

EV battery pack burn using Gasoline

Dean D. MacNeil

Senior Research Officer

Energy, Mining and Environment – Ottawa

613-990-1769

Co-authors : NRC : Steven Recoskie, Oltion Kodra, Giulio Torlone, Ryan Kroeker; Transport Canada : Ghislain Lalime

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Introduction

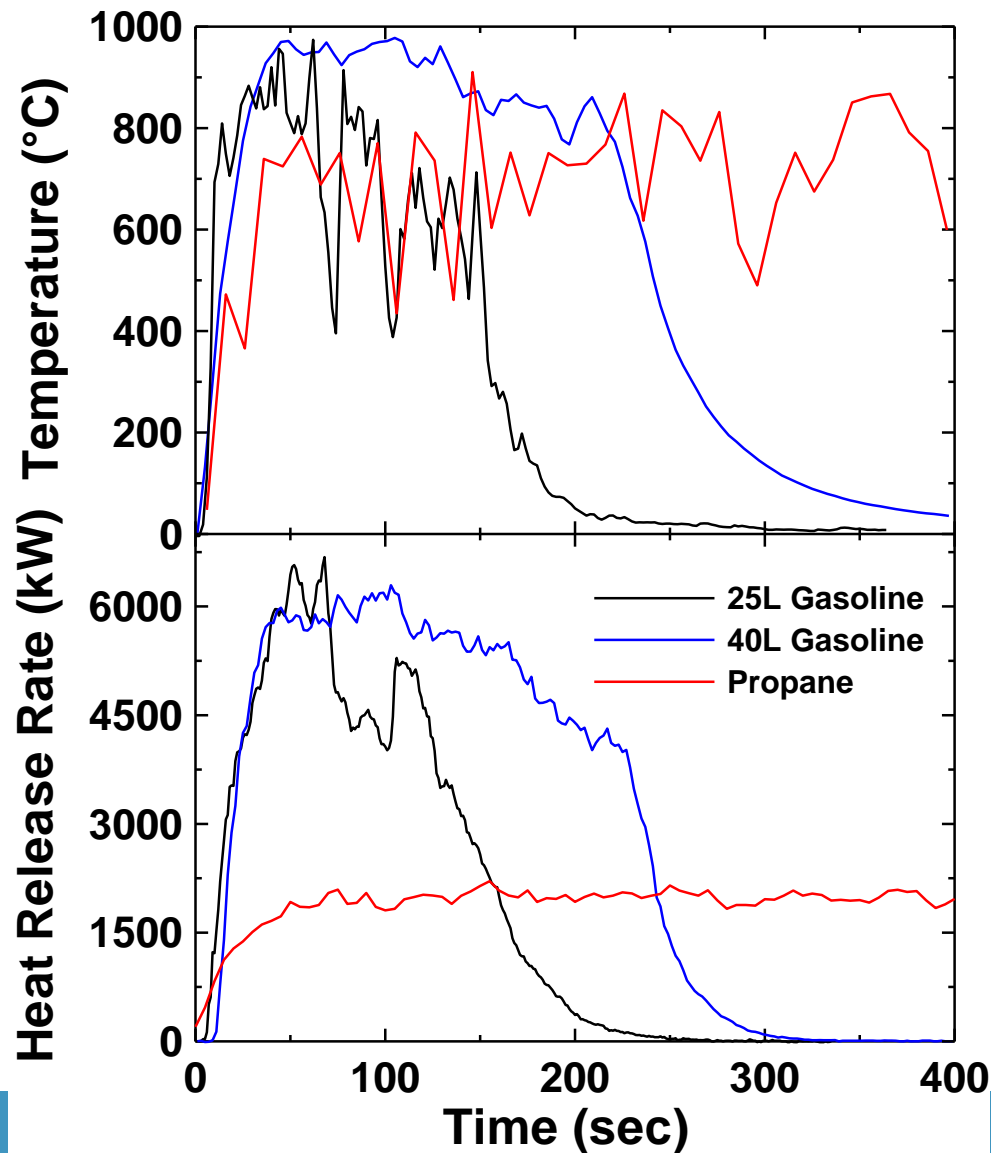
- Previous work by Canada concentrated on exposure of cells, packs and EVs to an external fire source, using a controlled (consistent 2 MW burner) propane fuel source
- There was discussion within previous TF meetings as to whether gasoline should be used as the fuel
- To provide the GTR with data as to whether there is a difference when gasoline is used as a fuel instead of propane, lithium-ion packs from our thermal propagation study, that were not fully consumed, were burned with 40L of gasoline prior to disposal.

Objectives and Goals

- Compare the results of burning an EV battery pack with Gasoline versus propane
- 40L of regular Canadian winter grade unleaded gasoline was used
- Gasoline was placed in the pan above a small pool of water to ensure adequate dispersion of the gasoline



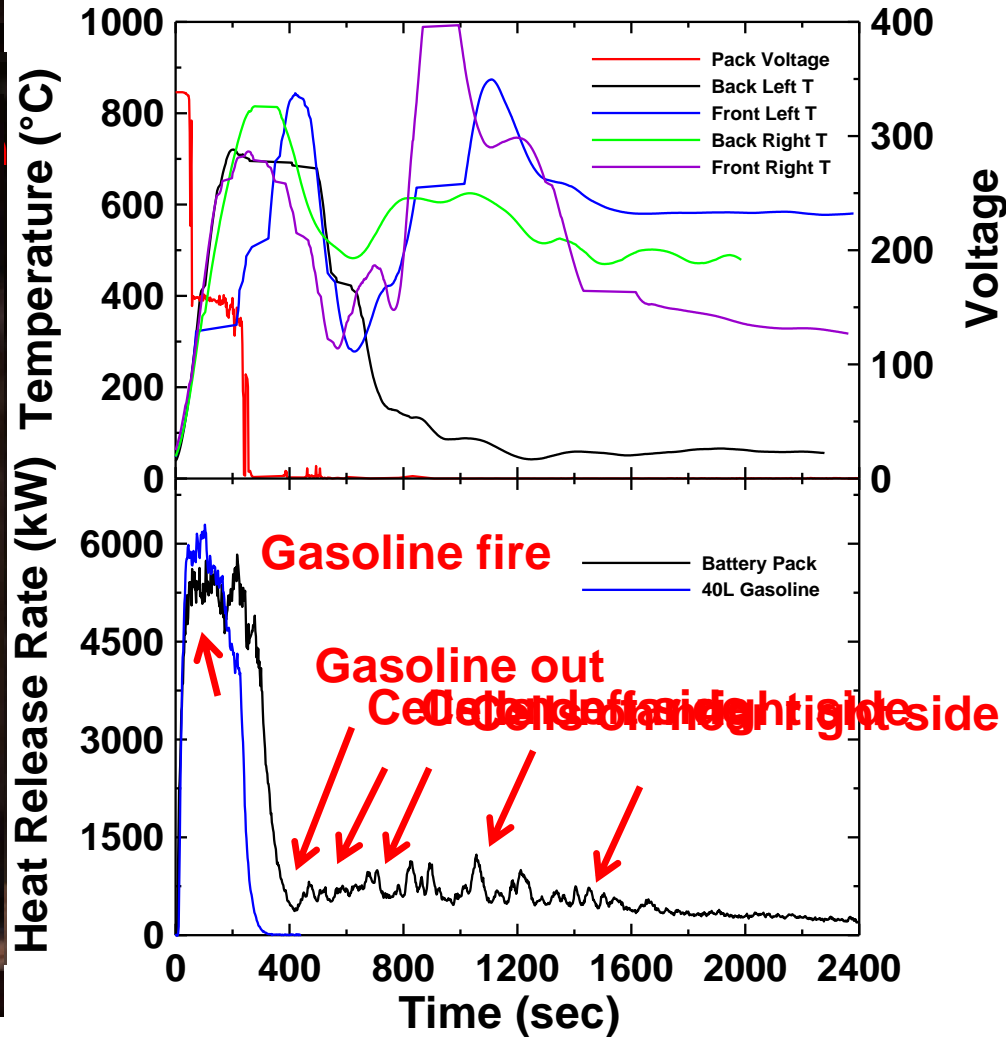
Baseline Test



Test 1

- A thermal propagation test was conducted on a commercial EV battery pack
- No thermal runaway event was detected from either heater installed within pack
- The highest recorded cell surface temperature was 532°C
- Before disposal of the pack, 40L of gasoline was added to the pan underneath the pack on a ~3 cm layer of water
- The highest recorded temperature within the pack before initiation was 65°C with an average of 13°C

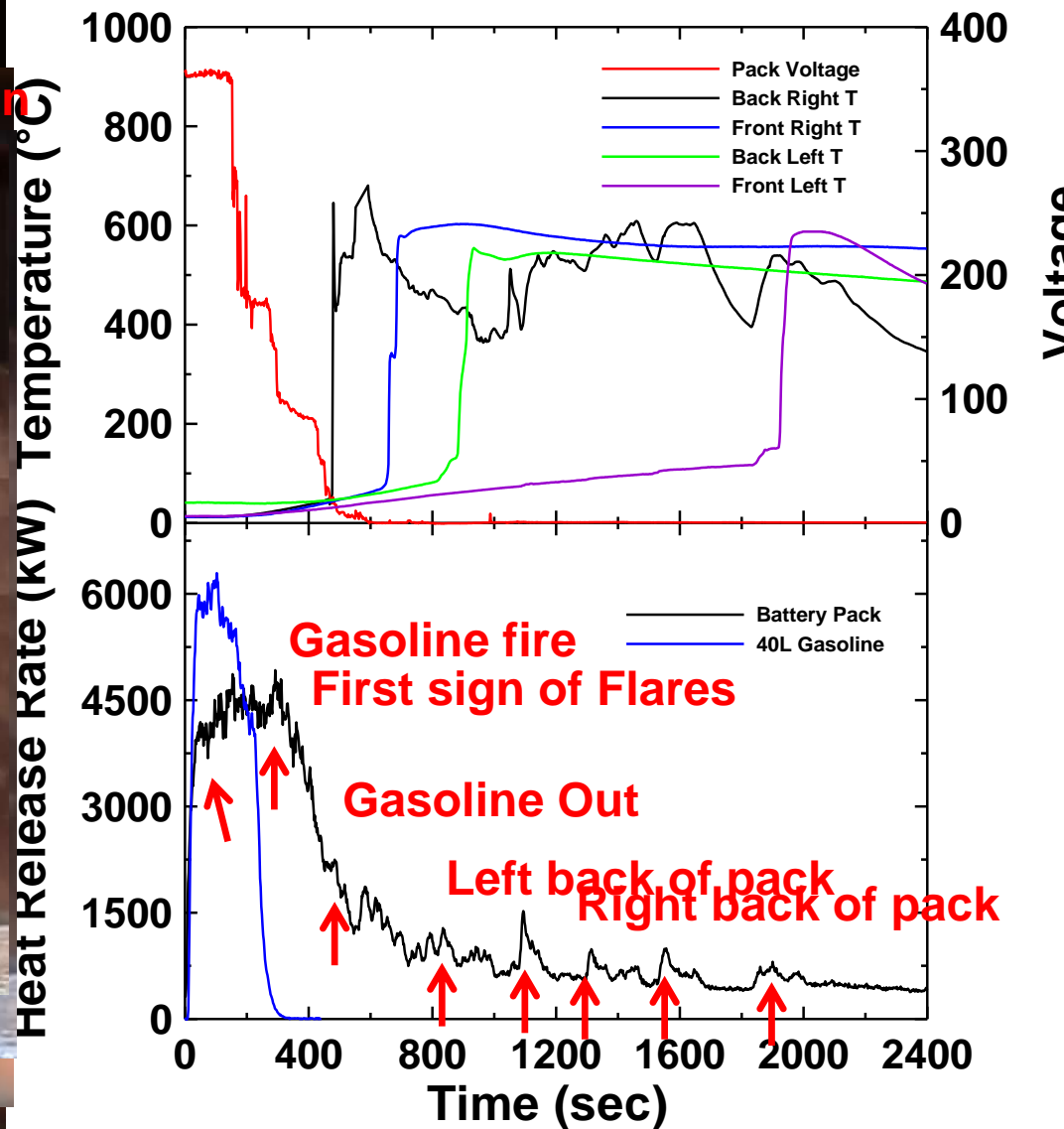
Test 1



Test 2

- A thermal propagation test was conducted on a commercial EV battery pack
- A thermal runaway event was detected at both heaters installed within the pack, but propagation did not occur passed the 4 cells in each of the sub-module where the heater was located.
- The remaining cells in the pack were not affected.
- Before disposal of the pack, 40L of gasoline was added to the pan underneath the pack on a ~3 cm layer of water
- The highest recorded temperature within the pack before initiation was 69°C with an average of 32°C

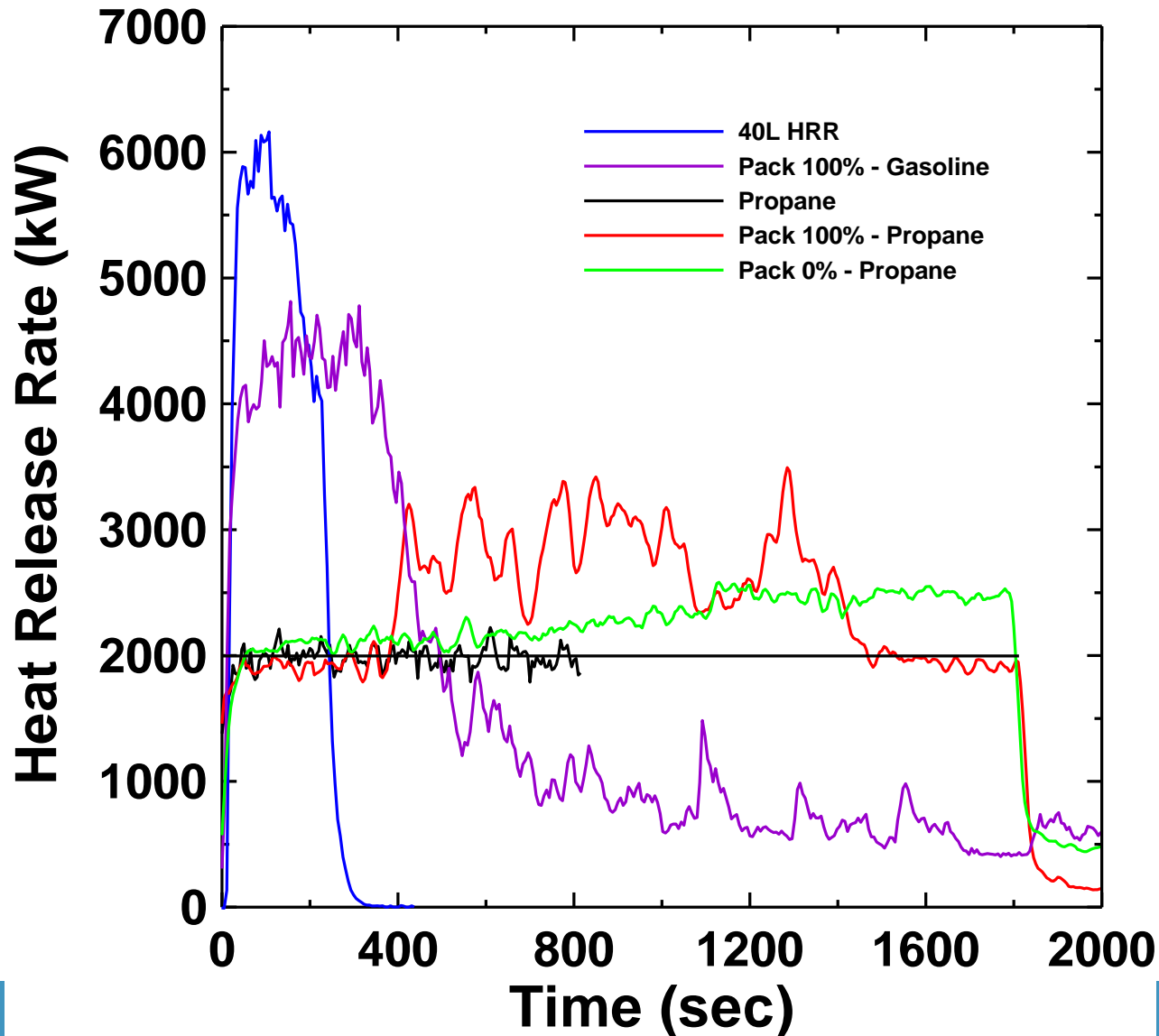
Test 2



Comparisons

Battery Pack	Initial Weight (kg)	Mass Loss (kg)	Peak Heat Release Rate (kW) (non-fuel)	Total Heat Release (MJ)	Effective Heat Combustion (kJ/g)
EV – A #1 (100% charged) Propane	299	58	1656	1045	18.0
EV – A #2 (0% Charged) Propane	310	50	582	916	18.3
EV – A #3 (100% charged – 8 cells) 40L Gasoline	277	48	4900	1227	25.6
EV – C #1 (100% charged) 40L Gasoline	242	56	5700	1217	21.7

Comparison Propane versus Gasoline Fuel



Conclusions and Take away message

- Canada has shown pack level fire testing using both LPG and Gasoline as fire source
- Irrespective of fuel source, the time for temperature to rise inside the pack varies depending on pack construction
- 2 min is not a sufficient exposure time for a battery pack level test, let alone a vehicle level test
- Gasoline presents high heat flux at the initial stages of testing but battery packs still have elevated reactivity at test times greater than 30 min for some battery packs

Acknowledgements

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Thank you for your kind attention!

Any Questions or Comments