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Introduction

The meetings were successful in addressing most items. Three(3) of the key items , however, still need to be addressed. Proposals for resolving these items are discussed below.

1. **Exclude the low pressure hydrogen systems that are down-stream of the compressed hydrogen storage systems from Part B.**

   At the previous meeting in Mainz-Kastel, OICA recommended that hydrogen systems down-stream of the compressed hydrogen storage system not be regulated based on the fact that the systems are less than 25 bar-liters as used you in the European Pressure Equipment Directive (PED). While the survey of all manufacturers is incomplete, it seems highly probably that all current and foreseeable hydrogen systems (even for buses) are well less than 25 bar-liter trigger-point of the PED. These systems, therefore, do not contain adequate "energy" to pose a significant hazard that requires regulation in Part B of this regulation.

   While injuries are possible if people are within close proximity of the low pressure hydrogen systems, the likelihood and severity of such events can be effectively managed through the use of "standard engineering practice" (SEP) as defined in many existing standards such as SAE J2579. Such information can be provided in Part A as part of the rationale – without including as specific regulatory requirements in Part B of the GTR.

2. **Exclude regulation of ignition sources from Part B.**

   While control of ignition sources is a commonly-addressed subject, the Japanese have performed studies and the ignition of leaks within vehicles does not, in fact, represent a serious hazard. See the attached presentation that was given at the SAE World Congress. They studied leaks ranging from small through a factor of 8 higher allowed post-crash.

   It is, therefore, proposed that the control of ignition sources does not have to be regulated (in Part B of the GTR). As part of the rationale in Part A, a discussion of "standard engineering practice" (SEP) as defined in SAE J2578 and IEC 60079 should be sufficient without any regulatory content to Part B of the GTR.

3. **Improve the definition of allowable hydrogen discharges from hydrogen and fuel cell vehicles**

   There is still an action item to define source and validity of the 3-second rolling-average that is applied to the measurement of exhaust concentration. There is a concern that the 3-second criteria is unnecessarily design restrictive and (at the same time) ineffective in addressing the local hazard of "ignitability". The following proposal is intended to address both concerns.

SAE studied the hazardous associated with hydrogen discharges from vehicles as part of developing SAE J2578, and the hazard was managed by addressing two regions:

1) The local region around the point-of-discharge from the vehicle had to be non-hazardous to people standing in the vicinity. The SAE Safety Working Group developed a performance-based ignition test for vehicle manufacturers to determine that the discharge is non-hazardous for situations where the hydrogen content in the exhaust exceeds 4% hydrogen (the lower flammability limit or LFL).

   Unfortunately, in previous discussions at these meetings, type of test method in SAE J2578 was deemed unnecessarily complicated so an alternative proposal (based on the priniciple) has been developed: limit the hydrogen content to 7-8% in the vehicle exhaust on an instantaneous basis. Testing of flowing discharges has shown that propagation from the ignition source readily occurs above 10% hydrogen, but does not propagate below 7-8%. By limiting the hydrogen content to 7-8%, no hazard is presented to people near the discharge, even if an ignition source is present.

   This criterion can be simply added to the testing of hydrogen concentration already envisioned in the Part B of the draft document.

2) The hydrogen discharge after dispersing into the space immediately surrounding the vehicle should be non-hazardous. In this case, SAE harmonized with the allowable hydrogen concentration used within US building codes and internationally-recognized standards such as IEC 60079 – less than 25% LFL (or 1% hydrogen) – such that the important parameter will be readily accepted by building officials and safety experts.

   In order to define a suitable criterion for the GTR, we again focus our attention on the test method that is already envisioned test of measure the hydrogen concentration in the vehicle exhaust. In item 1) above, we allow an excursion that is above 4% so the remaining question is “how long may this excursion occur such that the general space surrounding the vehicle remains non-hazardous?”

   In order to answer this question and determine the allowable excursion time, an extremely high hydrogen discharge rate (equivalent to the input to a 100 kW engine) was assumed. The allowable time was then calculated for the hypothetical space (as used in SAE) to exceed 25% LFL. The resultant time was 6 seconds for allowable time above. Coverage for a single excursion or multiple, shorter excursions can, therefore, be accomplished by using a “rolling average” of 4% hydrogen over any 12 second period.