Electric Vehicles Safety and the GTR

Volker Rothe
GM Alternative Propulsion Center

EVS GTR Meeting, Washington D.C., April 2012
Topics

- GM Alternative Propulsion Strategy
- Battery- and EV Testing
- Standards and Harmonization
- GTR Recommendations
**Advanced Propulsion Technology Strategy**

- Improved Vehicle Fuel Economy & Emissions
- Displace Petroleum

- Engine and Transmission Improvements
- Hydrid Electric Vehicles (including Plug-In HEV)
- Battery Electric Vehicles
- Hydrogen Fuel Cell

- Petroleum (Conventional & Alternative Sources)
- Bio Fuels (Ethanol E85, Bio-diesel)
- Electricity (Conventional & Alternative Sources)
- Hydrogen

Energy Diversity
Layers of Safety

Safety strategies at each level build from lower level designs
Battery Testing on Bench

- Tests on cell level
  - Power and energy
  - Calendar life at various temperatures
  - Cycle life (USABC DST profile & Volt specific profile)
  - Fault tolerance (overcharge, short circuit, crush, over temperature, etc.)

- Tests on pack level
  - Power
  - Energy
  - Efficiency
  - Thermal system
  - Controls
  - Cycle life
Battery Validation

Validation

- Crash
- Mechanical: shock, vibration
- Environmental: temperature, salt, water
- Electric: e.g. EMC
- Customer use life cycle
Battery Testing in Vehicle

- Hot weather testing
- Winter testing
- Mountain testing
- Several hundred thousand kilometers driven with the development fleet
Vehicle Crashworthiness

- Rigorous vehicle crash testing conducted
- Post crash evaluation includes the following items
  - Short circuits
  - Electrical arcing
  - Bonding of High Voltage enclosures to the EV chassis
  - Battery and component retention
  - High Voltage disconnect and HV bus discharge
  - High Voltage isolation from vehicle chassis
  - Visible electrolyte spillage from RESS
  - Cell venting behavior
EV and battery safety standards and research

- Multiple existing industry and regulatory codes and standards related to EVs provide a rich framework for EVS GTR discussions.

- In addition, various countries are conducting research on EV safety, including lithium battery safety.

- Learnings from these sources should guide the content of the EVS GTR to assure that it represents state-of-the-art knowledge when published.
Global harmonization

- Electrification of motor vehicle transportation is sweeping the world

- Regulatory harmonization is an important enabler for this transition to succeed

- Industry encourages contracting parties to adopt the EVS GTR into their national regulations when it is completed

- Avoid to the extent possible conflicting, altered, or duplicative regulations

- Electrification of auto transportation already faces significant cost challenges, non-harmonized regulations needlessly add burden to this
GTR Recommendations

• The EVS GTR should include in use and post crash electric safety requirements

• Preference for performance-based safety requirements provides the necessary flexibility to accommodate future innovations

• Requirements should reflect the usage of batteries in electric vehicles

• Sufficiently comprehensive requirements without options will avoid the need for country-specific regulations

• The scope of the GTR should be limited to safety requirements for electric vehicles

• Recommendations regarding charging infrastructure, first responders procedures or vehicle/components service, repair, maintenance and transportation issues could be given to the relevant organizations
Thank you!