



Advanced Rechargeable Batteries

**SAFETY COMMUNICATION:
Rescue and Training Manual
for batteries**

**Brussels, Feb 3rd, 2015
Claude Chanson**

- 1. NEED FOR BATTERY SAFETY INFORMATION**
- 2. RECHARGE'S RESPONSES**
- 3. RESCUE AND TRAINING MANUAL**

Background

Lithium-type batteries for e-mobility are heavy, have different chemical compositions and have high voltage.

They have potential cumulative hazards and risks

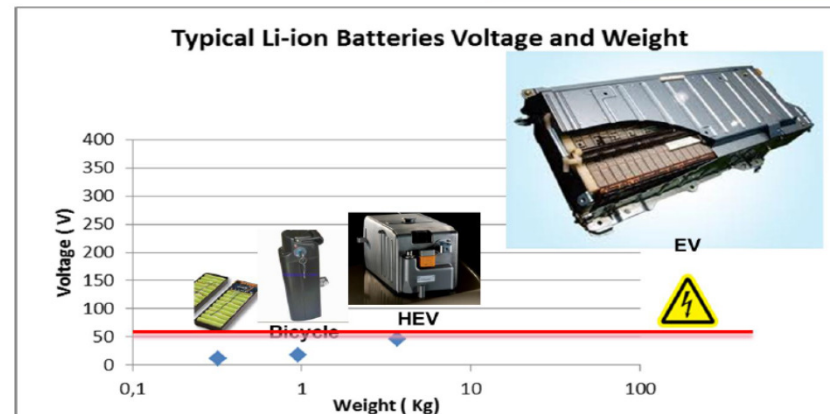


Fig. 7 : Li-ion batteries voltage and weight

Name	LCO	LNO	NCA	NMC	LMO	LFP	LTO
Full name	Lithium Cobalt Oxide	Lithium Nickel Oxide	Lithium Nickel Cobalt Aluminium Oxide	Lithium Nickel, Manganese Cobalt Oxide	Lithium Manganese Spinel	Lithium Iron Phosphate	Lithium Titanate
Cathode	LiCoO ₂	LiNiO ₂	Li(Ni _{0,85} Co _{0,1} Al _{0,05})O ₂	Li(Ni _{0,33} Mn _{0,33} Co _{0,33})O ₂	LiMn ₂ O ₄	LiFePO ₄	e.g.: LMO, NCA, ...
Anode	Graphite	Graphite	Graphite	Graphite	Graphite	Graphite	Li ₄ Ti ₅ O ₁₂
Cell voltage	3,7 - 3,9V	3,6V	3,65V	3,8 - 4,0V	4,0V	3,3V	2,3 - 2,5V
Energy density	150Wh/kg	150Wh/kg	130Wh/kg	170Wh/kg	120Wh/kg	130Wh/kg	85Wh/kg
Power	+	0	+	0	+	+	++
Safety	-	0	0	0	+	++	++
Lifetime	-	0	+	0	0	+	+++
Cost	--	+	0	0	+	+	0

Daimler analysis, Nationale Plattform Elektromobilität, 2010.

The current situation is not so good

The information provided by the OEMs (manufacturers) is very diverse in format, language (terminology), content,...



Plug-in Hybrid

Emergency Response Guide



RENAULT KANGOO Z.E.

Véhicule électrique

Guide pour les Services de Secours



The current situation is not so good

The availability to emergency services is not guaranteed, the timing of providing the information is not defined.



THE BMW i3 RESCUE GUIDELINE.

Einsatzhinweise
für Elektrofahrzeuge



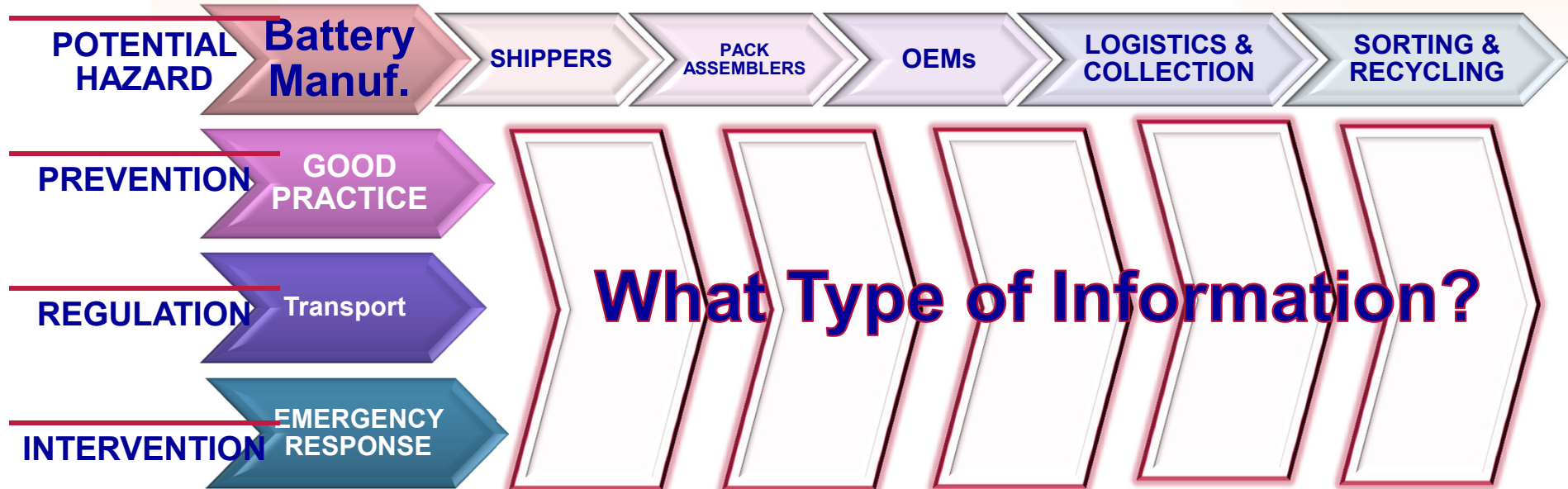
The 'in-vehicle' or 'on-vehicle' information is very diverse, not always easily accessible & readable, not sure whether information is for vehicle user, for car service personnel, or for emergency services.

1. DEMAND FOR INFORMATION



1. From Actors in the supply chain
2. From Competent Authorities
3. New Comers : e.g. Insurance C°.

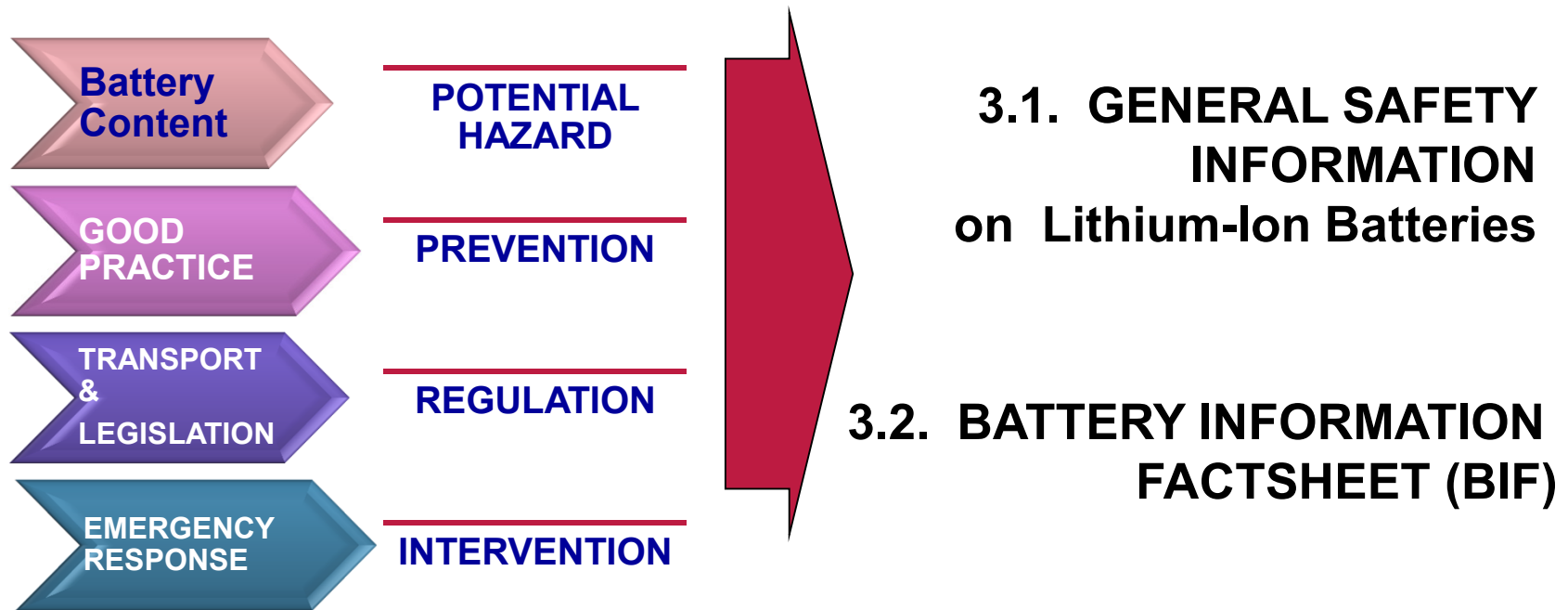
1. WHAT TYPE OF INFORMATION



What Type of Information?

1. From Actors in the supply chain
2. From Competent Authorities
3. New Comers : e.g. Insurance C°.

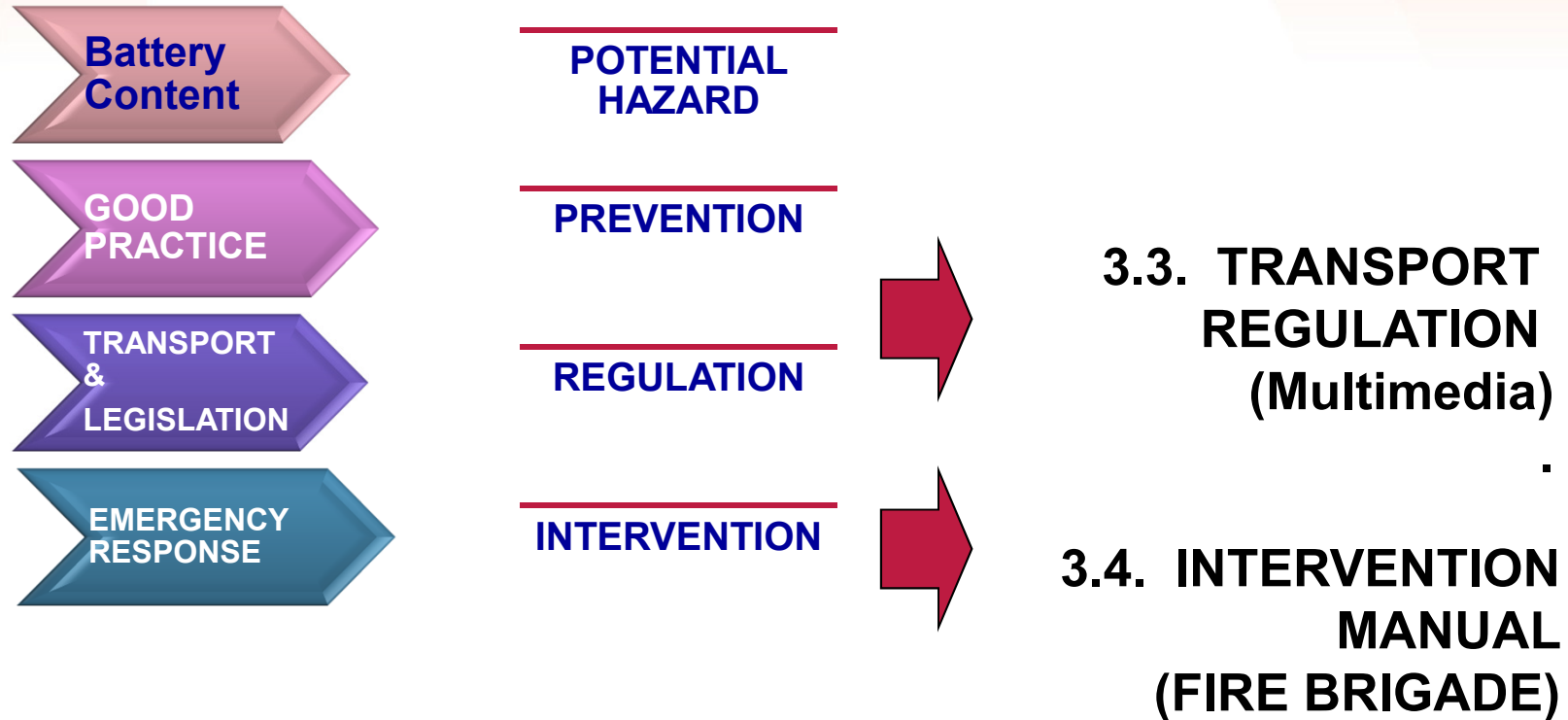
2. RECHARGE's RESPONSE



Documents on RECHARGE website:

<http://www.rechargebatteries.org/knowledge-base/safety/>

2. RECHARGE's RESPONSES



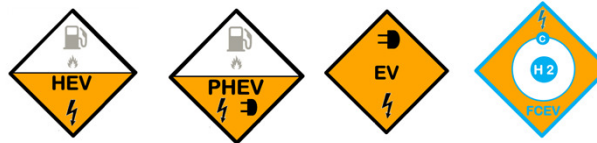
Documents on RECHARGE website:
<http://www.rechargebatteries.org/knowledge-base/safety/>

3. RESCUE AND TRAINING MANUALS

INFORMATION FOR FIRST AND SECOND RESPONDERS RESCUE AND TRAINING MANUAL

HIGH VOLTAGE (HV) LITHIUM-ION BATTERIES

IN AN HYBRID (HEV), PLUG-IN HYBRID (PHEV) , FULL ELECTRIC VEHICLE (EV)
AND FUEL CELL ELECTRIC VEHICLE (FCEV)



CONTENT

1. GENERAL INFORMATION	Page 2.
2. HAZARD ASSOCIATED WITH LEAKING Lithium-Ion BATTERIES	Page 6.
3. Hazards Associated with a Lithium-Ion Battery Fire	Page 7.
4. Environmental Aspects	Page 9.
5. Specific requirements for packaging, storage and transportation of damaged Lithium-Ion batteries and batteries at end of life.	Page 10.
6. Explanation Used Symbols	Page 12.

3. RESCUE AND TRAINING MANUALS

1. Danger by spills/leaks (absence of fire)

Under normal conditions of use, the battery does not present any risk of exposure to its content.

SPILLS

Specific Attention



2.1 Inhalation in non-fire situations

The electrolyte used in the Li-ion battery cells contains a volatile flammable organic solvent and a corrosive substance.

- **Inhalation:** High vapour concentrations may cause respiratory tract irritation.
- **Eye contact:** Eye contact may cause severe irritation and possibly a burning sensation or corneal tissue injury.
- **Skin contact:** skin contact may cause irritation. Prolonged contact with electrolyte mixture may result in more severe irritation.
- **Ingestion:** swallowing electrolyte mixture may cause gastrointestinal tract burns. May cause nausea and vomiting.

Safety Measures



2.2 Recommended Personal Protective Equipment:

Use personal protective equipment. Avoid contact with skin and eyes. Ventilate the area. Position yourself in the wind direction.

The information below refers to exposure to the substances contained in the battery.

- Respiratory track protection
Protective mask for acidic vapours or Self Contained Breathing Apparatus (SCBA) or Air-purifying respirator equipped with acid gas cartridge
- Hand protection
Neoprene or nitrile gloves (EN 374) or equivalent.
- Eye protection
Safety glasses with side-shields conforming to EN166, or face shield equivalent.
- Skin and body protection
Boots, apron, long sleeved clothing.

Absorption/neutralisation see chapter 4: **Environmental aspects**

3. RESCUE AND TRAINING MANUALS

1. Environmental Aspects

IN ALL CASES

Specific Attention



Safety Measures



4.1 Absorbent materials.

- To confine the spillage of liquids and the fire: use dry materials such as sand or mineral absorbing agents.
- Cleanup all spills/leaks immediately using an absorbent material such as vermiculite or dry sand. Neutralization is not necessary.
- Collect all contaminated absorbent material in a designated approved plastic waste container (non-conductive).
- In case of abundant use of water, care should be taken to confine and neutralise the water outflow.
- After intervention, rinse the affected areas with water adequately.

4.2 Recommended Personal Protective Equipment:








- Handle Li-ion spills using the following personal protective equipment (PPE)
 - Safety glasses or face shield
 - Chemical resistant neoprene or nitrile gloves
 - Protective apron or coveralls
 - Protective mask for acidic vapours or SCBA.

Perform gross decontamination by removing affected clothing. Wash skin with water and soap.

4.2 Treatment of Waste Water.

- Confine the effluent or the contaminated material and collect it as hazardous waste (water) for appropriate treatment.
- Pick up and transfer to properly labelled containers.
- Dispose of in accordance with local waste management legislation and emissions regulations.

3. RESCUE AND TRAINING MANUALS

	<p>High voltage battery pack with indication type of battery <i>Draft</i> Orange R/G/B: 255/165/0 Black Text: Arial rounded MT Bold</p>
	<p>NiMH battery, high voltage <i>Draft</i> Orange R/G/B: 255/165/0 Black Text: Arial rounded MT Bold</p>
	<p>Lithium ion battery, high voltage <i>Draft</i> Orange R/G/B: 255/165/0 Black Text: Arial rounded MT Bold</p>
	<p>Ultra capacitor, high voltage <i>Draft</i> Orange R/G/B: 255/165/0 Yellow R/G/B: 255/255/0 Black</p>
	<p>Induction power (magnetic field) <i>Draft</i> Orange R/G/B: 255/165/0 Black</p>
	<p>Use water to extinguish <i>Draft</i> Blue R/G/B: 56/93/138 White</p>
	<p>Don't use water to extinguish <i>Draft</i> Red R/G/B: 255/0/0 White</p>

3. RESCUE AND TRAINING MANUALS

INFORMATION FOR FIRST AND SECOND RESPONDERS
AND FIRE BRIGADE IN STORAGE FACILITY'S

RESCUE AND TRAINING MANUAL

DRAFT

LITHIUM BATTERIES

IN A STORAGE FACILITY

CONTENT

1. General Information	Page 2.
2. HAZARDS ASSOCIATED WITH LEAKING LITHIUM BATTERY	PAGE 4.
3. Hazards Associated with a Lithium Battery Fire	Page 5.
4. Environmental Aspects	Page 7.
5. Specific requirements for packaging, storage and transportation of damaged Lithium batteries and batteries at end of life	Page 8.
6. Other Requirements	Page 9.
7. Explanation Used Symbols	Page 11.

4. CONCLUSIONS

- 1. There is a need of a clear and organized communication of the safety information.**
- 2. Coordination is required for a good homogeneity between the documents contents.**
- 3. ISO standard process is supported to create new standards, valided and widely available.**