

Transmitted by the informal group "Hydrogen/Fuel Cell – Vehicles"

## Road Map to develop Hydrogen / Fuel Cell GTR(s)

### **A Introduction**

The World Forum for Harmonization of Vehicle Regulations (WP.29) initiated the development of regulations on hydrogen vehicles in 2001. More specifically, two draft regulations on liquid hydrogen and compressed gaseous hydrogen onboard storage systems (LH<sub>2</sub>, CGH<sub>2</sub>) were presented by Germany as potential ECE Regulations under the 1958 Agreement during the 123rd session of WP.29 on 6-9 March 2001. They were subsequently presented to the GRPE during its 42nd session on 28-31 May 2001. At these meetings, the UN ECE members supported the initiative from Germany. A GRPE informal group on hydrogen and fuel cells vehicles was formed to prepare these ECE Regulations.

The GRPE informal group on hydrogen and fuel cells vehicles, under the chairmanship of Germany, has met several times since 2001 to discuss the two proposals. The two drafts for new ECE Regulations for hydrogen vehicles have been recently presented as formal documents to the GRPE (TRANS/WP.29/GRPE/2003/14 and TRANS/WP.29/GRPE/2003/14/Add.1 for liquid hydrogen vehicles; TRANS/WP.29/GRPE/2004/3 and TRANS/WP.29/GRPE/2004/3/Add.1 for compressed gaseous hydrogen vehicles). The scope of these Regulations is limited to the components used for the storage and delivery of hydrogen to the fuel cell system or internal combustion engine and their installation onboard the vehicle.

The GRPE requested the informal group on hydrogen and fuel cell vehicles to prepare a proposal for a specific action plan (road map) for the assessment of the hydrogen technologies for motor vehicles and development of GTR(s) for hydrogen vehicles.

The GRPE informal group on hydrogen and fuel cells vehicles met on 6-7 October 2003 in Munich, on 12th January 2004 in Geneva and on 13-14th May 2004 in Washington to discuss the preparation of the road map to GTR(s).

### **B Road Map to H<sub>2</sub>/FC GTR(s)**

#### **1 Scope and Content**

The GTR(s) should extend to OEM vehicles (categories to be defined) powered or equipped entirely or partially by hydrogen used in an internal combustion engine, fuel cell, auxiliary power unit, heater, etc. as well as their associated storage systems (liquid, gaseous or hydrids) and cover main aspects as identified by the informal group for:

## **1.1 On-board storage system safety**

Safety of Container and Components

Lifecycles

Requalification

Performance

Purging Limits

Material Characteristics

Leakage

Damage Tolerance

Fire Protection

Aging

Material Characteristics

Refueling

Mechanical Properties

## **1.2 Whole vehicle safety**

Crashworthiness

Fire Safety

Hydrogen System Integrity

Normal Operation

Post-Crash

Intentional Hydrogen Releases (e.g. purging, leakage, permeation)

Explosion Protection

Road Hazards Exposure

EMS (Electro-Magnetic-Susceptibility)

Electric-Shock Protection

Normal Operation

Post-Crash

Emergency Medical Rescue

Controls and Display

## **1.3 Other aspects including energy and environmental considerations**

Pollutant Emissions

Hydrogen and Water Emissions

Fuel Consumption

Recycling

Regeneration

FC Disposal / Hazardous Materials

Fuel Quality

Engine Power

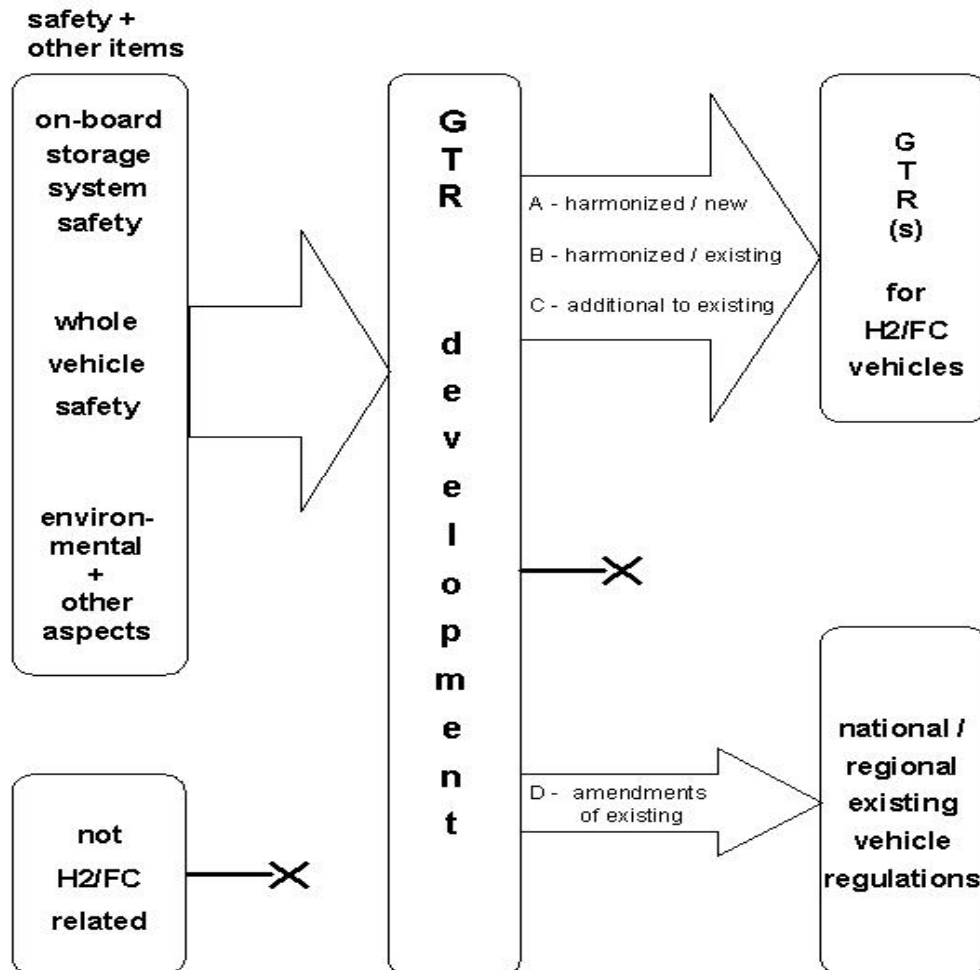
EMI (Electro-Magnetic-Integrity)

Low Temperature

The detailed scope, content, test requirements and the number of GTR(s) required are to be finalised at a later date after the approach is confirmed by the GRPE.

## 2 Concept to Develop the H2/FC GTR(s)

The following diagram shows the principle pathways (A – D) to H2/FC GTR(s) and the relationship to existing national / regional regulations. For each case (see item list 1.1 – 1.3) and based on the review of existing regulations / standards and the need for additional testing and research, the fitting pathway can be found during the GTR development. The diagramme is for illustrative purposes and does not serve as a definition of the scope of work and decision process.



- A: Harmonized GTR(s) for new items (e.g. safety of H2 storage systems)
- B: Harmonization of existing regulations for H2/FC vehicles (e.g. electrical safety)
- C: Harmonized requirements, additional applicable to existing national / regional regulations (e.g. additional crash requirements)
- D: No harmonization, but amendments of national / regional regulations (e.g. NOx limit value for internal combustion engines fuelled with H2)

The informal group agrees that the goal is to develop regulations, harmonized and performance based to the greatest extent possible, taking into consideration benefits and cost effectiveness of the new GTR(s).

### 3 Organization of Work

The informal group recognises the need to establish subgroups a.s.a.p. as to efficiently deal with the aspects listed above in the scope and content.

The main tasks of the sub groups will be to review the existing regulations and standards, to assess the need for additional testing and research and to develop the draft(s) of the GTR(s). The sub groups will have to coordinate with each other so that duplicated requirements which cover same aspect are avoided.

The informal group also anticipates the involvement of other GR's as required and the cooperation with international standardisation bodies, e.g. ISO/TC 197.

### 4 Timing for the availability of GTR(s)

The informal group estimates the following time frame:

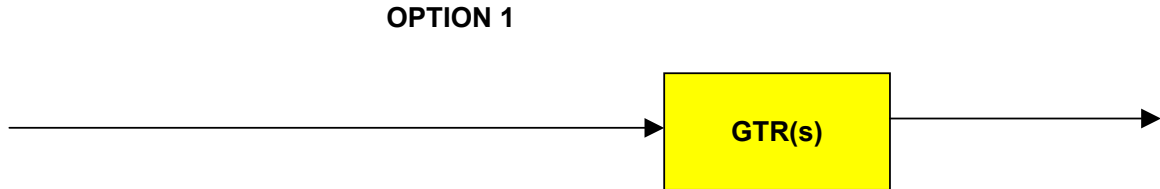
Item	Schedule
Road map to GRPE/WP.29	June 04
Mandate by WP.29 on the basis of the road map (formal proposal(s) to be submitted later)	June 04
Sponsorship and formal proposal	June 04 – Nov. 04
Implementation and organization of subgroups and Initiation of contacts with GRs	Sept. 04 – Jan. 05
Review of existing regulations and standards, assessment of need of tests and research	Starting in Sept. 04 depends on the progress of the subgroup
Drafting of GTR(s)	Sept. 04 – 2010
Detailed schedule of GTR process and review of organization	June 05
Submission of the 1 <sup>st</sup> draft to GRPE	2006 - 2008
Final draft of the GTR(s) to WP.29	2010

## 5 Approaches — Available options for the development of the GTR(s)

Three principle options were originally considered for the development of GTR(s) and presented in informal document no. GRPE-47-24. The two remaining options under current consideration are:

### 5.1 Option 1 - One step approach

With this option, the development under the 1958 Agreement of the two ECE draft Regulations on liquid hydrogen and compressed gaseous hydrogen components (ref. TRANS/WP.29/GRPE/2003/14 Add.1 and TRANS/WP.29/GRPE/2004/3) would be frozen and the GRPE would focus directly on GTR development:



### 5.2 (Option 2 no longer considered, because covered by option 3)

### 5.3 Option 3: Three step approach

Step 1: Limit the work under the 1958 Agreement to the completion of the two ECE draft Regulations for on-board liquid hydrogen and compressed gaseous hydrogen components. These two ECE Regulations are to be of a limited life expectancy and replaced by GTR(s) at a second stage.

Step 2: Simultaneously, initiate the development of GTR(s) that will cover all aspects of the hydrogen and fuel cell vehicles (onboard storage systems, fuel cells, safety in normal and crash conditions, fuel consumption, etc.).

Step 3: Combine the results of steps 1 and 2 to have GTR(s) that cover all aspects of the hydrogen and fuel cell vehicles.

