



## MODULE 4

### WORKSHEET 3: HYDROGEN STORAGE MANAGEMENT SIMULATION WITH WMS

#### Substantive introduction

Simulating practical WMS applications allows us to understand the challenges and benefits of its use. In this worksheet, we will focus on managing a virtual hydrogen storage facility, taking into account the specific characteristics of this medium. Remember that hydrogen, especially at high pressure, requires special storage and handling conditions.

#### In the WMS system, key modules include:

- **Goods receipt:** Delivery records, quality and compliance control.
- **Storage:** Location allocation, space optimization.
- **Picking:** Preparing orders for shipment.
- **Shipping:** Loading and documentation.
- **Inventory management:** Monitoring stock levels, inventory.
- **Batch/Serial Number Tracking:** Critical for security and traceability.

#### For hydrogen, the WMS should also include:

- **Pressure and temperature:** Monitoring tank storage conditions.
- **Expiration dates/technical inspections:** Tank rotation management.
- **Safety Zones:** Separation of different hydrogen types or tanks.
- **Specialized equipment:** Managing the availability of forklifts adapted to Ex zones.

**Task objective:** Simulating warehouse operations using WMS in the context of hydrogen.

**Scenario:** You're the team responsible for managing a hydrogen warehouse that has just received a large shipment of tanks. You need to receive them, properly store them, and prepare them for shipment to several customers.

## Instruction:

**1. Delivery:** You receive a delivery list (Appendix 1). In the WMS system, you must:

- Register a new delivery by entering the details of each tank (type, pressure, production date, last test date).
- Allocate appropriate, safe storage locations in the warehouse, taking into account safety zones and space optimization (you can create a simplified warehouse plan on paper).

**2. Inventory Management:** Review "Inventory Status" (Appendix 2). Identify which tanks are approaching their next inspection date.

**3. Picking and Shipping:** Prepare orders for three customers (Appendix 3). In the WMS system, you must:

- Register orders.
- Select tanks for completion, preferring those that require early shipment (e.g. due to the test date).
- Update inventory after picking.
- Generate shipping documents (e.g. waybill, handover protocol).

## Appendix 1: Sample Delivery Table

ID Tank	Tank Type	Pressure (bar)	Production Date	Date of Last Inspection	Status (new/used)
H2-001	High-pressure	350	[15.01.2024]	[1.06.2024]	New
H2-002	High-pressure	350	[15.01.2024]	[1.06.2024]	New
H2-003	Low-pressure	200	[20.11.2023]	[10.05.2024]	Used

## Appendix 2: Sample Inventory Table

ID Tank	Tank Type	Pressure (bar)	Production Date	Date of Last Inspection	Lokalizacja Magazynowa	Status
H2-004	High-pressure	350	[1.09.2023]	[15.04.2024]	A1-01	Available
H2-005	Low-pressure	200	[10.02.2024]	[1.07.2024]	B2-05	Available

## Appendix 3: Sample Customer Order Table

Client	Order ID	Required tanks (ID)
Client A	Z-001	H2-001, H2-004
Client B	Z-002	H2-003
Client C	Z-003	H2-002

## Tips:

- You can use cards, a board, or a simple spreadsheet to simulate how a WMS works.
- Focus on the logical flow of information and decisions.
- Remember the "first in, first out" (FIFO) or "first out, first out" (FEFO) principle, especially in the context of technical inspection dates.
- Consider how a WMS would help you complete these tasks faster and more safely in reality.

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