

European Hydrogen Safety Panel (EHSP)
Webinar "Safety planning and management in EU hydrogen and
fuel cell projects", 22 April 2022

Safety plan implementation, monitoring and reporting

Chapter 3 of "Safety planning and management in EU hydrogen and
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<https://www.fch.europa.eu/page/european-hydrogen-safety-panel>

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Up-to-date reference documents (2019 - 2021)



Safety Planning Implementation and Reporting for EU projects



Statistics, lessons learnt and recommendations from the Analysis of the Hydrogen Incidents and Accidents Database (HIAD 2.0)



Simple template for a safety plan Interim publishable version



Template for the assessment of events contained in HIAD 2.0

Key objective of the safety plan :

- safety provisions of systems and processes related to the project
- identify system or process vulnerabilities, select incident scenarios
- assess hazards and associated risks for selected scenarios
- continuously update the initial safety plan during the project execution

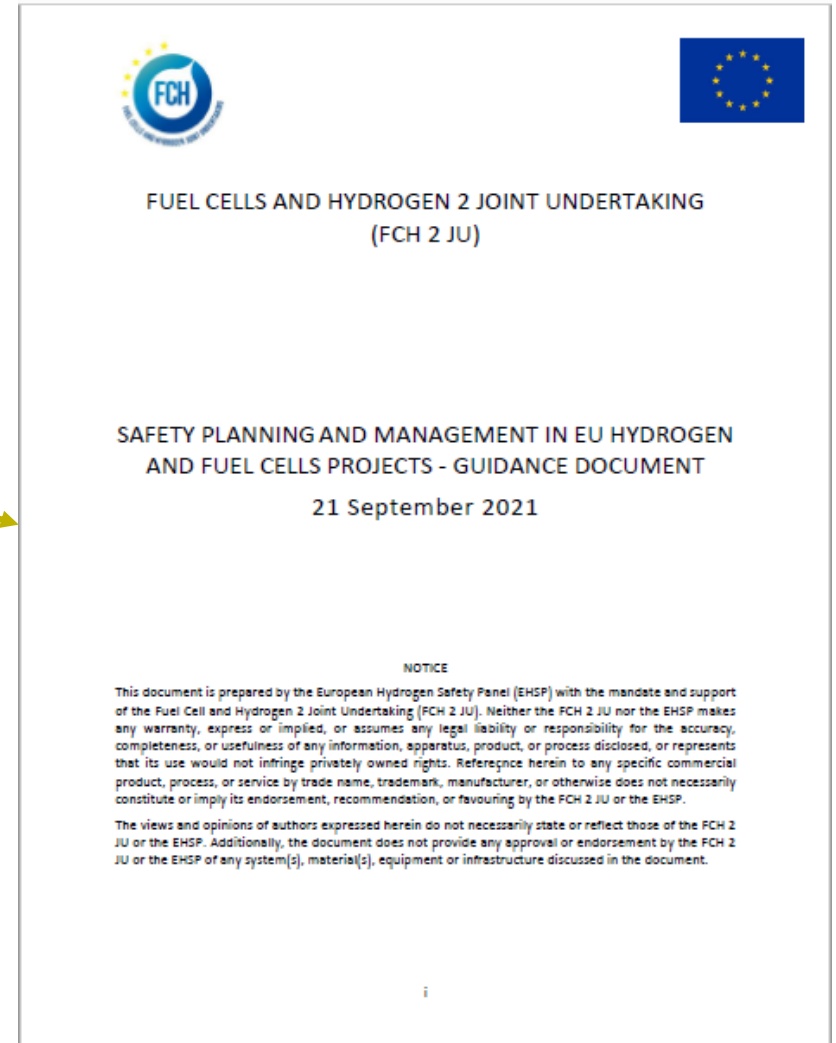


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Successful safety plan development and delivery :

- preparation of detailed safety plan by hydrogen safety experts
- monitoring of its progress during the entire project
- reporting of results and observations

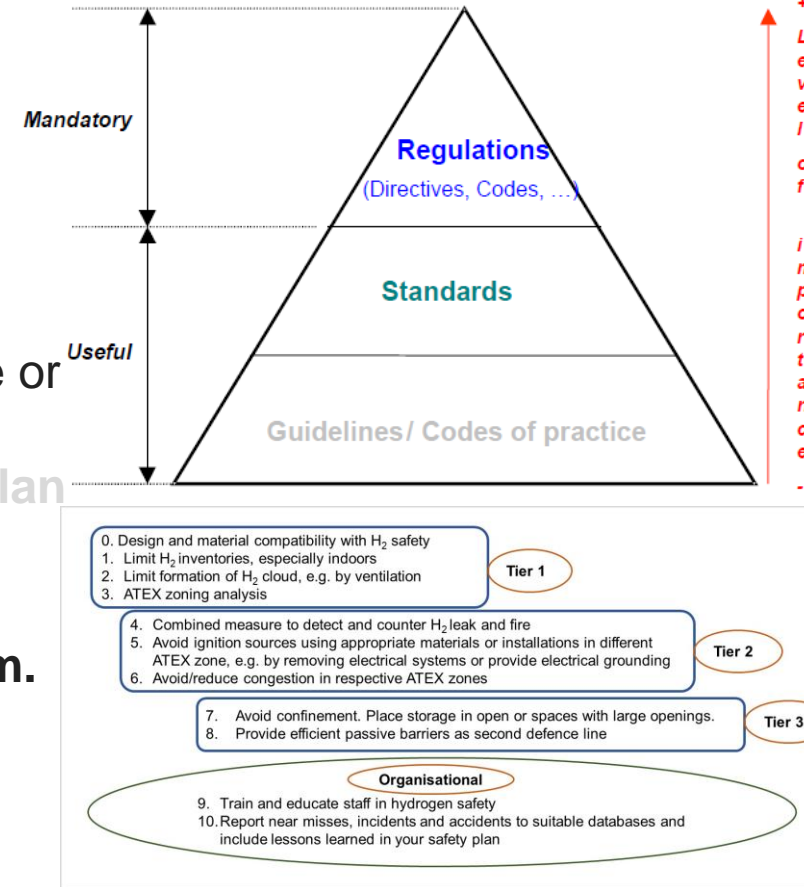
- ✓ **PREPARATION OF SAFETY PLAN**
 - **Project brief (in 2 slides)**
 - **Description of technical hydrogen safety activities (in 1 slide)**
 - **Description of organisational safety activities (in 3 slides)**
 - **Other relevant documentation, safety procedures and outreach activities (in 1 slide)**

- ✓ SAFETY PLAN IMPLEMENTATION, MONITORING AND REPORTING
 - Performing safety reviews
 - Implementation of hydrogen safety engineering process
 - Examples of best practices in hydrogen safety engineering
 - Project safety documentation

- ✓ ...

- **Description of a system, process or infrastructure to be developed by the project:**
 - nature of the work with an emphasis on safety elements: lab-scale, bench-scale, engineering development, prototyping, testing, operation, demonstration, etc.
 - quantity of hydrogen and the form in which it will be handled/stored (CGH₂, CCH₂, LH₂) including replenished in storage and by what method
 - preliminary layout, PID, functional description of each component with geometrical and flow parameters
 - location of activities (facilities, types of personnel, other operations/testing performed at the facility, adjacent facilities), any relevant permits
- **Description of safety systems and their functions.** If there knowledge gaps or safety concerns within the project then the safety plan should describe how it is planned to close these knowledge gaps and technological bottlenecks. It is recommended to have an associated safety-related work package (WP)
- **Safety expertise and responsibilities in the project:** Safety analysis ensuring that safety issues are properly addressed and budgeted; RCS review and safety engineering solutions; inspection and regular reviews of the installation for safe execution; investigation of safety events, formulation of lessons learned and reporting to databases and publicly available sources, etc.

- **Relevant RCS.** Project teams should consult local authorities early in the project. *Appendix 2*
- **Best safety practices.** Hazards and risk assessment procedure, system, process or infrastructure could be identified either at the preparatory stage or at the start of the project. *Appendix 3 gives examples of known best practices to implement safety strategies when preparing the safety plan*
- **Schedule of the safety plan update and reporting**
- **Composition, responsibilities and reporting schedule of a safety team.** The project safety team should include representatives having education, training and experience in safety. The team can be composed of the technical team (solving hydrogen safety issues) and the operational management team dealing with overall safety arrangements beyond the specific hydrogen safety issue. The composition and responsibilities should be identified at the initial stage. External safety experts and representatives of local authorities and first responders could be co-opted to the project hydrogen safety team



- **Identification of safety vulnerabilities, hazards and associated risks**
- **The state-of-the-art** knowledge in the project area, experience of some partners in hydrogen safety research and engineering should be described
- **Selection of incident scenarios**
- **Content and methods of hydrogen safety engineering to be applied**
- **Prevention and mitigation strategies and innovative engineering solutions**
- **Reporting results on hydrogen safety engineering progress and risk assessment as applicable.** The safety plan should be prepared in the way that its monitoring and reporting are clearly defined both in timing and expected results at the particular stage

- **Description of work to be performed by staff that needs formal safety procedures.** Describe how the safety policies and procedures are implemented. Project team members' involvement is important in the development and implementation of the safety plan, its monitoring and reporting. The plan should list existing and planned design, installation/commissioning, operations, and maintenance procedures that describe the steps for the system, apparatus, equipment, facility, etc. Specific safe work practices should be referenced. The whole chain of project activities should be detailed in the safety plan:
 - Operating steps
 - Sample handling and transport: the relevant policies and procedures that are in place to ensure their proper handling
 - Equipment and mechanical Integrity including monitoring and inspection
 - Other relevant work components

The written procedures on safe operations:

- Steps for each operating phase, such as start-up, normal operation, normal and emergency shutdown. Operating limits
- Safety considerations, such as precautions necessary to prevent exposure
- Measures to be taken if physical contact or airborne exposure to hazard occurs
- Safety systems and their functions

- **General safety considerations to prevent harm to people in a workplace**
- **Personnel training and education plan.** Background information and elements related to training are:
 - an overview of the system/process/infrastructure, operating procedures with emphasis on the **hydrogen safety and health hazards**, emergency operations including shutdown, and safe work practices
 - **refresher training** to assure that the personnel understand and adhere to the current standard operating procedures
 - **training documentation** to ensure that all personnel involved in operating has **received and understood the training**
 - the training needs to ensure that a **person can safely perform the job tasks** for people doing maintaining equipment, performing calibrations, etc.
- **Safety review procedures and/or self-audits.** The safety reviews could include:
 - **early project** identification and safety vulnerabilities (**ISV**) and hazards to identify major safety concerns
 - **design stage ISV** to identify safety concerns related to the details of the project
 - **pre-start-up safety review** to make sure that all the hazards and risk reduction plans have been implemented
 - **other safety reviews** including those required by organisational policies and procedures

The plan should describe how the project team will verify that safety-related procedures and practices are being followed through the duration of the project

- **Emergency response arrangements** procedures include communication and interaction with neighbouring occupancies and local emergency response officials. This also includes technical details and specific hazards associated with the hydrogen systems, e.g. high-pressure equipment, electrolysers, electrical circuits, etc.
- **Management of Change (MOC) procedures** are applied to all proposed changes to materials, technology, equipment, procedures, personnel, and facility operation and their effect on safety vulnerabilities. All materials or equipment that is not replaced “in-kind” should be reviewed. Changes to operating procedures should be handled to help avoid unanticipated safety concerns. A MOC review is required for any change that affects the original hazard identification, risk assessment or system safeguards
- **Reporting on safety management and lessons learnt.** The reporting should describe the progress in safety operations and management, how safety events (accidents, incidents and near-misses) will be handled by the team. Sharing information on safety related experience, including lessons learnt and consequences of incidents and accidents, frequency, technical details and the effect of human factors are very important. This information must be reported regularly

Other relevant documentation, safety procedures and outreach activities

- **Positive data reporting.** Integrating this reporting in safety management will contribute deriving appropriate statistics and a more complete view on the safety performance in general
- **Emergency management procedures.** This could include information material for upper management, general public and media
- **Dissemination plan of project findings in hydrogen safety, including closed knowledge gaps and addressed technological bottlenecks.** The plan of generation and sharing useful safety information beyond the project partners to all stakeholders is encouraged

Thank you

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