DANGEROUS GOODS PANEL (DGP)
WORKING GROUP MEETING (DGP-W/23)

Rio de Janeiro, Brazil, 15 to 19 May 2023

Agenda Item 4: Managing safety risks posed by the carriage of lithium batteries by air (Ref: Job Card DGP.003.04)

THERMAL INCIDENT DATA RELATED TO AIRCRAFT OPERATIONS REPORTED THROUGH THE VOLUNTARY THERMAL RUNAWAY INCIDENT PROGRAM (TRIP)

(Presented by the Secretary)

SUMMARY

Attached is information given to the DGP Working Group on Electronic Storage Devices (DGP-WG/Electronic Storage Devices) during its face-to-face meeting in Rio de Janeiro (11 to 12 May 2023). It contains thermal incident data related to aircraft operations reported through the voluntary thermal runaway incident program (TRIP).

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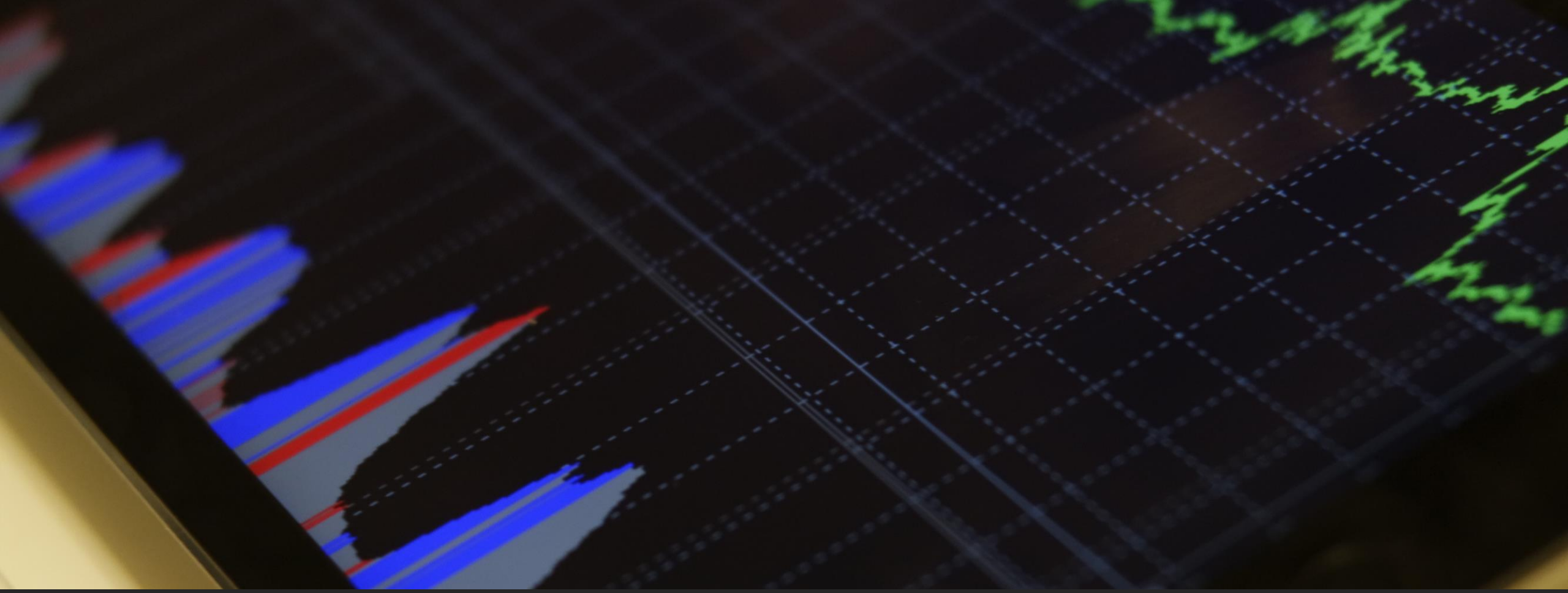


TRIP Data Summary

Data from TRIP participants and FAA reports 2018-2022

Current TRIP Participants

Air Canada	**Horizon Air**
Alaska Airlines	JetBlue Airways
Allegiant	Omni Air International
American Airlines	PSA Airlines
Ameristar	SkyWest
Delta Air Lines	Southwest Airlines
Emirates	Spirit
Envoy	United Airlines
FedEx	UPS Airlines
Hawaiian Airlines	US Postal Inspection Service

Bold indicates new participants since the last LiBASAC public meeting

Data constraints and limitations

Compilation of 601 incidents thru 04/18/2023.

3 years of tailored reporting.

- Lithium Battery/Aviation specific.
- Passenger / Baggage / Cargo.

Includes “near miss” / non-reportable incidents (segregated).

Increasing participation and data availability. Includes incidents from FAA lithium battery incident summaries.

Subset of airline industry – not a complete accounting, is not the full story.

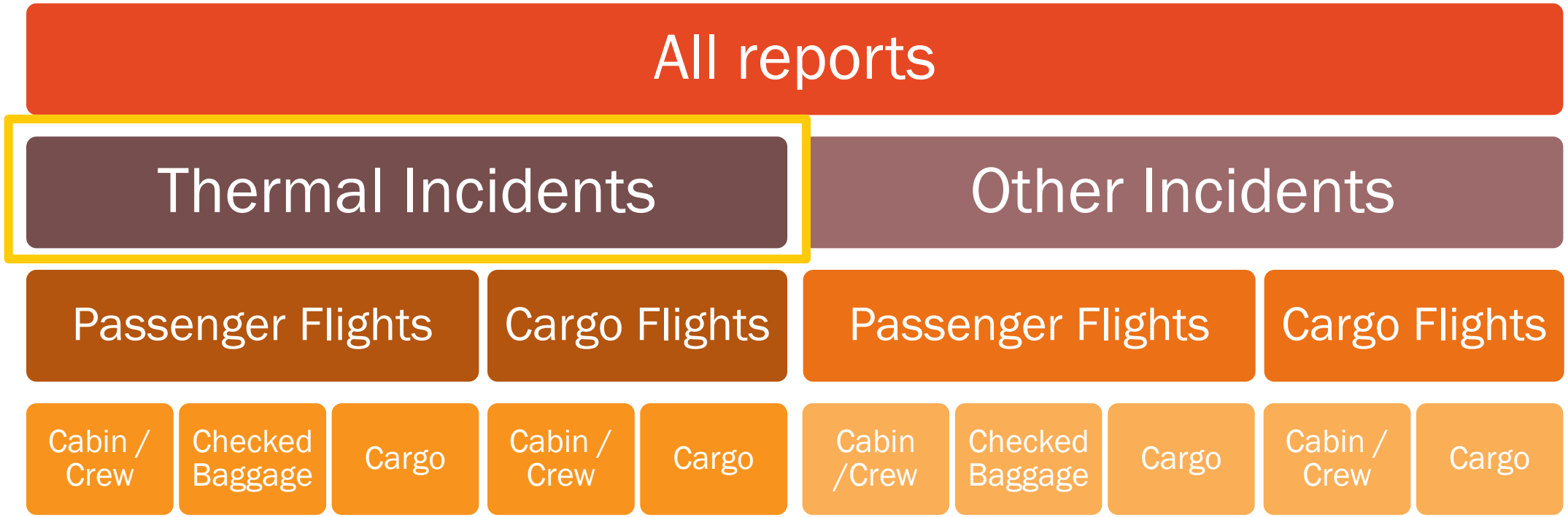
Incident data capture process has “gaps.”

- Source is the crew – priority to safety, not data capture.
- Device ownership, damage, etc. limit detailed data capture.
- Lack of forensic process and resources at airlines limits root cause.

Structural and operational changes due to Covid complicate trending & analysis.

PIPELINE AND HAZARDOUS MATERIALS SAFETY ADMINISTRATION (PHMSA)
LITHIUM BATTERY AIR SAFETY ADVISORY COMMITTEE

Data analysis framework

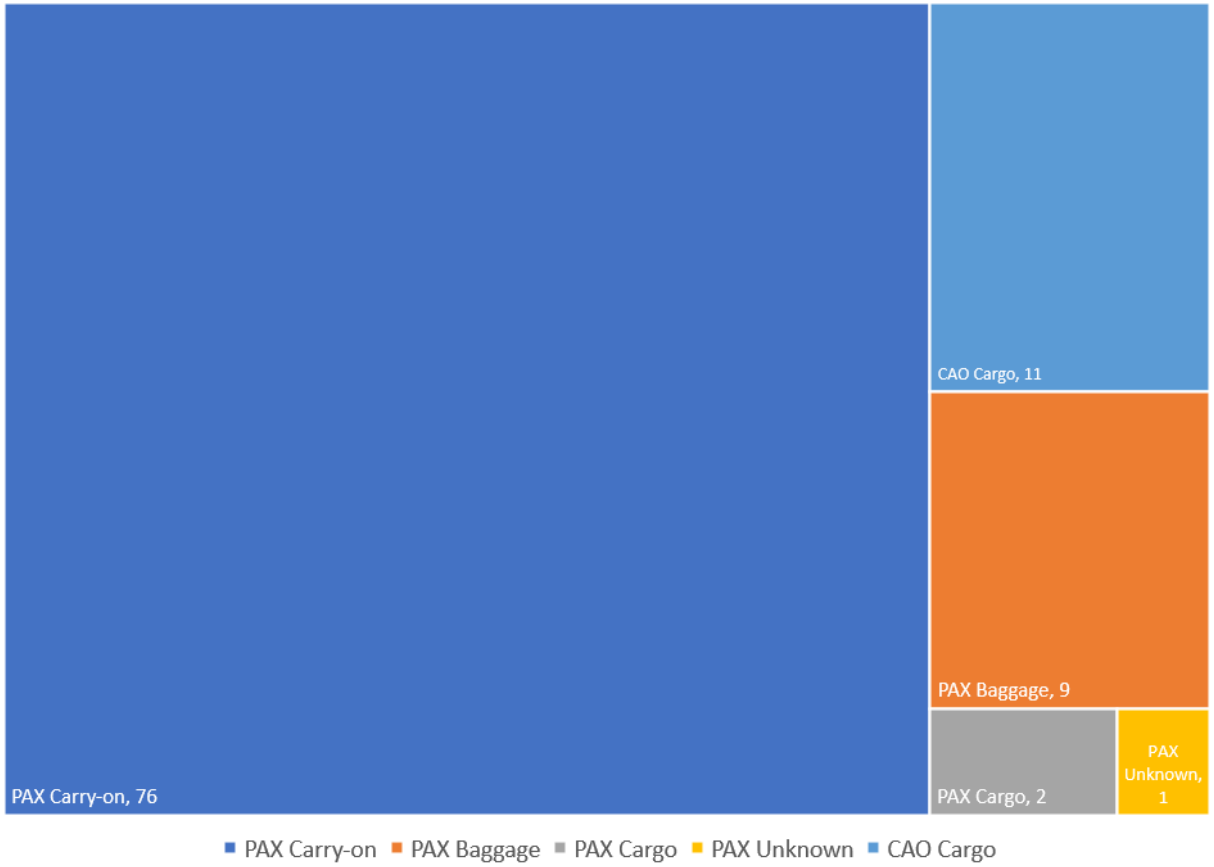


PIPELINE AND HAZARDOUS MATERIALS SAFETY ADMINISTRATION (PHMSA)
LITHIUM BATTERY AIR SAFETY ADVISORY COMMITTEE

2022 Data Summary

THERMAL INCIDENTS, 2022

Thermal incidents, by flight type and report type, 2022



Source: ULSE TRIP Database, participant and FAA reports, as of 2023-04-18

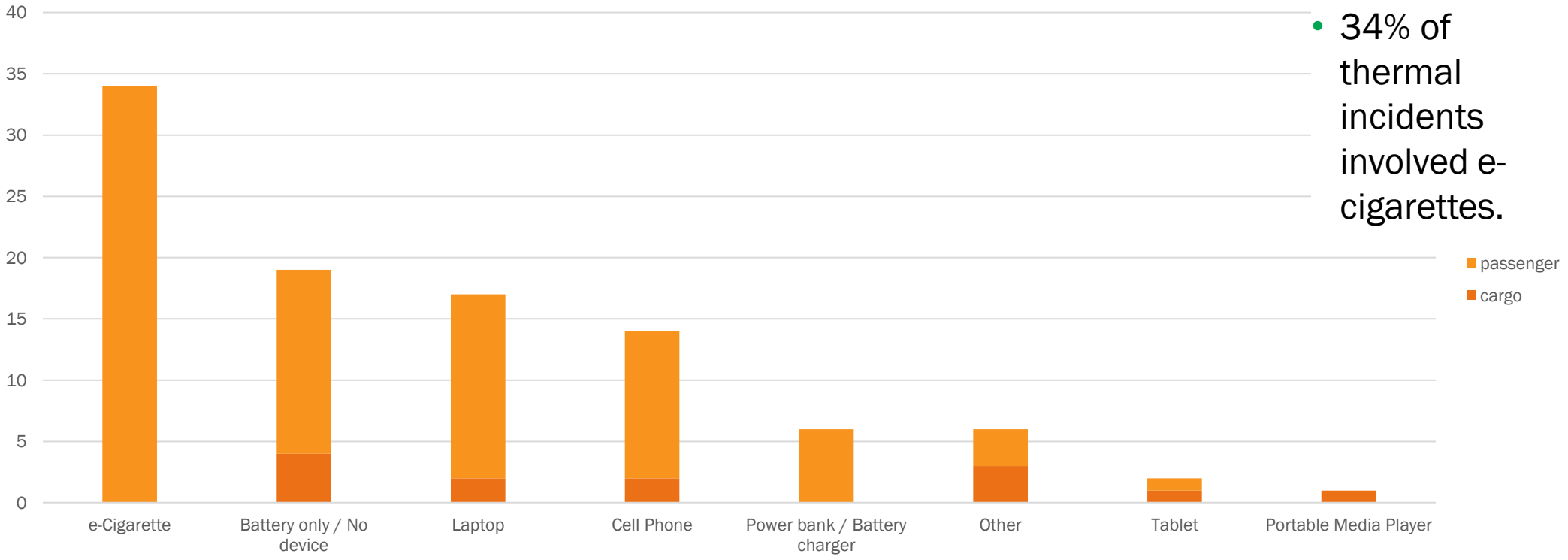
99 thermal incidents

Incidents shown are events that involve a “a fire, violent rupture, explosion, or a dangerous evolution of heat.”

Near miss, swollen or damaged batteries and procedural issues are <u>not included</u> in this presentation.

PIPELINE AND HAZARDOUS MATERIALS SAFETY ADMINISTRATION (PHMSA)
LITHIUM BATTERY AIR SAFETY ADVISORY COMMITTEE

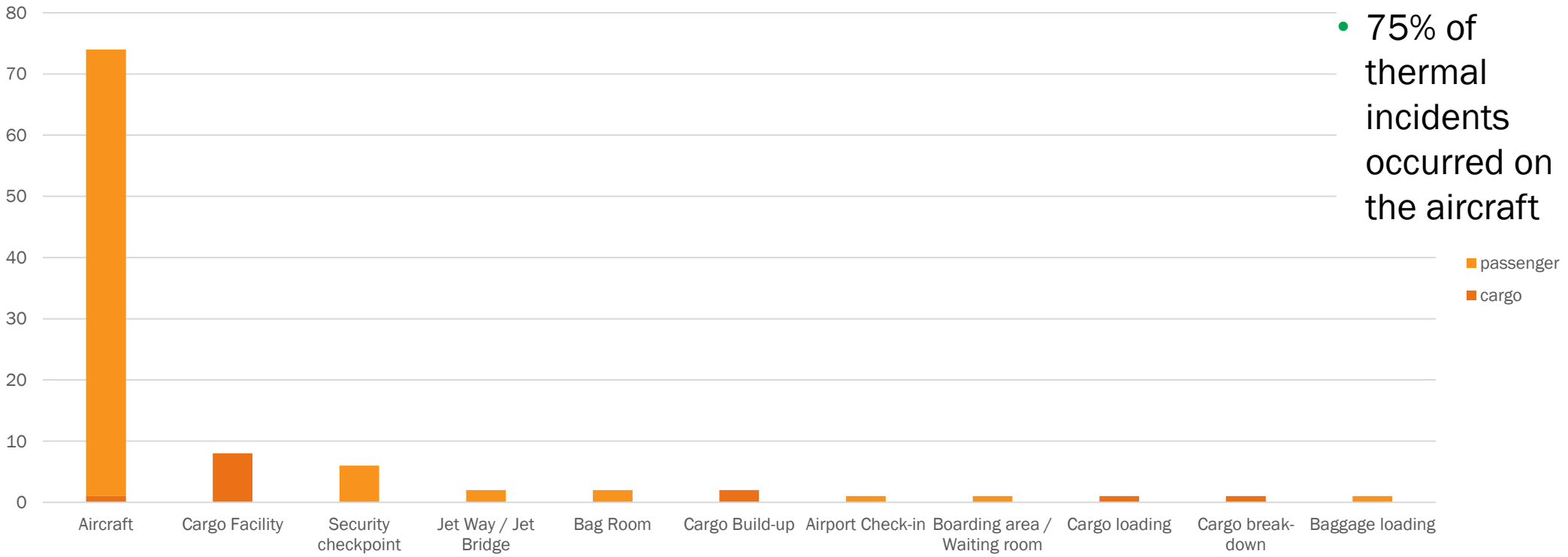
2022 thermal incidents, by device type



- 34% of thermal incidents involved e-cigarettes.

Source: ULSE TRIP Database, participant and FAA reports, as of 2023-04-18

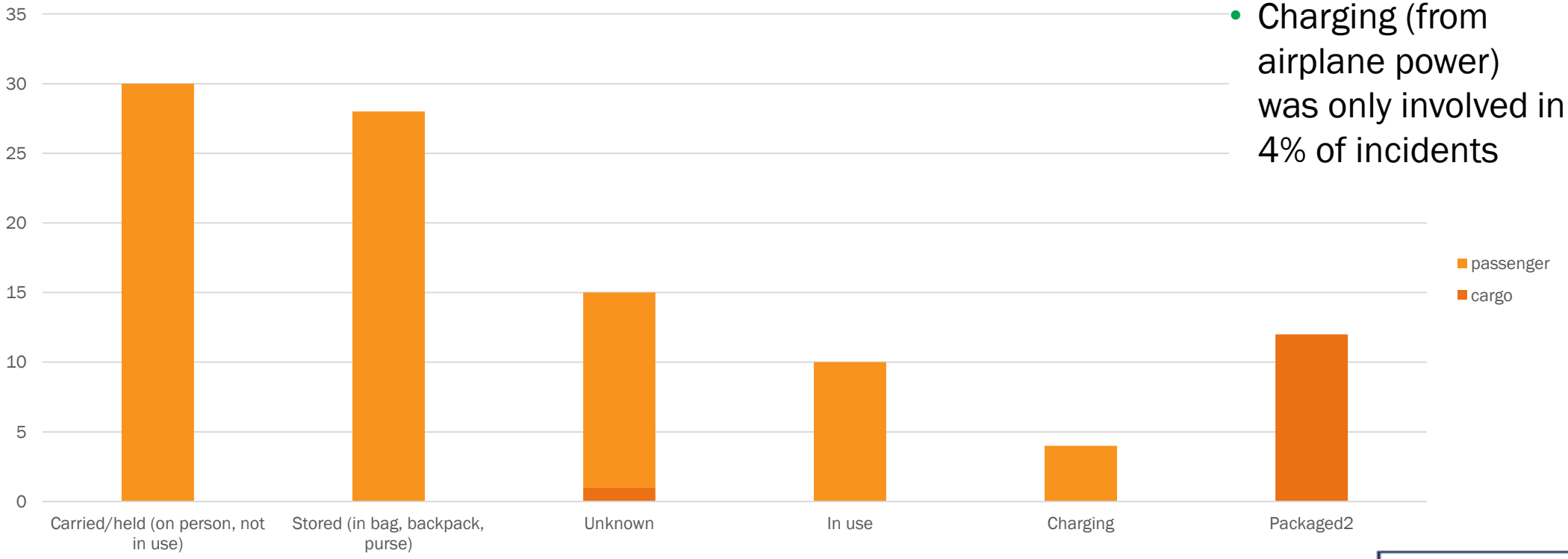
2022 thermal incidents, by location



- 75% of thermal incidents occurred on the aircraft

Source: ULSE TRIP Database, participant and FAA reports, as of 2023-04-18

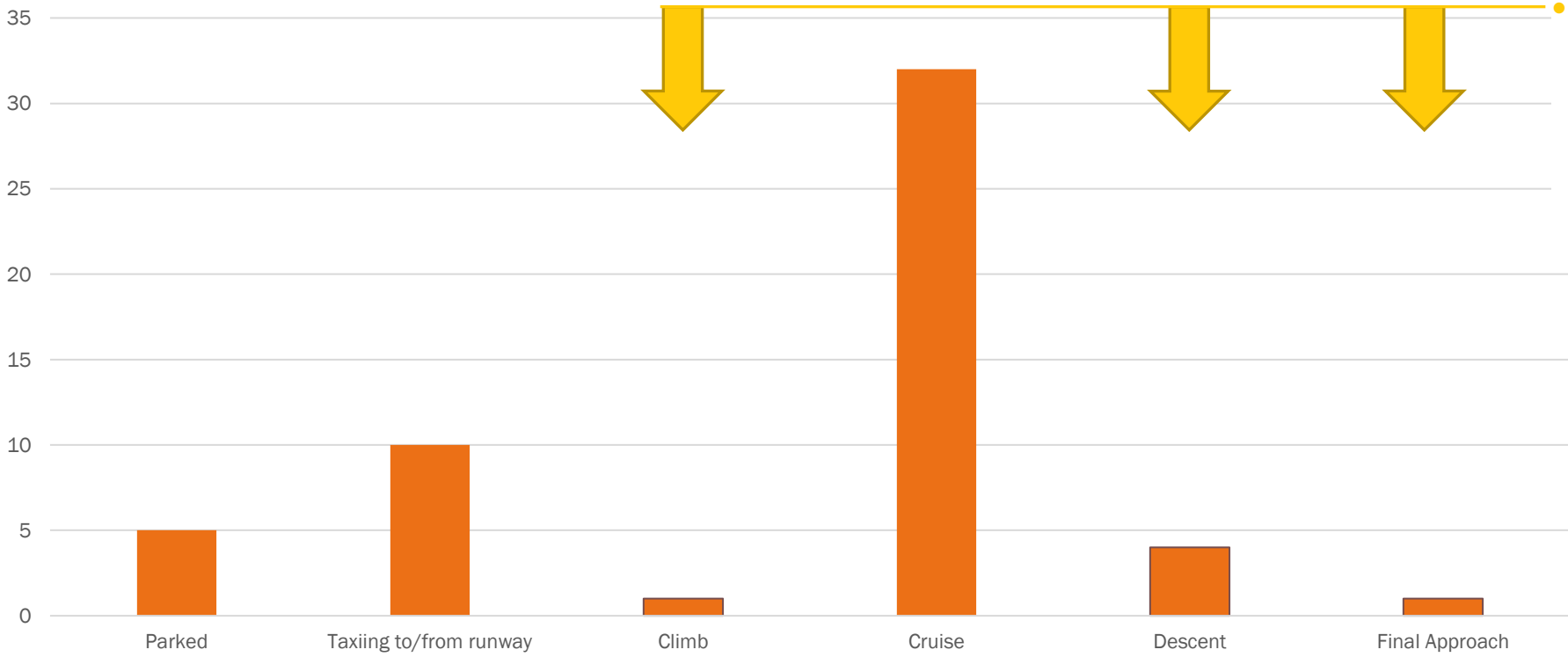
2022 thermal incidents, by device activity



- Charging (from airplane power) was only involved in 4% of incidents

Source: ULSE TRIP Database, participant and FAA reports, as of 2023-04-18

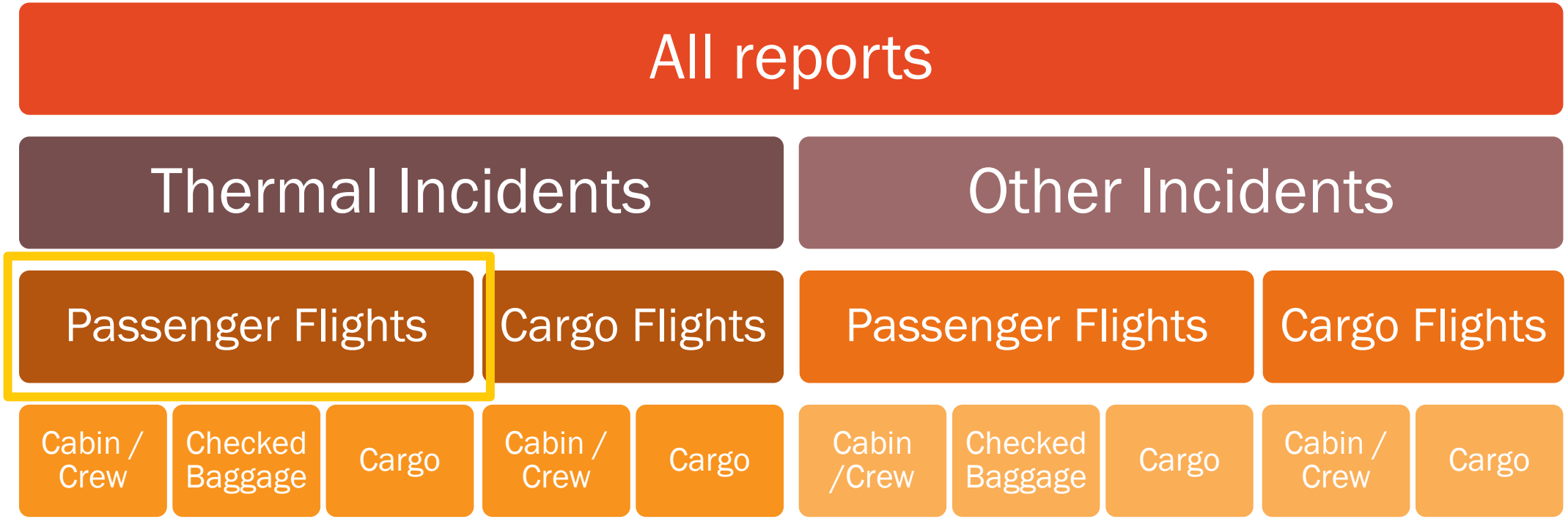
2022 thermal incidents, by phase of flight, (location = aircraft)



- At least 7% of incidents occurred in critical phases of flight (takeoff, climb, descent, final)

Source: ULSE TRIP Database, participant and FAA reports, as of 2023-04-18

Data analysis framework



PIPELINE AND HAZARDOUS MATERIALS SAFETY ADMINISTRATION (PHMSA)
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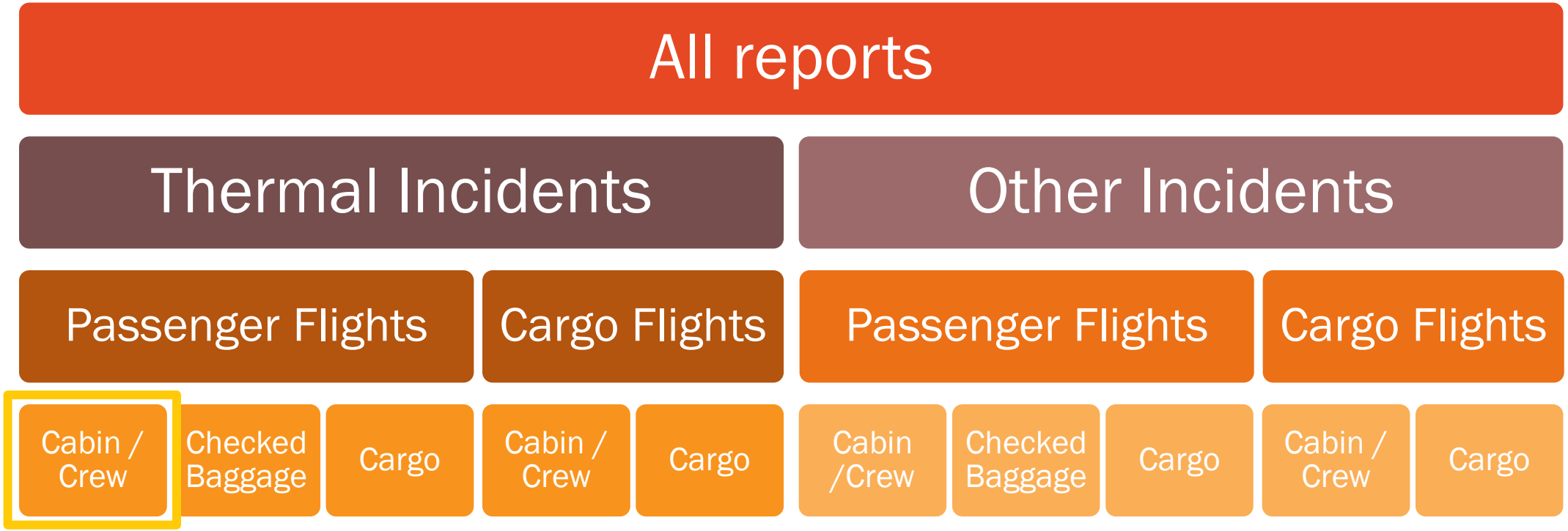
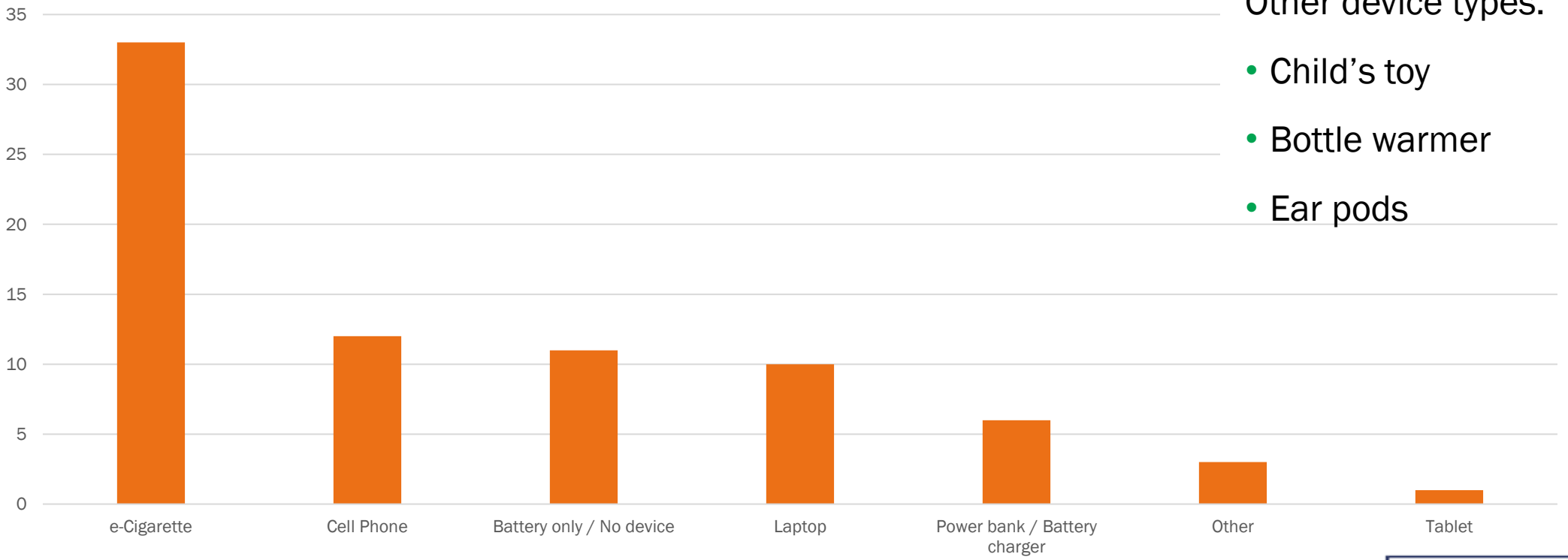
Data analysis framework



PIPELINE AND HAZARDOUS MATERIALS SAFETY ADMINISTRATION (PHMSA)
LITHIUM BATTERY AIR SAFETY ADVISORY COMMITTEE

2022 thermal incidents, by device type, passenger flights, cabin/crew

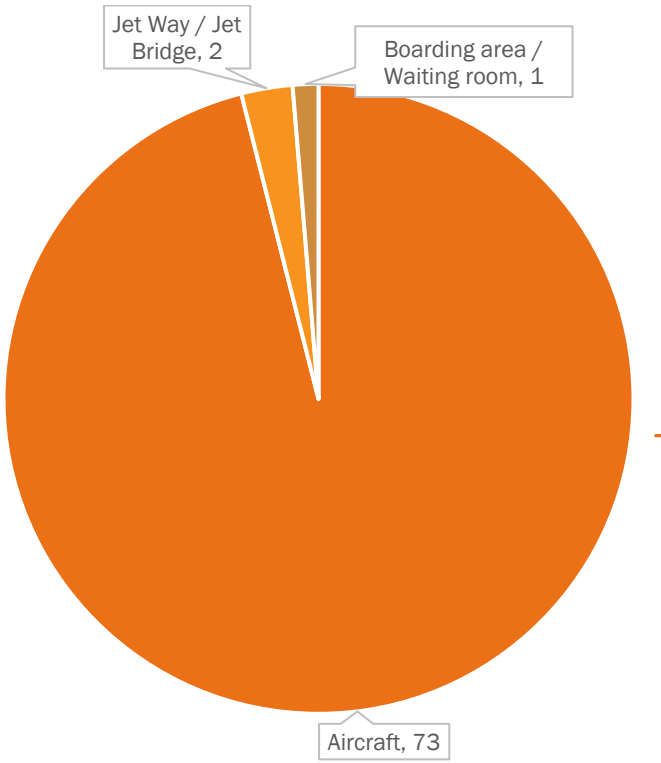


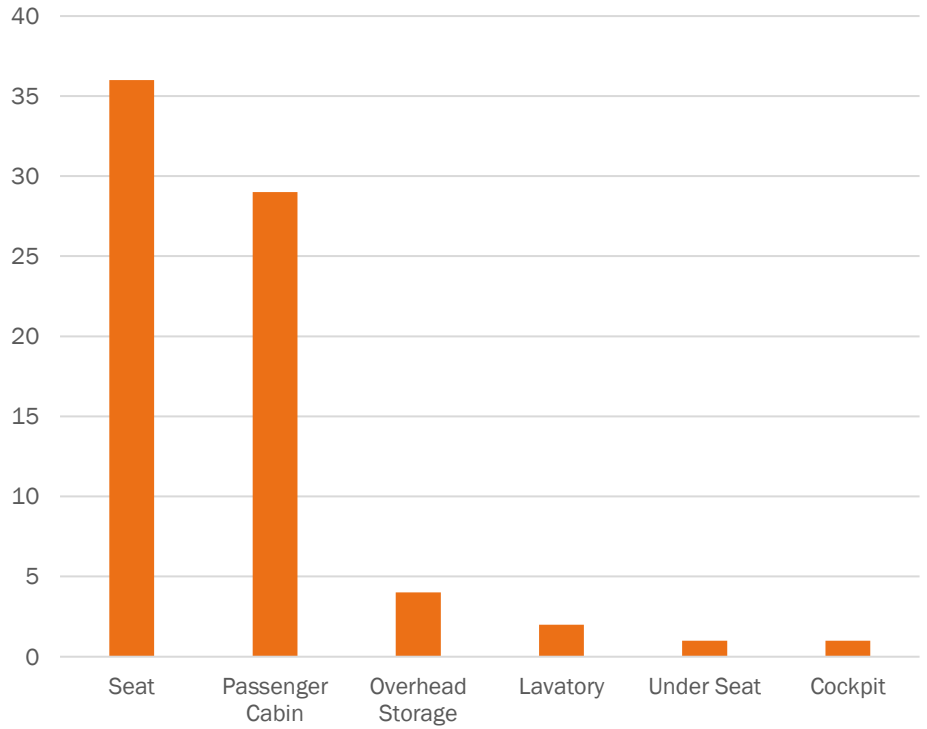
Other device types:

- Child's toy
- Bottle warmer
- Ear pods

Source: ULSE TRIP Database, participant and FAA reports, as of 2023-04-18

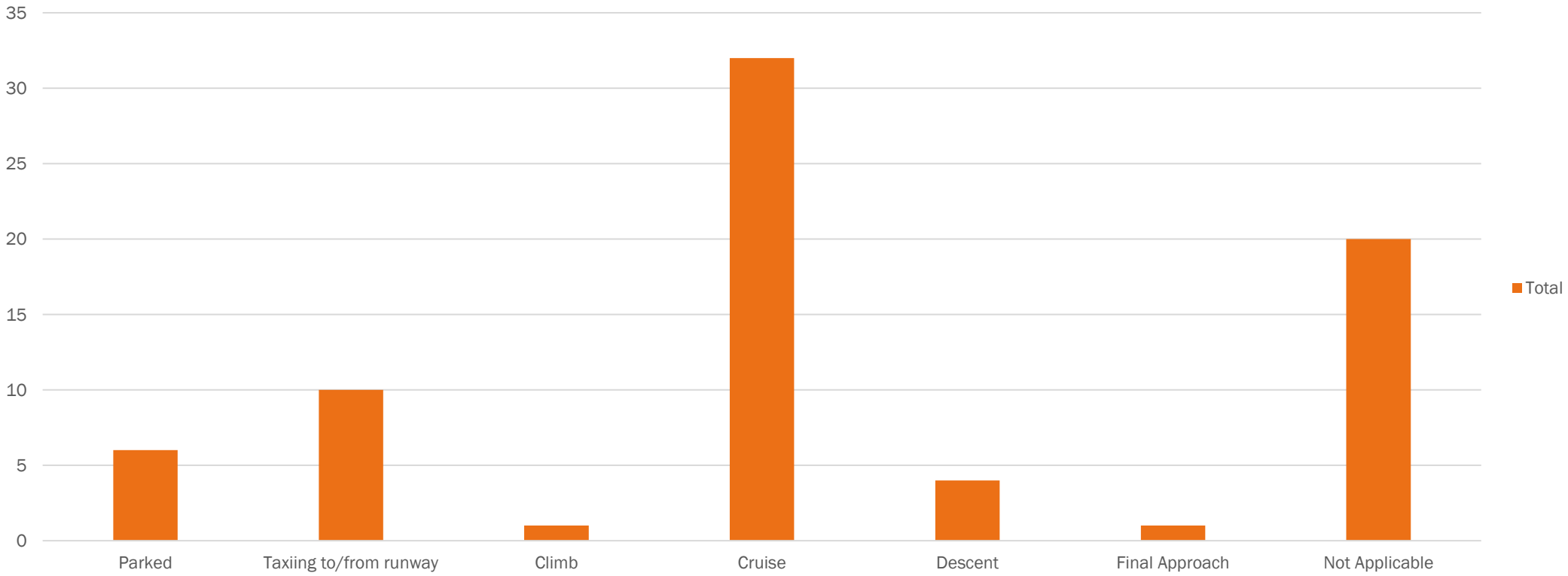
2022 thermal incidents, by location, passenger flights, cabin/crew



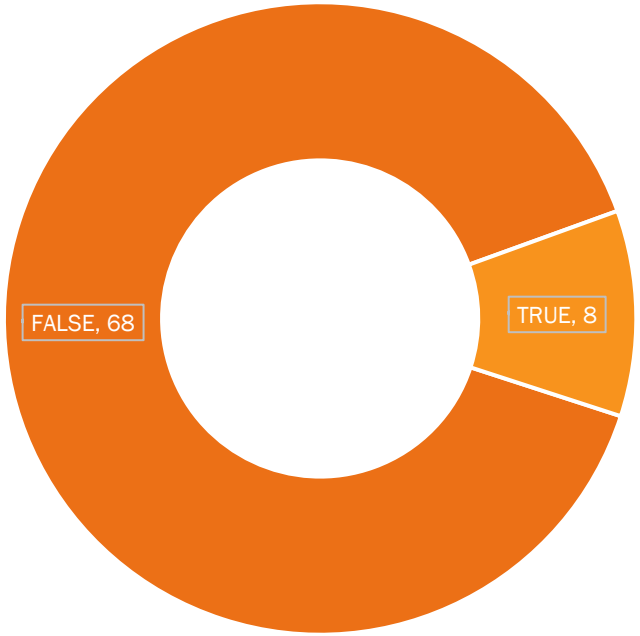


Source: ULSE TRIP Database, participant and FAA reports, as of 2023-04-18

2022 thermal incidents, by phase of flight



2022 thermal incidents, injury involved, passenger flights, cabin/crew



Five (5) incidents involved burn injuries to passengers.

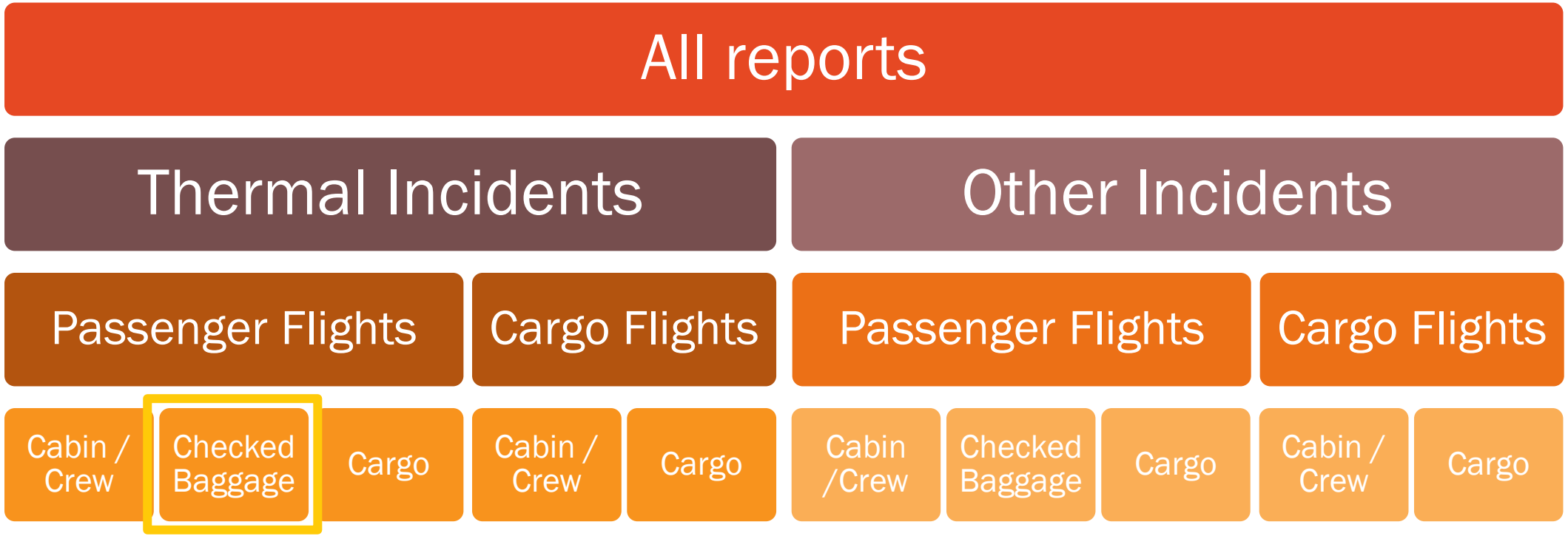
One (1) incident involved several passengers requiring medical attention due to smoke inhalation or injury from evacuation.

One (1) incident involved burn injury to crew member.

One (1) incident involved unspecified injuries to a crew member.

Source: ULSE TRIP Database, participant and FAA reports, as of 2023-04-18

Data analysis framework



PIPELINE AND HAZARDOUS MATERIALS SAFETY ADMINISTRATION (PHMSA)
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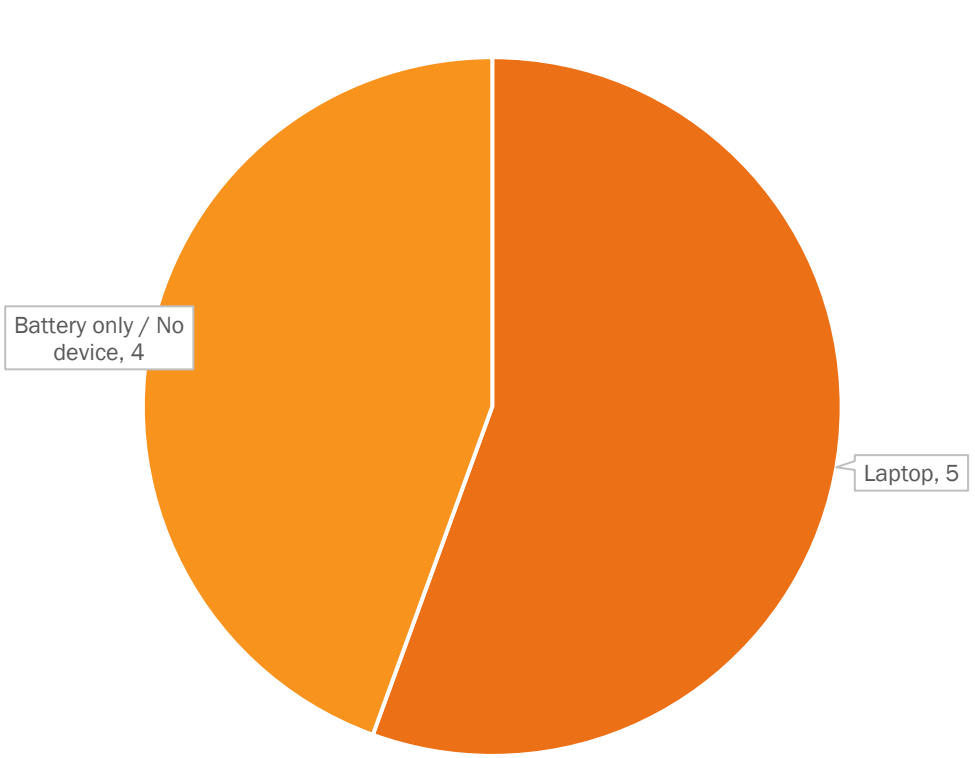
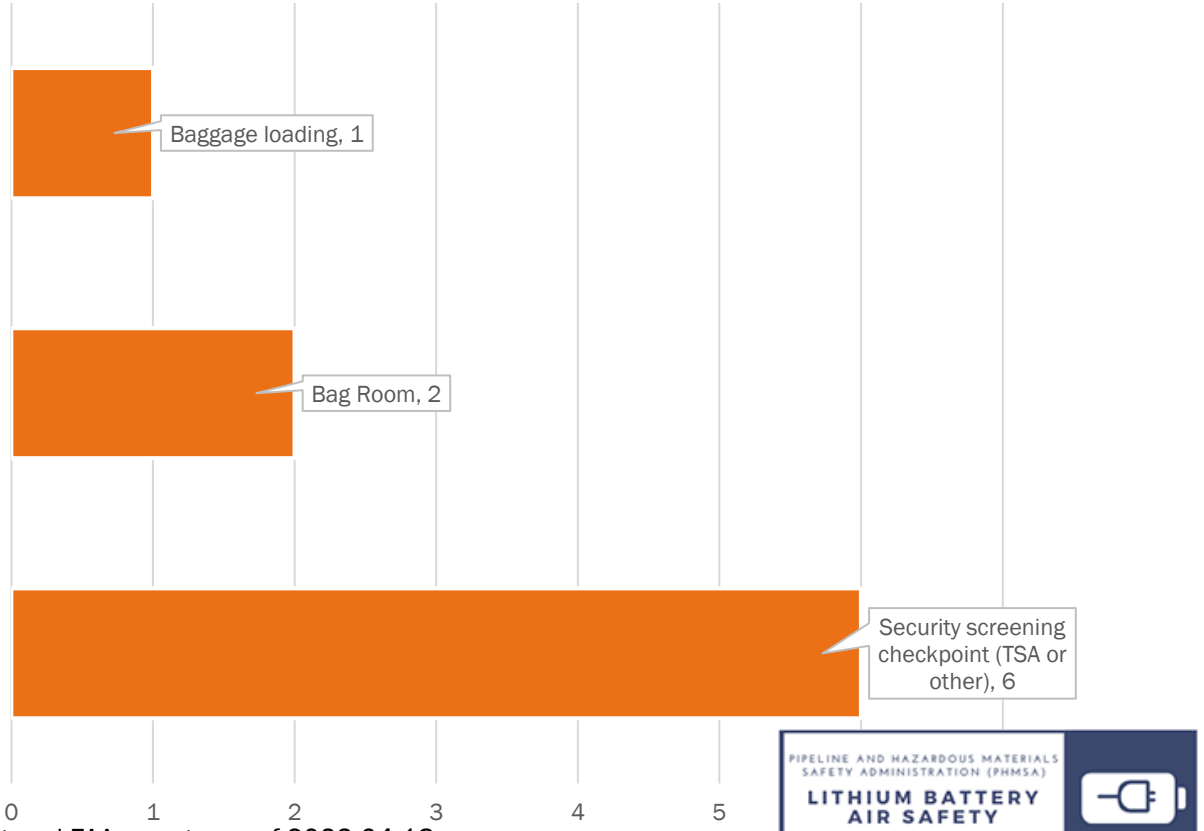
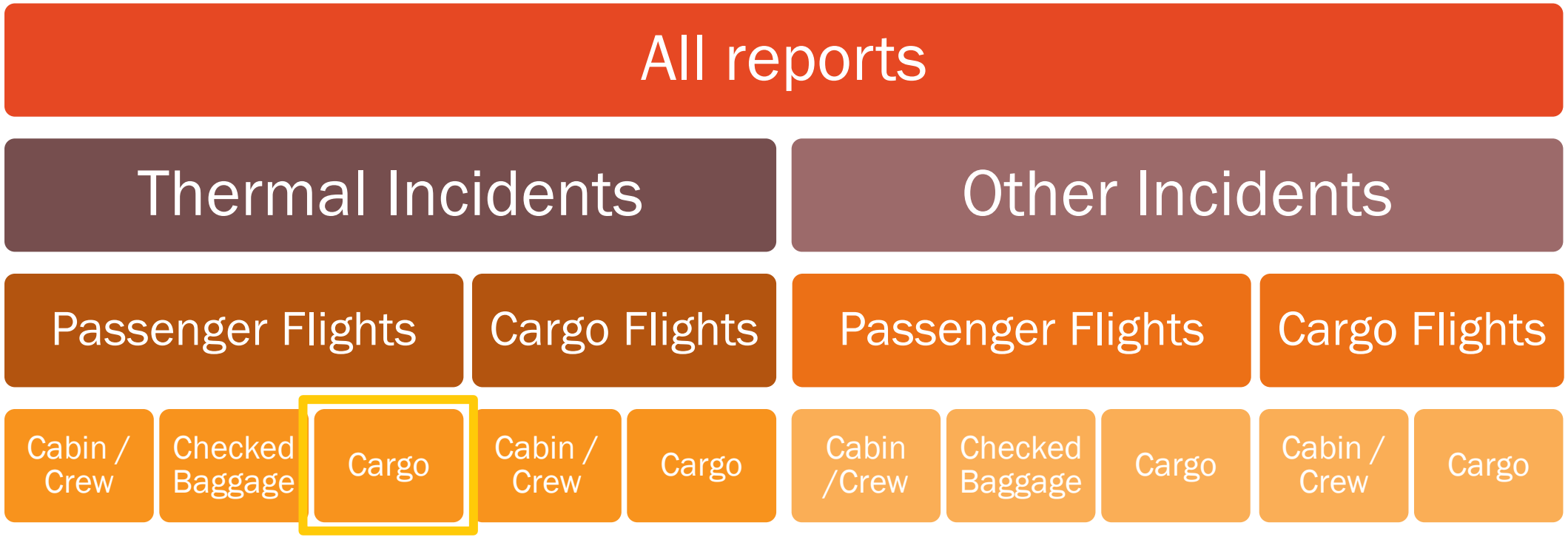
2022 thermal incidents, by device type, passenger flights, checked baggage





Source: ULSE TRIP Database, participant and FAA reports, as of 2023-04-18

Data analysis framework



PIPELINE AND HAZARDOUS MATERIALS SAFETY ADMINISTRATION (PHMSA)
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2022 thermal incidents, passenger flights, cargo incidents

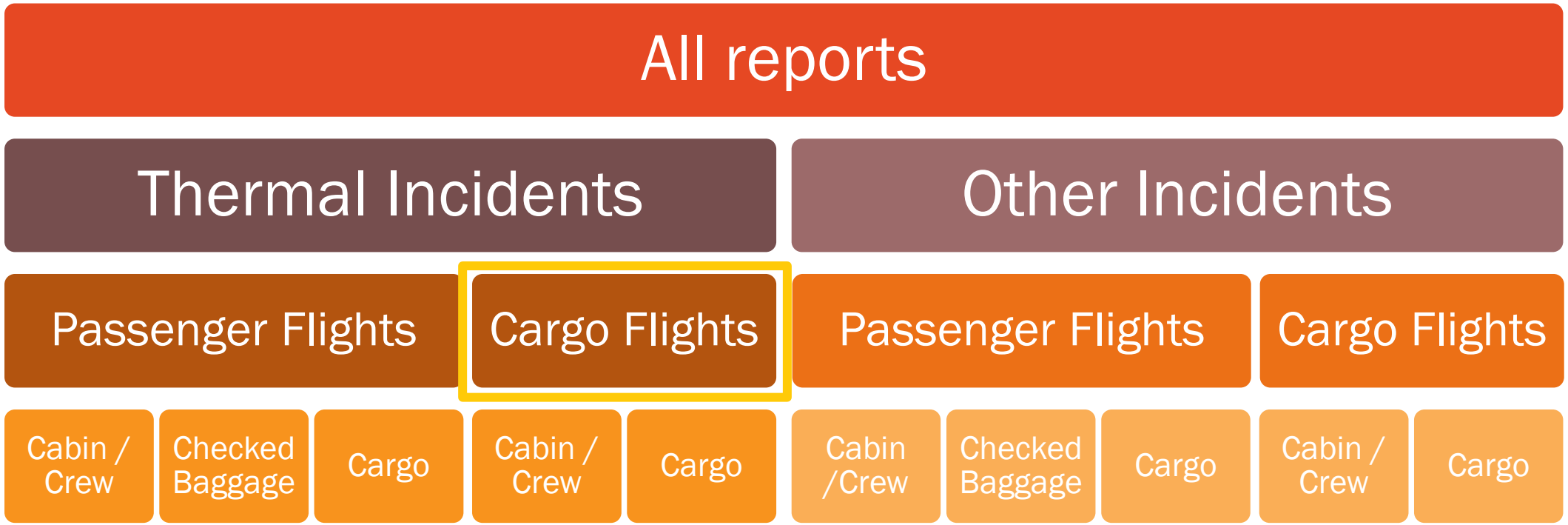
A **cell phone** (UN3481) was found burning in a US Mail shipment during the **Cargo Build-up** phase prior to loading on a passenger flight.

A **sealed, lead-acid battery** was found emitting a Sulphur smell and smoke after a US Mail shipment was loaded on a passenger **aircraft**.

Source: ULSE TRIP Database, participant and FAA reports, as of 2023-04-18

PIPELINE AND HAZARDOUS MATERIALS SAFETY ADMINISTRATION (PHMSA)
LITHIUM BATTERY AIR SAFETY ADVISORY COMMITTEE

Data analysis framework



PIPELINE AND HAZARDOUS MATERIALS SAFETY ADMINISTRATION (PHMSA)
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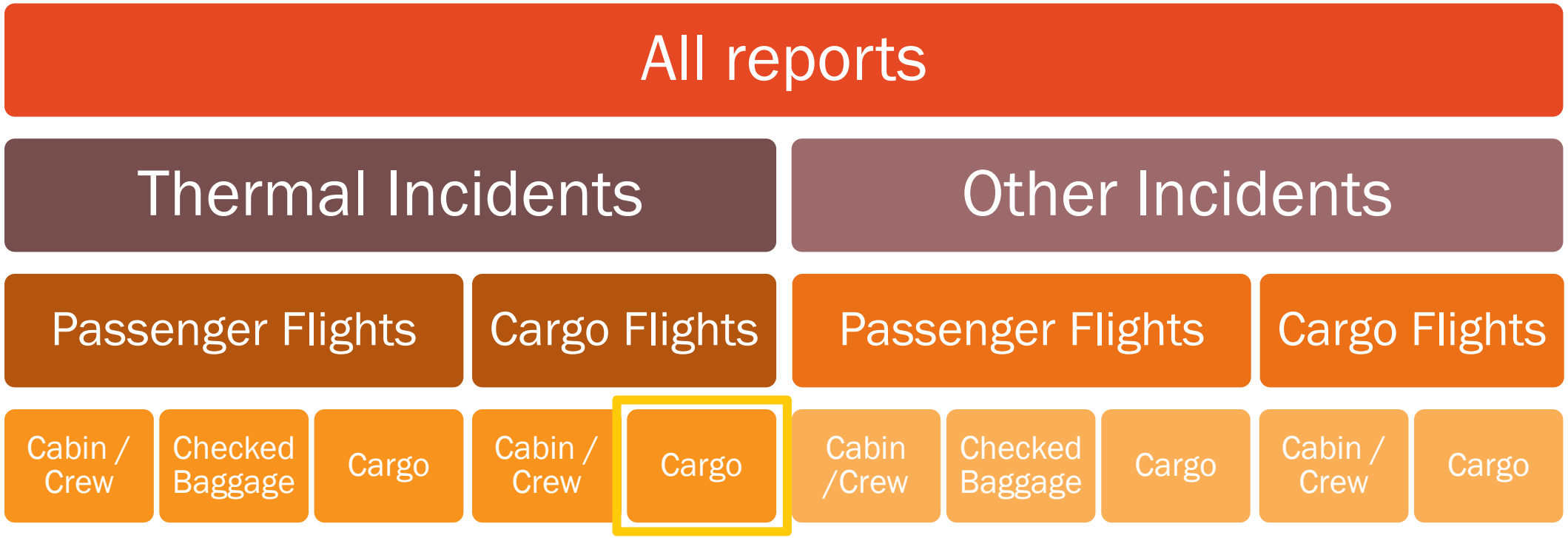
Data analysis framework



PIPELINE AND HAZARDOUS MATERIALS SAFETY ADMINISTRATION (PHMSA)
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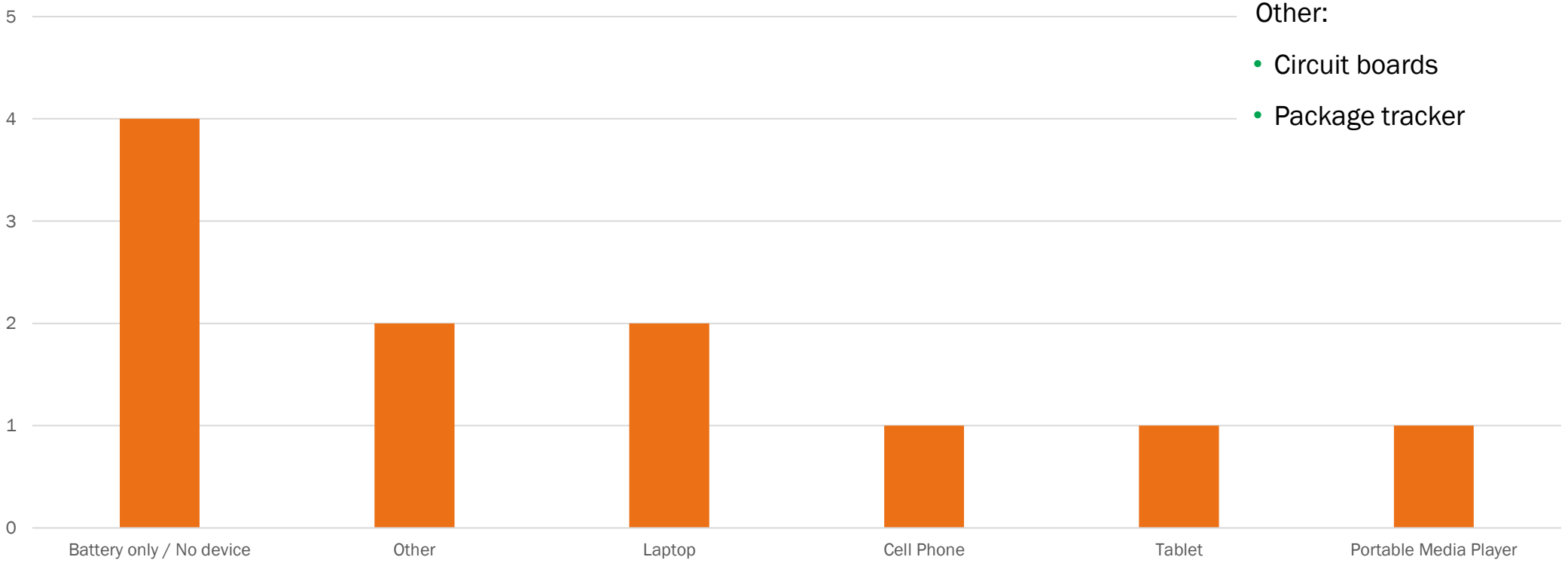
2022 thermal incidents, by device type, cargo flights

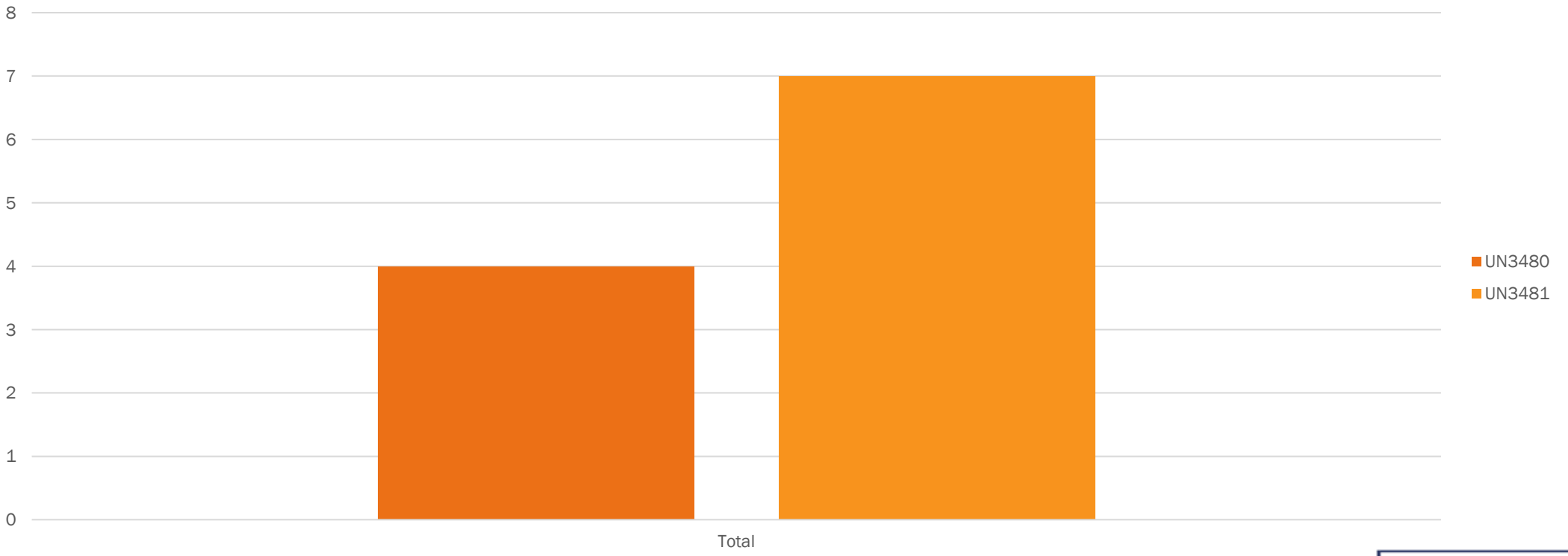


Other:

- Circuit boards
- Package tracker

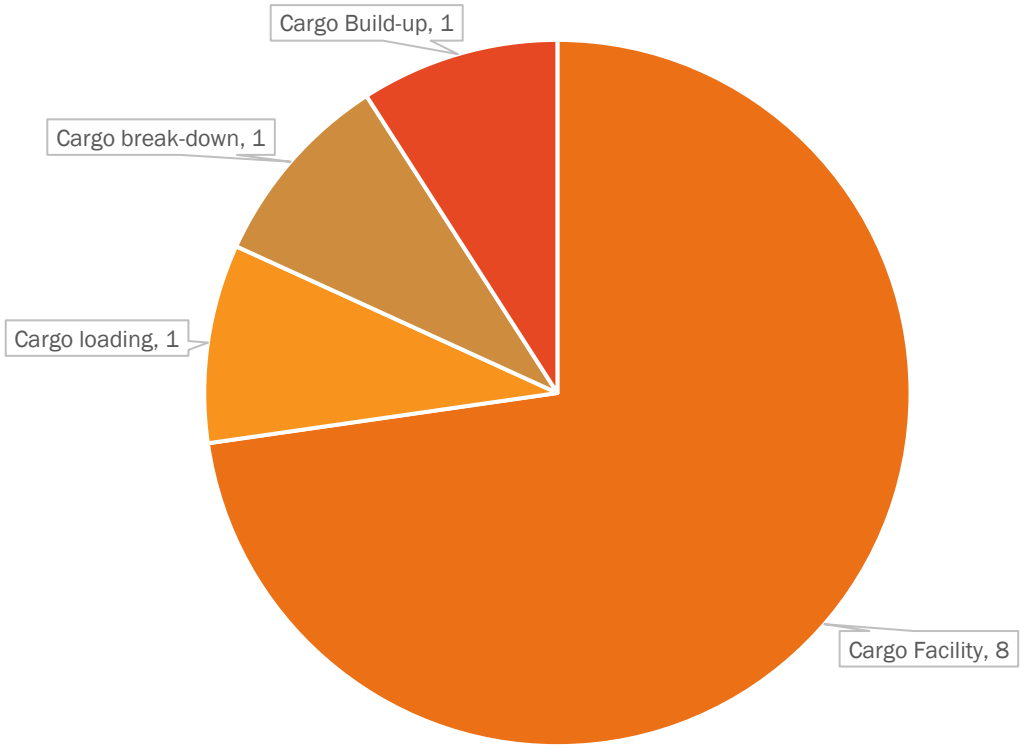
Source: ULSE TRIP Database, participant and FAA reports, as of 2023-04-18

2022 thermal Incidents, cargo flights, by UN Classifications



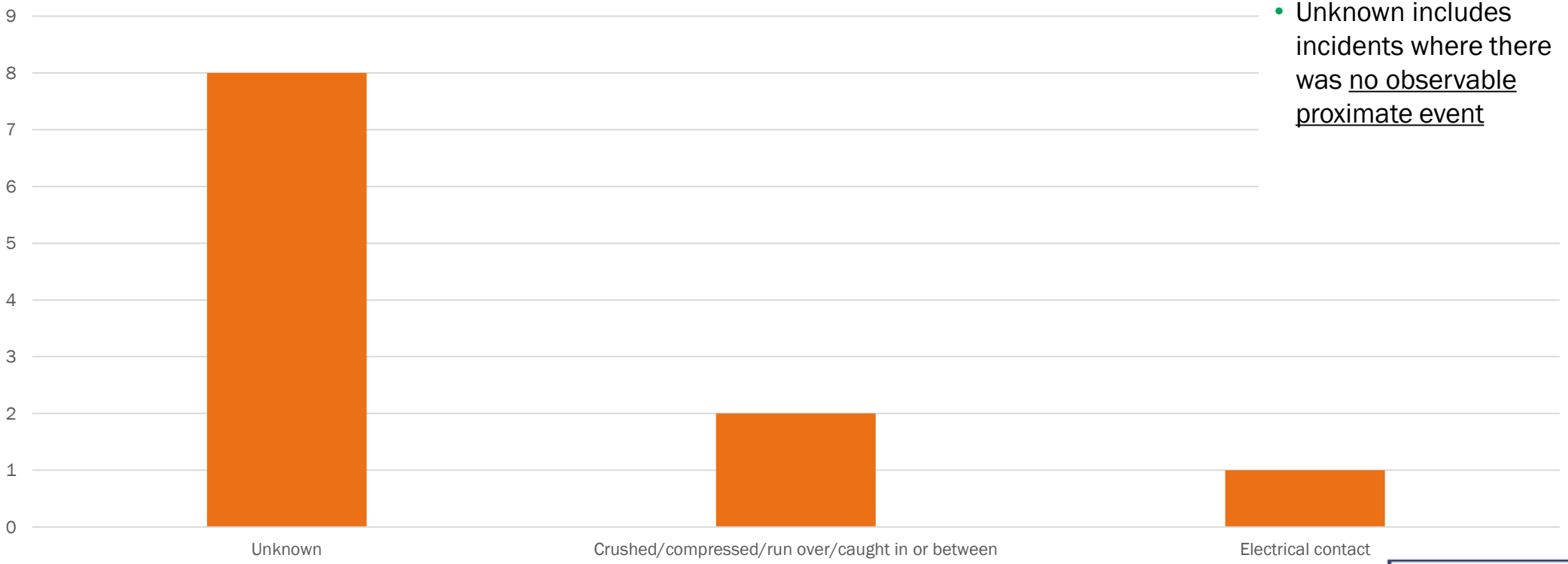
Source: ULSE TRIP Database, participant and FAA reports, as of 2023-04-18

2022 thermal incidents, cargo flights, by location



Source: ULSE TRIP Database, participant and FAA reports, as of 2023-04-18

2022 thermal incidents, cargo flights, by preceding event



- Unknown includes incidents where there was no observable proximate event

Source: ULSE TRIP Database, participant and FAA reports, as of 2023-04-18

5-Year Trends

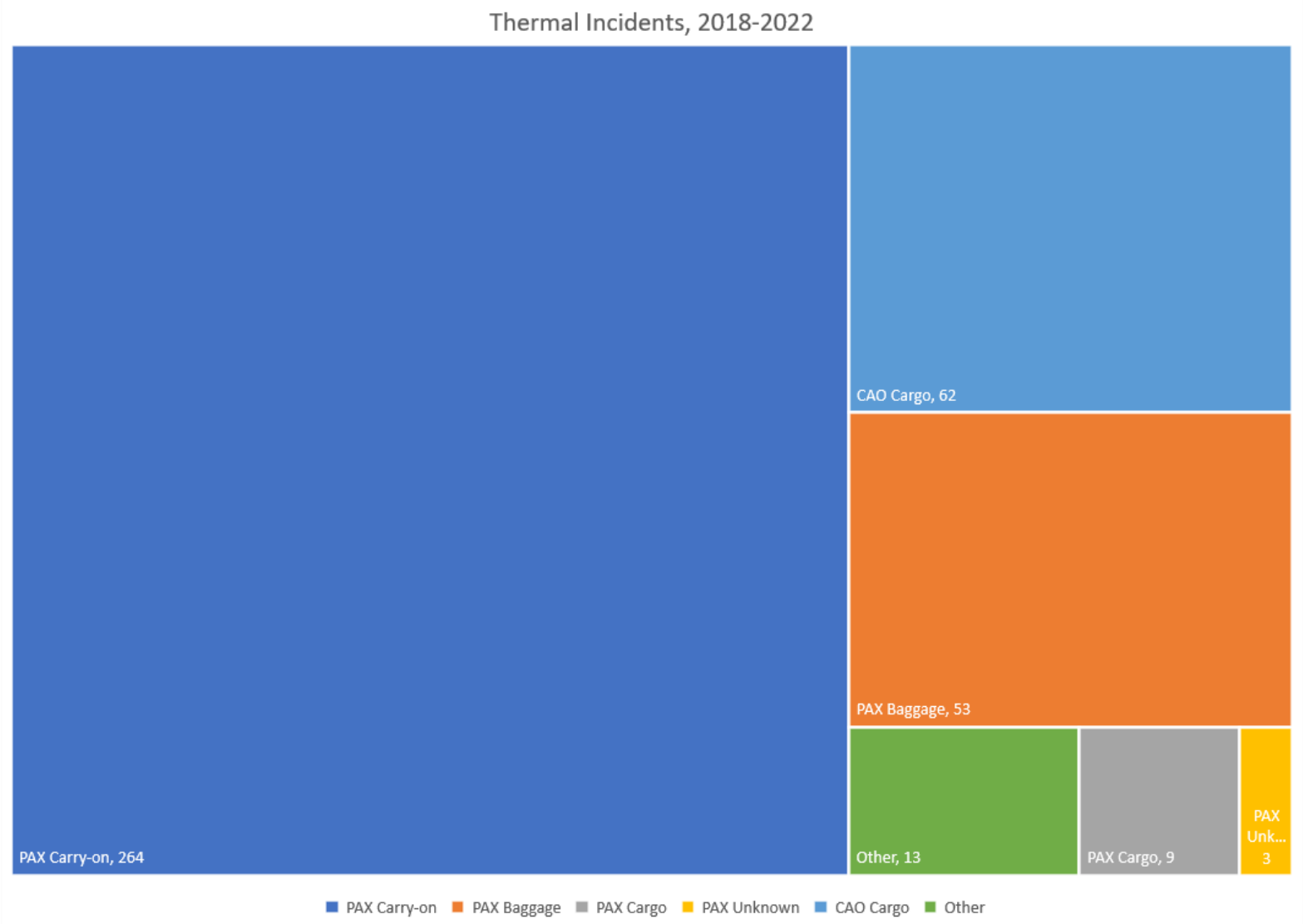
THERMAL INCIDENT REPORTS

All thermal incidents by flight type and path

404 thermal incidents

52 carriers + TSA

2018 & 2019 data include news and informal reports



Source: UL TRIP Database, participant reported thermal incidents from 2018-2022. As of 2023-04-18

PIPELINE AND HAZARDOUS MATERIALS SAFETY ADMINISTRATION (PHMSA)
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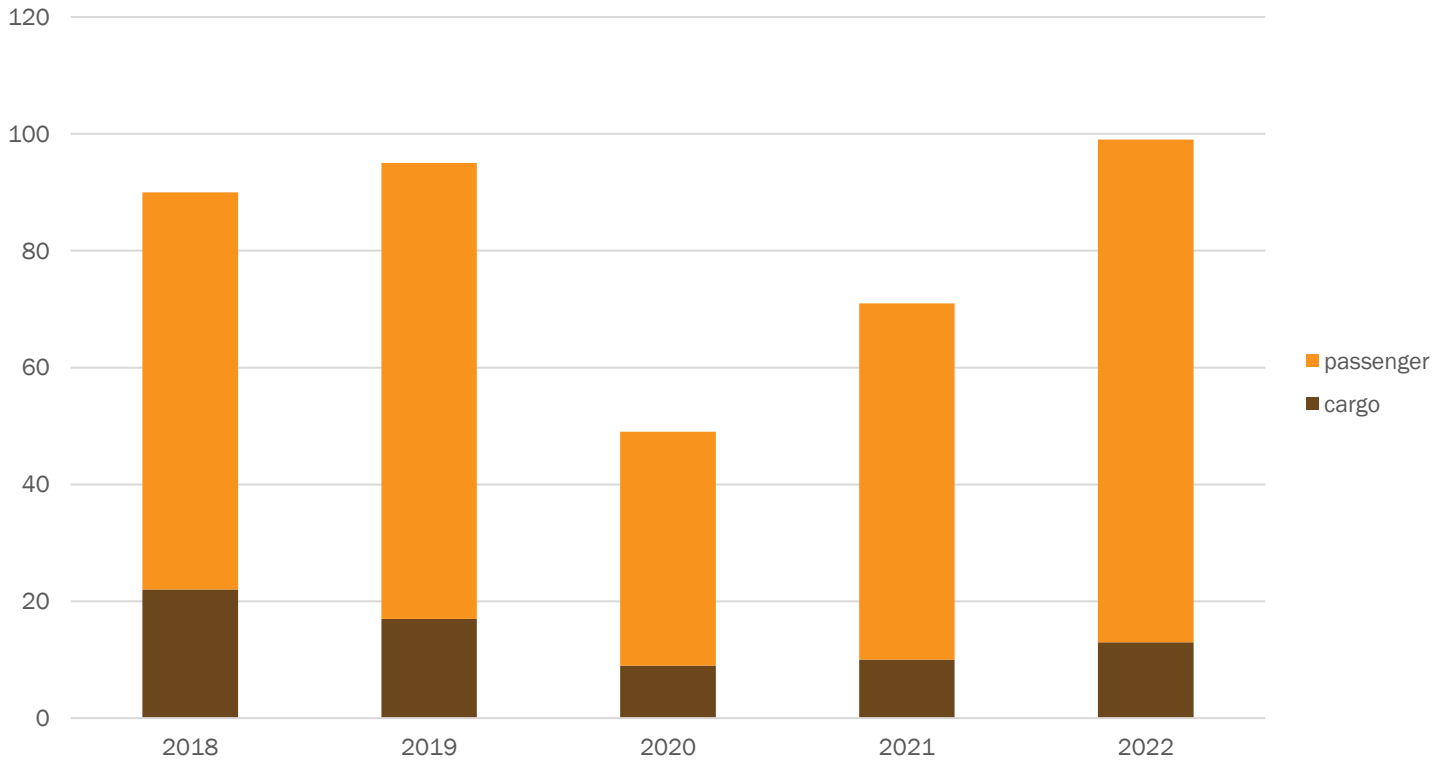
5-Year Trend, all thermal incidents, 2018-2022



404 thermal incidents

Incidents shown are events that involve a “a fire, violent rupture, explosion, or a dangerous evolution of heat.”

Near miss, swollen or damaged batteries and procedural issues are <u>not included</u> in this chart.

Source: UL TRIP Database, participant reported thermal incidents from 2018-2022. As of 2023-04-18

PIPELINE AND HAZARDOUS MATERIALS SAFETY ADMINISTRATION (PHMSA)
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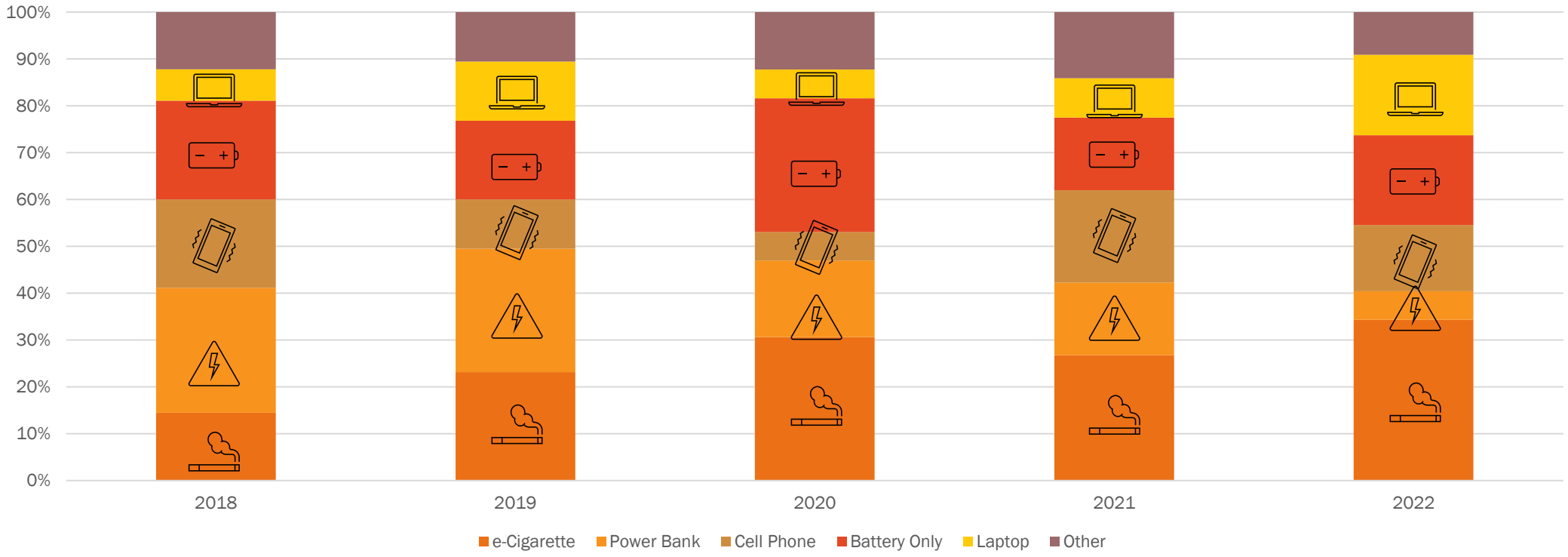
All thermal incidents, by device type, 2018-2022



Source: UL TRIP Database, participant reported thermal incidents from 2018-2022. As of 2023-04-18

PIPELINE AND HAZARDOUS MATERIALS SAFETY ADMINISTRATION (PHMSA)
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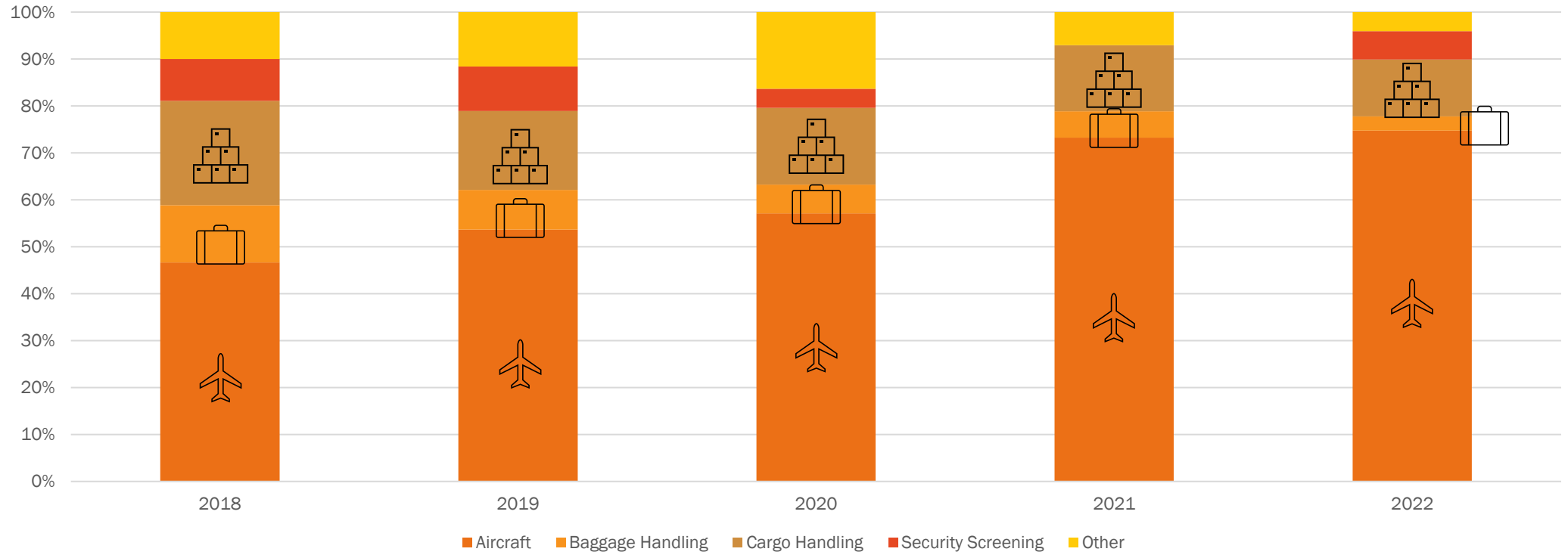
All thermal incidents, by location, 2018-2022



Source: UL TRIP Database, participant reported thermal incidents from 2018-2022. As of 2023-04-18

PIPELINE AND HAZARDOUS MATERIALS SAFETY ADMINISTRATION (PHMSA)
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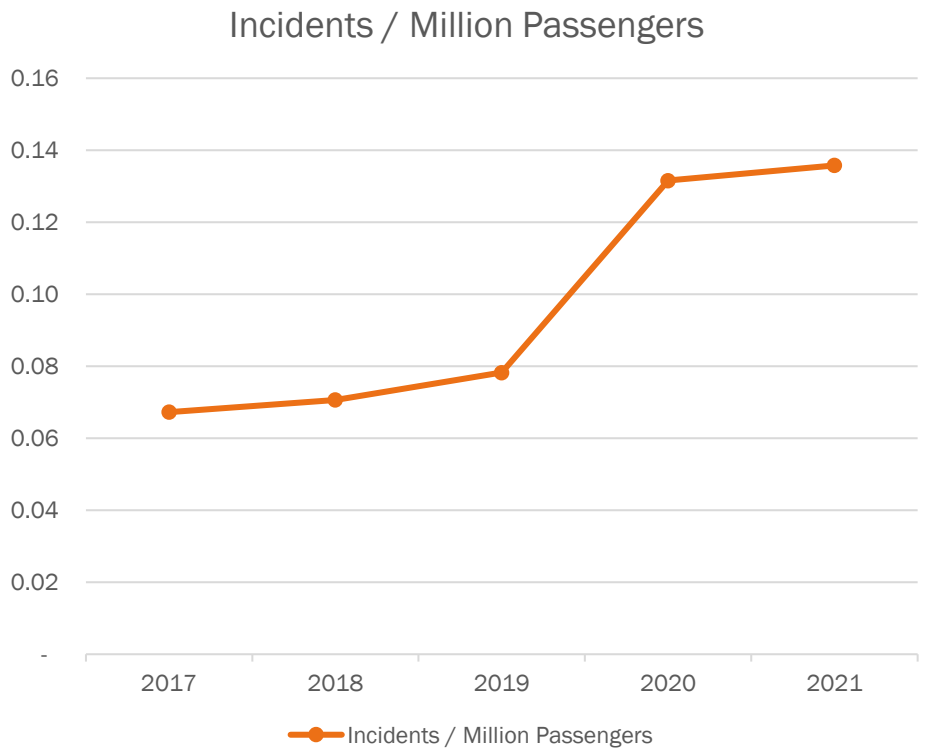
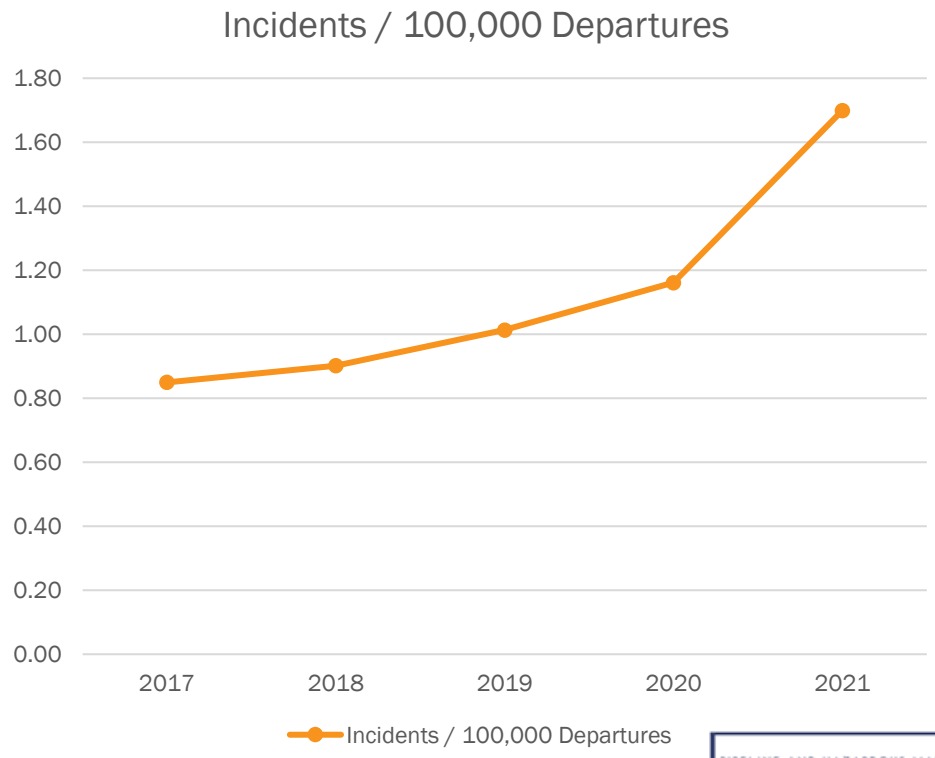
Incident rates, passenger operations, 2017 - 2021





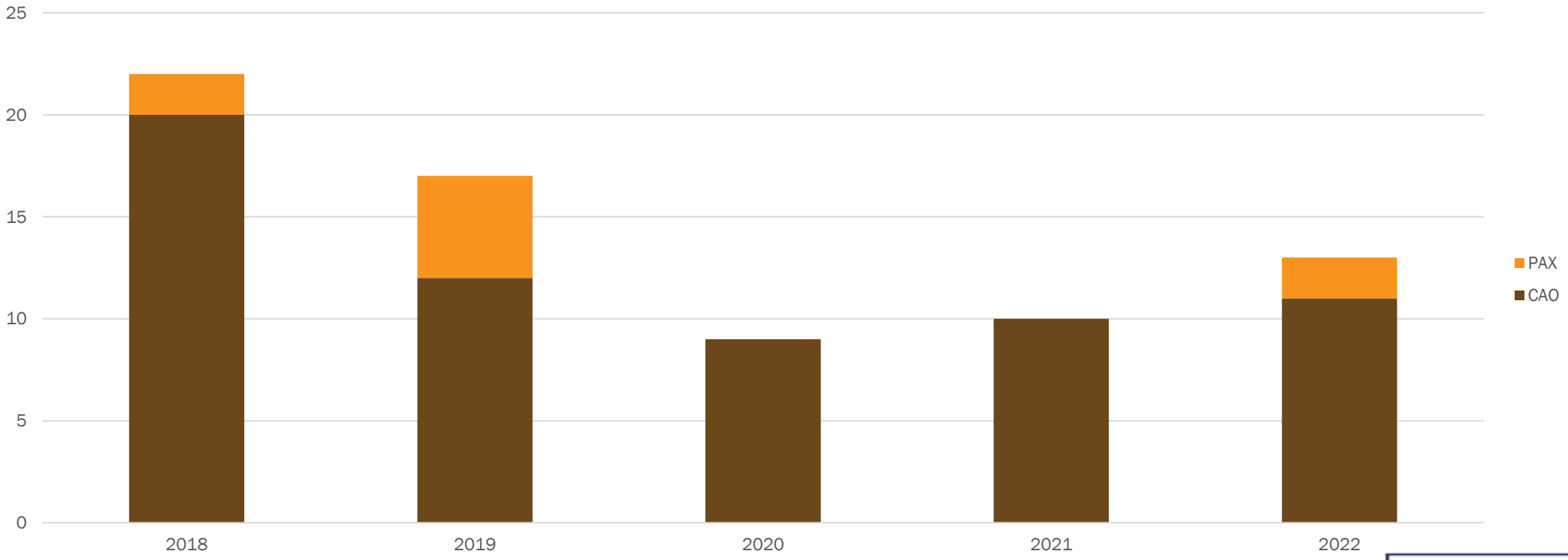
Sources: UL TRIP Database, participant reported incidents from 2017 – 2021. As of 2022-09-30
U.S. Department of Transportation, Bureau of Transportation Statistics, Office of Airline Information. Passenger and departure volumes 2017-2021. Accessed 2022-09-11

PIPELINE AND HAZARDOUS MATERIALS SAFETY ADMINISTRATION (PHMSA)
LITHIUM BATTERY AIR SAFETY ADVISORY COMMITTEE

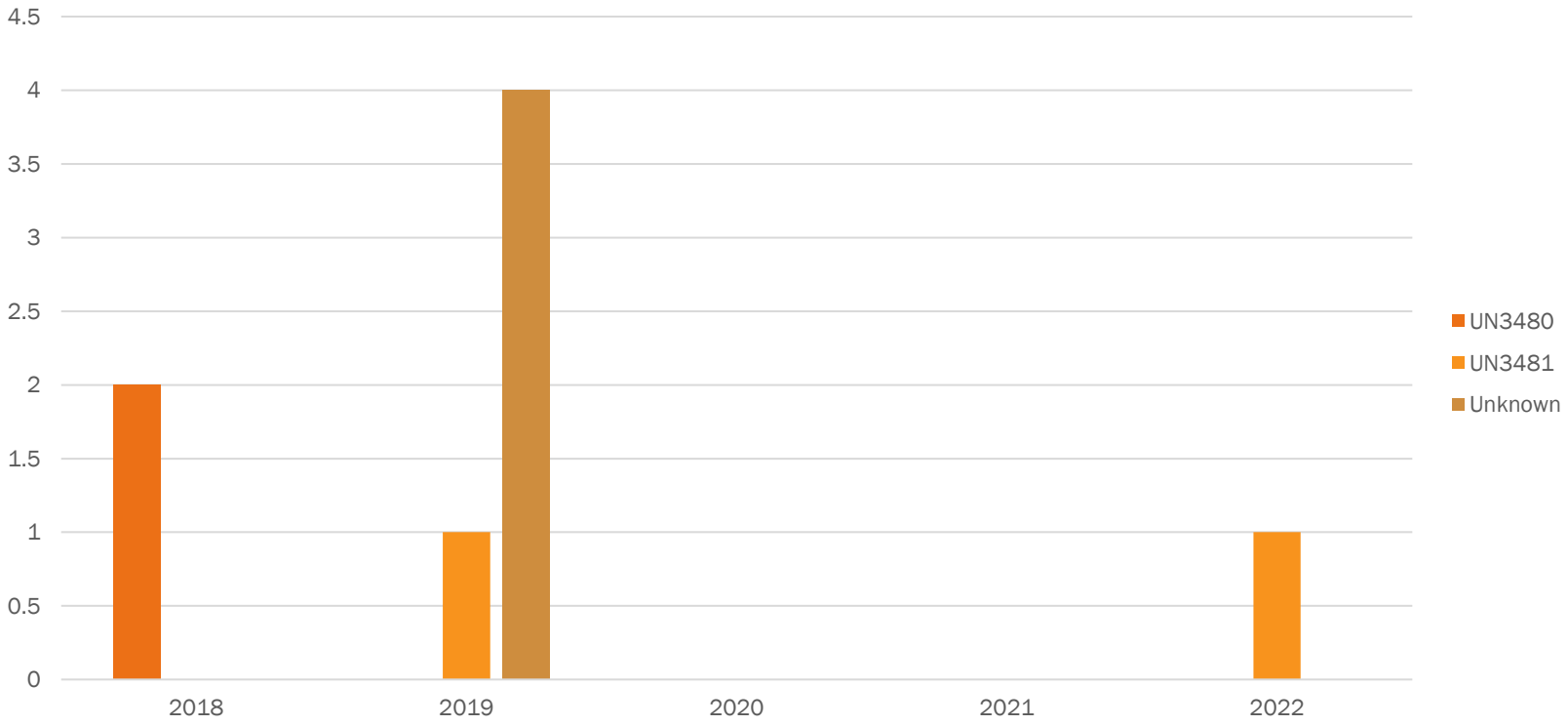
Cargo

THERMAL INCIDENTS, 2018 - 2022

Thermal incidents, cargo incidents, by carrier type, 2018-2022



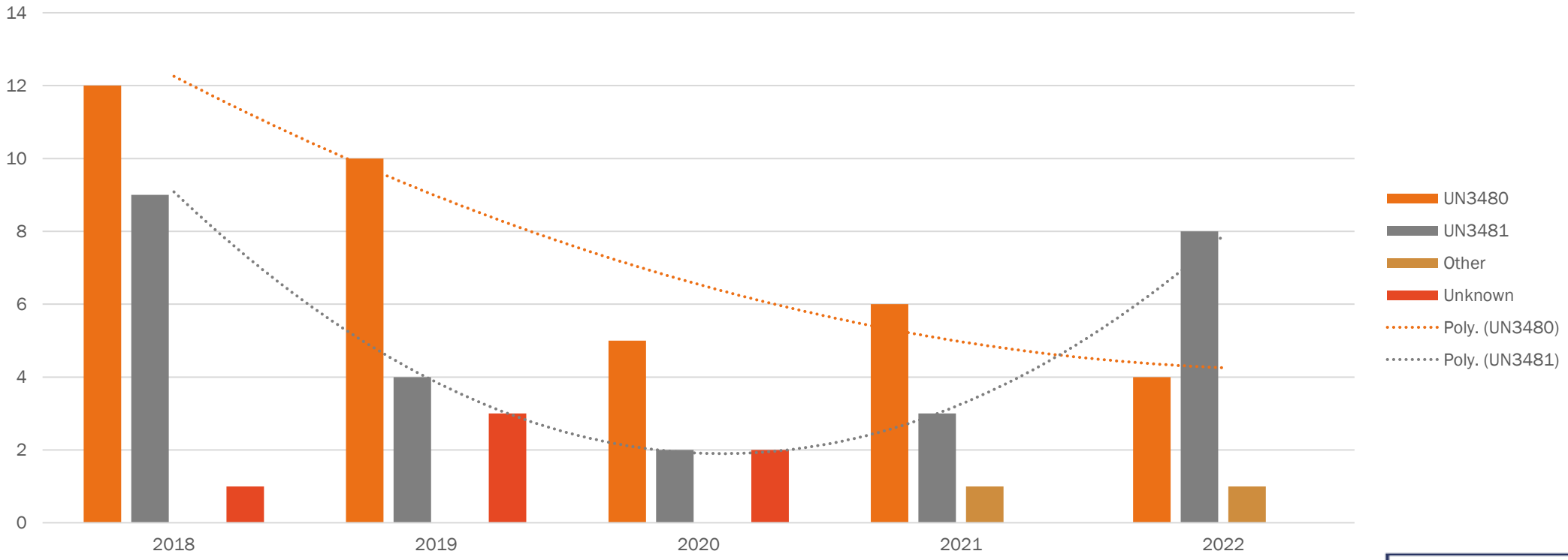
PAX cargo incidents, by UN classification, 2018-2022



5 of 8 incidents involve US Mail shipments

Source: UL TRIP Database, participant reported thermal incidents from 2018-2022. As of 2022-09-30

Cargo incidents, by UN classification, 2018-2022



Source: UL TRIP Database, participant reported thermal incidents from 2018-2022. As of 2022-09-30

PIPELINE AND HAZARDOUS MATERIALS SAFETY ADMINISTRATION (PHMSA)
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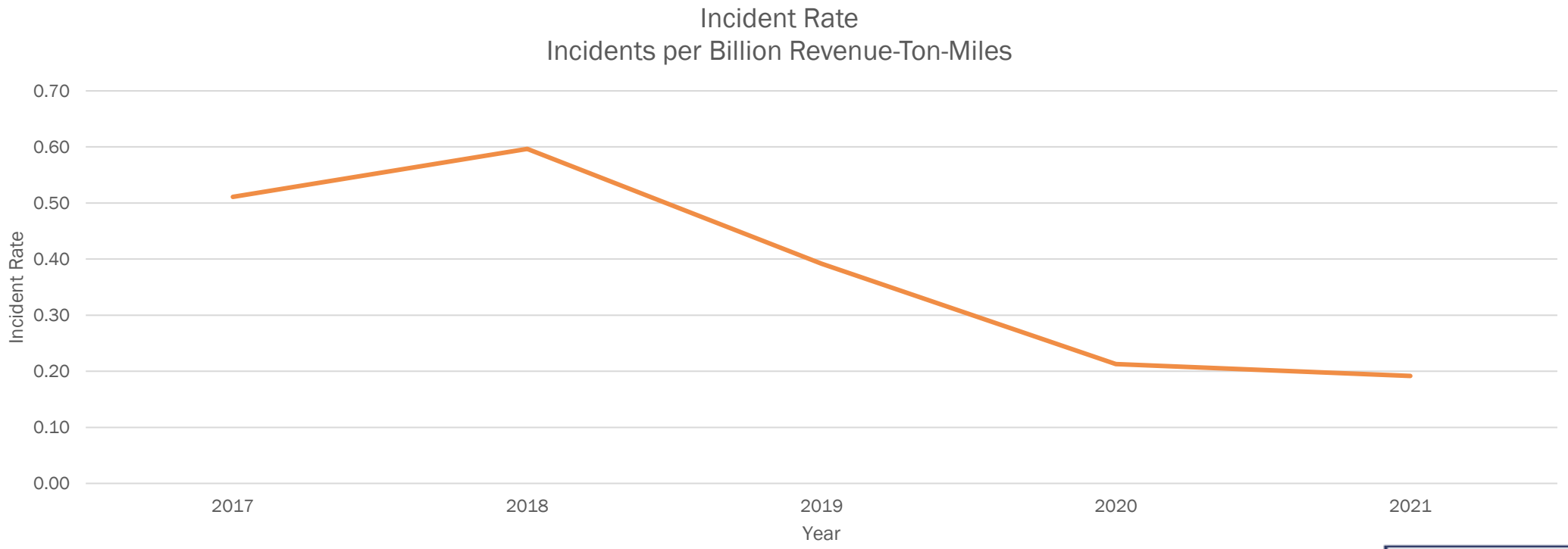
Cargo thermal incident trend, 2017-2021



Sources: UL TRIP Database, participant reported incidents from 2017 – 2021. As of 2022-09-30
U.S. Department of Transportation, Bureau of Transportation Statistics, Office of Airline Information. Cargo volumes 2017-2021. Accessed 2022-09-11

PIPELINE AND HAZARDOUS MATERIALS SAFETY ADMINISTRATION (PHMSA)
LITHIUM BATTERY AIR SAFETY
ADVISORY COMMITTEE

Insights

Passenger

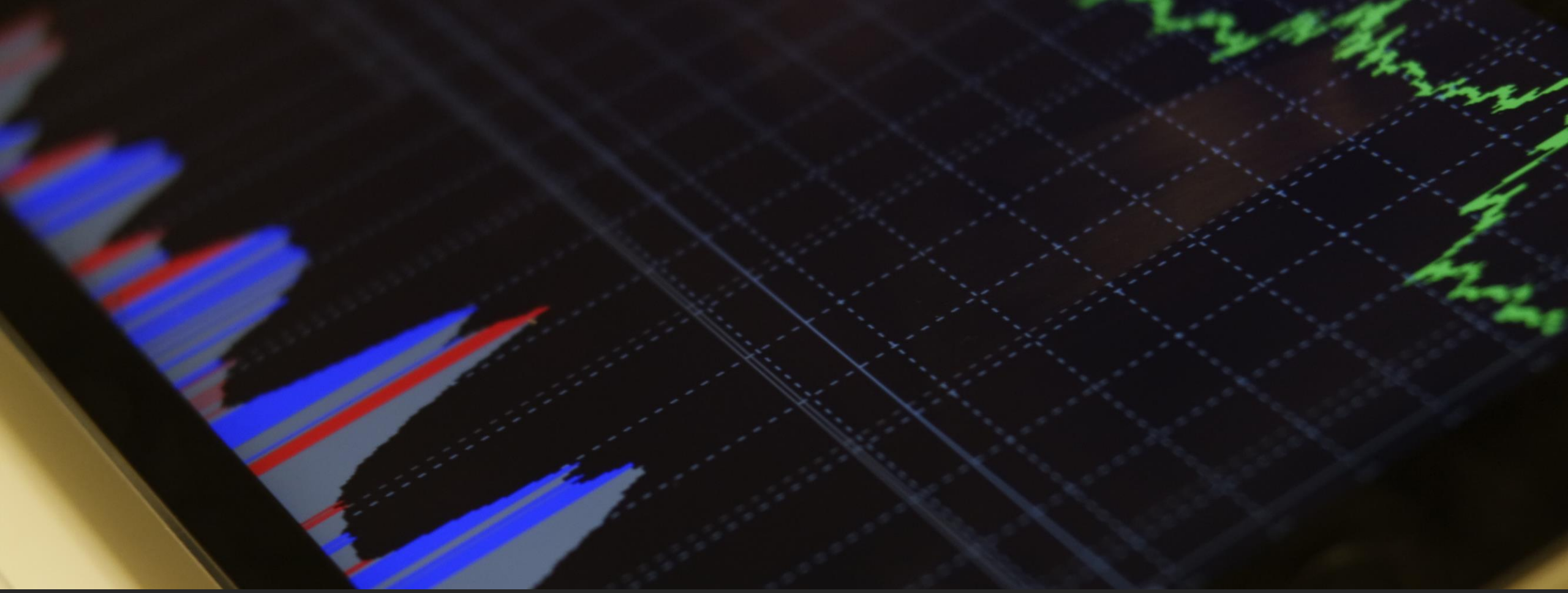
- 84% of incidents over the last 5 years
- Cabin / crew incidents
  - 76% occur on the aircraft
  - PED's (30%), e-Cig's (30%), Power Banks (20%)
  - 7% of incidents during critical flight phases (2022)
- Checked Baggage (2022)
  - 15% (9) incidents occurred on the aircraft
  - Spare batteries and laptops
- 2022 had more incidents than any other year.
  - Must normalize to determine overall trend.

Cargo

- 16% of incidents over the last 5 years
- Small numbers, trending is difficult
- Passenger flights with cargo
  - 6 of 9 incidents involve US mail
- Cargo freighter operations
  - No cabin/crew incidents
  - No incidents on the aircraft
  - UN 3481 incidents rising
- 2022 had more incidents than previous two years

PIPELINE AND HAZARDOUS MATERIALS SAFETY ADMINISTRATION (PHMSA)
LITHIUM BATTERY AIR SAFETY ADVISORY COMMITTEE

Questions and discussion

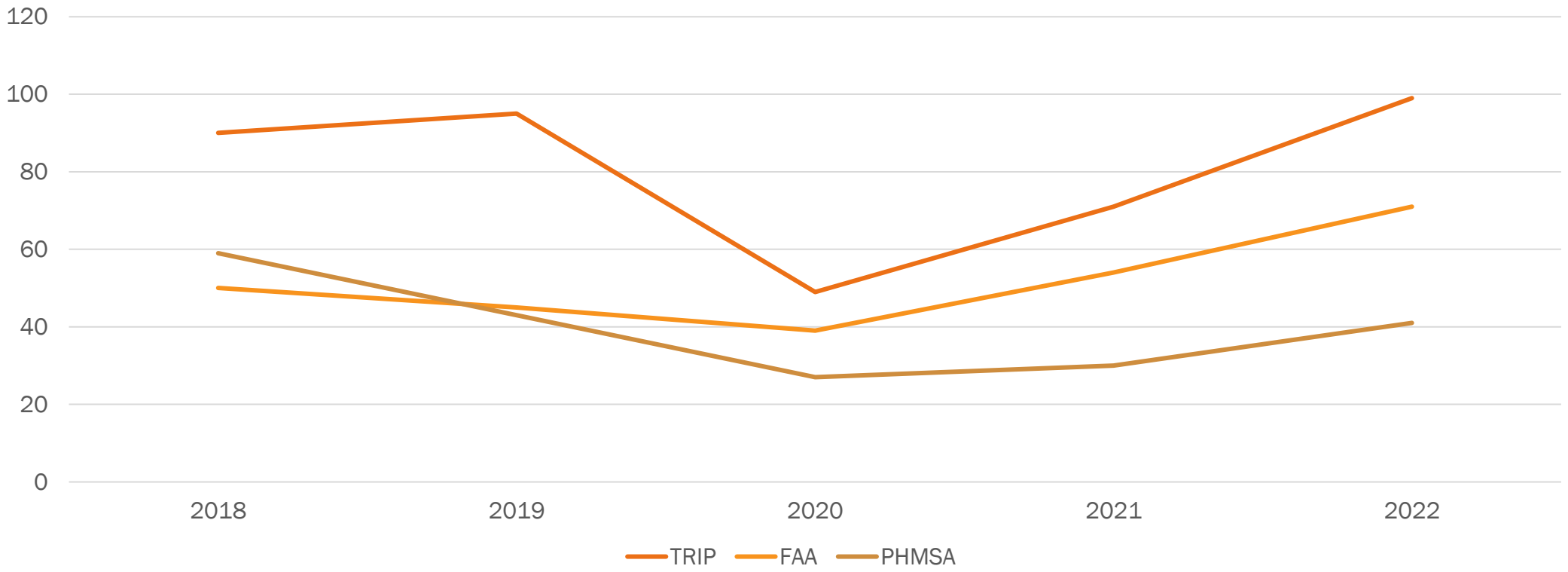


DOT 5800.1 Data Summary

Stephane Rosetti, Medtronic

PIPELINE AND HAZARDOUS MATERIALS SAFETY ADMINISTRATION (PHMSA)
LITHIUM BATTERY AIR SAFETY
ADVISORY COMMITTEE

Data comparisons: TRIP, FAA, PHMSA



Sources: UL TRIP Database, participant and FAA reported incidents from 2018-2022. As of 2023-04-18.
FAA Lithium Battery Incidents involving smoke, fire or extreme heat, Lithium Battery Incidents | Federal Aviation Administration (faa.gov), Accessed 2023-04-18
MDTC Analysis of DOT 5800.1 data from PHMSA Hazmatics, 20 Apr 2023.