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Assessment of the smoke hazard of in EV passenger compartment

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Hazard related with LIB thermal runaway gas

- Evaluation of fumes **opacity** can be done by visual inspection with a camera placed in the passenger compartment

- Evaluation of the **toxic risk** in the passenger compartment is a complex matter. The best compromise between a scientific based toxicity threshold and simplicity of measurement seems to be based on ISO 13571:2012 (for the threshold determination) and a CO measurement in the passenger compartment.

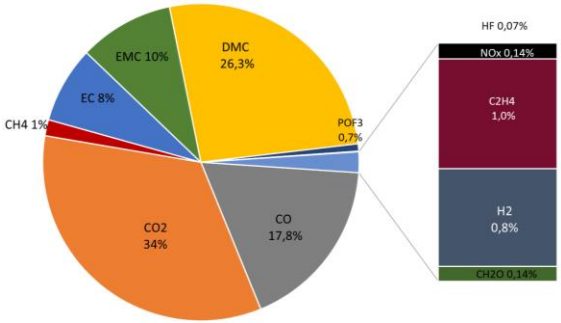
Toxic hazard : threshold definition

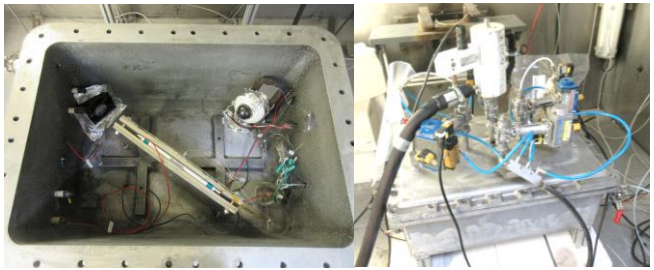
- ISO 13571:2012 is the recognized standard to address the consequences of human exposure to the life-threatening components of fire. It estimates the time at which individuals may reach the incapacitation stage, a critical state requiring external rescue over self-evacuation of impacted population
- Takes into account asphyxiant (CO, HCN, CO_2) with time dependency and irritants (HCl, HBr, HF, SO_2…)
- Without being "perfect" it seems more appropriate in this scenario than using values such as VSTAF, AEGL, TEEL, IDLH…

Proposed approach

- Toxicity step 1 : measure gas composition at cell level WITHOUT inflammation (for example see protocol of UN SCTDG IWG[1])

Typical gas mix in the absence of Fire (mass%)





Example of test set-up for gas mix measurement

- Toxicity step 2 : Based on step 1 results and ISO 13571:2012 define TR gas volume acceptable in the passenger compartment during 5 min

1- https://unece.org/sites/default/files/2023-06/UN-SCETDG-62-INF14e.pdf

Proposed approach

- Toxicity step 3 : Based on CO measurement performed inside the passenger compartment, extrapolate the TR gas volume inside the passenger compartment and check that it remains bellow threshold calculated in setp2

- Opacity : use a camera for visual inspection and documentation of the loss of visibility

Example of an emission of 7 L of TR gas in an 8 m^3 chamber

Proposed test set-up