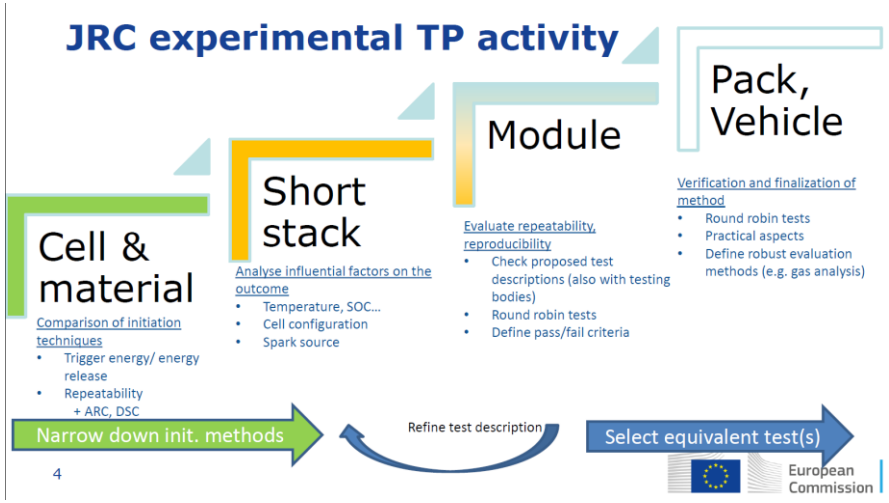
OICA Questions
to
EVS18-E1TP-0200, JRC

Progress on thermal propagation testing Slide #4

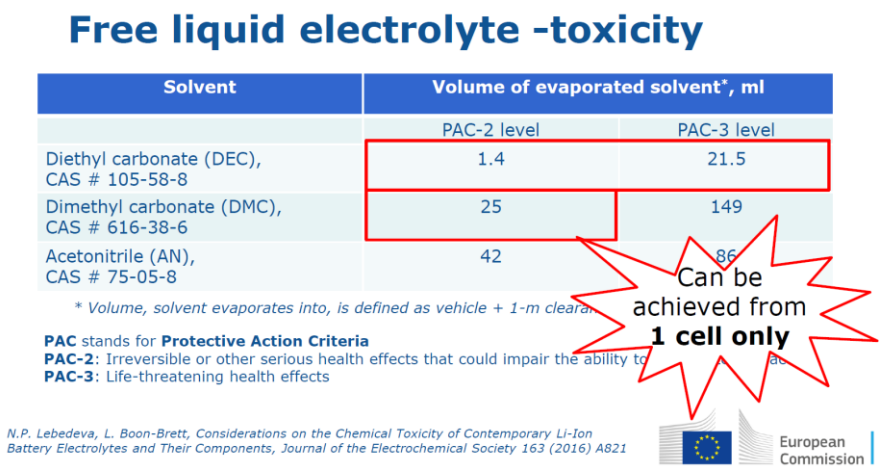


It is OICA's understanding that the IWG is to complete its work on Phase 2, including finalization of proposed regulatory text, by the end of 2020.

1) How much of the research work described on this slide will be completed in time to support this timeline?

2) When is the 'Pack, Vehicle' work estimated to be complete?

Electrolyte leakage/venting verification
Slide #41



What value (ppm, mg/m^3) was used to determine the DEC volume calculation?

According to current (Revision 29) data (https://sp.eota.energy.gov/pac/Search/Reports/975)

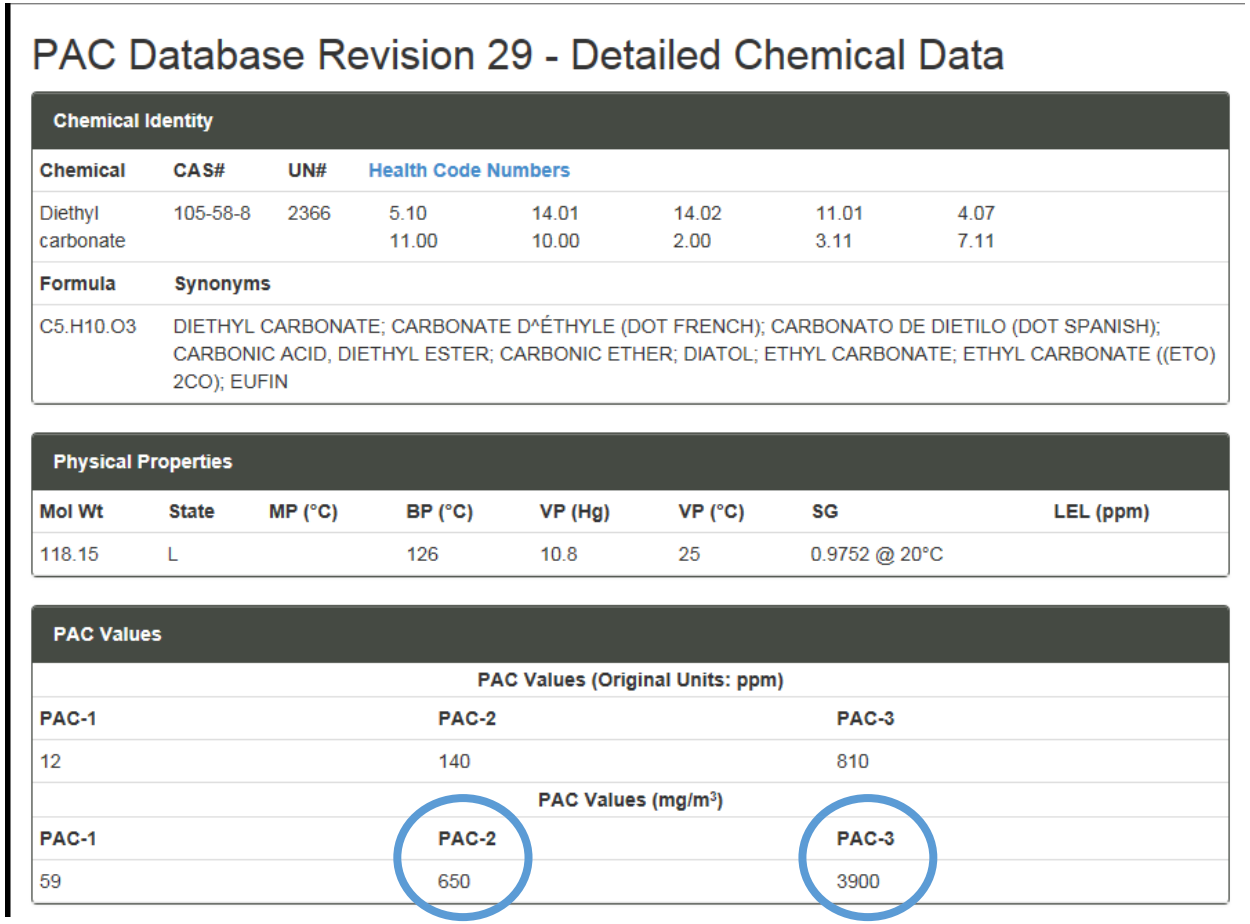
- PAC-2 = 140 ppm or 650 mg/m^3
- PAC-3 = 810 ppm or 3900 mg/m^3

[The indicated reference [1] shows significantly different values. Perhaps an update was published?]

Using the current PAC published specific gravity (0.9752) and 61.5 m^3 space, this would require ~41 ml of DEC to achieve PAC-2 levels.

1. N.P. Lebedeva, L. Boon-Brett, Considerations on the Chemical Toxicity of Contemporary Li-Ion Battery Electrolytes and Their Components, Journal of the Electrochemical Society 163 (2016) A821.

From https://sp.eota.energy.gov/pac/Search/Reports/975



PAC Database Revision 29 - Detailed Chemical Data

Chemical Identity

Chemical	CAS#	UN#	Health Code Numbers				
Diethyl carbonate	105-58-8	2366	5.10 11.00	14.01 10.00	14.02 2.00	11.01 3.11	4.07 7.11

Formula	Synonyms
C5.H10.O3	DIETHYL CARBONATE; CARBONATE D^ÉTHYLE (DOT FRENCH); CARBONATO DE DIETILO (DOT SPANISH); CARBONIC ACID, DIETHYL ESTER; CARBONIC ETHER; DIATOL; ETHYL CARBONATE; ETHYL CARBONATE ((ETO) 2CO); EUFIN

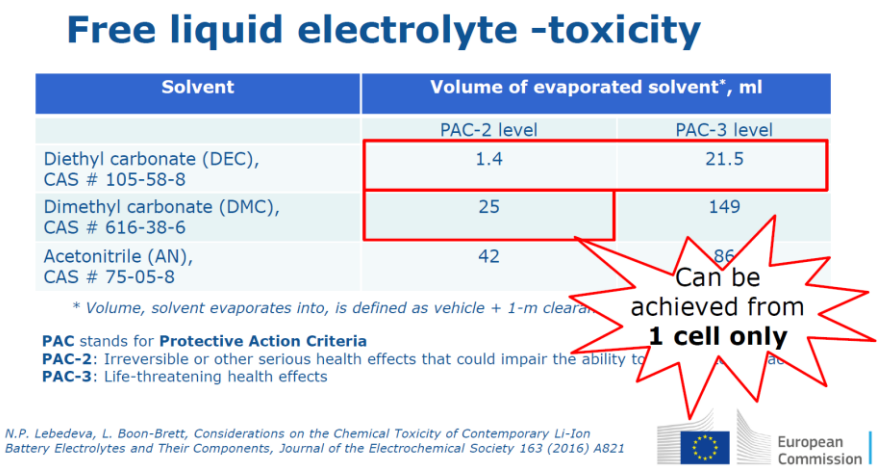
Physical Properties

Mol Wt	State	MP (°C)	BP (°C)	VP (Hg)	VP (°C)	SG	LEL (ppm)
118.15	L		126	10.8	25	0.9752 @ 20°C	

PAC Values

PAC Values (Original Units: ppm)		
PAC-1	**PAC-2**	**PAC-3**
12	140	810
PAC Values (mg/m³)		
PAC-1	**PAC-2**	**PAC-3**
59	650	3900

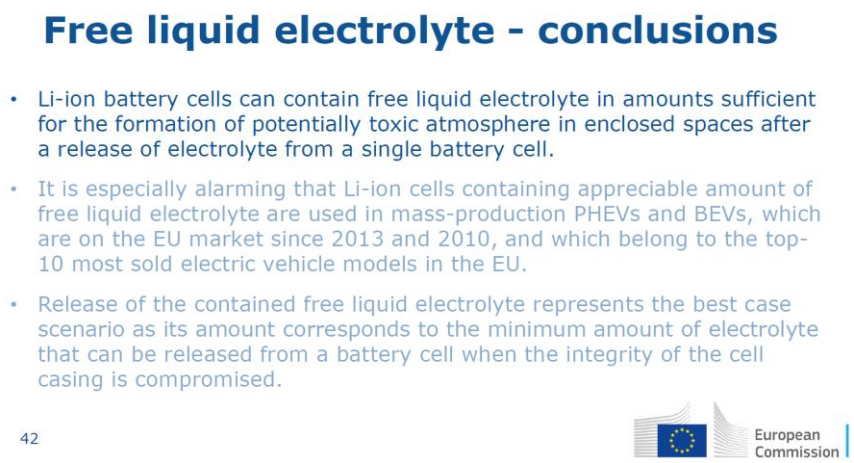
Electrolyte leakage/venting verification
Slide #41



According to the PAC website (https://sp.eota.energy.gov/pac/TeelDef), the values are based on a one hour exposure at the indicated level of concentration.

- In an open environment, the most probable condition for an automotive application, any concentrations would quickly dissipate.
- In an enclosed environment, an air exchange rate exists which would reduce the concentration over time. Air exchange rates of 0.03 to 0.3 exchanges per hour are representative of “extremely tight” to “ventilated” conditions *(SAE J2578, 5.2.1, 5.2.2)*.

Electrolyte leakage/venting verification
Slide #42 – first bullet



The stated conclusion requires all free electrolyte to exit the cell and evaporate simultaneously.

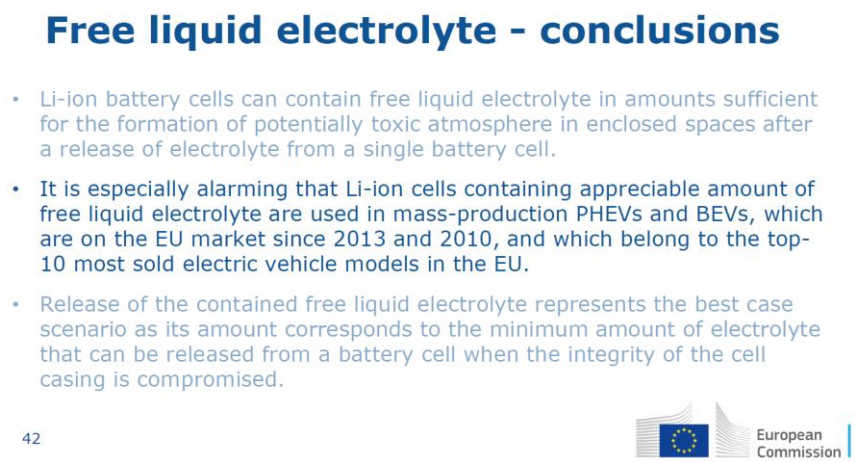
- What evidence do you have that this would occur in an actual battery?
- For a realistic, in-vehicle leakage condition, what is the estimated leakage rate of liquid electrolyte out of a cell? How was this determined?

The functional purpose of free electrolyte inside of a cell is to support longer life. As cells age, electrolyte is consumed.

- For the single cell type in the reference [2], an average of 95% of the free electrolyte was gone at ~50-75% of expected useful life.
- The stated conclusion is only valid at the time a cell is new, which is also the time that it would be least likely to leak.

2. N. P. Lebedeva, F. Di Persio, T. Kosmidou, D. Dams, A. Pfrang, A. Kersys, L. Boon-Brett, Amount of Free Liquid Electrolyte in Commercial Large Format Prismatic Li-Ion Battery Cells, Journal of the Electrochemical Society 166 (2019) A779-A786.

Electrolyte leakage/venting verification
Slide #42 – second bullet



Given the duration of the indicated cells in the market, is there any evidence that the speculated concern regarding electrolyte leakage and toxic effects has actually occurred in vehicles in the field?