### Incident Type By Jurisdiction

<table>
<thead>
<tr>
<th>City</th>
<th>Abandoned Waste/Disposal Unauthorized</th>
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<th>Asbestos</th>
<th>Bio-Agent or Bio-Hazard/Infectious Waste</th>
<th>Chemical and/or Hazardous Condition Spill Notification</th>
<th>Chemical Odor, Exposure, Transportation Related</th>
<th>Fire with Chemical Involvement</th>
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### 2022 HIRT Response Times Summary

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<th>Month</th>
<th>Monthly Average</th>
<th>YTD Average</th>
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<td>January</td>
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<td>May</td>
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<td>June</td>
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<td>July</td>
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<td>December</td>
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</table>

### HIRT Activity Report

Jan 1 to July 31, 2022

**Highest Number of Responses by Incident Type**

<table>
<thead>
<tr>
<th>Incident Type</th>
<th>Number</th>
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<tbody>
<tr>
<td>Chemical Odor, Exposure, Transportation Related</td>
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<tr>
<td>Abandoned Waste/Disposal Unauthorized</td>
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<td>Asbestos</td>
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<td>Fire with Chemical Involvement</td>
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<td>Transportation Related</td>
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**2022 YTD Total**

<table>
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<th>Category</th>
<th>Total</th>
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<tbody>
<tr>
<td>Total</td>
<td>249</td>
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</tbody>
</table>

Last Updated: 8/11/2022
Pool Truck Incidents
Pool Truck Accident

Oceanside
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 metal is extremely water reactive
Lithium-Ion Battery Types

- Cylindrical Cells (18650) are used almost exclusively by Tesla vehicles – 3K-7K cells per vehicle
- Cylindrical Cells (18650) are also the most common battery in all other mobile applications (bikes, scooters, etc.)
- Prismatic and Pouch Cells are found in all other electric vehicles
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
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.

Global passenger car sales*

*Excludes commercial vehicles
Source: Canalys estimates, January 2021
Differences in Lithium-Ion Battery Fires

- Very toxic atmospheres
- Burn temperatures are higher
- Lithium 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 – Up to 7 days later!
Battery Energy Storage System (ESS)

MOST DANGEROUS. HIGHEST RISK OF FIREFIGHTER INJURY
Battery Energy Storage System (ESS)

- Lithium Titanate (LTO)
- Large Systems
  - Example Locations: Qualcomm, NBC Studios, San Diego Zoo, and more…
- Surprise, AZ – APRIL 19, 2019
  - ESS Fire/Explosion
  - Injuries to 8 FF’s
    - Chemical Burns
    - Inhalation Injuries
    - Compression Blast Injuries
      - Thrown 75’ through fence

Fatality Incident (China)

- On April 16, 2021, an explosion occurred when Beijing firefighters were responding to a fire in a 25 MWh lithium-iron phosphate battery connected to a rooftop solar panel installation. Two firefighters were killed and one injured.
Two engineers hug on top of a burning wind turbine, moments before their death.
Electric Vehicles (EV)
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.
  - Rekindle is likely and can occur up to 21 days later!

Tesla – Cylindrical Cell Batteries
18650 cell generation

LOTS OF WATER
2 Keys to Success

- EV Identification
- Secure a Water Supply
Micro-Mobility Devices

E-BIKES, SCOOTERS, HOVER BOARDS, ETC.
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.
PPE

- **Toxic Gases**
  - Primary Hazard
  - **Respiratory protection is a must throughout including overhaul!**
  - Hydrogen Fluoride (HF), Phosphorus Pentafluoride, Phosphoryl Fluoride, Hydrogen Gas, Cobalt
  - Some batteries may release their energy and gases long after fire is extinguished

- **Fire and Explosive Potential**
  - Full structural firefighting PPE
  - Hydrogen Gas poses explosive potential
  - Fires burn hotter
  - Batteries may release their energy and gases long after fire is extinguished

- **Additional hazards:**
  - Electrical
  - EVs can move without warning
SIGNIFICANT INCIDENTS
Germany parking lot bands EVs following EV fire
April 18, 2022

- Chandler, AZ
- 6,000 sqft ESS – 9 MW
- 15-day operation
- All businesses in the area were evacuated due to toxic gases prior to robots opening the facility doors to allow toxic/explosive gases to vent
- EMF in the area prevented wireless robot utilization. Hardline robot utilized to open doors and take atmospheric reading prior to fire personnel ensuring the fire was extinguished
FDNY issues warning to public after 4 fires erupted in 2 days
- 3 in Manhattan
- 1 in Brooklyn

E-bike

FDNY issues PSA message

https://www.fdnysmart.org/be-fdnysmart-when-using-any-devices-powered-by-lithium-ion-batteries/
April 29, 2022

- Paris, France
- Second electric bus fire in less than 1 month
- All 149 electric buses from Parisian transit service are taken offline until further notice
May 2, 2022

- E-Bike Battery Fire
- "Farmer" apartment
  - Charging multiple e-bikes

Removed from the 3rd Alarm this morning in Sunset Park.
60 residential fires due to lithium-ion batteries – Jan 1 to May 3, 2022

233% increase from the same period in 2021
May 15, 2022

- EV Hybrid Fire (Chevy Volt) – Escondido, CA
- 5,000 gallons used
- Respiratory exposure to gases by crew member
May 15, 2022

- Seattle, WA
- 1 of 2 Micromobility fires in the city that day trapped 2 in their bedroom on the 5th floor
- Rescued by ladder company
May 19, 2022

- San Diego, CA
- 2 Lithium Batteries – 77 cells, 12 lbs
- General Atomics battery testing facility
- Crews followed recommended procedures
- Damage batteries turned over to General Atomics staff
June 12, 2022

- Sacramento, CA
- Tesla Fire in a Wrecking Yard
- Damaged and reignited in yard after 3 weeks!!
June 26, 2022

- Brooklyn, NY
- 3rd Alarm e-bike shop, residential over commercial
July 23, 2022

- Hamden, CT
- Electric city bus
- FD let bus burn
September 12, 2019

- Conception Dive Boat
- 34 dead
- Photography Lithium-ion batteries “involved”
February 16, 2022

- Coast of Portugal
- 1000s of EVs involved
- Ship sank
Other

Electric Tugboats

Vessel Specifications

**Overall Dimensions**

- Moulded Length: 82’
- Length at Waterline: 77’ 4”
- Depth: 37’ 3”
- Draught (Draft): 9’ 0”
- Beam: 41’
- Bowland: 75 short tons (estimated)
- Speed: 12 knots

**Grave Tonnage (US Regulatory):** 7,200 GRT

**Main Engine Model:** MAN Energy Solutions 9L468ME-C9.5
**Drive Propulsion:** Caterpillar 3516B DDEC V12 Engines
**Generator for long travel:** 2 x 350 kW
**Fuel:** 98,000 gal (98%)

**Electrical Integrator (ABB): Providing the Following**

- Main Propulsion Battery: Conval 62 MWh
- Thrusters: Twin Screw Propulsion Thruster
- Electric Motors: 2 x 2900 kW TAWEM Motors
- Switchboards: ABB Onboard DC Grid™ and AC TeckHouse
- Intelligent Maneuvering: ABB Marine Pilot Control
- Autonomous Operations: ABB Marine Pilox

**Fresh Water:** 750 gal
**Battery Room Fixed Fire Suppression:** Water Mist
**Berths:** 4
WHERE DO WE GO FROM HERE?
MULTI FACETED APPROACH
RECOMMENDATIONS

- Early identification of EV fire
- Request TRT
- Ensure Water Supply / Consider Water Tender
- Add Hazmat if batteries are out of vehicle
- Prepare for a prolonged operation
- ** See EV SOG Draft **
RECOMMENDATIONS

MICROMOBILITY FIRES

- Early identification of battery involvement
- Ensure all personnel wearing SCBA
- Assume all batteries have stored energy and could off-gas and ignite
- Request Hazmat to respond, advise of Li Batteries present:
  - To remove batteries from area
  - Render them safe
  - Proper disposal
- Do not allow any personnel to enter without SCBA (i.e. investigators) until batteries are removed
STILL TO-DO

- Standardize an Emergency Response Plan for BESS facilities
- Mandatory through Fire Prevention/Code
THANK YOU!

Contact Battalion Chief Rob Rezende with any questions:
rrrezende@sandiego.gov