

# MODULE 1

## WORKSHEET 2: HAZOP RISK ASSESSMENT MAP FOR A HYDROGEN REFUELING STATION

### The Objective

Participants will acquire the skills to recognize potential hazards and deviations from standard practices in hydrogen logistics processes through the **HAZOP (Hazard and Operability Study)** method. They will be instructed in a systematic approach to risk analysis and the formulation of corrective measures.

### Substantive Introduction

**HAZOP** is a systematic and structured risk analysis methodology employed to identify potential deviations from the intended operation of a system, along with their causes and consequences. It is especially beneficial in intricate chemical and energy processes, including those that involve hydrogen. In HAZOP, a team of experts examines individual nodes (components) of the process utilizing keywords (e.g., none, more, less, part, opposite, other than) to uncover possible deviations and their implications. This approach facilitates the proactive identification of safety gaps and the design of effective countermeasures.

Your objective is to perform a streamlined HAZOP analysis for a designated process node of a hydrogen refueling station. Select one of the nodes listed below or suggest an alternative, pending prior approval from the instructor:

- **Unloading** hydrogen from a tanker at the refueling station.
- **Compressing** hydrogen into storage tanks at the refueling facility.
- Hydrogen **refueling** for a vehicle (e.g., car, bus).

For the chosen process node, please complete the HAZOP table provided below.

### HAZOP Analysis Table:

Parameter / Intent	Keyword	Deviation	Possible causes	Effects / Consequences	Existing security measures	Recommended preventive/corrective actions

## Guidelines for Participants

- Select a specific process node and concentrate on it.
- For each parameter/intention (e.g. flow rate, pressure level, thermal state, duration, composition) utilize distinct terminology.
- Exercise creativity in identifying potential causes of deviations; these may include equipment malfunctions, human errors, or external influences.
- Consider all potential consequences—not solely the direct ones, but also the indirect ones (e.g., environmental impact, costs, reputation).
- Recall the current safeguards – what measures are already established to prevent a specific event or alleviate its consequences?
- The paramount consideration is the suggested corrective and preventive measures—what actions can be implemented to enhance safety? Please be specific and pragmatic.
- Prepare to present and discuss your risk assessment map.

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