Safety Science 48 (2010) 991–999

Contents lists available at ScienceDirect

Safety Science

journal homepage: www.elsevier.com/locate/ssci

The regional emergency plan requirement: Application of the best practices to the Brazilian case

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ARTICLE INFO

Article history:
Received 28 January 2009
Received in revised form 25 May 2009
Accepted 26 June 2009

Keywords:
Individual emergency plan
Regional emergency plan
Risk analysis
Emergency exercise simulation

ABSTRACT

The objective of this study is to define new requirements for a Brazilian regional emergency plan based on the best practices used in countries such as the USA, UK, Canada, Japan and Australia. Therefore, the risk analysis methodologies and emergency frameworks used in these countries will be taken into account and a critical analysis will be carried out in order to customize and apply their best practices to Brazilian case. In addition, other issues will be looked at, such as the number of accidents and environmental impact in some areas, related to environmental sensitivity in order to define the environment reliability of the whole system in a specific area. Currently in Brazil resources are not optimized in an emergency offshore plan, rather company has to implement its own emergency plan without any kind of coordination. Despite the existence of some procedures, there are no national or regional frameworks to coordinate emergency plans in Brazil.

1. Introduction

The importance of emergency plans is clear whenever a catastrophic accident happens that requires efficient emergency procedures. Despite efficient risk management, in many cases catastrophic events cannot be avoided over the lifetimes of enterprises. Moreover, some of these are triggered by natural catastrophes such as hurricanes, landslides and earthquakes, other by terrorist attacks.

Catastrophic events are characterized by social and environmental damage and losses to industry. These kind of events are more frequent in some particular industries such as oil and gas, aeronautics and the nuclear sector. Therefore, safety management has had to take catastrophic events as being possible and implement strict procedures that have been improved following a history of accidents over the last decades.

International studies (Moraes and Giovanni de Araujo, 2004) reports claim that more than 500 million people were affected by natural catastrophes between 1970 and 2000 and that there are more than 200,000 deaths in workplaces every year. Globally speaking there are terrible scenarios related to the workplace, such as:

⇒ 20–90% of employees work without safety and health assistance;

⇒ 80% of employees are based in developing countries;
⇒ 30–50% of employees are exposed to toxic substances.

Even though such scenarios, emergency plan, which is take part into safety management, is not well applied in many cases.

In Brazil, there were catastrophic accidents last 10 year in the oil and gas industry resulting in new requirements to create emergency procedures, improve risk management and for increase precautions in new projects. The P-36 and Guanabara Bay accidents forced the Brazilian government to be much stricter in regard to safety and environment requirements, creating new laws for the oil and gas industry. Despite improvements following these accidents, the regional and national emergency plans were not evaluated and remain a critical point for the Brazilian safety system in relation to the oil and gas industry.

That paper will discuss the approaches used in different countries around the world in order to propose the best practices to be applied in a regional Brazilian emergency plan.

2. Emergency plan

The emergency plan is a group of procedures to be implemented in case of a catastrophic event situation involving communication, planning, action, risk analysis, operational support, logistic support and whatever is necessary to reduce accident impacts.

There are three emergency levels – individual, regional and national. Depending on the criticality of events and their damages, one of those levels has to be implemented. The remarkable point in emergency plan is the emergency framework which involves industry, government and society with different levels of responsibilities. It has a significant influence on the efficiency of emergency

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doi:10.1016/j.ssci.2009.06.005

response. The particular issues of each emergency level will be described below.

2.1. Individual emergency plan

The individual emergency plan is required for industries which have dangerous processes that in the case of accidents can cause serious damage to employees or the environment. The chemical, oil and gas and nuclear industries are considered to have high risk levels, thus they are required to carry out risk management which support individual emergency plan. In order to prepare for critical accidents when environment or health damage is possible, an emergency plan has to be prepared, evaluated and tested frequently in order to propose the best practices that can reduce damage in case of accident. The individual emergency plan involves communication and operational procedures to reduce impacts and operate industrial plants in accident situations. Emergency escape routes and reference points in industrial plants are defined for each accident scenario.

Individual emergency procedures are based on accident scenarios requiring emergency team training in different situations with different types of equipment. It is very important to bear in mind that no matter how developed the individual emergency plan is, it cannot take into account every combination of situations and it has to be improved constantly. In some cases, an individual emergency plan is not enough to deal with a catastrophic situation, so in this case regional and national emergency plans are required.

2.2. Regional emergency plan

The regional emergency plan covers all individual emergency plans in a specific area in order to respond to an emergency situation when an individual emergency plan is not enough to response and control situation. The regional emergency plan requires a good level of coordination among the organizations involved, while most often command is centralized in public authorities in order to guarantee society welfare.

The regional emergency framework for supporting emergency responses is critical and depending on the situation, that always required efficient command framework but in some cases it is overworked.

The multi-organizational model is proposed to analyze organizational interactions taking into account the cognitive decision process (Shu and Furuta, 2007). Fig. 1 shows the multi-organizational model as representing several organizations.

These issues are critical to the regional emergency plan because they can strongly influence the efficiency of emergency response in the event of catastrophic events.

2.3. National emergency plan

The national emergency plan is the most complex plan and requires multi-organizational cooperation and involves many different types of resources, such as human, logistical, equipment and technological from different sources which require a high coordination capacity, as well as the very well prepared authority for their implementation. Similar to the regional emergency plan, the efficiency of the coordination will have a significant influence on emergency response.

In most cases, the national emergency plan is centralized requiring many decisions in a short period of time from the command center. During the September 11 terrorist attacks in the US, all decisions were centralized in the President and the delay in response made the situation worse because the lack of communication with him. This is an extreme case, but it is nonetheless advisable to carry out some form of analysis of the national emergency framework in order to check it efficiency. The multi-organizational simulation model is proposed in order to check command availability. In Japan simulations are carried out to analyze multi-organization performance in the case of catastrophic events, while it is also possible to check if the proposed framework is the most suitable. The other possibility is to carry out emergency exercises but due the complexity and resources involved, this is not done frequently, therefore simulations support decision making and contribute to improving the national emergency plan. Fig. 2 shows the Japan case study which analyzes the efficiency of the emergency framework.

One of the main results of this model is communication occupancy. In Kouhou it is over 100%. This shows that some improvement is required in order to avoid response delays.

For some types of events there are criteria to define when individual, regional or national emergency plans will be required. For oil spills, the classification depends on the oil spill quantity. TIER ONE, TWO AND THREE represent the individual, regional and national emergency plans, respectively.

3. Sensitivity analysis

The main objective of the sensitivity analysis is to define the most critical areas in terms of the environmental, social and eco-

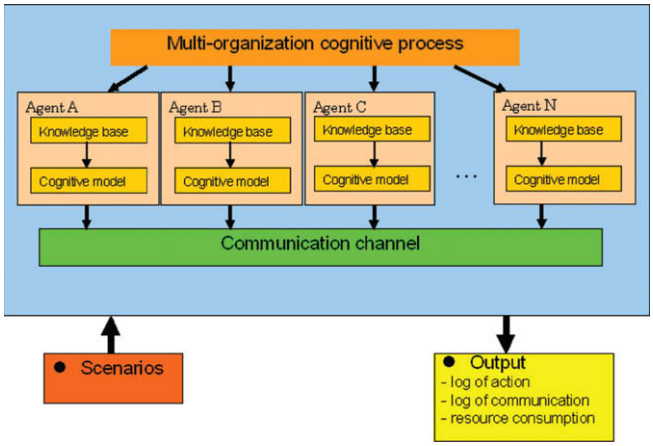

Fig. 1. Multi-organization cognitive process.

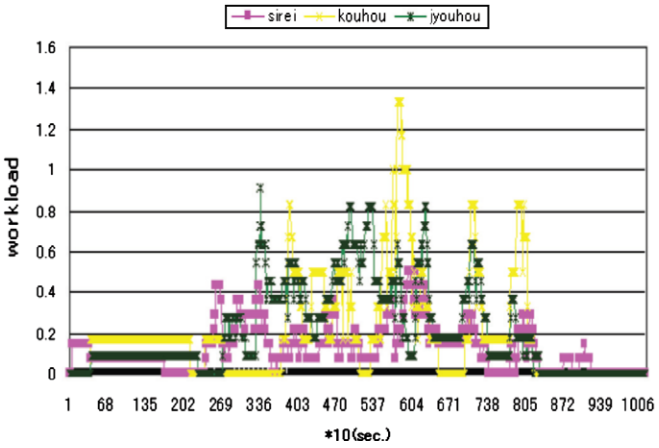

Fig. 2. Communication workload.

nomic effects of catastrophic accidents. As emergency resources are limited the priority areas of protection in the event of accidents have to be defined, for which reason many different methodologies are used. Usually an index is attributed to each area in relation to it's resources and emergency resources are located as near as possible, so that in the event of an accident these areas can be protected first. The sensitivity index combines industrial risk with environment sensitivity, but depending on the situation both natural catastrophes and terrorist attacks have to be taken into account. Although it is less common, the complete approach provides a more robust solution but it is not necessary in all cases. Therefore, when a sensitivity analysis is carried out, all the risks involved have to be taken into account, in order to obtain good results with low vulnerabilities.

3.1. Technological risks

Technological risks (Mazzarotta and Silvetti, 2006) associated with plant processes and the transportation of dangerous goods, are currently assessed based on QRA and TRA approaches. Both cases determine the individual risk at any specific location in the proximity of the installation or along the transportation route. The individual risk (IR) values has been converted into severity index (SI) terms, by setting suitable threshold values for negligible and unacceptable risks and a correspondence rule within this range.

Industrial installations are located in different areas all over the world, and may or may not be critical depending on the social and environmental impacts of accidents near installations. Despite the technologies involved in protecting the environment, society and employees, as well as risk management, high level system protection and so on, the possibility of accidents will always exist. Therefore, sensitivity analysis has to be carried out in relation to the environmental resources around the industrial area to locate emergency resources and define the appropriate resources.

3.2. Natural risk

When an earthquake, hurricane or other natural hazard event occurs (Woo, 1999), the main focus is on the direct impact of the tremors, wind speed, etc. However, in addition to direct influences, there is also a possibility of indirect losses due to the occurrence of ancillary hazardous events triggered by the primary ones. Such secondary losses can severely exacerbate losses from the primary event in both human and financial terms. An ancillary hazardous event may be another natural hazardous contingency emanating directly from the primary event, such as a landslide for example. Alternatively, an ancillary hazardous event may be the outcome of a man-made failure, such as flooding, environmental pollution, an explosion, or a power black-out following primary hazard damage to an industrial facility or infrastructure.

Depending on the area being analyzed, a number of natural phenomena may have the potential to represent a real hazard for the exposed population (Mazzarotta and Silvetti, 2006). Moreover, natural catastrophes may affect technological items, such as tanks or tankers containing hazardous materials, acting as triggers for events capable of causing large damages through domino effects.

3.3. Sensitivity map

The sensitivity index results from technological and natural risks as well as areas that are environmentally, socially and economically sensitive to accident impacts. The sensitivity map represents the critical area and defines the position of emergency resources. However, it needs to be borne in mind that risks change over time depending on risk frequency. Also of importance to the sensitivity map are species routines in ecological preservation areas. Its advisable to keep species routines updated in order to be aware of the real situation of environment criticality over time. The same applies to social activities such as fishing and tourism. Therefore, in the case of accidents in sensitive areas, priorities will change depending on the time when they occur. The sensitivity index varies from 1 to 10 in some methodologies and each environmental, social or human resource is represented by a different colored polygon on the sensitivity map. Fig. 3 shows the San Diego sensitivity map.

4. International emergency approaches

4.1. US emergency approach

The US has one of the most complete emergency frameworks in the world which was created to respond to natural catastrophes, industrial accidents and terrorist attacks. It involves integrated cooperation between the different organizations, such as universities, the government and industry, in order to evaluate technologies that can support emergency responses for the three levels of response, namely individual, regional and national emergencies.

In the oil and gas industry, responsibilities are well defined. According to the national emergency plan, the EPA (Environmental Protection Agency) is responsible for developing planning and actions and for supporting state and industry in meeting the requirements of an efficient emergency framework response.

Despite government support in the event of accidents, industries are responsible for implementing their individual emergency plans and keeping the authorities informed who will analyze the situation and implement other emergency resources if necessary to preserve public welfare and protect the environment.

In the maritime zone, the Coastguard is responsible for supervising emergency plan implementation and if necessary for providing support in response to emergencies. Economic resources have been committed by 105 companies to be used in the event of an accident to buy equipment, pay for human resources, and other types of support. Every company that transports or operates with toxic products has to implement individual emergency plans and send the procedures to the local authorities to be analyzed. The quantitative risk analysis and the consequence assessment are carried out using CAMEO, ALOHA and MARPLOT software.

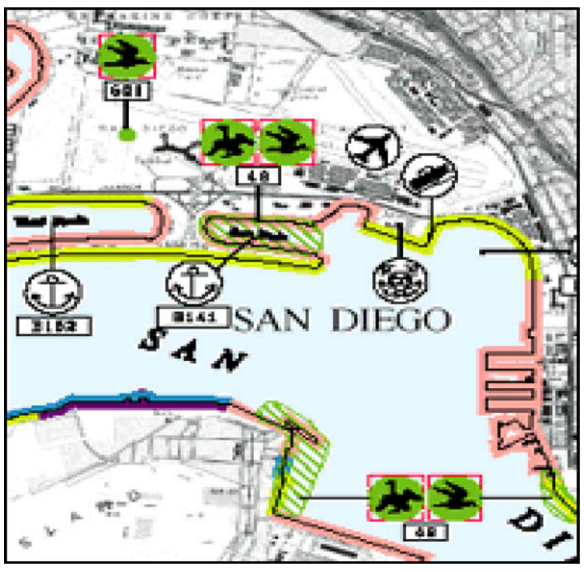

Fig. 3. San Diego sensitivity map.

MARPLOT is an electronic map databank used to support risk assessment to provide an idea of the impacts of accident on surrounding areas.

ALOHA software enables risk assessment for accidents in relation to environmental characteristics such as wind velocity, temperature, humidity, type of product, linkage configuration, type of vessel. This software has many types of chemical products and its features as well as toxic limits.

Fig. 4 shows an example of consequence assessment in case of Cl vessel linkage. It is possible to check the toxic limits.

In Fig. 4 it can be seen that the red[1] area is the most critical because of its impact, with it achieving a distance of 1484 yards with 20 ppm of toxic Cl concentration. This is tolerable for a maximum of 60 min. The orange area is less critical, although it can cause impacts on health for 1.9 miles with 2 ppm of Cl concentration for over 60 min exposure. The least critical area is the yellow one, around 3.1 miles with toxic concentration of 0.5 Cl, tolerable for up to 60 min. This type of analysis allows the possible consequences in exposure areas to be examined in advance. It also enables emergency procedures to be carried out properly and for risks to be mitigated, or in some cases even to be eliminated. CAMEO software is able to check the procedures for each type of emergency situation depending on the toxic products examined. Fig. 5 shows the accident area can be checked, analyzing vulnerability using the MARPLOT map databank.

The vulnerable areas in Fig. 5 are a school (black) and hospital (green) located near industrial plants. If an accident occurs these areas may not be specifically impacted, but if the wind direction changes, one of these will probably be impacted by the toxic cloud. If an accident occurs these area may not be impacted, but if the wind direction changes probably one of then will be impacted by the toxic cloud.

Further analysis is necessary in order to analyze accident consequences. The sensitivity map is required when environmental resources are located around industrial plants and the transportation routes of toxic products. In order to define the sensitivity index in coastal area the following are analyzed:

⇒ Environmental sensitivity of coastal areas.
⇒ Biological resource sensitivity.
⇒ Environmental resources used socially.

In the first case the natural resources of ecosystems, such as species, vegetation, and other environmental characteristics, are analyzed, and are represented by colored lines to highlight the criticality of these resources as shown in Fig. 3.

In the second case autotrophic species are analyzed, which are represented by colored geometrics forms. Further information about species frequency in vulnerable areas is required to help define which areas are the most vulnerable over time.

Finally the economics resources of the environment are analyzed, such as tourist areas, beaches, fishing and other areas in which some economic activity is carried out.

The technological resources allow individual, regional and national emergency frameworks to be prepared, with the subsequent mitigation or elimination or risk whenever necessary in order to preserve the environment, employees and society as a whole.

4.2. The emergency approach in Canada

The emergency approach in Canada is quite similar to the US approach in many details.

[1] For interpretation of color in Figs. 4 and 5, the reader is referred to the web version of this article.

Risk analyses are carried out to check vulnerable areas using the CAMEO and ALOHA software, while in the event of oil spills in the ocean or along coastal areas the Coastguard is responsible for checking the implementation of individual emergency plans, as well as analyzing accident situations in order to implant regional or national emergency plans whenever necessary. Furthermore, economic funds are available to support emergency responses in all aspects as equipment, human resources and technological resources.

The emergency management framework is complex with many different command levels supported by various staff levels and specialized groups. There are three main management processes, namely:

⇒ Response Management System (RMS) processes.
⇒ Report processes.
⇒ Incident Action Plan meeting (IAP).

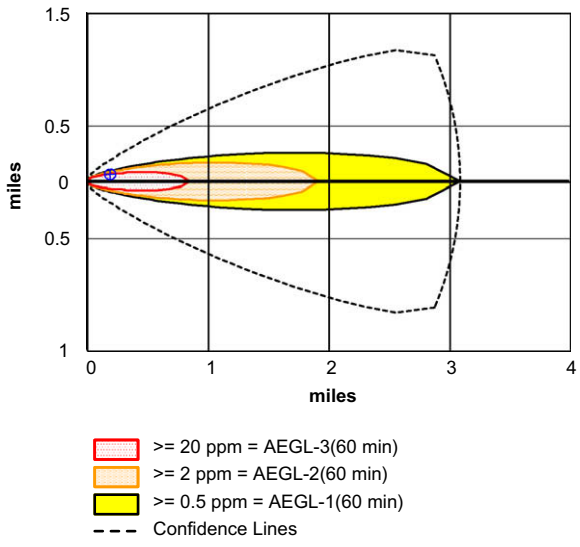

Fig. 4. Consequence assessment.

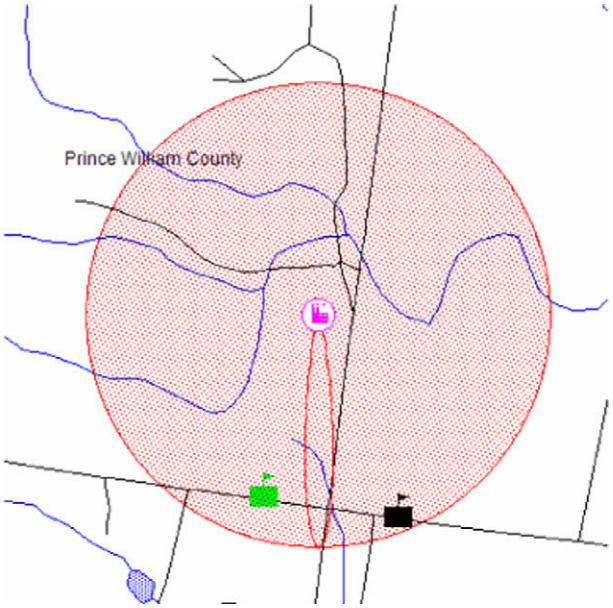

Fig. 5. Vulnerable accident area.

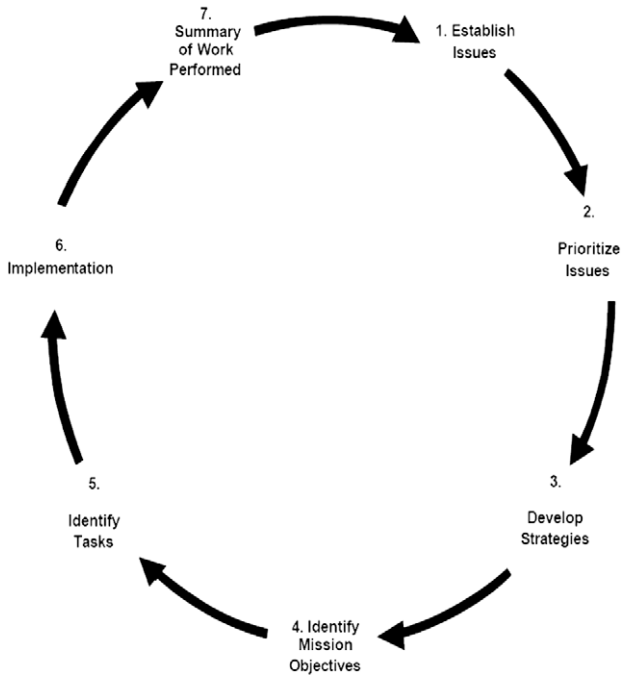

Fig. 6. The RMS process.

The main objective of the Response Management System (RMS) process is to analyze the emergency situation in order to define the priority area to be protected, as well as actions, strategies, and resources and the response level to ensure an efficient response. The Response Management System (RMS) process flow is shown in Fig. 6.

The report process is carried out throughout the emergency response in order to provide support for emergency response analysis after the completion of the accident and emergency response.

The Incident Action Plan meeting (IAP) is held during the emergency response in order to check actions and define new strategies if necessary whenever accident scenarios change. The emergency management process is summarized in Fig. 7.

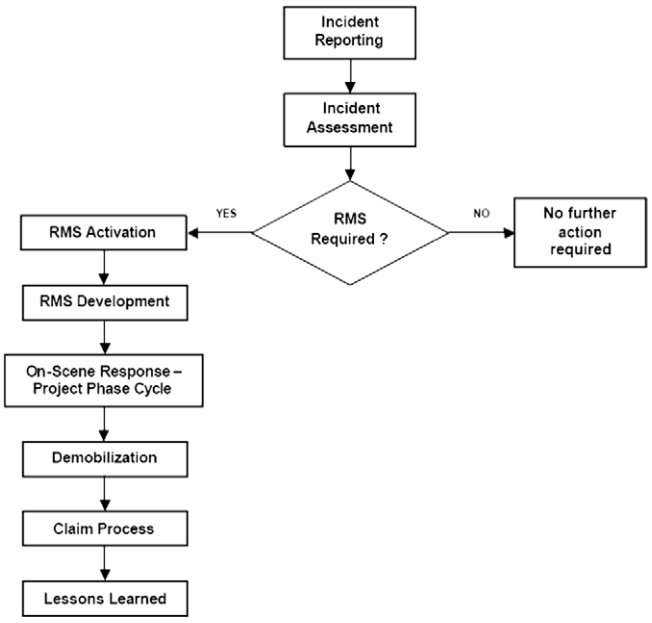

Fig. 7. Emergency management process.

4.3. The emergency approach in Australia

The emergency approach in Australia has a strong framework, centralized in the government, while a risk assessment process is carried out each year to support decisions and improve emergency plans at all levels.

To respond to emergency situations in the case of oil spills there are a group of specialized companies that provide support such as equipment and teams. Private companies make some of their equipment available for 100% emergency response throughout the year. This approach allows economic resources to be saved as well as the centralization of emergency responses. Moreover, government authorities analyze accidents in order to define which level of response is required.

Based on AMSA reports, more than 60 accidents involving oil spills of more than 1 ton occurred between 1993 and 2004. The worst accident took place at Damspier, in Western Australia in 1991. The same year there were oil spills with 17,700 tons in the south of the country and 700 tons in the east. Despite their high environmental impact accidents have been reduced over time due to improvements in ship design and procedures.

Port accidents are the most representative type of accident, involving 75% of total accidents and are influenced by intensive traffic. The main cause is grounding. However, in most cases other vessels provided assistance or towing and oil spills were avoided. The east coast is the most vulnerable area as shown in Fig. 8.

Based on the DNV report, from the point of view of risk the effect of an increased emergency response capacity is small. The cost-effectiveness of subsidizing private contractors to introduce dedicated emergency towing and salvage vessels is likely to be low. Current coverage, regulated by market forces, has not led to any increase in risk level compared to the situation 5 years ago.

4.4. The emergency approach in the UK

In the UK, in addition to a well defined and structured centralized emergency framework, there is also an oil spill analysis which reports annually on the main causes, locations and tendencies of relevant events.

Despite intensive ship traffic, oil platforms in British seas are responsible for most oil spill events as shown in Fig. 9. This is a totally different oil spill accident causes comparing with other countries.

As shown in the figure above, UKSC oil spills are the most critical. In addition to oil spill locations and tendencies, environmental sensitivity is also assessed in order to locate emergency resources in the UK. Like other countries, the sensitivity index covers oil spill frequency and environment sensitivity. In addition, the Marine and Coastguard Agency (MCA) which is responsible for marine emergencies, usually assesses port and ship characteristics, proposing improvement and defines accident prevention requirements. Each company which processes or transports toxic products have to formulate an individual emergency plan and submit it to the authorities for approval. In the case of oil spill accidents the MCA assesses the accident and defines it as one of three TIER levels to implement the emergency plan. In TIER ONE local emergency resources are sufficient to deal with the emergency, in TIER TWO regional resources are required, while in TIER THREE national resources are necessary. Fig. 10 shows the most critical areas and emergency resources located in the UK.

4.5. The emergency approach in Brazil

In Brazil the individual emergency plan is very well defined with a centralized framework and very well applied in companies which process or transport toxic products. However, regional and

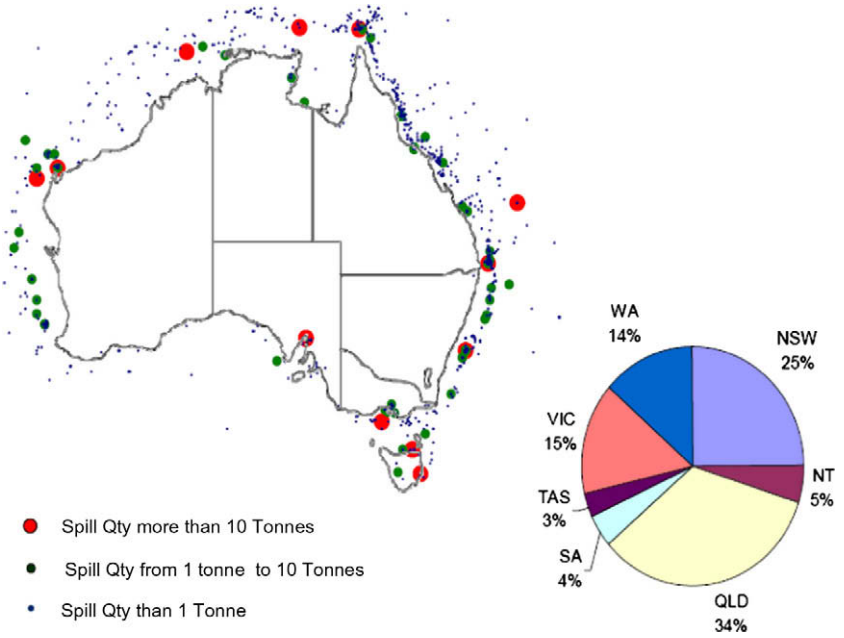

Fig. 8. Oil spills in Australia.

Enumeration area	Open sea	Tidal river/ estuary	Bay/nearshore waters	Beach/shore	Port/harbour	Totals
1. North-east England	1 (1)	-	-	-	4	5 (1)
2. Eastern England	1	-	-	1	-	2
3. Essex & Kent	3	-	-	-	9	12
4. Southern England	3	-	1	-	13	17
5. South-west England	3	-	1	1	15	20
6. Bristol Channel & South Wales	1	-	-	-	18 (1)	19 (1)
7. Irish Sea	3	-	2	-	10 (1)	15 (1)
8. Western Scotland	-	-	4	-	8	12
9. Orkney & Shetland Islands	3	-	1	-	6	10
10. Eastern Scotland	5	-	2	1	19 (1)	27 (1)
11. UKCS oil & gas installations	383 (101)	-	-	-	-	383 (101)
11. UKCS vessels	26 (2)	-	-	-	-	26 (2)
Totals	**432 (104)**	-	**11**	**3**	**102 (3)**	**548 (107)**

Fig. 9. Oil spill sources in the UK (2004).

national emergency plans are not. Law 9966 stipulates that emergency plans should have three levels, namely local, regional and national. Unfortunately there are many diverging interests between companies and government departments. Even though the regional and national emergency framework has not been evaluated some initiatives have been carried out, such as:

⇒ INFOPAE software for assessing oil spills and supporting emergency decisions.

⇒ SIRA software to support Federal Environment Department (FEEMA) and Estate Environment Department to make decisions about environmental licenses and to provide support in the event of accidents.

After the accident in Guanabara Bay, the Brazilian authorities forced the oil and gas industry companies to follow some specific procedures related to emergency plans and risk management. Despite this initiative, neither regional or national levels was the specific emergency framework involving government authorities, companies and society has been evaluated.

The importance of regional and national emergency plans not withstanding, in the environment and safety management approach in Brazil there have been no joint efforts between the different interested parties, while it is becoming increasing difficult to formulate these regional emergency plans, defining responsibilities and the emergency state framework. The Brazilian government currently controls the oil and gas industry whenever possible, though the Department of the Environment but is not able to carry out all necessary activities, such as issuing environmental licenses, inspection and evaluations in order to certify good practices in the industry. There are many individual initiatives for the preparation of emergency frameworks in case of regional or national emergencies. Even if emergency resources are available to respond to regional or national emergency situations, government authorities have to take some decisions and take part in the response. In this case simulations have to be formulated, organized and carried out in order to avoid mistakes and inefficiency in real emergency situations. Unfortunately not too much is being done to improve and evaluate the regional and national emergency framework in Brazil by authorities.

In Brazil, most of initiatives to implement regional emergency plan came from oil and gas industry companies. A good example is company X, which evaluate an emergency framework to attend local emergencies with local authority and other companies with similar environment aspects. That company X together with other

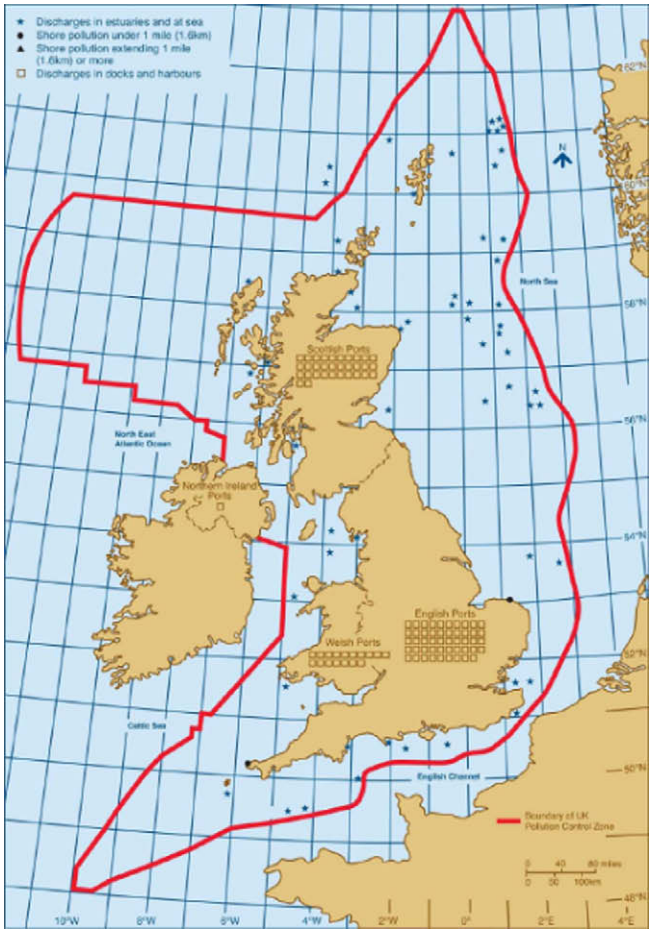

Fig. 10. Oil spill locations in the UK (2005).

three companies and local authorities evaluate a local emergency plan, defining human resources, equipments and responsibilities. There are two emergency concepts that are before accident oil spill in 2001 and after accident oil spill as shown in Fig. 11.

The emergency framework above was implemented before accident oil spill. The company X was prepared for response oil spill scenarios that was assessed and did not preview a huge oil spill requiring additional resources. The oil spill accident in 2001 was a huge environment impact being considered a huge oil linkage (over 700 tons). That accident was a events combination including project mistakes, human error and management mistakes as cut off maintenance equipment investment.

The environment impact was catastrophic, achieving rural areas, and polluting river which supply all population around such area. After that accident so many action were implemented and a new emergency framework was implemented as shown in Fig. 12.

Consequently was make up a local emergency framework, with defined responsibilities and resources among private companies and local authorities. In fact, local authorities coordinates all actions together with company X in case off local emergency plan required. In this situation, the emergency plan is not enough to control emergency. The other three private companies supply human resources to implement local emergency plan and company X provide all equipment necessary. There is a regular emergency simulation to test out the local emergency plan efficiency. Whenever local resources are not enough to attend emergency, The regional emergency plan is required. The company X, evaluate an emergency center to support regional emergencies whenever is necessary. That regional emergency center is manage to company

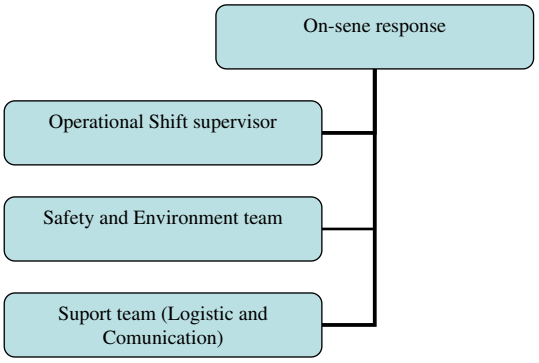

Fig. 11. Emergency framework after accident.

Y, having all equipment necessary afforded for company X and a independent emergency team. In case of accident and if additional resources to response emergency is necessary, additional emergency equipment resources will be supplied by company Y which charge for company X. Despite is a local authorities responsibilities, the regional emergency plan was implement for company X in order to have an efficient response in case of oil spill and another kind of accident.

The second case study is the regional emergency simulation exercise carried out for a group of companies and local government authorities. The emergency scenarios was a truck accident cause toxic product spill in local river having an environment impact. This simulation exercises comprises Transport Company, surrounded companies and chemical product supplier.

There has been 2 days to plan emergency exercise simulation, 1 week to contact authorities and 1 day to execute then. There was established in emergency exercise simulation plan two different point in river to put barriers but unfortunately there was a mistake and the second one was put below the defined point. Fig. 13 shows local accident scenario.

This case was one of the first try to implement regional emergency plan in Brazil and was very well succeed for a good relationship between local companies and government authorities. Some important aspect must to be underling as:

- High cooperation level between private companies and local authorities.
- Difficulties in coordinate so many different human resources in emergency exercise simulation.
- Problems in communication between command and operational teams which cause a mistake in launch barriers on second point.
- Software to simulate accident will be implemented to support planning decisions and operational actions.

This emergency simulations case is not usual in most of states in Brazil due to bad relationship between companies and local authorities. Despite this situation, this is a good example to know how to proceed to implement regional emergency plan comprising local authorities and private companies.

5. Critical analysis

Although individual emergency plans have been formulated, assessed and implemented for oil and gas industry companies in Brazil, until the present no regional or national framework has yet been established for Brazilian authorities in general. There is only one isolated case of regional emergency plan implemented.

Very good approaches highlight the best practices used in many countries such as the US, Canada, UK and Australia, and it would be

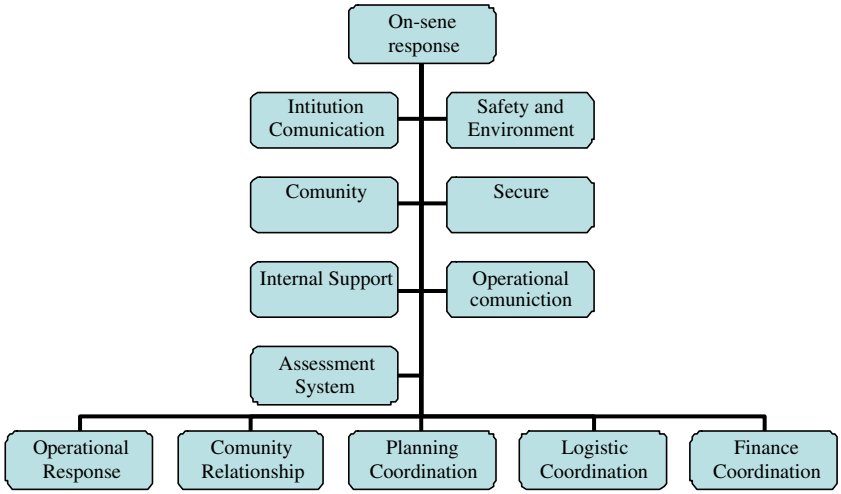

Fig. 12. Emergency framework before accident.

Fig. 13. Emergency accident scenario.

implement in Brazil taking into account the characteristics of the different industries involved and local areas.

The emergency approach in USA is complex and takes into account natural catastrophes, terrorist attacks and industrial accidents. In Brazil even though historically there have been no terrorist attacks or natural catastrophes such as tsunamis, volcanic eruptions or earthquakes, it is nonetheless advisable to take into account these events to be prepared for any sort of emergency. The software which can provide this type of analysis has been evaluated in Brazil but it is not as widely spread out as it is in the US, so it is difficult to make improvements and test the consistency of this software.

The emergency approach in Australia is based on private emergency resources providing economic funds to pay cope with the emergency. Despite being economically efficient, there are some doubts about the availability of emergency resources in the case of an increase in the flow of private ships. Nevertheless, there is no doubt that it represents a good practice to be implemented but in Brazil case due to low number of companies in oil and gas industry, make no many sense to implement such model.

The risk analysis and reporting of oil spills carried out in Australia and the UK is a good practice but requires a proper framework to be implemented. It would be useful in Brazil in order to supply information to about sensitivity assessment and to define the location of emergency resources.

The new approaches to manage emergencies are based on simulations which are able to analyze the many different features of emergency responses, such as frameworks, efficient procedures, and emergency response location. It is possible to carry out this analysis without investing much time or many human resources like in emergency simulation exercises. Although they do not substitute emergency exercises, simulations are able to carry out analyzes and improve emergency procedures, frameworks and communications quite fast. The usual simulation is related to the consequences of accidents, such as oil spill trajectories, toxic clouds, explosions or fires. The new approaches, such as the one proposed by Furuta, simulate organizational decisions in order to check bottlenecks in command.

In Brazil, local and regional emergencies are private companies' initiative. Despite that attitude, local and regional authorities would have their own human resources and equipment to attend local and regional emergencies and would not permit companies without minimum emergency framework to operate.

In so many cases, the private companies as company X is required to help in emergency situation involving other companies, reducing their emergency team availability and increasing equipment emergency maintenance cost.

6. Conclusions

Regional and national emergency plans are a great challenge for government authorities in Brazil due to many divergent intentions and understandings of the emergency framework. The different approaches around the world have shown different types of approaches to response emergency situations and how important it is to be well prepared to do so.

Despite technological important advances, resulting in important evaluation tools to assist emergency decision making, the most critical barrier is persuading interested parties to combine their efforts and work together to evaluate the best approach to the Brazilian case.

The Guanabara accident shows how bad it is for society when the relevant authorities do not make the correct decisions on time and adopt reactive approaches to dealing with emergencies. Unfortunately, nowadays if emergencies occur in Brazil that requires a regional or national framework the appropriate response will not be available in so many areas with catastrophic consequences to environment, economy and society. Despite private companies' initiatives, it's necessary to local, regional and national authorities

to be more involved implementing action to make those emergency frameworks easier and effective.

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