Operational Annex Contents

Intervention Strategy Notes

Operational Practice 1 RESCUE

Operational Practice 1 RESCUE		
STEPS	**ACTIONS**	**GOALS**
RECOGNITION	IDENTIFY	- Contact the safety manager of the installation for the details of the incident and obtain site plan; - Take into account the risk of explosion of hydrogen in confined spaces; - Take into account the risk of anoxia in confined spaces.
	PROHIBIT	- Prohibit the progress downwind. It is imperative to establish an exclusion zone of 50 m = evacuation; - Prohibit the use of electrical or electronic devices in the non ATEX exclusion zone (cell phones, radios, etc.).
	INSPECT	- Operate the external power cuts of the building
RESCUE	ACT ISOLATE	**-In case of hydrogen leak in confined spaces:** Wear a self-contained breathing apparatus Remove the affected casualty outside the exclusion zone **- If risk of electrified or electrocuted victim** Use the electro-rescue equipment to remove the victim Avoid contact of the first responders with electrical elements;
PREPAREDNESS/INCIDENT SETTLEMENT		Confirm or refine exclusion zone (50 m) Conduct surveys using an explosimeter (from top to bottom of the installation or storage facility)
PROTECTION		**- Actions to prevent a risk of anoxia:** • Close the hydrogen supply valves • Ventilate the area by promoting the natural drawing (do not use electrical and thermal fans **Action on the electrical risk:** Press the emergency shutdown device of the installation (delay of 20 minutes with the presence of residual current)
CLEAR OUT **OVERHAUL**		The monitoring phase ceases as soon as: the oxygen level in the room is normal (about 20 vol. %) Repeatedly check H2 presence in the atmosphere • the electrical system is secure and supported by a technician

Operational Practice 2 FIRE ON THE ELECTRICAL COMPONENTS

Operational Practice 2 FIRE ON THE ELECTRICAL COMPONENTS		
STEPS	**ACTIONS**	**GOALS**
RECOGNITION	**IDENTIFY**	1. Contact the safety manager of the installation for the details of the incident, obtain site plan; 2. - Take into account the “low voltage” hazards
	PROHIBIT	1. Prohibit downwind progression and imperatively establish an exclusion zone of 50 m = evacuation; 2. Prohibit the use of non ATEX electrical or electronic devices in the exclusion zone (cell phones, radios, etc.).
	INSPECT	1. Operate the external power cuts of the building;
RESCUE	**ACT** **ISOLATE**	1. In case of hydrogen in confined spaces: 2. Wear a breathing apparatus 3. Remove the affected person outside the exclusion zone 4. Administer medical support 5. If risk of electrified or electrocuted victim 6. Use the electro-rescue equipment to remove the victim 7. Avoid contact of the first responders with electrical elements 8. Request specialist support
PREPAREDNESS **INCIDENT** **SETTLEMENT**		1. Confirm or refine exclusion zone (50 m) (based on the sound of a leak under pressure, readings of explosimeter, etc.); 2. Proceed to the extinction of the flame based on its virulence: 3. With a powder or CO2 fire extinguisher at a distance more than > 1m 4. with variable flow-rate nozzles in, spray attack pulse at a distance of more than 3m
PROTECTION		1. Press the emergency shutdown device installation (20 minutes from time with the presence of a residual current); • Take into account the flow of water during the timeout shutdown phase of the installation (electrical hazard); • Close hydrogen supply valves; 2. Ventilate premises facilitating natural drawing (opening existing outlets).
CLEAR OUT **OVERHAUL**		1. Look for high temperature points on hydrogen storage using thermal imaging device on Hydrogen storage (UAV for example if available); 2. The monitoring phase ends when it is found that the actions aimed at extinguishing measures proved effective.

Operational Practice 3 EXTERNAL FIRE THREATENING Application or H2 storage

Operational Practice 3 EXTERNAL FIRE THREATENING Application or H2 storage		
STEPS	**ACTIONS**	**GOALS**
RECOGNITION	IDENTIFY	Contact the safety manager of the installation for the details of the incident, obtain site plan; - Take into account the risk of explosion of a hydrogen tanks under fire, with projections (several tens of meters for bottles to several hundred for trailers).
	PROHIBIT	- Prohibit the progress downwind and imperative to establish an exclusion zone of 50 m = evacuation; - Prohibit the use of non ATEX electrical or electronic devices in the exclusion zone (cell phones, radios, etc.).
	INSPECT	- Operate the external power cuts of the building;
RESCUE	ACT ISOLATE	- In case of hydrogen in confined spaces: Wear a breathing apparatus Remove the affected person/victim outside the exclusion zone Administer medical support - If risk of electrified or electrocuted victim Use the electro-rescue equipment to remove the victim Avoid contact with electrical stakeholder bodies Request specialist support
PREPAREDNESS/ INCIDENT SETTLEMENT		- Confirm or refine the exclusion zone (tanks or Installation directly threatened by the flames); - Proceed with the extinction of fires - Provide preventive cooling of the facilities and hydrogen storage in the following ways: Establishment of a "peacock tail “type nozzle Direct attack spread water jet on the hydrogen tanks using with variable flow-rate nozzles spear 250l/min minimum (avoid directing the jets on pipes) establishment of spread water jet for the protection of sensitive point (power Bay ....)
PROTECTION		Press the emergency shutdown device (20 minutes from time with the presence of a residual current); - Close hydrogen supply valves; - Ventilate premises facilitating natural drawing (opening existing outlets).
CLEAR OUT OVERHAUL		- Look for high temperature points on hydrogen storage using thermal imaging device on hydrogen storage (UAV for example if available); -The monitoring phase ends when it is found that • actions aimed at extinguishing proved effective. • the water spread on the hydrogen tanks do not evaporate on contact with surfaces

Operational Practice 4 IGNITED HYDROGEN LEAK

Operational Practice 4 IGNITED HYDROGEN LEAK		
STEPS	**ACTIONS**	**GOALS**
RECOGNITION	IDENTIFY	1. Contact the safety manager of the installation for the details of the incident, obtain site plan; **2.** Take into account the dispersion of H_2 in premises before the ignition (possibility of UVCE unconfined vapour cloud explosion).
	PROHIBIT	1. Prohibit downwind progression and imperatively establish an exclusion zone of 50 m = evacuation; 2. Prohibit the use of non ATEX electrical or electronic devices in the exclusion zone (cell phones, radios, etc.). 3. Prohibit the extinguishment of the hydrogen flames. 4. - Prohibit the actions on the electrical system of the facility in case of hydrogen leak.
	INSPECT	1. Operate the external power cuts of the building 2. Confirm the presence of an ignited leak ghost and its length using thermal camera (hardly visible flame in its entirety, in the day light); 3. - Pay attention to the significant sound of an ignite gas leak.
RESCUE	ACT ISOLATE	**In case of hydrogen in confined spaces:** • Wear a breathing apparatus • Remove the affected person(s) outside the exclusion zone • Administer medical assistance **If risk of electrified or electrocuted victim** • Use the electro-rescue equipment to remove the victim • Avoid contact with electrical stakeholder bodies • Seek specialist support
PREPAREDNESS INCIDENT SETTLEMENT		1. Refine the exclusion area (explosimeter measurements, information on the nature of the incident ...); 2. Set up water curtains to prevent a fire spread; 3. - If necessary, provide preventive cooling on hydrogen storage and facilities nearby.
PROTECTION		1. Close hydrogen supply valves; 2. Ventilate premises facilitating natural drawing (opening existing outlets).
CLEAR OUT OVERHAUL		1. Look for high temperature points on hydrogen storage using thermal imaging device on Hydrogen storage (UAV for example if available); 2. Conduct surveys of explosimeter in confined spaces prioritizing high points; 3. Press the emergency shutdown device of the installation (delay of 20 minutes with the presence of a residual current).

Operational Practice 5 IGNITED HYDROGEN LEAK

Operational Practice 5 IGNITED HYDROGEN LEAK		
STEPS	**ACTIONS**	**GOALS**
RECOGNITION	IDENTIFY	- Contact the safety manager of the installation for the details of the incident, obtain site plan; - Take into account the dispersion of H_2 in premises before the ignition (possibility of UVCE unconfined vapour cloud explosion).
	PROHIBIT	- Prohibit downwind progression and imperatively establish an exclusion zone of 50 m = evacuation; - Prohibit the use of non ATEX electrical or electronic devices in the exclusion zone (cell phones, radios, etc.). - Prohibit the extinguishment of the hydrogen flames. - Prohibit the actions on the electrical system of the facility in case of hydrogen leak.
	INSPECT	- Operate the external power cuts of the building - Confirm the presence of an ignited leak ghost and its length using thermal camera (hardly visible flame in its entirety, in the day light); - Pay attention to the significant sound of an ignite gas leak.
RESCUE	ACT ISOLATE	**- In case of hydrogen in confined spaces:** Wear a breathing apparatus Remove the affected person(s) outside the exclusion zone Administer medical assistance **If risk of electrified or electrocuted victim** Use the electro-rescue equipment to remove the victim Avoid contact with electrical stakeholder bodies Seek specialist support
PREPAREDNESS/INCIDENT SETTLEMENT		Refine the exclusion area (explosimeter measurements, information on the nature of the incident ...); Set up water curtains to prevent a fire spread; If necessary, provide preventive cooling on hydrogen storage and facilities nearby.
PROTECTION		Close hydrogen supply valves; Ventilate premises facilitating natural drawing (opening existing outlets).
CLEAR OUT **OVERHAUL**		Look for high temperature points on hydrogen storage using thermal imaging device on Hydrogen storage (UAV for example if available); Conduct surveys of explosimeter in confined spaces prioritizing high points; Press the emergency shutdown device of the installation (delay of 20 minutes with the presence of a residual current).

Operational Practice 6 UNIGNITED HYDROGEN LEAK

Operational Practice 6 UNIGNITED HYDROGEN LEAK		
STEPS	**ACTIONS**	**GOALS**
RECOGNITION	IDENTIFY	- Contact the safety manager of the installation for the details on the incident, obtain site plan; - Take into account the risk of explosion
	PROHIBIT	- Prohibit downwind progression and imperatively establish an exclusion zone of 50 m = evacuation; - Prohibit the use of non ATEX electrical or electronic devices in the exclusion zone (cell phones, radios, etc.). - Prohibit the actions on the electrical system of the facility in case of hydrogen leak.
	INSPECT	- Operate the external power cuts of the building
RESCUE	ACT ISOLATE	- In case of hydrogen in confined spaces: • Wear a breathing apparatus • Remove the affected person (s) outside the exclusion zone • Administer medical assistance - If risk of electrified or electrocuted victim • Use the electro-rescue equipment to remove the victim • Avoid contact with electrical stakeholder bodies • Seek specialist support
PREPAREDNESS/ **INCIDENT SETTLEMENT**		- Refine the security area based explosimeter measurements (from top to bottom of the installation); - Close hydrogen supply valves; - Ventilate premises facilitating natural drawing (opening existing outlets).
PROTECTION		
CLEAR OUT **OVERHAUL**		- The monitoring phase ends when there is no risk of explosion in a secure area (complete emptying of the tank or draining in open air in a secure area monitored by the operator, efficient ventilation of the premises) - Press the electrical emergency shutdown device of the installation (delay of 20 minutes with the presence of a residual current)

Tactical Notes

Important notice: Remember that the **casting** distances are INDICATIVE.
The incident commander must enlarge or reduce the safety perimeter, taking into account the reality of the situation and in particular, the capacity of the H_2, LH_2 (or O_2) tank concerned.

Tactic 1 FC CAR / FC FORKLIFT / FC BUS / FC TRUCKS / FC TRAINS / FC SHIP NO LEAK NO FIRE (technical alarm, work accident, road traffic accident)

FC CAR / FC FORKLIFT / FC BUS / FC TRUCKS / FC TRAINS / FC SHIP		Hy Responder
Tactic Number 1	**NO LEAK NO FIRE** (technical alarm, work accident, road traffic accident)	
AT THE FIRE STATION		
TAKE USEFUL information ABOUT THE INCIDENT • **Assure the precise incident location (may include using vehicle tracking)** • **Are there any person involved in the incident?** • **Type of vehicle concerned with manufacturer's emergency response guidance** • **What happened?** **TAKE USEFUL INFORMATION ABOUT THE METEOROLOGICAL SITUATION** • **Wind direction** • **Wind speed** **ITINERARY, choose a safe itinerary** • **Do not cross an eventual explosive gas cloud** • **Do not reach scene from bellow** • **Anticipate the need of a hydrant** **TAKE FOLLOWING TOOLS (if available use drone UAV)** • **Gaseous hydrocarbons detector** • **H2 detector** • **O2 detector** • **Thermal imaging camera**		
ARRIVAL ON SCENE		
ARRIVAL • **Choose a safe way to get to the incident ground, preventing the fire appliance to cross a flammable gas cloud, and make sure to arrive upwind** • **Stop the fire appliance 50 meters before the incident** • **Away from a possible ignited flammable liquid leak progression distance** • **Engage the pump and connect the fire appliance to a hydrant** **SAFETY AREA** • **Set up a safety area for the public beyond a radius of 50 meters** • **Ensure that unauthorized/untrained personnel do not enter the hazardous area** •		
SIZE UP THE SCENE		
QUESTION WITNESSES AND OBSERVE, SEEK ANSWERS TO THE FOLLOWING QUESTIONS		

- **What type of vehicle is affected?**
- **What happened?**
- **Vehicle gas tank size and content in litres**
- **Is someone injured? Threatened?**
- **Has a leak occurred? Is a leak still occurring?**
- **Is a part of the vehicle damaged?**

Check energies present in the involved vehicle (tank type, refueling hose type, vehicle registration papers...)
Identify Vehicle (H2 car may be identified by FCHV Fuel Cell Hybrid Vehicle badges)
Operate H2 detector

RESCUE

Rescue of humans override all but personal safety considerations

Engage rescue as a conventional accident with hazmat support

EXPOSURE PROTECTION

- **Use only necessary personnel**
- **Open the doors and hoods (if present)**
- **Set parking brake**
- **Wedge the vehicle**
- **Turn off the ignition key**
- **Press the fuel cell emergency shutdown device**
- **For bus, an emergency shutdown device is generally located near the driver seat on left side and another is on fuel cell in "engine" compartment, located at the back of the bus.**
- **For trucks, trains and ships: safety data sheets or on-board rescue sheet**
- **If it's not possible to reach Ignition key, remove all the fuses in the fuse boxes and then, cut the negative low voltage battery cable (12 or 24V) taking care not to create an ignition spark**
- **Repeatedly check H2 presence in the atmosphere. If H2 is detected apply H2 leak tactic**
- **Check if high temperature points exist on the vehicle (more than 150°C/302°F)**
- **Stretch a fire hose line to protect the action of teams**

INCIDENT TREATMENT

If no H2 leak and no sign of fire is detected

- **Engage incident settlement following manufacturers Emergency Response Guides**

DO NOT

- **Cut or crush H2 lines**
- **Cut or crush High Voltage Lines (orange)**
- **Damage H2 tank**
- **Damage traction Battery Stack**

If a H2 leak is detected, apply tactic n°2 "H2 LEAK WITHOUT FIRE"

OVERHAUL

After a last H2 atmospheric control, make sure that the vehicle or the wreckage is evacuated by authorised personnel (ideally manufacturer)

FC CAR / FC FORKLIFT / FC BUS / FC TRUCKS / FC TRAINS / FC SHIP		Hy Responder
Tactic Number 2	**H2 LEAK WITHOUT FIRE**	

AT THE FIRE STATION

TAKE USEFUL information ABOUT THE INCIDENT

- **Assure the precise incident location (may include using vehicle tracking)**
- **Are there any person involved in the incident?**
- **Type of vehicle concerned with manufacturer's emergency response guidance**
- **What happend?**

TAKE USEFUL INFORMATION ABOUT THE METEOROLOGICAL SITUATION

- **Wind direction**
- **Wind speed**

ITINERARY, choose a safe itinerary

- **Do not cross an eventual explosive gas cloud**
- **Do not reach scene from bellow**
- **Anticipate the need of a hydrant**

TAKE FOLLOWING TOOLS (if availble use drone UAV)

- **Gaseous hydrocarbons detector**
- **H2 detector**
- **O2 detector**
- **Thermal imaging camera**

ARRIVAL ON SCENE

ARRIVAL

- **Choose a safe way to get to the incident ground, preventing the fire appliance to cross a flammable gaz cloud, and make sure to arrive upwind**
- **Stop the fire appliance 50 meters before the incident**
- **Away from a possible ignited flammable liquid leak progression**
- **Engage the pump and connect the fire appliance to a hydrant**

SAFETY AREA

- **CAR and FORKLIFT Set up a safety area for the public beyond a radius of 100 meters**
- **BUS, truck, train, ship: Set up a safety area for the public beyond a radius of 200 meters**
- **Ensure that unauthorized/untrained personnel do not enter the hazardous area**

SIZE UP THE SCENE

IF A PERSON IS INSIDE THE HAZARDOUS AREA, ENGAGE RESCUE OPERATIONS
IF NO ONE IS INSIDE THE HAZARDOUS AREA, answer the following questions

- **What type of vehicle is affected?**
- **What happened?**

• **Vehicle gas tank size and content in litres** • **Has a loud hissing sound been eared before the FR arrive?** **Vehicle identification, H2 car may be identified by FCHV Fuel Cell Hybrid Vehicle badges** **Confirm the safety area with the H2 detector** **If H2 is detected, refine the safety area** **Check if high temperature points exist on the vehicle (more than 150°C/302°F)**
RESCUE
Rescue of humans override all but personal safety considerations **Engage rescue as a conventional accident with hazmat support, if a human is threatened or concerned by the gas leak** **• Team 1: extract the victim(s) from the danger zone by any possible means** **• Team 2: stretch a fire hoseline to protect the action of the team 1 in case of an ignition of the cloud** **Evacuate the passengers in the opposite direction of the wind**
EXPOSURE PROTECTION
Use only necessary personnel **Evacuate adjacent buildings** **If the vehicle is in a building, prevent H2 accumulation by operating wide ventilation of the building** **Open the doors and hoods (if present)** **Set parking brake** **Wedge the vehicle** **Turn off the ignition key** **Press the fuel cell emergency shutdown device** **For busses, an emergency shutdown device is generaly located near the driver seat on left side and another is on fuel cell in "engine" compartment, located at the back of the bus.** **For trucks, trains and ships: safety data sheets or on-board rescue sheet** **Do not operate any other electrical breaker to avoid creation of electrical spark** **Repeatedly check H2 presence in the atmosphere** **Refine safety area** **Check if high temperature points exist on the vehicle (more than 150°C/302°F)**
INCIDENT TREATMENT
If H2 Leak still exist after "exposure protection step "anf if it exists, close H2 valve as close as possible of the H2 tank **If it is not possible to reach a H2 valve, allow H2 to leak safely until the tank is empty**
OVERHAUL
After a last H2 atmospheric control, Make sure that the vehicle or the wreckage is evacuated by authorized personnels (idealy manufacturer)

FC CAR / FC FORKLIFT / FC BUS / FC TRUCKS / FC TRAINS / FC SHIP		Hy Responder
Tactic n° 3	**FIRE**	

AT THE FIRE STATION

TAKE USEFUL information ABOUT THE INCIDENT

- **Assure the precise incident location (may include using vehicle tracking)**
- **Are there any person involved in the incident?**
- **Type of vehicle concerned with manufacturer's emergency response guidance**
- **What happend?**

TAKE USEFUL INFORMATION ABOUT THE METEOROLOGICAL SITUATION

- **Wind direction**
- **Wind speed**

ITINERARY, choose a safe itinerary

- **Do not cross an eventual explosive gas cloud**
- **Do not reach scene from bellow**
- **Anticipate the need of a hydrant**

TAKE FOLLOWING TOOLS (if availble use drone UAV)

- **Gaseous hydrocarbons detector**
- **H2 detector**
- **O2 detector**
- **Thermal imaging camera**

ARRIVAL ON SCENE

ARRIVAL

- **Choose a safe way to get to the incident ground, preventing the fire appliance to cross a flammable gaz cloud, and make sure to arrive upwind**
- **Stop the fire appliance 50 meters before the incident**
- **Away from a possible ignited flammable liquid leak progression**
- **Engage the pump and connect the fire appliance to a hydrant**

SAFETY AREA

- **CAR and FORKLIFT Set up a safety area for the public beyond a radius of 100 meters**
- **BUS, truck, train, ship:Set up a safety area for the public beyond a radius of 200 meters**
- **Ensure that unauthorized/untrained personnel do not enter the hazardous area**

SIZE UP THE SCENE

IF A PERSON IS INSIDE THE HAZARDOUS AREA, ENGAGE RESCUE OPERATIONS then answer the following questions

- **Is someone threatened by the fire? Where?**
- **How many vehicles are involved in the fire?**
- **How many of these vehicles are powered by H2 or another compressed flammable Gaz?**
- **Has a loud hissing sound been eared before the FR arrive?**

Vehicle identification, H2 car may be identified by FCHV Fuel Cell Hybrid Vehicle badges

RESCUE

Rescue of humans override all but personal safety considerations

Engage rescue as a conventional accident with hazmat support, if a human is threatened or concerned by the fire
- **Team 1: extract the victim(s) from the danger zone by any possible means**
- **Team 2: stretch a fire hoseline to protect the action of the team 1**

Evacuate the passengers in the opposite direction of the wind

EXPOSURE PROTECTION

Use only necessary personnel
Evacuate adjacent buildings
Prevent the fire from spreading to a uninvolved vehicle(s) or building(s)
Move ajacent non involved vehicles by any way possible (driving, towing, pushing…)
If the vehicle is in a building, prevent combustion gases and H2 accumulation by operating wide ventilation of the building

Open the doors and hoods (if present)
Set parking brake
Wedge the vehicle
Turn off the ignition key
Press the fuel cell emergency shutdown device

For buses, an emergency shutdown device is generaly located near the driver seat on left side and another is on fuel cell in "engine" compartment, located at the back of the bus.

For trucks, trains and ships: safety data sheets or on-board rescue sheet

Repeatedly check H2 presence in the atmosphere
Refine safety area
Repeatedly check H2 tanks temperature with thermal imaging device

INCIDENT TREATMENT

In case of High stake level situation, operate an offensive fire attack, each team prepare 80 m of hoselines directly connected to the fire appliance pump
- **Team 1: aims to cool the H2 tank and so doing prevent Thermal Pressure Release Device to operate**
- **Team 2: aims to extiguish the vehicle fire**

The teams avoid passing through danger angles

Mind that violent reactions are possible between water and burning materials
as soon as possible, wedge the vehicle

Mind that water will be polluted during extinction (especialy if battery is damaged.), operate its containement

In there is no identified stake, evaluate the opportunity to let the vehicle burn safely

OVERHAUL

- **Cool the wreckage as soon as no heat point is detected by the thermal imaging device**
- **After a last H2 atmospheric control, Make sure that the vehicle or the wreckage is evacuated by authorized personnels (idealy manufacturer)**

FC CAR / FC FORKLIFT / FC BUS / FC TRUCKS / FC TRAINS / FC SHIP		
Tactic Number 4	**EXTERNAL FIRE THREATENING THE APPLICATION**	

AT THE FIRE STATION

TAKE USEFUL information ABOUT THE INCIDENT

- Assure the precise incident location (may include using vehicle tracking)
- Are there any person involved in the incident?
- Type of vehicle concerned with manufacturer's emergency response guidance
- What happend?

TAKE USEFUL INFORMATION ABOUT THE METEOROLOGICAL SITUATION

- Wind direction
- Wind speed

ITINERARY, choose a safe itinerary

- Do not cross an eventual explosive gas cloud
- Do not reach scene from bellow
- Anticipate the need of a hydrant

TAKE FOLLOWING TOOLS (if availble use drone UAV)

- Gaseous hydrocarbons detector
- H2 detector
- O2 detector
- Thermal imaging camera

ARRIVAL ON SCENE

ARRIVAL

- Choose a safe way to get to the incident ground, preventing the fire appliance to cross a flammable gaz cloud, and make sure to arrive upwind
- Stop the fire appliance 50 meters before the incident
- Away from a possible ignited flammable liquid leak progression
- Engage the pump and connect the fire appliance to a hydrant

SAFETY AREA

- CAR and FORKLIFT Set up a safety area for the public beyond a radius of 100 meters
- BUS, truck, train, ship: Set up a safety area for the public beyond a radius of 200 meters (220 yd)
- Ensure that unauthorized/untrained personnel do not enter the hazardous area

SIZE UP THE SCENE

Answer the following questions

- What is burning?
- What's the fire strength?
- What's the distance between the fire and the FCH vehicle?

- **Is someone injured? Threatened?**
- **Has a leak occured? Is a leak still occuring?**

RESCUE

Rescue of humans override all but personal safety considerations

Engage rescue as a conventional accident with hazmat support.

If a human is threatened or concerned by the fire

- **Team 1: extract the victim(s) from the danger zone by any possible means**
- **Team 2: stretch a fire hoseline to protect the action of the team 1**

Evacuate the passengers in the opposite direction of the wind

EXPOSURE PROTECTION

Team 1: attenuate the radiant heat by providing a water spray curtain between the fire and the FCH vehicle.

INCIDENT TREATMENT

Operate an defensive fire attack, each team prepare 80 m of hoselines directly connected to the fire appliance pump

- **Team 1: attenuate the radiant heat by providing a water spray curtain between the fire and the FCH vehicle**
- **Team 2: put out the fire with water, foam or powder depending what is burning**

If putting fire out is not possible, or if enouth personnel is available, move the FCH vehicle by any way possible (driving, towing, pushing…) away from the radiant effect of the fire

OVERHAUL

Check temperature on the FCH vehicle with thermal imaging device

Tactic 5 H2 (LH2) Trailer NO LEAK NO FIRE (technical alarm, work accident, road traffic accident)

H2 (LH2) trailer		
Tactic Number 5	**NO LEAK NO FIRE (technical alarm, work accident, road traffic accident)**	
AT THE FIRE STATION		
TAKE USEFUL information ABOUT THE INCIDENT • Assure the precise incident location (may include using vehicle tracking) • Are there any person involved in the incident? • Type of vehicle concerned with manufacturer's emergency response guidance • What happend? **TAKE USEFUL INFORMATION ABOUT THE METEOROLOGICAL SITUATION** • Wind direction • Wind speed **ITINERARY, choose a safe itinerary** • Do not cross an eventual explosive gas cloud • Do not reach scene from bellow • Anticipate the need of a hydrant **TAKE FOLLOWING TOOLS (if availble use drone UAV)** • Gaseous hydrocarbons detector • H2 detector • O2 detector • Thermal imaging camera		
ARRIVAL ON SCENE		
ARRIVAL • Choose a safe way to get to the incident ground, preventing the fire appliance to cross a flammable gaz cloud, and make sure to arrive upwind • Stop the fire appliance 50 meters before the incident • Away from a possible ignited flammable liquid leak progression • Engage the pump and connect the fire appliance to a hydrant **SAFETY AREA** • Set up a safety area for the public beyond a radius of 50 meters • Ensure that unauthorized/untrained personnel do not enter the hazardous area		
SIZE UP THE SCENE		
BY QUESTIONNING THE WITNESSES AND OBSERVATION, ANSWER THE FOLLOWING QUESTIONS • Which Type is the involved vehicle? • What has happened? • Is someone injured? Threatened? • Has a leak occured? Is a leak still occuring? • Is a part of the truck damaged? • Is the trailer dismanteled?		

Check energies present in the involved vehicle (tank type, refuelling hole type, vehicle registration papers...)
Does a flammable liquid leak exists?
Operate H2 detector

RESCUE

Rescue of humans override all but personal safety considerations
Engage rescue as a conventional accident with hazmat support

EXPOSURE PROTECTION

Use only necessary personnel
Set parking brake
Wedge the vehicle
Turn off the ignition key

Repeatedly check H2 presence in the atmosphere. If H2 is detected apply H2 leak tactic
Check if high temperature points exist on the vehicle (more than 150°C/302°F)
Stretch a fire hoseline to protect the action of other teams

INCIDENT TREATMENT

Check and close every H2 valve on the trailer
If no H2 leak and no sign of fire is detected, engage incident settlement following usual road trafic accident and extrication guidelines

DO NOT

- **cut or crush H2 lines**
- **damage H2 tanks**

If the trailer is dimanteled, inspect individualy each cylinder, contact the transport company hotline to evacuate safely the cylinders

OVERHAUL

After a last H2 atmospheric control, make sure that the vehicle or the wreckage and the cargo is evacuated by authorized personnels (idealy transport company

Tactic 6 H2 Trailer H2 LEAK WITHOUT FIRE

H2 trailer		
Tactic Number 6	**H2 LEAK WITHOUT FIRE**	
AT THE FIRE STATION		
TAKE USEFUL information ABOUT THE INCIDENT • Assure the precise incident location (may include using vehicle tracking) • Are there any person involved in the incident? • Type of vehicle concerned with manufacturer's emergency response guidance • What happend? • Type of trailer concerned? Size, full or empty? • Is the cargo dismanteled? **TAKE USEFUL INFORMATION ABOUT THE METEOROLOGICAL SITUATION** • Wind direction • Wind speed **ITINERARY, choose a safe itinerary** • Do not cross an eventual explosive gas cloud • Do not reach scene from bellow • Anticipate the need of a hydrant **TAKE FOLLOWING TOOLS (if availble use drone UAV)** • Gaseous hydrocarbons detector • H2 detector • O2 detector • Thermal imaging camera		
ARRIVAL ON SCENE		
ARRIVAL • Choose a safe way to get to the incident ground, preventing the fire appliance to cross a flammable gaz cloud, and make sure to arrive upwind. • Stop the fire appliance 50 meters before the incident • Away from a possible ignited flammable liquid leak progression • Engage the pump and connect the fire appliance to a hydrant. **SAFETY AREA** • Set up a safety area for the public beyond a radius of 100 meters • Ensure that unauthorized/untrained personnel do not enter the hazardous area		
SIZE UP THE SCENE		
IF A PERSON IS INSIDE THE HAZARDOUS AREA, ENGAGE RESCUE OPERATIONS **IF NO ONE IS INSIDE THE HAZARDOUS AREA, BY QUESTIONNING THE WITNESSES (DRIVER) AND OBSERVATION, ANSWER THE FOLLOWING QUESTIONS** • Which Type is the involved vehicle? • What happened? • Is the trailer dismanteled? • Has a loud hissing sound been eared before the FR arrive?		

Confirm the safety area with the H2 detector . If H2 is detected, refine the safety area
Check if high temperature points exist on the vehicle (more than 150°C/302°F)

RESCUE

Rescue of humans override all but personal safety considerations
Engage rescue as a conventional accident with hazmat support
If a human is threatened or concerned by the gas leak

- **Team 1 : extract the victim(s) from the danger zone by any possible means**
- **Team 2 : stretch a fire hoseline to protect the action of the Team 1 in case of an ignition of the cloud**

EXPOSURE PROTECTION

Use only necessary personnel
Set parking brake
Wedge the vehicle
Turn off the ignition key

Check if high temperature points exist on the vehicle (more than 150°C/302°F)
Stretch a fire hoseline to protect the action of other teams

INCIDENT TREATMENT

Listen to abnormal noises
Repeatedly check H2 presence in the atmosphere.
Check and close every H2 valve on the trailer
If there is no means for preventing H2 leak, and no identified stake
evaluate the opportunity to let the vehicle leak safely

OVERHAUL

After a last H2 atmospheric control, Make sure that the vehicle or the wreckage and the cargo is evacuated by authorized personnels (idealy transport company)

Tactic 7 H2 Trailer FIRE

H2 trailer		
Tactic Number 7	**FIRE**	
AT THE FIRE STATION		
TAKE USEFUL information ABOUT THE INCIDENT • Assure the precise incident location (may include using vehicle tracking) • Are there any person involved in the incident? • Type of vehicle concerned with manufacturer's emergency response guidance • What happend? • Type of trailer concerned? Size, full or empty? • Is the cargo dismanteled? **TAKE USEFUL INFORMATION ABOUT THE METEOROLOGICAL SITUATION** • Wind direction • Wind speed **ITINERARY, choose a safe itinerary** • Do not cross an eventual explosive gas cloud • Do not reach scene from bellow • Anticipate the need of a hydrant **TAKE FOLLOWING TOOLS (if availble use drone UAV)** • Gaseous hydrocarbons detector • H2 detector • O2 detector Thermal imaging camera		
ARRIVAL ON SCENE		
ARRIVAL • Choose a safe way to get to the incident ground, preventing the fire appliance to cross a flammable gaz cloud, and make sure to arrive upwind. • Stop the fire appliance 50 meters before the incident • Away from a possible ignited flammable liquid leak progression • Engage the pump and connect the fire appliance to a hydrant. **SAFETY AREA** • Set up a safety area for the public beyond a radius of 500 meters • Ensure that unauthorized/untrained personnel do not enter the hazardous area		
SIZE UP THE SCENE		
IF A PERSON IS INSIDE THE HAZARDOUS AREA, ENGAGE RESCUE OPERATIONS **IF NO ONE IS INSIDE THE HAZARDOUS AREA, BY QUESTIONNING THE WITNESSES (DRIVER) AND OBSERVATION, ANSWER THE FOLLOWING QUESTIONS** • Which Type is the involved vehicle? • What happened? • Is the trailer dismanteled? • Is a cylinder involved in fire? **Check the fire scene with the thermal imaging camera**		

• **Is a cylinder provide a ignited H2 leak?** • **Is a cylinder impinged by a flame dart?**
RESCUE
Rescue of humans override all but personal safety considerations **Engage rescue as a conventional accident with hazmat support, if a human is threatened or concerned by the gas leak** • **Team 1: extract the victim(s) from the danger zone by any possible means** • **Team 2: stretch a fire hoseline to protect the action of the Team 1**
EXPOSURE PROTECTION
Evacuate adjacent buildings **Prevent the fire from spreading to a uninvolved vehicle(s) or building(s)** **Move ajacent non involved vehicles by any way possible (driving, towing, pushing…)**
INCIDENT TREATMENT
In case of high stake level situation, operate an offensive fire attack, each team prepare 80 m of hoselines directly connected to the fire appliance pump • **Team 1: aims to cool the H2 tank to prevent pressure increase in the tanks** • **Team 2: aims to extiguish the vehicle fire. Mind that foam can be used to extinguish the truck (tractor) while water is used to cool the trailer tanks. Make sure not to flush foam with water** **THE INCIDENT COMMANDER WILL EVALUATE THE OPORTUNITY AND THE SEQUENCE ORDER TO CLOSE LEAKING TANKS AS SOON THEY ARE NO MORE SUBMITTED TO A PRESSURE INCREASE** **If the fire concerns an ignited H2 leak, the only safe way to put out the fire is to close the appropriate valve** **Previosly, the incident commander must have took appropriate actions to prevent pressure increase in the tanks and checked the efficiency** **Mind that violent reactions are possible between water and burning materials** **as soon as possible, wedge the vehicle** **Mind that water will be polluted during extinction , operate its containement** **If there is no identified stake, evaluate the opportunity to let the vehicle burn safely** **Mind that a cylinder or a bottle is not equiped with pressure release device and will explose if submited to a pressure increase**
OVERHAUL
Cool the wreckage as soon as no heat point is detected by the thermal imaging device **After a last H2 atmospheric control, make sure that the vehicle or the wreckage is evacuated by authorized personnels idealy transport company**

Tactic 8 H2 Trailer EXTERNAL FIRE THREATENING THE APPLICATION

H2 trailer		
Tactic Number 8	**EXTERNAL FIRE THREATENING THE APPLICATION**	

AT THE FIRE STATION

TAKE USEFUL information ABOUT THE INCIDENT

- **Assure the precise incident location (may include using vehicle tracking)**
- **Are there any person involved in the incident?**
- **Type of vehicle concerned with manufacturer's emergency response guidance**
- **What happend?**
- **Type of trailer concerned? Size, full or empty?**
- **Is the cargo dismanteled?**

TAKE USEFUL INFORMATION ABOUT THE METEOROLOGICAL SITUATION

- **Wind direction**
- **Wind speed**

ITINERARY, choose a safe itinerary

- **Do not cross an eventual explosive gas cloud**
- **Do not reach scene from bellow**
- **Anticipate the need of a hydrant**

TAKE FOLLOWING TOOLS (if availble use drone UAV)

- **Gaseous hydrocarbons detector**
- **H2 detector**
- **O2 detector**

Thermal imaging camera

ARRIVAL ON SCENE

ARRIVAL

- **Choose a safe way to get to the incident ground, preventing the fire appliance to cross a flammable gaz cloud, and make sure to arrive upwind.**
- **Stop the fire appliance 50 meters before the incident**
- **Away from a possible ignited flammable liquid leak progression**
- **Engage the pump and connect the fire appliance to a hydrant.**

SAFETY AREA

- **Set up a safety area for the public beyond a radius of 500 meters**
- **Ensure that unauthorized/untrained personnel do not enter the hazardous area**

SIZE UP THE SCENE

Answer the following questions

- **What is burning?**
- **What's the fire strength?**
- **What's the distance between the fire and the H2 trailer?**
- **Is someone injured? Threatened?**
- **Has a leak occured? Is a leak still occuring?**

RESCUE

Rescue of humans override all but personal safety considerations
Engage rescue as a conventional accident with hazmat support, if a human is threatened or concerned by the fire

- **Team 1: extract the victim(s) from the danger zone by any possible means**
- **Team 2: stretch a fire hoseline to protect the action of the Team 1**
  evacuate the passengers in the opposite direction of the wind

EXPOSURE PROTECTION

Team 1: Attenuate the radiant heat by providing a water spray curtain between the fire and the H2 trailer

INCIDENT TREATMENT

Operate an defensive fire attack, each team prepare 80 m of hoselines directly connected to the fire appliance pump

- **Team 1: Attenuate the radiant heat by providing a water spray curtain between the fire and the H2 trailer.**
- **Team 2 : Put out the fire with water, foam or powder depending what is burning.**

If putting fire out is not possible, move the H2 trailer by any way possible (driving, towing...) away from the radiant effect of the fire
Mind that a cylinder or a bottle is not equiped with pressure release device and will explose if submited to a pressure increase

OVERHAUL

Check temperature on the H2 trailer with thermal imaging device.
After a last H2 atmospheric control, Make sure that the vehicle or the wreckage is evacuated by authorized personnels idealy transport company)

Tactic 9 REFUELLING STATION NO LEAK NO FIRE (technical alarm, work accident, road traffic accident)

REFUELLING STATION		
Tactic Number 9	**NO LEAK NO FIRE (technical alarm, work accident, road traffic accident)**	

AT THE FIRE STATION

TAKE USEFUL information ABOUT THE INCIDENT

- **Assure the precise incident location (may include using vehicle tracking)**
- **Are there any person involved in the incident?**
- **Are there any vehicle involved in the incident?**
- **What happend?**

TAKE USEFUL INFORMATION ABOUT THE METEOROLOGICAL SITUATION

- **Wind direction**
- **Wind speed**

ITINERARY, choose a safe itinerary

- **Do not cross an eventual explosive gas cloud**
- **Do not reach scene from bellow**
- **Anticipate the need of a hydrant**

TAKE FOLLOWING TOOLS (if availble use drone UAV)

- **Gaseous hydrocarbons detector**
- **H2 detector**
- **O2 detector**
  Thermal imaging camera

ARRIVAL ON SCENE

ARRIVAL

- **Choose a safe way to get to the incident ground, preventing the fire appliance to cross a flammable gaz cloud, and make sure to arrive upwind.**
- **Stop the fire appliance 50 meters before the incident**
- **Away from a possible ignited flammable liquid leak progression**
- **Engage the pump and connect the fire appliance to a hydrant.**

SAFETY AREA

- **Set up a safety area for the public beyond a radius of 50 meters**
- **Ensure that unauthorized/untrained personnel do not enter the hazardous area**

SIZE UP THE SCENE

BY QUESTIONNING THE WITNESSES, TECHNICAL STAFF OF THE REFUELLING STATION AND OBSERVATION, ANSWER THE FOLLOWING QUESTIONS

- **What has happened?**
- **Is someone injured? Threatened?**
- **Has a leak occured? Is a leak still occuring?**
- **Is a vehicle connected to the refuelling sation? (if yes, apply FCH vehicle related tactic)**

Check energies present in the involved vehicle (tank type, refuelling hole type, vehicle registration papers...)
Operate H2 detector
Where emergency shutdown devices of the refuelling station activated?

RESCUE

Rescue of humans override all but personal safety considerations
Engage rescue as a conventional accident with hazmat support

EXPOSURE PROTECTION

Use only necessary personnel
Repeatedly check H2 presence in the atmosphere. If H2 is detected apply H2 leak tactic
Stretch a fire hoseline to protect the action of teams
Push emergency shutdown devices
If the dispenser if physcaly damaged, close the valves between the storage area and the dispenser

INCIDENT TREATMENT

If no H2 leak and no sign of fire is detected, engage incident settlement with conventional techniques
If a FCH vehicle is connected to the refuelling station, disconnect it and move it away
If a H2 trailer is connected to the refuelling sation storage, close the valves between the trailer and the storage and apply simultaneaously the tactic related to trailers

DO NOT

- **cut or crush H2 lines**
- **cut or crush High Voltage Lines (orange)**
- **damage H2 tank**

OVERHAUL

After a last H2 atmospheric control, make sure that the refuelling station will be checked be authorized personnels before restart

Tactic 10 REFUELLING STATION H2 LEAK WITHOUT FIRE

REFUELLING STATION		
Tactic 10	**H2 LEAK WITHOUT FIRE**	

AT THE FIRE STATION

TAKE USEFUL information ABOUT THE INCIDENT

- **Assure the precise incident location (may include using vehicle tracking)**
- **Are there any person involved in the incident?**
- **Are there any vehicle involved in the incident?**
- **What happend?**

TAKE USEFUL INFORMATION ABOUT THE METEOROLOGICAL SITUATION

- **Wind direction**
- **Wind speed**

ITINERARY, choose a safe itinerary

- **Do not cross an eventual explosive gas cloud**
- **Do not reach scene from bellow**
- **Anticipate the need of a hydrant**

TAKE FOLLOWING TOOLS (if availble use drone UAV)

- **Gaseous hydrocarbons detector**
- **H2 detector**
- **O2 detector**
- **Thermal imaging camera**

ARRIVAL ON SCENE

ARRIVAL

- **Choose a safe way to get to the incident ground, preventing the fire appliance to cross a flammable gaz cloud, and make sure to arrive upwind.**
- **Stop the fire appliance 50 meters before the incident**
- **Away from a possible ignited flammable liquid leak progression**
- **Engage the pump and connect the fire appliance to a hydrant.**

SAFETY AREA

- **Set up a safety area for the public beyond a radius of 100 meters**
- **Ensure that unauthorized/untrained personnel do not enter the hazardous area**

SIZE UP THE SCENE

IF A PERSON IS INSIDE THE HAZARDOUS AREA, ENGAGE RESCUE OPERATIONS
IF NO ONE IS INSIDE THE HAZARDOUS AREA, BY QUESTIONNING THE WITNESSES, TECHNICAL STAFF OF THE REFUELLING STATION AND OBSERVATION, ANSWER THE FOLLOWING QUESTIONS

- **What has happened?**
- **Is someone injured? Threatened?**
- **Has a leak occured? Is a leak still occuring?**
- **Has a loud hissing sound been eared before the FR arrive?**
- **Is a vehicle connected to the refuelling sation? (if yes, apply related tactic)**

Check energies present in the involved vehicle (tank type, refuelling hole type, vehicle registration papers...)
Operate H2 detector
Where emergency shutdown devices of the refuelling station activated?

RESCUE

Rescue of humans override all but personal safety considerations
Engage rescue as a conventional accident with hazmat support, if a human is threatened or concerned by the gas leak

- **Team 1: extract the victim(s) from the danger zone by any possible means**
- **Team 2: stretch a fire hoseline to protect the action of the Team 1 in case of an ignition of the cloud**

Evacuate the persons in the opposite direction of the wind

EXPOSURE PROTECTION

Use only necessary personnel
Repeatedly check H2 presence in the atmosphere, if H2 is detected apply H2 leak tactic
Stretch a fire hose line to protect the action of teams
Push Emergency shutdown devices
If the dispenser if physically damaged, close the valves between the storage area and the dispenser

INCIDENT TREATMENT

Close the valves between the dispenser and the H2 storage

If a FCH vehicle is connected to the refueling station, disconnect it and move it away
If a H2 trailer is connected to the refueling station storage, close the valves between the trailer and the storage and apply simultaneously the tactic related to trailers

Prevent H2 to accumulate in enclosed premises

DO NOT

- **cut or crush H2 lines**
- **cut or crush High Voltage Lines**
- **damage H2 tank**

OVERHAUL

After a last H2 atmospheric control, make sure that before restart, the refuelling station will be checked be authorized personnels and the malfuction and damages repaired

Tactic 11 REFUELLING STATION FIRE

REFUELLING STATION		Hy Responder
Tactic 11	**FIRE**	

AT THE FIRE STATION

TAKE USEFUL information ABOUT THE INCIDENT

- **Assure the precise incident location (may include using vehicle tracking)**
- **Are there any person involved in the incident?**
- **Are there any vehicle involved in the incident?**
- **What happend?**

TAKE USEFUL INFORMATION ABOUT THE METEOROLOGICAL SITUATION

- **Wind direction**
- **Wind speed**

ITINERARY, choose a safe itinerary

- **Do not cross an eventual explosive gas cloud**
- **Do not reach scene from bellow**
- **Anticipate the need of a hydrant**

TAKE FOLLOWING TOOLS (if availble use drone UAV)

- **Gaseous hydrocarbons detector**
- **H2 detector**
- **O2 detector**
  Thermal imaging camera

ARRIVAL ON SCENE

ARRIVAL

- **Choose a safe way to get to the incident ground, preventing the fire appliance to cross a flammable gaz cloud, and make sure to arrive upwind.**
- **Stop the fire appliance 50 meters before the incident**
- **Away from a possible ignited flammable liquid leak progression**
- **Engage the pump and connect the fire appliance to a hydrant.**

SAFETY AREA

- **Set up a safety area for the public beyond a radius of 500 meters**
- **Ensure that unauthorized/untrained personnel do not enter the hazardous area**

SIZE UP THE SCENE

IF A PERSON IS INSIDE THE HAZARDOUS AREA, ENGAGE RESCUE OPERATIONS
IF NO ONE IS INSIDE THE HAZARDOUS AREA, BY QUESTIONNING THE WITNESSES, TECHNICAL STAFF OF THE REFUELLING STATION AND OBSERVATION, ANSWER THE FOLLOWING QUESTIONS

- **What has happened?**
- **Is someone injured? Threatened?**
- **Has a leak occured? Is a leak still occuring?**
- **Has a loud hissing sound been eared before the FR arrive?**
- **Is a vehicle connected to the refuelling sation? (if yes, apply related tactic)**

Check energies present in the involved vehicle (tank type, refueling hole type, vehicle registration papers...)

Operate H2 detector
Where emergency shutdown devices of the refuelling station activated?

RESCUE

Rescue of humans override all but personal safety considerations
Engage rescue as a conventional accident with hazmat support, if a human is threatened or concerned by the fire

- **Team 1: extract the victim(s) from the danger zone by any possible means**
- **Team 2: stretch a fire hoseline to protect the action of the Team 1**

Evacuate the passengers in the opposite direction of the wind

EXPOSURE PROTECTION

Evacuate adjacent buildings
Prevent the fire from spreading to a uninvolved vehicle(s) or building(s)
Move ajacent non involved vehicles by any way possible (driving, towing, pushing…)
Push Emergency shutdown devices on the dispenser and the storage
Close the valves between the storage area and the dispenser

INCIDENT TREATMENT

The fire concerns the dispenser area

- **Push Emergency shutdown devices**
- **Prevent the fire to spread to a uninvoved part of the refuelling station with water spray curtains**
- **Put the fire out**

The fire concerns the storage area.(High stake level situation)

- **Push Emergency shutdown devices**
- **prevent the fire to spread to a uninvoved part of the refuelling station with water spray curtains**
- **put the fire out**

If the fire concerns an ignited H2 leak, the only safe way to put out the fire is to close the appropriate valve
Previously, the incident commander must have took appropriate actions to prevent pressure increase in the tanks and checked the efficiency.
Operate an offensive fire attack each team prepare 80 m of hoselines directly connected to the fire appliance pump

- **Team 1: aims to cool the H2 tank to prevent pressure increase in the tanks**
- **Team 2: aims to extiguish the fire**

Mind that H2 storages are equiped with Pressure release devices that may open and close several times depending the pressure inside the tank
Mind that violent reactions are possible between water and burning materials
Mind that water will be polluted during extinction, operate its containement
In there is no identified stake, evaluate the opportunity to let the vehicle burn safely

OVERHAUL

Cool the wreckage as soon as no heat point is detected by the thermal imaging device
Repeatedly check H2 presence in the atmosphere

Tactic 12 REFUELLING STATION EXTERNAL FIRE THREATENING THE APPLICATION

REFUELLING STATION		
Tactic 12	**EXTERNAL FIRE THREATENING THE APPLICATION**	

AT THE FIRE STATION

TAKE USEFUL information ABOUT THE INCIDENT

- **Assure the precise incident location (may include using vehicle tracking)**
- **Are there any person involved in the incident?**
- **Are there any vehicle involved in the incident?**
- **What happend?**

TAKE USEFUL INFORMATION ABOUT THE METEOROLOGICAL SITUATION

- **Wind direction**
- **Wind speed**

ITINERARY, choose a safe itinerary

- **Do not cross an eventual explosive gas cloud**
- **Do not reach scene from bellow**
- **Anticipate the need of a hydrant**

TAKE FOLLOWING TOOLS (if availble use drone UAV)

- **Gaseous hydrocarbons detector**
- **H2 detector**
- **O2 detector**

Thermal imaging camera

ARRIVAL ON SCENE

ARRIVAL

- **Choose a safe way to get to the incident ground, preventing the fire appliance to cross a flammable gaz cloud, and make sure to arrive upwind.**
- **Stop the fire appliance 50 meters before the incident**
- **Away from a possible ignited flammable liquid leak progression**
- **Engage the pump and connect the fire appliance to a hydrant.**

SAFETY AREA

- **Set up a safety area for the public beyond a radius of 500 meters**
- **Ensure that unauthorized/untrained personnel do not enter the hazardous area**

SIZE UP THE SCENE

BY QUESTIONNING THE WITNESSES, TECHNICAL STAFF OF THE STATION AND OBSERVATION, ANSWER THE FOLLOWING QUESTIONS

- **What has happened?**
- **Which part of the application is concerned by the incident? (dispenser, storage, electrical equipment...)**
- **Is someone injured? Threatened?**
- **Has a leak occured? Is a leak still occuring?**
- **What is burning?**
- **What's the fire Strength?**

- **What's the distance between the fire and the refuelling station? The station manager is able to provide accurate informations**

RESCUE

Rescue of humans override all but personal safety considerations
Engage rescue as a conventional accident with hazmat support, if a human is threatened or concerned by the fire

- **Team 1: extract the victim(s) from the danger zone by any possible means**
- **Team 2: stretch a fire hoseline to protect the action of the team 1**

Evacuate people in the opposite direction of the wind

EXPOSURE PROTECTION

Team 1: Attenuate the radiant heat by providing a water spray curtain between the fire and the refuelling station

INCIDENT TREATMENT

Operate an defensive fire attack, each team prepare 80 m of hoselines directly connected to the fire appliance pump

- **Team 1: attenuate the radiant heat by providing a water spray curtain between the fire and therefuelling station**
- **Team 2: put out the fire with water, foam or powder depending what is burning**

Mind that a refuelling station storage ist equiped with pressure release device
A H2 leak may occur if the storage is submitted to a high temperature flux

OVERHAUL

Cool the wreckage as soon as no heat point is detected by the thermal imaging device
Repeatedly check H2 presence in the atmosphere

Tactic 13 Stationary power generation unit (SPGU) / Hydrogen-based energy storage system NO LEAK NO FIRE (technical alarm)

Stationary power generation unit (SPGU) / Hydrogen-based energy storage system (H2ESS)		
Tactic 13	**NO LEAK NO FIRE (technical alarm)**	

AT THE FIRE STATION

TAKE USEFUL information ABOUT THE INCIDENT

- **Assure the precise incident location and the concerned power**
- **Is this stationary power generation unit kwown by the fire service?**
- **Does a firefighting plan exists? Take it in the fire appliance and read it on the road.**
- **Which part of the application is concerned by the incident? (Fuel cell, H2/O2 storage, photovoltaic panels, wind tubine...)**
- **Are there any person involved in the incident?**
- **What happend?**

TAKE USEFUL INFORMATION ABOUT THE METEOROLOGICAL SITUATION

- **Wind direction**
- **Wind speed**

ITINERARY, choose a safe itinerary

- **Do not cross an eventual explosive gas cloud**
- **Do not reach scene from bellow**
- **Anticipate the need of a hydrant**

TAKE FOLLOWING TOOLS (if availble use drone UAV)

- **Gaseous hydrocarbons detector**
- **H2 detector**
- **O2 detector**

Thermal imaging camera

ARRIVAL ON SCENE

ARRIVAL

- **Choose a safe way to get to the incident ground, preventing the fire appliance to cross a flammable gaz cloud, and make sure to arrive upwind.**
- **Stop the fire appliance 50 meters before the incident .**
- **If a wind turbine is concerned, stop at a distance of twice the height of the wind turbine**
- **Away from a possible ignited flammable liquid leak progression**
- **Engage the pump and connect the fire appliance to a hydrant.**

SAFETY AREA

- **If H2/O2 storage is concerned, set up a safety area for the public beyond a radius of 500 meters**
- **If a wind turbine is concerned, set up a safety area for the public beyond a radius of twice the height of the wind turbine**
- **If fuel cell or electrical devices is concerned, set up a safety area for the public beyond a radius of 50 meters**
- **Ensure that unauthorized/untrained personnel do not enter the hazardous area**

SIZE UP THE SCENE

BY QUESTIONNING THE WITNESSES, TECHNICAL STAFF OF THE SPGU/H2ESS AND OBSERVATION, ANSWER THE FOLLOWING QUESTIONS

- **What has happened?**
- **Which part of the application is concerned by the incident? (Fuel cell, H2/O2 storage, photovoltaic panels, wind tubine...)**
- **Is someone injured? Threatened?**
- **Has a leak occured? Is a leak still occuring?Which ones?**
- **Is the system delivering electricity?**
- **Is a technician present on the plant area?**

Look for the mergency fire and rescue plan
Locate precisely dangerous areas, Emergency shutdown devices, valves
Evaluate the amount of compressed gases present in the tanks

RESCUE

Rescue of humans override all but personal safety considerations
Engage rescue as a conventional accident with hazmat support
To reach safely a casualty, it is necessary sure that he's not already submited to an electrical current.
Push Emergency shutdown devices, take fallen cables away with appropriate elctrical gloves...

EXPOSURE PROTECTION

Push Emergency shutdown devices of the concerned aera
As it is possible, isolate (pressure, gas supply, electricity) energy production unit, fuel cell and storages (each one from the others)
Check and note every ESD or valve turned off on the emergency plan

Repeatedly check H2 presence in the atmosphere. If H2 is detected apply H2 leak tactic

INCIDENT TREATMENT

If no H2 leak and no sign of fire is detected, engage incident settlement

DO NOT

- **cut or crush H2/O2 lines**
- **cut or crush High Voltage Lines (orange)**
- **damage H2/O2 tank**

If a H2 leak is detected, apply tactic n°2 "H2 LEAK WITHOUT FIRE"

Mind that Photovoltaic panels still produce high voltage electricity when exposed to daylight

OVERHAUL

After a last H2 atmospheric control, make sure that the application will be checked be authorized personnels before restart.

Tactic 14 Stationary power generation unit (SPGU) / Hydrogen-based energy storage system H2 LEAK WITHOUT FIRE

Stationary power generation unit (SPGU) / Hydrogen-based energy storage system (H2ESS)		
Tactic 14	**H2 LEAK WITHOUT FIRE**	

AT THE FIRE STATION

TAKE USEFUL information ABOUT THE INCIDENT

- **Assure the precise incident location and the concerned power**
- **Is this stationary power generation unit kwown by the fire service?**
- **Does a firefighting plan exists? Take it in the fire appliance and read it on the road.**
- **Which part of the application is concerned by the incident? (Fuel cell, H2/O2 storage, photovoltaic panels, wind tubine...)**
- **Are there any person involved in the incident?**
- **What happend?**

TAKE USEFUL INFORMATION ABOUT THE METEOROLOGICAL SITUATION

- **Wind direction**
- **Wind speed**

ITINERARY, choose a safe itinerary

- **Do not cross an eventual explosive gas cloud**
- **Do not reach scene from bellow**
- **Anticipate the need of a hydrant**

TAKE FOLLOWING TOOLS (if availble use drone UAV)

- **Gaseous hydrocarbons detector**
- **H2 detector**
- **O2 detector**

Thermal imaging camera

ARRIVAL ON SCENE

ARRIVAL

- **Choose a safe way to get to the incident ground, preventing the fire appliance to cross a flammable gaz cloud, and make sure to arrive upwind**
- **Stop the fire appliance 50 meters before the incident**
- **If a wind turbine is concerned, stop at a distance of twice the height of the wind turbine**
- **Away from a possible ignited flammable liquid leak progression**
- **Engage the pump and connect the fire appliance to a hydrant**

SAFETY AREA

- **If H2/O2 storage is concerned, set up a safety area for the public beyond a radius of 500 meters**
- **If a wind turbine is concerned, set up a safety area for the public beyond a radius of twice the height of the wind turbine**
- **If fuel cell or electrical devices is concerned, set up a safety area for the public beyond a radius of 50 meters**
- **Ensure that unauthorized/untrained personnel do not enter the hazardous area**

SIZE UP THE SCENE

BY QUESTIONNING THE WITNESSES, TECHNICAL STAFF OF THE SPGU/H2ESS AND OBSERVATION, ANSWER THE FOLLOWING QUESTIONS

- **What has happened?**
- **Which part of the application is concerned by the incident? (FC, H2/O2 storage, ...)**
- **Is someone injured? Threatened?**
- **Has a leak occured? Is a leak still occuring?**
- **Is the system delivering electricity?**
- **Is a technician present on the plant area?**

Look for the mergency fire and rescue plan
Locate precisely dangerous areas, Emergency shutdown devices, valves,
Evaluate the amount of compressed gases present in the tanks

RESCUE

Rescue of humans override all but personal safety considerations
Engage rescue as a conventional accident with hazmat support, if a human is threatened or concerned by the fire

- **Team 1: extract the victim(s) from the danger zone by any possible means**
- **Team 2: stretch a fire hoseline to protect the action of the team 1**

Evacuate the passengers in the opposite direction of the wind

EXPOSURE PROTECTION

Note that a SPGU is supposed to produce electricity as soon as it is no longer supplied by the electrical network, so it is necessary to stop the electrical production of the SPGU before any other action by pushing emergency shutdown devices
As it is possible, isolate (pressure, gas supply, electricity) energy production unit, fuel cell and storages (each one from the others)
Check and note every ESD or valve turned off on the emergency plan
Repeatedly check H2 presence in the atmosphere

INCIDENT TREATMENT

If no H2 leak and no sign of fire is detected, engage incident settlement
DO NOT : cut or crush H2/O2 lines, cut or crush High Voltage Lines (orange), damage H2/O2 tank
Fire services are not supposed to open the Fuel Cell comparment
Locate precisely the H2 leak, if located in an building, operate a wide ventilation of all concerned premises
According to information provided by the emegency plans and the validation of the technicians (if available), close appropriate valves, ESD...
Repeatedly check H2 presence in the atmosphere
Mind that photovoltaic panels still produce high voltage electricity when exposed to daylight
Mind that H2 and O2 storages are equiped with Pressure release devices that may open and close several times depending the pressure inside the tank

OVERHAUL

After a last H2 atmospheric control, make sure that the application will be checked be authorized personnels before restart

Tactic 15 Stationary power generation unit (SPGU) / Hydrogen-based energy storage system FIRE

Stationary power generation unit (SPGU) / Hydrogen-based energy storage system (H2ESS)		
Tactic 15	**FIRE**	

AT THE FIRE STATION

TAKE USEFUL information ABOUT THE INCIDENT

- **Assure the precise incident location and the concerned power**
- **Is this stationary power generation unit kwown by the fire service?**
- **Does a firefighting plan exists? Take it in the fire appliance and read it on the road.**
- **Which part of the application is concerned by the incident? (Fuel cell, H2/O2 storage, photovoltaic panels, wind tubine...)**
- **Are there any person involved in the incident?**
- **What happend?**

TAKE USEFUL INFORMATION ABOUT THE METEOROLOGICAL SITUATION

- **Wind direction**
- **Wind speed**

ITINERARY, choose a safe itinerary

- **Do not cross an eventual explosive gas cloud**
- **Do not reach scene from bellow**
- **Anticipate the need of a hydrant**

TAKE FOLLOWING TOOLS (if availble use drone UAV)

- **Gaseous hydrocarbons detector**
- **H2 detector**
- **O2 detector**
  Thermal imaging camera

ARRIVAL ON SCENE

ARRIVAL

- **Choose a safe way to get to the incident ground, preventing the fire appliance to cross a flammable gaz cloud, and make sure to arrive upwind.**
- **Stop the fire appliance 50 meters before the incident .**
- **If a wind turbine is concerned, stop at a distance of twice the height of the wind turbine**
- **Away from a possible ignited flammable liquid leak progression**
- **Engage the pump and connect the fire appliance to a hydrant.**

SAFETY AREA

- **if H2/O2 storage is concerned, set up a safety area for the public beyond a radius of 500 meters**
- **If a wind turbine is concerned, set up a safety area for the public beyond a radius of twice the height of the wind turbine**
- **If fuel cell or electrical devices is concerned, set up a safety area for the public beyond a radius of 50 meters**
- **Ensure that unauthorized/untrained personnel do not enter the hazardous area**

SIZE UP THE SCENE

BY QUESTIONNING THE WITNESSES, TECHNICAL STAFF OF THE SPGU/H2ESS AND OBSERVATION, ANSWER THE FOLLOWING QUESTIONS

- **What happened?**
- **Which part of the application is concerned by the incident? (Fuel cell, H2/O2 storage, photovoltaic panels, wind tubine...)**
- **Is someone injured? Threatened?**
- **Has a leak occured? Is a leak still occuring?Which ones?**
- **Is the system delivering electricity?**
- **Is a technician present on the plant area?**

Look for the mergency fire and rescue plan
Locate precisely dangerous areas, Emergency shutdown devices, valves,
Evaluate the amount of compressed gases present in the tanks

RESCUE

Rescue of humans override all but personal safety considerations
Engage rescue as a conventional accident with hazmat support, if a human is threatened or concerned by the fire

- **Team 1: extract the victim(s) from the danger zone by any possible means**
- **Team 2: stretch a fire hoseline to protect the action of the Team 1**

Evacuate the passengers in the opposite direction of the wind

EXPOSURE PROTECTION

Evacuate adjacent buildings
Prevent the fire from spreading to uninvolved buildings
Note that a SPGU is supposed to produce electricity as soon as it is no longer sullpied by the electrical network, so it is necessary to stop the electrical production of the SPGU before any other action by pushing emergency shutdown devices
As it is possible, isolate (pressure, gas supply, electricity) energy production unit, fuel cell and storages (each one from the others)
Check and note every ESD or valve turned off on the emergency plan
Repeatedly check H2 presence in the atmosphere

INCIDENT TREATMENT

The fire concerns the photovoltaic panels or wind turbine area.

- **Push emergency shutdown devices**
- **Prevent the fire to spread to a uninvolved part of the plant with water spray curtains**
- **Put the fire out**

The fire concerns the Fuel cell Compartment.

- **Push emergency shutdown devices**
- **Prevent the fire to spread to a uninvolved part of the plant with water spray curtains**
- **Do not open the FC comparment**

The fire concerns the storage area.(High stake level situation)

- **Push Emergency shutdown devices**
- **Prevent the fire to spread to a uninvolved part of the plant with water spray curtains**

Put the fire out with an offensive fire attack, each team prepare 80 m of hoselines directly connected to the fire appliance pump

- **Team 1: aims to cool the H2 tank to prevent pressure increase in the tanks**
- **Team 2: aims to extiguish the fire**

If the fire concerns an ignited H2 leak, the only safe way to put out the fire is to close the appropriate valve
Previosly, the incident commander must have took appropriate actions to prevent pressure increase in the tanks and checked the efficiency
Mind that H2 storages are equiped with pressure release devices that may open and close several times depending the pressure inside the tank

Mind that violent reactions are possible between water and burning materials **Mind that water will be polluted during extinction, operate its containement** **In there is no identified stake, evaluate the opportunity to let the fire burn safely**
OVERHAUL
Cool the wreckage as soon as no heat point is detected by the thermal imaging device **Repeatedly check H2 presence in the atmosphere**

Tactic 16 Stationary power generation unit (SPGU) / Hydrogen-based energy storage system EXTERNAL FIRE THREATENING THE APPLICATION

Stationary power generation unit (SPGU) / Hydrogen-based energy storage system (H2ESS)		Hy Responder
Tactic 16	**EXTERNAL FIRE THREATENING THE APPLICATION**	

AT THE FIRE STATION

TAKE USEFUL information ABOUT THE INCIDENT

- **Assure the precise incident location and the concerned power**
- **Is this stationary power generation unit kwown by the fire service?**
- **Does a firefighting plan exists? Take it in the fire appliance and read it on the road.**
- **Which part of the application is concerned by the incident? (Fuel cell, H2/O2 storage, photovoltaic panels, wind tubine...)**
- **Are there any person involved in the incident?**
- **What happend?**

TAKE USEFUL INFORMATION ABOUT THE METEOROLOGICAL SITUATION

- **Wind direction**
- **Wind speed**

ITINERARY, choose a safe itinerary

- **Do not cross an eventual explosive gas cloud**
- **Do not reach scene from bellow**
- **Anticipate the need of a hydrant**

TAKE FOLLOWING TOOLS (if availble use drone UAV)

- **Gaseous hydrocarbons detector H2 detector O2 detector Thermal imaging camera**

ARRIVAL ON SCENE

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Check and note every ESD or valve turned off on the emergency plan
Repeatedly check H2 presence in the atmosphere

INCIDENT TREATMENT

The fire threats the Fuel cell Compartment, the photovoltaic panels or wind turbine area.

- **Push Emergency shutdown devices**
- **Prevent the fire to spread to a uninvolved part of the plant with water spray curtains**
- **Put the fire out**
- **Do not open the FC comparment**

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