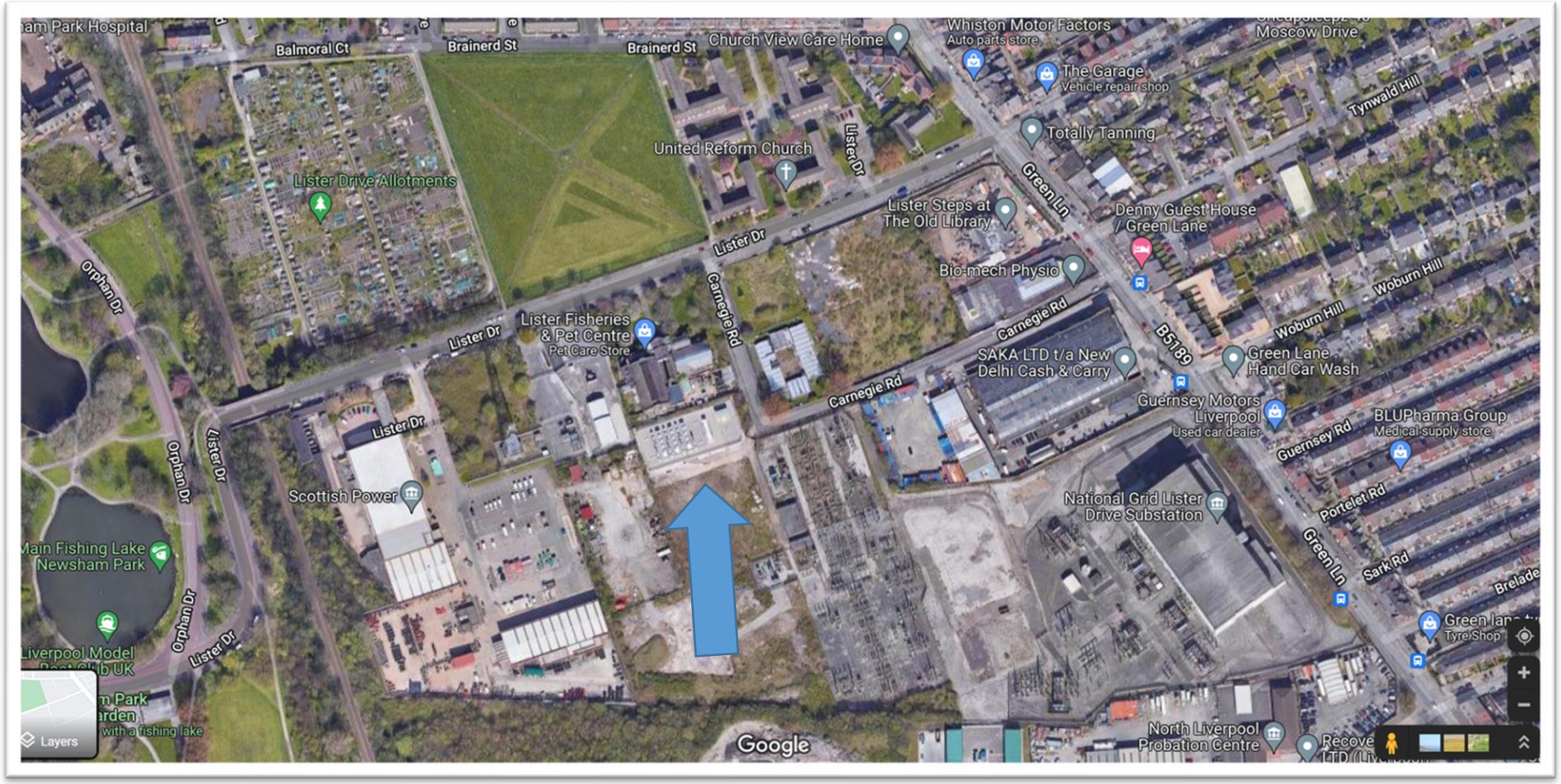
Merseyside Fire & Rescue Service
BESS Thermal Event, Carnegie Rd, Liverpool
15th September 2020

Station Manager John O'Boyle

Location of BESS site.
Old Swan, Liverpool, UK.



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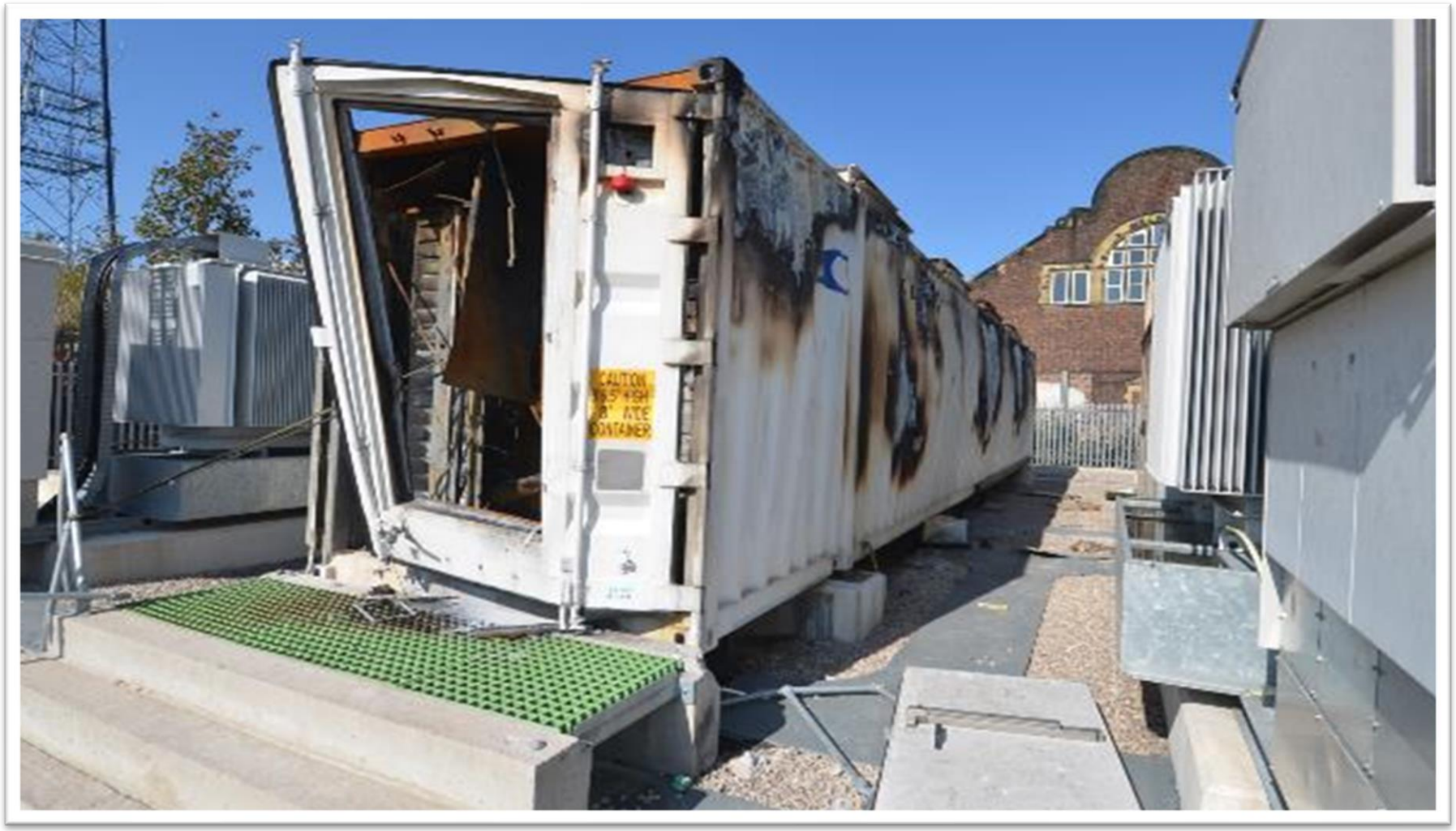
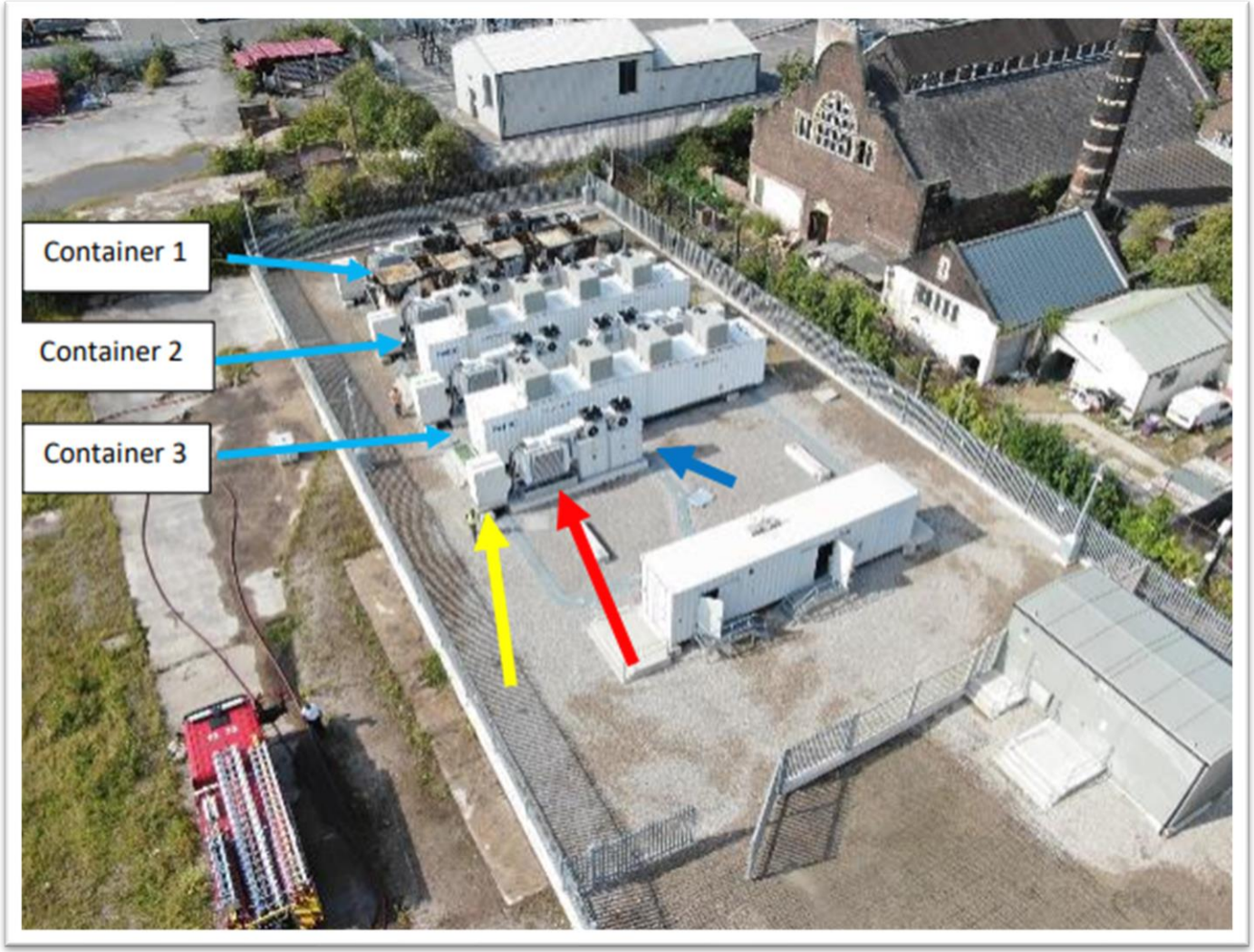


What is a BESS site?

- Battery Energy Storage Systems 20 MW site
- Stored energy Lithium ferrous phosphate(LFP) cells – in excess of 20,000 per unit
- Supports National Grid
- Continual Charge/Discharge
- 33kV per unit as average

- Next to each BESS is a high voltage switch Ring Main Unit (RMU) (yellow arrow on the photograph),
- Transformer 33kV – 415V (red arrow on the photograph)
- A cooler inverter (blue arrow on the photograph).
- On the top of the BESS containers are four HVAC systems.



MFRS incident: 15th September 2020

- Call received at 00:49hrs
- Reports of explosion
- Potential Vapour Cloud Explosion (VCE)
- Initial attendance 2 pumps
- Initial discovery of powerful, well developed fire.
- Evidence of blast – debris
- Make pumps 5 for water
- SM and HMA requested
- Image approximately 01:30hrs
- Wind speed 8kph,16 C, Clear sky

Firefighting Imagery:

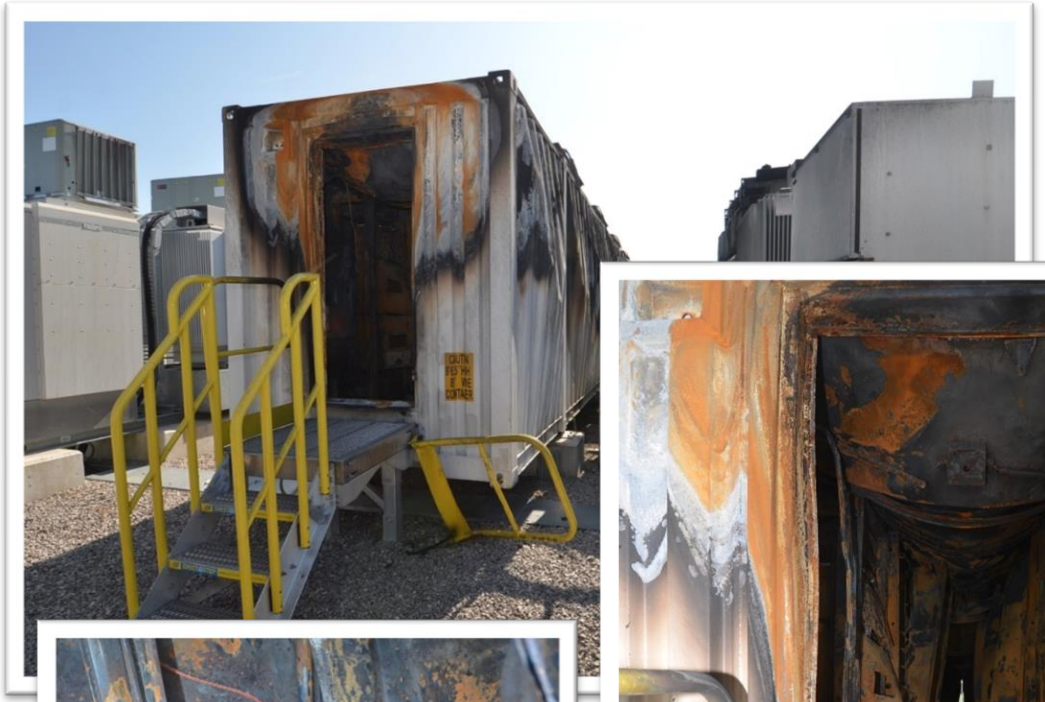
Incident progression:

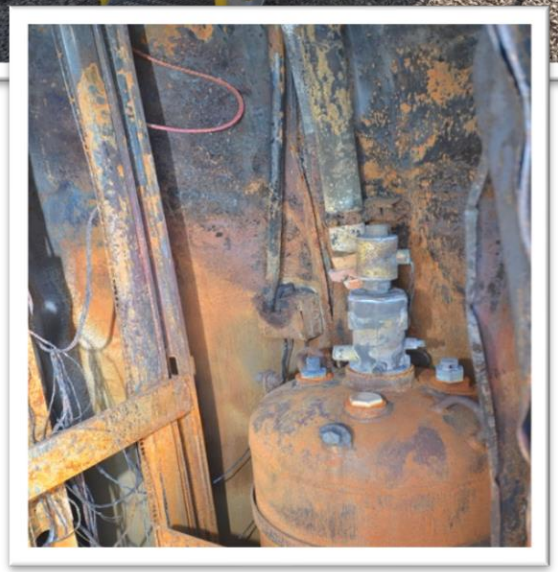
- Incident scaled back to 2 appliances within first 6 hours.
- Attendance maintained for 59 hours
- Copious amounts of water used for cooling
- Run off contained on site
- Smoke plume diluted at height, little wind impact

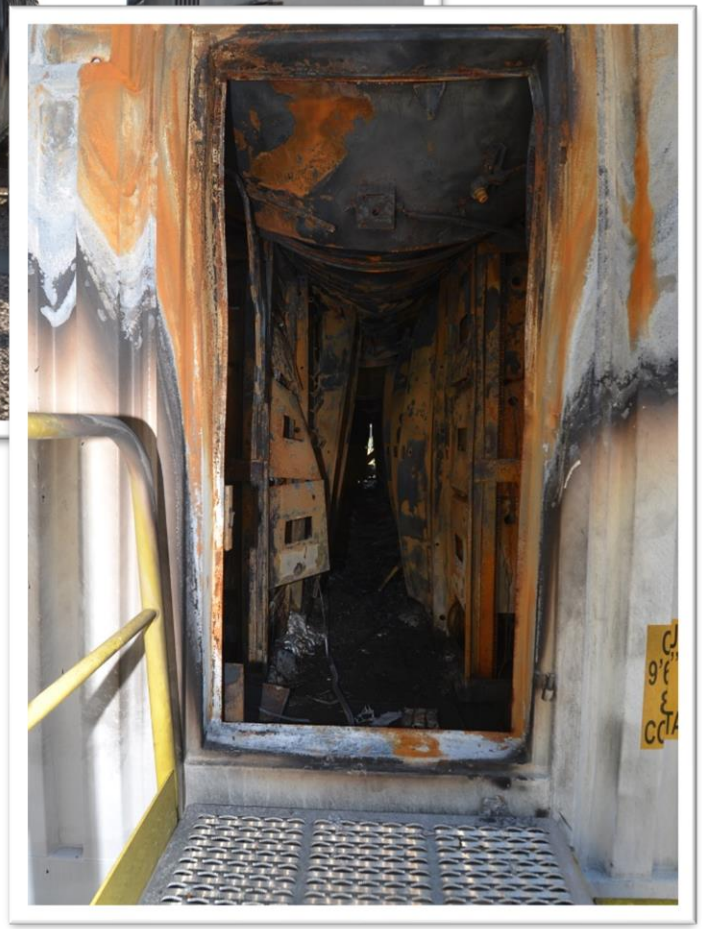
Hazards Identified:

- Thermal runaway
- Lithium Ion cell instability over 100 degrees
- Pressure build up within unit
- Hydrogen Fluoride in run off/plume
- Hydrochloric Acid in run off/plume
- Mass electrocution risk – within unit

Incident Investigation imagery:







The Image shows the damaged container with signs of expansion/distortion that is equal across the container and not localised to the area of the initial failure

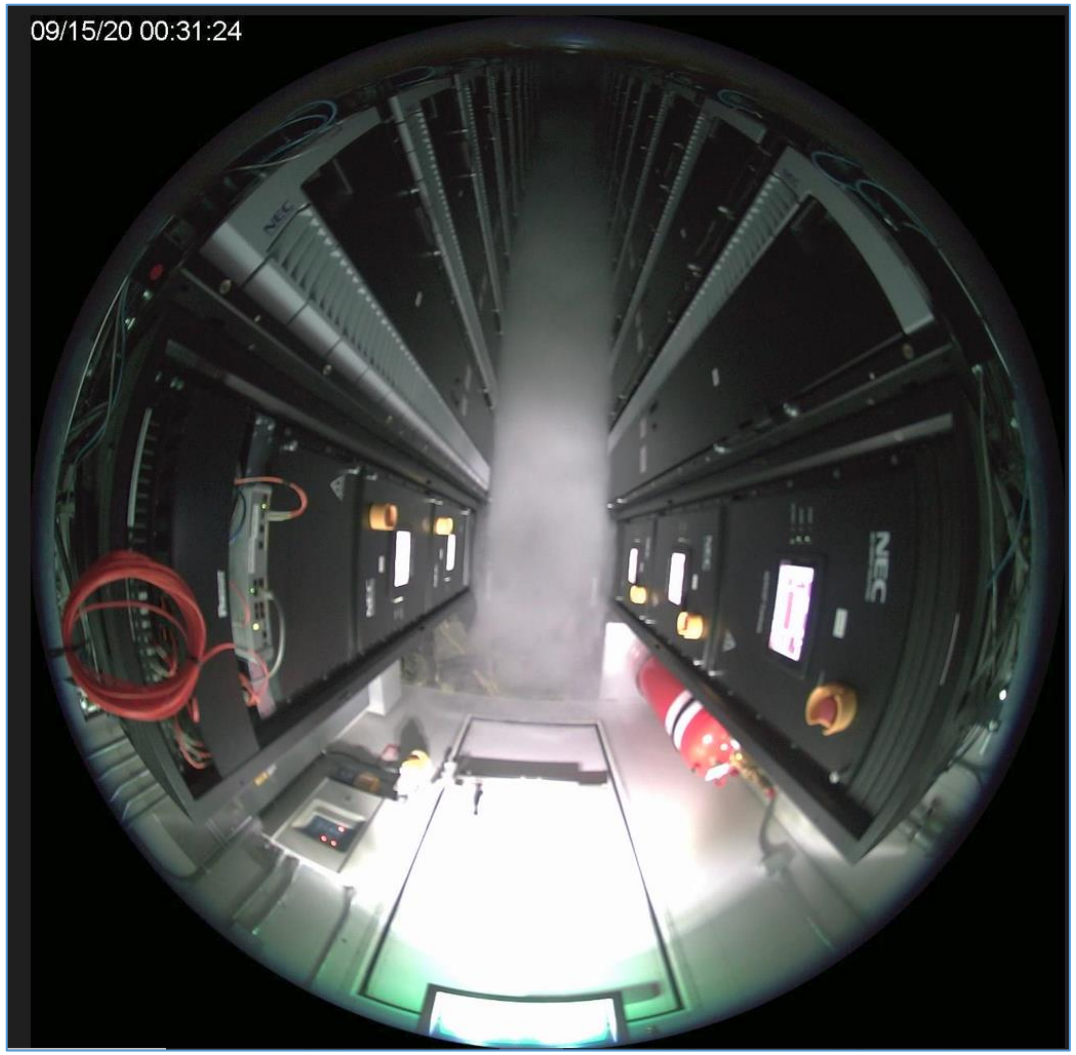
Lessons Learned:

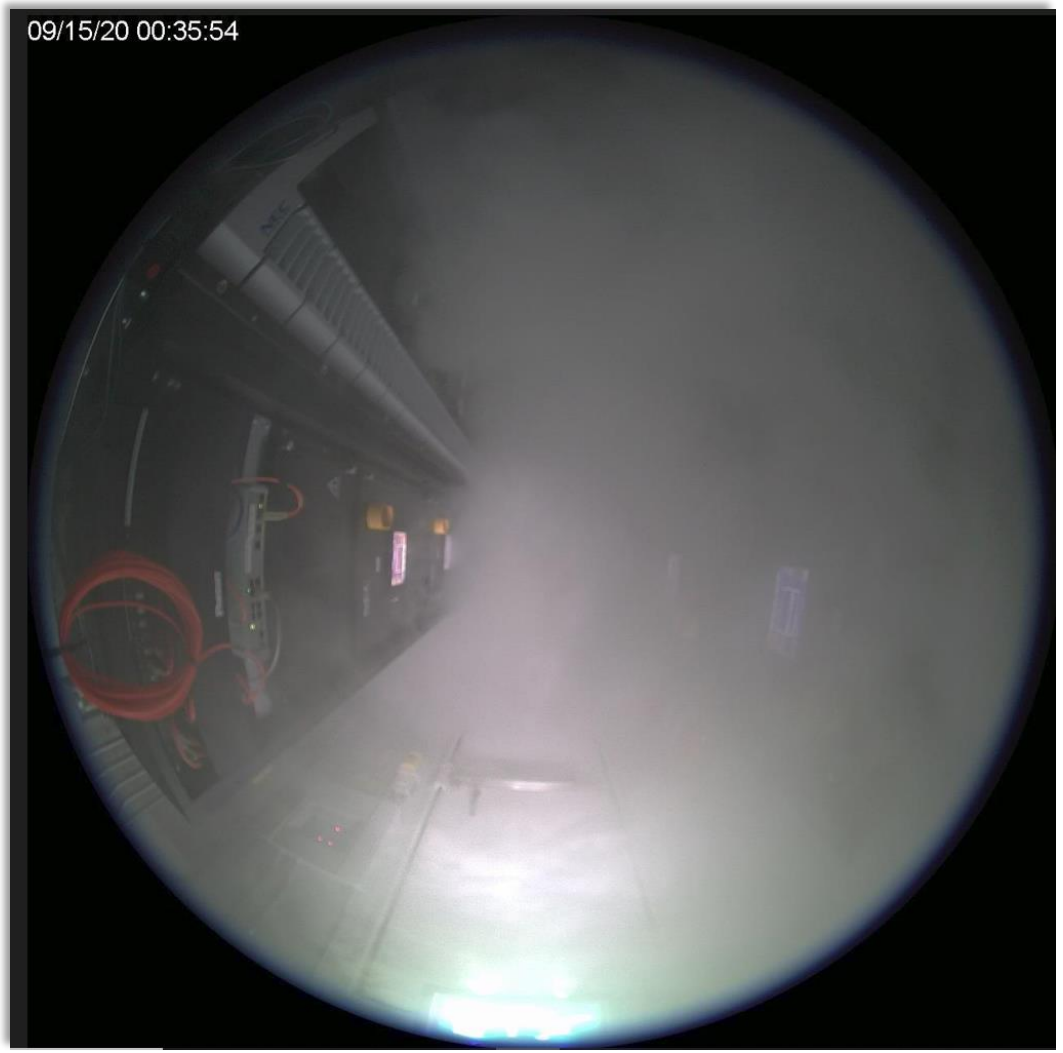
- Risk of projectiles/blast if unit has not failed prior to arrival. Debris found 22m from origin.
- Risk of rapid pressure build up/fire development within units.
- High voltage hazards – do not enter compounds or units.
- Unit will recycle heat energy and reignite – problematic to extinguish.
- Environmental risk – run off and plume, both contained/limited for MFRS incident, may not be the case elsewhere.
- Industry recommendation – cooling water application – consequence of producing Hydrogen Fluoride/Hydrochloric Acid.
- Potential to let it burn!
- Protect surrounding structures / buildings

Incident Investigation

- Incident investigation started on the morning of September 15th 2020
- Joint investigation was conducted in conjunction with industry experts, the managing company, and a representative for the supplier.
- Due to concerns of contaminants, the investigation began by gathering data and information on the system, testing and installation whilst sampling was conducted.
- An examination was then conducted of a neighbouring container
- Review of CCTV conducted

CCTV



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Examination of example cells from the same site

Suppression system

- Due to Covid, a joint inspection was conducted remotely of the suppression system which showed that the firing pin had activated.

Physical examination

- Once a physical examination of the container was cleared an inspection hatch was made next to the area of origin
- When this area had been cleared the container was cut into three sections
- This gave access to the rack and module of interest
- Due to the extent of fire damage the investigation team removed the module of interest which was sent for scanning.

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The explosion was a result of a failure within Battery Zone 3-Rack 7 Module 6 (BZ3-R7M6) which led to thermal runaway, which, in turn produced gases within the container culminating in a deflagration.

Observations & Recommendations

- SIB(GERDA) box which would contain:
- Plans of the building
- Description of the building and or site
- Information regarding the use of the site and significant risks
- Details of key personnel and emergency contact details
- Evacuation strategy within the local area
- Construction and layout including emergency access points and isolation systems
- Details of fire safety systems, alarms and suppression systems
- Any unusual features i.e. environmental protection plan

Carnegie Road Update August 2023

- PIB(GERDA) box which would contain:
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- Details of fire safety systems, alarms and suppression systems
- Any unusual features i.e. environmental protection plan
- Deflagration panels
- Mimic Panel available to MFRS on site
- Traffic light system regarding internal conditions
- External to secure compound Fire Service coupling to each container drenching system

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STB3


Container 1
Container 2
Container

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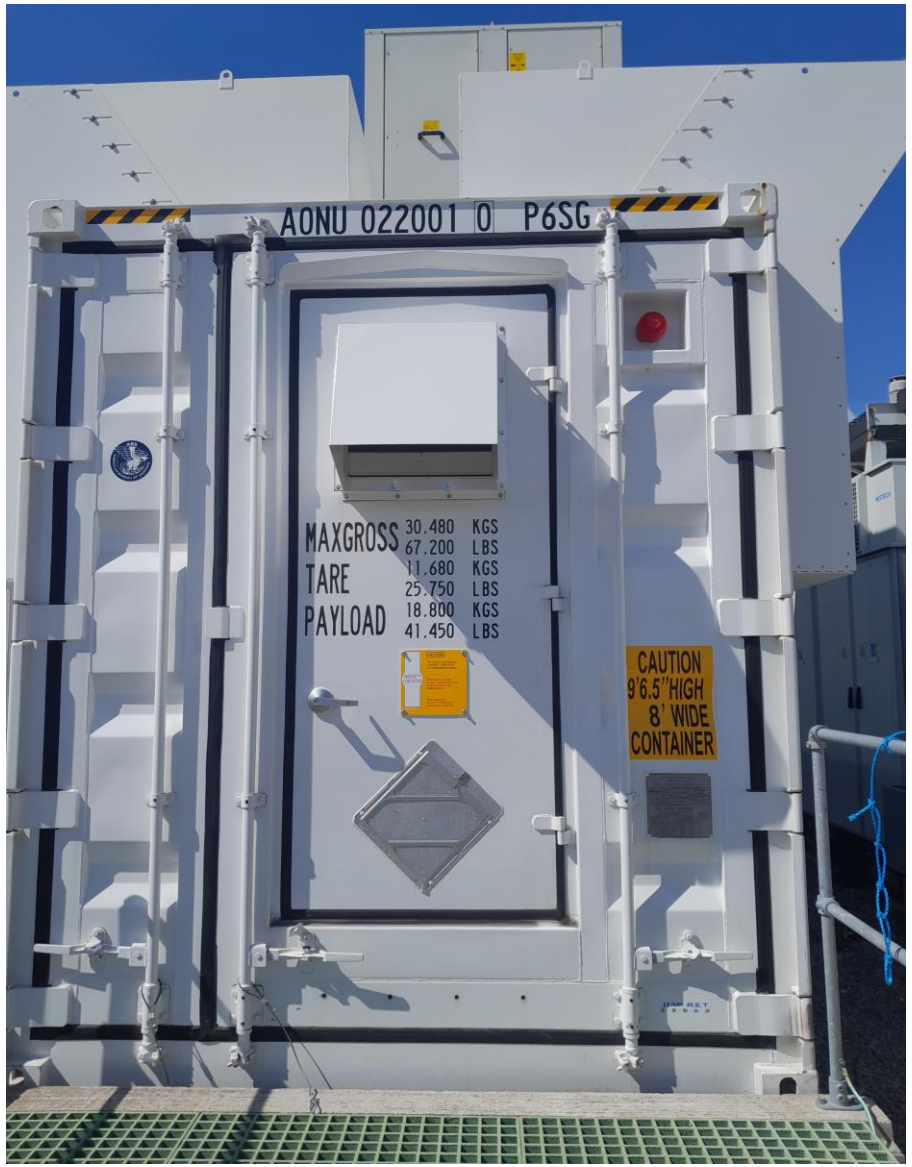
AONU 022001 0 P6SG
MAXGROSS 30.480 KGS
67.200 LBS
TARE 11.680 KGS
25.750 LBS
PAYLOAD 18.800 KGS
41.450 LBS
CAUTION
9'6.5"HIGH
8' WIDE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CONTAINER

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Thank you for listening.

Are there any questions?

E Mail: johno@merseyfire.gov.uk