Table 4-10: Commissioning and Initial Operations – Safety in Operations.

Safety in the operation of FCBs– see also Planning and Procurement in Sections 2 and 3
In the more than 20 years of European Fuel Cell Bus Demonstration projects, the issue of the safety of the new technology has remained a constant focus. As with all new technologies, each project has developed and refined procedures that have allowed overwhelmingly safe operations. Despite that, during the latter part of the JIVE projects there was a case of an empty FCB being involved in a fire. This event was thoroughly investigated and a public report was issued by the local fire department (in the local language). Unfortunately, the bus company has yet to provide details of their report. Given that fire is not unknown in conventional buses, this is not of itself a cause for alarm. However, the incident does serve to remind all that this is new technology that brings together high voltage electricity with ignitable gas under pressure. Ensuring various parts of a FCB System (buses/bus operation including maintenance, refuelling and hydrogen supply) has been challenging for some. Insurance companies, as for regulators and first responders have few established, customised protocols to work with, although this is changing rapidly. JIVE/JIVE 2 sites have prepared their own Hydrogen Safety Plans from information freely available. These include procedures for H_2 leaks and displaying important emergency contacts. Safe operating protocols must always be observed and constantly reviewed. The experience drawn from reported incidents in the Hydrogen Incidents and Accidents Database HIAD suggests that particularly attention has to be given to these activities when dealing with hydrogen: • Transferring hydrogen from one system to another • Executing repair/maintenance works, • Operating systems manually, • Integrating sub-systems from several providers/contractors (quality assurance, etc.), • Involving non experts (public safety!) **Generally speaking: Good Training and Maintenance = Safe Operations** To learn about HIAD and to download the dataset, go to: https://minerva.jrc.ec.europa.eu/en/shorturl/capri/hiadpt To register an incident on HIAD email: JRC-PTT-H2SAFETY@ec.europa.eu See also Resources in Table 4-13. Numerous commercial bodies can also advise on Hydrogen Safety in Transport.

Table 4-1: Where Route Planning, Training and Safety Intersect: A Recent Incident.

A Recent Incident
One site, for which the routes had been carefully planned, had an incident where the top of an empty bus returning to the depot hit the bottom of a low bridge. This was the result of a driver deciding to take a "short cut" back to base (https://www.rtvdrenthe.nl/nieuws/16246527/streekbus-klem-onder-viaduct-bij-wijster). Due to components on the roof, FCBs are often taller than their diesel counterparts and this was a deviation from the careful route planning. This incident highlights some important lessons: • Training of drivers must ensure they understand FCB differences and emphasise the importance of taking only approved routes (although this had been covered in the driver's initial training) • The hydrogen tanks withstood the impact well and safety valves isolated the vessels that still contained hydrogen. A pressure gauge downstream the safety valves signalled '0 bar'. While the situation was safe in this respect, fire service/emergency services staff need to be aware that a '0 bar' reading at one point of the piping does not necessarily mean that all elements of the system are pressureless/empty. • Even though the main electricity switch of the bus was turned off, the high-voltage electrical system on the roof remained 'live' and the fire service/emergency services' lack of experience with FCBs could have created a dangerous situation. Fortunately, the head