Electrification and Sustainable Fire Suppression

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Fire Suppression has Three Purposes

- Save Lives
- Save Equipment
- Protect our Waterways and Environment

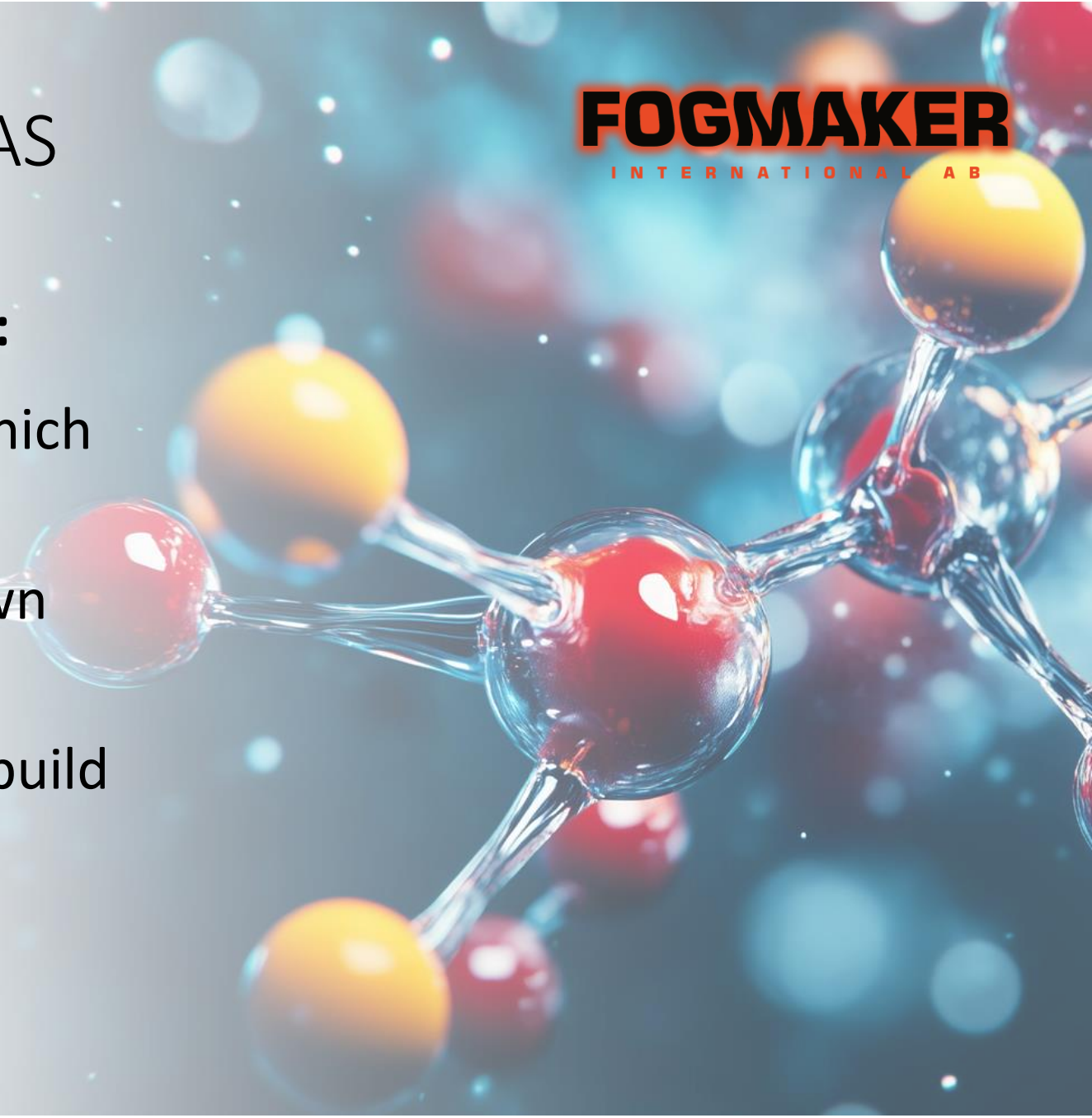
A Demand from Customers and Authorities

- The Swedish environmental legislation (miljöbalken) stipulates that the “most environmentally friendly product” must be selected
- Individual PFAS substances are regulated in legislation at global, EU, and national levels
- A restriction of PFAS is expected to be decided in 2025 (EU)

Suppressants contain(ed) PFAS

Per- and polyfluoroalkyl substances:

- Are stable chemical compounds which remain in nature for a long time
- Many PFAS components break down slowly or not at all
- They can be bioaccumulating and build up in animals and people



“Green” liquids are entering the market

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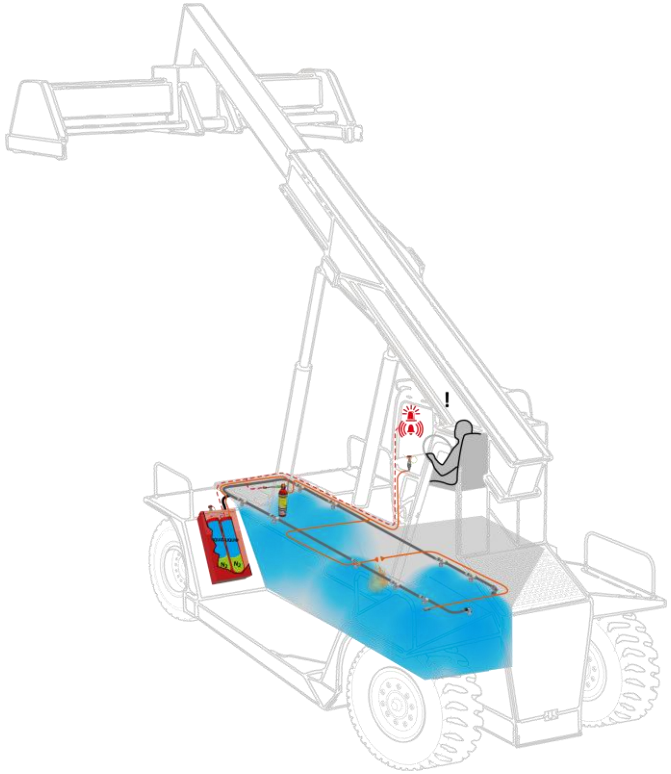
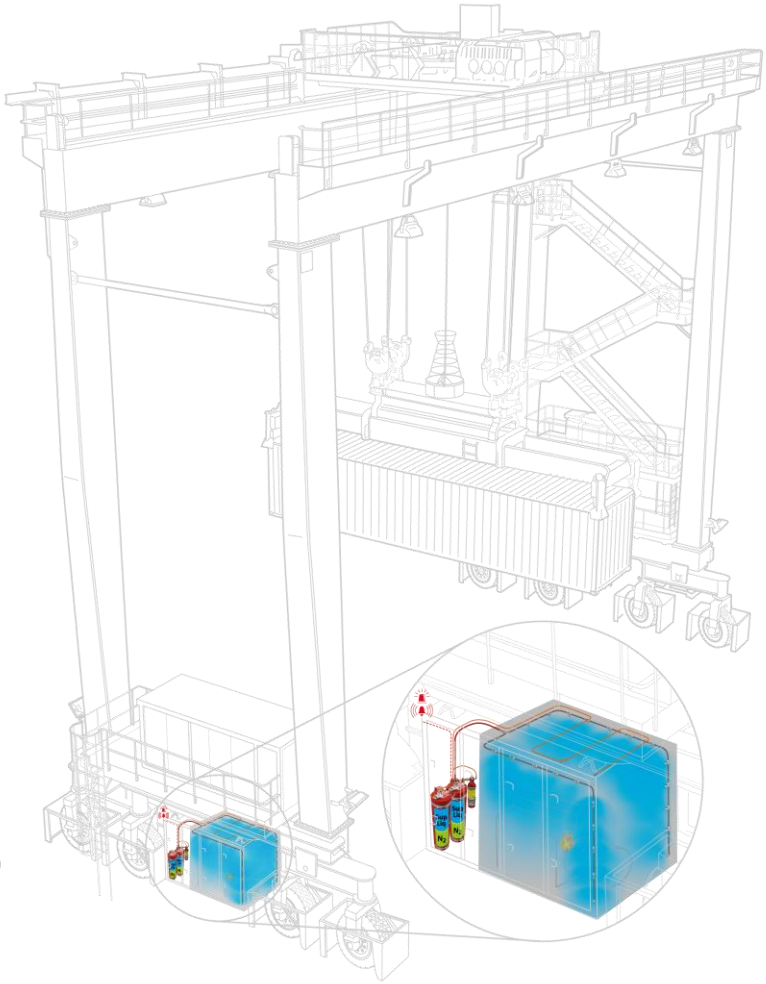
- Traditional suppressants are not bio-degradable (PFAS)
- Suppressants containing PFAS are expected to be banned
- 3M plans to stop PFAS manufacturing by end of this year
- The new suppressants coming out are 100% PFAS free (already legal requirement on some markets)

Going ‘Green’ - Water Based Mist FSS in EVs

Same same, but different

- *EVs are very different compared to conventional vehicles, but…*
- *…FSS installation is still very similar to what we are used to*



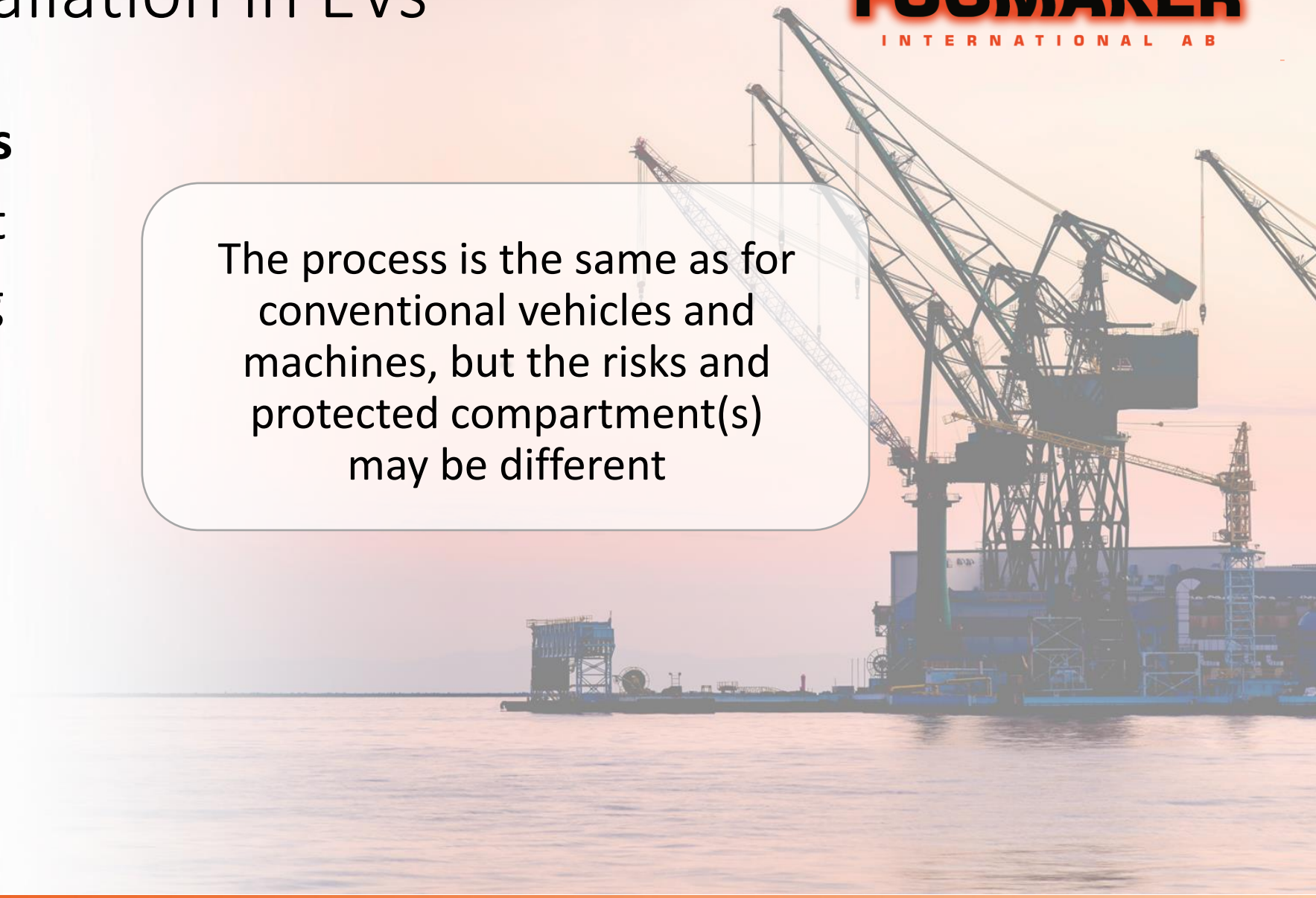


Process for installation in EVs

Installation Process

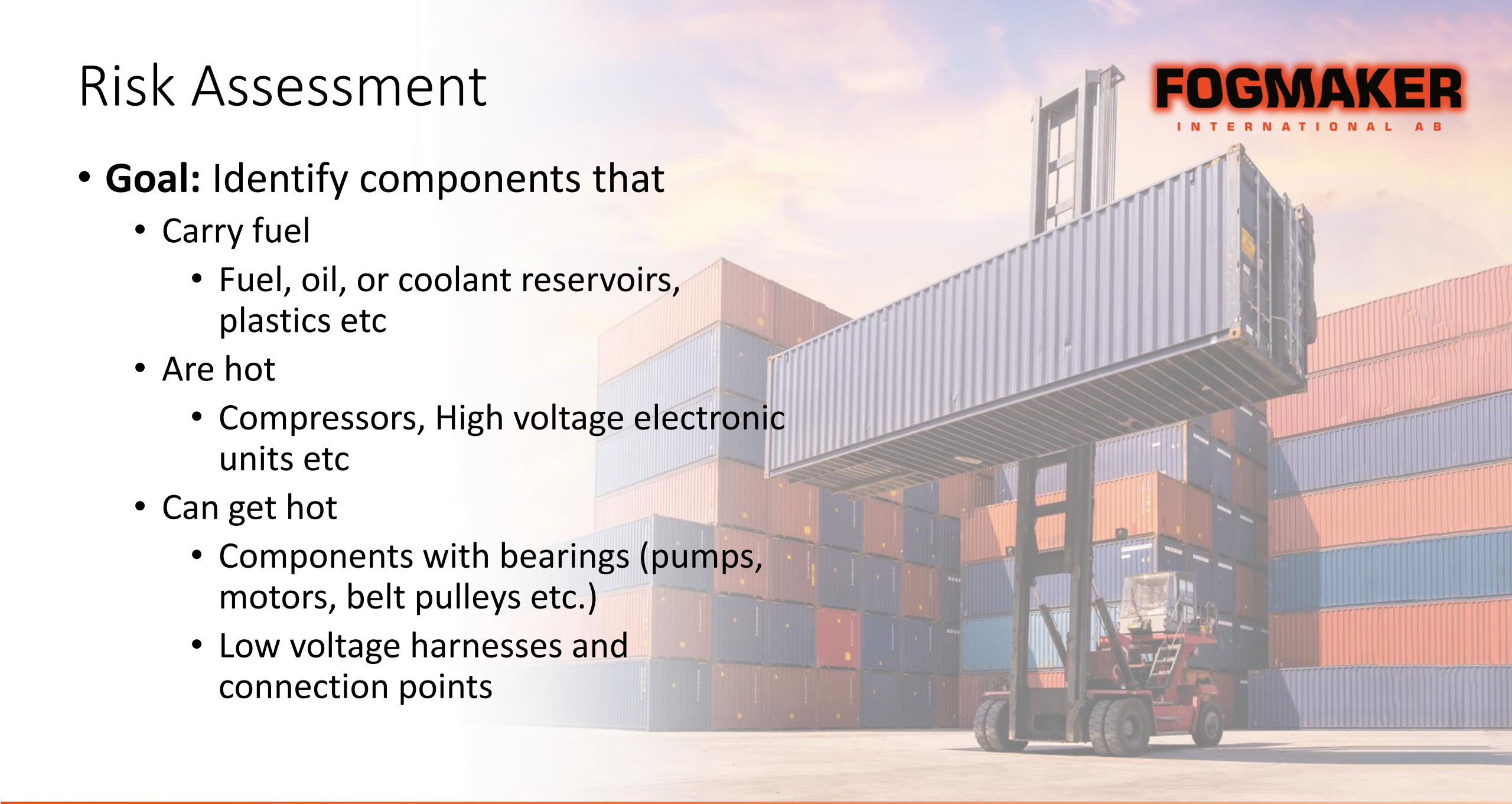
1. Risk Assessment
2. Project Planning
3. Installation
    1. Suppression
    2. Detection
    3. Alarm

The process is the same as for conventional vehicles and machines, but the risks and protected compartment(s) may be different



Risk Assessment

- **Goal:** Identify components that
  - Carry fuel
    - Fuel, oil, or coolant reservoirs, plastics etc
  - Are hot
    - Compressors, High voltage electronic units etc
  - Can get hot
    - Components with bearings (pumps, motors, belt pulleys etc.)
    - Low voltage harnesses and connection points



Common misunderstandings

Question

- Can you get electrocuted if you use water based mist in high voltage areas?

Disclaimer: Always act with caution around high voltage

Answer

- There are (usually) no persons in the compartment we protect.
- The water mist will not penetrate IP 66 or higher.
- High voltage systems are *not grounded* through the chassis as the 24 V system.
- To get electrocuted you need to be in contact with both the *positive and negative* conductor.
- There are several safety features in the vehicle

Common misunderstandings

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Question

- Will the vehicle be damaged if you use water-based fire suppression?

Answer

- Vehicles and machines are designed to withstand rain, road splash, high humidity, condensation from temperature changes and washing.

  As long as there is a IP66-rating there are no problems using Water Based Mist FSS on EVs

What about the Batteries?

- The Li-ion battery is usually the first that comes to mind
- There are many other risks, often also bigger
- Remember, Risk = *Probability* x Consequence
- It is more likely for a fire to start outside the battery pack
- If protected, place Detection tube close to the (battery) vent
- Nozzles can possibly keep flames down
- Extinguishing is not possible from the outside

Summary

- Our strategy is to protect against fires that can spread to the battery pack
- The battery pack can be shielded with water-based mist to reduce flames. It is unlikely to completely extinguish a fire but may give extra time for evacuation
- As long as protected components are IP66 or higher there is no risk for damages caused by water-based mist