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Northern Adriatic Oil Spill Training Platform

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Abstract. In the Slovene coastal sector of the Gulf of Trieste, it is possible to build an Oil Spill training centre. In this paper the basic experimental equipment, software, and facilities necessary are described. The first include: high frequency radar capable of measuring surface currents, three oceanographic buoys providing a variety of data, several meteorological stations positioned on the coast, several stationary unit current measurement stations, a stationary oil spill radar, a mobile oil spill radar, one of the most advanced VTS systems currently available, access to real time satellite imagery in conjunction with Space.si, a dedicated oil spill crisis team using a specialized vessel and a Transas oil spill simulator linked to a full bridge navigation simulator. The University of Ljubljana, Faculty of Maritime and Transport, has a team of experts using all such equipment for research purposes and has already organized many courses on oil spill response for the private and governmental sectors. This paper will describe the basic exercises conducted both in the field and on the simulator. It will present the synergy of all the data obtained from the various equipment and the simulator, as well as the methods of preparation, monitoring, and collection of various data during the exercise and the complete event after the exercise. The exercise designed for the simulator is then analysed using the simulator with all experimental data embedded in the system.

Keywords: marine pollution, oil spill simulation, PISCES 2, surveillance and detection, OPRC, contingency plan, IPIECA, stakeholders, training course

1. Introduction

The International Maritime Organization's International Convention on Oil Pollution Preparedness, Response and Co-operation, 1990 (OPRC 90) requires national authorities to have in place a process of oil spill training to ensure that all involved in the response to a maritime oil spill are sufficiently educated, trained, and prepared. The Protocol on Preparedness, Response and Co-operation to Pollution Incidents by Hazardous and Noxious Substances, 2000 (OPRC-HNS Protocol) extends this regulatory framework to address pollution incidents involving hazardous and noxious substances; i.e., chemicals [1]. To comply with IMO convention and standards, we need to develop standards for such training. The training basics will be adapted to the IMO model courses and tailored to Slovenian needs for the Port of Koper, local harbours and marinas. The Law on Protection against Natural and Other Disasters [2] is an overarching law that regulates the activation Civil Protection units in the event of marine pollution. The law also contains an article on the training of participants, but does not address the content and methods of training. There is also a decree on the organization, equipment, and training of protection and aid forces [3], which also does not address the content of the actual training. The law requires that a protection and rescue plan be prepared based on risk assessment and professional knowledge and good practice. The Slovenian emergency response plan in the event of accidents at sea [4] is supplemented by the following important documents: regulation on specifications for emergency plans, instruction on the analysis of threat assessments, and instructions on providing information on natural and other accidents.

The northern Adriatic is a closed and ecologically sensitive ecological system [5]. The Slovenian coast forms a semi-enclosed part of the Gulf of Trieste, which is the northernmost part of the Adriatic Sea. This small region (see figure 1) contains three major ports Koper (Slovenia), Trieste (Italy) and Monfalcone (Italy), all of which have terminals including liquid petrol and chemical terminals. Marine traffic in and out of the ports and between them is very intensive, so the risk of collision or grounding is not negligible and must be considered as a high pollution risk. The amount of crude oil, various products, and liquid chemicals transported via the Adriatic Sea is currently 70 to 80 million tons per year and rising [6]. There is also oil pollution risk from moving and anchored vessels. From time to time the region is confronted with very strong winds, gusting to 200 km/h and more from northerly directions [7].

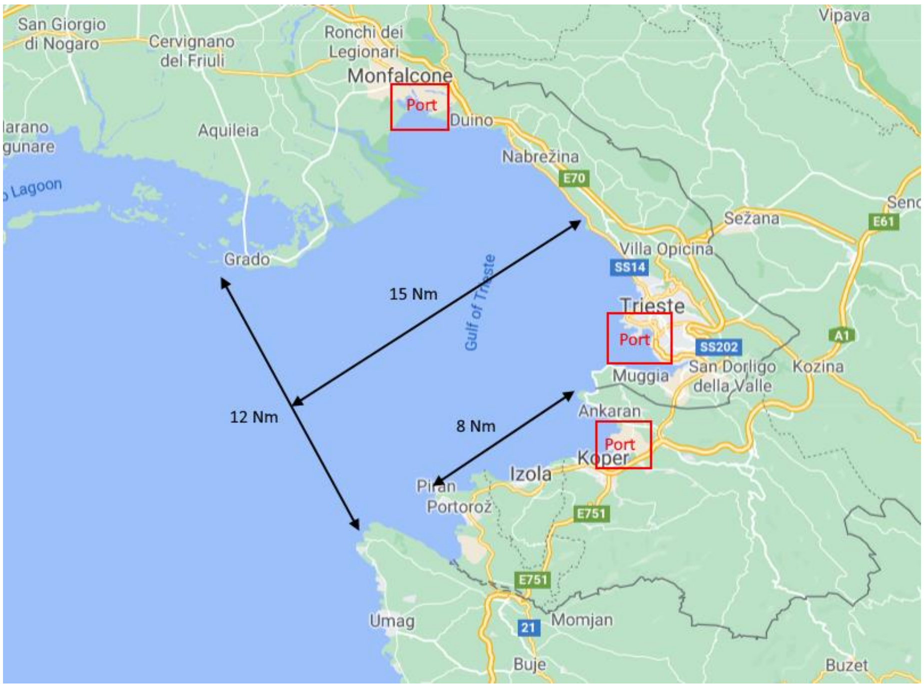

Figure 1. The northern Adriatic region with Gulf of Trieste. Red rectangles show positions these ports: Koper, Trieste and Monfalcone.

Strong northerly winds can cause extreme waves, 5 m high and 50 m long, mainly in the SW part of the gulf, its entrance. The other primary extreme wind comes from the SE, but is not as strong as that from the north, but can produce high waves near that same entrance to the gulf, as well as reflection waves that come from the open Adriatic. This is not to mention winds accompanying storms from the south and southwest, which occur periodically each year. The currents in this area are generally counterclockwise. The tides alternate between diurnal and semidiurnal in periods of about 15 days; measured strictly by the tides, the water level generally varies by less than a meter, but may rise more at certain times.

An oil spill anywhere on the Slovenian coast would be a disaster, with the cost of the clean-up and economic loss incalculable. This brings us to one of the main concerns regarding possible oil spills [8]. The westernmost part of the Slovenian Sea is near Croatia's Savudrija Peninsula, where the Sečovlje

Salt Pans are located in the Bay of Piran in the alluvial plain of the Drnica and Dragonja rivers. A large part of the salt pans is actually below sea level. They are protected by dams, but could easily be destroyed by a confluence of circumstances: An already elevated sea level, high tides and strong winds from the southwest - all common events - need only be combined with an oil spill to destroy a heritage that dates back thousands of years. Once oil breaks through the channels of the salt pans, it would be carried up to three kilometres inland.

The geographical and meteorological environment of the northern Adriatic Sea provides an interesting training zone for all kinds of real training conditions and equipment testing. At the Faculty of Maritime Technology and Transport in Portorož there are already many facilities that can be used for such a training platform: modern lecture halls, a modern computer room equipped with various Transas-Wartsila, Kongsberg, and Elman simulators, such as a full bridge simulator, an oil spill simulator, a cargo handling simulator, an engine room simulator and communications simulator, two boats of different size, an electrical laboratory, a navigation laboratory, etc.

For quality training, especially for teaching management skills, an integrated simulator centre is required, one that works in real time with physically and mathematically calculated values. And to ensure the safety of the ship, cargo, crew and environment, the company's main personnel and first responders must have the requisite skills such a teaching apparatus can provide. In the process of knowledge acquisition, all personnel should be confronted with the crucial multi-dimensional question "What happens if..." Appropriate simulation training provides an accessible introduction to the background theories through the realistic operation of the simulator. The faculty closely cooperates with governmental and local institutions in the maritime sector and has access to their equipment and personnel. For example, a new VTS centre was recently commissioned. The modern integration of VTS with other maritime traffic control instruments and equipment is one of the starting points for a generation of oil pollution exercises that will be described in section 3.

2. Equipment

As part of the preparation of the National Oil and Chemical Spill Contingency Plan for Slovenia (NOCSCP), in which the Faculty of Maritime Studies and Transport has also actively participated, the acquired equipment for the management of critical situations at sea - Potential Incident Simulation, Control and Evaluation System is a response simulator intended for the preparation and conduct of command centre exercises and area exercises in oil spill response. The PISCES 2 [9] is designed to perform tasks required by the Oil Pollution Act 1990 (OPA 90) for improved training of managers in oil spill response. PISCES 2 provides exercise participants with an interactive information environment based on mathematical modelling of an oil spill interacting with the environment and response facilities. The system includes information collection facilities to allow evaluation of participant performance. The method of using PISCES 2 implies that two groups of people participate in oil spill response exercises: Instructors and Trainees. There are three phases of an exercise: preparation, execution, and debriefing. PISCES 2 operating modes corresponding to these phases (Forecast, Conduct, and Debrief) are used to reproduce the "reality" of the exercise, automating the instructor's activities, and recording the key events of the exercise. The PISCES 2 simulator is also equipped with five operational stations designed for civil protection, port authority, marine police, researchers, and environmental agency researchers. The simulator can work not only as a training device, but also as an actual oil spill response. PISCES 2 can receive real-time data from AIS, RADARS, and a METOCEAN receiver located on Mt. Slavnik and controlled by the Port Authority. The configuration of such integrated simulator equipment at the faculty of maritime studies is unique at this time (Figure 2). The complex integrated simulator centre is connected via a secure VPN to external traffic sources, such as the VTS system based on Automatic Identification System in the office of the Slovenian Maritime Administration, the VTS system based on RADAR in the administration and the marine police, and the oceanographic and meteorological source in the marine biological station. It is also possible to integrate satellite images of oil spills. Such simulator integration is suitable for education and training of national personnel intended for operations in crisis situations at sea and, moreover, can be very useful in a real case as a crisis centre. It is unique in the world in the number of different scenarios with different malfunctions that can be simulated, including those with a low probability of occurrence.

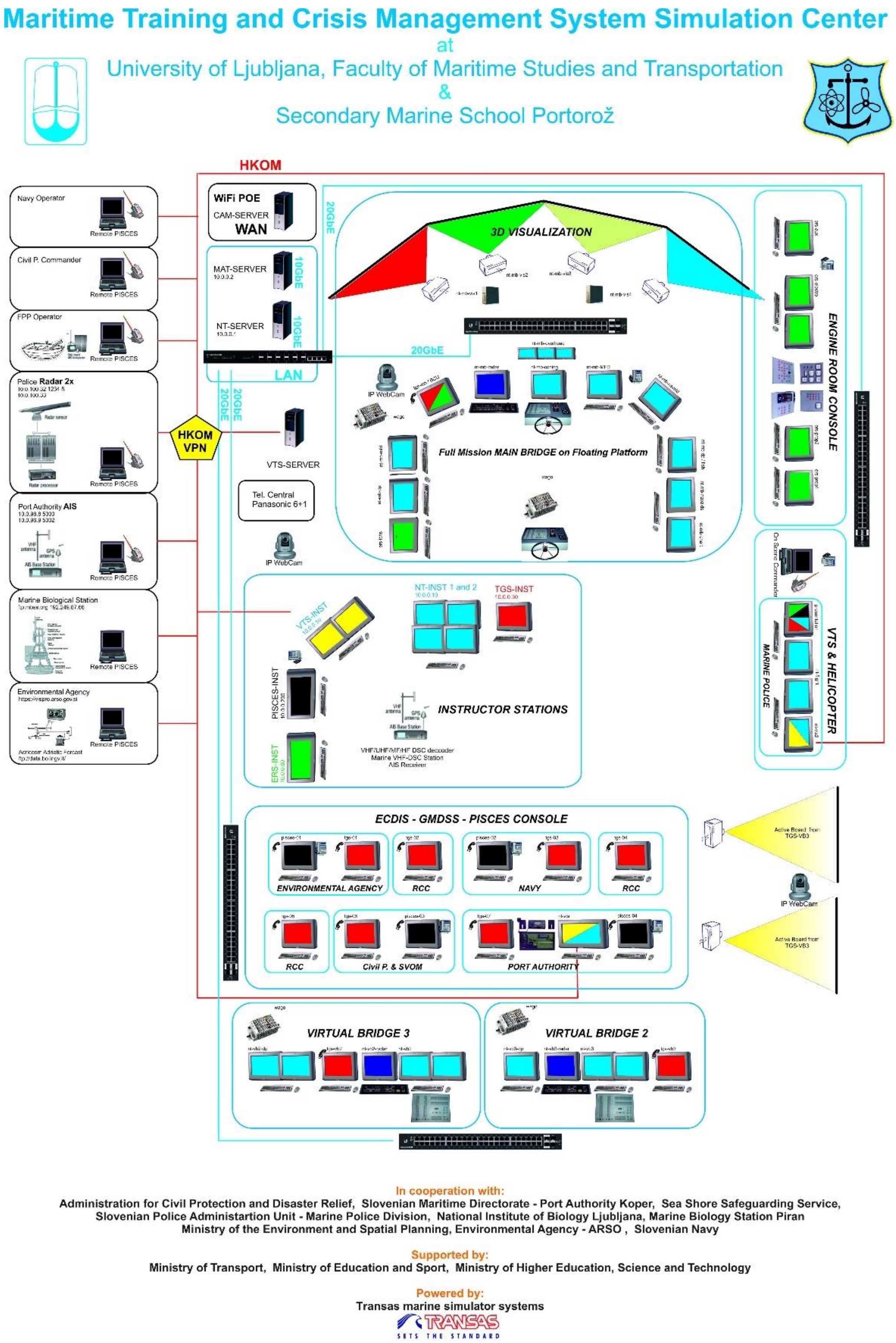

Figure 2. Crisis Management System Simulation Center

3. Basic exercises

Under the Regional Marine Pollution Emergency Response Centre for the Meduiteranean Sea established in Malta (1977), the sub-regional contingency plan among Italy, Croatia, and Slovenia has been presented to the Barcelona Convention and awaits final adoption [10]. Though Figure 3 is rather straight-forward it is necessary to emphasise the importance of personnel training, for without intensive execution the entire scheme collapses; for this reason Slovenia, for example, has established a modern simulation based oil spill crisis management centre that provides not only training but doubles as an active centre for real emergencies (since its inception it has been used in cases from the Levant to the English Channel) [11,12]. In the process of cooperating toward activating the international sub-regional contingency plan, new vessel traffic surveillance, metocean buoys, spill detection radar and high-frequency radar [13] have all been installed by stakeholders (Figure 4).

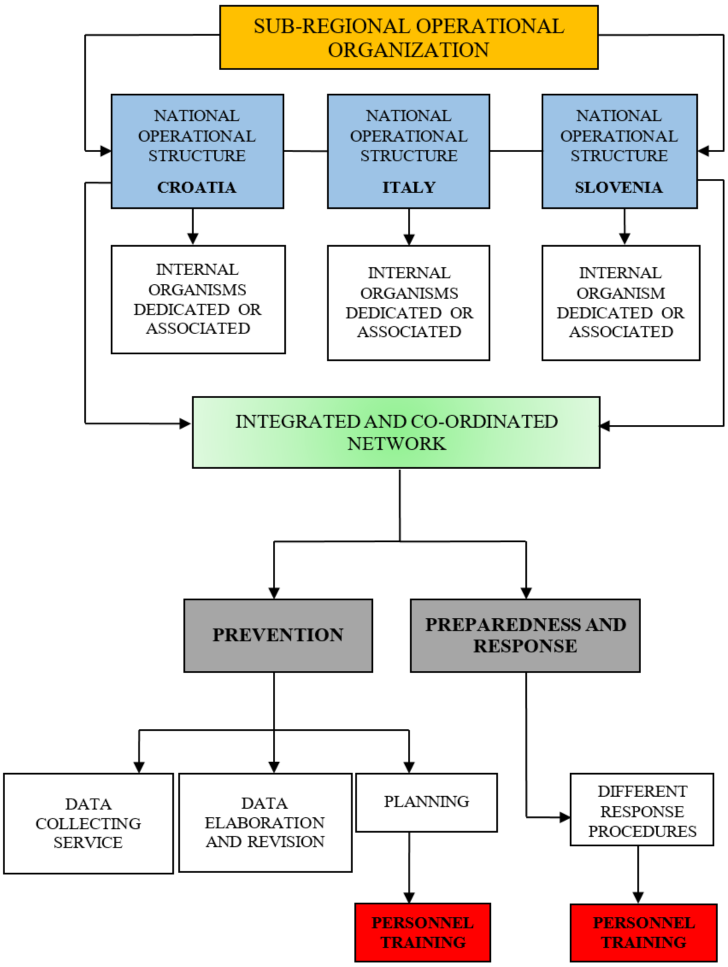

Figure 3. Trans-border cooperation in case of prevention, preparedness and response [6]

Effective oil spill preparedness and response is based on a systematic assessment of oil spill risks, conducted in an appropriate operational environment and taking into account the environmental and socio-economic resources that may be at risk. This assessment should lead to the establishment of capacities commensurate with these risks in terms of emergency organization, procedures, trained personnel, oil spill response equipment and logistical support. Oil spill contingency plans are the main tools necessary to ensure that the capacities created are managed and coordinated within a framework for an integrated response among all relevant organizations.

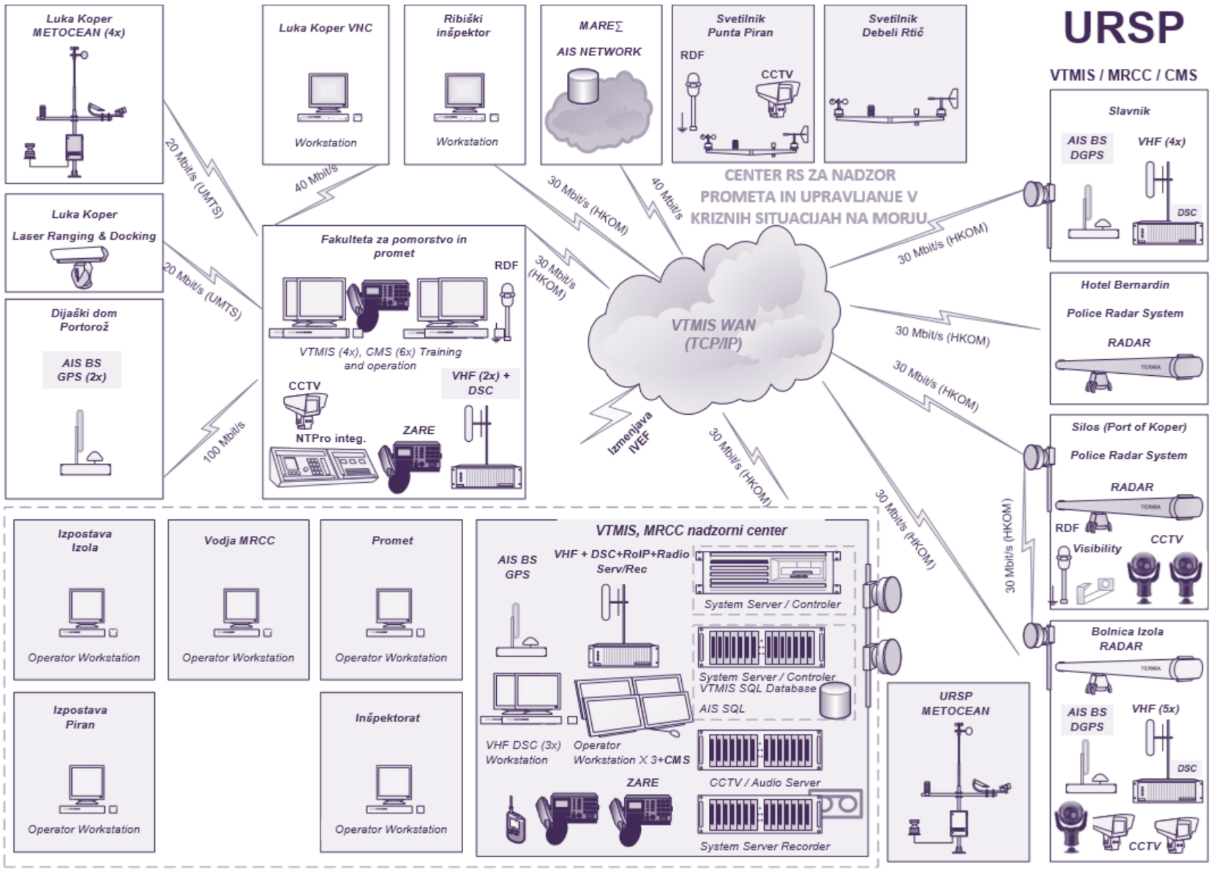

Figure 4. VTMIS Centre integrated with Regional MAREΣ AIS network, extensive METOCAN data sources, surveilance, detection and training centre

Oil spill drills include the activities through which personnel can practice and review oil spill contingency plans and the procedures required therein. This may include incident assessment and decision making, working with outside organizations, mobilizing or deploying equipment, and developing staff competency through continuous improvement. An exercise program for an organization or facility is a fundamental tool for reviewing and improving the effectiveness of oil spill preparedness and response capabilities. The importance of oil spill exercises is recognized by governments and industry. This is underlined by the IMO Convention on Oil Pollution Preparedness, Response and Co-operation, 1990 (OPRC Convention). Article 6(2)(b) of this Convention calls on governments to work with the oil and shipping industries, port authorities, and other relevant bodies to establish "... an exercise program for oil pollution response organizations and for the training of relevant personnel". It is instructive and important to note the link between exercises and training in this article.

IPIECA, in collaboration with IMO, has produced a number of IOGP publications on oil spill training. For example, the Good Practice Guidelines (IPIECA 2014 and 2005) [14,15] are recommended in relation to how exercises can be an integral part of a training program. These guidelines should benefit all persons who may be involved in oil spill response, especially those responsible for oil spill planning and response in national and local government agencies, oil companies, and shipping companies. These same individuals should also be involved in the implementation of oil spill contingency plans - the final but ongoing activity of which is practicing. Developing and testing crisis and emergency management organizations and procedures through oil spill exercises has the added benefit of improving preparedness for response to other emergencies.

Typical exercise planning process schema, shown in figure 5, defines basic points and decision paths for a quality exercise planning and its design.

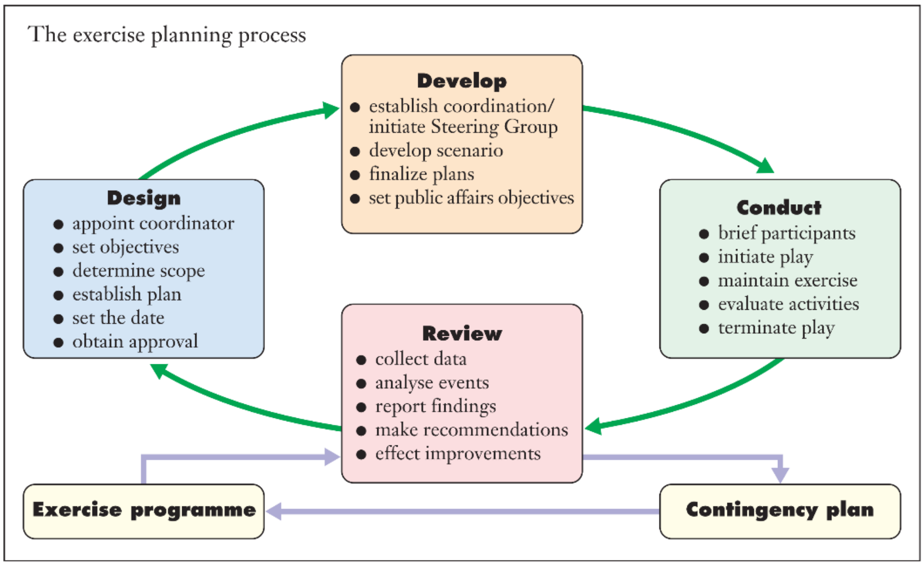

Figure 5. Oil spill exercise planning process (IPIECA, 2005)

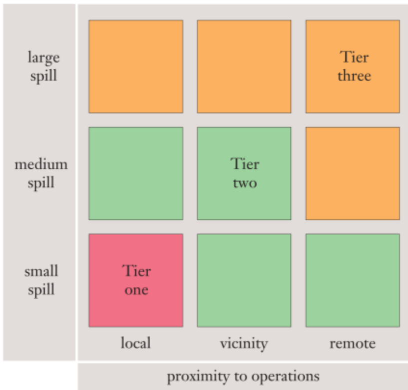

Figure 6. Shows the Tiered Response graph

Figure 6 illustrates the Tiered Response's approach to contingency planning, which recommends developing a series of integrated plans at different levels or tiers in conjunction with Figure 2. According to figure 3, there are the following three scenarios:

- Tier 1: for small spills, often caused during ship loading and unloading or bunkering, which should be responded to with local resources immediately available to the terminal;
- Tier 2: for moderate spills, often caused by a minor accident at sea or an accident in a tank farm or pipeline, which should be responded to with local and, if necessary, national resources;
- Tier 3: for major spills, usually caused by major accidents at sea or well blowouts, which should be responded to with local, national and, if necessary, international resources.

It is very important that government representatives participate in exercises involving industry and that industry representatives participate in government-initiated exercises. Only in this way can all parties fully explore and understand the various roles and responsibilities. Such regular contact also serves to develop and strengthen the personal relationships that are so important in emergencies.

The purpose of conducting exercises is to test the plan, equipment, and capabilities of the response team and the resources available to it. No exercise is complete without an evaluation and review leading to recommendations for improvements to the plan, availability of resources, or training of personnel.

The existing national emergency response plan for accidents at sea sets out the basic actions to be taken in the event of accidents at sea. In preparation for an oil spill, it is suggested that all team members undergo appropriate training as recommended by the International Convention on Oil Pollution Preparedness, Response and Cooperation, 1990 (OPRC) (IMO 1990) in the area of oil spill preparedness and response. In this context, four model training courses have been developed with the following objectives:

- **LEVEL 0:** Introduction or Raising Awareness
- **LEVEL 1:** First Responders (Operational)
- **LEVEL 2:** Supervisors and On-Scene Commanders (Tactical)
- **LEVEL 3:** Administrators and Senior Managers (Strategic)

The OPRC-HNS Technical Group has developed two model courses for maritime incident preparedness and response involving hazardous and noxious substances. The purpose of these model courses is to provide practical training and guidance on preparing for and responding to HNS incidents. The courses have not been designed to train response personnel as this is a separate and very specific subject [16]. These courses, when properly linked to a country's national emergency response plan, can be used to train personnel who will be the cornerstone of conducting and managing an effective response to a marine HNS accident.

Well-trained responders who are appropriate and equipped for their role can handle all types of minor or moderate pollution-related emergency situations.

4. Conclusions

Despite the fact that shipping is economic, safe and the most environmentally friendly way to transport goods, sometimes we are still confronted with shipping accidents resulting in loss of human lives or severe environmental damage. Luckily, large accidental pollution incidents are now rare. Significant reduction has been achieved through successful prevention programs, mainly those introduced by the International Maritime Organization.

Marine oil spills, both potential and actual, pose a risk for the European coastlines in terms of ecological damage, socio-economic losses and the influence on the coastal industry.

This article describes the basic design and approach to the possible establishment of an oil spill training platform for the northern Adriatic Sea. Currently, all the necessary equipment, rooms and personnel are already on site. The approach to establishing appropriate plans and exercises is largely described in the documents (IPIECA, 2005) and (IPIECA, 2014) and needs to be elevated to a national legislative level. Formally, a solid foundation is in place to begin the process of formalising platform status. A complete structure should be unified under one roof, necessary exercises must be developed accordingly. Finally, the new centre must receive certification at the national or classification level, perhaps both.

Work with the ship handling, cargo handling, engine room, vessel traffic service, oil spill and communication simulators demonstrably reduces the likelihood of human error - i.e., operational failures and miscommunications commonly cause major accidents and expensive breakdowns with severe economic, environmental, and health consequences.

Currently, everything is in place in the northern Adriatic region for the area to become a leader in oil spill response and training. All stakeholders are well equipped and the University of Ljubljana's Faculty of Maritime already conducts training courses when necessary custom designed for ports, marinas, the maritime administration. All courses adhere to IMO guidelines, and not the Gulf of Trieste is surveyed by state of the art VTMIS equipment, sensors have been installed for detecting and tracking oil spills, and software enabling the study of the weathering process of oils and chemicals inadvertently released will increase the capabilities of experts in this field in the future. The Blu4Seas program should prove beneficial to all cooperating parties, extending the reach of knowledge, establishing university level programs for stakeholders, and through study in our region continue to improve all aspects of response. Such a program is of course designed with more than local expertise in mind, and we expect a synergistic improvement of all-around knowledge and effectiveness through coordination and exchange of experience and ideas with partners from the Mediterranean, Black Sea, and Atlantic. In fact, such cooperation as that which is evident now, is building on previous cooperative efforts and exchanges among partners from around the globe, so that we can confidently say that current efforts are but extensions of a stream of knowledge that flows continuously.

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