

MARINER



Enhancing HNS preparedness
through training and exercising

TITLE OF THE DOCUMENT

Task D: HNS RESPONSE;
IDENTIFICATION/ADAPTATION OF
EXISTING RESPONSE PROTOCOLS
TO MARINE ENVIRONMENTS

Action D.1&D.2

Last updated: 07/02/2018

Version: 1

Authors: INTECMAR & CEDRE

Participants: U. VIGO

This document covers activities implemented with the financial assistance of the European Union. The views expressed herein should not be taken, in any way, to reflect the official opinion of the European Union, and the European Commission is not responsible for any use that may be made of the information it contains.

INDEX

1. Introduction	3
2. Methodology	3
2.1. Expertise analyzed.....	4
2.2. Intervention Group for Technological and Environmental Emergencies (GIETMA) from the Emergency Military Unit (UME)	4
2.3. Spanish National School of Civil Protection (ENPC)	5
2.4. Galician Academy of Public Security	7
2.5. Curium	7
2.6. Sobegi	9
2.7. Séché	11
2.68. Environment Canada	16
2.69. SDIS	21
2.610. SARP	25
2.611. LAFD	28
2.12. Scope	30
2.13. Huelva	33
3. Evaluation of antipollution vessels equipment.....	34
4. Adaptation of response protocols.....	41
5. Testing of adapted protocols	41



1. Introduction

The general objective of MARINER is to improve regional cooperation in planning, preparedness and response to HNS spills by improving training and exercise, increasing awareness and information exchange, and by capitalization and translation of HNS relevant R&D projects' outcomes into operational products. The specific objectives are to:

- Compile available information and knowledge relevant for HNS response and make it widely accessible and usable for responders through a friendly web based tool.
- Identify relevant results and outputs from public research projects and facilitate its translation into operational products for end users, frontline responders and for integration into contingency plans.
- Improve the applicability and accessibility of modelling tools and methodologies for risk and impact assessment.
- **Identify and adapt existing protocols and equipment for oil spill response and land-based events and define good practice and lessons learnt through liaison with key experts from industry, civil defence and emergency responders.**
- Improve training and exercises by developing innovative processes, tools, materials and activities to aid the development of bespoke exercise scenarios and training packages.
- Carry out a target transfer of key outcomes to selected audiences.

Experience from major industrial accidents involving dangerous chemicals resulted in a broad experience gained by the chemical land based industries and emergency operating groups (civil defence, fire brigades). They have generated a huge amount of knowledge, protocols and good practices with a great potential to be adapted and tested in marine incidents involving HNS combat. Through the analysis and adaptation of all this information MARINER has elaborated adapted protocols for key response options in marine incidents.

2. Methodology

MARINER has identify key expertise, knowledge and relevant protocols utilized by the chemical industry, civil defence and fire brigades in the targeted areas in order to develop the basis for the production of adapted protocols to deal with HNS spills in the marine environment. For that purpose, meetings and interviews with specific emergency response groups have been carried out.

Different land services operations and protocols were analysed and adapted for the different steps: pre-planning considerations, communication and operational procedures and technical considerations. Protocols covering different behaviours of HNS (evaporators, floaters, sinkers and diluters) were evaluated, as well as recommendations to better interpret the physical properties of HNS.

Special effort was made on adapting of existing equipment in specialized antipollution vessels to be used for HNS incidents. Differences between the use of equipment for oil incidents or

HNS incidents were highlighted. Risk control measures were evaluated (e.g. safe approach, cordons inner and outer establishment, public safety considerations and evacuation).

With all mentioned considerations, adapted protocols for key response options in marine incidents were elaborated as recommendations for their inclusion of good practices in the contingency plans.

2.1. Expertise analyzed

In order to collect as much spectrum of experience as possible, different groups of expertise were contacted:

- Public institutions that have competence in HNS fighting episodes,
- Private companies with experience in some aspects of HNS fighting or specialty on specific HNS,
- Training centres with experience in HNS fighters training,
- Attendance of field exercises that include HNS fighting in marine environment.

In all cases, the methodology of information recovery included:

- Main activity covered by the institution/company/centre/event,
- Identification of experts/installations/equipment/protocols/information useful for HNS fighting in marine environments.

2.2. Intervention Group for Technological and Environmental Emergencies (GIETMA) from the Emergency Military Unit (UME)

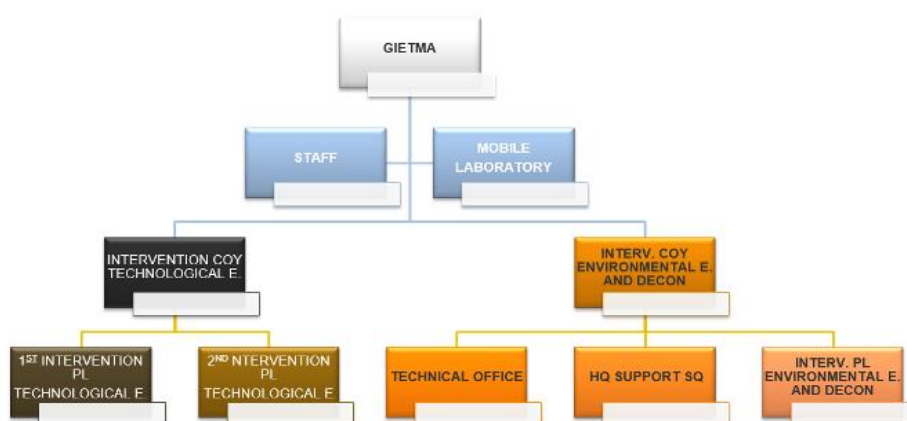
This group is specially designed to be able to act in the focus of the emergency caused by technological risks as it has highly qualified personnel and the most modern systems for identification, decontamination and intervention in this type of situations. GIETMA also has the Technological Emergency Intervention Company (CIET) which has two types of intervention vehicles in contaminated areas (VINTAC). The personnel of this company is specialized and has the necessary means for the intervention in this type of emergency (control of leaks, transfers, etc.). On the other hand, this company has all the necessary capabilities for detection, sampling and initial identification of NRBC agents. Among the many capabilities available, the Light Vehicle of Recognition (VELIRE) has a complete range of NRBC detectors integrated in the vehicle. On the other hand, in order to protect people, GIETMA has a powerful section of decontamination and fight against environmental pollution. The availability of a wide variety of stations allows them to deal with NRBC decontamination of personnel, heavy, sensitive materials, soil, interior facilities and even treat water contaminated with NRBC agents. To complete the chemical and biological identification capabilities, the GIETMA is equipped with a Laboratory Identification Unit (LABIR) consisting of a portable laboratory with the capacity to perform a confirmed chemical or biological identification of a sample in a maximum of four hours. The UME also has a very fluid relationship with the Nuclear Safety Council (CSN). The GIETMA is, therefore, at the national level the best prepared group for rapid interventions in emergencies derived from technological risks.

Seven are the capacities that the UME has at the moment of intervening before any emergency: command and control, intervention in emergencies that have their origin in risks (floods, earthquakes, large snowfalls or other Meteorological phenomena), those caused by

forest fires, those resulting from technological hazards, those caused by terrorist attacks or illegal acts and violent, those derived from pollution of the environment and those in support of the civilian population affected due to a catastrophe.

GIETMA has a strong experience in emergency response on a wide range of chemicals and on different environments. It is a service that has the capacity to respond rapidly, 24/24 with the mobilization of personnel all around Spain.

Focusing on the ability to act in emergencies caused by technological risks, the GIETMA has highly qualified staff and modern identification systems, decontamination and intervention in this type of situations. The dedication of its 146 members to these risks, as well as the capabilities of their equipments; made the GIETMA an invaluable tool that contributes to the National Civil Protection System.



The GIETMA is, therefore, at Spanish national level the best prepared group for rapid interventions in emergencies derived from technological risks. However, the location of its equipment (mainly located in Madrid), even though they have a very fast deployment system, it can be a problem for incidents that take place very close to shore and that therefore the immediacy in the response is fundamental.

For more information visit: http://www.ume.mde.es/LA_UME_POR_DENTRO/medios/gietma/

2.3. Spanish National School of Civil Protection (ENPC)

Civil Protection, as an instrument of public security policy, is the public service that protects people and property by ensuring an adequate response to the different types of emergencies and catastrophes caused by natural causes or derived from human action, whether accidental or intentional. The Directorate General for Civil Protection and Emergencies (DGPCyE) is the driving force behind the planning of the National Civil Protection System in Spain. The DGPCyE

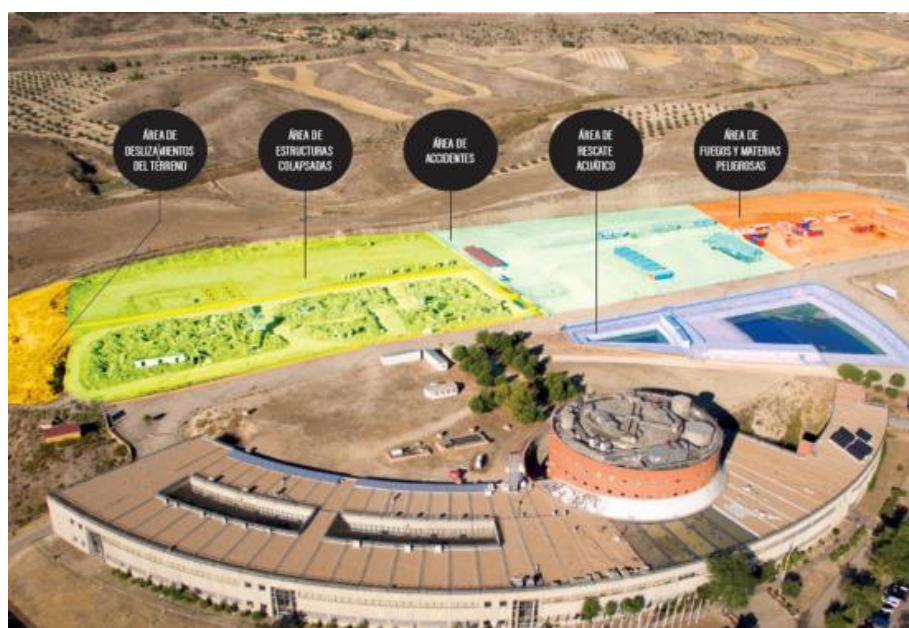
coordinates the different actors involved in Civil Protection, both in the Autonomous Communities and Cities, Supranational and international organizations, providing useful means for the management of major emergencies or when there is a high probability that these occur.

One of the strategic pillars on which the DGPCyE is based is training as an essential instrument for the coordinated operation of the system and in order to maintain the human resources of the civil protection system with the capacity to operate at all times and needs demanded by emergencies. To this end, the National Civil Protection School (ENPC) acts as a backbone of specialized training and high level management, developing, among others, the activities of:

- a) Educate and train the personnel of the civil protection services of the General State Administration and other public and private institutions, as well as other groups that are of interest to the National Civil Protection System
- b) develop R & D & I actions in civil protection training
- c) collaborate with the civil protection training centers of the other Public Administrations
- d) collaborate in training activities provided for under the European Union Civil Protection Mechanism or other initiatives to promote the interoperability of equipment and services

The Spanish system of training in emergencies is based on a systemic and decentralized conception. That is to say, this training is a competence shared between the training organisms dependent on the three levels of the Public Administration: national, autonomic and local, and they are managed and organized of different way.

In the case of Galicia, the Xunta de Galicia has the Directorate General of Emergencies and Interior (DGEI), which is responsible, among others, for the direction in civil protection and emergencies, as well as the planning and direction of risk management and the mandate of the Nuclear Safety Council for radiological surveillance.



ENPC Rivas-Vaciamadrid facilities

For more information visit: <http://www.proteccioncivil.es/escuela-nacional/presentacion>

2.4. Galician Academy of Public Security

The DGEI has since 1992 the Galician Academy of Public Security (AGASP), which is an autonomous organization of an administrative nature, whose purpose is to develop training activities aimed at vocational training, with the possibility of training the fire brigades, volunteering and civil protection personnel.

Within the scope of the training of civil protection, fire fighters and forest agents, the AGASP is responsible for:

- a) Elaborate the formative programs and impart the courses of training and improvement focus to the members of the services of civil protection and to the members of the bodies of fire fighters.
- b) Impart the courses directed to the forest agents.
- c) Collaborate with the local entities in the selection and continuous training of the personal member of the bodies of fire fighters and of civil protection.
- d) Support to the city councils in the emergencies response.
- e) Execution of specific services for fire fighters and civil protection.

For the development of its activities the Academy counts with a building of more than 10.000 m² useful situated in an enclosed enclosure of more than 180.000 m². Those installations comprise a residence with capacity for 120 people, different types of classrooms, laboratories, rooms of study, conferences and meetings, living room of acts, library, field of shot, sportive installations, and areas of recreation, cafe and restaurant. Such variety of infrastructures allow the realization of all type of activities of study or training, like seminars, workshops, courses, conferences, etc.

The Academy also involves of special areas for training in handling extinguishers and BIE, extinction of fires abroad, extinction of fires confined to buildings, simulation of accidents with hazardous materials. It also has an accident area dedicated mainly to training and simulation of multiple accidents of traffic or rail.

The AGASP has a strong experience in training for emergency response on a wide range of chemicals and on different environments. It has the possibility of imparting formation for personnel all around Galicia.

The extensive experience on training of personnel involved in emergencies, as well as the close relationship with the municipalities of the region, makes the Academy a key place in the transfer of knowledge to the stakeholders of the response in Galicia.

The AGASP is, therefore, at the regional level the best training centre for interventions in emergencies derived from HNS risks.

For more information visit: <https://agasp.xunta.gal/es>

2.5. Curium

This French society is involved in the management of high environmental risks since 1994, at the beginning with the name *Maintenance Service Environnement* and since 2015 with the name CURIUM. Its activities are split into different fields: decontamination, emergency response unit, management of gas processes and support in project management and depollution. CURIUM gathers about 15 employees and 25% of the turnover is realized abroad.

The society announces a presence at an international level, mainly in north of Spain and Italy. The CURIUM's core of activities is dedicated to studies set up of solutions and operations in order to prevent, manage and eliminate all chemicals risks (toxic, CMR...) from equipment, processes and industrial facilities.

The skills developed by the society concern:

- chemical, radiological and biological risks,
- process engineering (gaz, liquid, solid),
- analytical chemistry,
- management of the regulation: e.g. ADR, transboundary movement (Basel Convention, EU1013/2006).

CURIUM is involved in a network of European treatment facilities. It includes the possibility to perform several treatments and recycling of: arsenic, mercury, dibromide, liquefied gaseous ammonia, nitric and sulfonic acids.

Curium has a chemical emergency response team available 24/24. In case of incidents/accidents of chemical products, experts of Curium intervene as soon as possible and manage the entire operations, from people and goods protection to the transport and treatment of hazardous products, in respect of the regulation in law (ADR, IMDG, Basel Convention, and European EU1013/2006). It must be noticed that the mobilization of an employee of CURIUM is possible in one hour if a duty service has been contracted.

They also propose a 24-hour emergency hotline to assist its clients in the event of a spill.

After cooperation with the rescue services, they put into place safety area to secure people and goods. They also use the appropriate equipment and methods to ensure an optimal risks management.

CURIUM's chemical emergency response unit is working on all chemical road transport accidents/incidents or on industrial sites. The following products may be concerned for emergency intervention: Br_2 , HF, BF_3 , TiCl_4 , NaClO_3 , HCl, CS_2 , HNO_3 , HCl_3Si , As, Hg.

As references, CURIUM declares to stand-by for BROMAID, a bromine producer, 24/24 (European bromine transportation safety): neutralization of bromine vapor by hydrogen nitride, neutralization and retention container via mineral basis. CURIUM also does intervention for army on a chlorosulfonic tank for repackaging.

Curium has a strong experience in emergency response on a wide range of chemicals and different industrial sectors (chemical, pharmaceutical, petrochemical industries) and a specialty on gas processes. It is also involved in European networks, including different treatment facilities or Bromaid network. It has a capacity to respond rapidly, 24/24 with the mobilization of an employee with a departure less than 1 hour at an international level, mainly in north of Spain and Italy.

For more information visit: <http://www.curium.world/?lang=en>

2.6. Sobegi

The Lacq (Pyrénées-Atlantiques) plant, dedicated to gas production and treatment since the discovery of a local deposit, has been gradually redesigned to accommodate other productions. Since 2000, it has become the Induslacq platform and host different societies (among them Abengoa, Arkema, Biolacq Energies, OP system, Retia, Sobegal, SOBEGI, SOBEGI Environnement and Toray). The societies gather about 700 employees on a surface of 224 hectares and the main industrial activities are related with hydrogen sulfide and thiochemical products, ethanol, carbon fibers and other organic and mineral chemistry.

SOBEGI offer shared services/utilities:

- Steam: 5 steam boilers, 4 systems from 4 to 110 bars,
- Electricity: 63 kV station and 5.5/20 kV distribution system, Auto production capacity up to 34 MW,
- Industrial fluids: industrial water, demineralized water, fire system water,
- Industrial gas: compressed air, nitrogen,
- Treatment of effluents: wastewater treatment plant,
- Possible connection to existing network: to the treatment plant,
- **Safety/security: medical care service, fire department, firemen specializing in chemical risk,**
- Full service possible: plug&Play connection, optical fiber, high-speed internet, telephone network,
- Technical support functions: analytical laboratory,
- Infrastructure management: rail traction.

Other services/utilities are proposed:

- Cooling water, ice water,
- **Training center, special center for security training (CESS),**
- IT services are under the responsibility of each company.

Skills developed:

The firemen specialized in chemical risk has a strong experience as they are concerned by a daily risk on the industrial platform Induslacq. They have developed special skills on:

- H₂S - many thiochemical products,
- Commercial gas,
- Ethanol (region with dense woodland and cereal crops)
- Sulfur chemicals,
- Carbon fibers,
- Organic and mineral chemicals.
- Continuous process related to all products mentioned above.

Facilities and procedures

- 1 High Power Vehicle carrying 10500 L concentrate Synthetic Film-forming Versatile Multi proliferation foam, 2 cannons 3000 L.min⁻¹ and 8000 L.min⁻¹ water or premix,
- 1 Bi extinguisher carrying 5500 L of water, 1200 L of liquid versatile synthetic emulsifier such as A4P type (synthetic polymer based foam concentrate capable of extinguishing a wide variety of fires) 1 spear gun for water or foam 4500 L.min⁻¹

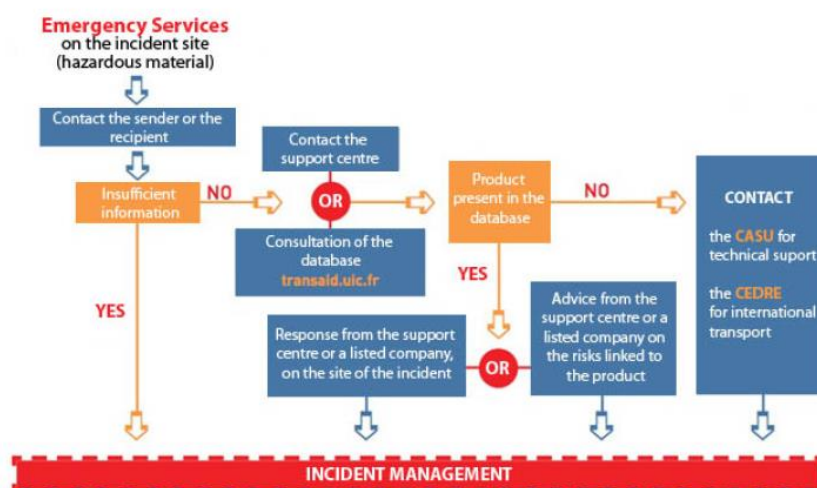
- 4 foam trailers carrying: 27000 L with a foam maker pump with a flow of 20 m³.h⁻¹ under 4 bars and 11000 L with a pre-mix auxiliary group of 400 m³.h⁻¹.
- 2 Trailers 2800 litres for concentrated foam with 1800 L.min⁻¹ water/foam
- 1 truck container pumper hose layer with 1600 m length hose
- 2 water cannons towable mixt water/foam of 3000 L.min⁻¹
- 2 advanced life support rescue vehicles
- 2 response chemical risks vehicles
- 1 helicopter pad



In Lacq the fire network measures 26 km in length, with 300 regulated fire posts and is fed through seven full rated 3300 m³ flowpumps / h at a pressure of 10 to 11 bars.

SOBEGI is involved in Transaid, an Emergency Services Assistance Protocol between the UIC (chemical industry association) and the French Ministry of the Interior. This protocol concerns accidents involving the transport of hazardous materials outside of industrial sites, on roads, railways or waterways. To efficiently respond to requirements in the event of an incident, immediate actions are: identification of the product(s), protection of people and the site. The protocol is based on a voluntary basis for companies with 3 levels of response: consultation by telephone, consultation on site and response action.

Diagram in case of accident:



Specificities of emergency response unit:

SOBEGI's response team is able to intervene 24/24. The firemen are trained to respond on specific risks related to the activities of the platform. The good knowledge on specific activities is supported by a performing center to settle realistic scenarios:

- CEPARI: Self Contained Breathing Apparatus (SCBA) Port training center offers four intensive multi-level technical training programs,
- Multi-activities Modules: operations take place in a 16 meter high tower,
- MDT training area: trucks, coaches, loading arm... In case of fires and leaks,
- Production unit: production Installations to secure facilities before maintenance,
- Fire Platform: gas fire installations for propane, butane, liquid and gas, in open air environments,
- Ammonia Risk Prevention Unit: confined area with real-life ammonia leaks,
- Flash-over Box prevention training: fires in confined areas,
- Fire exercise training area: propane fire in liquid or gas phases.

SOBEGI has a robust firefighters response team, trained to face general risks but also specialized to respond on some specific chemical risks. They have reliable equipment and very important reserve of chemical response products (particularly foam). To be prepared they also have a security training center on site which is very useful to maintain an operational capacity in case of chemical spill.

For more information visit: <http://www.sobegi.com/en/post/sobegi-security-training-centre>

2.7. Séché

This French company was created in 1970 (building and public works). In 1985, the activity evolved towards waste treatment. In the 1990s and 2000s, the company bought several other companies to create a local network in the country. Their complementary skills allowed them to provide local solutions for all forms of waste, even the most specific ones. In 2013, a special unit called "Séché Urgences Interventions" (SUI) dedicated too emergency response in case of oil or HNS spill was created.

Séché Environnement analyses requirements and can adapt its solutions to individual needs. They can handle all steps in the process, from collection and processing to the transfer to dedicated or onsite final treatment sites (industrial effluents, polluted soils), regardless of the volume of waste to be treated.

The group has developed a wide range of skills:

- Product recovery from waste. In accordance with the principle of hierarchy in waste management, we give priority to product recovery:
 - Sorting of non-hazardous packaging and waste from business activities,
 - Composting unit,
 - Solvent regeneration,
 - Decontamination of transformers prior to product recovery,
 - Cooking oil, engine oil,

- By-products from the chemical treatment of metals,
- Recovering energy from waste. All Séché Environnement's waste treatment sites (non-hazardous waste storage facilities, thermal treatment units) have developed expertise in producing renewable energies or recovering energy. Priority is given to ecological industrial solutions, depending on local requirements:
 - Electricity production,
 - Cogeneration and the supply of steam to businesses and industries
 - Creation and supply of urban heating networks
 - Production of solid fuels from waste recovery
 - Solar farm
- Non-recyclable waste residue. Non-recyclable waste is treated at our sites, which meet high environmental standards (certified ISO 9001 – ISO 14001 – OHSAS 18001). Séché guarantees full traceability and visibility over the entire waste treatment chain:
 - Sorting / grouping platform for dispersed hazardous waste,
 - Hazardous waste storage site,
 - Non-hazardous waste storage site,
 - Thermal treatment facilities
- Specific waste treatment expertise:
 - The technical unit of specially-trained chemical experts handles waste presenting a chemical, biological or pyrotechnic risk,
 - The decontamination department provides site remediation or decommissioning services for all types of pollution,
 - The Tredi Salaise and Tredi St Vulbas sites offer specially-developed solutions for very specific types of waste (aerosols, industrial gases, PCB decontamination, etc.), including onsite processing and collection.

Additionally to the general skills presented in the section above, a Séché Environnement subsidiary specialized in waste and hazardous substances management (Triadis services) has developed a range of services for emergency interventions. It is called Séché Urgence Intervention (SUI) and offers a 24h/24 7d/7 emergency response services. They can intervene after an industrial accident, chemical accident or natural disaster with the help of environmental experts experienced in dealing with chemical and environmental risks in order to prevent the propagation or spread of pollution. They announce they can intervene anywhere on the globe, for any type of pollution or risk, including management of waste, whether it involves a single risk (chemical, biological, etc.) or combined risks (chemical and biological, etc.). The mobilization delay is announced to be 4h. 180 people can be mobilized.

Among the skills used for the core of activity in the waste treatment, SUI can oversee the confinement and packaging of hazardous waste, along with the necessary administrative procedures to ensure traceability through to the treatment equipment used. Depending on the location of the accident, the Trédi Salaise (France) facility can operate a direct service with authorisation to treat waste involving chemical risk, biological risk, and waste that is highly odorous.

Considering the skills and experiences of SUI, they announce to have the capacity to intervene on different types of pollutions: biological risk, chemical pollutant (organic, PCB, pesticide, PCB, pesticide pollution, etc...), asbestos, accidental spillage of industrial sludge or effluent, etc.

SUI is convinced that the multi-disciplinary teams help with administration and the management of all types of emergency treatment operations. They have mobile equipment that can be rapidly deployed in the field. These facilities offer solutions to pre-treat waste before storage in order to modify the chemical nature of the waste and make it inert before storage, thus avoiding the release of pollutants into the environment. To secure these processes they announce that their teams include experts in biodiversity-related matters. They claim they work alongside the stakeholder throughout the cleanup process through to remediation of the impacted site: analysis, identification of onsite or offsite treatment solutions, earthworks, waste packaging, confinement, stabilization, site security, destruction, demolition, transport of waste to treatment units, administrative follow-up, and remediation.

Nearly all equipment is stored in container (air and sea) to facilitate the transport and deployment.



Photo 1: containers for emergency material storage

Some vehicles are placed in different centers in France and they are ready to go in the field as they contain basic material such as PPE, confinement/pumping material, etc.



Photo 2: containers for emergency material storage

Other vehicles can be towed to the pollution site:



Photos 3 and 4: boat and quad to transport persons/materials

If energy is missing on site a power generator can be started:



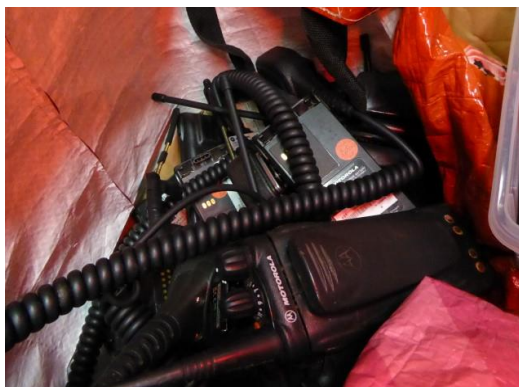
Photos 5: power generator

The response teams deployed in the field are equipped with a PPE package:



Photos 6, 7 and 8: type 1 suit, filtrating mask and gas detector

They must be able to coordinate with the following communication apparatus:



Photos 9: VHF radios

Hereafter are presented examples of materials for the response, on an evaporating product:



Photos 10: deflector to create curtain water

Responders can spread sorbent on a liquid spilled on soil:



Photos 11: diatomaceous earth used to sorb liquid on soil

Séché Environnement has a strong capacity of response, as well as in terms of materials than human resources. They are thus theoretically able to intervene all over the world for all

situations. Their response capacity can be deployed 24h/24 and 7d/7. They have an excellent capacity to manage waste storage and treatment in their own facilities. This keeps being true if the transport is not too complicated, for example with a difficult access to a distant spilled site.

The experience of the society is oriented towards industrial or coastal or inland spills. They have no experience in a maritime accident. In case of chemical product(s) spilt at sea, this lack of experience would make them rather a supporting team of responders than a leader. They could bring their knowledge of many chemical products to help maritime authorities.

For more information visit: <http://www.seche-waste-treatment.com/our-solutions/emergency-intervention-after-industrial-accidents-and-natural-disasters/>

2.8. Environment Canada

Under the Canadian Environmental Protection Act (CEPA 1999), Environment and Climate Change (ECC) conducts scientific Research and Development (R&D) and related scientific activities associated with environmental emergencies. The Emergencies Science and Technology Section is the primary provider of these activities to Environment and Climate Change Response Program (EEP). In this framework, ESTS supplies knowledge and expertise that EEP then transfers to response personnel across Canada during spill emergencies.

The ESTS provides Scientific and Technical response support expert advice across Canada for over 1000 of the incidents that are considered a high or medium risk to the environment. The section conducts R&D on the fate of chemicals in the environment and their effect on the environment. When a major environmental incident occurs, ESTS provides scientific and technical advice to clients and partners to assist in cleaning up oil and chemical spills and ensure that environment is adequately protected.

The ESTS has more than 30 years of experience and scientific knowledge in the behavior, fate and effects of spilled oil and chemicals, remote sensing R&D, environmental emergencies, advice and R&D on cleaning up spills and contaminated sites, spill modeling, and counterterrorism R&D. The ESTS also trains ECC's Emergencies Officers and Enforcement Officers and other government first responders in hazardous materials response, sampling protocols, and personal portable analytical instrumentation used at spill sites.

Expertise:

- Oil and chemical properties, behavior, sampling and analysis,
- Treatment of spilled hazardous materials,
- Counter-measures to spill, including spill treating agents (e.g. spill dispersants), mechanical recovery, in situ burning,
- Modeling of fate and behavior of spilled oil and chemicals in air, water and soil,
- Field and response research and operational spill response,
- Planning and response to spills,
- Remote sensing,
- Risk assessment of chemical and petroleum infrastructure projects.

Project areas:

- Oil physical properties and behavior,
- Oil forensic analyses including oil sands,
- Spill manuals,
- In situ counter-measures
- Spill modelling,
- Shoreline fate & counter-measures,
- Equipment assessment,
- Site remediation,
- Spill safety,
- Burn emissions,
- Treating agents,
- General information,
- On-site assistance,
- Biodegradation,
- Biological effects,
- Environmental fate,
- Counter-terrorism,
- Remote sensing,
- All projects done co-operatively – many with US agencies.

ESTS can be contacted to perform measurements in its laboratory or to mobilize some chemists and materials in the field in order to make chemical analyses or support for the emergency response. ESTS has a mobile lab that can be brought in the field and that allows to perform sampling of different types of substrates polluted. However the delay for the laboratory is about 4-6 weeks for a complete analysis.



Photo 1: Automatic bump test and calibration system (for Photo Ionization Detector)

ESTS launched the construction of a customized drone (see photo 2) but the project was too expensive. They considered that the most cost effective choice is to buy a commercial product.

ESTS has a project of drone in order to pump and collect sample in case of spill. Another drone, supplied by Aeryon society and equipped with IR/UV detection, will be able to perform programmable flights.



Photo 2: Customized drone for spill assessment

ESTS is able to determine different physic-chemical parameters of chemicals and oils. Among them:

- Density,
- Freeze point,
- Pouring point,
- Surface tension,
- Viscosity,
- Vapor pressure,
- Chemical composition with GC-FID,
- Etc.

To obtain a better understanding of the behavior and the fate of oils and chemical products, ESTS works at different scales. A tank plume is under construction in order to perform experimentations. The latter is inspired by the one built at Cedre and in the future both institutes will be able to compare their experimental results.



Photo 3: Vapor pressure tester

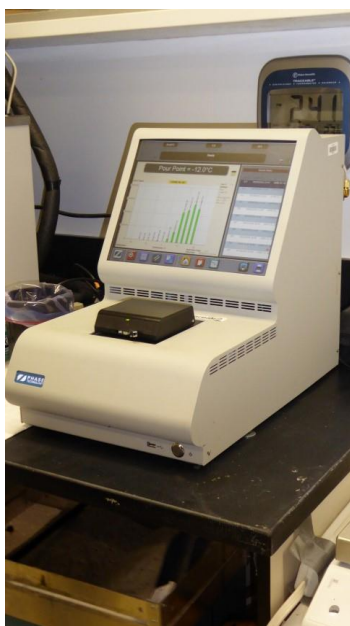


Photo 4: Freeze point, viscosity and density analyzer & Photo 5: Contact angles measurement



Photo 6: Rotative evaporator & Photo 7: Thermoregulated incubators

ESTS trains Emergencies Officers and Enforcement Officers and other government first responders to Hazmat handling and also to clean up and decontamination when a terrorism event occurs. The trainees learn about materials response, sampling protocols, and personal portable analytical instrumentation used at spill sites. To complete the training, ESTS supply some spill manual to manage different types of incident depending on the product.



Photo 8: Training room with various Personal Protective Equipment



Photo 9: Different types of suits & Photo 10: chemical suit of type A

ESTS has a consequent experience and is strongly involved in a very wide range of activities related to emergency response. This section is proactive to create new tools and procedures in order to improve the understanding and the behavior and the fate of HNS in the environment. ESTS also works on remote sensing R&D, environmental emergencies, advice and R&D on cleaning up spills and contaminated sites and spill modeling. It thus represents an essential partner in Canada or at an international level in terms of expertise on HNS.

Despite its lack of experience concerning marine spills, ESTS has a solid knowledge on HNS and could especially supply an interesting point of view on the strategies and techniques to implement for complex situations involving HNS.

For more information visit: <https://www.canada.ca/en/environment-climate-change/services/environmental-emergencies-program/science-technology-research.html>

2.9. SDIS 29

SDIS is defined as Department Service of Fire and Assistance, it is a public service funded and organized at the scale of French departments (counties). In addition to their basic missions such as firefighting or their duty to assist people in danger, firemen can be asked to take care of chemical hazard management. In case of accident involving HNS spills, firemen through their local center would often be the first to be on site for intervention besides responsible industrial strike team.

At the date of January 1st 2015, they were 454 professionals and 2101 volunteers, spread into 70 fire centers across the county of Finistère. Brest and Quimper are the most important centers and include a management service which is in charge of the coordination through the county.

Firemen have a specialized section dedicated to fight HNS spills: the CMIC, which means Mobile Container for Chemical Intervention. Depending on seriousness of an accident, four levels can be activated:

- 1st level: a unit of firefighters is immediately mobilized to perform a survey, rescue operations, protection of people and environment, dodge of explosion or fire, evacuation of suspected area, transmission of information. Depending of the nature and the extent the 2nd level can be activated.
- 2nd level: mobilization of a survey team (1 chief with 1st level chemical risk and operational crisis management qualifications + 2 team-mates with 1st level chemical risk qualification). It intervenes on different operations. It takes first emergency measures (exclusion area, protection of 1st responders, isolation of victims), qualifies the accident (survey and collection of information on the danger, assess the chemical risk) and supports the operations (the possible arrival of the response team, execution of commander orders, participation of the deployment of the decontamination units). Depending of the nature and the extent the 3rd level can be activated.
- 3rd level: mobilization of a response team (1 chief with 2nd level chemical risk and operational crisis management qualifications + 2 team-mates with 2nd level chemical risk qualification). This group takes protective measures (Upholding or evolution of the deployed dispositive, protection of the population, decontamination of responders/materials) qualify the incident/accident (Survey, detection and localization of the source of danger, risk assessment), attenuation of the incident/accident (suppression or limitation of the risk, dodge or limitation of contaminant transfer) and support of the operations (with other response teams, deployment of decontamination units). Depending of the nature and the extent the 3rd level can be activated.
- 4th level: mobilization of a chief with 3rd level chemical risk or a technical advisor with a chemical risk expertise to play the role of on-scene-commander and supervise the survey and response team(s).

The SDIS 29 is reachable 7d/7 24h/24 for emergency response, with an intervention in less than 20 minutes. They are the first responders on land in case of HNS release in the environment (soils or inland waters).

The SDIS 29 center of Brest is the 2nd most important of France in terms of size. For an efficient response to face chemical risk, SDIS 29 has many facilities and vehicles (cf photos of equipment), among them:

- Fleet of responses vehicles,
- Assistance and rescue vehicles,
- Specialized container (chemical, radiological and clearance response),
- Foam concentrate,
- Detectors 4 gas (CO, H₂S, O₂, LEL) and other specific detectors (chlorine, ammonia, etc.),
- Dräger tubes to find a product with successive test by dichotomy,
- Different types of Personal Protective Equipment whom suit type 1 (Matissec™) equipped with a system of communication.



- 1: Fleet of responses vehicles & 2: Assistance and rescue vehicle



- 3: Specialized container (chemical, radiological and clearance response)



- 4: basic material, whom isolating respiratory apparatus (on the right), in a chemical and radiological specialized vehicle



- 5 : Leakage response equipment



- 6 : Respiratory assistance container



- 7: Inflatable decontamination chamber

The SDIS 29 can be called for:

- **Response to gaseous and liquid leaks**
 - √ Source response – plugging the leak (lead frame, air chamber, quick-set clip for pipes, inflating pillow, lifting bag for tanker...),
 - √ Source response – acting on pipes (“Denso” strip to glue around the pipe, ice plug with wet tissue iced with the gas, clamp ring, external inflatable sleeves...),
 - √ Source response – severe leaks (manhole bag, emptying, burning or flaring),
- **Response to gaseous leaks**
 - √ Acting on the flow (peacock tail hoses, spray hoses, monitor, water curtain)
- **Response to liquid leaks**
 - √ Containment in pipe (inflating plug)
 - √ Containment on manhole cover (plastic cover plate, plastic tarp with sand),
 - √ Floor containment (merlon, sorbent rolls, gap, plastic tarp with sand)
- **Response to evaporating liquids**
 - √ Limiting vapor flow (plastic tarp, sorbents, layer of foam)
- **Response to lost stranded package (container, barrel, etc.)**
 - √ Recovery (if possible containment with an over packing procedure, specialized strike team)
- **Decontamination**
 - √ Mobile unit (inflatable decontamination lock chamber)

Firefighters have a capacity to respond rapidly, 24h/24 7d/7 and the fleet of specialized vehicles can be on site in less than 20 minutes. In case of HNS spilled on soil or in inland waters, the SDIS, and in the county the SDIS 29, will automatically be contacted to manage first response in the public domain. Firemen are highly trained and own equipment allowing them to intervene in various environments. If the means of responsible industrials are not enough to

contain the pollution, SDIS will be the link with French authorities and will generally play the role of on-scene-commander to coordinate the response. They also have a strong collaboration with French Navy Firefighters and they can support each other in a real case if necessary.

First they have original knowledge of response related to marine incident, for example with technical and procedure for over packing packages lost at sea and stranded. Moreover they use specific off-road vehicles to intervene at places where access is difficult.

For more information visit: <http://www.sdis29.fr/>

2.10. SARP

This French company is specialized in sanitation, pumping and waste management. Created in 1937 in Paris area to manage drainage of agriculture pollutants, the SARP is now a subsidiary of Veolia Propreté, a waste management major French company.

Its activities are split into different fields, decontamination, emergency response unit, drainage of accidental spill (HNS and oil) and global toxic and hazardous waste management. The SARP is composed of 3500 employees in 140 different places across the France.

The SARP is located only in France, and even if each branch office is specialized into one field, all of them can take care of every activity. As drainage and waste management is the SARP core of activities, they developed a wide range of technics in order to operate in any field and any environment. The company can be contracted either by public entities, such as cities, individuals or industrial industries.

The skills developed by the society are mainly oriented towards floating, or even sinking or dissolving products, and concern:

- Hydrocarbons decontamination,
- Vacuum of powdery product,
- Pipe inspection by camera,
- Pumping and dredging of pipes in confined areas,
- Sanitation (HNS and oil) in maritime environment as well,
- Geo-tracked vehicles fleet (flusher, drainer car...),
- Monitoring solution (drones, camera),
- Innovative nozzles for pipes dredging.

The SARP owns its own transit center near the Brest office. It is certified by French government as an Environmental Protection Classified Installation (ICPE) and thus is able to temporary store hazardous waste before sending them for treatment. Many other SARP offices through France have their own center, which ensure high reactivity and traceability.

The entity is reachable 7d/7 24h/24 for emergency response.

The SARP is involved in different sectors:

- **Public entities:**
 - ✓ Depollution (diagnosis of depollution, depollution of site and removal of waste, depollution of waste),
 - ✓ Sanitation (discharge and decontamination of networks of pipelines containing muds, sands, organic waste; management of wastewater facilities),

- ✓ Maintenance (pumping station, fountain, pipe network),
- ✓ Monitoring (Pipe inspection by nozzle equipped with camera, conformity control).
- **Businesses (restaurant, resort ...):**
 - ✓ Routine maintenance (grease tank cleaning, filters degreasing, exhaust hood servicing, hydrocarbons separators, pumping station, rat-extermination)
 - ✓ Collection (used vegetable oils, treatment)
 - ✓ Emergency response unit (emergency pipe unplugging)
- **Collective and individual housing:**
 - ✓ Routine maintenance (septic tank cleaning, leak test, network diagnosis, pre selling real estate diagnosis, rat-extermination, collection chute cleaning, hydrocarbons separators, pumping station)
 - ✓ Decontamination (fuel tank neutralisation),
 - ✓ Emergency response unit (emergency pipe unplugging)
- **Industrial services and oil industry:**
 - ✓ Routine maintenance (hydrocarbons separators maintenance and installation, fuel tanker maintenance – drainage, leak test, products transfer, pipes network maintenance)
 - ✓ Treatment (hazardous and non-hazardous waste)
 - ✓ Specific maintenance (cutting of tank, neutralization, gas station maintenance)
 - ✓ Emergency response unit (on-site response, fight against accidental spill, site depollution)

The SARP has a chemical emergency response team available 24h/24, in case of incidents/accidents of chemical products, mainly floating and in some extent sinking or dissolving products. Experts of the SARP intervene as soon as possible and manage the response against pollution, from people and goods protection to the transport and treatment of hazardous products. It must be noticed that the SARP is certified GEHSE, MASE, and ISO 9001.

They also propose a 24h/24 emergency hotline to assist its clients in the event of a spill.



1 : Response unit vehicle



2: Use of sorbents to contain an oil spill



3 : Flusher tank vehicle



4 : Drone used for monitoring and spreading



5 : Waste transit centre of Brest & 6: Nozzles used to dredge clogged pipes

The SARP has a strong experience in hazardous waste management. Being a subsidiary of a group as important as Veolia, insures that floating, and in some extent, sinking or dissolving products can be treated. Recovery and recycling of pollutants due to accidental spill is eased by the implantation of offices and waste transit centers all over France.

Monitoring through drones – for large natural polluted areas, or camera – for pipes allows giving accurate estimation of the amount of product to collect. They also own a drone, equipped with nozzles in order to spread a spray with chemicals in the framework of woof treatment. This technique might be an interesting solution in the case of floating chemical spilled at sea that could be dispersed (If, and only if, several conditions are satisfied such as sufficient height of water column, sufficient current, no toxicity, etc.), e.g. for vegetable oils.

The SARP uses innovative nozzles in order to dredge pipes, this type of equipment could be used to clean clogged pipes of chemical tanker. Nozzles equipped with a camera could be used for pipe inspection.

Finally it has a capacity to respond rapidly, 24h/24 7d/7.

For more information visit: <http://www.sarpi.fr/pmepmi/collecter-vos-dechets-speciaux>

2.11. LAFD

Response at sea in case of chemical spill is carried out by two complementary stations: station 24 dedicated to Hazmat and station 20 which owns a response vessel presented in next section (vessels equipment).

Station 24

The fire station 24 is specialized in Hazmat (Hazardous materials) emergency response. It is situated at 9411 Wentworth St, Sunland-Tujunga, CA 91040, USA. The Hazardous Materials Inventory and Business Emergency Response Plan Program regulates the use and storage of hazardous materials by business and industry. It is implemented by Los Angeles Fire Department Fire Prevention Bureau.

The Business Emergency Plan (BEP) is defined in the California Health and Safety code. It requires that businesses which use, store or handle hazardous materials file an emergency plan indicating their preparations for and actions in an emergency. The information is also shared with emergency response personnel to mitigate a release and to minimize harm or damage to human life, the environment, and property.

Station 24 is specialized in Hazmat response and is one of the two specialized stations in this field in Los Angeles.



Station 24 is equipped with a truck dedicated to Hazmat emergency response. Several racks surround the truck and contain equipment for the emergency response on HNS.



Equipment is sorted in different categories:

- Personal Protective Equipment: 12 A level suits dedicated to frontline response,
- A capacity of 5000 gallons of foam,



Thermal infra red camera

Thermal infra red pointer



Photo Ionization Detector & Radiological

Since September the 11th 2001 event, American funding to protect from CBRN attack has drastically increased, and consequently equipment to face HNS spill. The complementarity of LAFD's skills and equipment to face HNS spills onshore or at sea is very interesting. Moreover, despite the fact that very new and performing sensors or materials are present in the two stations visited or on the response ship, no very innovative principle of detection or response was met.

For more information visit: <http://www.lafd.org/fire-stations/station-20>

<http://www.lafd.org/fire-stations/station-24>

2.12. Scope

What's SCOPE2017

SCOPE 2017 is a joint project between the Norwegian Coastal Administration as the coordinator, and the Swedish Coast Guard, the Royal Danish Navy, the Environment Agency Island, South-East Police District, Norway and the Intermunicipal Emergency Response Organisation (IUA) in Telemark. In addition, the NCA is expecting other organisations to participate during the exercise, including resources from the EU.

Master scenario description

On September 26th 2017 at 02:14 local time, the product tanker "NCA OIL", IMO nr. 9682978, westbound from Slagentangen, collided with the gas (LPG) tanker "NCA CHEM", IMO nr. 9744922 inbound for Herøya in Porsgrunn. The gas tanker was loaded with ammonia. The collision took place west of the pilot boarding area, outside Grenland in Telemark county, on the south east coast of Norway.

The collision occurred just before the pilot embarked the gas tanker.

Collision point: N 58° 56,50 E 009° 46,85

Sequence of events for observers

During the first day, a briefing was given to the observers on the sequence of events and on security aspects. During the second day, observers had the opportunity to go on a special vessel chartered to follow operations at sea. During the third day, cleaning operations on the shoreline were carried out as well as chemical operations at “chem land”. The latter took place at a port where the LPG tanker Clipper Harald Stavanger IMO 9173068.

Among all very interesting and relevant operations performed at sea related to Search and Rescue of the crew, operations for oil recovery, etc. We focus here only on relevant procedures and equipment used for chemical operations.

The response vessel used was a tug owned by the Swedish Coast Guard and is named KBV03 AMFITRITE. She was built in 2010, has a 3804 t gross tonnage, a 2232 t summer DWT and stainless steel tanks with 250 m³ of storage capacity. She also has an overpressure system and a special gas filter for use in hazardous atmosphere (hydrocarbons) and is thus classified as a Chemical Recovery vessel.



Assessment and survey with a drone above the LPG vessel



Deployment on the concerned LPG vessel of a chemical response team with the help of a basket lifted with a crane from the specialized response vessel.

On day 3, at “chem land”, we had the opportunity to see an emergency by firefighters on the berthed vessel:



The firefighters hold their equipment and suits



Firefighters equipped with type 1 suits to intervene on the ammonia leakage



Firefighters equipped with type 3 suits with SCBA to intervene to support the front line response



Decontamination of responders after the intervention on the vessel



Responders equipped with suits and air purifying respirators

SCOPE2017 was a huge exercise funded by DG Echo. It was a comprehensive exercise with many aspects dealt both with oil and HNS concerns: notification, field exercise, equipment deployed, media communication, etc. It was an exceptional opportunity to have an overview of the management of the response on a chemical vessel.

For more information visit: <https://scope2017.com/>

2.13. Huelva

The General Directorate of the Merchant Marine (DGMM) through the Navy Captaincy of Huelva and in collaboration with the Port Authority of Huelva, organized the exercise to fight against marine pollution in the waters of the maritime province of Huelva (HUELVA-17) during 3 days in October 2017. Taking into account the chemical activity presented by the port of Huelva, the DGMM decided to carry out a simulation with a scenario in which a chemical tank was involved.

Scenario: Chemical tank vessel STOLT KINGFISHER, IMO Nº 9154323, flag of the United Kingdom, with pilot on board, in manoeuvre of exit from terminal located in zone I (interior ría de Huelva), after loading different SNL products from MARPOL Annex II, navigating to full load, had a failure of propulsion with power plant fall, running out of propulsion or government, proceeding to anchor immediately but without time to stop the start and beach on the right

bank of the estuary in the breakwater area of the dredging area No. 4, at the height of buoy No. 8 of the navigation channel. The tide had been dropping an hour at the time of the beached and the ship can not get rid of it until the next high tide, with the assistance of tugboats. Suffered structural damage in double hull, detected when probing ballast tanks, there are indications that one or several SNL cargo tanks could be affected. Once afloat free of the grounding, it is decided to move it towed to the anchorage Alfa of the Port of Huelva in order to make an underwater inspection by the underwater unit of Fire-fighters of Huelva, in which it is confirmed that it has two damaged cargo tanks with cracks, losing product (phenol and acetone) through them. This scenario involved the NRBQ Unit of the UME and the Underwater Fire Department of Huelva. Once the leaks are stabilized with the appropriate actions, it was decided to put the ship to the terminal with the assistance of tugs to proceed with its unloading, tank cleaning, degassing, etc., for provisional repair and transfer to another port for its dike entry.

The use of NRBQ equipment of GIETMA (UME) group was tested in both underwater and onboard.



GIETMA NRBQ group boarding on the chemical tanker during the exercise



GIETMA NRBQ sub aquatic group during the exercise



GIETMA NRBQ sub aquatic group during the exercise



GIETMA NRBQ group during the exercise

3. Evaluation of antipollution vessels equipment

Antipollution vessels of Galician Coastguards were evaluated to be adapted to HNS spill response:



R/S Sebastián de Ocampo



B/S Irmãos García Nodal

The equipment of the two vessels is included in Annex 1.

CBRN Response vessel at Long Beach Station 20, Los Angeles Fire Department (USA)

The fire station 20 is specialized in emergency response at sea in the port area of Long Beach. It situated at 401 Pier D Ave., CA 90802, USA.

Station 20 is specialized in marine emergency response in case of fire or CBRN issue. This station gathers trained fire fighters and equipment to respond at sea.

Fire-fighters from station 20 and 24 have developed complementary skills to intervene at sea in case of HNS spill. In such a situation, firefighters from station 24 will bring their own equipment and join firefighters from station 24 to intervene at sea.

A response ship stands at the station 20 and is able to be rapidly deployed in case of problem at sea.



Many equipment are present on the ship, including:

- FIFI system (fire fighting system):



Foam storage



VSP (Voith Schneider Propulsion), allowing propulsion and steering in one unit



Fixed fire-fighting system



Mobile (removable) fire-fighting system

- Search and rescue materials:



Lamp



Stretcher

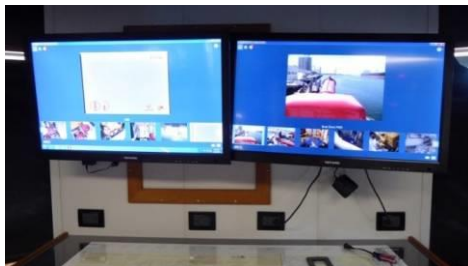


Dinghy



Fan

- Devices for observation:



Visible and infrared cameras





360° visibility and double control panel

- Devices for communication:



Location



Radios

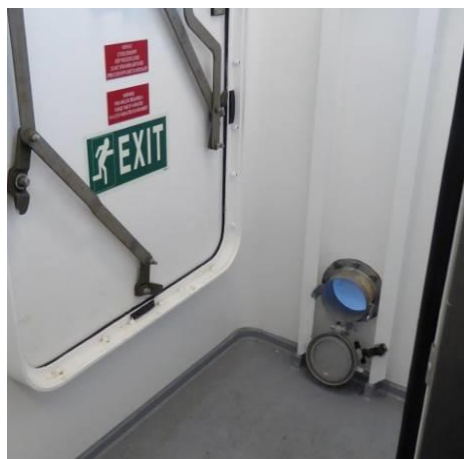


Mobile satellite TV systems

- Overpressure system: when the ship must enter in a toxic atmosphere, a preliminary and dedicated procedure is necessary to switch the operating mode of the ship, especially the citadelle, under positive atmosphere.



First of all the alarm warns the crew of the CBRN mode and request them to close hatches



An automatic aperture of airsweep allows air evacuation



The firefighters have some equipment available in the citadelle. They can wear PPE and get ready in an intermediate exit room, playing the role of transitory space, before going out.



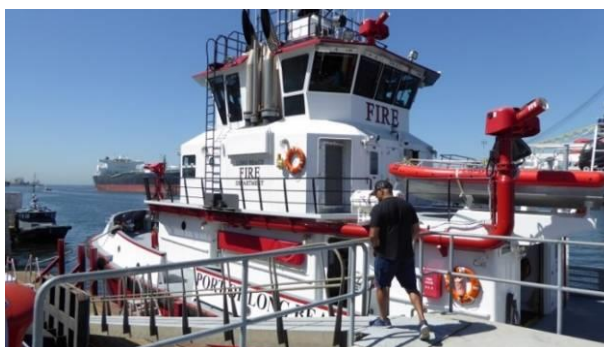
Some red and green lights clearly indicate respectively the prohibition or authorization to exit the citadelle. An outdoor decontamination shower is present on the bridge for a rough decontamination.



Once in the intermediate room, both shower and an air purification system are present to end decontamination



Depending on the nature of the chemical a recovery or rejection of waste water is possible
Double diesel engine with filtered air inlet



Filter for air inlet

4. Adaptation of response protocols

Taking into account all the land experiences and information analyzed a practical response guide aimed at the responders crew was developed. Annex 2 contains the guide: **Protocols for responding to HNS spills at sea.**

5. Testing of adapted response protocols

In order to test the adapted protocols and once the equipment of Galician Coastguards vessels was partially adapted to deal with HNS according to them, several exercises where carried out in field exercises. Information recovered during the exercises can be found on Mariner's exercise video: [Dealing with HNS spills at sea.](#)