We are Allianz Commercial

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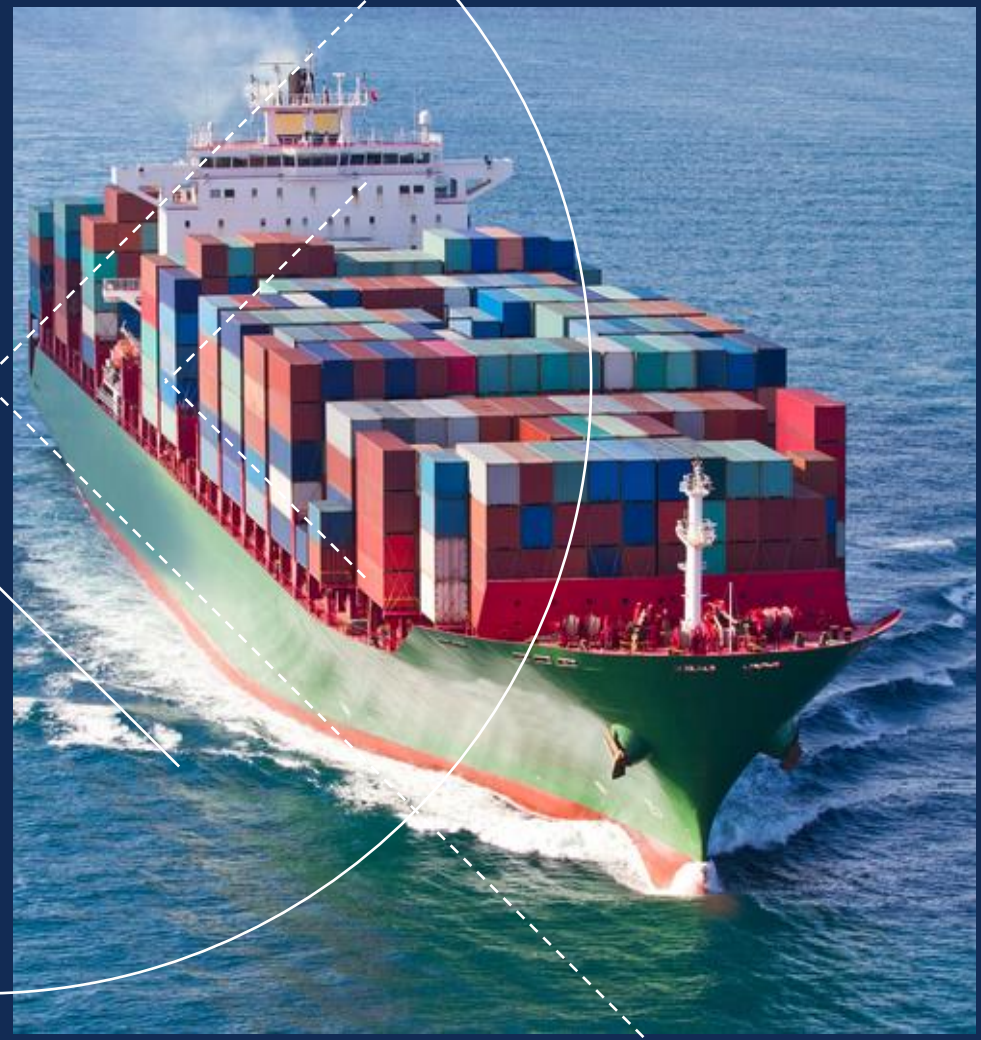


Managing Lithium-Ion Battery Risks: Storage and Transportation
19th Annual Marine Insurance Day Seminar
01 October 2025
Baruch College, New York, NY

Capt. Randy Lund, MBA, NAMS-CMS
Sr. Marine Risk Consultant
Allianz Risk Consulting

Risk Bulletins

Risk Bulletin

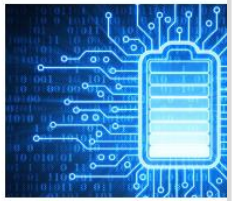
2017

Allianz Global Corporate & Specialty

Lithium-Io

Allianz Risk Consulting

Introduction



Source: iStock

An electric battery is a device consistin
electrochemical cells with external cor
to power electrical devices. A battery r
multiple cells that convert chemical er
energy. **Lithium-ion batteries** are a r
of rechargeable battery types in which
from the negative electrode to the pos
during discharge and back when charg
most widely used type of rechargeable
and are common in home electronics,
medical applications and industrial ap
consumer electronics, lithium-ion batt
growing in popularity for military and
well as aerospace and marine applicat

This risk bulletin is issued in support of
awareness of businesses involved in th
packaging, transporting, usage and sto
of batteries, as well as products contai
batteries.

Allianz Risk Consulting
North America

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Lithium-ion batteries

Emerging Risk Trend **Talk 1**

Emerging risks have unique characteristics that require specialist technical, management and organizational skills. Our Risk Consulting expertise across different industries and lines of insurance business around the world is key to helping companies understand and mitigate these. In our Emerging Risk Trend Talk series, we address such topics, highlight loss events and look at targeted loss prevention measures.

The risk

A lithium-ion (Li-ion) battery is a type of rechargeable battery used to power a wide range of consumer and electronic goods, as well as electronic vehicles (EVs). They are also widely used in grid-scale energy storage and aerospace applications.

Compared to other rechargeable battery technologies, Li-ion batteries have high energy densities, low self-discharge, and no memory effect. They have a Battery Management System (BMS) which can monitor not only the State of Charge (SoC) of the battery but also the conditions of the cells and modules. The BMS acts as a safety back-up if conditions are outside the normal parameters and will shut down the device. For larger applications, such as a Battery Energy Storage System (BESS), an Energy Management System (EMS) with integrated thermal management and monitoring processes is utilized to track the entire system.

Li-ion batteries can be a safety hazard if not properly engineered, manufactured, transported, installed, charged, and stored because cells have flammable electrolytes. If damaged or incorrectly charged, Li-ion batteries' high temperatures can lead to explosions and fires, as has been seen with a number of recent incidents on land and at sea.

Unlike lithium batteries, Li-ion batteries do not contain lithium metal, which is highly combustible and reactive with water. Water is currently the best medium to fight a Li-ion battery fire due to its effective cooling capabilities. However, these fires can be very difficult to extinguish and can reignite hours, days or weeks later unless their stored energy has been completely discharged.

Hazards to watch

The main hazards associated with Li-ion batteries are:

- **Fire**: electrolyte is an ignitable liquid.
- **Explosion**: release of ignitable vapor in a confined space.
- **Thermal runaway:** rapid self-heating that may cause fire or explosion.
- **Poisonous/Toxic gases:** released during these events.

Lund, Randall (Allianz Commercial) (r

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2024

well as insurance underwriters,
and testing currently available.
d to assist in determining the risks
of Li-ion batteries as standalone
within vehicles.

Li-ion batteries as a possible cause or contributing factor.

Content / Topics

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01 Review Acronyms & Battery Chemistry

02 Review Risks & Hazards

03 Latest newsworthy incidents

04 Regulatory Update

05 Loss Prevention & Best Practices

06 Risk Mitigation

07 Fire Protection & Suppression

08 Summary – Q & A

Acronyms

EV: Electric Vehicles

HEV: Hybrid Electric Vehicles

PHEV: Plug-in Hybrid Electric Vehicles

ESS: Energy Storage Systems

BESS: Battery Energy Storage Systems

Li-ion, LI (LiB): Lithium Ion (Lithium-ion Battery)

BMS: Battery Management System (battery cell/modules parameters)

EMS: Energy Management System (BESS container parameters)

SOC: State of Charge (0-100%)

SOH: State of Health

Primary vs. Secondary Batteries

Stranded Energy: Potential energy remaining in a battery

What are we talking about?

Mobility devices – e-bikes, scooters, hoverboards, wheelchairs, golf carts, vacuums, etc.

Power tools, computers, phones, numerous other electronic devices

(i) Electric Unicycle

(ii) Egret (kick electric scooter)

(iii) Electric Scooter

(iv) Three-wheeler Electric Scooter

(v) Electric Mobility Cart

(vi) Electric Bike (bicycle)

(vii) Hoverboard

(viii) Segway

(ix) Electric Caster Board

What are we talking about?

EVs – autos, buses, delivery vans, forklifts

What are we talking about?

BESS – wind & solar farms, grid-scale energy, military, commercial industries & storage warehouses as power back-up (typically outside 20’/40’ units)

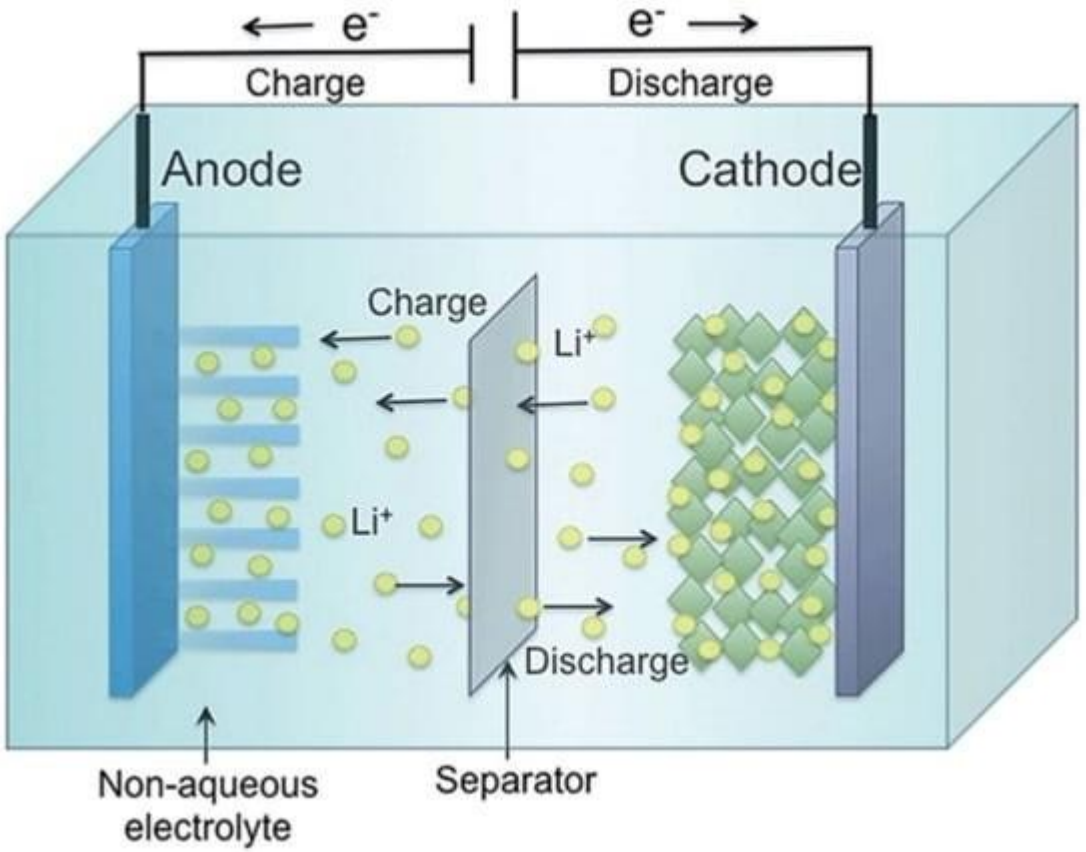
What are we talking about?

Packaged batteries – cartons, pallet loads, container/trailer loads, box railcars

Battery Chemistries

LMO / LiMn2O4	Lithium Manganese Oxide
NMC	Lithium Nickel Manganese Cobalt Oxide
LFP / LiFePO4	Lithium Iron Phosphate
LCO / LiCoO2	Lithium Cobalt Oxide

Factors
Energy Density, capacity, time to charge, cost, raw material



NOTE: Lithium-ion batteries do NOT contain any lithium metal

Battery Chemistries

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Chemical Name	Common Name	Energy Density	Thermal Stability
LMO/LiMn2O4	Lithium Manganese Oxide	Low	High
NMC	Lithium Nickel Manganese Cobalt Oxide	high energy density	Low
LFP/LiFePO4	Lithium Iron Phosphate	Lower energy density	Higher >250C (482F)
LCO/LiCoO2	Lithium Cobalt Oxide	high energy density	Low 150C (302F)

Factors:
Energy Density, stability, capacity, time to charge, cost, raw material supply

Cell Types:
Cylindrical, Prismatic, Pouch

Identifying the Risk – MAIN HAZARDS

- **FIRE** Electrolyte is ignitable liquid
- **EXPLOSION** Release of ignitable vapor in confined space (ie. container)
- **TOXICITY** Gases released during fire/explosion can produce irritation, corrosive and/or toxic gases
- **THERMAL RUNAWAY** Rapid self-heating that can cause fire or explosion

Identifying the Risk - COMMON CAUSES

- Substandard manufacturing
- Over-charging
- Short circuiting
- Damaged batteries

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Recent Lithium-ion battery incidents

- September 2025 – Solar facility, Boulder City, Nevada
- July 2025 – Inspected passenger vessel fire – USCG issues safety alert USCGSA 14-25
- June 2025 – Vessel Morning Midas in North Pacific sank
- January 2025 – Power Plant, Monterey, California
- December 2024 – High school classroom, Staten Island
- September 2024 – Port of Montreal container fire & Ports of LA/Long Beach BESS overturned/fire
- July 9, 2024 – Tractor trailer load on I-90 in Washington State – Fire causing traffic delays
- April 28, 2024 – Yacht “Flagship”, Miami, FL (inoperable BMS) $5M CTL
- July 5, 2023 – Ro/Con “Grande Costa D’Avorio”, Port Newark, NJ (2 shoreside firefighters died)(not a LiB incident)
- 2023 – NY state has 3 separate BESS fire incidents

New York City has Seen a 53% Increase in Structural Fires Caused by Lithium-Ion Batteries in 2025

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Lithium-ion battery incident reporting

The proliferation of lithium-ion batteries and the products that run on them has resulted in an exponential increase in incidents resulting in injuries and fatalities.

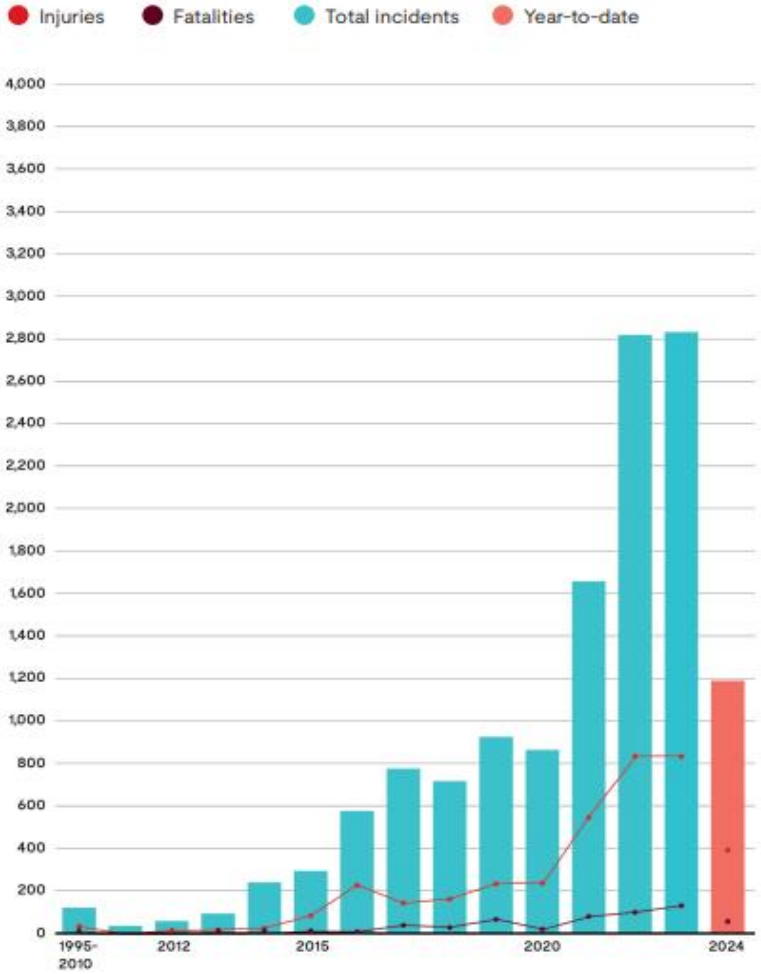
13,153 total incidents

1,187 incidents in 2024 to date

Knowledge is power

Tracking and transparent reporting of battery-related incidents — including product type, what happened and the impact — is critical to helping drive understanding of this technology and where the greatest risks exist.

Increase in total incidents over time



Total over time: 3,820 | 562

2023 incidents are incomplete, with additional reports anticipated through Q2.

Total incidents reported for each category

(1995-2024 YTD)

CONSUMER PRODUCTS

1,806 total injuries | 152 total fatalities

ELECTRIC VEHICLES (>20MPH)

166 total injuries | 91 total fatalities

MICRO-MOBILITY DEVICES (<20MPH)

1,784 total injuries | 315 total fatalities

ENERGY STORAGE SYSTEMS

64 total injuries | 4 total fatalities

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UL Solutions

Safety. Science. Transformation.™

Lithium-ion battery incident reporting

The proliferation of lithium-ion batteries and the products that run on them has resulted in an exponential increase in incidents resulting in injuries and fatalities.

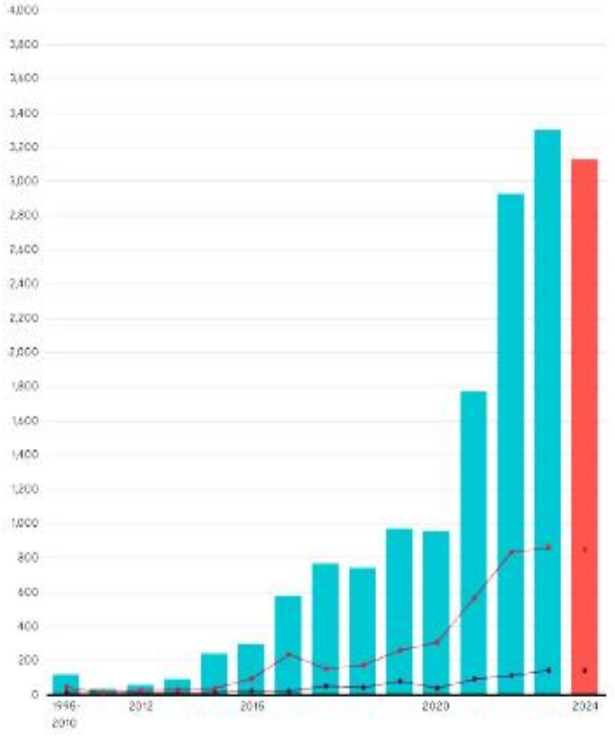
15,949 total incidents

3,126 incidents in 2024 to date

Knowledge is power

Tracking and transparent reporting of battery-related incidents — including product type, what happened and the impact — is critical to helping drive understanding of this technology and where the greatest risks exist.

Increase in total incidents over time



Injuries · Fatalities · Total incidents · Year-to-date

Total over time: 4,417 646

2024 incidents are incomplete, with additional reports anticipated through Q4

Total incidents reported for each category

(1995-2024 YTD)

CONSUMER PRODUCTS

2,178 total injuries | 199 total fatalities

ELECTRIC VEHICLES (>20MPH)

192 total injuries | 103 total fatalities

MICRO-MOBILITY DEVICES (<20MPH)

1,982 total injuries | 340 total fatalities

ENERGY STORAGE SYSTEMS

65 total injuries | 4 total fatalities

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Recent News Headlines around the Globe

EV owners burn with anger over Seoul's charging limit in wake of fire

The Korea Daily 19Aug2024

South Korean alarm over EV fires puts spotlight on safety concerns

Reuters 14Aug2024

Incheon, S. Korea – underground car park fire – EV probable cause – damaged 100 vehicles, and sent over 20 people for treatment, while 100's were evacuated

Tenfold increase in lithium battery fires is Sydney's west ignites urgent policy response

Austalia's The Mandarin 16July2024

Fire in a battery container causes EUR 700,000 in damage in Germany

PV Magazine 18June2024

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Regulations & Standards

Hazmat REGULATIONS

US DOT/PHMSA – 49 CFR

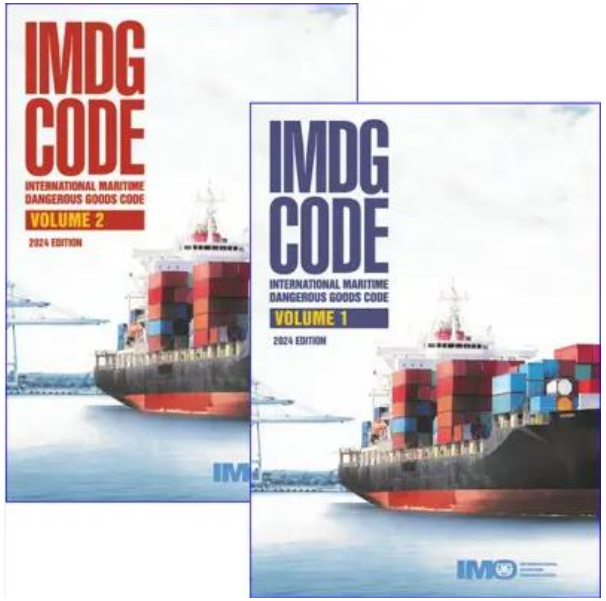
OSHA – 29 CFR 1926

EPA – 40 CFR 273

EU ADR (road) / RID (rail)

IMDG Code (IMO requirement - seafreight)

IATA-ICAO Requirements (air freight)

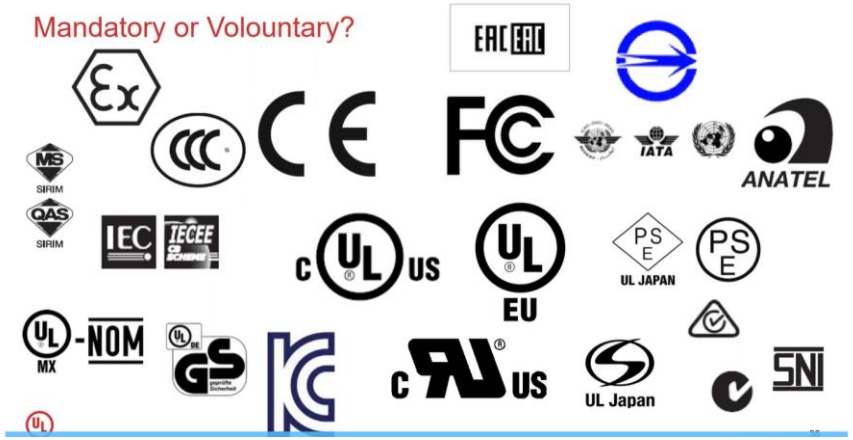


STANDARDS

UL: 1642, 1973, 2271, 2580, 2743, 9540, 2054, 2056

FM Global: datasheets 5-33 (**April 2025**), 3-26, 7-15, 7-29, 8-1

NFPA: 230, 231, 855, 600; ISO 17840



REGULATIONS & STANDARDS are evolving, however:

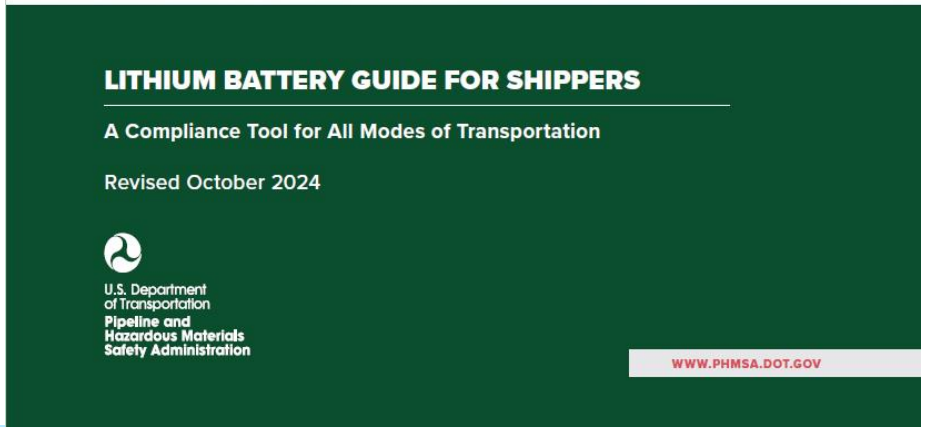
- SLOW TO IMPLEMENT
- DIFFICULT TO ENFORCE

Regulations & Standards

GUIDANCE The UN manual of tests and criteria (UN38.3) sets out a series of design tests for battery manufacturers

TEST SUMMARIES from manufacturers are required by the regulations

US DOT – Pipeline and Hazardous Materials Safety Administration (PHMSA) Lithium Battery Guide for Shippers | PHMSA (dot.gov)



LOSS PREVENTION – Best Practices

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For Marine Assureds:

- Reputable manufacturers
- Test Summaries (TS) from manufacturers are required by the regulations
- Know the State of Charge (SOC) < 30%
- Prevent short circuits
- Follow packing instructions
- Increased container & warehouse inspections
- Is the Battery Damaged, Defective, or Recalled? (may be subject to additional packaging requirements)
- Know the characteristics of the battery type? (important for classification, possible exceptions)

LOSS PREVENTION – Best Practices

FOR CARGO WAREHOUSES:

- Undeclared/mis-declared cargo – documents match
- Advanced monitoring, detection and suppression systems in warehouses 24/7
- Develop a pre-plan with local fire dept. and engage yearly training – exercise the plan!
- Ensure protocols are in place for damaged packages of LiBs
- Increase cargo separation distances from LiBs
- Training of all employees is vital !!

LOSS PREVENTION – Best Practices

FOR CARRIERS & TRUCKERS

- Booking oversight and verify shipping document review (safety data sheets, UN38.3)
- Ensure proper stowage and segregation (stowed away from heat sources, no charging of EV's)
- Provide adequate watch keeping in warehouses, increase fire rounds & monitoring
- SOC (ie. 30%, if above 30% for EV's…..reason?)
- Driver Training (cargo handling & emergency in route)
- Increase detection and fire fighting capabilities

FIRE PROTECTION – OLD & NEW SOLUTIONS

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- Copious amounts of water
  - large storage facilities should have independent, duplicate water supply sources (water tanks, ponds, hydrants)

- 24/7 monitoring devices & services (local or remote)
  - CCTV
  - Smoke detection
  - Gas detection
  - Temperature alarms
  - Audio and visual alarms
  - TIC (thermal imaging cameras)
  - Instant notifications with auto alarms
  - AI powered systems

- Developments with “In-Rack” storage sprinkler & deluge systems

FIRE SUPPRESION – NEW SOLUTIONS

- WATER, WATER, WATER
- Fire blankets, fire curtains, fire guard parking barriers
- Container piercing devices (fire hose)
- EV dipping containers
- New packaging materials
- New fire suppression systems, including encapsulating agents (F-500 EA) and advanced monitoring technology
- Developments with “In-Rack” storage sprinkler systems
- Semi-automated, targeted early detection/suppression systems (Fire Rover LLC – Detect/Extinguish/Protect)

SUMMARY - CAN THE RISK BE CONTROLLED ?

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1. Training is PARAMOUNT! Communication is Vital!
2. Ensure all required domestic and international (if applicable) hazmat regulations are being complied with.
3. Establish Protocols and Standard Operating Procedures (SOPs) for receiving & storing LiBs.
4. Ensure shipping papers reflect actual cargo being delivered.
5. Train your drivers and warehouse work force on the risks, hazards, handling precautions, as well as Emergency Response procedures.
6. Increase warehouse inspections, (never transport damaged or suspect LiB packages)
7. Know your clients. Ask the questions!
8. Engage your local Fire Departments: pre-incident & ER plans are vital!
9. Exercise the plan – at least annually.
10. Would your warehouse facility benefit from your own “on site” fire dept.? Train, train, train!

IN CONCLUSION

- INCREASED RISK FOR INSURERS - BUT IT CAN BE MITIGATED!

- COLLABORATION IS REQUIRED FROM ALL STAKEHOLDERS with INSURANCE PROVIDERS:

✓ Manufacturers
✓ Shipping lines / Transporters
✓ Warehouses
✓ Regulatory bodies
✓ Inspectors and first responders

- TRAINING & EDUCATION

Thank you

Contact:
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Let no man's ghost come back to say "My training let me down" FDNY

Resources Available

Lithium Battery Guide for Shippers | PHMSA (dot.gov)

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Online training: Lithium-ion batteries in marine shipping (allianz.com)

Allianz Risk Barometer 2025

Global Risk Dialogue

Allianz Risk Bulletin

Emerging Risk Trend **Talk 1**

Offshore Wind Opportunities

Safety and Shipping Review 2025 | Allianz Commercial

… all available on our website **commercial.allianz.com**

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Reports and executive summaries

Expert risk articles

Risk advisory

Podcasts

Videos

Press releases

INLAND MARINE UNDERWRITERS ASSOCIATION

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Online training: Lithium-ion batteries in marine shipping (allianz.com)

QUESTIONS ??

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