Environmental and Fire Protection in Marinas and Ports

Development of a Protocol for the Inspection of Marinas and Ports in Costa Rica

Sponsored by:

El Benemérito Cuerpo de Bomberos de Costa Rica

Submitted to:

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Abstract

We developed a protocol for the Costa Rican Fire Department to inspect marinas and ports for compliance with environmental and fire protection laws. Recent incidents have caused significant environmental and property damage at these facilities. We compiled relevant laws and regulations on fire protection, researched environmental safety practices, interviewed marina management and fire officials, and assessed conditions at five ports and marinas in Costa Rica. We then created an interactive protocol that inspectors can use to determine compliance with fire prevention laws and help ensure the safe operation of ports and marinas.

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Sincerely,
Jacob Czarnowski, Shane Sampson, Hayley Sandgren, and Ian Weyburne

Executive Summary

Dangerous incidents, including fires and hazardous materials spills, can occur in facilities such as marinas and ports. These incidents can endanger human health and have negative impacts on the environment. Costa Rican laws on fire protection and environmental control exist to aid in preventing such incidents. These laws include the National Fire Protection Association (NFPA) codes, which were adopted by Costa Rican law in 2007. The Costa Rican Fire Department, or El Cuerpo de Bomberos, wanted to develop a method to inspect marinas and ports for compliance with these laws and regulations, and improve the safety of these facilities. They wanted the inspection protocols to address not only the operation of ports and marinas, but also their planning and construction.

Our project goal was to develop inspection protocols for ports and marinas. To accomplish this, we examined NFPA codes and researched relevant Costa Rican laws and regulations on fire protection in ports and marinas. We also investigated laws related to environmental protection in Costa Rica and the United States. Then, we visited five ports and marinas to gain a better understanding of the current state of these facilities with regard to both environmental and fire protection. These site visits also provided context for how the protocol should be organized and the major areas it would focus on. In general, we found that the marinas and ports we visited were compliant with some but not all of the laws and regulations that applied to their facilities. We also found that many managers were aware of relevant environmental concerns and had made some efforts to ensure that their facilities were environmentally safe.

We compiled the relevant laws and regulations and information from our site visits into an inspection protocol. We created an interactive Microsoft Excel workbook that can be used on a tablet computer. The protocol is different for each type of site (Pacific ports, Atlantic ports, and marinas) since the laws differ for each. The stipulations of each regulation are divided into different areas of the facility. For example, all the laws related to fueling docks are grouped into one category. Each criterion is marked as pass, fail, or not applicable during the inspection. When completed, the workbook automatically compiles a list of every inspection criterion,

grouped into those that were failed, passed, and not applicable. This allows the Bomberos to inform the marina or port management of the inspection results and to determine corrective actions.

The protocol we created focuses on prevention of incidents by inspecting fire protection, environmental protection, and general management practices of marinas and ports. We also evaluated response plans for emergencies. We surveyed managers at the ports and marinas, and interviewed local Bomberos at three of the five facilities. Our project included how the marina and port management should respond in the event of a fire or a chemical spill. We used input from the managers and Bomberos along with information that we had gathered to recommend a response protocol to best suit the Bomberos and the managers of these facilities. This response includes provisions such as training staff on how to use fire protection equipment and having an emergency contact who is available at all times if an emergency occurs.

As a result of this project, the Bomberos of Costa Rica will be able to thoroughly inspect marinas and ports. The protocol has been created for use during planning and construction of the facility, as well as during regular operations. The inspection protocol will help prevent hazardous incidents by indicating where corrective action must be taken at marinas and ports in order to ensure proper environmental and fire protection. This project contributes to improving marinas and ports in Costa Rica through the enforcement of NFPA codes and other Costa Rican laws, which will maintain safe operation of these facilities.

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Glossary of Terms

Bomberos – The Costa Rican Fire Department (fire fighters)

Class A Fire – Fires in which the fuel is wood, paper, trash, and other ordinary combustibles

Class B Fire – Fires in which the fuel is oil, gas or other flammable liquids

Class C Fire – Fires in which the fuel is either ordinary or flammable liquids but also has electrical current in the flame

Electrical datum plane – A horizontal benchmark, two feet above the highest high tide, below which no electrical equipment should be installed. This plane is determined by the high tide water level mark according to tidal fluctuation. (NFPA 303:5)

Fire Brigade A group of privately employed people trained in emergency response

Heat Release Rate – "The rate at which heat is generated by fire" (InterFire Online, 2011).

Hydrocarbons – "An organic compound (as acetylene or butane) containing only carbon and hydrogen and often occurring in petroleum, natural gas, coal, and bitumens" (Merriam-Webster, 2011). For the purposes of our project, hydrocarbons are flammable liquids including gasoline, oil, and diesel.

Marina – A dock or basin providing secure moorings for pleasure boats (Merriam-Webster, 2011)

Port – A harbor where large, commercial ships take on and discharge cargo (Merriam-Webster, 2011)

Slip – "A ship's or boat's berth between two piers" (Merriam-Webster, 2011)

Standpipe – "A high vertical pipe or reservoir that is used to secure a uniform pressure in a water-supply system" (Merriam-Webster, 2011)

List of Acronyms

AHJ – Authority Having Jurisdiction

EPA – Environmental Protection Agency

EIA – Environmental Impact Assessment

FRP – Facility Response Plan

HRR – Heat Release Rate

IMDG – International Maritime Dangerous Goods Code

IMO – International Maritime Organization

NFPA – National Fire Protection Association

MSDS – Material Safety Data Sheet

RECOPE – Refinadora Costarricense de Petróleo, or Costa Rican Petroleum Refinery

SETENA – Secretaría Técnica Nacional Ambiental (National Environmental Technical Secretariat)

SOPs – Standard Operating Procedures

SPCC – Spill Prevention, Control, and Countermeasure Plans

Chapter 1: Introduction

Ports and marinas can be vulnerable to emergencies that endanger the property of the facility, the health of the surrounding environment, and the safety of facility employees and clients. In 2009, a boat in the Costa Rican port of Puntarenas caught fire. Because the facility was not in compliance with Costa Rican regulations on fire protection equipment, personnel were unprepared for and incapable of combating the fire. The fire spread to forty boats, which were released from their dockings and floated along the coastline, spreading the fire to several hundred meters of land. The Bomberos are worried that another incident of this magnitude could occur without proper protection or preparation in these facilities. Each of these incidents can have serious environmental impacts in addition to threatening human safety.

Threats to the environment are a significant issue for Costa Rica as the country is economically, socially and culturally dependent on its environment. Fisheries, for example, provide thousands of employment opportunities which has reduced poverty in the country. They also provide food locally, and their exports amount to millions of dollars each year (Food and Agriculture Organization of the United Nations, 2004). The Costa Rican environment has become a large attraction for tourists, which has also contributed greatly to the country's coastal economy (Food and Agriculture Organization of the United Nations, 2004).

Life safety in marinas and ports is an additional concern. If marinas and ports are not following regulations which govern fire protection, the workers, clients and neighbors of that facility can be put in danger. Fires, like the one at the port of Puntarenas, can spread quickly unless they are swiftly extinguished.

Costa Rican laws exist that address these issues. In 2007, Costa Rica adopted the National Fire Protection Association (NFPA) codes, which set specific requirements related to fire protection. However, there are very few measures taken to check compliance with laws and regulations like these. In 2011, the government assigned El Cuerpo de Bomberos, or the Costa Rican fire department, the responsibility of inspecting marinas and ports for environmental and fire protection. In order for the Bomberos to assume this inspection responsibility, an inspection protocol is needed that addresses all of the relevant regulations and laws during the design,

construction, and operation phases. Their intention with this protocol is to ensure public health and safety, and also prevent environmental damage caused by hazardous materials incidents.

For this project, our team assisted the Fire Department in developing an inspection protocol to ensure that ports and marinas are constructed and operated safely and according to legal requirements. We began by researching Costa Rican laws and regulations on construction and maintenance of these facilities. We then investigated current operating procedures in Costa Rican marinas and ports to help guide the development of the inspection protocol, and utilized previous incidents in such facilities as examples for preventing future incidents. We created an in-depth protocol for inspection of current and future marinas and ports, which focuses on fire protection, environmental protection, and general management practices. By assisting the Bomberos in their efforts, we hope to have contributed to the safety of Costa Rican communities through the inspection and assurance of fire and environmental protection in ports and marinas.

Chapter 2: Literature Review

In this chapter, we discuss information that assisted us in developing the inspection protocol for marinas and ports. We first investigated marina and port operation and management in Costa Rica, including layouts of marinas and ports. Then, we examined emergencies that can occur in marinas/ports related to fires and hazardous materials. We researched fire prevention measures, environmental impacts of hazardous materials spills and regulations to prevent incidents from occurring. Finally, we examined codes, laws and regulations regarding marina and port operation and safety.

2.1 Marina and Port Overview

This project involved evaluating marinas and ports for compliance with laws and regulations. First, we investigated marina and port layouts in general terms. A marina is "a dock or basin providing secure moorings for pleasure boats," including those for tourism, sports, fishing, and other recreation (Merriam-Webster, 2011). A port is a harbor where large, commercial ships take on and discharge cargo (Merriam-Webster, 2011). In general, marinas are considered small and private, whereas ports are large and commercial.

The layout of a marina or port is dependent on the type and number of boats present and the purpose of the facility. These factors affect how the boats are docked. The main method of docking is wet storage, meaning the boat remains in the water. The place where a boat is docked in the water is called a slip. These slips are built to suit the size of the boats that use the slip. The slips may be floating or fixed. At ports, slips are most frequently fixed as they are more stable and therefore suited for loading and unloading potentially heavy cargo. At marinas, floating slips are more common as stability is not as significant for marina function. The depth of water needed for larger boats also affects the construction of the slips in marinas and ports. The front of a slip is perpendicular to the dock or pier, which is the stretch of walkway that extends out into the water (Morris, 2005). Depending on the size of the marina, more than one pier can be present. Boats may also be stored dry. Dry storage can be either in a building or simply out of the water on the marina grounds. Many times boats in dry storage are stored in racks, which hold

them above the ground. Rack storage has regulations regarding its fire protection, so identifying whether marinas or ports use rack storage is important in knowing which regulations apply. Figure 1 provides an example of a marina layout with three piers and fifty slips. Figure 2 provides an example of a port layout with one pier and four large slips.

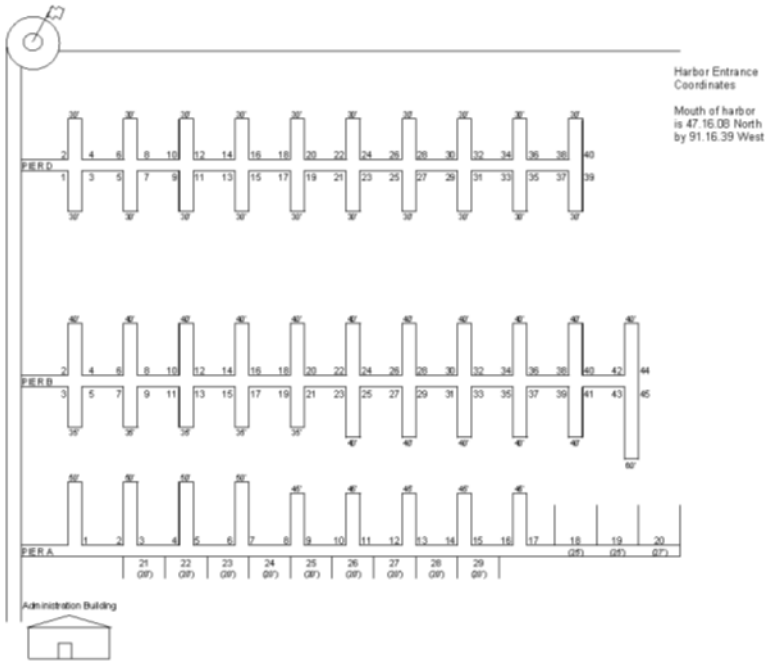


Figure 1: Sample marina layout (Morris, 2005).

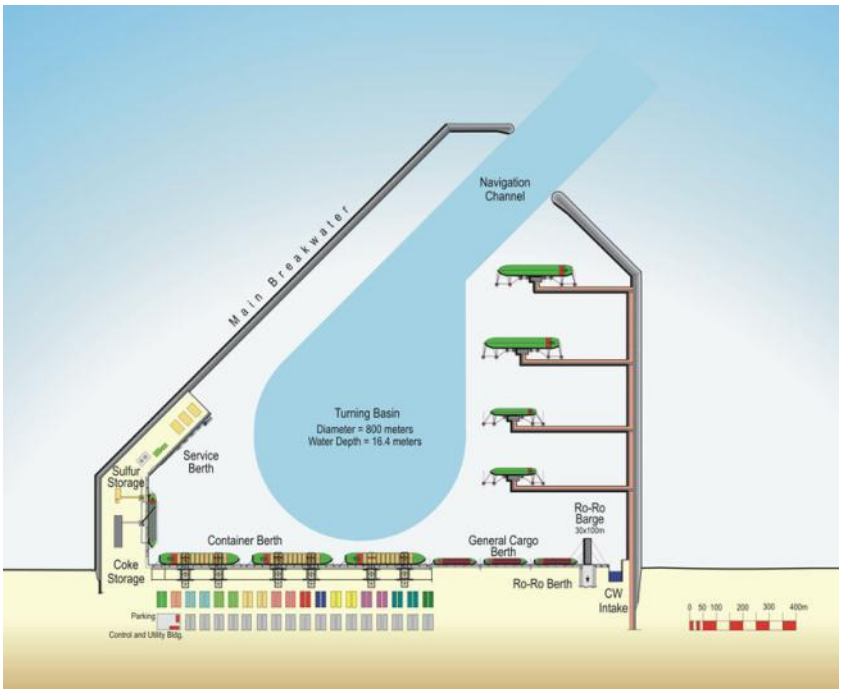


Figure 2: Sample port layout (Al Brega, 2010).

Wet storage is the primary type of storage at ports, as ships are generally only present at ports for as long as needed to load and unload cargo. Dry storage is more common at marinas, where boaters typically store their boats for longer periods of time. Ports typically have fewer, larger piers than marinas to accommodate transport ships, as can be seen in comparing Figure 1 and Figure 2. Each pier typically services a small number of ships at a time, as opposed to marina piers where a large number of slips and boats can be located on a pier. Ports also have sections located along the shore called cargo berths. These berths are used for loading and unloading cargo ships (Al Brega, 2010).

2.2 Emergencies in Ports and Marinas

In this section we discuss emergencies in commercial ports and private marinas. We begin by examining areas in ports and marinas that are potential sources of incidents. We then review how marine fires occur and how they can be prevented. Finally, we detail a marine fire that occurred in Costa Rica in 2009 which specifically motivated this project.

2.2.1 Areas of Concern

Marinas and ports contain materials that can be harmful to the environment, including oil and paint for servicing boats, and hydrocarbons for fueling. Hydrocarbons include gasoline, diesel and oil, and are the material of focus in our project as they are a constant in both marinas and ports. Individual boats have hydrocarbons on board, and many marinas and ports also have docks for selling and dispensing fuel, which requires that they have fuel storage tanks. These tanks need to safely contain the hazardous materials, and the dispensing equipment must be used properly and maintained to ensure that the materials will not leak or spill into the water or onto the pier, where they can be washed into the water by rain (NFPA, 2011, 30A). As improper usage or faulty equipment can result in spills and other emergencies, fueling docks and fuel storage tanks are some of the most incident-prone locations and items in marinas and ports.

There is a higher risk of environmental damage at ports than at marinas because ports contain a larger quantity and variety of hazardous materials. The vessels at ports also have significantly larger fuel tanks than most private boats. Cargo can range from non-hazardous items such as food to hazardous items like flammable materials and explosives (Instituto Costarricense de Puertos del Pacifico [Costa Rican Institute of Pacific Ports], 2006). Therefore, cargo storage facilities are prone to incidents in ports.

2.2.2 Marine Fires

Fires that occur in marinas can be fought in a manner similar to terrestrial fires, but preventing them requires an understanding of how most marine fires begin. Boat fires are one of the most common ways that port and marina fires can begin. These fires can spread to the rest of the marina or port and to other boats. While the Bomberos are prepared to respond to marine fires, they hope to prevent such fires through inspections, standardizing the fire protection equipment, and standardizing the practices of the marinas.

The most common causes of boat fires are electrical malfunctions, unattended portable heaters, smoking, and poor housekeeping (Seattle Fire Department, 2010). Many home fire prevention tips apply to boats as they share many similarities, especially in boats with sleeping quarters and kitchenettes (Seattle Fire Department, 2010). Smoking is a common cause of fires, whether on a boat or in the port or marina (Maritime Training Advisory Board (U.S.), 1979).

Smoking materials must be extinguished properly and safely disposed of in order to minimize the possibility of fires. Electrical fires are also common, and can occur whether the boat is or is not in use (Maritime Training Advisory Board (U.S.), 1979). For example, exposed wiring can arc to outside materials, or it can short circuit. Wiring on boats can become exposed due to the constant movement of the boat in the water as well as the corrosive properties of the damp sea air. Improperly sized fuses or circuit breakers can also cause wiring to arc to another material. Overloading electrical sockets and accidents with light bulbs may also cause electrical fires on boats. One of the important functions of marinas and ports is to store boats; if batteries are not ventilated during storage or especially during charging, they can build up hydrogen gas that is highly volatile (Maritime Training Advisory Board (U.S.), 1979). Enforcing an inspection program of all electrical equipment can prevent some fires from occurring. This can be done by either the marina or port management, or the fire department themselves (Seattle Fire Department, 2010).

Other sources of fires in boats and ports include those caused during maintenance and operation, including fuel transfer, welding, and cargo stowage. Controlling the distribution of fuel is important both on a boat and on the shoreline. If the fuel tanks are overfilled, the overflow could ignite inside the boat (Maritime Training Advisory Board (U.S.), 1979). If the fuel begins to leak on the shoreline, it could spread on the pier or light the actual fuel storage tank and cause a fire. Ensuring that the fueling pumps and pipes are safely installed is also important in minimizing fires due to fuels. The storage of boats can be unsafe if possibly hazardous equipment is used in the area, such as blow torches or portable heaters (NFPA, 2011, 1). The potential for cargo fires is especially dangerous in ports, where large quantities of possibly hazardous materials are transported and handled every day. It is important that ports adhere to regulations to minimize the possibility of an incident involving flammable materials.

Fires in ports and marinas are potentially calamitous. Fires may cause the spread of hazardous materials, especially hydrocarbons from boats and storage tanks. The types of cargo passing through ports can be hazardous and may be in danger of spilling during a fire or another incident. Fires may also ignite when the boats are not being operated or even supervised. To prevent such fires from spreading, monitoring the boats should be required. Another prevention strategy is to require that fire extinguishers be located within certain distances of each other, or to keep other means of fire protection equipment in specific locations, such as standpipes in

storage buildings. Following fire protection codes ensures that safety equipment is held to a dependable standard and is located in optimal locations.

2.2.3 Port of Puntarenas Fire

In the port of Puntarenas, the Coast Guard had seized and was holding several boats for drug-related crimes. On April 7, 2009, one of the boats, the Eduardoño, caught fire at about 5 P.M. The fire grew rapidly and spread to other boats in the marina. The mooring ropes burned through, and the outgoing tide carried the boats all over the estuary. As the boats moved away from the dock while still on fire, they released hazardous chemicals into the water. In addition, the boats that floated to the coast set buildings and other boats aflame. As a result of this fire, 40 boats were damaged or destroyed, almost 850 meters of the coast were set aflame, and several natural springs were contaminated. This fire was significant not only because of its size, but also because it grew to this size from a fire on one boat. If the fire on the Eduardoño had been extinguished, this catastrophe could have been avoided. The Bomberos are concerned with strengthening fire prevention so as to reduce the chances of another incident of this magnitude (Campos, Benavides, & Navarro, 2009).

The port of Puntarenas is the oldest port in Costa Rica. It was developed in 1840 to handle increasing coffee bean production. Since that time, more ports have been built to handle the larger modern cargo ships, but the Puntarenas port remains important for commercial fishermen (Garrigues, 1996). The facilities are old, and the fire suppression systems present have not been updated to meet today's standards. This fire serves as an example to examine where problems can arise in marinas and ports.

The fire grew rapidly because it was not reported immediately. In addition, the local fire department was about 15 km (9 miles) away from the station putting out another fire, which delayed their response time (Umaña & Soto, 2009). Figure 3 shows the growth rate of a fire with no suppression. The growth rate is exponential until the fire runs out of fuel and begins to decay. This figure demonstrates why a quick response time is important for putting out the fire. With time, the heat release rate (HRR), increases exponentially. This is because as the fire grows, the heat of its surroundings increases, making them easier to ignite. Without a quick response, the fire remains undisturbed and is able to grow rapidly.

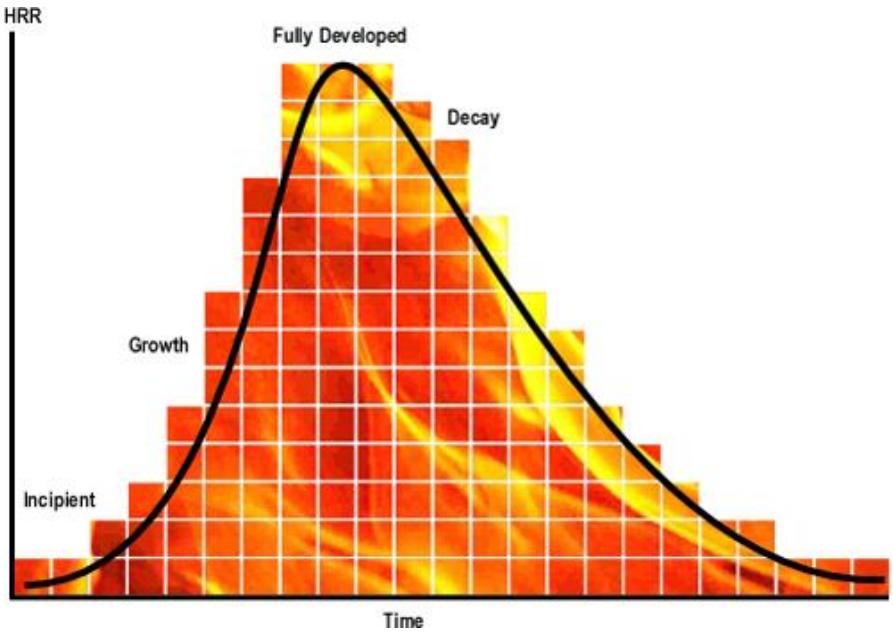


Figure 3: Fire growth curve with stages of a fire (Hartin, 2011)

The fire department could not respond quickly because it was not immediately notified by the port workers. If there were protocols in place for the port management to follow in an emergency, the fire might have been reported more quickly to the fire department via an employee.

Fire suppression on premises is also important. Although there was a fire extinguisher present at Puntarenas, it was too small to put out the fire and was the only source of fire suppression for that dock. If a deployable fire hose or suitable fire extinguisher had been present, the fire may have been better controlled. Large ports in the United States also employ dedicated response teams that can act quickly in an emergency. However, Puntarenas is a small port and they did not have an emergency crew on staff.

Another problem with this port is the location. As seen in Figure 4, the port is located on a peninsula with only one road connecting it to the mainland. If anything were to happen to that road, or if it had a backup of traffic, help would not be able to reach the port in a reasonable amount of time. This aspect is important to consider in the planning stages of port construction.

Figure 4: Map of the Port of Puntarenas (Google Maps, 2011)

The port of Puntarenas had boats which were moored directly adjacent to each other, as seen in Figure 5. The rate of heat transfer is inversely related to distance between each body. Therefore, if there were docks between each boat, increasing the distance between them, the speed with which the fire spread would have been reduced.

Figure 5: Puntarenas fire investigation photograph (Campos *et al.*, 2009)

Although it was not a factor in this fire, one problem with this port was the storage of flammable gas tanks which is seen in Figure 6. Fortunately, the Puntarenas fire did not reach these tanks. However, it is important to ensure that all flammable materials are stored correctly

so they will be safe from fires, and so they are not a hazard to emergency responders. If a tank were to rupture from the heat, responders could be severely injured or killed.

Figure 6: Storage of flammable gas tanks in Puntarenas in 2009 (Campos *et al.*, 2009)

A number of problems contributed to the fire at the Port of Puntarenas growing out of control, causing safety hazards and polluting the environment. Effective inspections of ports and marinas to ensure they are compliant with laws and regulations are crucial in preventing such catastrophes.

2.3 Impacts of Hazardous Materials Incidents

There are a variety of hazardous materials present in marinas and even more at ports because of cargo shipments. Accidental or intentional spills of these materials can negatively impact the environment, wildlife, and human health. For our project, we focused on hydrocarbons as they are most common hazardous materials in ports and marinas, and are frequently involved in hazardous materials incidents. Hydrocarbons can travel against a current, making their movement unpredictable and the spill difficult to contain. Knowledge of how hydrocarbons behave after a spill is therefore necessary in responding to incidents (Smith, Snook, Muscutt, Smith, 2010).

The general public is most familiar with the damage caused by hazardous materials spills from graphic photographs of oil-coated marine mammals and birds, like the one in Figure 7.

Depending on the magnitude of these incidents, they can not only cause devastating external damage to the local organisms, covering them in oil and killing them outright due to toxins, but can also leave ongoing diseases that persist even after the oil has been removed. Hydrocarbons are difficult to remove and often can only be effectively cleaned off through human intervention. If the oil is not removed, it can kill the animal by suffocating or poisoning it. Harmful effects can occur when aquatic species ingest hydrocarbons or when the hydrocarbons are absorbed through the skin. For example, whale pods that came into contact with the Exxon Valdez spill of 1989 have suffered lasting health effects, including reproductive difficulties and immune disorders. Hydrocarbons can be carcinogenic, and fish in the vicinity of an oil spill have been found to have an escalated number of DNA adducts in their liver cells, which is a known cause of cancer (Amat *et al.*, 2006).

Figure 7: Bird coated in oil from the Black Sea oil spill (Golubenkov, 2007).

Humans are also at risk for negative health consequences from hydrocarbon spills. Much like fish, human liver cells can accrue genetic damage if exposed to toxins, making handling these materials dangerous (Amat *et al.*, 2006). The health effects of oil contamination can cause disease in nearly every organ in the body. Of these diseases, cancer affects the most organs, including the skin, brain, thyroid, and bladder. Respiratory distress is common among responders, and can last for more than seven years (Weinhold, 2010). Using protective gear can keep responders safe from both cancerous and respiratory effects. While the focus of our project

is environmental preservation, the Bomberos will want to be aware of these dangers to keep their personnel safe.

Entire ecosystems are endangered by hazardous materials spills. Mangroves form important and delicate ecosystems along Costa Rica's shoreline and are incredibly fragile. Mangrove roots that are embedded in hydrocarbon-laden sediments perish if the concentration of hydrocarbons is at an appreciable level (Ghosh, 2011). The destruction of an ecosystem such as a mangrove forest could cause a chain of events that result in the death of entire populations of wildlife.

If a hazardous materials spill occurs, it is important to clean up as much as possible because many kinds of hazardous materials biodegrade slowly. Once a hydrocarbon is spilled into the water, it remains on the surface as a thin oil slick. Hydrocarbons proliferate horizontally across the surface of the water and are spread by both the water current and wind. However, even in a flowing river, diesel fuel can remain trapped in the river sediment for more than a year (Smith *et al.,* 2010). Three months after the 2009 spill of the "Pacific Adventurer" off the coast of Moreton Island, Australia, the local species had not even begun a short term recovery, or shown any sign of a long term recovery being possible (Schlacher, Holzheimer, Stevens, & Rissik, 2011). An incident with persistent impacts occurred in Panama in 1986, where a fuel storage tank ruptured on the coast into a large grove of mangroves (Burns, Garrity, Jorissen, MacPherson, Stoelting, Tierney, & Yell-Simmons, 1994). While the exposed oil has since degraded, a significant amount of oil remained sheltered in the mangroves along the shoreline for years (Peacock, Nelson, Solow, Warren, Baker, Reddy, 2005). Costa Rica, with its own mangrove forests, could experience a similar incident along its own shores.

2.4 Governing Policies

The inspection protocol for marinas and ports is highly dependent on Costa Rican laws and regulations that specifically address these locations. The Bomberos assisted us in finding laws and regulations that are related to marina and port inspection. We also researched fire codes, environmental regulations, and materials regulations. The Bomberos also requested that in addition to incorporating Costa Rican policies into the inspection protocol, we include additional items based on the more developed United States policies. As of now, Costa Rica already

follows the National Fire Protection Agency (NFPA) codes and standards, which were developed in the United States. We synthesized all of this information for the development of the inspection protocol, and here summarize the most relevant aspects of each law and regulation that we researched.

2.4.1 NFPA Codes

The NFPA is a nonprofit organization based in Quincy, Massachusetts that develops and maintains codes regarding electrical, building, and fire safety. It is composed of over 70,000 members worldwide who contribute to the code making process (NFPA, 2011). The NFPA codes that we examined for marinas and ports included mainly NFPA 1, 303, and 30A. These three codes cover different regulations pertaining to marinas and marina operation. In NFPA 1, Fire Code, chapter 28 was particularly useful to our project as it involves many of the fire codes required in marinas and ports. NFPA 1 applies to every building in the country so it is important that marinas and ports are held to these standards for fire safety as well. NFPA 1:28 covers the basic protection and inspection of marinas and other coastal facilities. This includes fire extinguishers, both portable and fixed, and other protection systems. These protection systems have to be installed on piers, fueling piers, buildings on piers, and large buildings. It also covers outdoor and indoor storage, including rack storage and the protection required for these buildings. NFPA 303:6 covers much of the same information, including fire extinguishers and buildings. Marine fueling is covered by NFPA 30A. Specifically, 30A:11 includes the piping systems that supply fuel to vessels on the pier. This code also defines what safety precautions need to be taken in the fueling areas, responsibilities for before, during and after fueling, and fuel storage in portable tanks.

NFPA 303, Fire Protection Standard for Marinas and Boatyards, has a number of important chapters that apply to marinas and ports. NFPA 303:4 covers marina and port management, including their interactions with the fire department. These interactions include inspection of firefighting equipment, such as extinguishers, hoses, and fixed systems. It also includes the obligations of the facility management to the fire department and the boat owners, such as providing access to all areas of the marina or port to the fire department, or providing safety information to boat owners and visitors. These requirements are important since they will

help the fire department and the facility management work together so that emergency mitigation is as efficient as possible. NFPA 303:5 involves the regulations of electrical equipment in marinas. This section also defines what the electrical datum plane is, which is a horizontal benchmark, two feet above the high tide mark, below which no electrical equipment can be installed. If electrical boxes were installed below this datum plane, there would be a potential for water to enter them, presenting a shock hazard. There also exists the potential for an electrical short, which may start a fire. NFPA 303:5 also includes the location, maintenance, and safety features of electrical wiring and equipment.

The NFPA sets strict regulations on dry storage of boats, which is the storage of boats on land for a season or in a storage facility. If a boat is stored incorrectly, especially if it has flammable materials on board, there is an increased chance of a fire occurring. When a boat is stored, it must be inspected for any hazardous materials and corrective measures taken if needed, as instructed by the inspector (NFPA, 2011, 30A 7.2.1.5.1). Batteries must also be disconnected and may not be charged while being stored. Buildings with boats in dry storage require extra fire protection measures, such as automatic sprinklers and standpipes, which must be able to reach the highest boats being stored. There are a few inspection steps management must perform on the boat before it can be stored for a long period of time, which include checking for the presence of hazardous materials, gas cylinders, portable fuel tanks and filling permanent tanks (NFPA, 2011, 303 7.2.1.5). For wet storage, where the boat is being stored in the water, the boats must be stored in a way that allows for the removal of one boat without moving any others. If a boat catches on fire, the boats around it may need to be moved away quickly to avoid spreading the fire. The distance between any boats in storage and the fire department's source of water must not exceed 45 meters. Temporary fuel storage tanks are permitted on boats in wet storage with the approval of the "authority having jurisdiction" (NFPA, 2011, 30A 11.8.1), namely a fire official. In order to contain fires that may break out on-board, all vessels are required to have fire extinguishers. The number, location, and type of fire extinguishers required are determined by the size of the vessel. A requirement of NFPA 302 on Fire Protection Equipment is that a fire extinguisher must be within a distance of either half the total length of the boat or 33 feet, whatever is shorter, from all locations on the vessel (NFPA, 2010, 302 12.1.2.7). Fire extinguishers are made to be effective against five different classes of fires. However, NFPA regulates that fire extinguishers in marinas and ports should be effective against only three of

those classes, “A”, “B”, and “C” fires. Class “A” includes fires in which the fuel is wood, paper, trash, and other ordinary combustibles. A “B” class fire is a fire where the fuel is oil, gas or other flammable liquids. Finally, a class “C” fire is one in which the fuel is either ordinary or flammable liquids but also has electrical current in the flame, which complicates the extinguishment process.

Marinas and ports contain flammable liquids such as gas, diesel, and oil to service and maintain the boats that occupy them. The NFPA puts strict regulations on the amounts of these liquids that may be present at an outdoor site, and regulations on their storage. In the United States, individual sites that have liquid motor fuel are limited to tanks no larger than 12,000 gallons, and the maximum amount of these particular tanks on a single site is four (NFPA, 2011, 30A 4.3.2.3). Tanks are required to be located on shore or on piers of a solid fill type, which ensures that they are on a stable platform. There are also inspection rules associated with sites containing these tanks, which entail inspection of the tanks by an expert to ensure that they are operating correctly (NFPA, 2011, 30A 6.3.6). The National Fire Protection Agency requires marina and port management to inspect fuel sites per code 6.3.6.1, which states: “A visual inspection of the fuel dispenser and its associated hanging hardware (hose nozzle valve, hose, breakaway valve, and hose swivel) shall be conducted at least weekly and shall be documented. Documentation shall be available for review by the authority having jurisdiction upon request.” If the fittings are being inspected weekly, any mechanical deterioration should be noticed quickly so there will be minimal leakage of fuel.

The management of marinas and ports is responsible for following appropriate safety precautions as outlined by regulative documents. The fire equipment on site must be inspected and tested on a regular basis; this includes extinguishers, hoses and any other firefighting systems (NFPA, 2011, 303 4.2). There should be rounds performed hourly and at the closing of each day to make sure all areas are safe and free of obstructions (NFPA, 2011,303 4.5.2.2). Management is also responsible for allowing the fire department access to all areas of the marina or port that may be locked or inaccessible to the public, both during emergencies and inspections (NFPA, 2011, 303 7.4).

Defined in La Ley del Cuerpo de Bomberos [the Law of the Fire Department], the Bomberos are “responsible for prevention training and care planning” (El Presidente de La República y El Ministro de La Presidencia [The President of the Republic and the Ministry of the

Presidency], 2009). However, the law does not explain what this training entails. To get a better understanding of what this might include, we looked to the NFPA guidelines on the responsibilities of the fire department. Section 303, Standards for Marinas and Boatyards, code 4.41, states that "the local fire department shall visit the facility (marina) annually to become acquainted with every part of the facility and to conduct employee training sessions." The NFPA also gives a list of pre-incident planning steps that management and the local fire department must go through together. These steps include: discussing entry and access routes for trucks in the marina; defining "location, construction, use, and accessibility of all buildings and all their subdivisions including basements and storage lockers"; locating outside labor areas; identifying site and access of both dry and wet storage vessel areas; determining water line details including location and where lines may be affected; and cataloging "types and capacities of facility equipment, including work or tow boats, portable pumps, pier-mounted hose cabinets, and all portable fire extinguishers" (NFPA, 2011, 303 4.4.2). Pre-planning is a valuable tool to firefighters so they are familiar with the basic floor plans of the site, and the particular areas in which they should exercise caution, such as flammable materials storage.

2.4.2 Costa Rican Laws and Regulations

In addition to the NFPA codes, there are several Costa Rican laws relevant to marinas and ports. These include the Law of Concession and Operation of Tourist Marinas and its associated regulation [Ley de Concesión y Operación de Marinas Turísticas; Reglamento a La Ley de Concesión y Operación de Marinas Turísticas], the General Regulation of Port Services of the Costa Rican Institute of Pacific Ports [Reglamento General de Servicios Portuarios del Institúto Costarricense de Puertos del Pacífico], and the Regulation of Atlantic Port Operations [Reglamento de Operaciones Portuarios del Atlántico]. We also incorporated research of Costa Rican policies including the General Law of Health [Ley General de Salud], the Organic Environmental Law [Ley Orgánica del Ambiente], the Water Law [Ley de Aguas], and the General Regulation of Environmental Impact Assessment (EIA) Procedures [Reglamento General Sobre los Procedimientos de Evaluación de Impacto Ambiental (EIA)].

The Law of Concession and Operation of Tourist Marinas describes the process by which a developer obtains and retains its grant for operation of a marina. The law outlines the rights of

the owner and local municipality in regards to the tourist marina. The law defines that a developer must have a grant prior to construction of a marina, and defines the requirements of the construction plan prior to the grant being given. It also defines the reasons for which a grant may be revoked or terminated (La Asamblea Legislativa De La República De Costa Rica [The Legislative Assembly of the Republic of Costa Rica], 1997).

The General Regulation of Port Services of the Costa Rican Institute of Pacific Ports defines the rules associated with the operation of Pacific ports. One relevant requirement is that each port obtains specific information about a ship at least 7 days prior to that ship's arrival, including the materials present in its cargo. The documentation includes the size of the ship; the ship's origin and destination; its estimated time of arrival and output at the port; the tonnage of the cargo; a list of hazardous cargo on board and their classification based on the International Maritime Dangerous Goods Code (IMDG) as according to the International Maritime Organization (IMO); any other information related to the cargo handling or safety of the ship in the port; the Materials Safety Data Sheets (MSDS); and other items (Instituto Costarricense de Puertos del Pacifico [Costa Rican Institute of Pacific Ports], 2006). Cargo must be packaged and marked appropriately with weights and codes clearly printed. Depending on the type of cargo present on a ship, it may have to undergo a certain inspection or specific loading and unloading procedures as defined by the regulation. Chapter 16 of the law defines the transportation and handling of dangerous cargo. Due to the possible presence of dangerous cargo, smoking is prohibited in warehouses, workshops, and inside the terminal. The next chapter in the law describes the unloading and reloading of flammable liquids, including the safety precautions that must be taken prior to beginning these procedures (Instituto Costarricense de Puertos del Pacifico [Costa Rican Institute of Pacific Ports], 2006).

The Regulation of Atlantic Port Operations defines the rules associated with the operation of ports located on the Atlantic coast of Costa Rica. It currently regulates the only Atlantic port, the Limón-Moin port, and is established for any Atlantic ports in the future. This regulation also defines hazardous cargo as that defined by the IMO IMDG code. Ships must submit relevant information to the port one week prior to the movement of cargo. They must submit the same information required by Pacific Ports as previously described. Article 43 defines the procedures and rules for carrying flammable liquids, including informing the port authority of the amount, name and class of the product. Tanks and trucks that carry this type of cargo must be equipped

with containers or trays for catching leaks and avoiding spills onto the ground or floor (Junta de Administración Portuaria y de Desarrollo Económico de la Vertiente Atlántica [Board of Port Administration and Economic Development of the Atlantic], 2003). The law describes rules for parking and truck operation, and inspection of vehicles entering and leaving the port area. It describes how goods shall be handled as they pass through the port. In both laws on ports, dumping of materials in the water or on land is illegal.

The General Law of Health defines duties and restrictions on actions and operations relating to hazardous substances. These include that anyone importing, manufacturing, handling, storing, selling, transporting, distributing and supplying substances considered hazardous by the IMO IMDG code are subject to strict regulatory requirements according to the Ministry of Public Health. Any entity that deals with hazardous substances as such must ensure that operations are done under conditions that reduce the risk to health and safety as much as possible. All substances and products must be marked appropriately in Spanish with the relevant symbols, nature of the product, warnings, and antidotes if appropriate. The law obliges all persons to contribute to the maintenance of the well-being of the environment, including prohibiting actions that deteriorate the environment or alter it such that it is unsuitable for certain uses. Entities interested in developing an industry are required to demonstrate to the Ministry of Public Health that the site chosen will be developed such that it will not cause or contribute to contamination of the water, air and soil. The industry must have legal permission from the Ministry of Public Health to begin construction (Ministeria de Salud [Ministry of Health], 1973).

The Water Law governs the use of public water by all individuals, groups and industries. Article 162 states that if actions or functions make water harmful to animals, agriculture, or industry, and result in a loss of greater than one hundred colones, the perpetrator will be imprisoned from three to twelve months or fined. Impaired health or death of humans, animals, or the destruction of property due to water pollution are considered crimes by this law (El Congreso Constitucional de la Republica de Costa Rica [Constitutional Congress of the Republic of Costa Rica], 1942).

The General Regulation of Environmental Impact Assessment (EIA) Procedures gives details on how EIA's should be conducted. The purpose of an EIA is to identify potential environmental issues related to a prospective project. Based on the findings of an EIA, recommendations and limitations are made for each project with an Environmental Management

Plan and other documents. The EIA is conducted by a representative from the Secretaría Técnica Nacional Ambiental (SETENA [National Environmental Technical Secretariat]). The regulation states that SETENA has the authority to conduct random inspections to monitor the environmental control of projects during construction and operation, and must apply sanctions when needed. Developers are required to submit environmental reports to SETENA according to their respective terms of agreement. These reports form part of the environmental compliance inspections. These inspections are conducted using a protocol in the EIA Manual (El Presidente de la Republica [President of the Republic], 2004). Environmental audits, which "audit and monitor the compliance with environmental commitments established in the granting of a license," are conducted at least once per year (El Presidente de la Republica [President of the Republic], 2004, Article 49). The EIA procedures demonstrate that environmental integrity issues are already largely addressed by SETENA.

The Organic Environmental Law of Costa Rica is an act that "seeks to provide, to Costa Ricans and the state, the instruments necessary to achieve a healthy and ecologically balanced environment" (La Asamblea Legislativa de La República de Costa Rica [The Legislative Assembly of the Republic of Costa Rica], 1995, Article 1). The law describes basic regulations and goals for protecting environmental integrity and defines pollution in qualitative terms. Chapter XIX of the Organic Environmental Law defines administrative sanctions, which are given after a violation of environmentally protective laws or after environmentally dangerous conduct. Article 101 of Chapter XIX defines that violators, including responsible companies or groups, are expected to take responsibility for the damage they have caused to the environment. If a false environmental impact evaluation results in environmental damage, those officials who performed that evaluation are held responsible (La Asamblea Legislativa de La República de Costa Rica [The Legislative Assembly of the Republic of Costa Rica], 1995, Article 101).

2.5 Prevention, Preparation and Response for Emergencies in Ports and Marinas

Fires and hazardous waste spills at marinas or ports can result in significant property damage and have devastating impacts on Costa Rica's fragile ecosystems. For example, the incident that occurred in Puntarenas spread over two kilometers and contaminated several springs in the area. It is important that safety precautions are taken by the ports and marinas to

prevent incidents. It is equally important that the Bomberos are prepared to respond appropriately to incidents if they do occur.

Currently, there is no specific system in place to manage fire and spill prevention in Costa Rican marinas or ports. However, NFPA standards are created specifically for fire prevention, and also address hazardous materials spills. Therefore, incident prevention can be achieved by closely following NFPA codes, as well as following other practices outlined by the other legal framework we have reviewed. Preparation for incident mitigation is also important, as accidents can still occur even if preventative actions are taken. In the event of a fire, there are important measures that should be taken to diminish environmental damage and clean up any chemicals that are spilled. Because fire departments are already trained to respond to emergencies, our focus is the response that can be taken by marina and port employees themselves.

One way for ports and marinas to prepare for incidents is to have a standardized method of response to hazardous materials spills. This should focus on methods of preventing the spread of materials and methods of removing materials from the environment. The substances of concern are petroleum distillates like oil, gasoline, or diesel in most cases. Many countries make efforts to protect their ecosystems with such response plans. In the U.S., the Environmental Protection Agency (EPA) has created the Spill Prevention, Control, and Countermeasure plan (SPCC), which is a part of the Clean Water Act developed in 1972. This plan was created to hold facilities to a standard where they are actively preventing water pollution through clean water programs and safety measures. These include public education programs, programs for marina or port management to follow, and signage to make sure the laws are known to the public. The SPCC also includes protocols for ports and marinas to follow in the event of a hazardous materials spill. Under this plan, the EPA stipulates that establishments of sufficient size and risk must have a Facility Response Plan (FRP). According to the plan, the management must immediately notify the appropriate authorities, and must have up to date documentation regarding hazardous materials storage at the site (United States Environmental Protection Agency, 2011). This plan reduces the environmental impact of incidents since marinas and ports are immediately reporting any spills, which decreases the response time by the appropriate agencies. It also encourages businesses to actively prevent hazardous materials incidents, while also preparing for the beginning stages of responding to incidents.

In Seattle, Washington, the Fire Department's fire prevention division released a brochure for what marina management and their clients can do in the event of an emergency. They stress the importance of quick action when an emergency occurs. The brochure not only describes how fire extinguishers should be operated, but also outlines steps that should be taken when a fire occurs. These steps include immediately calling 9-1-1, evacuating people, and disconnecting power and fueling systems. In addition to steps to take in emergencies, it also has pre-incident steps for the managers and the boaters, such as drills for the clientele and pre-planning drills with the fire department. This brochure also lists prevention guidelines including good maintenance practices of the marina and the boats within, a section in the lease to state that the clients are aware of fire protection practices, and the actual enforcement of these policies (Seattle Fire Department, 2010).

The Emergency Response Guidebook is a reference used by emergency responders to quickly identify chemicals and give important facts about each chemical. In addition, the guidebook includes information on how far away the public should be kept from substances and what to do in the event that a chemical contacts skin. Although this guidebook is primarily used by firefighters, it can be a valuable reference to managers at ports to take quick actions to ensure the safety of dockworkers in the event of a spill during cargo transport (Emergency Response Guidebook, 2008).

2.7 Summary

From our review of available research and policy, we have presented several topics that are relevant to inspecting marinas and ports with a focus on hazardous materials, and topics relevant to addressing incidents involving these hazardous materials. We learned basic marina and port protocol to achieve a general understanding of our project's setting. We conducted in-depth research of legal framework to learn specific information that the inspection protocol should address. Finally, we reviewed standard procedures to respond to incidents involving hydrocarbons, to assist in the development of our recommendations for response methods.

Chapter 3: Methodology

Our project goal was to develop a protocol to assist the Bomberos of Costa Rica with inspecting marinas and ports. The secondary goal of our project was to make recommendations for response to hazardous materials incidents. In order to achieve these goals, we researched policy documents pertaining to marinas, ports and hazardous materials. Then, we conducted site evaluations of two marinas and three ports, and surveys and interviews of the stakeholders. Finally, we developed the inspection protocol, as well as recommendations for management response to incidents in these facilities. This chapter provides details of each of these methods.

3.1 Policy Documents

We first evaluated the policies and government documents that regulate construction and operation of marinas and ports. The Bomberos provided the team with NFPA codes 1, 30A, and 303. We obtained additional applicable codes directly from the NFPA website, including NFPA codes 302 and 307. Because NFPA codes are followed in the United States, Costa Rica, and other countries, these codes were available in English. We were provided with the Law of Concession and Operation of Tourist Marinas and its associated regulation, and the General Regulation of Port Services of the Costa Rican Institute of Pacific Ports. We searched for additional relevant documents regarding marinas and ports, and investigated environmental regulations that were electronically sent to us by a representative from the National Environmental Technical Secretariat (SETENA). The additional documents we found and examined were the Costa Rican government documents including the Regulation of Atlantic Port Operations, the General Law of Health, the Organic Environmental Law, the Water Law, the General Regulation of EIA Procedures, and the EIA Manual. All of the documents that we reviewed were publicly available online, with the exception of the EIA Manual, which we received from a SETENA representative via email. The laws specific to Costa Rica were only available in Spanish and were translated into English.

We determined which laws, codes, and regulations were most important for the inspection based on site evaluations, interviews and surveys, as discussed in the following sections. This included proper operation and construction, as we detail in Section 3.5.

3.2 Marina and Port Site Evaluations and Observations

We conducted a site evaluation of Marina Los Sueños in Herradura and Marina Papagayo in Guanacaste, which are both located along the Pacific coast of Costa Rica. We also conducted site evaluations at the Port of Puntarenas, the Port of Caldera, and the Port of Limón. Both Puntarenas and Caldera are located on the Pacific coast, while Limón is located on the Atlantic coast. Figure 8 shows the location of each marina and port. The port locations are significant in terms of inspection purposes because they handle different cargo based on their location. They are also governed by different laws and regulations which pertain to either Atlantic or Pacific ports. The site visits took between one and two hours for each location.

Figure 8: Site assessment locations map (Adapted from: Geology.com, 2011)

The main objective of the site evaluations was to assess the aspects of marinas and ports that pertain to boat operation, boat storage, and fueling stations, since those areas are the most prone to fire. However, we did not limit our assessments to these areas. Before traveling to each

site, we created a site evaluation form so we could observe the marinas and ports in an organized manner. This form, shown in Appendix A, includes discrete questions and space for detailed observations on cleanliness, upkeep, maintenance, signage, water quality, security, fire protection, and the facilities present. We determined cleanliness by examining the boatyard and pier area, taking note of trash, visually observing the water quality, and recording noteworthy indicators of contamination such as oil sheen on the surface of the water, or the presence of hazardous materials located near the water. For upkeep, we noted whether the pier appeared to be well maintained, if there were any spill stains on decks, and if any litter was observed. We noted signage that informs boaters of government regulations, security measures to restrict access, and the presence of fire extinguishers and fire protection systems. We observed and noted the number of boats present, their approximate sizes, how they refueled, and how they were docked and stored. For marinas with fueling docks, we observed fueling stations, including fire protection equipment, signage, and security.

3.3 Interviews and Surveys

We conducted surveys to obtain more detailed information on the facilities, operations, and emergency response capabilities of both the marinas and ports. The survey participants were the marina and port management Results of the surveys provided valuable input to the focus of the inspection protocol.

At both marinas and two of the three ports, we surveyed a member of the marina or port management in order to determine how closely regulations were being followed. The surveys focused on aspects of the facility that we could not evaluate visually, regarding enforcement of rules, security practices, and performing their own inspections. It also included questions to determine how committed the management is to cooperating with the Bomberos in complying with regulations, performing inspections, and working towards keeping the environment safe. We designed the survey with an open-ended question allowing the marina management to give us additional input. The survey is provided in Appendix B. The anonymity of management employees was emphasized to allow for more candid responses. The questions did not directly mention rules and regulations in order to encourage truthful responses. The same marina managers that took the surveys also provided feedback through their discussions with the team

regarding aspects of the facility such as documentation of cargo and ships and details on equipment.

We compared the site evaluations and marina and port management surveys with the laws and regulations that we had compiled to determine if the marinas and ports are currently following regulations. By comparing legal requirements and current compliance at the sites we visited, we determined important categories, such as fire protection, that should be included in the inspection protocol.

3.4 Incident Response Plan Recommendations

Our team investigated current emergency response plans at the five marinas and ports through surveys with the management of the facilities and interviews with the Bomberos local to each site, and researched possible response plans that these facilities could implement. As detailed emergency response plans were outside the scope of our project, emergency response plans were addressed in the inspection protocol based on legal requirements, which require that facilities have established response plans. These response plans included both general plans for the facility in case of incidents, and specific response plans in case of incidents with hazardous materials.

To evaluate the current situation in regards to environmental response plans in marinas and ports, we used data from our site assessments, information provided to us by the managers at each site, and our research of NFPA requirements and emergency response methods. Information gathered during the site assessments that addressed emergency response plans included the presence of spill response materials, such as booms or absorption materials at the docks as well as areas where hazardous materials might be stored. We also looked for signage, like evacuation diagrams, at each site. We asked for information about employee emergency response training, including whether any fire brigades existed on site. Our surveys of the management included questions about their relationship with the local Bomberos. We also interviewed the Bomberos local to the sites at Port of Puntarenas, Marina Papagayo, and Marina Los Sueños for additional information such as the common causes of fires, how often each particular site had an incident, and their opinions regarding emergency response by the employees. These questions can be

found in Appendix C. All of the firefighters with whom we spoke were members of the Costa Rican fire department or the site's fire brigade.

To recommend possible emergency response plans that the Bomberos can implement in ports and marinas, we researched plans from the United States. From the information that we gathered during the site evaluations, surveys and interviews, we learned the current emergency response methods that exist at certain sites, and what methods the Bomberos recommended. With this information, we determined which types of plans were most feasible for implementation in Costa Rica.

3.5 Inspection Protocol

We used information from regulations and policy documents to produce a draft of the inspection protocol prior to our site visits. While on site visits, we made observations on marina and port operations and compared our observations to the draft protocol to determine areas to add or emphasize. We also used the on-site surveys and interviews to gather further information on important criteria to include in the final protocol. In sum, we synthesized information from laws, site visits and stakeholder feedback to create the final inspection protocol.

We determined the most important factors to include in the protocol with regard to fire protection, fire response, hazardous materials and environmental protection. We then developed yes or no questions to address each specific criterion. We compiled the applicable criteria into inspection areas, such as piers and fueling docks. We categorized criteria by whether they were applicable to marinas, ports or both. Lastly, we categorized criteria by their applicability to design and construction, operations or both. We gathered all of these categorized criteria into a Microsoft Excel workbook to create the inspection protocol, and programmed the document to assist inspectors in finalizing the inspections with greater ease. Finally, we translated the final protocol into Spanish for the Bomberos.

Chapter 4: Results and Analysis

We created an inspection protocol for the Bomberos to inspect marinas and ports with regard to three main criteria: fire protection, environmental protection, and management practices. To accomplish this goal, we conducted site assessments at five ports and marinas, administered surveys to marina management, and interviewed local Bomberos at the facilities.

4.1 Fire Protection

We compared NFPA regulations on fire protection with our observations at ports and marinas and with information provided by facility management. These factors included fire protection equipment, signage, and the accessibility of the facility by the fire department.

NFPA requires fire extinguishers listed for class A, B, and C fires to be located such that the maximum travel distance to an extinguisher does not exceed 22.86 meters (75 feet) on piers. At least two extinguishers must be located near fuel storage tanks. Several other NFPA regulations specify where extinguishers must be located in other areas of the ports and marinas, and the class fires for which they must be listed. We observed that fire extinguishers in the marinas we visited appeared to be in compliance with the majority of the regulations. However, neither marina had fire extinguishers at all intersections of piers and land. The ports, on the other hand, had few extinguishers on the premises. The ports of Caldera and Limón had fire extinguishers located in certain buildings, but had only one or no fire extinguishers present along the pier. The Coast Guard dock in Puntarenas had one working fire extinguisher for the entire facility, which should have had 5 extinguishers present according to NFPA. The other dock that we visited in Puntarenas, which was being operated by a scuba diving company, only had one fire extinguisher listed for A, B, and C fires, where it required at least three. There were other fire extinguisher mounts on the walls, but the extinguishers were missing which can be seen in Figure 9. In both surveys and discussions, managers of each facility said they conducted annual inspections of their fire extinguishers, which was evident on the fire extinguisher inspection labels of the extinguishers that were present that we observed.

Figure 9: Fire extinguisher missing from its mount at port (Hayley Sandgren, 2011)

NFPA requires hydrants adjacent to every pier and no further apart than 90 meters (300 feet) or half that distance from a dead end area. It appeared that marinas followed these standards more closely than the ports, but even so did not always meet the specified distances. Marina Los Sueños appeared to meet the standards; however, other sites did not have enough fire hydrants at the appropriate distances. In Marina Papagayo, two piers were not properly equipped with hydrants according to NFPA code. However, fire hoses connected to the water system were located approximately every hundred feet on all of the piers in both of the marinas we visited. Of the ports we visited, only the Port of Limón appeared appropriately equipped with hydrants.

Signage provides notification to the public and staff of restrictions that apply to certain areas or facilities within a marina or port. NFPA requires that signage be present at specific locations, such as fueling procedures at fueling stations, as well as throughout ports and marinas. Signage including "No Smoking" signs, fire safety signs, hazardous materials storage signs, and evacuation route signs were scarce, if even present in many of the sites. The few signs that were present were not standardized according to NFPA in size or color, with a white background and 5.1 centimeter (2 inch) tall red letters. We found that the marinas we visited had more proper signage than ports but were still lacking in some areas. Signage in the ports was almost non-existent except in a few select areas, such as the customs warehouse in Caldera, but even those areas did not appear fully compliant with regulations.

As part of our site visits, we examined fuel storage areas, fuel dispensing equipment, cargo storage, service facilities, and electrical wiring for compliance with regulations. For the most part, the fuel dispensing equipment and fuel storage areas appeared within regulations at both marinas. Although the signage was not the regulation color or size, there were signs present at the fuel storage tanks and the dispensing equipment in both marinas. The tank storage areas at both Papagayo and Los Sueños were equipped with a fire hydrant and at least two fire extinguishers, and signage to prevent smoking and unauthorized use. The ports did not have fueling capabilities for ships, but did have fuel stations for dock equipment. The pumps at these stations did not have any safety signage as required by NFPA, and did not appear to meet regulations for extinguishers and hydrants. NFPA codes also state that fuel dispensing equipment is required to be restricted to port or marina employees only. This regulation was followed by all of the sites we visited that had fueling stations.

Storage of cargo, including hazardous materials cargo, was present in two of the three ports. The Port of Limón ships its cargo immediately after unloading it from the ships and a secure area had been fenced off for hazardous cargo to be stored separate from ordinary cargo while waiting for a truck. Caldera had extensive cargo storage on site, where the cargo containers were stacked five high at the maximum, following NFPA regulations. An area had been separated from the rest of the cargo containers where hazardous materials could be stored, which follows NFPA regulations on hazardous materials storage. Electrical wiring at most of the sites appeared well maintained, with no apparent fraying or problematic repairs. For the most part, wiring was not noticeable at all at most of the sites, and connections that were observed had no visible issues. Puntarenas was the exception, as both docks we visited had exposed and frayed wiring. Junction boxes at the Coast Guard dock were open and the wiring inside was exposed, which can be seen in Figure 10. NFPA regulations require that any frayed or exposed wiring be replaced before being used. While looking at electrical systems, we were also looking to make sure electrical boxes were above the electrical datum plane. Although we did not see a specific datum line at any site, we did not observe any junction boxes that were close to the water which could have been a serious safety hazard.

Figure 10: Exposed electrical junction box at Puntarenas (Hayley Sandgren, 2011)

The final area we evaluated within fire protection was boat storage. A significant motivator for this project was a recent boat fire which grew rapidly due to improper boat storage. Boat storage is more prevalent in marinas rather than ports, as most ports contain ships which generally do not stay at ports longer than needed to load and unload cargo. Both marinas had enough space to dock at least 180 boats and every boat was assigned its own slip, which allowed it to be removed independently of the other boats, in accordance to NFPA requirements. This allows easier access to the vessel in responding to an emergency and also helps prevent the spread of a fire as the boat can be quickly removed and secluded. The Port of Puntarenas had long-term wet storage, and did not follow this regulation. There, we found that boats were docked such that removal of one boat would require the removal of several others. We also observed that many of the vessels were tied to each other and very close together, which would impede the removal of the affected vessel and contribute to the spread of a fire from one boat to another.

Boat storage can also be out of the water, which is called dry storage. Marina Papagayo had a small fenced in area that was holding 5 boats on the ground, and we were informed that an indoor storage facility was being planned for the future. Marina Los Sueños had capacity for 100 boats in outdoor rack storage. This area had 24-hour security and boats in dry storage were restricted from using electricity at night. There were fire extinguishers and hoses present on each series of racks and a fire hydrant was present in the center of the yard. The manager of Los Sueños informed us that they do a complete inspection of the vessels when they first arrive for

seasonal storage, checking for hazardous materials. NFPA also requires that batteries be disconnected, portable tanks removed or emptied with their covers removed, onboard stove supplies removed, and permanent fuel tanks filled at least 95 percent full. Marina Los Sueños included these requirements in their inspection. The reason for filling the permanent tanks is to prevent vapors from building up, which increases the likelihood of an explosion. For rack storage, NFPA also requires that equipment, such as forklifts, be present in order to remove a boat from storage at any time; Marina Los Sueños had this equipment ready for immediate service.

The observations we made at the site visits and the results of the management surveys show that in many cases, facilities are not properly equipped with fire protection according to NFPA codes. This makes facilities vulnerable to incidents like the fire of Puntarenas, detailed in Chapter 2. The Bomberos hope to prevent fire related incidents with inspections. Therefore, fire protection regulations were emphasized in the final inspection protocol.

4.2 Environmental Protection

To gauge environmental controls at marinas and ports, we compared site observations with environmental laws and research on environmentally damaging incidents. Site observations included water quality, the presence of spilled oil in the facility, and waste containment. There was not much concrete legal framework regarding environmental protection in the Costa Rican laws we compiled. Most laws prohibit environmentally damaging incidents but do not give specifics that could be incorporated into the inspection protocol. Therefore, we consulted environmental regulations from the US, including EPA regulations, to guide our site assessments and develop the protocol.

The first environmental observation we made at ports and marinas was water quality, which included oil spills in the water, garbage in the water, and indications of a healthy ecosystem. Indications of a healthy ecosystem include the presence of wildlife, like the many fish species observed at Marina Papagayo, and the coloration of the water. The color of water at the ports of Limón and Caldera and Marina Papagayo was normal (clear and dark as their water facilities were primarily in deep water). Marina Los Sueños had shallower waters and the water was similar to the color of the bottom silt. At these four ports and marinas, the water had a normal salt water smell. At Puntarenas, the water was cloudy, brown, and had an odor of

garbage, indicating poor water quality. In addition, the sink at Puntarenas drained directly into the water, allowing soap and other chemicals used in the sink to enter the water (Figure 11). The presence of oil on the water is an indicator of poor water quality. The Port of Limón had several slicks of oil floating on the surface of the water and visible spills of oil on the rocks near the piers. There was also an issue at Limón and Puntarenas, where debris from wrecked boats was present in the water from past incidents. This debris is not only a safety hazard, but can affect ecosystems by releasing chemicals into the water.

Figure 11: Sink drain at Puntarenas draining directly to ocean (Hayley Sandgren, 2011)

In addition to observing water characteristics, we observed general littering and waste containment throughout each site. This included if we saw trash or litter on the ground, if there were trash and recycle bins present for proper disposal of waste, and if trash seemed to be regularly removed from the facility. Although there are no current regulations that require this, our site evaluations showed that well-secured garbage bins with lids should be present on piers and dry storage areas, as these are the places with the most human activity. These would help

prevent garbage from polluting the ground and the water near the facility. We developed questions that would address this type of recommendation on the inspection protocol, which are considered “extra credit” as they are not legal requirements.

Waste and oil containment and disposal was another important characteristic of the ports and marinas. Some of the sites we visited held waste oil in containers that followed NFPA regulations, but other sites had oil in containers which did not appear to be appropriately sealed. In addition, the method of containing those materials varied among sites. For example, Marina Los Sueños had a trough which surrounded the entire fueling station and led to an oil-water separator. A containment wall also surrounded the above-ground fuel storage tanks, which would hold the liquid in the event that a tank ruptured. The Port of Limón had a similar trough, though it did not completely surround the fueling station. Other sites did not appear to have this method of protection against oil spills. The Port of Caldera had a service facility which was poorly contained in terms of hazardous materials; the dirt floor of the mechanics shop was covered in oil. However, the manager of Caldera indicated that plans existed for installing an oil-water separator by the equipment service facility. In addition to observing oil containment, we observed methods for disposal of wastewater at Marina Papagayo, as they had a pump-out station for waste located on their fueling dock. The other marinas and ports did not have these services.

Another inconsistency among the sites we visited was their preparedness for response to emergencies in regards to preventing or mitigating environmental damage caused by materials spills. Both of the marinas we visited were well equipped for addressing these incidents. Marina Papagayo had numerous spill containment kits located along the fueling dock, while Marina Los Sueños had containment equipment stored on the pier close to the fueling dock. The ports did not appear as well prepared. The Port of Limón had some booms in its waters, but they did not enclose any areas entirely, meaning they were not being utilized properly, as shown in Figure 12Figure 12. No containment equipment was observed at the other ports we visited.

Figure 12: Floating boom in Port of Limón surrounding part, but not all of a submerged vessel (Hayley Sandgren, 2011)

Due to the lack of concrete legal framework on environmental protection in Costa Rica, we developed inspection questions to address the environment based on our own research as well as our findings from site evaluations. These questions prompt the inspector to note environmental qualities that can be evaluated visually, which include noting oil slicks in the water, trash or boat debris in or near the water, the color and smell of the water, waste containment and disposal practices, and oil spill containment options.

4.3 Management of Facilities

Security is a major responsibility for management and was a subject of several of our survey questions and observations in our site evaluations. Security at ports is especially important due to the cargo and hazardous materials kept on site and being transported. Security protects the people at the port and the environment, and also ensures that cargo is not tampered with.

NFPA requires that cargo is enclosed with high wire or chain link fence unless a fence surrounds the entire terminal. Both cargo ports appeared well secured in this aspect as the only entrance to each facility was through a security checkpoint. NFPA requires that facility management maintain control over all personnel access to storage facilities and boats stored indoors. Both cargo ports maintained control over access to their cargo storage with their

security checkpoints. Los Sueños was the only marina with storage of materials including lubricants and oils, and the security department maintained a watch over the small storage units that were on site. The security department at Los Sueños also watched over the boats in dry storage, though they were outdoors and did not require surveillance by law. Papagayo also had a security watch for the entire facility. The two docks that we visited in Puntarenas appeared well secured with enclosing walls and barbed wire, though they did not store cargo and were therefore not required to be fenced in. The information that we gained from the surveys, conversations with the marina and port managers, and site assessments indicated that security at the ports and marinas we visited is well developed. The inspection protocol addresses the regulations specified by both NFPA and the Costa Rican regulations for security.

Facilities that have fueling stations have additional requirements. The NFPA requires that the fueling attendant be familiar with the equipment they are using and follow a list of safety precautions before, during and after fueling. Both marinas we visited had fueling docks for vessels, and two of the ports and both of the marinas had fueling stations for boatyard equipment. All sites had locks on their fueling equipment and management assured us that only one employee had the means to unlock and administer fuel. It is imperative that every marina and port follow this law to prevent dangerous incidents. The sites we visited all appeared to be in compliance with fueling requirements. These regulations are included in the inspection protocol to ensure compliance at all ports and marinas.

An important organizational requirement by the NFPA is that facilities have a list of hazardous materials on site, with their location, amount and name. This list must be available for responders in the case of an emergency, so that they can be aware of the materials they are handling and respond appropriately. This is especially important in ports since large amounts of materials are brought into and removed from the facilities. Costa Rican laws require that both boats and cargo be documented seven days in advance in both Pacific and Atlantic ports. These laws also require hazardous cargo to be classified and documented by IMCO. The two port managers with whom we spoke at these ports assured us that they constantly have a record of the materials that they have on site.

4.4 Emergency Response

Our team investigated emergency response methods that could be implemented in Costa Rican marinas and ports by conducting research on existing response methods in the United States as well as examining current response methods at the marinas and ports we visited. Detailed research of emergency response plans was not within the scope of our project, so only legal requirements regarding emergency response were incorporated into the inspection protocol. However, we compiled information and our findings were provided to the Bomberos, as recommendations for ways marina and port management can be more prepared for responding to incidents within their facilities.

In our research on specific ways to respond to hazardous incidents at marinas and ports, we focused on hazardous materials spills since they can have a big impact on the environment and are almost always present in marinas and ports. The Bomberos are already trained to respond to these types of incidents, but they want marina and port management to have plans so they can immediately start mitigating any incidents. More detailed information regarding addressing hazardous materials spills can be found in Appendix D.

Before responders can address a hazardous materials spill, they must be properly equipped with protective gear to prevent negative health effects. We learned that the first step towards mitigating a hazardous materials spill is to contain the contaminated area. If spills occur on land, the liquids can be contained using a dirt dike, which a row of dirt piled to create a barrier. If spills occur on water, there are a number of methods that can be used to contain the material, particularly for materials like hydrocarbons which float on water. One of these methods is using booms, which are long chains of floatation devices that also contain materials within a barrier.

Once the materials are contained, they must be treated or removed from the contaminated area. This can be done using skimmers, which pick up the material, or sorbent booms, which absorb the material. Hydrocarbons can also be chemically treated using dispersants, which help to break down the material so that it can be more easily degraded by microorganisms. These can be controversial in terms of environmental impacts, so they must be used appropriately (Lewis, 2008).

Depending on the conditions of each marina or port, such as how strong the water current is in the area or the amount of hazardous materials present at the site, certain options for

materials spills response will be more ideal than others. These considerations are further explained in Appendix D. Each facility should determine the response plan that best suits its conditions.

NFPA code 307: 8.13 requires that a facility that has any hazardous materials present on site has an emergency response plan in place. This plan requires detailed instructions for managers, employees, and affiliates of the facility. The plan should be reviewed and approved by the authority having jurisdiction before it is implemented, and the facility should practice the plan at least twice per year. Facilities are also required to have means of communication for making emergency calls. NFPA requires that the fire department visit each facility annually to familiarize itself with the site and conduct safety trainings. In addition, employees are required to be educated on how to properly use a fire extinguisher and the fire suppression equipment on site. The manager of Marina Los Sueños told us that they educate their employees on extinguisher use annually when they empty and replace the contents of their extinguishers. As facilities are required to have these plans and trainings by NFPA code, this was included in our inspection protocol.

One port manager stated that his facility has a fire brigade in addition to spill control systems for responding to emergencies, and described their emergency response methods as effective. The other port manager stated that his personnel do not have emergency response capabilities, and that in the event of an emergency, they immediately call the fire department and the nearby Costa Rican Petroleum Refinery (Refinadora Costarricense de Petróleo or RECOPE) as appropriate. RECOPE has a specially trained team that can respond to incidents involving spilled petroleum distillates. Both port managers said that they used an employee-watch system to spot incidents.

Both marina managers detailed that the marinas are well prepared to address hazardous materials spills, which was also evident through our site evaluations. Both marinas have spill containment equipment located on or near the fueling docks, including absorbent pads and booms, which are shown in Figure 13. Both marinas have their own fire brigades, which are on the premises and ready to respond to emergencies at all times. Marina Papagayo's fire brigade consists of teams on the facilities staff that are trained to respond to incidents that occur within the facility. The Papagayo fire brigade has two fire trucks and an ambulance, as well as equipment for responding to incidents. The Los Sueños fire brigade, which consists of well-

trained staff, has its own fire boat, shown in Figure 14, which the manager stated is capable of responding to incidents at any location in the marina within two minutes. Fire brigades are beneficial for mitigating emergencies as they can promptly take action. Although they said they had never needed to, they were aware that they should call the Bomberos if an emergency occurred that was too large for them to handle.

Figure 13: Spill containment kit at Marina Papagayo (Shane Sampson, 2011)

Figure 14: Fire boat at Marina Los Sueños (Shane Sampson, 2011)

Good relationships between facility management and the local Bomberos ensure that the Bomberos are notified immediately of any emergencies, allowing them to respond quickly and minimize potential damage. We interviewed the Bomberos local to Marina Papagayo, Marina

Los Sueños, and the Port of Puntarenas to gain additional information regarding emergency response in Costa Rican marinas and ports. The Bomberos said that the management at each port was cooperative when incidents occurred. The marinas do not have close relationships with the local Bomberos as they have their own fire brigades and training programs for staff, which still allows for quick response to incidents. Most of the Bomberos reported having few or no calls to any of the marinas or ports, though the Bomberos at Puntarenas said they had responded to severe incidents, such as the Fire of Puntarenas. The Bomberos of Papagayo and Los Sueños believed that each site's emergency preparedness was sufficient.

The Bomberos advocated the use of fire brigades on the premises of each port and marina. This way, emergencies can be responded to promptly, and the fire department can be contacted for additional assistance if needed. All of the Bomberos also believed that each site should have emergency response plans in place to aid in quick response; however they did not provide any suggestions for improvements to the port and marina response protocols. The fire fighter from Marina Papagayo suggested that an increased effort in education for the boaters about fire prevention would be beneficial.

Some of the marinas and ports we visited did not have their own emergency response plans established. Our team conducted research on ways to respond to incidents, which can be recommended to marina and port managements for implementation. An example list of actions to take in the event of an emergency can be found in Appendix E for marinas and Appendix F for ports. We found that many countries make efforts to protect their ecosystems with response plans like the ones the Costa Rican Bomberos would like to implement. One such plan is that of the United States Environmental Protection Agency (EPA) called the Spill Prevention, Control, and Countermeasure plan (SPCC), which we discussed in Chapter 2. The SPCC includes protocols for facilities like ports and marinas to follow in the event of a hazardous materials spill. The plan defines actions that must be taken in the event of an emergency, including immediately notifying authorities like the fire department and having a readily accessible diagram of the site plan that identifies where all hazardous materials are stored. The plan must also identify the emergency equipment on site and provide emergency contact information (United States Environmental Protection Agency, 2011). This plan prepares the staff of marinas and ports to be ready in the event that a hazardous material spill occurs in their facility.

The Seattle Fire Department in the United States developed a plan that focuses on marina management fire response. It states that when a fire occurs, the fire brigade or the fire department should be immediately notified. Then, all boaters should be evacuated and all power should be shut down. A vital aspect to the plan was that the management should be working with the local response agencies when creating their protocol, not only to get valuable input, but also to familiarize the responders with the area (Seattle Fire Department, 2010), which is also required by NFPA code 307: 8.13. We have provided the plan developed by the Seattle Fire Department in Appendix G for the Bomberos to distribute to boaters. This plan is helpful to make boaters aware of how they can prevent fires and make sure that their marina is safe. These plans can help marinas and ports respond to emergencies and help to mitigate threats to the environment and to human safety.

An important reference that can be used to develop emergency response plans is the Emergency Response Guidebook which details how to identify spilled chemicals and how to address the incident (United States Department of Transportation, 2008). If managers are familiarized with the contents of this guidebook, they can quickly reference it in the event of an incident in order to better understand the spilled chemical and the dangers it may present. They will be much better informed to react to the emergency.

Our research, interviews, surveys, and conversations with marina a port management provided information concerning the emergency plans of each site we visited, regulations relating to emergency response plans, as well as possible plans that can be implemented in marinas and ports of Costa Rica.

Chapter 5: Inspection Protocol

The content of the inspection protocol is based on our findings from site assessments, surveys, interviews, and research, as presented in the previous chapter. It is comprised of items which are required by laws and regulations, and includes inspection criteria as they apply to design, construction, and operation of facilities. There are four different inspection protocol documents. They apply to marinas in the design or construction phase, marinas in operation, ports in the design or construction phase, and ports in operation. This chapter describes the content of the inspection protocol and how inspections can be conducted using this protocol.

5.1 Content of the Protocol

Interviews with the Bomberos revealed what they felt the inspection protocol should specifically address. They explained that marine fires, specifically the fire at the Port of Puntarenas, were a major concern. They also explained concern for the well-being of the environment with regards to the hazardous materials that can be present at marinas and especially at ports. The Bomberos emphasized that the inspection protocol should address all of the regulations, laws, and codes that apply to marinas and ports in addition to other environmental aspects based on our own recommendations.

Site assessments and surveys verified that compliance with laws, regulations, and codes must be inspected thoroughly. Based on our assessments, it appeared that compliance to the newly adopted NFPA standards was not consistent. Each site appeared to be in violation of some rules, and the managers were not aware of all of the laws and regulations that applied to their facilities. We found that managers of newer facilities were more knowledgeable about all of the codes and regulations that applied, including NFPA standards, than the managers of older facilities. The Bomberos hope that implementation of an inspection protocol for marinas and ports will improve the safety of these sites and inform managers of the laws and regulations their facilities should follow.

We synthesized data from laws and regulations, site assessments, interviews and surveys to determine the key elements of the protocol. The protocol is intended to be used by inspectors when they are on site at marinas and ports. It is divided into sections based on areas of the marina or port as follows:

- General facility layout and services
- Administration and documentation
- Piers
- Fueling docks
- Fueling stations on land
- Buildings
- Indoors
- Wet storage of boats
- Dry storage of boats
- Electrical Systems
- Cargo areas
- Flammable and hazardous materials

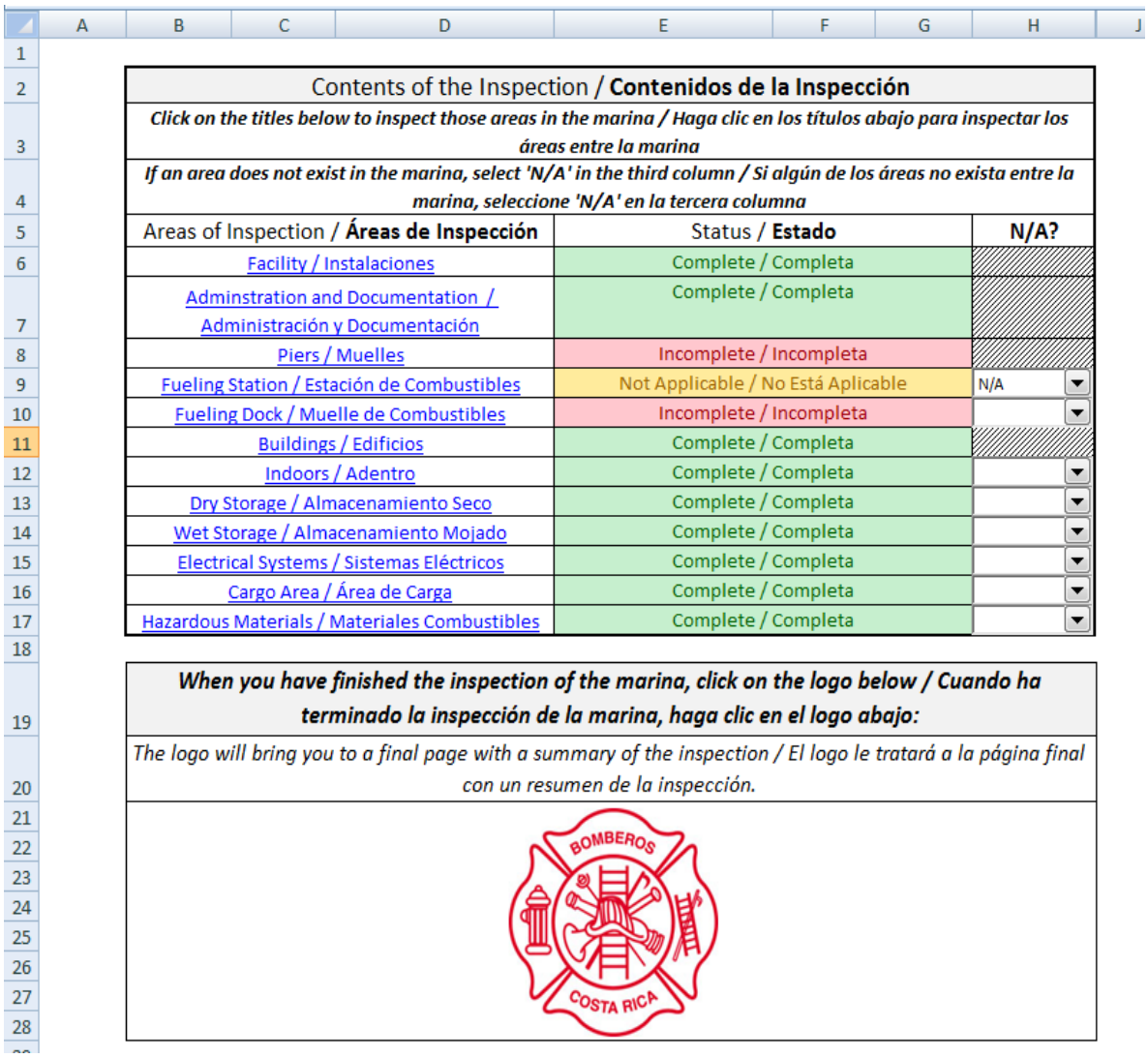
Each of these sections has questions regarding fire protection, environmental protection, and general management of the facilities, as appropriate. These were the criteria we found to be most pertinent based on our research. Each criterion is followed by the law, regulation, or code from which the requirement was taken, such as "NFPA 307:6.3.2"; criteria developed by our team are followed by "WPI Recommendation." For consistency, each question is worded such that a "yes" is a pass and a "no" is a fail for that criterion. There is also an option to select "not applicable". While there are four different inspection protocol documents, the only difference between these documents is the inspection criteria. This is because different laws and regulations apply depending on the phase of the facility (design and construction or operation) and whether the facility is a marina or port.

Each criterion within the inspection protocol has different significance in regards to whether a marina or port is operating safely and appropriately. This means that each criterion cannot be given the same weight in the inspection. Because of this, our team decided that the most appropriate final output of the inspection protocol is a summary sheet that lists all failed

items together, followed by all passed items and all inapplicable items. . The inspector and the Bomberos can review the summary sheet to determine what corrective action should be taken at each facility, and can forward the inspection outcome to the facility managers.

5.2 Inspection Protocol Operation

The inspection protocol is an interactive, programmed Microsoft Excel workbook. To begin, the inspector opens the document which applies to the facility he or she will be inspecting, which is either a marina in the design or construction phase, a marina in operation, a port in the design or construction phase, or a port in operation. The workbook opens on a start page, in which the inspector inserts the name of the port or marina. The inspector then clicks on the Bomberos logo, which opens a page of contents, as seen in Figure 15. This page lists all of the possible areas within the facility as discussed in Section 5.1. Next to the list of areas is a column which states the inspection status of each area as complete or incomplete. The status of each area updates as the inspector completes the inspection. For all facilities, inspectors are required to complete the areas on general facility operation and layout, administration and documentation, piers, and buildings. For other areas, the inspector can complete the information or select “not applicable” as appropriate. If an area, such as a fueling station on land, is not applicable, its respective page in the document becomes cross-hatched, and its status on the contents page displays “Not Applicable.”



Contents of the Inspection / **Contenidos de la Inspección**		
Click on the titles below to inspect those areas in the marina / Haga clic en los títulos abajo para inspectar los áreas entre la marina		
If an area does not exist in the marina, select 'N/A' in the third column / Si algún de los áreas no exista entre la marina, seleccione 'N/A' en la tercera columna		
Areas of Inspection / **Áreas de Inspección**	Status / **Estado**	**N/A?**
Facility / Instalaciones	Complete / Completa	
Adminstration and Documentation / Administración y Documentación	Complete / Completa	
Piers / Muelles	Incomplete / Incompleta	
Fueling Station / Estación de Combustibles	Not Applicable / No Está Aplicable	N/A
Fueling Dock / Muelle de Combustibles	Incomplete / Incompleta	
Buildings / Edificios	Complete / Completa	
Indoors / Adentro	Complete / Completa	
Dry Storage / Almacenamiento Seco	Complete / Completa	
Wet Storage / Almacenamiento Mojado	Complete / Completa	
Electrical Systems / Sistemas Eléctricos	Complete / Completa	
Cargo Area / Área de Carga	Complete / Completa	
Hazardous Materials / Materiales Combustibles	Complete / Completa	

When you have finished the inspection of the marina, click on the logo below / Cuando ha terminado la inspección de la marina, haga clic en el logo abajo:
The logo will bring you to a final page with a summary of the inspection / El logo le tratará a la página final con un resumen de la inspección.
BOMBEROS COSTA RICA

Figure 15: Contents page of the inspection protocol

The inspector may choose the first area which he or she will inspect, and click on its title. The document opens the appropriate inspection worksheet for that area which has the applicable questions. The inspector may answer each question by selecting “Yes,” “No,” or “Not Applicable” from a drop-down menu. In addition, he or she can add comments next to each question. When the inspector has answered all of the questions, he or she may click on the Bomberos logo to return to the Contents page. The status of that inspection area will change from “Incomplete” to “Complete.” The inspector may return to the Contents page even if a certain area has not been fully inspected, and may return to that area later. When the inspector

has completed the inspection, the status of all applicable areas is “Complete,” or “Not Applicable”. The inspector may finalize the inspection by clicking on the Bomberos logo below the Contents table. This prompts the workbook to collect all of the failed, passed, and inapplicable items from each section and print them on a final page.

The final summary page first lists all of the failed criteria, organized by the area of the facility in which the criteria were failed. Then, lists of the passed and inapplicable items follow in the same format. The summary page also includes any comments that the inspector noted when evaluating the criteria. This list can be given to the manager of the inspected marina or port as a summary of the inspection, and can be evaluated by the Bomberos for determining any corrective action that should be taken.

Since laws and regulations are updated and changed from time to time, we included a set of instructions to the Bomberos so they would be able to edit the workbook to add and change inspection criteria. The English instructions that we provided to the Bomberos can be found in Appendix H.

The Bomberos have Trimble Yuma tablets, which are mobile tablet computers. These devices allow the inspectors to complete the workbook on site while performing the inspection. Alternatively, the inspectors may bring a hard copy of the protocol on site, and later enter the data into the workbook.

Chapter 6: Conclusion and Recommendations

The goal of this project was to provide the Bomberos with a standardized way to inspect marinas and ports. We compiled laws and regulations regarding these facilities and organized them into topics regarding fire protection, environmental protection, and general facility management. We then created an easy to follow protocol in Microsoft Excel, which focuses on those particular topics in each area of a marina or port. The protocol allows for thorough inspections, which can be reviewed by the Bomberos to determine corrective actions for improving legal compliance at each marina and port that is inspected.

Our protocol provides a summary of all criteria that were passed, failed, and inapplicable during an inspection. An extension of this project could be to determine when a facility passes or fails the overall inspection. The Bomberos have experience in inspecting facilities and thus can create a grading system that weights each criterion in the protocol. A final score can be determined by adding the number of points associated with each inspection criterion that the facility passes.

Some of the Costa Rican laws that contributed to the protocol are not specific. Several laws say that the ports and marinas are prohibited from harming the environment but do not define the meaning of this in specific or quantitative terms. Overall, the laws governing marinas and ports in Costa Rica are inadequate to support an inspection protocol which fully addresses environmental control and other items not covered by more specific regulations like NFPA codes. We suggest that research be done into adopting laws and regulations based on those from countries with more developed environmental laws regarding marinas and ports, such as the United States. In addition, our site evaluations revealed that the inspection protocol lacks a proper method of testing environmental conditions. The questions that we developed for the inspection protocol are based on visual observations. We recommend that the Bomberos

coordinate with another agency to quantitatively inspect the environmental conditions of ports and marinas.

The NFPA codes were recently adopted in by Costa Rica and thus there is a lack of prior experience with following these codes. During our site assessments, none of the sites appeared to be compliant with all of the codes. Once the inspection protocol is in place, it would be beneficial for the Bomberos to send the results of inspections to the facility management after performing inspections. In doing so, the Bomberos will facilitate the improvement of marine facilities in regards to legal compliance and fire protection.

One of the firefighters that we interviewed during a site evaluation suggested that marina boaters be educated about fire prevention. As previously mentioned, a list of prevention tips that were gathered from the Seattle Fire Department can be found in Appendix G. We recommend that the marina management be required to educate their clientele about preventing incidents and responding to incidents. We also recommend that marina and port staff be required to be educated on fire prevention and emergency response techniques.

Our results for the emergency response plans that marina and port management can implement are a start to a potential future project. We found a number of regulations that specify how certain emergency response plans, such as those for hazardous materials incidents, should be organized. As there is a significant body of information on these topics, we recommend that another project be initiated to produce concrete emergency plans.

The protocol we produced should serve as an efficient and effective way by which the Bomberos can inspect ports and marinas. It is a comprehensive summary of all related laws and regulations from Costa Rican legislation and NFPA regulations. The protocol is designed to be accessible and simple enough to be completed by any Bomberos inspector.

By implementing the inspection protocol, the Bomberos hope to prevent emergencies and prepare marinas and ports for responding to incidents. The protocol helps ensure that facilities are well maintained, well managed, and operating safely. The protocol prepares ports and marinas for responding to incidents by verifying that fire protection equipment is available, up to date, and maintained properly. We believe that the inspection protocol is a useful tool that the Bomberos will be able to use to help ensure safe operations within marinas and ports, protecting humans and the environment.

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Appendix A: Site Evaluations

Site Evaluation Format

Site name: _____
Date: _____
Time: _____

1. Usage
    a. How many boats are present? _____
    b. How many people are present? _____
    c. Size of boats: _____
    d. Types of storage (Wet/Dry/Indoor/Rack): _____
    Other:_____
    _____
    _____
    _____
    _____
2. General Upkeep
    a. Trash cans available and regularly emptied? _____
    b. Spills of oil: _____
    c. Quality of piers: _____
    Other:_____
    _____
    _____
    _____
    _____
3. Water Quality
    a. Trash in the water: _____
    b. Oil/chemicals in the water: _____
    Other:_____
    _____
    _____
    _____
    _____

4. Signs Present
    a. Quality of Signage _____
    b. Does it inform users of the environmental protection laws
    _____
    c. Do signs follow format required by NFPA: _____
    d. Are they present where they are required: _____
    Other:_____
_____
_____
_____
_____

5. Fire Protection
    a. Are buildings being protected by automatic sprinkler systems where required
    _____
    b. Are standpipes located in buildings with rack storage: _____
    Other:_____
_____
_____
_____

6. Fire Extinguishers
    a. Are they present where required by NFPA: _____
    b. Are they being properly inspected and updated with a tag: _____
    c. Are they clearly visible: _____
    Other:_____
_____
_____

7. Fire Response
    a. Is there room for the fire department to maneuver their apparatus
_____
_____
_____

8. Security
    a. Restrict general public from accessing piers and buildings with rack storage:
    _____
    Other:_____
_____
_____

9. Service Facilities
    a. Upkeep of facility (oil stains on ground): _____
    Other:_____
_____
_____

10. Water Supply
    a. Is there a water supply within specified distance of all piers, boats, and buildings

_____
_____

11. Other Facilities
    a. Fuel Dock: _____
    b. Pump Out Station: _____
    c. Oil Recycling centers: _____
    Other:_____

_____
_____

12. Other General Observations

_____
_____
_____
_____
_____
_____
_____
_____
_____

Completed Site Evaluations

Site Evaluation: Marina Papagayo

Date: 11/16/2011

Time: 11:10-12:45

1. Usage
    a. How many boats are present? 15
    b. How many people are present? 10
    c. Size of boats: 30+ feet (max 50 feet)
    d. Types of storage (Wet/Dry/Indoor/Rack): wet and dry storage

    Other:
    A. Dry storage area was not lit, and no fire extinguishers present
    B. Said they winterized the boats which means the tanks were pretty full (probably about 90%)

2. General Upkeep
    a. Trash cans available and regularly emptied? Yes
    b. Spills of oil: No
    c. Quality of piers: New and very well maintained

    Other:
    A. Garbage cans had tops and could be secured

3. Water Quality
    a. Trash in the water: only two pieces of trash (had skimmers to clean anything on hand)
    b. Oil/chemicals in the water: No

    Other:
    A. Clear water, lots of sea life
    B. Said there were boats that sank near playa de coco which were sending pollution
    C. Fishing is prohibited (mentioned in the signs as per concession 7744

4. Signs Present
    a. Quality of Signage: Very clear and plentiful
    b. Does it inform users of the environmental protection laws: Yes
    c. Do signs follow format required by NFPA: no smoking signs were opposite colors they should be
    d. Are they present where they are required: yes

    Other:
    A. Restricted Access to docks
    B. No cell phones and smoking signs in fueling areas
    C. Instructions for fueling
    D. No fishing signs
    E. Clearly labeled fire protection equipment

5. Fire Protection
    a. Are buildings being protected by automatic sprinkler systems where required: Yes
    b. Are standpipes located in buildings with rack storage: N/A

    Other:
    A. Plenty of Fire Hydrants (one hydrant was possibly missing from B dock) (one was close to the fuel tanks
    B. Occupant use hoses next to every extinguisher on the docks (about every 100 feet

6. Fire Extinguishers
    a. Are they present where required by NFPA: for the most part
    b. Are they being properly inspected and updated with a tag: yes
    c. Are they clearly visible: yes

    Other:
    A. Extinguishers about every 100 feet
    B. Fuel tank had 2 extinguishers ABC

7. Fire Response
    a. Is there room for the fire department to maneuver their apparatus
        1. Yes depending on the dock, one dock would be a little difficult to gain access (A dock)
        2. fire fighters on staff who have 2 trucks and an ambulance

8. Security
    a. Restrict general public from accessing piers and buildings with rack storage: Yes, 4 guards in the busy seasons and 2 in the lull season

9. Service Facilities
    a. Upkeep of facility (oil stains on ground): N/A

    Other:
    A. Plans to build one in future

10. Water Supply
    a. Is there a water supply within specified distance of all piers, boats, and buildings
    Yes

11. Other Facilities
    a. Fuel Dock: 12,000 gallon (2 diesel and 1 gas tanks)
    b. Pump Out Station: Yes has a wastewater treatment
    c. Oil Recycling centers: Yes

    Other:
    A. Only 2 stains on the ground (6 inch and 12 inch in diameter)
    B. Spill collection equipment (socks and absorbent pads on docks, and floating booms on the land that are able to contain the entire fuel dock.
    C. Each pump had emergency stops for the pumps and one by the tanks
    D. Each staff member is trained to respond to spills
    E. Small incident- staff
    Medium- fire department on staff
    Large- call government (hasn't happened)
    F. Shutoff valves for fuel at point where dock meets land and flexible couplings, also the fuel lines were all divided in two

12. Other General Observations
    A. Was an exceptional marina, staff were really concerned with protecting the environment and public safety
    B. Manager was very helpful, very knowledgeable
    C. Very clean and well-kept facility
    D. inspected twice a year by CIMAT
    E. when it was being constructed they had the floating booms set up and the perimeter dock to make sure no debris went into the water
    F. Manager asked about whether the water pipes for fire systems should be under the water or not

Site Evaluation: Marina Los Sueños

Date: 11/17/2011
Time: 12:50-1:25

1. Usage
    a. How many boats are present? 280
    b. How many people are present? 250
    c. Size of boats: 30’ to 60’
    d. Types of storage (Wet/Dry/Indoor/Rack): wet and dry outdoor rack

    Other:
    A. Can fit 200 wet storage (usually 90% full) and 100 in dry storage (usually 100% full)
    B. Stacked 3 high

2. General Upkeep
    a. Trash cans available and regularly emptied? Not on docks, but there were a couple on shore
    b. Spills of oil: none
    c. Quality of piers: good, relatively new (just did maintenance)

3. Water Quality
    a. Trash in the water: None visable
    b. Oil/chemicals in the water: non visable

    Other:
    A. Water color was a nice green color in the center and brownish towards rocks
    B. water was not as clear as marina papaguyo but this marina is used much more heavily
    C. crabs were seen crawling around

4. Signs Present
    a. Quality of Signage- not many no smoking signs
    b. Does it inform users of the environmental protection laws
    c. Do signs follow format required by NFPA:
    d. Are they present where they are required:

    Other:
    A. Lack of general signage (no smoking signs on docks and dry storage)
    B. Fuel dock had a lot of signs giving instructions on fueling, no smoking, and locations of spill equipment

5. Fire Protection
    a. Are standpipes located in buildings with rack storage: (N/A)

    Other:
    A. Standpipe with 1.75 inch hose and fire extinguishers located every 100'
    B. Fire Boat which is deployable within 2 minutes without requiring power
    C. Staff live on premises and are trained to respond to fires
    D. Emergency shutoffs for fuel docks, located on mainland and on the dock

6. Fire Extinguishers
    a. Are they present where required by NFPA: Yes
    b. Are they being properly inspected and updated with a tag: Yes
    c. Are they clearly visible: Yes (paint on boxes were faded on docks)

    Other:
    A. Manager said extinguishers were emptied each year and filled and when that happened, the used the old extinguisher filling to train staff
    B. Two extinguishers around fueling tanks

7. Fire Response
    a. Is there room for the fire department to maneuver their apparatus
    Not really to the docks but there is a fire boat that can access it, other areas were accessible

8. Security
    a. Restrict general public from accessing piers and buildings with rack storage: Yes

    Other:
    A. Guards present in storage and fueling area
    B. Security checkpoint to enter facility
    C. Video camera system

9. Service Facilities
    a. Upkeep of facility (oil stains on ground): (N/A)

    Other:
    A. Only had waste oil transfer pumps which were contained in a stainless steel trough so the dripping oil would not enter the water

10. Water Supply
    a. Is there a water supply within specified distance of all piers, boats, and buildings
    1. Fire hydrants present all over the place
    2. Each hydrant had a wrench, length of hose and adapter next to it
    3. Water supply was fed by gravity, does not require electric pumps (50,000 gallon tank

11. Other Facilities
    a. Fuel Dock: Yes
    b. Pump Out Station: Yes
    c. Oil Recycling centers: Yes

    Other:

    A. Fuel dock had spill containment equipment including a deployable floating boom on the dock.
    B. Employees must hold the nozzle while fueling (wont dispense fuel unless it is held)
    C. Welded fittings where the hoses go to the docks
    D. All fittings and hoses are gasohol ready (10% alcohol like in US)
    E. Tanks were above ground and surrounded by retaining walls which could contain a spill
    F. Gasoline tank was above ground in a building encased in sand
    G. Fuel delivery area (where the truck parks) was surrounded by troughs which lead to oil-water separators to contain any minor spills
    H. Tanks were 8,000 gallon capacity (2 diesel) and 3,000 gallons (1 diesel and 1 gas)
    I. Storage facilities for each boater which were subject to inspections by staff
    J. Dry storage had a water supply and each boat was inspected before entering the rack storage, no electricity at night

12. Other General Observations
    A. Doctors and a clinic was present on facilities

Site Evaluation: Port of Caldera

Date: 11/15/2011
Time: 9:10am – 11:30am

1. Usage
    a. How many boats are present? 2 in dock (room for 3)
    b. How many people are present? Approximately 100 (workers)
    c. Size of boats: 490m long
    d. Types of storage (Wet/Dry/Indoor/Rack): Wet storage only for boats; all containers stored outside; staging area

    Other:

        a. Containers stored outside in 9 different patios, 2 warehouses, no pictures allowed on site.
        b. Hazardous materials cargo stored in separate patio from other cargo.
        c. Hazardous materials stored on dirt, as they should be, but there were some weeds/grass which are flammable and should not have been present.
        d. Customs warehouse was well-organized and labeled, separating cargo appropriately including hazardous materials.

2. General Upkeep
    a. Trash cans available and regularly emptied? Yes
    b. Spills of oil: A lot near the mechanics shop. Oil visible in water traveling through gutters, which most likely are emptied into the water.
    c. Quality of piers: Piers in good condition.

    Other:

    A. Only stacked 5 containers high, everyone wearing safety vests and hard hats, found fertilizer in small pile on ground.
    B. Tarps over water to prevent fertilizer from spilling when being moved from ship to truck; men sweeping the fertilizer off the ground and cleaning it up.

3. Water Quality
    a. Trash in the water: No trash visible
    b. Oil/chemicals in the water: Not noticed

    Other:

    A. Crabs living in water and on rocks in port.
    B. See comment about gutters and oil slicks above.

4. Signs Present
    a. Quality of Signage: Good: 7 no smoking signs in second warehouse (customs), not many in first warehouse (basic workspace); signage about safety equipment; propane tank outside did not have any signage; emergency exit signs present; evacuation diagrams on the outside of warehouses on docking side; floatation devices on dock side; signs mention ISPS, codes which should be followed;
    b. Does it inform users of the environmental protection laws? No
    c. Do signs follow format required by NFPA: Not quite: signs were red background with white lettering rather than opposite
    d. Are they present where they are required: Mostly – in warehouse where there was wood/flammables there were a lot of signs; outside of warehouse did not have many signs

    Other:
        A. Dangerous cargo containers had placards.

5. Fire Protection
    a. Are buildings being protected by automatic sprinkler systems where required? No
    b. Are standpipes located in buildings with rack storage: N/A

    Other:
    A. Standpipes present in warehouses.
    B. No sprinklers present in office.
    C. Warehouse had manual fire hoses (approximately 200ft apart, 4 in second warehouse).
    D. Not enough fire hoses.
    E. Do not have automatic fire alarms but have people on staff trained to address/respond to fires, and use video monitoring and a watch system.
    F. 4 total water supplies for entire port (not enough, as hose size has maximum requirement).

6. Fire Extinguishers
    a. Are they present where required by NFPA: Not outside, but in customs warehouse. Not in first warehouse (only 1 visible, which would also be used for entire dockside/pier).
    b. Are they being properly inspected and updated with a tag: Yes
    c. Are they clearly visible: Yes

    Other:
        a. 1 extinguisher by the fuel pumps.

7. Fire Response
    a. Is there room for the fire department to maneuver their apparatus? Yes, lots of space for truck access.

        Other:
    A. They have a trained response team / fire brigade.

8. Security
    a. Restrict general public from accessing piers and buildings with rack storage: Yes

        Other:
        A. 2 checkpoints to enter port, second checkpoint being search of vehicle.
        B. 8 foot tall barbed wire fences, armed guards, video monitoring.
        C. ISPS followed.
        D. Member of management stayed with guests at all times and ensured they were wearing proper gear for being at the port.
        E. No pictures allowed within port.
        F. Guests kept from being too close to boats and water.

9. Service Facilities
    a. Upkeep of facility (oil stains on ground): Lots of oil stains on ground at service facilities.

        Other:
        A. No fueling dock, only fueling station for port's property.
        B. Tanks of Freon, nitrogen, oxygen, and acetylene not properly stored (should be in cabinets).
        C. Drains did not have oil-water separators on them (manager told us that this is a project currently and they are working on installing these).
        D. No air-tight storage for used rags.
        E. Oil collection facilities very messy, one container was wide open.
        F. Had Speedy-Dry on hand (sand) for use in case of spills.
        G. Wiring not properly concealed.
        H. Had a few extinguishers but not many near the tanks of gas.

    Other Facilities
    b. Fuel Dock: No fueling dock present. Ships have fuel trucked in. Fueling station for port-owned equipment.
    c. Oil Recycling centers: Collection center only

        Other:
    A. Fueling station for port-owned equipment has 30,000 L and is stored underground.
    B. Only one person has the key to operate the fueling station.
    C. Diesel filters were in good condition.

Site Evaluation: Port of Puntarenas Site 1 (Diving Company)

Date: 11/15/2011
Time: 2:00pm – 2:25pm

1. Usage
    a. How many boats are present? 1
    b. How many people are present? Less than 10
    c. Size of boats: 65 ft long
    d. Types of storage (Wet/Dry/Indoor/Rack): Wet storage

    Other:
    A. Had a floating pier and a fixed pier, floating pier would fit a smaller boat.
    B. A lot of old storage of random items (55 gallon barrels of gasoline and oil, boat parts, random stuff)

2. General Upkeep
    a. Trash cans available and regularly emptied? No
    b. Spills of oil: No
    c. Quality of piers: Pretty good condition, floating dock was not particularly well-maintained but fixed pier was.

Other:
A. Trash sitting on pier, leaking down pier and into water.
B. Lot of trash in water.

3. Water Quality
    a. Trash in the water: Yes, a lot
    b. Oil/chemicals in the water: Not noticeable

    Other:
    A. Sediment did not look good
    B. Water was brown and smelly
4. Signs Present
    a. Quality of Signage: no ‘no smoking’ signs, no emergency exit signs, not really necessary though because it was so small.
    b. Does it inform users of the environmental protection laws? No
    c. Do signs follow format required by NFPA: Not enough signs
    d. Are they present where they are required: No

5. Fire Protection
    a. Are buildings being protected by automatic sprinkler systems where required? No
    b. Are standpipes located in buildings with rack storage: N/A

    Other:
    A. No standpipes present.

6. Fire Extinguishers
    a. Are they present where required by NFPA: No, one missing
    b. Are they being properly inspected and updated with a tag: Yes
    c. Are they clearly visible: Yes, except one was not there

    Other:

A. One only B&C (for piers has to be A, B & C?).
B. Located approximately 50 ft from each other (not including the missing extinguisher)

7. Fire Response
    a. Is there room for the fire department to maneuver their apparatus? Yes

8. Security
    a. Restrict general public from accessing piers and buildings with rack storage: Yes, large gate and fence present

9. Service Facilities: N/A
    a. Upkeep of facility (oil stains on ground): _____

10. Water Supply
    a. Is there a water supply within specified distance of all piers, boats, and buildings? No, no fire hydrants or stand-pipes noticed

11. Other Facilities
    a. Fuel Dock: No
    b. Oil Recycling centers: No

12. Other General Observations

A. No datum plane: water mark visible on wire-box, wire box contained several exposed wires which led to an outlet.
B. Wiring near pipes.
C. Broken light fixtures.

Site Evaluation: Port of Puntarenas Site 2 (Coast Guard dock)

Date: 11/15/2011
Time: 2:30pm – 3:00pm

1. Usage
    a. How many boats are present? About 10
    b. How many people are present? About 40
    c. Size of boats: Ranged from 30ft to 70ft
    d. Types of storage (Wet/Dry/Indoor/Rack): Wet

    Other:
    A. Lots of equipment storage (boat parts, etc)

2. General Upkeep
    a. Trash cans available and regularly emptied? No
    b. Spills of oil: Not noticeable
    c. Quality of piers: Awful, see below

    Other:
    A. Very messy pier, part of pier was destroyed by fire.
    B. Drains from sinks led directly to the water (whatever is washed away is immediately put in water, could be any materials).
    C. Dead fish strewn on pier, trash in many places which appeared old and weathered (probably washing into water).
    D. A lot of random, garbage-like stuff stored on land.
    E. Burned boat from Puntarenas fire still present.

3. Water Quality
    a. Trash in the water: A lot of trash in water
    b. Oil/chemicals in the water: Not noticeable, but chemicals were definitely there considering the sink drain systems (soap, detergent, etc)

    Other:
    A. Water was brown and smelly.

4. Signs Present
    a. Quality of Signage: Poor, if present at all
    b. Does it inform users of the environmental protection laws? No
    c. Do signs follow format required by NFPA: No
    d. Are they present where they are required: No

    Other:
    A. Signs were not present for fire extinguishers, only red and white stripes painted on walls.

5. Fire Protection
    a. Are buildings being protected by automatic sprinkler systems where required? No
    b. Are standpipes located in buildings with rack storage: N/A

    Other:
A. No standpipes present.
B. Had portable pumps to pump seawater.

6. Fire Extinguishers
    a. Are they present where required by NFPA: No
    b. Are they being properly inspected and updated with a tag: No
    c. Are they clearly visible: No

    Other:
A. 4 locations painted where extinguishers should be present (no signs) but the extinguishers were not present.
B. 1 present which should have been re-inspected this past August 2011.
C. Another non-functioning extinguisher.

7. Fire Response
    a. Is there room for the fire department to maneuver their apparatus

    Cannot move one boat independently from others, they were very closely docked and tied together, often blocking each other from being able to exit pier. Difficult to navigate a fire truck to the port and impossible to get hoses from fire truck to piers.

8. Security
    a. Restrict general public from accessing piers and buildings with rack storage: Yes

    Other:
    A. Fenced in and guests regulated by security watch / check-in.

9. Service Facilities
    a. Upkeep of facility (oil stains on ground): Very poor, see general upkeep for comments
10. Water Supply
    a. Is there a water supply within specified distance of all piers, boats, and buildings? No, closest one was across the street through the complex.

11. Other Facilities
    a. Fuel Dock: No
    b. Oil Recycling centers: No

12. Other General Observations
A. Poor lighting, many broken fixtures, a plethora of exposed wiring, overloaded sockets.
B. Malfunctioning equipment (air compressor not functioning).

Site Evaluation: Port of Limón

Date: Nov. 29, 2011

Time: 10:05 AM to 11:20 AM

1. Usage
    a. How many boats are present? 2, capacity is 5
    b. How many people are present? 200
    c. Size of boats: large cargo barges
    d. Types of storage (Wet/Dry/Indoor/Rack): None

2. General Upkeep
    a. Trash cans available and regularly emptied? No trash cans present on docks, some in service area
    b. Spills of oil: Yes
    c. Quality of piers: Decent, some paint splatter

    Other:
    A. Small oil spills in the water along one of the docks.
    B. One warehouse that is not in use due to a fire.
    C. A medium size cargo ship sunk alongside one of the docks.
    D. Some areas have bags full of trash out in the open. Open box of old bottles.

3. Water Quality
    a. Trash in the water: Some near the site of the sunk ship
    b. Oil/chemicals in the water: multiple small oil slicks

    Other:
    A. Second pier, which had boat that sunk next to it, oil stains were present on rocks on shore.
    B. Boom was present about ten feet off shore next to 2nd pier.

4. Signs Present
    a. Quality of Signage: Almost none, did not see a single No Smoking sign
    b. Does it inform users of the environmental protection laws: Nope
    c. Do signs follow format required by NFPA: Nope
    d. Are they present where they are required: Nope

    Other:
    A. There were no “no smoking” signs in the entire complex.
    B. Only visible signage in the entire complex was a “Restricted Access” sign near the explosive or hazardous materials cargo area.

5. Fire Protection
    a. Are buildings being protected by automatic sprinkler systems where required: Nope
    b. Are standpipes located in buildings with rack storage: N/D

    Other:
    A. There were no standpipes in any of the buildings.

6. Fire Extinguishers
    a. Are they present where required by NFPA: No
    b. Are they being properly inspected and updated with a tag: Yes
    c. Are they clearly visible: Sometimes, two in service area where hidden behind desk in office.

    Other:
    A. The only fire extinguishers in the complex were located in the service facility.
    B. The extinguishers were mostly qualified for B and C type fires, with only one qualified for A, B, and C type fires.
    C. There were no fire extinguishers located near any of the docks or near the hazardous cargo storage area.

7. Fire Response
    a. Is there room for the fire department to maneuver their apparatus
    Yes, there was plenty of room for the cargo trucks and equipment to move through the entire facility, indicating that there was more than enough room to fit a fire truck or other fire department equipment. Former fire in warehouse was extinguished by department quickly they mentioned. Bomberos station right around the corner from the port.

8. Security
    a. Restrict general public from accessing piers and buildings with rack storage: Yes
    Other: The entire complex was restricted for non-qualified personnel. The docks are restricted to access to anyone except for workers when ships are present at the port. There was a security checkpoint at the entrance and exit to the facility, license plate number recorded at entrance and outgoing cargo inspected at exit. The entire complex was fenced in. ID's were required to access certain areas.

9. Service Facilities
    a. Upkeep of facility (oil stains on ground): Very minor in service facility. None in the docks area.
    Other:
    A. Very minor stains in the service facility, but the management ensure that the building is cleaned regularly.
    B. No oily rag or combustible material bins present.
    C. Gas cylinders not in use were being stored in cages

10. Water Supply
    a. Is there a water supply within specified distance of all piers, boats, and buildings
    Yes, fire hydrants are interspersed along piers within regulations. The other two piers had standpipe connections under metal plates (to protect them from trucks and heavy equipment). Three total methods of supply, ocean fed pipes on two of the lesser used piers. 4-inch standpipe every 30 or so meters on main pier. On the far side of the complex fire hydrants were present every 50 to 60 meters.

11. Other Facilities
    a. Fuel Dock: None
    b. Pump Out Station: None
    c. Oil Recycling centers: Yes, all catch basins around (not fully around) fuel pump and storage tanks fed to an oil-water separator, 3 step separator

    Other:
    A. The fuel pumps for equipment were restricted; only one manager was allowed access.
    B. The pumps had an oil-water separator in case of spillage.
    C. There were no fire extinguishers or any hydrants by the pumps.
    D. The pumps were piped to two underground storage tanks.
    E. Storage tanks each had a capacity of 15,000 liters and both stored diesel.
    F. Management stated smoking and cell phones were not allowed in fueling area but no signs present telling people this.

12. Other General Observations
    A. Bulk dry cargo is not stored in the port, it is immediately moved out by trucks.
    B. A warehouse on site had a fire 2 years ago from a trash can fire and now tires and large cardboard cylinders blocked its entry. Fire damage could be seen from the outside.
    C. Another small fire occurred a few years ago on a cargo ship that was quickly extinguished. Jacinto said they had investigated it when it happened.
    D. Had a separate yard for hazardous or dangerous materials that had a fence and barbed wire around it.

Appendix B: Marina/ Port Management Survey

NOTICE:

Buenos días. Somos estudiantes del Instituto Politécnico de Worcester (WPI), Massachusetts en Los Estados Unidos. Estamos trabajando con El Cuerpo de Bomberos de Costa Rica para asegurar la seguridad en puertos y marinas en el país. La información que recogemos con esta encuesta estará publicada en un reporte y compartida con los Bomberos, pero las encuestas son confidenciales y las identificaciones de las personas quienes hacen la encuesta no estarán pedidas ni compartidas. Esta información solamente estará vista por los estudiantes de WPI, y no estará vista por los Bomberos. Además, No colectaremos la información relatada a su bote, incluyendo su nombre y locación. Por esta razón, manteneremos su anonimato y el anonimato del puerto. Todas las respuestas se considerarán confidenciales y se recogerán así. Usted no tiene que responder a todas las preguntas, pero las respuestas vayan a ayudarnos mucho en nuestro proyecto.

Good day. We are students from Worcester Polytechnic Institute (WPI), Massachusetts in the United States. We are working with the Costa Rican Fire Department to ensure safety in ports and marinas in the country. The information that we gather with this survey will be published in a report and shared with the Fire Department, but the surveys are confidential and the identities of the people who take them will not be asked for or shared. This information will only be seen by the WPI students, and will not be seen by the Bomberos. In addition, information related to your marina or port, including its name and location, will not be recorded. Since this information is not recorded, your identity will remain confidential. All answers are considered confidential and will be collected this way. You are not required to respond to all of the questions, but your answers will help us very much in completing our project.

1. [¿Cual es su puesto en este empresa?] What is your position on the Marina Staff?
   _____
2. [¿Cuantas botes puedan quedar aquí?]How many boats does your marina hold?_____
3. [¿Tiene bombas?] Do you have fueling capabilities?
   a. [Si] Yes
   b. [No] No
4. [¿Como guarda su combustible?] How do you store your fuel?
   a. [Tanques encima de la tierra] Above Ground Tanks
   b. [Tanques debajo de la tierra] Below Ground Tanks
   c. [Otros] Other _____

5. [¿Tiene un taller de botes aquí?] Do you have a service facility to work on your customer's boats?
    a. [Si] Yes
    b. [No] No
6. [¿Tiene un cubo de basura de aceite usado y otros químicos para el público y sus obreros?] Do you have facilities to dispose of waste oil and other chemicals for use by the marina staff and your customers?
    a. [Si] Yes
    b. [No] No
7. [¿Habia algunos incidentos en su Puerto/marina? Por favor marcar todos que applicar]] Have you ever had any incidents in your marina? Please check all that apply
    a. [Incendios de botes] Boat Fires
    b. [Incendios de los edificios?]Facility Fires
    c. [Derrame de quimicos?] Chemical Spills
    d. [Otros] Other _____
8. [Si contestaría si a la pregunta pasada, ¿escribiría sobre el incidente?] If you answered Yes to the last question please elaborate on the incidents and be specific

_____

_____

9. [¿Tiene capacition para responder a derrames de materiales peligrosas como aceite o gasolina?] Do you have training to respond to Hazardous Materials Spills like oil, or gas?
    a. [Si] Yes
    b. [No] No
10. [Si contestaría si a la pregunta pasada, ¿que incluye su capacitión?] If you responded Yes to the last question what did your training entail?

_____

_____

11. [¿Como responder el Puerto/marina si ocurra un derrame de materiales peligrosas?] How does the Marina respond in the event of a Hazardous Material Spill?

_____

_____

12. [¿Hay inspecciones seguridades de los equipos de su puerto/la marina?] Do you conduct safety inspections of your equipment?
    a. [Si] Yes
    b. [No] No
13. [Si contestaría si a la pregunta pasada, ¿que incluye las inspecciónes de equipos?] If you answered Yes to the last question what do your inspections entail?

    _____

    _____

    _____

14. [¿Hay inspecciones seguridades de los botes en su puerto/marina?] Do you conduct safety inspections of the boats in your marina?
    a. [Si] Yes
    b. [No] No
15. [Si contestaría si a la pregunta pasada, ¿que incluye las inspecciónes de botes?] If you answered Yes to the last question what do your inspections entail?

    _____
    _____
    _____

[¿Hay otras experiencas con este marina o otros marinas que quiere compatir con nosotros? Recuerde que sus respuestas son totalamente anonimos.] Is there anything else about your experiences with this marina that you would like to share with us? Please remember your answers will never be associated with your name.

_____
_____
_____
_____
_____

[Gracias para su parcipitacion, nosotros la apreciamos mucho] Thank you for participating in our survey, we appreciate your input.

Appendix C: Bomberos Interview Questions

1. [¿Cuál es su puesto en esta estación?] What is your Position at the Station?

_____
_____
_____

2. [¿Cuantos incídenos tiene cada mes?] On average, how many calls do you respond to per month? _____
3. [¿Cuantos incidentes cada mes esta en puertos/marinas?] How many of these calls involve responding to marinas/ports? _____
4. [¿Tiene capacition para responder a derrames de materiales peligrosas?]Are you trained to respond to hazardous material spills?
    a. [Si] Yes
    b. [No] No
5. [Si contestaría si a la pregunta pasada, ¿escribiría sobre su capitación?] If so, can you elaborate on your level of training?

_____
_____
_____

6. [¿Cuantos incidentes de materiales peligrosas responden cada año que están en puertos/marinas?] About how many hazardous material spills calls do you respond to a year?_____
7. [¿Tiene algunos equipos para responder a incidentes de materiales peligrosas?]Are the apparatus in your station equipped to respond to hazardous material spills?
    a. [Si] Yes
    b. [No] No
8. [¿Cuantos incidentes cada año esta en puertos/marinas?] Which kinds of incidents occur at marinas most often?
    a. [Incendios de edificios] Building fires
    b. [Incendios de botes] Boat fires
    c. [Derrames de materiales peligrosas] Hazardous material spills
    d. [Emergencias de Salud] Medical calls
    e. [Otros]
    Other:_____
    _____
    _____
9. [¿Escribiría sobre algunos incidentes grandes en puertos/marinas que puede recordar?] Can you describe any big incidents that occurred at a marina or port which you can remember?

_____
_____
_____

10. [¿Cómo reacciona los manejos de puertos/marinas a derrames de materiales peligrosas?] How well does the marina management react to spills?
    a. [Informa los bomberos del incidentes y se ayuda con obras y da informacion sobre el puerto/marina] Report the incident and actively help manage the emergency
    a. [Informa los bomberos del incidentes y solamente da informacion sobre el Puerto/marina] Report the incident and actively help to give you information
    b. [Informa los bomberos del incidentes y no se ayuda] Report the incident and then leave it up to you
    c. [No informa los bomberos del incidentes] Don't report the incident at all
    d. [Otros]Other:_____
    _____
    _____
    _____

11. [¿Como crees que los manejos de puertos/marinas deben responder a incidentes en sus puertos/marinas? ¿Hay un protocol que los deben seguir?] How is marina/port management supposed to respond to / address incidents? Is there a specific protocol they are supposed to follow?

_____
_____
_____
_____

12. [¿Tiene sugerencias para cambiar este protocolo?] Do you have any suggestions for changing this protocol?

_____
_____
_____
_____

13. [¿Escribiría sobre experiencias (malos o buenos) con los manejos de puertos/marinas?] Can you elaborate on any outstanding (good or bad) experiences with marina management that you have had?

_____
_____
_____

14. [¿Es viable a inspectir todos los puertos y marinas cada año?]Would it be feasible to perform annual inspections on all marinas and ports in the Bomberos jurisdiction?
    a. [Si] Yes
    b. [No] No
    c. [No esta seguro] Unsure

15. [¿Puede los bomberos dar castigos a puertos y marinas si no los pasa un inspeccion?] Are the Bomberos able to pass penalties onto ports and marinas if they fail inspection?
    d. [Si] Yes
    e. [No] No
    f. [No esta seguro] Unsure

Appendix D: Response to Hazardous Materials Spills

The typical procedure to handle hazardous materials spills is to first secure the area of the spill, called "the hot zone," as well as the area downwind of the spilled chemicals so that no victims will be exposed to the harmful vapors. While responders are securing the area, it is also important to identify the material to evaluate the dangers it may pose. An important resource to responders in the United States is the Emergency Response Guidebook, which lists all known hazardous materials and response guidelines in the event of a spill (Firefighter's Handbook, 2004, 807).

An important aspect of hazardous materials response is protecting the responders who must physically interact with the spilled material. There are different levels of personal protective equipment (PPE) that can be worn, ranging from coveralls, to fully enclosed suits with a self-contained breathing apparatus (SCBA). If anyone comes into contact with the hazardous materials, they must go through a decontamination process in order to ensure that they do not bring the hazardous materials into a clean area. In order to remove chemicals from clothing, responders set up specialized showers that contain the contaminated water, preventing it from running off into the environment. They can then bring the water to a treatment facility to remove the dangerous chemicals (Chandler, 2010).

Cleaning up hazardous materials involves containing the material to limit spread such that any environmental damage is confined to a limited space, and then treating the affected area to remove the material. Containing the hazardous materials is effective for smaller spills. For high volume spills, such as an oil tanker spill of millions of gallons, different methods are used. There are many different commercial products available as well as materials on hand that can be used for containment. For example, a dike made of dirt can be used to keep liquid on land from spreading farther. If the material is on the water it can be more difficult to control (Firefighter's Handbook, 2004). One way to address this situation is to use a boom, which is a long chain of floatation devices that contain the oils within a barrier (see Figure 1). As long as the material stays on the surface and the water conditions are calm, the boom will keep oil within a limited area. For use in Costa Rican marinas and ports, a fence boom is probably most appropriate as it is inexpensive and works relatively well as long as water and weather conditions are calm (Fingas, 2000, 75). If the water conditions around the marinas or ports are rougher, it might be more appropriate to invest in curtain booms, which are designed to prevent leakage due to larger waves (Fingas, 2000, 75). Booms are often used to funnel floating hazardous materials into a recovery device such as a skimmer or sorbent pad to help in recovering the materials.

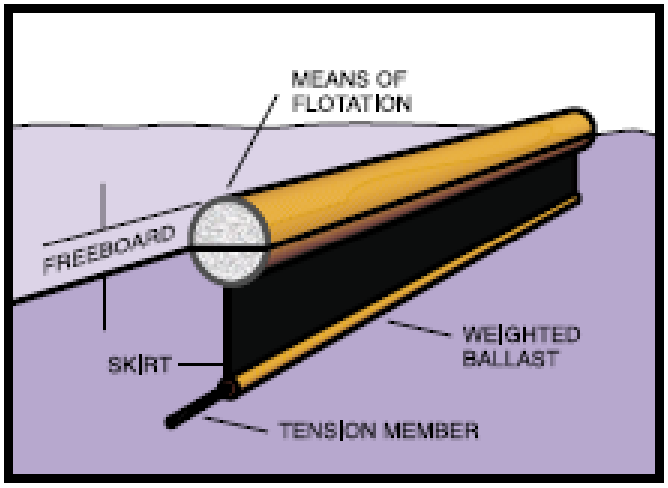

Figure 1: Containment Boom Diagram

Once the material has been contained it has to be recovered. "Vacuum techniques," otherwise known as vacuum skimmers, pick up materials when they gather in high concentrations (Ghannam, 2003). Salt water helps this process as the salt increases the buoyancy of the oil, making an oil vacuum much more cost effective in salt water marinas (Ghannam, 2003). The vacuum skimmer is the most economic of all skimmers. Oil skimmers are often deployed in conjunction with a series of booms to funnel the oil and scoop it off the surface (Petrucci, 2007). There are a number of types of non-vacuum skimmers, each with different advantages and disadvantages. A drum skimmer is a good choice for smaller marinas as it works well with fuels and is small enough that it does not require specialized equipment to run (Fingas, 2000, 92). A weir skimmer is another good choice for marina conditions as it picks up fuels easily and works well in calmer waters (Fingas, 2000, 95).

Another method of gathering hazardous materials is using a sorbent boom to sponge up oil. Sorbent booms are essentially the same as normal booms in that they contain the oil within a confined space, but they also soak up the oil for removal (Fingas, 2000, 85). Sorbent materials can also be used in non-boom form and spread across the spill to absorb the oil. Examples of sorbents include polypropylene, volcanic ash, and straw (Bayat, 2005). All of these materials are hydrophobic so that they do not absorb water and only absorb the hydrocarbons present. Sorbents could be one of the more practical removal options to have stored at marinas because they work well on smaller spills of hazardous materials which are likely in recreational marinas. Once a sorbent has absorbed a large amount of oil, it may leak, requiring careful handling in order to minimize the amount of oil that is released (Fingas, 2000, 103). The use of sorbents can cause problems during cleanup if too much sorbent is used or if the spill is very large, as some sorbents are tedious to recover (Fingas, 2000, 105).

An alternative way of dealing with an oil or fuel spill is to use dispersants, though they do not work with other types of hazardous materials. Dispersants work by changing the properties of the oil or fuel that they are applied to, allowing water to mix with the oil or fuel and dissolve it. This greatly reduces the concentration of the substance and allows it to be more easily degraded by microorganisms (Lessard, 2000). Dispersants can be controversial as they can, in fact, contribute additional environmental damage if not used appropriately. Therefore, the toxicity of the dispersants should be assessed based on the concentration and type of dispersants used, in order to avoid such additional damage (Fuller, 2004). This directly addresses a specific

goal of the Bomberos, which is to determine environmentally safe ways to clean up hazardous spills.

The most feasible options for cleaning up hazardous materials that have reached the shoreline are to either rely on microorganisms to break down the materials or to use chemicals to wash the materials out. Relying on microorganisms to decay the materials is a lengthy process that can be expedited using "fertilizers" that nourish the growth of microbiota (Xu, 2005). Surfactants can be used to wash sand clean of oil, though the possibility of toxic byproducts being present in industrial surfactants is high. Research is being done into biosurfactants, which involve attempts to manufacture surfactants without any toxicity (Urum, 2006). If a spill is small enough, it might also be feasible to dig out the contaminated sand and put it into storage to prepare it for treatment.

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Appendix E: Marina Response Plan

The Seattle Fire Department created a pamphlet for marinas that included good examples of a marina emergency response plan as well as guidelines, for boaters, of fire prevention. The pamphlet includes many recommendations that are requirements put forth by the NFPA.

Marina Emergency Response Plan

It is important to take the time to prepare for a fire emergency. An emergency response plan should outline the responsibilities of staff and boat owners have in responding to the risk of fire. Establish a safety committee to develop an emergency plan that outlines the actions staff should follow in the event of a fire and the training guidelines needed to maintain their readiness. The following list includes many of the elements that should be included in your plan:

1. Call 911 to report the emergency.
2. Evacuate boaters and guests.
3. Shut off all electrical power to the fire area.
4. Shut down the fuel dock.
5. Move adjacent boats away from the fire area but do not untie burning boats to drift away.
6. Move any vehicles that may obstruct firefighting operations.
7. Assign personnel to direct incoming emergency responders to the right location and remain available as an information resource.
8. Work with Fire Department personnel during the development of your plan. Firefighters can assist you with procedural decisions and you can help them by providing pre-fire information particular to your marina.
9. Train staff to make decisions based on the plan. Training should include how to report a fire, conduct an evacuation, and extinguish a fire using on-site firefighting equipment as applicable. If you expect staff to use equipment, you need to provide the training to safely and properly use each piece.
10. Schedule drills for marina employees at least twice a year. Drills allow employees the opportunity to test and practice the marina emergency response plan. Drills also provide an opportunity to update and change the plan as needed. No matter how detailed or basic, the plan should be written down and updated regularly. (Seattle Fire Department, 2010)

Appendix F: Port Response Plan

Sample Port Emergency Response Plan

It is important to take the time to prepare for emergencies that may occur in ports. An emergency response plan should outline the responsibilities of staff and boat owners have in responding to the risk of fire. Establish a safety committee to develop an emergency plan that outlines the actions staff should follow in the event of a fire or other incident and the training guidelines needed to maintain their readiness. The following list includes many of the elements that should be included in your plan:

1. Immediately call an onsite Fire Brigade or 911 to report the emergency.
2. Evacuate dock workers and equipment that may obstruct fire department apparatus
3. Shut off all electrical power to the fire area.
4. Shut down the fuel dock.
5. Move adjacent boats away from the fire area but do not untie burning boats to drift away.
6. Assign personnel to direct incoming emergency responders to the right location and remain available as an information resource, in addition, have information about what kinds of materials are being stored in the port at that time. Another good resource is a map of the facility outlining fire hydrants and other suppression equipment, as well as evacuation routes, and other important considerations for the fire department
7. If cargo is on fire or exposed to flame, use placards and the Emergency Response Guidebook to establish a safe perimeter.
8. If material is spilled in water, have floating booms ready to be deployed to contain the spill.
9. Work with Fire Department personnel during the development of your plan. Firefighters can assist you with procedural decisions and you can help them by providing pre-fire information particular to your port.
10. Train workers to make decisions based on the plan. Training should include how to report a fire, conduct an evacuation, and extinguish a fire using on-site firefighting equipment as applicable. If you expect workers to use equipment, you need to provide the training to safely and properly use each piece.
11. Schedule drills (small, medium, and large incidents) for port employees at least twice a year. Drills allow employees the opportunity to test and practice the emergency response plan. Drills also provide an opportunity to update and change the plan as needed. No matter how detailed or basic, the plan should be written down and updated regularly and detailed training records should be kept. (adapted from Seattle Fire Department, 2011 and Environmental Protection Agency, 2011)

Appendix G: Fire Prevention Guidelines

One of the Costa Rican firefighters that we interviewed thought it would be valuable to educate the boaters on fire safety within the marina. These fire prevention guidelines created by the Seattle Fire Department give some good examples of items marina management can provide to educate boaters.

Boater Fire Prevention Guidelines

1. Develop an addendum to the leasing contract that clearly spells out the marina fire prevention procedures for each boat owner.
2. Review the insurance policies for both the marina and boat owners. Audit your files regularly to ensure that these insurance certificates have not lapsed.
3. Post evacuation diagrams in public areas for tenants and guests.
4. Keep public areas clean—docks, parking lots, landscaping, offices, etc.
5. Institute an electrical inspection program to ensure that all shore power cordsets are marine grade, in good condition and that all permanent electrical fixtures are maintained in prime working condition. Educate boat owners so they can recognize faulty or dangerous electrical equipment.
6. Contact owners of boats that see little use or are rarely at the marina to check on them. Neglect breeds fire.
7. Conduct special training sessions for boaters prior to the start of boating season to remind them of fueling procedures and at the end of the boating season to discuss safe winterizing.
8. Take control. Enforce the fire safety procedures you have developed. (Seattle Fire Department, 2011)

Appendix H: Instructions for Updating the Excel Workbook

How to update the Inspection Protocol

We recommend that at least one member of the Bomberos team become familiar with Excel, such that they only need loose instructions in order to make changes, additions and updates to the documents.

The Bomberos should ensure that the inspection protocol documents have macros enabled.

If the Bomberos encounter any programming errors or issues that these instructions do not cover, they should consult a knowledgeable Excel programmer, which may be done using an Excel forum online.

Make changes to a question or update it

Making changes or updating questions will have no effect on the programming of the workbook. Simply click on the cell you want to update, and change the question. Do not change any other cells than the one with the question you are updating.

Add questions to an area of inspection

To add questions to a particular sheet, follow these steps:

1. Find the location (the row) where the new question best fits in regards to the topics on the sheet.
2. Right click on the row number that corresponds with the row you want to be below the new question.
3. Select “Insert”.
4. Now, click on the column letter D and drag to F.
5. Right click on the selection and select “unhide”
6. Now select the row number of a close row that has a question and an answer drop-down menu.
7. Copy the entire row (ctrl+C or right click and select “copy”)
8. Paste the row into the empty row you just created.
9. Right click on the drop down menu that you just inserted.
10. Select “Format Control”.

11. You will see the "Cell link:" option. Click on the square button to the right of the "Cell link:" value.
12. Now, click on the cell in the E column which is in the same row as the new question.
13. Press "Enter" twice.
14. Now, enter the new question in the B column, where the copied question is.
15. Right click on the E column and select "Hide".

In order for the spreadsheet to function correctly, it is VERY IMPORTANT that you follow these steps exactly, especially in regards to steps 9 through 13.

Add an area of inspection

To add a new area of inspection (an entirely new sheet), follow these instructions:

1. First, create a simple excel document separate from the inspection protocol with all of the questions that belong in the new sheet. You only need to have the questions written out in this document, so information should only be in one column.
2. Now, count the number of questions that apply to the new area of inspection.
3. In the Inspection Protocol document, find a sheet with a similar number of questions. Do not include the "Instalaciones," "Administración y Documentación," "Muelles," or "Edificios" sheet when choosing.
4. Right click on that sheet's title, which is a tab at the bottom of excel. (For example, it may say "Instalaciones")
5. Select "Move or Copy..."
6. Choose the inspection sheet you would like the new sheet to be in front of. It should not be in front of the Finale, Contenidos, or Empieza pages.
7. Click the box next to the words "Create a copy"
8. Click "OK"
9. Double click on the tab of the new sheet. Enter the name of this area of inspection.
10. Change the questions by pasting those you created in a separate document, into the appropriate column in the new sheet (Column B). Follow the directions for "Add questions to an area of inspection" to complete this step. Do not do step 15 as you will need Column E unhidden until later.
11. If you have extra rows of questions that you do not need, select the row numbers. Right click on the row number and select "Cut." Paste these rows into a blank Excel document. You can close this new Excel document without saving.

To insert the new area of inspection to the Contents page:

12. Return to the contents page by clicking on the Bomberos logo on the new sheet.
13. Right click on the row which corresponds to the area of inspection that is now after the new sheet. Select "Insert"
14. In the new row, right click on the cell under the "Area of Inspections" title.
15. Select "Hyperlink"
16. On the left of the box that opens, select "Place in This Document"
17. Then, select the new sheet's name and click "OK"
18. In the cell, delete the apostrophes and other punctuation such that the link is formatted similarly as the others.

19. In the new row, click on the cell under the “Status” title.
20. Type
    ='Sheet Name'!C2
    Where Sheet Name is the name of the new sheet you created.
21. Click on a cell in a different row under the “Status” title.
22. Find the “Format Painter” button in your version of excel, and click on it.
23. Click on the “Status” cell in the new row. This should change the cell to either green or red.
24. What is the number of the new row? Write this number down. Here, we will call it ##.

If the page might be “Not Applicable”, follow these steps to create the “Not Applicable” option. Otherwise, skip to step 34:

25. Select column H and drag to column J. Right click, and select “Unhide”
26. From the “N/A?” column, copy a drop-down menu. Paste it into the new row that applies to the new area of inspection.
27. Right click on the drop down-menu and select “Format Control”
28. You will see the “Cell link:” option. Click on the square button to the right of the “Cell link:” value.
29. Now, click on the cell in the I column which is in the same row as the new area of inspection (row ##).
30. Press “Enter” twice.
31. Go to the new sheet. Click on cell B5. It should read something like:
    =NoAplicable(Contenidos!I9)
32. Rewrite this formula so that it reads:
    =NoAplicable(Contenidos!##)
    Using the row number you wrote down in step 24.
33. Press enter.

To update the Status cell at the top of the new sheet:

34. Go to the new sheet.
35. Click on the Status. It will say something like:
    =Estado(E7:E69,Contenidos!I6)
36. Delete the letter and number which corresponds to E69.
37. Scroll down the page to the last question of the new sheet. Click on the cell in the E column of that last question.
38. Press enter.