LITHIUM ION BATTERY EMERGENCIES

Hazardous Incident Response Team H.I.R.T.

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Common Lithium Batteries?

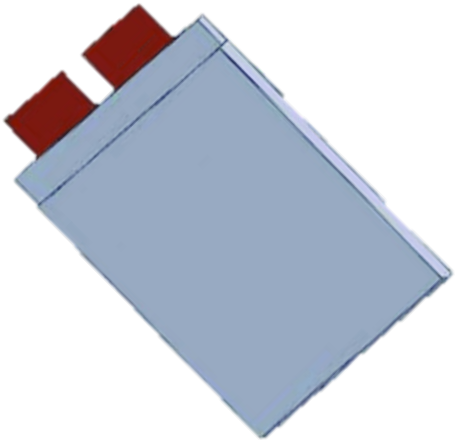
Non-rechargeable Batteries (Lithium Metal)

Highest energy density

Very stable medium

Lithium metal found inside is **extremely water reactive**

Common Lithium-Ion Batteries

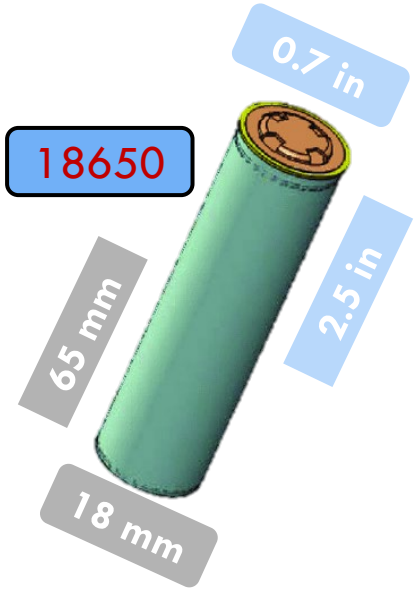


Rechargeable Batteries

Good memory resistance

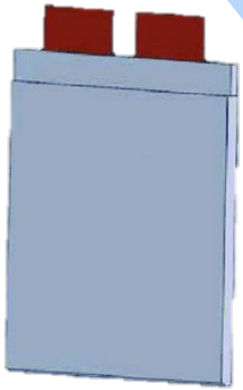
Very stable medium

Lithium-Ion Battery Types



Cylindrical Cell

Prismatic Cell

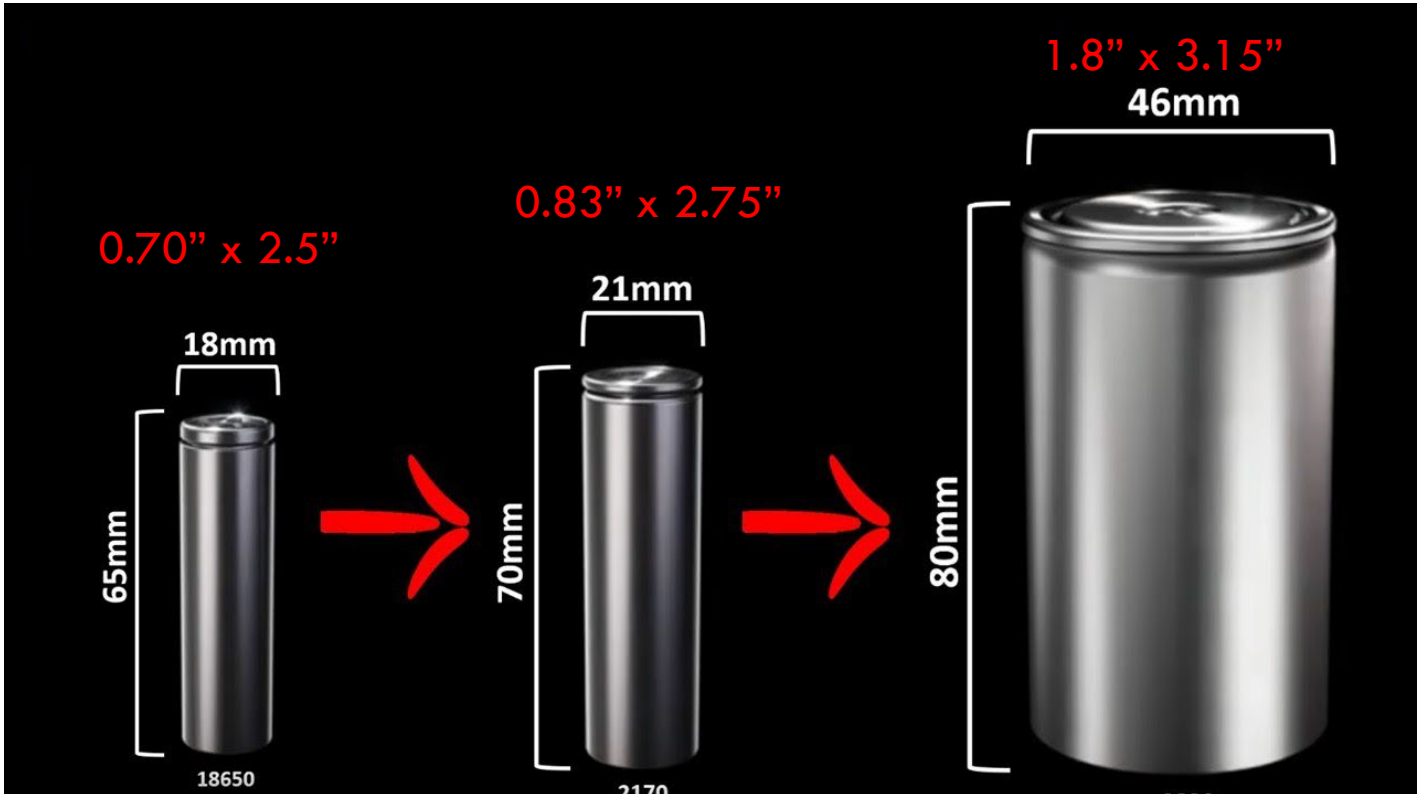


Pouch Cell

2170

- Cylindrical Cells (18650) are the most common battery in most mobile applications (bikes, scooters, etc.)
- Cylindrical Cells are also used by electric vehicles, where you can find anywhere from 3K-7K individual cells
- Prismatic and Pouch Cells are found in all other electric vehicles

Evolution of the Cylindrical Cell



- Here is an example of how the cylindrical cell size has evolved over time

Exponential Increase – Infrastructure

Federal Infrastructure Investment and Jobs Act (11/15/2021)

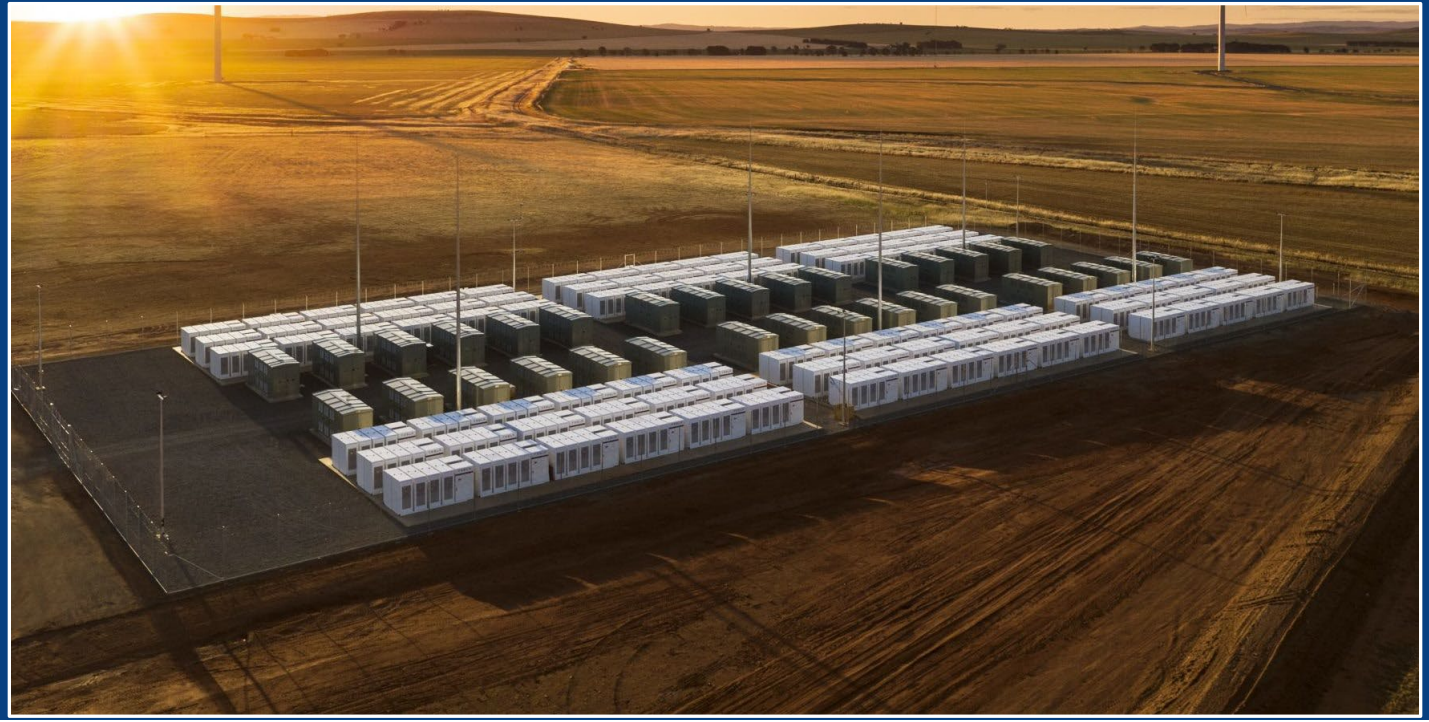
- $6 Billion
  - Battery Storage
- $7.5 Billion
  - Rapid charging stations – 500,000 along highways and in communities
- $1 Billion
  - School Buses

School Buses?

Rapid smoke and flame production

Three Primary Presentations of LIB

- Energy Storage Systems
- Electric Vehicles
- Micro-mobility



Battery Energy Storage System (ESS)

Battery Energy Storage System (ESS)

- Large Systems
- Multiple racks of batteries
- Surprise, AZ - 2019
  - ESS Fire/Explosion
  - Injuries to Hazmat FF's
    - Chemical Burns
    - Compression Blast Injuries
  - NFPA 1855

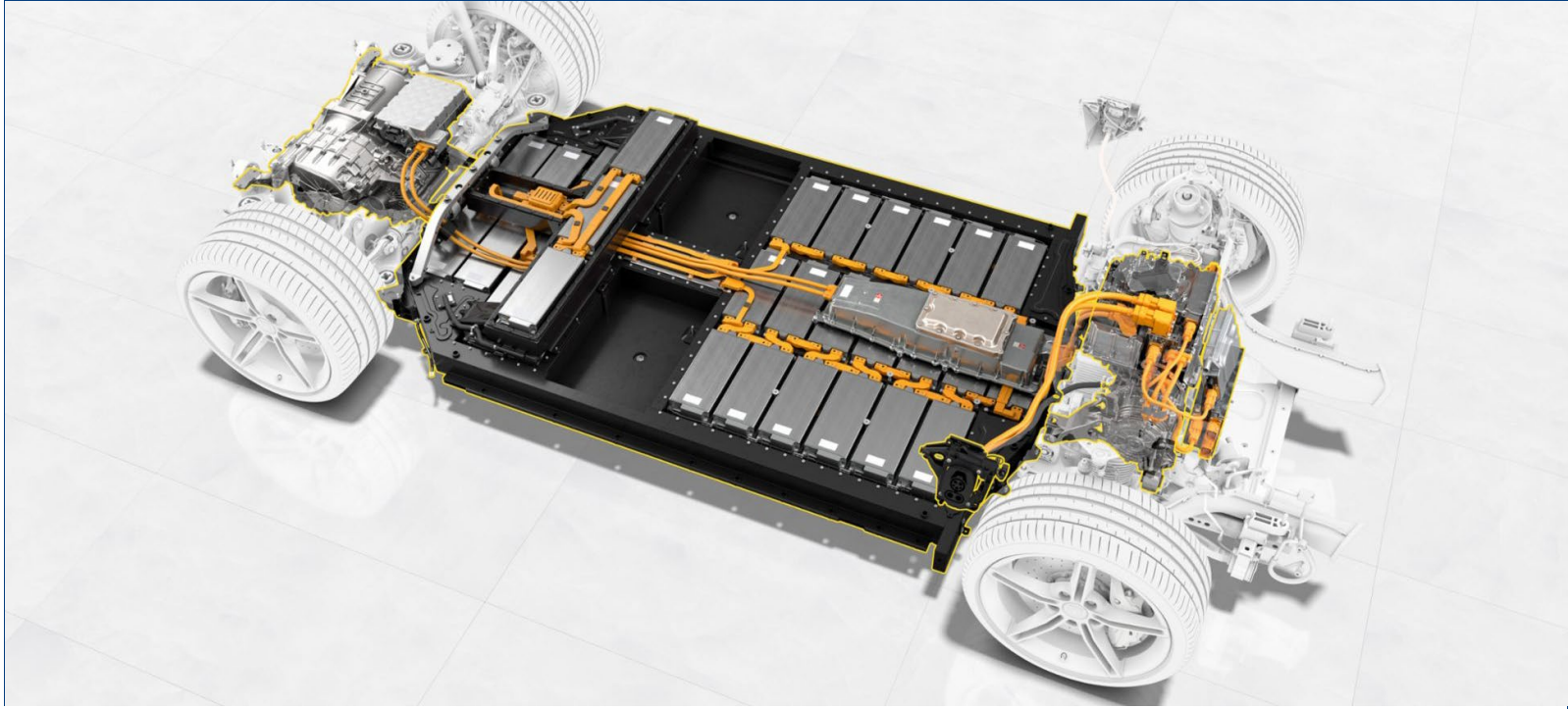
KEY TAKEAWAYS FROM APS EXPLOSION REP

SEVERAL VALLEY FIREFIGHTERS HURT IN 2019 BLAST

abc 15 ARIZONA

Battery Energy Storage System (ESS)

- September 20, 2022
- Moss Landing, CA
- Tesla Battery Energy Storage Facility



Electric Vehicles (EV)

Exponential Increase – Electric Vehicles (EV)

% of EVs Global Auto Sales

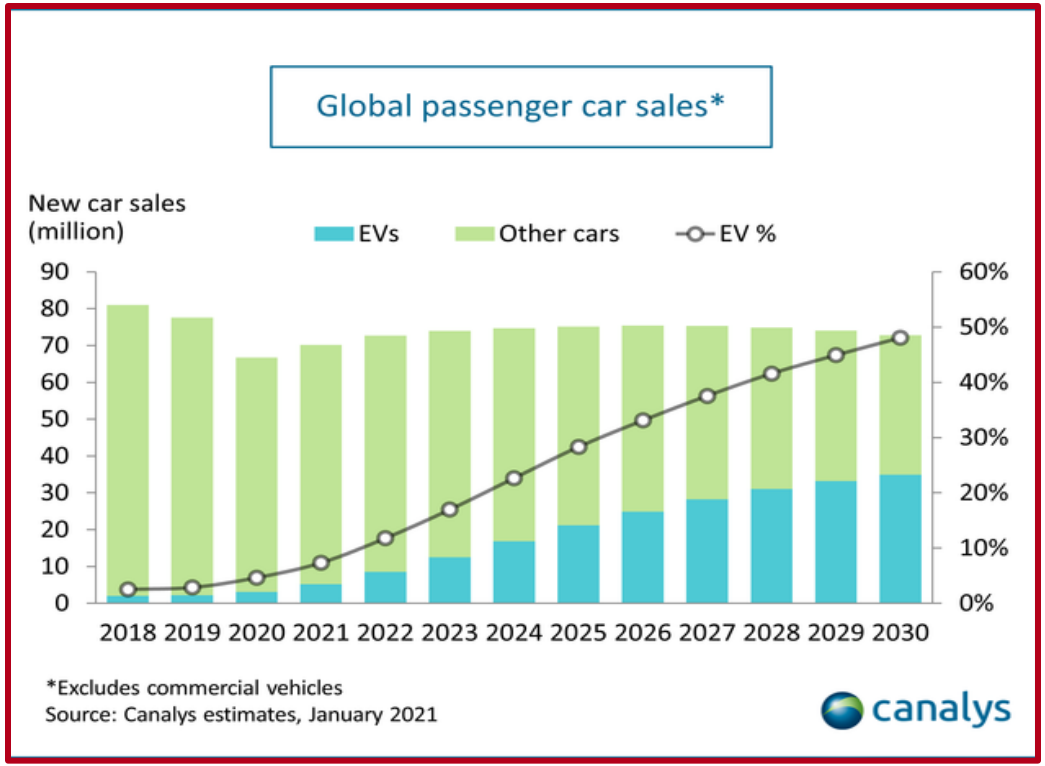
4.7% - 2020

15% - 2025

48% - 2035

California forecasted to be much higher.

By 2035 100% of all vehicle sales in CA must be battery or hydrogen powered



Electric Vehicles (EV)

- Lithium-Ion Batteries primarily located in underside of vehicle
  - White smoke
  - Battery cell projectiles
  - Hissing/popping sounds
  - Water is considered best cooling agent for suppression
    - Water needs to be applied under the vehicle and up at the batteries.
  - **<u>Rekindle is likely and can occur up to 21 days later!</u>**

Tesla – Cylindrical Cell Batteries

18650 cell generation

<u>LOTS OF WATER</u>

3 Keys to Success

EV Identification

Let it Burn

PROTECT EXPOSURES!

Secure a Water Supply

WHAT DOES THE FUTURE BRING FOR EV?

Micro-Mobility Devices

E-BIKES, SCOOTERS, HOVER BOARDS, ETC.

HOW FAST DO THEY FAIL?


UL/FSRI DEMONSTRATION
NBCPhiladelphia
5:44
43°
10
2022/11/04 16:39:31

Differences in Lithium-Ion Battery Fires

- Very toxic atmospheres
- Burn temperatures are higher than normal
- Fires can burn without Oxygen – can't smother!
- Explosive potential – Hydrogen Gas
- Thermal Runaway reaction
  - Chemical reaction – rapid degradation
  - Does not require Oxygen
  - Nearly impossible to stop once it starts
  - Could happen in seconds or days
- Re-ignition is common – <u>As much as 21 days later!</u>

Micro-Mobility Devices

- Public exposure concerns
  - Stored and charged inside occupied residences and businesses
  - Often near children's bedrooms
  - Can ignite with little-to-no warning
  - **Rekindle is likely. Remove all batteries outside as part of overhaul**

Micro-Mobility Devices

- Lithium-Ion batteries do not require Oxygen to burn and are water reactive.

VIP Pedicabs
1433 Market St/ 1434 Island Ave
San Diego, 11/9/22


CHINA
VIP
MADE IN CHINA


53105

Put Batteries in with Vermiculite/Cell Block?

EVOLVE SKATEBOARDS POST INCIDENT SAMPLING

by Wirschem, Leon

8/29/22

NO.2619050058

Zhejiang Tianhong Lithium-ion Battery Co., Ltd

SAFETY DATA SHEET

Lithium-ion Battery 36volt C 36V 14Ah 504Wh

SECTION1 PRODUCT AND COMPANY IDENTIFICATION

Product name:	Lithium-ion Battery 36volt C 36V 14Ah 504Wh
Company:	Zhejiang Tianhong Lithium-ion Battery Co., Ltd
Address:	No. 559 Changcheng Road, Taihui Street, Changxing Town, Huzhou City, Zhejiang Province, 313100, P.R.China
Email:	xiexin369958@cnthpower.com
Fax:	86-572-6216061
Emergency Phone:	86-572-6216650
SDS Number:	2619050058
Effective Date:	2019-06-19

SECTION2 HAZARDS IDENTIFICATION

Hazards Identification:

Class 9, miscellaneous. The battery has passed the test items of UN Model Regulations, Manual of Test and Criteria Section UN 38.3.

Emergency Overview:

Caution: Avoid contact and inhalation the electrolyte contained inside the battery.

SECTION3 INFORMATION ON INGREDIENTS

Product name: Lithium-ion Battery 36volt C 36V 14Ah 504Wh

Ingredient	Concentration	CAS No.	EC No.
Lithium Manganese Nickel and Cobalt Teary	15-35%	346417-97-8	620-032-4
Carbon/Graphite	10-25%	7440-44-0	231-153-3
Copper	10-20%	7440-50-8	231-159-6
Electrolyte	10-20%	96-49-1	202-510-0
Aluminum	5-15%	7429-90-5	231-072-3
Silicon Rubber	2-10%	63394-02-5	/
Nickel Tab	1-5%	7440-02-0	231-111-4
Conductive Carbon	1-2%	7782-42-5	231-955-3
Polyethene (PE)	0-2%	9002-88-4	618-339-3

2


evolve
SKATEBOARDS
Lithium Ion
Rechargeable Battery
36 volt
14 Amp Hours
504 Watt hours
Samsung INR
18650-35E 3500 mAh
CAUTION

NMC 21700 Molicel

Lots Smoke from LiPO4 ESS Batt

Client: County of San Diego
Project/Site: Evolve

Job ID: 570-108005-1
SDG: 2870 Whiptail Loop #103, Carlsbad, CA

Client Sample ID: 20044

Date Collected: 08/29/22 10:40
Date Received: 08/29/22 18:10

Lab Sample ID: 570-108005-1

Matrix: Water

Method: 6010B - Metals (ICP) - STLC Citrate

Analyte	Result	Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Antimony	ND		2.0		mg/L		09/01/22 09:12	09/01/22 09:31	1
Selenium	ND		1.0		mg/L		09/01/22 09:12	09/01/22 09:31	1
Molybdenum	ND		1.0		mg/L		09/01/22 09:12	09/01/22 09:31	1
Lead	ND		1.0		mg/L		09/01/22 09:12	09/01/22 09:31	1
Zinc	ND		5.0		mg/L		09/01/22 09:12	09/01/22 09:31	1
Vanadium	ND		0.20		mg/L		09/01/22 09:12	09/01/22 09:31	1
Thallium	ND		1.0		mg/L		09/01/22 09:12	09/01/22 09:31	1
Nickel	ND		1.0		mg/L		09/01/22 09:12	09/01/22 09:31	1
Copper	1.4		1.0		mg/L		09/01/22 09:12	09/01/22 09:31	1
Cobalt	ND		1.0		mg/L		09/01/22 09:12	09/01/22 09:31	1
Chromium	ND		1.0		mg/L		09/01/22 09:12	09/01/22 09:31	1
Cadmium	ND		0.20		mg/L		09/01/22 09:12	09/01/22 09:31	1
Beryllium	ND		0.20		mg/L		09/01/22 09:12	09/01/22 09:31	1
Barium	ND		0.20		mg/L		09/01/22 09:12	09/01/22 09:31	1
Arsenic	ND		2.0		mg/L		09/01/22 09:12	09/01/22 09:31	1
Silver	ND		0.20		mg/L		09/01/22 09:12	09/01/22 09:31	1

Method: 7470A - Mercury (CVAA) - STLC Citrate

Analyte	Result	Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Mercury	ND		0.0025		mg/L		08/31/22 15:55	09/01/22 13:14	1

General Chemistry

Analyte	Result	Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
pH	8.2	HF	0.1		SU			08/31/22 11:23	1

Client Sample ID: 20045

Lab Sample ID: 570-108005-2

Client Sample ID: 20045
Date Collected: 08/29/22 10:45
Date Received: 08/29/22 18:10

Lab Sample ID: 570-108005-2
Matrix: Water

Method: 6010B - Metals (ICP) - STLC Citrate

Analyte	Result	Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Antimony	ND		2.0		mg/L		09/01/22 09:12	09/01/22 09:50	1
Selenium	ND		1.0		mg/L		09/01/22 09:12	09/01/22 09:50	1
Molybdenum	ND		1.0		mg/L		09/01/22 09:12	09/01/22 09:50	1
Lead	ND		1.0		mg/L		09/01/22 09:12	09/01/22 09:50	1
Zinc	ND		5.0		mg/L		09/01/22 09:12	09/01/22 09:50	1
Vanadium	ND		0.20		mg/L		09/01/22 09:12	09/01/22 09:50	1
Thallium	ND		1.0		mg/L		09/01/22 09:12	09/01/22 09:50	1
Nickel	ND		1.0		mg/L		09/01/22 09:12	09/01/22 09:50	1
Copper	3.0		1.0		mg/L		09/01/22 09:12	09/01/22 09:50	1
Cobalt	ND		1.0		mg/L		09/01/22 09:12	09/01/22 09:50	1
Chromium	ND		1.0		mg/L		09/01/22 09:12	09/01/22 09:50	1
Cadmium	ND		0.20		mg/L		09/01/22 09:12	09/01/22 09:50	1
Beryllium	ND		0.20		mg/L		09/01/22 09:12	09/01/22 09:50	1
Barium	ND		0.20		mg/L		09/01/22 09:12	09/01/22 09:50	1
Arsenic	ND		2.0		mg/L		09/01/22 09:12	09/01/22 09:50	1
Silver	ND		0.20		mg/L		09/01/22 09:12	09/01/22 09:50	1

Method: 7470A - Mercury (CVAA) - STLC Citrate

Analyte	Result	Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Mercury	ND		0.0025		mg/L		08/31/22 15:55	09/01/22 13:20	1

Disposal procedures for batteries

- After battery no longer poses a fire hazard and when ready for disposal, do the following:
- At Residence: Provide resident contact information for their local Household Hazardous Waste program to determine requirements for acceptance. Provide guidance to ensure safety during transportation (background temperature, Properly sealed container for waste with liquids, lid ajar if transporting solids only). The haulers list also includes HHW contacts. Let them know that if HHW does not take it, they will need to contact a private hazardous waste hauler, may want to talk to their insurance provider.
- At Business: Provide business the hazardous waste haulers list and provide proper disposal guidance. Refer to DEHQ for follow-up.

Batteries taken off site for safety reasons

(congratulations you likely now own them):

1) Check the temperature with TIC.
2) When waste is at ambient temperature and ready for disposal, pH the saltwater.
3) Contact hazardous waste hauler or battery recycler, provide photos and documentation on temperature/pH to determine if waste can be taken as is with saltwater solution and battery(s). If they can take it, go to step 5.
4) If waste hauler/recycler cannot accept batteries in water and pH is between 5 and 12.5, the waste is sewerable pending no EPA regulated heavy metals present (consult DEHQ). Previous incidents by EPA and DEHQ have determined this is not a corrosive waste or toxic due to regulated heavy metals.
5) Take photos and send documentation information to your recycler/hauler for disposal/recycling.

June 30, 2023

U.S. Department
of Transportation

**Pipeline and Hazardous
Materials Safety
Administration**

1200 New Jersey Avenue, SE
Washington, DC 20590

DOT-SP 21193
(FOURTH REVISION)

EXPIRATION DATE: 2027-05-31

(FOR RENEWAL, SEE 49 CFR 107.109)

1. GRANTEE: KULR Technology Corporation
San Diego, CA

2. PURPOSE AND LIMITATIONS:

a. This special permit authorizes the manufacture, mark, sale, and use of specially designed thermal runaway shield (TRS) packagings for the transportation in commerce of damaged, defective, or recalled lithium ion cells and batteries and lithium metal cells and batteries and those contained in or packed with equipment. This special permit provides no relief from the Hazardous Materials Regulations (HMR) other than as specifically stated herein. The most recent revision supersedes all previous revisions.

Need Help?

- If you need additional assistance, you can contact a DTSC Duty Officer at 916-255-6504 or (800) 260-3972 during work hours or afterhours via CalOES Warning Center at 800-852-7550
- If the incident is large you can also contact Fed EPA Duty Officer at 800-300-2193

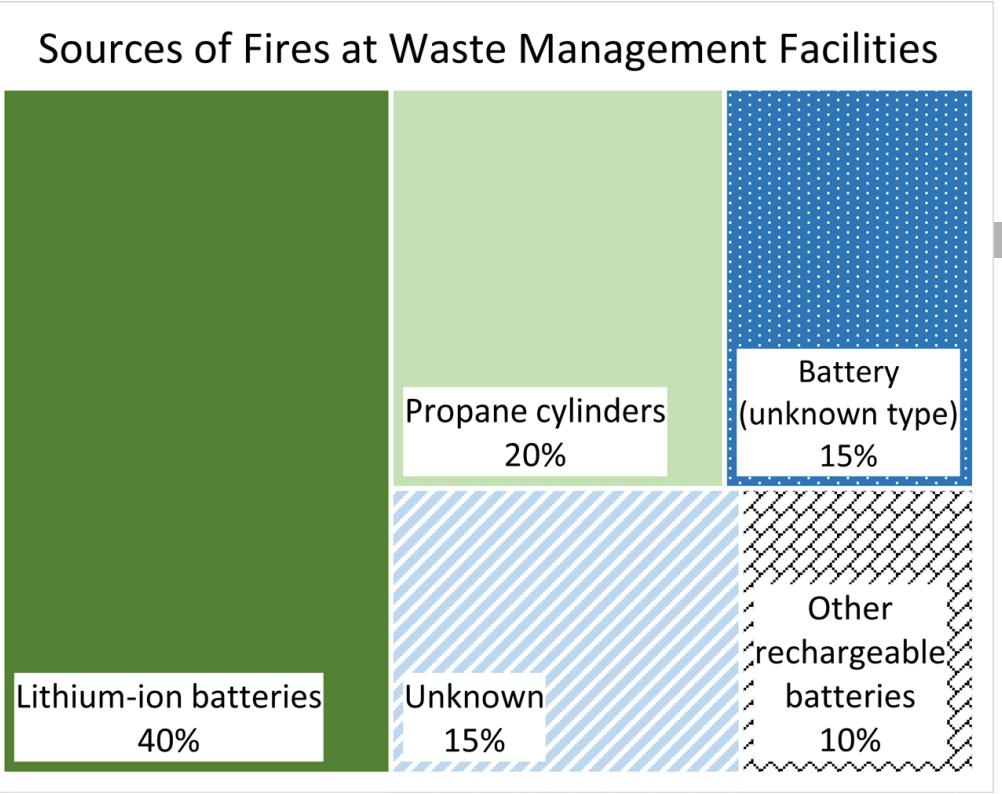
Another Option- DOT Special Permit containers

The kit includes individual packaging for the battery, a drum liner, cell block, stickers and instructions with the containers

Waste Management Fires

Disposal Challenge

- Trash trucks/recycling facilities




What Can We Do?
FIRESCOPE
CALIFORNIA
6LEG083