Update of MMEWG
Regarding Letter sent Dec. 16, 2024 to Fire Marshal

Safety of the Public and First Responders in the Event of a Lithium Ion BESS Fire

Presented by William Palmer P. Eng.

January 9, 2025

Overview of Cover Letter (P1)

- IESO has already approved 1880 MW / 7500 MWh of BESS as LT1-RFP
- LT2-RFP proposes acquisition of contract capacity to generate 14 TWh with 1600 MW of capacity.
  - *14 TWh possible from 5327 MW of wind (at 30% capacity factor) or 1775 MW of nuclear (at 90% capacity factor).*
  - *1600 MW of capacity cannot be assured by wind or solar, so would require BESS if wind or solar selected to supply energy in short term*
- Elected members of councils who are part of MMEWG have expressed concern with safety to public and first responders in event of BESS fires

Overview of Cover Letter (P2)

- IESO provided link to document “Solar Electricity and Battery Storage Systems Safety Handbook for Firefighters” (the Handbook) prepared by the Canadian Renewable Energy Association (CanREA) in collaboration with the Ontario Association of Fire Chiefs (OAFC).
- Review of Handbook identifies many concerns:
  - Handbook provides inadequate consideration of public safety related to fires in BESS facilities , and downplays risk faced by first responders
  - Does having the industry association advocating more BESS prepare the handbook remind of “leaving the fox guarding the henhouse?”
- Fire Marshal is charged by the Fire Protection and Prevention Act *“to co-operate with any body or person interested in developing and promoting the principles and practices of fire protection services, or to take action to remedy or reduce the threat to public safety.”*

Overview of Cover Letter (P3)

- Notes urgency due to pending installation of BESS systems such as 400 MW / 1600 MWh Neoen Ontario Tara BESS (formerly known as the Shift Solar Grey Owl BESS)
  - approval did not even require notification of residents of the municipality of Chatsworth, even though the nearest residence is within 100 metres
  - Approval did not consider capability of 25 Tara volunteer fire fighters to cope with a fire in this 1600 MWh BESS facility, nearly 4 times larger than the 450 MWh Neoen “Victorian Big Battery Facility” in Australia, which required 150 firefighters when that BESS caught fire
  - The handbook identifies, “Water is considered the preferred agent for suppressing lithium-ion battery fires.” Firefighters would need to deliver water by tanker to the site, and the run-off would discharge to the Sauble river, covered by Ontario Source Water Protection, which flows through the site of the BESS.

Overview of Cover Letter (P4)

- Notes concerns identified in Australian Government EV FireSafe Study
  - Toxic vapour cloud of flammable gases pose respiratory and explosion risk (to first responders and the neighbouring public)
  - Thermal runaway makes it difficult to extinguish the fire
  - Even once suppressed, there is a risk of fire re-ignition, hours or days later
  - Lithium ion battery fires are not yet well understood by emergency agencies
- The Tara BESS is equivalent to 16,000 to 26,000 stacked EV batteries
- Cover Letter included 3 attachments
  1. Concerns identified in review of the “Solar Electricity and Battery Storage Systems Safety Handbook for Firefighters.”
  2. Findings identified in the EV FireSafe study conducted for the Australian Government, Department of Defence.
  3. Additional Resources and References for Consideration in Revision of the “Solar Electricity and Battery Storage Systems Safety Handbook for Firefighters.”

Distribution of Letter (Dec. 16, 2024)

- Office of the Fire Marshal (Directed to send to Nancy Macdonald-Duncan Deputy Fire Marshal, Fire Investigations, Midhurst, ON)
- Copies sent to:
  - Rick Byers – MPP Grey Bruce Owen Sound (received auto response it was received)
  - Steve Tiernan – Fire Chief – Arran Elderslie
  - Steve Hammell – Mayor Municipality of Arran Elderslie (plus CAO)
  - Scott Mackey – Mayor Township of Chatsworth (plus CAO)
  - Tom Allwood – Chair Multi-Municipal Energy Working Group (plus Secretary)
  - IESO
  - Ontario Association of Fire Chiefs
- As of Jan. 5, 2025 no acknowledgement from any recipient other than auto response from Rick Byers' office, acknowledging receipt

Attachment 1 – Concerns with “the Handbook” (P1)

- press release states that the handbook, *“addresses the pressing need for up-to-date safety guidelines,”* and continues, *“the handbook prepares firefighters for potential hazards that might arise during emergency situations involving solar PV and battery storage systems,”*
  - BUT - the descriptions, examples, and photographs deal primarily with smaller residential scale systems.
  - The specific electrical hazards of Battery Energy Storage Systems (BESS) connected to high voltage transmission lines, and battery arrays that may cover acres, are very poorly described.
  - A firefighter whose training was based on the handbook would be very inadequately prepared to deal with BESS installations
  - there is no information on the necessity to contact the system operator to ensure BESS shutdown, and for information about hazards (such as toxic gases) before approaching the system.
  - does not address the particular risks of larger scale (farm sized) solar arrays that may incorporate acres of installed PV panels

Attachment 1 – Concerns with “the Handbook” (P2)

- Description of larger BESS inadequate
- Does not identify that Li-Ion batteries are what is found in large BESS
- Does not identify the significant difference between the battery types that impacts the risk of each is the stored energy density of each type
- description does not identify that thermal runaway (and fire) can be caused by charging Li-Ion when too cold, or if the cell gets too hot, or that the risk is enhanced if the cells are maintained at a high state of charge, as they will by design in a BESS.
- Nowhere in the handbook is the requirement to take action to protect citizens, from either the toxic vapour cloud, or the liquid effluent from fire suppression discussed.

Attachment 1 – Concerns with “the Handbook”(P3)

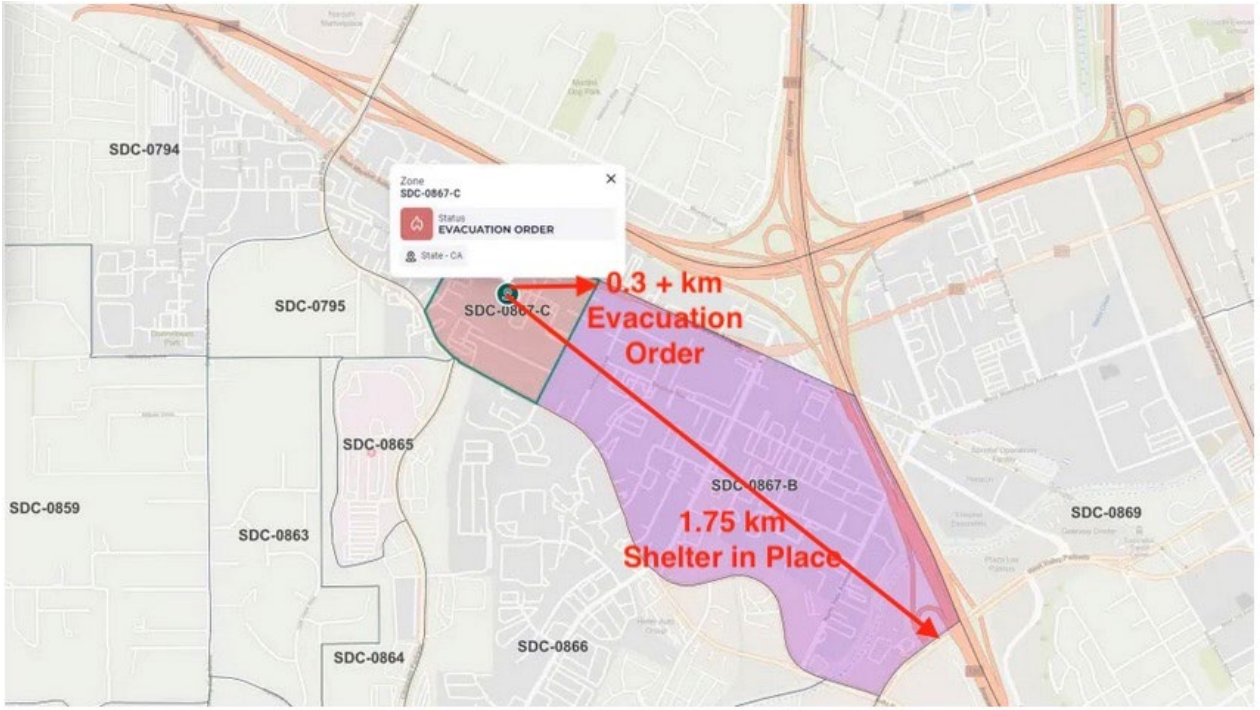
- Attachment shows examples of recent Li-Ion Battery fires
  - Montreal port – Sept 2024.
    - Firefighters evacuate ~ 100 people and warn others in Hochelaga-Maisonneuve to stay in and turn off ventilation (at distance from 1.0 to 1.75 km downwind)
  - Fire at 30 MW, 150 MWh unit at Escondido California, September 2024
    - prompted evacuations (within 0.3 km) of more than 500 businesses and 1,500 SDG&E customer homes and Shelter in place orders out to 1.75 km downwind
- Handbook does not consider toxic liquid effluent from fire fighting
  - Effluent from fire at TARA BESS would run into Sauble River flowing through the site, upstream of the TARA Drinking Water Source Water Protection area

Attachment 1 – Concerns with “the Handbook”(P4)

A fire at a shipping container at the Port of Montreal on Sept. 23, 2024. **Global Montreal**

Attachment 1 – Concerns with “the Handbook”(P5)

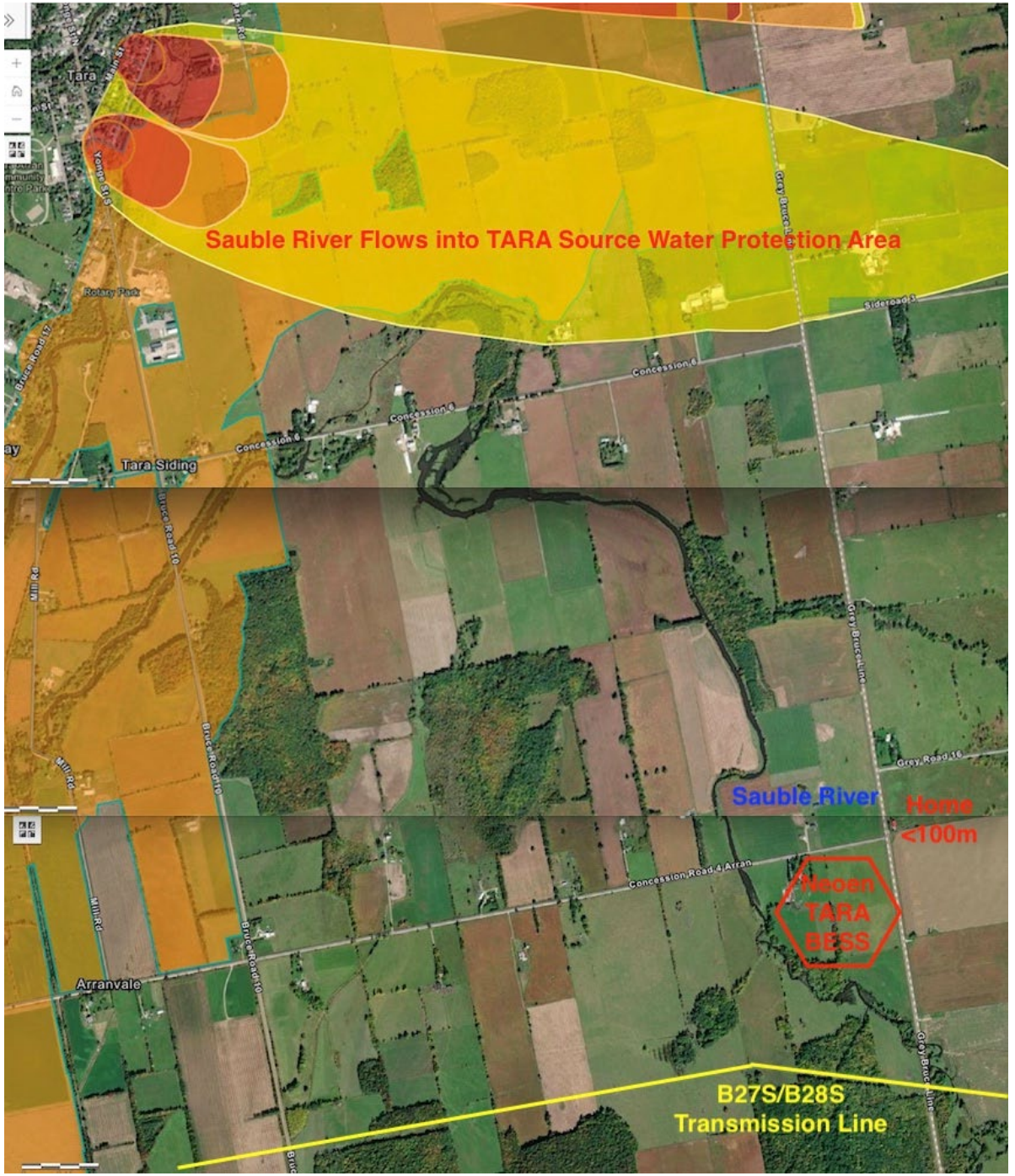
A fire burns at a SDG&E lithium-ion battery facility in Escondido, prompting evacuations, Sept. 5, 2024.



Residents in the pink highlighted area are under a mandatory evacuation order, while those in the purple area have been ordered to shelter in place.

Attachment 1 – Concerns with "the Handbook"(P6)

- The Handbook does not discuss toxic gas hazards to firefighters or neighbours. The handbook does not discuss pressure relief panels on BESS containers, that vent toxic gases to the environment (to prevent bursting the containers - *But immediately venting the gases to neighbours.)*
- The TARA BESS is located within 100m of the nearest neighbour (in adjacent, unconsulted municipality)
- Examples just shown had evacuation of neighbours at distances of about 500m, and shelter in place for neighbours (and presumably livestock) up to 1.75 km downwind. Shelter in place with ventilation turned off is hardly possible for grazing livestock.
- Note also Sauble River flowing through project site.



Attachment 2 – Findings of EV FireSafe Study

- Thermal runaway is how all EV battery fires start
- A battery under 50% charged is less likely to ignite *(hence BESS batteries, normally charged to 100% are more likely to ignite)*
- An EV lithium traction battery burns hotter than an ICE vehicle fire
  - A burning ICE car may reach 815-1000 degrees Celsius, an EV up to 1200 degrees Celsius.
- Fire behaviour is different & presents new challenges
- It's not smoke, it's a vapour cloud of highly flammable *(toxic)* gases
- Best practice; allow a traction battery to burn out
  - EV traction battery fires can reignite, hours or days later

Attachment 3 - Additional Resources and References (P1)

- CTIF – International Association of Fire and Rescue Services website:
  - 12 examples shown (including several that resulted in fatalities)
- Larsson, F., Andersson, P., Blomqvist, P. et al. Toxic fluoride gas emissions from lithium-ion battery fires.
  - The release of hydrogen fluoride from a Li-ion battery fire can therefore be a severe risk and an even greater risk in confined or semi-confined space.
- Bordes, A., Papin, A., Mariar, G. et al. Assessment of Run-Off Waters Resulting from Lithium-Ion Battery Fire-Fighting Operations
  - this water could be potentially hazardous to the environment, depending on the actual situation encountered in the case of thermal runaway propagation

Attachment 3 - Additional Resources and References (P2)

- Quant, M., Willstrand, O., Mallin, T., Hynynen, J., Ecotoxicity Evaluation of Fire-Extinguishing Water from Large Scale Battery and Battery Electric Vehicle Tests
  - analysis of the extinguishing water showed high toxicity toward the tested aquatic species
- Jeevarajan, J.A., Joshi, T., Parhizi, M., Rauhala, T., Juarez-Robles, D., Battery Hazards for Large Energy Storage Systems
  - Li-ion batteries are prone to overheating, swelling, electrolyte leakage venting, fires, smoke, and explosions in worst-case scenarios involving thermal runaway.
  - High and low temperatures can lead to different unsafe conditions in Li-ion cells and batteries.

Attachment 3 - Additional Resources and References (P3)

- Yang Peng, Lizhong Yang, Xiaoyu Ju, Baisheng Liao, Kai Ye, Lun Li, Bei Cao, Yong Ni, A comprehensive investigation on the thermal and toxic hazards of large format lithium-ion batteries with LiFePO4 cathode
  - Toxic gases released from lithium-ion battery (LIB) fires pose a very large threat to human health
  - The LIBs with higher state of charge (SOC) are found to have greater fire risks in terms of their burning behavior
  - Results show that the effects of irritant gases are much more significant than those of asphyxiant gases

Attachment 3 - Additional Resources and References (P4)

- Larsson, F., Andersson, P., Blomqvist, P. *et al.* Toxic fluoride gas emissions from lithium-ion battery fires
  - the emission of toxic gases can be a larger threat than the heat
  - Fluoride gas emission can pose a serious toxic threat and the results are crucial findings for risk assessment and management, especially for large Li-ion battery packs.
  - The release of hydrogen fluoride from a Li-ion battery fire can therefore be a severe risk and an even greater risk in confined or semi-confined spaces.
  - Using water mist resulted in a temporarily increased production rate of HF

Attachment 3 - Additional Resources and References (P5)

- Conzen, J., Lakshmipathy, S., Kapahi, A., Kraft, S., DiDomizio, M., Lithium ion battery energy storage systems (BESS) hazards
  - the industry has also been observing more field failures that resulted in fires and explosions
  - During the exothermic reaction process (i.e., thermal runaway), large amounts of flammable and potentially toxic battery gas will be generated
- Hydro One – BESS Fire Protection – Risk & Response Assessment Standard
- UL Standard 9540A – Test Method for Evaluating Thermal Runaway Fire Propagation in Battery Energy Storage System