

Vent Gas Collection During Pack-Level Test

September 2018

OICA Submission

Topics

- Key Messages
- Motivation
- Methodology
- Results
- Challenges

Key Messages

- Gas analysis for pack level testing can be done but will only provide general information regarding high quantity gases
 - Unlikely to find or accurately measure low volume gases
 - NOT suitable for vehicle-level testing
- May be possible to create a useful pack-level development test but not suited for a vehicle-level regulatory test methodology

Motivation

- EVS GTR Phase 2 topic
 - Flammability, toxicity and corrosiveness of vented gas (i.e. quantification of venting for tests addressing safety of REESS post-crash, potential risk of 'toxic gases' from non-aqueous electrolyte)
- To evaluate this topic, it is necessary to collect and analyze gases emitted from a battery pack
 - Evaluated one potential method to assess this at a pack level
 - Does not address additional issues associated with vehicle-level evaluations or how to accomplish this in a post-crash condition

Methodology

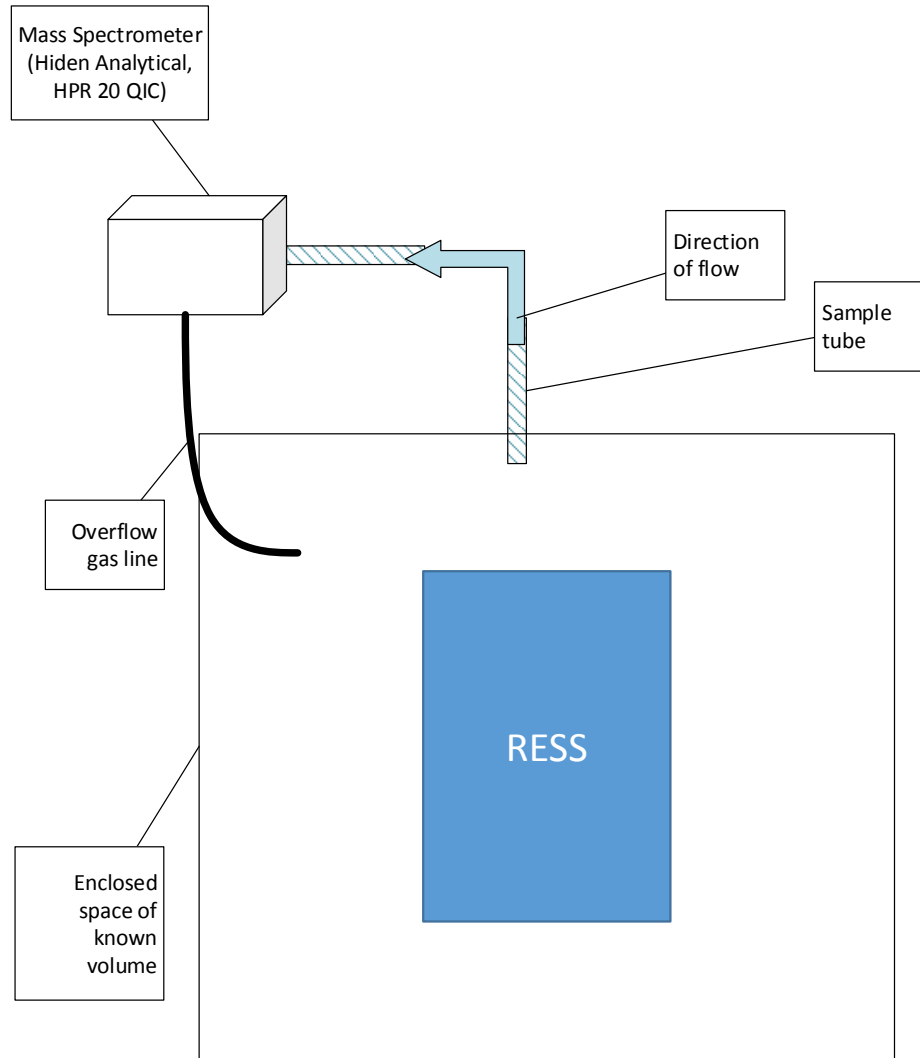
Key Considerations

- Potential hazard associated with vent gas is a function of gas concentration, not just presence
 - Toxicity measured in PPM, V/V%, etc.
 - Flammability measured in V/V% (LFL, UFL)
- To measure a gas, must know what gases are expected

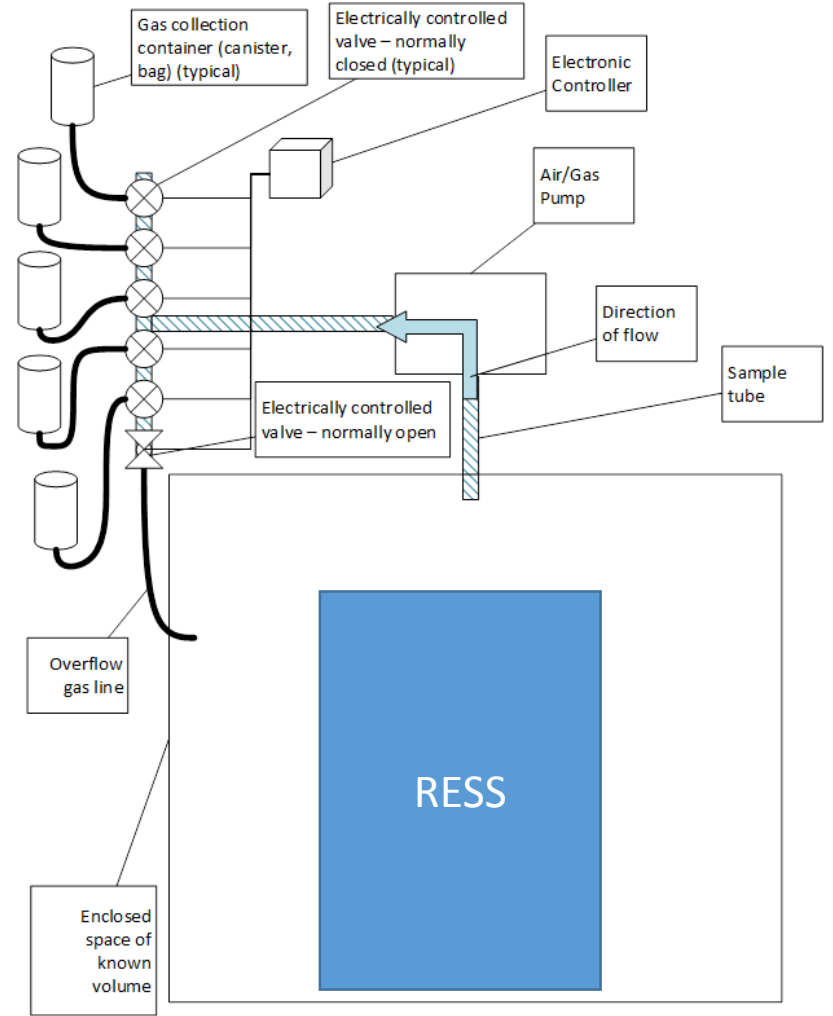
Methodology Overview

- Locate pack within appropriately sized enclosed space
- Initiate evaluation event on battery pack
- Sample enclosed space gases at appropriate locations and intervals

A Continuous Collection Methodology



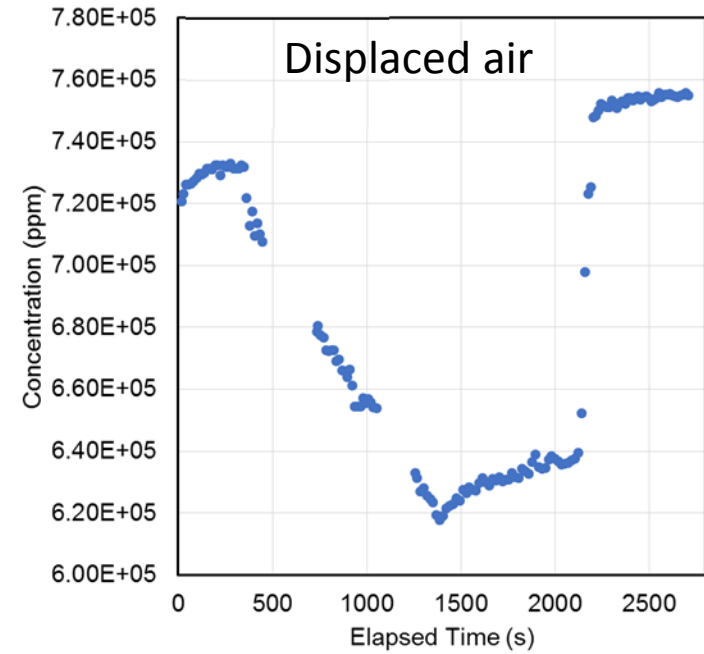
A Sample Collection Methodology



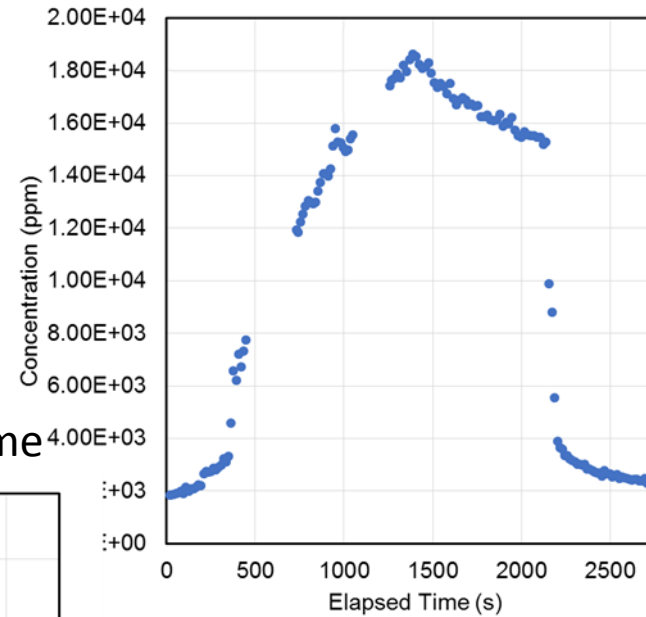
Test Set-up



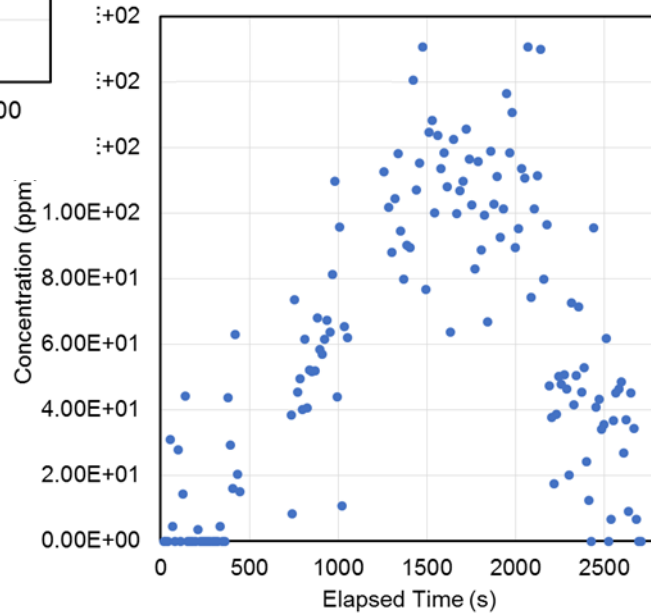
Results



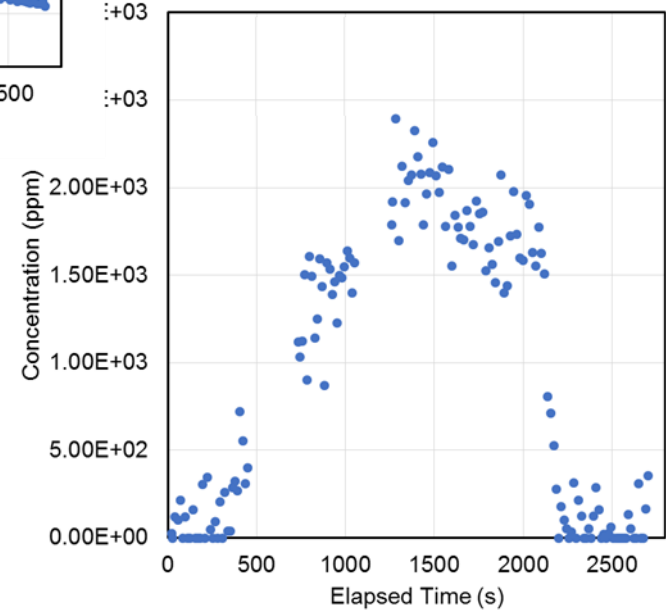
Vent gas – larger volume



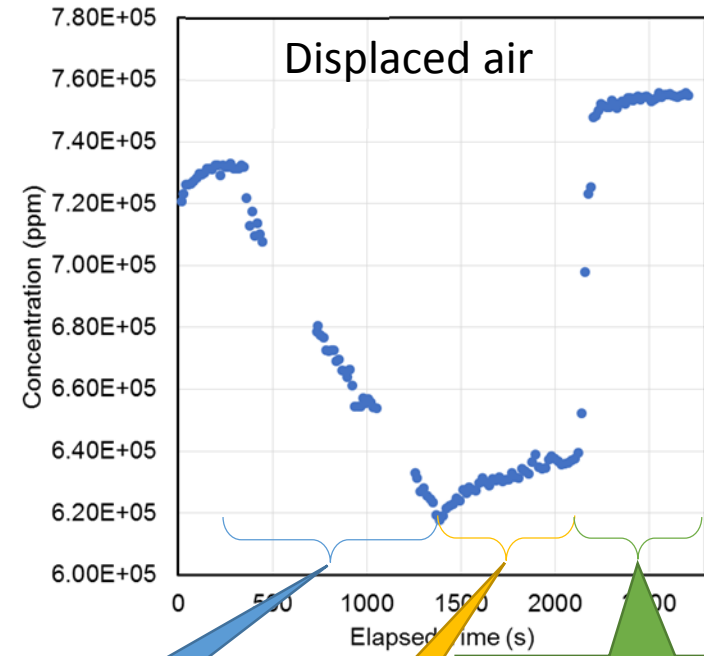
Vent gas – smaller volume



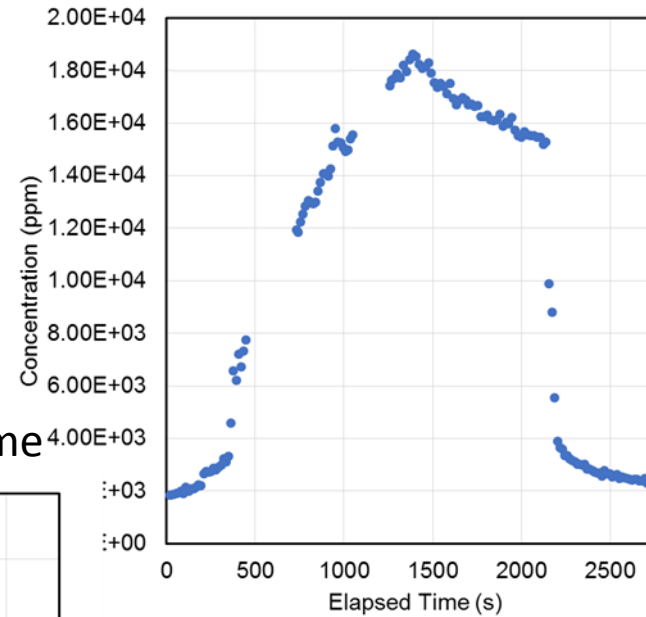
Vent gas – smaller volume



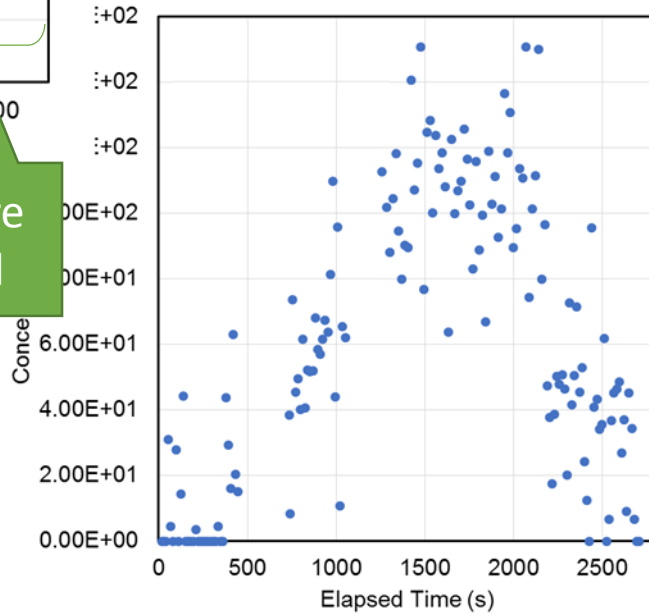
Results



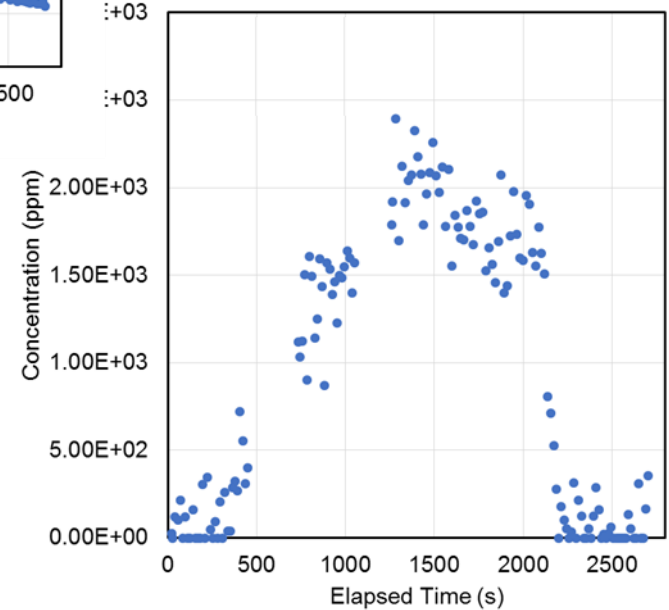
Vent gas – larger volume



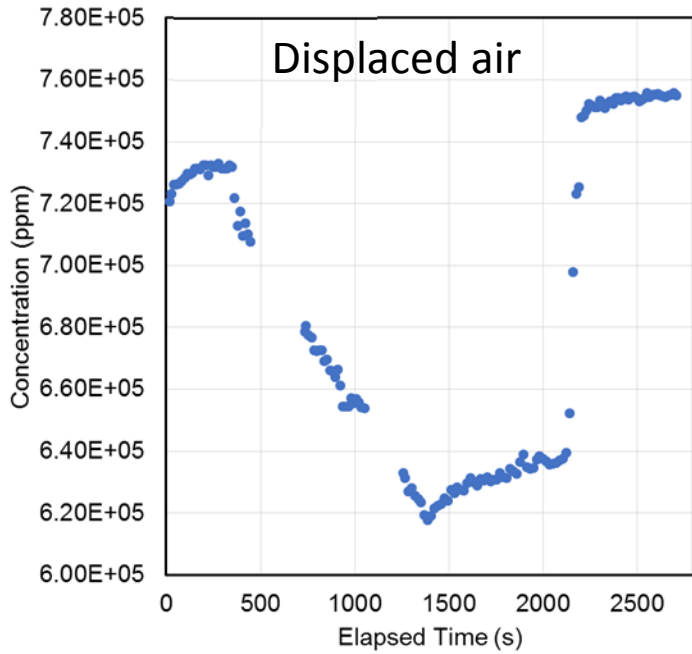
Vent gas – smaller volume



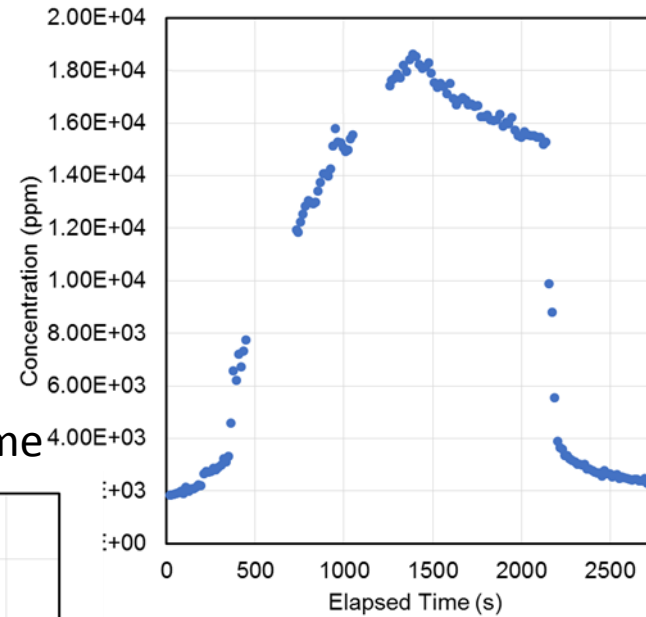
Vent gas – smaller volume



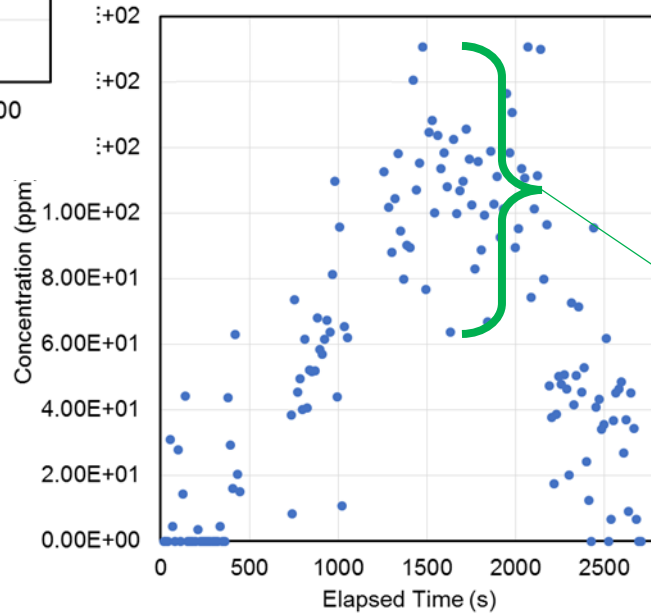
Results



Vent gas – larger volume

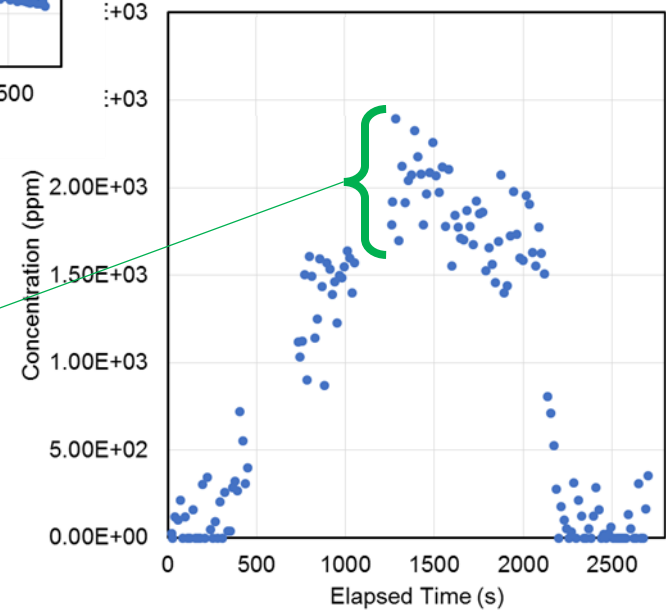


Vent gas – smaller volume



±20-40% variation
for smaller volume
gases

Vent gas – smaller volume



Challenges

- Significant challenges exist for accurate detection
 - Method to accurately measure gas concentration levels
 - Size of enclosed space
 - Test safety
 - Air exchange rate
 - Mixing behavior
 - Sampling strategy
 - Method
 - Frequency
 - Location
 - Real-time or post-test assessments?
 - Need to know what to be measured
 - What gases are expected
 - How to assess “unknown” gases
 - Small quantity gases
 - Detectability limits
 - Measurement noise