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Landfill facility fires → and the importance of being prepared

WasteMINZ 2025

Agenda

Type of landfill fires

Causes

Preparation, Prevention, Mitigation

Detection and Monitoring

Response

York Valley Landfill

Conclusions

Landfill fires

There are two types of landfill fires:

1. Surface fires

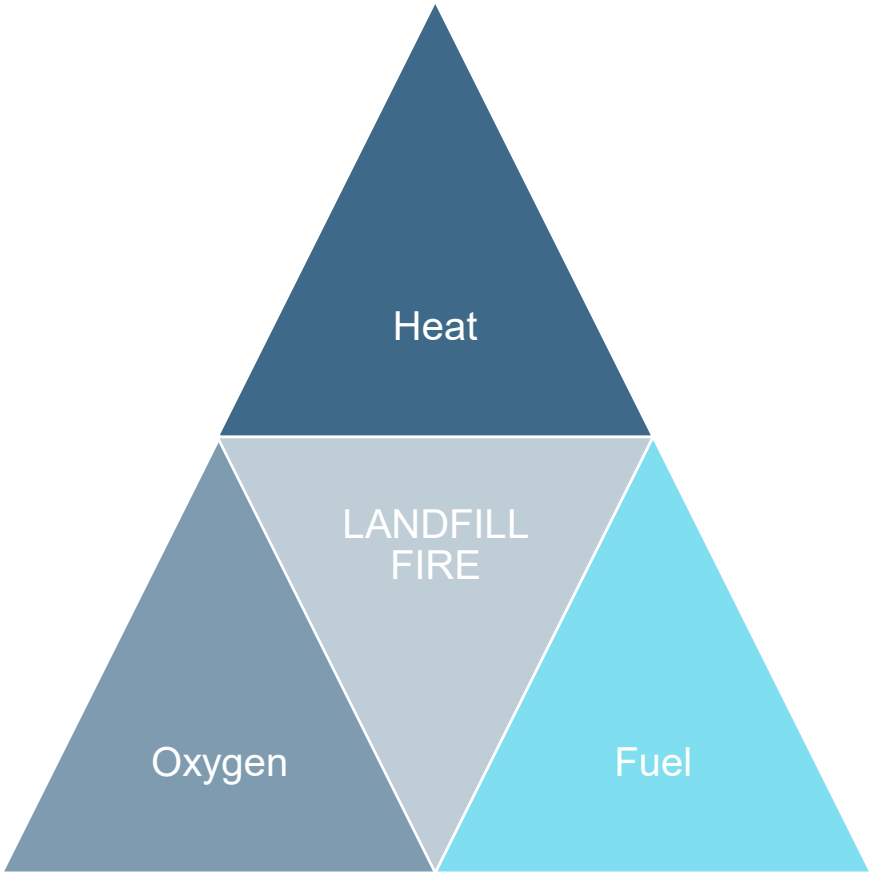
Surface fires at a landfill can occur in recently placed and/or uncovered waste

Surface fires are the most common fires at a landfill

2. Sub-surface fires

Sub-surface fires occur below the surface of the landfill

Sub-surface fires are more difficult to extinguish



Fire triangle

***Source**: International Solid Waste Association (ISWA), 2010, Landfill Operational Guidelines, 2nd Ed.*

Causes

Surface fires

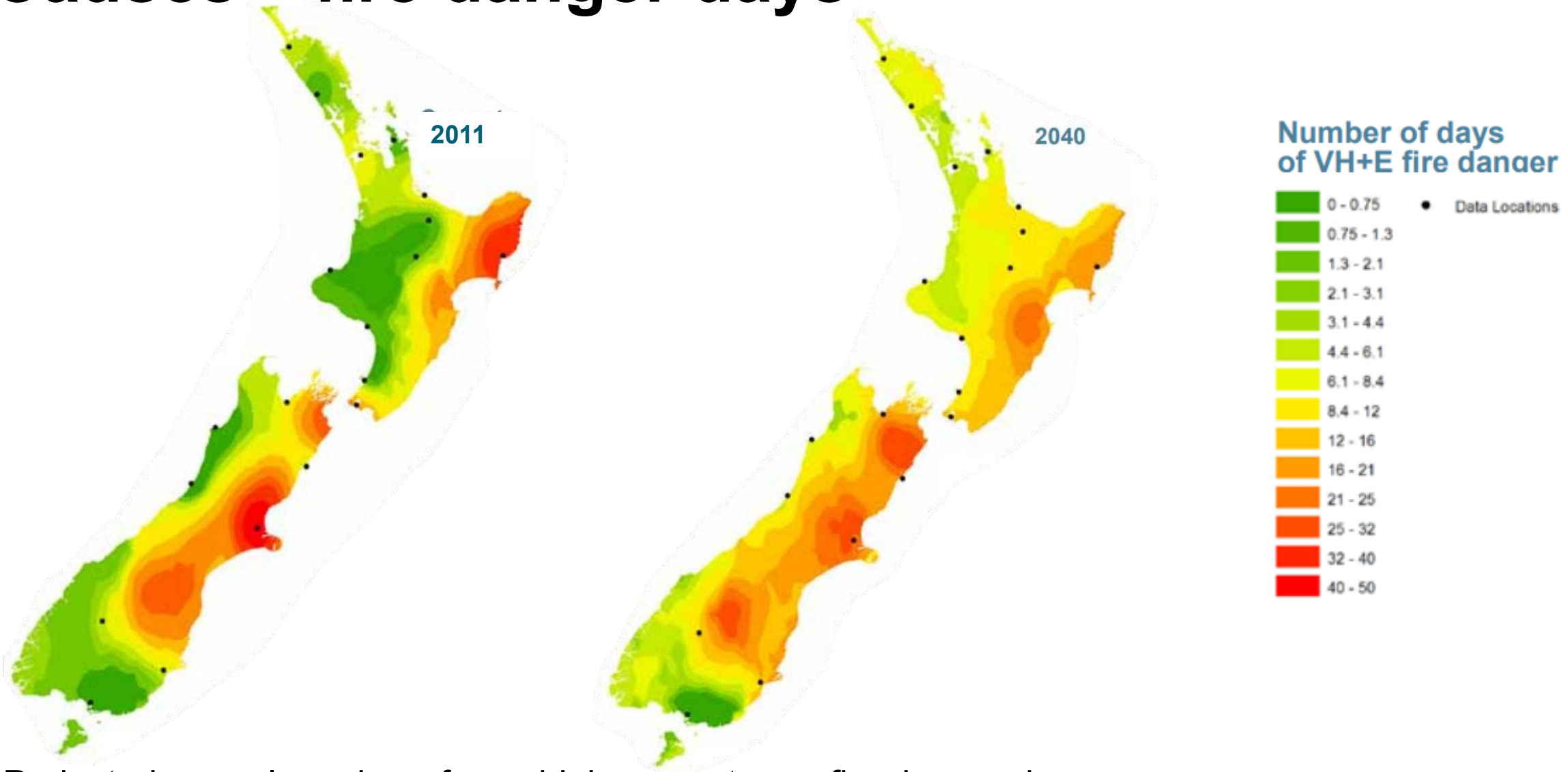
- Combustion of lithium ion batteries (more below)
- Dumping of hot materials
- Pilot ignition from engines and exhaust systems of vehicles
- Deliberate ignition from arson
- Mixing of reactive materials
- Extreme weather conditions (dry and hot weather)
- Embers from another fire
- A sub-surface fire extending to the surface
- Hot works
- Lightning
- A combination of the above.

Sub-surface fires

- Burying of surface fires
- Over extraction of landfill gas
- Air ingress other than due to landfill gas extraction system operations (typically on batters where it can be difficult to effectively cover and compact waste)
- Spontaneous combustion of materials
- Combustion of lithium ion batteries
- A combination of the above.

***Source**: Crosby RK, 20 December 2024, Toxic smoke warning continues as EPA steps in to help with Gunnedah landfill fire, New England Times*

Causes – fire danger days



Projected annual number of very high and extreme fire danger days

Source: Pearce, Kerr, Scion, Clark, Mullan, Ackerley, Carey-Smith, Yang, 2011, Improved estimates of the effect of climate change on NZ fire danger, Ministry of Agriculture and Forestry

Cause - Batteries

Number of lithium ion battery fires reported by FENZ

2020
51 fires

2024
104 fires

There has been an increase in the number of battery fires reported likely due to the increased number of lithium ion batteries on the market.

FRNSW reported a rise in frequency of fires caused by lithium ion batteries from about 1 in every 76 fires in 2023 to at least 1 in every 40 fires in 2024.

Removal of batteries

The NZ Government has declared six priority products for product stewardship under the Waste Minimisation Act 2008 including electrical and electronic products (e-waste including large batteries).

Further work is needed before obtaining Cabinet endorsement for seeking to put into law in New Zealand.

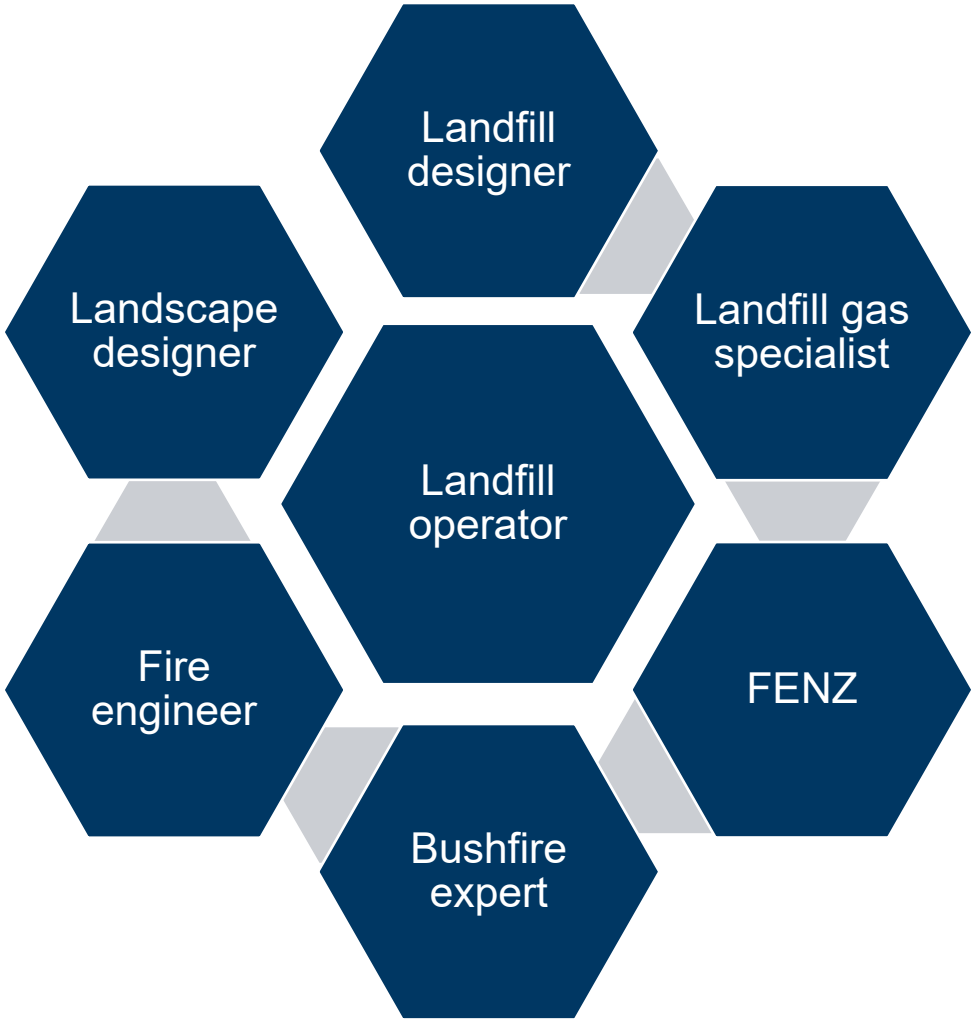
Battery bins

Number of lithium ion battery ignition events per month at York Valley Landfill

2023	2025
12 events	2 events

The NTRLBU introduced a Don't Bin battery bin campaign to facilitate free public drop off of waste batteries and use of custom made battery bins.

Multidisciplinary approach



Landfills – assessment and fire management

Step 1: Understand location, surrounding land use/site setting (proximity to vegetation and types and density of vegetation), design, operational practices, climate fire predictions, fire history records

Step 2: Review regulatory requirements and key guidance documents including international documents

Step 3: Assessment of fire risks

Step 4: Assessment of fire prevention, detection, reporting, and notification

Step 5: Refine fire risk mitigation and readiness measures

Step 6: Review and recommend as needed updates to fire response procedures

Step 7: Incident reporting and cause investigation protocol

Step 8: Revi8ew and evaluation of the protocol (feedback)

Step 9: External notification protocols

Source: UTS Institute for Sustainable Futures (2016) Waste fires in Australia: Cause for Concern?

Landfills – fire risk assessment

Some examples of risks to consider:

– Assess the risks of fires escaping from the landfill in windy conditions:

- Where, and how close are landfill working areas to adjacent areas of flammable vegetation?
- What access is provided for fire suppression appliances to contain a fire to the landfill area and prevent it spreading to adjacent vegetation?
- Are there areas of uphill slope and higher risk vegetation that require strengthened risk controls?
- What water supply and suppression equipment can be quickly activated and/or mobilised to higher escape risk areas?
- What vegetation management* can be applied to reduce escape risks?

*https://www.fireandemergency.nz/mi_NZ/outdoor-and-rural-fire-safety/protect-your-home-from-outdoor-fires/flammability-of-plant-species/#low

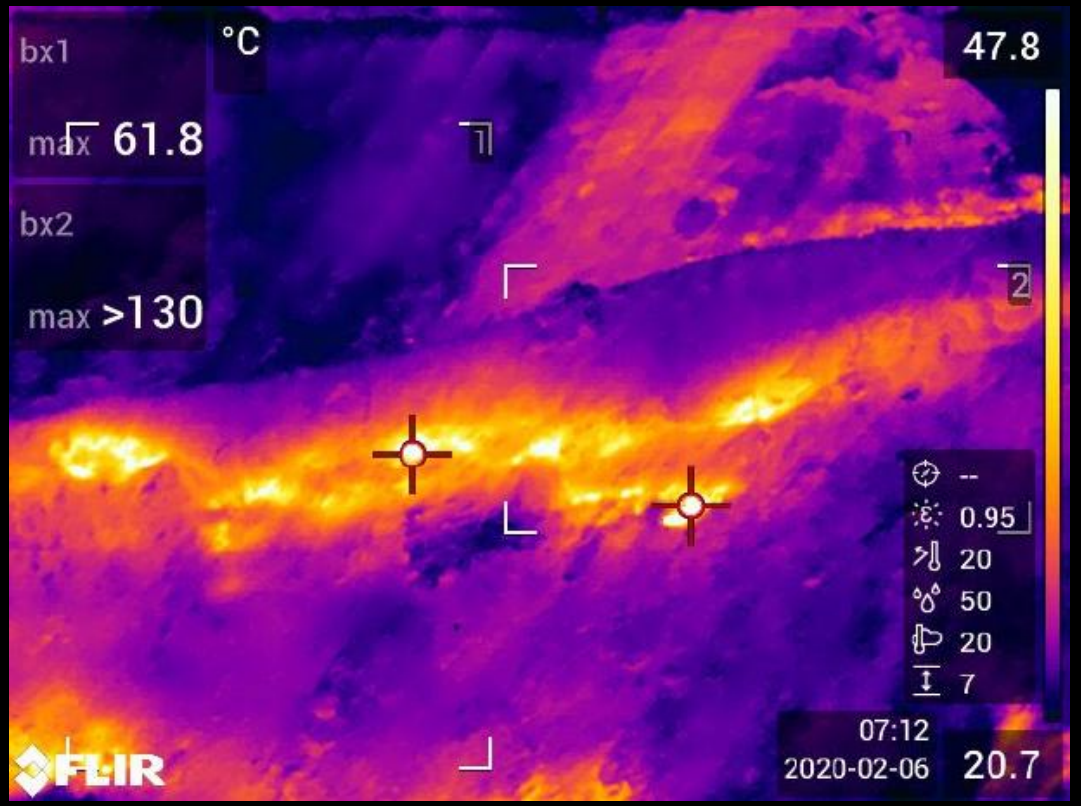
Prevention

- Non-combustible cover material and supply (with a site material balance / assessment to provide confidence in availability)
- Progressive final capping
- Waste screening and remove obvious flammable waste
- Reduced area of tip head (active tipping face)
- Appropriate management of landfill gas extraction and leachate management systems
- Additional controls during high and extreme fire danger days
- Perimeter and filling area set back, fuel breaks and low combustible vegetation

Source: UTS Institute for Sustainable Futures (2016) Waste fires in Australia: Cause for Concern?

Detection

- The natural biological decomposition of waste generally results in the temperature of landfilled waste below the surface in the range of between 40 – 60 degrees Celsius.
- Site surveillance
  - Visual inspections (smoking, steaming, slumping, clustering of birds on warm areas)
  - Thermal imaging camera
- Landfill gas monitoring:
  - Oxygen concentration greater than 5% and/or carbon monoxide greater than 100 ppm at the flare or within the gas collection system indicate further investigation is required. Carbon monoxide concentration exceeding 1000 ppm would typically indicate the presence of a subsurface fire
  - Other gas data such as methane to carbon dioxide ratio, % of balance / nitrogen gas can and gas temperatures can also be informative



Source: Confidential NSW Waste Facility.

Mitigation

- Fire water supply
- Non-combustible cover material supply near tip head (active tipping area)
- Staff training and fire drills
- Onsite fire fighting equipment
- General fire extinguishment methodologies

Source: ABC News, 27 August 2022, Why will it take three years to put out an underground fire in Melbourne's west? It's complicated

Response

Onsite:

- Clear roles and responsibilities
- Observations and extinguishment where safe to do so
- Knowing when to call FENZ for assistance
- Evacuation procedures
- Notification protocols
- Post extinguishment monitoring (to confirm the fire is extinguished)

Off-site:

Emergency access

Out of hours notification protocols

York Valley Landfill

Site surveillance using thermal imagery

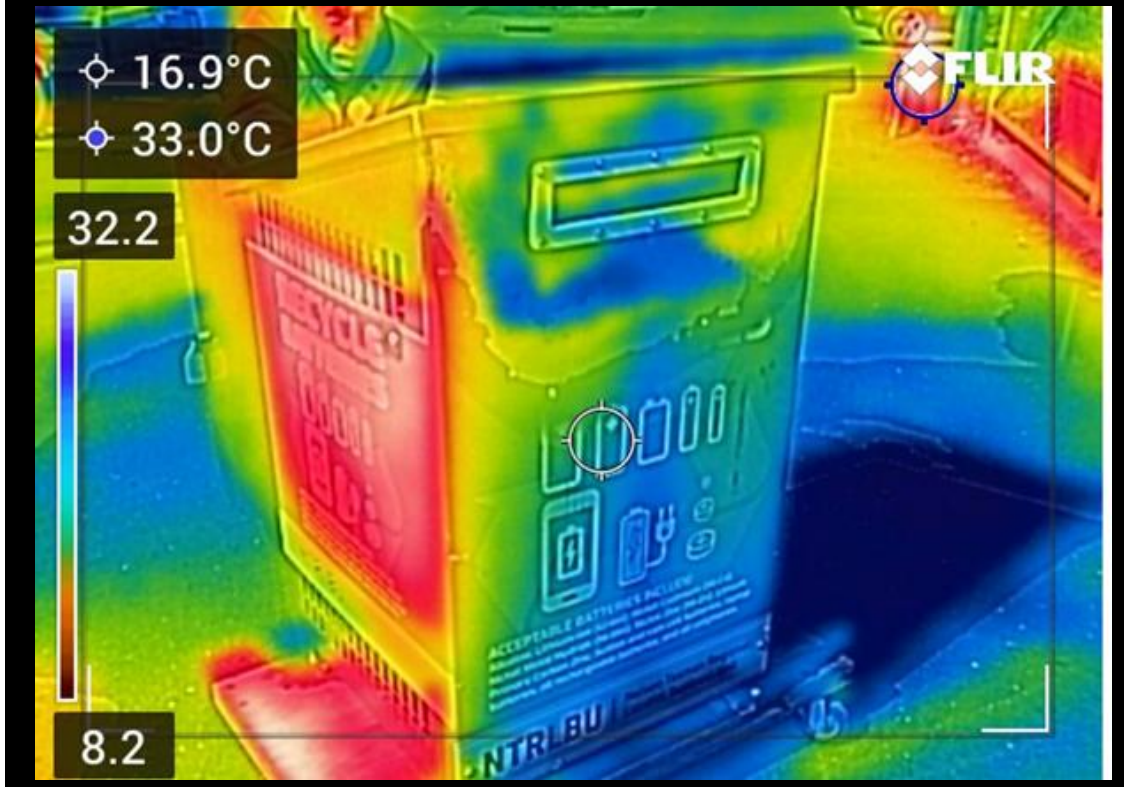
– Actual photo of York Valley Thermal camera working - compactor in the centre of the picture

Current list of Fire management items in our risk register, not including the fixed fire water tanks and fire pipework, response training and dry runs etc.

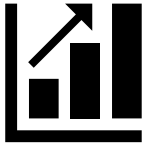
– Eliminate the need to undertake hot work through the use of alternative engineering solutions
– Provide intrinsically safe equipment - heat gun monitoring overnight
– Gas detection and monitoring
– Ventilation systems
– Manage sources of ignition (i.e. heat, smoking)
– Implement fire control and warning systems
– All electrical conduits exiting the ground must be sealed

York Valley Landfill

- No electrical work should be undertaken without testing for methane
- Remove sources of ignition such as batteries and gas bottles where possible
- Appropriate storage for hazardous substances and dangerous goods
- Relevant training
- Emergency plans, evacuation procedures in place and vehicles to be reverse parked
- Routine checks on fire equipment
- Smoking in designated areas only
- Machines kept clear of debris
- Inspect wate for flammable waste
- Watercart on site full and parked at tip head
- Additional PPE in TC hut



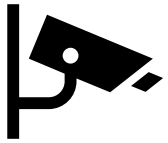
Conclusions



Landfill fires can be a costly and challenging matter to manage and are increasing in number with time

Being properly prepared is invaluable in relation to minimising the impacts associated with such events at your landfill

Collaboration with the right people is key to developing and implementing effective landfill fire management plans



Have the tip head (active tipping area) under constant surveillance during operations, with the ability to rapidly take action to extinguish ignition events and outside of operations cover waste with non-combustible cover (or have a system to otherwise manage the risk of having flammable materials exposed).

The prevalence of battery ignited fire events in New Zealand is increasing, battery disposal education campaigns and suitable waste battery containment bins reduce battery fire risks

Thank You

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