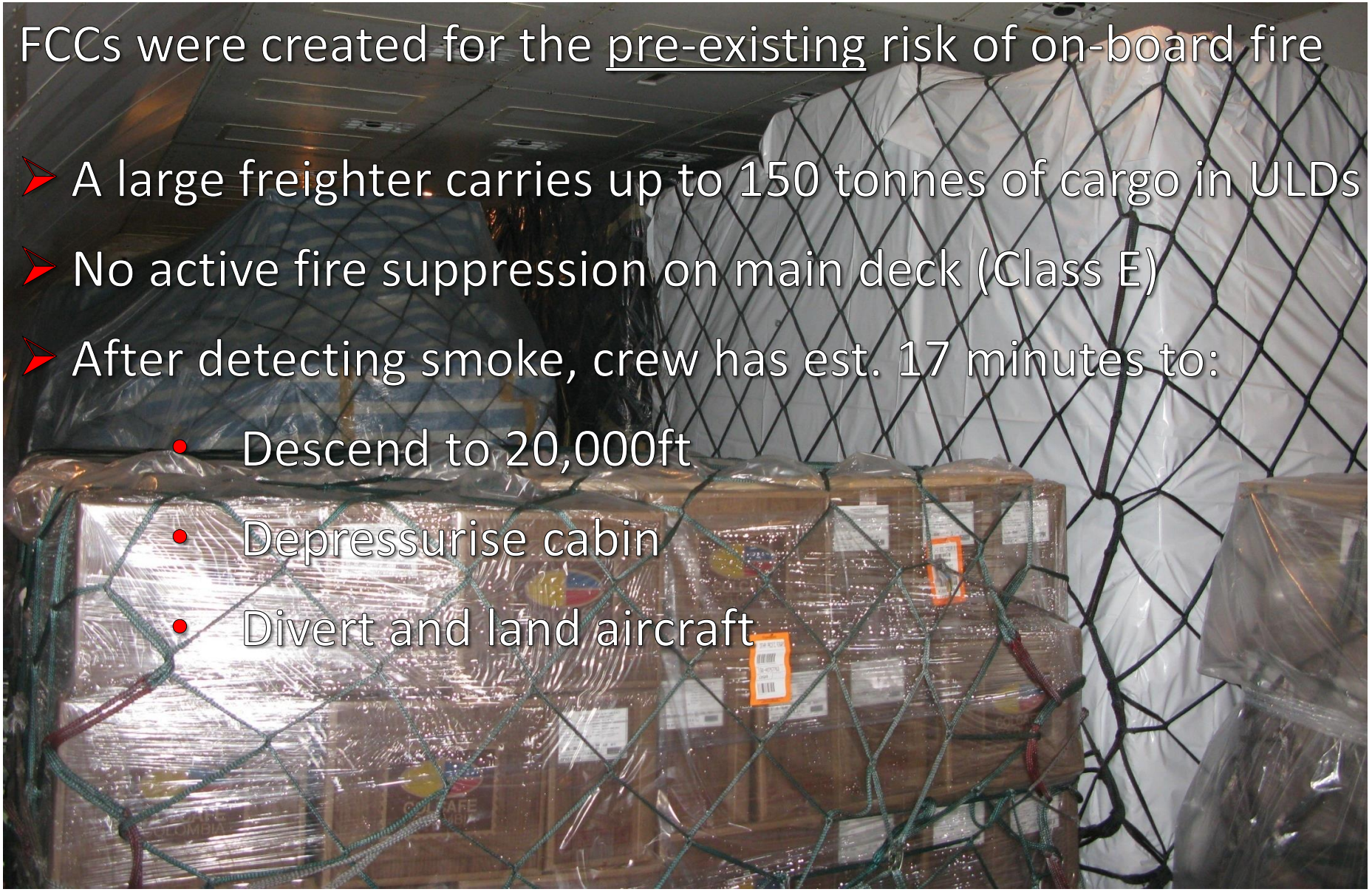
Passive, simple, effective, existing technology, quick to implement

- Fully developed
- Proven in sustained global operation
- Standardized design, performance & testing (AS6453 / ISO14186)
- Standardized operation & use (IATA ULDR SS 50/7 & OS 6/10)
- FAA Airworthiness certified (TSO C203)

Greatest industry challenge: apathy, denial and misinformation

Myth 1

"I don't carry Lithium Batteries, I don't need Fire Containment Covers"



FCCs were created for the pre-existing risk of on-board fire

- A large freighter carries up to 150 tonnes of cargo in ULDs
- No active fire suppression on main deck (Class E)
- After detecting smoke, crew has est. 17 minutes to:
  - Descend to 20,000ft
  - Depressurise cabin
  - Divert and land aircraft

All critical elements are present:

1. Ignition: Undeclared DG, fault, malicious incendiary
2. Combustibles: cardboard, paper, plastics
3. Potential: tonnes of cargo, packed closely together
4. Oxygen: restored in critical descent phase
5. Time: Limited

The next serious air cargo fire incident is overdue

Few airlines have implemented any protection

Fire Containment Covers;

- Contain fire at a single pallet position
- Shield the aircraft structure & systems
- Prevent fire spreading to next pallet/container
- Protect the cargo from fire outside the pallet
- Provide time to divert and safely land

TSO 203 approved FCCs provide;

- **Minimum 6 hours** 'Class A' fire containment

Myth 1

"I don't carry Lithium Batteries – I don't need Fire Containment"

Myth 2

"I don't need FCCs – they cannot contain a Lithium Battery Fire"

1. Li cells are prevalent in all aspects of life

2. They are being shipped by air
   - in bulk,
   - in devices & equipment containing batteries, and
   - as undeclared DG.

3. Li cells provide a unique and widespread threat to cargo aircraft:
   - as an autonomous ignition source causing a fire, or
   - as a hazardous fuel to an existing fire

Test

- TSO 203 approved FCC
- Standard 'Class A' test, with addition of charged lithium-ion batteries
- Batteries concentrated in 3 packages
- Packages distributed to critical areas
- 3 boxes ignited simultaneously

Battery Type	Lithium-ion rechargeable 18650 cylindrical batteries
Voltage (per cell)	3.7 V
Capacity (per cell)	2600 mAh
State of Charge (SOC)	75% - 90%
Total weight (approx.)	70.0 kg

Result

- Minimum 6 hours fire containment

Myth 2

"Fire Containment Covers Cannot Contain a Lithium Battery Fire"

- Threat established & increasing
- Future - FCC will form key part of wider all encompassing system
- Now – FCC is available. Alone it will greatly mitigate risk
- In all cargo fire situations - always better with an FCC, than without

1. What word would you use to describe the role of FCC/FRC in fire containment

1. An essential defense against the risks posed by Lithium batteries
2. Might do some good
3. No worthwhile contribution

and give some thoughts on your viewpoint

2. Fires are unpredictable affairs, and Lithium battery fires are proving more unpredictable than most. Repeated tests reveal different scenarios, moving the goal posts ever further down the track. Should airlines be prepared to accept that a good solution today is superior to a perfect solution tomorrow?

3. Do you think there will be a day when the " bullet proof solution" is actually arrived at or is this going to be a "never ending story"?

4. Currently IATA publishes any relevant FCC/FRC standards in the ULD Regulations but does little more when it comes to these items. What additional actions would you recommend that IATA be taking?

Chairman
Closing Remarks

5th IATA Lithium Battery Workshop

Outreach to enhance safety

Montreal, Canada, 29–30 September 2015

Welcome Reception

18:00 – 19:30

SAFRAN

Morpho