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Evaluating Feasibility of APELL in Santo Domingo, Costa Rica

Jeffrey Scott Rosen
Worcester Polytechnic Institute

Jennifer Victoria Kamara
Worcester Polytechnic Institute

Nell Elizabeth Finigan
Worcester Polytechnic Institute

Sarah Phyllis Mattessich
Worcester Polytechnic Institute

AWARENESS AND PREPAREDNESS FOR EMERGENCIES AT LOCAL LEVEL:

A FEASIBILITY STUDY IN SANTO DOMINGO, COSTA RICA

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Submitted to:
Professor Jennifer Rudolph
Professor Stanley Selkow

In Cooperation With
Sr. Carlos Perera, Director Ejecutivo
Sra. Akira Hidalgo, Ingeniero Ingeniería Química
Centro Nacional de Producción Más Limpia

Jennifer Kamara _____

Sarah Mattessich _____

Nell Nassiff _____

Jeffrey Rosen _____

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Professor Jennifer Rudolph

_____
Professor Stanley Selkow

AUTHORSHIP PAGE

As confirmed by the signatures below, every section of this report is comprised of the collaborative effort of Jennifer Kamara, Sarah Mattessich, Nell Nassiff and Jeffrey Rosen. All four students have actively and equally participated in the creation, development, and proofreading of each section.

Jennifer Kamara _____

Sarah Mattessich _____

Nell Nassiff _____

Jeffrey Rosen _____

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Sincerely,
Jennifer Kamara, Sarah Mattessich, Nell Nassiff and Jeffrey Rosen

ABSTRACT

This study, prepared for El Centro Nacional de Producción Más Limpia, assesses the feasibility of APELL (Awareness and Preparedness for Emergencies at Local Level) in Santo Domingo, Costa Rica. The objective is to organize local authorities, industries, and community to develop a cooperative emergency response protocol to mitigate dangers of technological emergencies. After conducting interviews to identify risks and resources in the canton and an informational forum to promote stakeholder interest, we concluded that APELL is feasible in Santo Domingo.

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EXECUTIVE SUMMARY

As a rapidly developing country, Costa Rica houses many technological industries that further its industrial growth. However, the usage of hazardous materials that accompanies economic growth is a pressing concern for many Costa Ricans. An additional threat exists for communities through which hazardous material is transported. Currently there is no cooperative protocol designed to respond to emergency situations. This is not only dangerous for the industries using hazardous chemicals, but it also puts at risk the surrounding communities and environments. There is an urgent need to alleviate this danger in Costa Rica.

The National Cleaner Production Center of Costa Rica (CNP+L) is a non-profit organization that aims to implement such a preventative measure in Costa Rica. CNP+L suggested a solution called Awareness and Preparedness for Emergencies at a Local Level (APELL) which was developed by the United Nations Environmental Programme (UNEP). APELL was created to minimize the harmful impact of technological emergencies, such as chemical spills, mining accidents, and fires. The program has been implemented in over 30 countries and can serve to reduce the impacts of technological emergencies in Costa Rica by establishing a communicative approach for immediate emergency response at the local level.

As APELL operates on a local rather than national level, CNP+L decided to focus a pilot study for this program in the canton of Santo Domingo de Heredia, which is seven kilometers northeast of San José. Santo Domingo provides the optimal environment for such a study, as it is vulnerable to chemical disasters due to the industries and gas stations located within its boundaries as well as the substantial amounts of chemicals that are transported through it. It also has representation from local authorities, industries, and the community, the three stakeholders whose participation in the APELL program is crucial for its success.

Our team contributed to CNP+L's efforts by raising awareness of the program and assessing the feasibility of its implementation in Santo Domingo. In order to accurately gauge the feasibility of implementing APELL in Santo Domingo, we needed to assess the current response to emergencies in the canton and generate stakeholder interest in the program. To recognize current technological hazards present in the canton as well as the existing emergency response protocols, our team organized meetings and focus groups with several members of the local authorities, industries, and the community. We met with the Bomberos (firefighters) of Santo Domingo, the Domingan Association for Environmental Management (ADOGA), representatives from 3M, the Ministry of Health, the Ministry of Environment, Energy, and Telecommunications (MINAET), and a well-known chemist to identify the outstanding hazards present in Santo Domingo and throughout Costa Rica.

At these meetings, we emphasized stakeholder participation and fostered the interest of local authorities in the program. Our greatest challenge was gaining industrial interest. In order to accomplish this, we contacted the Chemical Advisors for major industries in Santo Domingo, who are the government-assigned advisors from the College of Chemicals that oversee the purchasing, transporting, and safe-handling of chemicals for every industry. UNEP suggests that generating community interest in APELL should be one of the last steps of implementing the program due to the risk of creating panic in informing them about the potential for technological disasters; therefore, we did not approach this aspect of the program.

As a capstone effort to raise awareness, we invited influential stakeholders to a final forum, in order to reiterate the goals of APELL and stress the benefits of the program in Santo Domingo. We obtained feedback from attending stakeholders at a question and answer session following the presentation. At the end of the forum, we distributed an informational pamphlet that we created, along with a survey to gauge stakeholder interest in the program

Through meetings and interviews with members of the local authorities and focus groups, we identified the current status of technological emergency response in Costa Rica. We established that the major hazards present in Santo Domingo include the unmonitored transportation of hazardous materials, gas stations that are vulnerable to explosions, a polyduct which runs through the southern half of the canton, and the potential contamination of the canton's main water source, an underground aquifer. We discovered that many emergency protocols are already in place and that they are incorporated within the local authorities and industries. However even though industries are required to submit protocols to the Ministry of Health, they are often reluctant to cooperate. We also discovered that in the event of a technological disaster, the police force and community are often the first to arrive at the site. Since both the police and community are untrained in recognizing and reacting to these disasters, this exposes them to the dangers of the hazardous materials involved. We identified the strong need for APELL to enhance collaboration between municipal and industrial emergency responses, educate the officials who are untrained in chemical disaster response, and inform the community about the risks associated with technological disasters.

Voluntary stakeholder participation in APELL is critical to its success in Santo Domingo. In order for us to evaluate stakeholder participation, we created and distributed a survey at the final forum. The survey was geared towards determining the willingness of the stakeholders that attended to approve and partake in the establishment of APELL. The results showed that 100% of attendees were interested in the program and willing to participate in its implementation in Santo Domingo. At the end of the workshop, the mayor of Santo Domingo commented that the canton will begin implementing the APELL program next year. By identifying affirmative stakeholder participation, we were able to establish the feasibility of implementing the APELL program in Santo Domingo.

By analyzing the discussion at the final forum and the results of the survey, we identified concerns about APELL and made several recommendations to enhance the success of the program.

One of the most important aspects of APELL that we stressed was the development of the Coordinating Group. This group consists of members of each of the three stakeholders and who are responsible for the activities of APELL in Santo Domingo. We recommended the different parties who should be represented in the initial Coordinating Group in Santo Domingo as well as preliminary goals for the group to accomplish. We recommended ten tasks for the Coordinating Group, including the creation of a database of chemical accidents, first responder training programs, and programs to increase community awareness of APELL. Furthermore, to decrease the hazards associated with the unmonitored transportation of chemical waste, we recommended the definition of permissible routes and times for chemical transport through Santo Domingo. Defining routes and times will significantly improve the preparedness of emergency responders for handling accidents in transit.

Overall Santo Domingo will benefit greatly from the successful implementation of APELL by developing a coordinated emergency response system that will ensure the safety of its residents and the surrounding environment. The successful implementation of APELL can serve as a model for other communities in Costa Rica at risk of technological disasters. By embracing APELL and implementing the program in its communities, Costa Rica will be the first Central American country to join the ranks of the 30 countries that have successfully implemented this UNEP program. Not only will this accomplishment mitigate the destructive impact of emergencies throughout the nation, but also it will establish Costa Rica as a model for Central American countries seeking to protect their citizens and environment from technological disasters.

CHAPTER 1: INTRODUCTION

Technological disasters are unpredictable and devastating. Without an appropriate and immediate response, the well-being of the victimized public and environment are put at great risk. The most effective method to ensure safety and mitigate damages requires immediate response to the disaster, fortified by the collaboration of the surrounding people and the availability of valuable resources. The formation of a cooperative response protocol is the most essential preventative measure that can be taken to alleviate the destructive impact of these emergencies.

As a rapidly developing country, Costa Rica houses many technological industries that further its industrial growth and independence. However, the handling of toxic chemical waste at such industries is a pressing concern for many Costa Ricans. An additional threat exists for communities through which hazardous material is transported. Currently there is no cooperative protocol designed to respond to emergency situations. Not only is this dangerous for the industries at which these chemicals are used, but also for the surrounding communities and environments that are at risk during an emergency. There is an urgent need to alleviate this danger in Costa Rica.

Although there are protocols used by Costa Rican industries, local authorities, and communities for responding to disasters, these groups' efforts are not coordinated. The adverse effects of this gap in collaboration are witnessed in numerous past technological accidents in Costa Rica. During one such incident, the lack of immediate response to a fire in a resin factory in Alajuela allowed chemical waste to flow into nearby rivers (Tico Times, 2007). Therefore, a dynamic solution is needed to reduce the risks of technological emergencies by implementing a communicative approach for immediate emergency response at the local level.

The non-governmental organization the National Cleaner Production Center (CNP+L) aims to create such a preventative measure for Costa Rica. CNP+L was established in Costa Rica in 1998 "with the aim of building capacity at [the] national level about cleaner production, pollution

prevention and eco-efficiency". This organization was created by the United Nations Environmental Programme (UNEP) and by the Chamber of Industries of Costa Rica with the mission of "promoting the interests and needs of its members, [enhancing] their competitiveness and [contributing] proactively to the sustainable development of the industrial sector" (Cámara de Industrias de Costa Rica, 2010). CNP+L has been involved in the regulation and implementation of better waste management and the awareness of handling hazardous materials. The organization has also participated in the awareness of industrial social responsibility, which is "the principle that companies should contribute to the welfare of society and not be solely devoted to maximizing profits" (Investopedia Inc., p. 1).

CNP+L suggested a solution to reduce the risks of technological emergencies in Costa Rica by implementing a communicative approach for immediate emergency response at the local level. This plan, which will serve to mitigate severe damages to the community and environment, will be implemented using a program called Awareness and Preparedness for Emergencies at Local Level (APELL). APELL was created by UNEP in 1986. The program was organized to advance preventative standards for developing countries that were suffering from various industrial accidents. The program was created to be flexible yet effective, so that it can successfully address various types of technological emergencies, such as chemical spills, mining accidents, and fires. Its accomplishments in more than 30 countries have made it an appealing choice of programs for CNP+L.

An effective method to introduce APELL in Costa Rica is to implement the program in a pilot city. The canton of Santo Domingo provides the optimal environment for such a study, as it is vulnerable to chemical disasters due to the industries and gas stations located within its boundaries as well as the substantial amounts of chemicals that are transported through the canton. Santo

Domingo also contains a dynamic municipality, which regularly promotes programs to better the community.

In order to initiate the APELL program in Santo Domingo, our team conducted a feasibility study of the development of a local standardized emergency response protocol. During this study our team aimed to work with CNP+L to raise awareness of the safety and concern for the risks in Santo Domingo and to encourage communication between the community, the industries, and the local authorities.

To address the lack of standardized response in Santo Domingo, our team initially focused on promoting the goals of APELL to several significant community, local authority, and industry members. We raised awareness of the importance of a centralized emergency protocol by conducting multiple meetings and interviews to emphasize the significance of APELL and the necessity for cooperative efforts. Our team promoted APELL at the local level by communicating with local community organizations, such as the Domingan Association for Environmental Management (ADOGA). We met with members of the Bomberos, the fire department, to learn about existing protocols in the canton and also interviewed members of the Ministry of Health to understand the existing industrial emergency response protocols. We obtained an industrial perspective of the emergency response situation in Santo Domingo from a meeting with the company 3M and benefited from their suggestions on how best to incorporate APELL in the canton. Interaction with the different stakeholders provided us with better perception and understanding of the primary risks and hazards in Santo Domingo.

Using this information, we were able to make recommendations tailored to the needs of Santo Domingo for the implementation of the APELL program. To promote APELL, we drafted a pamphlet with details about the program to be used as a guide by CNP+L and other future APELL leaders during implementation of the program. We also designed an information poster about

APELL for dissemination at the local level. We presented the pamphlet at our final forum in Santo Domingo as a capstone effort to communicate the importance of APELL to a variety of stakeholders. The results of our feasibility study in Santo Domingo as well as recommendations for future implementation were presented at a final presentation for CNP+L. Our recommendations can be used to enhance the APELL program to develop safer, coordinated emergency response efforts for technological accidents in Santo Domingo. With success, this program can serve as a model in additional communities throughout the entire country.

CHAPTER 2: BACKGROUND

This chapter compiles background information on the hazards and concerns that confirm the need for local communicative emergency response protocols in Costa Rica. Specifically, we reviewed information on chemical management and incidents, Costa Rican environmental and travel conditions, and APELL background and execution. Our research supports the implementation of APELL in Costa Rica.

2.1 National Profile of Sound Chemical Management in Costa Rica

At the United Nations Conference on Environment and Development in 1992, 150 member countries adopted Agenda 21 as a series of guidelines for implementing sustainable development. The goal of all in attendance was to achieve sound chemical management by the year 2000 (National Coordinating Group of Costa Rica, 2008). To follow Agenda 21, every country began working on a National Profile to assess their approach to legal, administrative, and technical management of chemicals in an approach recommended by the Intergovernmental Forum on Chemical Safety (IFCS), a forum through which countries regularly discuss their progress and chemical activities. In completing these documents, a wide range of countries have developed overviews of their national chemical activity as well as targeted priorities for their improvement of safe chemical management. Since the purpose of this initiative is to increase international communication and program integration, these profiles can be easily accessed on the United Nations Institute for Training and Research (UNITAR) website (UNITAR, 2007).

Costa Rica completed their National Profile in 2005, which was officially published with updates in 2008. The profile provides information on current chemical activity and available resources in the country, identifies strengths and weaknesses, and suggests future goals for its improvement in chemical management. The profile calls for facilitating trade in chemical and agricultural products as well as creating an authoritative document on national chemical

management, including regulations that place more responsibility on the importer, manufacturer, distributor, or user. The document also reports that there is a lack of effective field control for regulating industrial chemical permits and practices. The chemicals that are highlighted are pesticides, fertilizers, industrial petroleum products, and chemicals marked for public consumption. The profile also reports that in accordance with current legislation, the National Emergency Commission for Risk Prevention and Emergency Response and the Bomberos of Costa Rica share the responsibility of responding to an emergency. However, the ability to respond to an emergency at a local level is often deficient. The number of trained staff and appropriate resources, such radiological, bacteriological, and chemical facilities, is minimal compared to the amount of chemical accidents presented daily. There is also a lack of ambulances that are equipped to treat patients suffering from chemical accidents as well as health services to provide the appropriate treatment (National Coordinating Group of Costa Rica, 2008).

The most recurring and significant goal is to open the lines of communication between stakeholders. This includes facilitating cooperation and information exchange between government ministries, helping ministries learn from each other and past experiences, and increasing dialogue between the government and other stakeholders, including the industries, the employees, and civil organizations (National Coordinating Group of Costa Rica, 2008).

2.2 Industrial Concerns in Costa Rica

Costa Rica hosts rich wildlife and environmental marvels; its varied environments such as rainforests and volcanoes promote biologically diverse ecosystems. In fact, the country, despite its small size, is home to about 5% of the Earth's plant and animal species. (Instituto Nacional de Biodiversidad, 2007). Forest covers 46.8% of Costa Rica, and conservation efforts provide protection for more than 26% of this land (Bureau of Western Hemisphere Affairs, 2010; Butler, 2006). The Costa Rican government actively contributes to sustainable development initiatives and

conservation efforts. In 1995, the government implemented a plan to protect 18% of the country as national parks and 13% as privately owned preserves. The areas targeted for protection were those with high biodiversity. These efforts have protected two-thirds of Costa Rica's remaining rainforests, demonstrating a strong government commitment to preserve Costa Rica's environment (Butler, 2006). However the growing industrial scene threatens these protective measures. The misuse of chemicals has been a rising concern for many Costa Ricans. As the government has demonstrated its interest to protect Costa Rica's forests from deforestation, it should also target with the same intensity of concern the threat that industries pose to Costa Rica's natural environment and local communities.

Costa Rican industries are becoming significant contributors to the economy. A variety of industries found in Costa Rica, including manufacturers of chemical fertilizers, textiles, plastics, electronics, and computer chips, have broadened export trade in recent years (Advameg, Inc., 2010). Consumer products are starting to surpass agricultural goods as Costa Rica's most profitable exports. In fact, in the 1990s, foreign investment in Costa Rica's free trade zone boosted manufacturing and industry's contribution to the gross domestic product (GDP), surpassing agriculture's contribution. Currently, industrial output constitutes 25.5% of Costa Rica's GDP (Bureau of Western Hemisphere Affairs, 2010). Examples of such industries include consumer product industries, such as 3M and Intel Corporation, and agricultural industries including Del Monte, Dole, and Chiquita (Bureau of Western Hemisphere Affairs, 2010). The result of external demand for the national production of manufactured goods is the growing dependence on chemical input (National Coordinating Group of Costa Rica, 2008).

Housing such industries in Costa Rica presents a great risk for potential technological emergencies. The National Profile reports that the only company in Costa Rica that has a facility for storing a specific type of chemical is Recope, a company that stores hydrocarbons. Currently,

imported chemicals are stored in warehouses that do not have areas designated for specific types of chemicals. Therefore explosive, corrosive, or contaminated products are uncontained and have the potential to cause major damage if an accident occurred in the facility (National Coordinating Group of Costa Rica, 2008).

Chemical accidents can be particularly devastating to humans and the environment, as they are toxic and can sometimes react explosively (Advameg, Inc., 2010). Intel Corporation, which opened its $1.996 billion microprocessor plant in Costa Rica in 1998, uses as many as 300 different chemicals to produce semiconductors, which are the solid, crystalline base material of computer chips (Bureau of Western Hemisphere Affairs, 2010). There is a demanding market that fuels the production of these semiconductors, even though they are made using hazardous chemicals. In 2004, Intel was reported to have the highest percentage of export distribution in the industrial sector, which was 38%. In comparison, the food industry contributed to 13% of the export market, followed by medical equipment with 11% and the chemical industry with 8% (National Coordinating Group of Costa Rica, 2008).

Although semiconductors are associated with computer chip production, only 44% of the semiconductor industry is directed towards computers. The other 56% is used for military, automotive, consumer, communications, and industrial products, further demonstrating the need for semiconductor production. At least 10 of the chemicals used to make semiconductors are known to be extremely harmful to human health, including significant amounts of heavy metals that can create devastating effects if they are mishandled and released into the environment. One of these chemicals, methyl chloroform, is used for washing the semiconductors. Accidental short term exposure to methyl chloroform through direct contact, inhalation, or ingestion can cause severe headaches, central nervous system depression, poor equilibrium, eyes, nose, throat, and skin irritation, cardiac arrhythmia, and even death (U.S. Department of Health and Human Services,

1978). Another of these chemicals, benzene, which is used for photo electrochemical etching, is a well-known carcinogen causing leukemia. In addition, exposure can cause damage to bone marrow, anemia, excessive bleeding, immune system effects, increased chance of infection, and reproductive effects (Holden & Kelty, 2005). Unfortunately, the full body suits that computer chip industries provide for their employees are designed as a protective measure for the semiconductor against contaminants from the employee, such as hair and skin, rather than for employee protection against the chemicals (Holden & Kelty, 2005). These suits would not provide protection for the workers in the case of an accident at the facility. Moreover, outsourced companies, such as Intel, are often reluctant to comply with Costa Rican protective standards. The National Profile reports that agreements related to chemicals management are difficult to acquire due to lack of economic resources and the involved procedures that must be met to obtain the cooperation of international agencies (National Coordinating Group of Costa Rica, 2008). Unfortunately, this deficient regulation also presents unnecessary risks to the local environment and people.

Past chemical accidents demonstrate the devastating nature of such disasters. For example, an incident in San Jose, California documents the seriousness of hazardous semiconductor materials. In 1981, reports showed that drinking water in the area was contaminated with the toxins trichloroethane and freon. The researchers suspected Fairchild Semiconductor and IBM of leaking tens of thousands of gallons of these toxic materials from their underground storage tanks. They supposed that the contamination was correlated with the surprisingly high number of birth defects reported by families in the areas surrounding these fabrication plants (Holden & Kelty, 2005).

One of the most infamous chemical accidents took place in Bhopal, India in 1984. A cloud of methyl isocyanate, a lethal pesticide, leaked out of one of Union Carbide's pesticide plants in the city. According to the Indian Council of Medical Research, approximately 2,000 people were immediately killed that night. In addition to the devastating number of human deaths, many plants

and animals were adversely affected by the disaster. Over 1,000 animals died within three minutes of inhaling the gas, and a number of the surviving cows stopped producing milk. Tomato and spinach plants were among the agriculture that was severely damaged (Centre for Science and Environment, 2010). Not only were these immediate effects devastating, but long-term impacts from this accident still threaten the Bhopal community. Since the Indian government claims that it does not have the necessary resources to decontaminate the area, residents are still drinking and bathing in polluted water. In 2007, 23 years after the disaster, residents were still protesting for the government to supply clean, piped water into the city. Furthermore, an estimated 100,000 residents are still suffering effects from exposure to the toxic gas. The most common long-term health effects observed in the survivors are lung diseases, such as fibrosis and tuberculosis. Other diseases include bladder and cervical cancers and eye disorders, such as early onset cataracts and blurred vision. Mental health issues and damage to the immune system are also common symptoms (Vince, 2009). The impact of this accident in India reveals the importance of chemical control in any country, including Costa Rica.

Costa Rica has also suffered its own industrial accidents. One such incident was a chemical fire in Alajuela in May 2007. The fire took place in the resin factory Suministros Industriales de Costa Rica. Investigators suspected that the fire was caused by faulty electrical wires that came in contact with chemicals in a storage room. The environmental damages caused by the accident were severe, as the absence of a waste-management system allowed chemical waste to flow into nearby rivers along with the one million liters of water used by firefighters to extinguish the flames. A lack of fire hydrants also inhibited firefighters from responding properly to the accident, which accounted for the slow response time to the emergency (Tico Times, 2007). Another example of an industrial accident in Costa Rica was a chemical fire that occurred in December 2006 at Químicos Holanda in Moín, Limón. Workers were welding near a truck which was unloading with flammable

chemicals. The fumes produced from unloading combined with the welding caused an initial explosion followed by a large fire. The fire raged for over five hours and was fueled by 150 tons of the mixture of the chemicals toluene and xylene. These chemicals were stored in separate storage tanks, and on their own they were not considered harmful. However, the combination of these chemicals produced a fire that released toxic gases and chemical particles into the air. The chemicals also contaminated the nearby river, leaving over 15,000 people in the Limón province without water (Tico Times, 2006). These two occurrences are only two examples of the variety and severity of the accidents which have occurred in Costa Rica.

In addition to the risks caused by technological industries, agricultural industries are one of Costa Rica's biggest concerns. Companies such as Dole and Chiquita rely heavily on pesticides to protect their bananas and pineapples. In fact, coffee farmers are also known to use harmful herbicides, such as paraquat and lead arsenate. Such chemical usage has been linked to skin cancer in populations that live near these plantations, and a two-fold increase of lung cancer rates has been observed in rural populations continually exposed to pesticides (Wesseling, 1999). Over 400 hospitalizations, about 60 of them fatal, occur from pesticide exposure each year in Costa Rica. In a study done from 1980 to 1986, 50% of hospitalizations for pesticide poisoning were attributed to occupational exposure, while 25% were caused by non-occupational accidents. Inadequate storing, mishandling of empty bottles, transportation of the pesticides alongside passengers, and drinking from contaminated waterways accounted for some of the non-occupational exposure (Wesseling, Castillo, & Elinder, 1993). Control of such adverse chemicals is important for the safety of the Costa Rican population.

Just as Costa Ricans protect their biodiversity and natural environments, they must also protect themselves against the hazards that accompany industrial growth. Many of these industries are using chemicals that have adverse environmental and health effects, and efforts to minimize any

kind of exposure to these chemicals should be enforced. Nationally, Costa Rica is attempting to enforce their chemical safety regulations and remind the industries of their social responsibility for proper chemical use (National Coordinating Group of Costa Rica, 2008). The development of a program that tailors emergency response for local communities can aid this national effort. Although accidents are unpredictable, cooperative protocols can greatly improve the response to chemical emergencies in Costa Rica and thereby minimize the damage.

2.3 Current Conditions in Costa Rica

The current travel and environmental conditions within Costa Rica have an impact on the potential for hazardous accidents. These situations include challenging road conditions, driving customs, and environmental conditions such as earthquakes, excessive rain, and landslides.

The transportation of chemicals within Costa Rica is a great concern due to the challenging travel conditions. Of the 35,330 kilometers of road throughout the country, only 24.4% are paved (Central Intelligence Agency, 2010). Often, traffic signs are not well-placed and therefore are not easily visible (Association for Safe International Road Travel, 2009). There are numerous potholes, and lines marking the center of a road are rare. Most bridges are one-lane, made of wood, and have no railings, which makes them less stable and more dangerous to cross. For example, in October 2009 a bridge collapsed over the Tárcoles River near Turrubares, Costa Rica, when a bus exceeded the bridge's maximum weight limit. This accident resulted in five deaths and many other injuries (Overseas Security and Advisory Council, 2010). These road conditions present many opportunities for accidents and can be dangerous for the transportation of chemicals.

Not only are the road conditions poor, but also the style of driving can also be inconsistent with the government laws. Driving laws in Costa Rica include stopping at stop signs before proceeding, yielding at yield signs, using traffic lights to monitor traffic, and yielding right of way. However, many drivers do not abide by these laws. For example, many people treat red stop lights

and stop signs as yield signs, where drivers slow down but do not come to a complete stop. According to the Association for Safe International Road Travel, "[Costa Rican] drivers may tailgate, fail to signal, and also make turns from across one or two lanes of traffic or attempt to pass on blind turns" (Association for Safe International Road Travel, 2009). In 2007, there were 710 road traffic fatalities in Costa Rica, as well as 19,903 injuries. Of the 178 countries examined by the World Health Organization in 2007, Costa Rica ranked 97th for the highest number of road fatalities per capita (World Health Organization, 2007). With this high rate of accidents in transit there is a great risk for transporting toxic chemicals.

While the driving and road conditions are poor in Costa Rica, the environment is also a potential factor in contributing to chemical accidents. The leading contributing environmental factors are earthquakes, heavy rain, and landslides. Costa Rica is a seismically active region, which means that the country resides near an area where two or more tectonic plates join, making the area vulnerable to many earthquakes. Due to this location, earthquakes are frequent, but are usually low on the Richter scale. However, earthquakes of any size are still capable of contributing to chemical accidents. It is necessary to plan for larger earthquakes as well, such as the one that occurred on October 9, 2010 in San José. This earthquake had a Richter scale magnitude of 5.9 and resulted in the loss of national cell phone service and various landslides (United Press International, 2010). Earthquakes such as these can cause chemical accidents if industrial facilities are not structurally sound or have poor chemical management.

In Costa Rica, rain pours down heavily for short periods of time during the rainy season, which lasts from May to November. The heavy rain causes flooding in many areas of the country. In San José, the average rainfall is between 60 and 80 inches annually, but other parts of the country can receive up to 240 inches per year (Toucan Maps Inc., 2010). The flooding caused from heavy rain can lead to power outages and damage to homes and buildings.

Earthquakes and heavy rain are the main causes of landslides, which contribute to dangerous situations such as blocked roads, power outages, and even death. The landslides caused by the January 8th, 2009 earthquake contributed to almost half of the total fatalities during the disaster. Electricity was also lost in some parts of San José (U.S. Geological Survey, 2010).On November 4th, 2010, heavy rains caused a landslide in San Antonio de Escazú. The landslide killed 20 people, left 14 missing, and sent 1,500 people to shelters throughout Costa Rica (Jimenez, 2010). In July of 2008, another landslide occurred on top of a water pipe, which caused the pipe to crack, leaving at least 400,000 residents in the San José area without water for four days (Raub, 2008). Had dangerous chemicals been released in these accidents, the damage to the population and environment could have been far worse than the initial incident.

Since these environmental conditions in Costa Rica are unpredictable, it is necessary to consider them in planning for emergencies. Given the number of earthquakes and large amount of rainfall, some protective measures are taken, such as building codes that ensure that structures withstand flooding and earthquakes of a certain magnitude. Emergency protocols exist in Costa Rica, but none involve the communication of first responders. A communicative emergency protocol for these cases will increase effective response and the safety of the community and environment.

A recent incident resulting from the extreme weather conditions in Costa Rica was the rupture of the Costa Rican Petroleum Refinery (Recope) polyduct. In early November 2010, torrents of rain caused the river Tárcoles to overflow, which led to landslides that damaged the polyduct. Two hundred meters of the pipe transporting diesel and gasoline were ruptured causing leakage of fuel into the mouth of the river. The spill resulted in contamination of water for the residents of the Quebrada Lapas area as well as damage to a hydroelectric plant operated by the utility company ICE (Agüero R., 2010). A month later, its effects had not yet been fully contained by Recope. The

incident was only granted four short briefings in the national newspaper and no mention was made of environmental officials monitoring water contamination levels. The amount of attention given to the incident infers an overall understatement of the dangers associated with water and soil contamination of a chemical spill. In addition, reports indicate limited collaboration between the first responders and the Recope responders in containing the spill (Agüero R., 2010). This accident depicts the devastation that can result from environmental conditions in Costa Rica.

2.4 Awareness and Preparedness for Emergencies at Local Level

To establish a localized emergency protocol in Costa Rica, CNP+L will use the program APELL, or Awareness and Preparedness for Emergencies at Local Level. APELL was established by UNEP in 1986 as a response to several accidents in developing countries that involved chemical spills and fires. As a result, UNEP created a program to foster risk awareness and emergency response for the wellbeing of the impacted community. UNEP created a guide titled *The APELL Handbook* in which the steps necessary for implementation are outlined. Countries seeking to implement APELL can use the handbook as a guide for establishing an emergency response protocol. The handbook outlines the steps to implement APELL, including the gathering of the cooperation of the community, the industries, and the local authorities. APELL will ultimately result in the establishment of a local emergency response protocol that addresses the potential hazards in a specific region (United Nations Environmental Programme, 1988).

2.4.1 Technological Emergencies

The International Labor Organization characterizes a technological emergency as

> "an occurrence such as a major emission, fire or explosion resulting from uncontrolled developments in the course of an industrial activity, leading to a serious danger to man, immediate or delayed, inside or outside the establishment, and to the environment, and involving one or more dangerous substances" (International Labour Organization, 1988).

This definition clarifies that for a technological emergency to be declared, the episodic and potentially long-lasting damages to people and the surrounding environment must be the result of a hazardous industrial accident.

There are many different guidelines and criteria for the classification of a disaster as a technological emergency, including criteria created by the Center for Research on Epidemiology of Disasters (Brussels, Belgium), the Contra Costa County (California, US), and the United Nation Environmental Programme (Paris, France). However, all of the organizations consider similar characteristics of the disaster, including the number of fatalities, injuries, and the monetary amount in damage. For example, UNEP requires that there are 25 or more deaths, 125 or more injured, 10,000 or more people evacuated, 10,000 or more people deprived of water, or that there is ten million U.S. dollars in overall damage. These numbers show the drastic damages caused by technological emergencies. Unfortunately many industrial accidents around the world fulfill these requirements (Shaluf, Ahmadun, & Mustapha, 2003; Shaluf I., 2007).

Technological emergencies can be categorized into different types based on their origins. According to the article "Socio-technical Disaster: Profile and Prevalence," there are at least four types of accidents that can occur. The most frequent types of disasters are plant and factory failures (explosions or leaks), transportation failures (crashes), public place failures (bystander injuries and fatalities), and production failures (system malfunctions) (Richardson, 1994). Of the four types of technological emergencies, transportation failure is the most likely to occur in Costa Rica due to the condition of the roads, the constant precipitation during the rainy season, and potential landslides.

There are also a variety of factors that can cause a technological emergency. These factors include human error, technical failure, and organizational dysfunctions. Human error can be subcategorized into two types: operational and managerial errors. Operational errors include lack of knowledge, training, and awareness, while managerial errors include poor priorities, delegation, and

planning. Technical failure ignores human error and specifies poor design and machine failure. Organizational factors include policy failure, neglect of safety protocol, and most importantly communication errors (Richardson, 1994; Shaluf, Ahmadun, & Shariff, 2003).

Most models of technological emergencies are broken down into a series of three events. First, an "incubation stage" occurs when an unavoidable flaw in a system grows and expands. Second, the flaw then escalates and forms the next phase in which it becomes a disaster. Lastly, the clean up and recovery phase takes place once the disaster begins to subside. These three events are known as the "before, during, and after" stages. The most important lesson from this model is that the damages from a disaster can only be minimized in the "before" stages by preparing for the specific causes (Richardson, 1994; Shaluf, Ahmadun, & Mustapha, 2003).

These factors drawn from the definition of a technological emergency are important for recognizing when these scenarios occur and communicating the impact of these disasters to tailor appropriate APELL initiatives. Understanding the criteria, types, factors, and models of a technological emergency is crucial to aid in the development of future preventative measures.

2.4.2 Stakeholders and Coordinating Group

One of the distinguishing aspects of the APELL program is the emphasis it places on the synergy between three sectors of the society, and its flexibility in adapting to the unique cultures of different countries in which it is implemented. These sectors, or stakeholders, are defined as the community, the industries, and the local authorities. Communication between these three groups is critical to the success of the program.

The community is composed of the public who are put at risk in the event of a technological disaster. It includes the residents of the region in question and Non-Governmental Organizations (NGOs) that may be interested in sponsoring or aiding the APELL program. The willingness of the public to participate is critical for the implementation of APELL. Therefore, an important goal of

APELL is to raise awareness and gain public support by encouraging the community to participate in emergency drills and information sessions, and to familiarize the society with the localized emergency response protocol. In fact, the APELL program is ineffective without the proper support from community members (United Nations Environmental Programme, 1988).

The industry stakeholder refers to established companies dealing with potentially hazardous materials. The industries that would be most involved in the APELL program are those whose production or transportation processes present a risk to the safety of the environment and neighboring communities. CEOs, high ranking managers and, if possible, members of the board of trustees are targeted for industrial participation in APELL as their input is invaluable in drawing attention to the potential risks of their industry (Young, 1990). For a country with overextended government resources, the government is less likely to commit funds for a program that aims to prevent a disaster that has not yet occurred and that might discourage industrial development. APELL seeks to alleviate this problem by encouraging communication between the government and industries, so that the industry leaders can provide justification for government support in a local program (United Nations Environmental Programme, 1988).

Local authorities who would be involved with APELL can be subdivided into two categories: first responders and municipality. The involvement of the local authorities is critical in the execution of the APELL program. The first responders, such as the fire and police departments, maintain response protocols and protect the public and environment by responding to emergencies. The municipality is also responsible for public health and safety and environmental protection (United Nations Environmental Programme, 1988).

The interconnection and dependency of each of these sectors' roles is fully appreciated by the APELL program. To ensure that synergy exists between the stakeholders, the program provides instructions for developing a Coordinating Group, whose role is to foster communication and

manage the relationship between the stakeholders. The Coordinating Group is composed of individuals from each of the three sectors who meet regularly to ensure that the goals set by APELL are being met and to discuss a plan of action for attaining future goals (Young, 1990). Participation in the Coordinating Group is entirely voluntary, and the success of the APELL program relies heavily on the organized and active progress of this group (United Nations Environmental Programme, 1988).

For the Coordinating Group to be successful, the relationship between the industries, local authorities, and community must be cooperative. Industrial officials should be reminded of their social responsible to protect the community from the risks presented by their industries. The local authorities and industry officials should work together to approve the collaboration of their existing emergency response protocols. Additionally, the public should be made aware of the risks that threaten their safety and the proper response for mitigating these risks.

2.5 Pilot Study: Santo Domingo

The National Cleaner Production Center chose Santo Domingo for a pilot study of the APELL program. Santo Domingo is one of ten cantons located in Heredia, which is one of the seven provinces of Costa Rica. The canton is seven kilometers from San José, the capital of Costa Rica, and encompasses about 25 square kilometers (Discovery Travel World, 2010). According to a census carried out by the National Institute of Statistics and Census (INEC) in 2000, the population of the canton of Santo Domingo is close to 35,000 people.

Santo Domingo is an ideal location for the APELL pilot project because it has members from all three sectors of society. There are three public banks, a Red Cross, a hospital, a school, and police and fire departments. Also, the company 3M, an international manufacturer of abrasive products, is based in Santo Domingo. The canton is governed by a town council which is led by a mayor (Municipalidad de Santo Domingo, 2010).

The canton is also appropriate for the pilot study because it serves as a major transportation hub. Several companies throughout the region transport chemicals, raw materials, processed products, and toxic waste to their final destinations through Santo Domingo (Cámara de Industrias de Costa Rica, 2010). Given the state of the roads and the harsh environmental conditions, a danger is posed to the inhabitants of Santo Domingo should any of the trucks transporting hazardous material have an accident. The large population of Santo Domingo makes this danger one of high priority and should be addressed immediately.

Overall, Santo Domingo has the appropriate resources to be considered as a host for the implementation of APELL. The threat of chemical accidents and the active local community provide the perfect environment to develop a cooperative emergency protocol. Results of a feasibility study can be used to assess and tailor the implementation of APELL in Santo Domingo.

2.6 Case Studies

Since APELL's establishment in 1986, local communities around the world have implemented the program with varying degrees of success. The APELL program stresses the importance of communication between the local authorities, the community, and the industries in the location of implementation. This aspect of the program and the degree to which it is followed results in either the successful or unsuccessful implementation of APELL. Regions in two countries which serve as examples for both successful and unsuccessful implementations are Curacavi, Chile and Rio de Janeiro, Brazil, respectively. Both implementations were on the same scale as a canton. The success or failure of one municipality or region in implementing APELL in a particular country has an impact on whether or not other regions or municipalities in that country choose to implement APELL. Although both countries had very different experiences with the establishment of APELL, each case is relevant to Costa Rica.

2.6.1 APELL in Chile

Chile established an APELL program in 1993. Chile is constantly exposed to unpredictable weather and earthquakes because of its long border with the Pacific Ocean and its location on the Nazca tectonic plate; therefore, nature has contributed to the volatility that necessitates APELL. Chile's economy primarily relies on port cities due to its border to the Pacific Ocean. Prior to the establishment of APELL, there were two major accidents in different ports. In 1985, an earthquake of 7.8 on the Richter scale struck the two largest ports, killing almost 200, injuring around 2500, and putting one million people into unemployment. One of the ports was out of service for nearly a year and a half. In 1992, a fire started during ship maintenance. This fire spread throughout the whole bay, damaging 60 fishing vessels and destroying nine. One person died while 1000 people lost their jobs. This accident could have escalated had the resulting fire reached the nearby 12 large petroleum storage tanks. As a result, representatives for APELL made visits to Chile, which were very successful in raising awareness of the program. By 1995, the preliminary visits led to the first workshop which explained the need for APELL. This resulted in more workshops for all sectors at the regional, provincial, and countrywide levels. Cooperation among the groups soon followed, and a Coordinating Group was formed. In 1996, an oil pipeline company located in Curacavi had two spills; one was the result of a terrorist act, and the other was caused by heavy machinery usage close to the proximity of the pipeline. The company agreed to comply with the Coordinating Group and be investigated proving that these were indeed accidents. The company worked with the Coordinating group to provide all of the requested information, and upon request of the community, the company produced a brochure about pipeline safety and instructions to be followed in the event of an emergency. This interaction is an excellent example of how an industry was unprepared for an emergency, and how all parties worked through the Coordinating Group to

increase preparedness. By using APELL, Chile has benefited by the creation of an accident prevention protocol and by open and effective communication among stakeholders (Palacios, 1997).

2.6.2 APELL in Brazil

One unsuccessful APELL implementation took place in Rio de Janeiro, Brazil, home of the Campos Eliseos Industrial Park. The community and environment of the city were regularly exposed to potential risks by many companies that use hazardous chemicals and toxic materials. Unlike the U.S. and other fully developed countries at the time, Brazil had almost no government regulations for industrial emergency protocol. Also, many firefighters and other responders were not trained to handle technological disasters. In 1991, the APELL process was initiated to help alleviate the dangers of Campos Eliseos Industrial Park by developing a cooperative emergency protocol. The Coordinating Group was established with members of each facility, local authorities, and community officials. Unfortunately, only a year later, the Coordinating Group's meetings became infrequent due to a lack of commitment from its members. Activity of the Coordinating Group ceased, and the APELL program was never reestablished. In March of 1998, gas leaks and explosions caused large fires lasting more than 15 hours in Campos Eliseos Industrial Park. Luckily there were no deaths and only four people were injured. During and after the accident, the news reported on both the TV and radio was misleading and inaccurate. These reports confused the public; many residents flooded the streets thinking they needed to evacuate. However, the local authorities eventually gained control of the situation. The public was upset about the incident, which led to class action law suits against the company. Had an APELL program been successfully established, the outcome of this chemical accident may have been mitigated in Rio de Janeiro (de Souza Jr., 2000).

2.6.3 Case Study Conclusions

The APELL program can be a very beneficial tool, but it must be implemented carefully to be effective. APELL in Chile proved to be successful due to the cooperative effort by all of the

stakeholders. The achievement can be seen in the actions taken by the oil pipeline company to comply with the needs of the community and local authorities. Chile is one of many countries that have successfully implemented APELL, including Mexico, India, Indonesia, and Thailand. The accomplishments of all of these programs were increased preparation for accidents, more personnel for responding to hazards, raised community awareness and involvement, regular testing for preparedness, national legislation and disaster planning, and lastly, international awareness of potential disasters (World Environment Center, 1997). Contrarily, the ineffective implementation of APELL in Brazil proves the importance of communication and cooperation within the Coordinating Group and the support of the local community. Without a centralized support system, the APELL program will fall apart. With knowledge of the past successful and unsuccessful implementations, we approached the APELL pilot study in Santo Domingo using the best practices to maximize the opportunity for success.

2.7 Conclusion

Current literature on both technological emergencies and APELL implementation worldwide supports the decision to initiate APELL in Costa Rica. Currently the transportation and handling of chemicals is not regulated while the potential for hazards and the severity of accidents is overlooked. There is a need for a collaborated protocol that will improve emergency response. The advantages of such a protocol are increased safety for employees and local communities as well as decreased damage to property and the environment. We used this research as justification for implementing APELL in Santo Domingo and for identifying the methodology for our feasibility study. By using APELL, promoted and increased communication among local authorities, the community, and the industries would be achieved as well as the development of a cooperative protocol for responding to emergencies. Our work raises awareness of the current hazards and lack of preparedness for technological emergencies, and stresses the importance of a cooperative

protocol that promotes the safety of the industries, the environment, and the communities in Costa Rica.

CHAPTER 3: METHODOLOGY

To promote safety for the environment and population of Costa Rica, CNP+L has adopted the APELL program to initiate the development of a standardized emergency response protocol at the local level. Our team contributed to the agency's efforts by raising awareness for the program and assessing the feasibility of APELL's success in the canton of Santo Domingo. To accomplish this goal, we identified the stakeholders present in Santo Domingo, their jurisdiction, and their interaction with one another. Through this process we were able to recognize the present hazards and the existing process of emergency response in the canton. We used this information to assess the feasibility of APELL in Santo Domingo and to make recommendations for a variety of tasks for the future Coordinating Group.

3.1 Identifying Stakeholders in Santo Domingo

The success of APELL depends on the complete and equal involvement of all three stakeholders: the local authorities, the surrounding industries, and the community. Our team needed to identify the specific parties in Santo Domingo that would represent each stakeholder. Initially Sr. Carlos Perera of CNP+L assisted in organizing meetings and interviews with members of the local authorities and industries. Interacting with initial stakeholders led us to establish more contacts in Santo Domingo. In this way we were able to establish a list of contacts in Santo Domingo that would play a role in the APELL program.

Our initial meetings in Santo Domingo were scheduled with influential local authorities. CNP+L's aided in establishing our team's connection with the Domingan Association of Environmental Management (ADOGA). ADOGA is an interest group consisting of members of the Municipality of Santo Domingo and a few community representatives that commits to projects within the community. After we explained the APELL program and its goals, ADOGA appointed a committee member, Luís Diego Rubí, an employee of the Municipality of Santo Domingo, to help

us identify which organizations would be potentially interested in the APELL program. His broad range of contacts within the local authorities in Santo Domingo helped us contact the ministries and first responders that have the most important roles in the canton pertaining to emergency protocols and response, including the Santo Domingo Bomberos and the Ministry of Health. With his guidance, we also identified a number of industries that could be potential contributors to the program.

Stimulating industrial involvement in APELL in Santo Domingo presented one of our greatest challenges. In order to generate industrial interest, we used influential sources, such as Chemical Advisors from the College of Chemicals, the Ministry of Health, and CNP+L, to contact industries in Santo Domingo. It was specifically helpful to target larger, especially international, industries since they are very cautious about their image in the community and are usually willing to participate with the local authorities.

It is crucial for the community to participate in APELL; however, community stakeholders do not have an immediate role in the program. The community can only be introduced into the program after the local authorities and industries have become adequately involved. For this reason, we did not identify community leaders for this feasibility study. It will be the responsibility of the local authorities and industries to inform the community of the current risks of technological disasters and about plans for a coordinated response. This diminishes the chance of miscommunication, thereby minimizing the likelihood of a fearful and panicked response from the public. In fact, the *APELL Handbook* suggests educating the community as the last step in implementation (United Nations Environmental Programme, 1988).

Just as defining the appropriate stakeholder organizations was crucial to our project, it was also necessary to determine the jurisdiction of every stakeholder in Santo Domingo and their interaction with one another. During each of the meetings that we conducted, we inquired about the

stakeholder's position in the community as well as their interaction with other stakeholders. This gave us a much clearer understanding of the current roles and amount of partnership that exist among stakeholders in Santo Domingo.

3.2 Identifying Current Status of Emergency Response

We analyzed information from a variety of meetings to identify the current risks and hazards in Santo Domingo in order to get a full understanding of the emergency response. The preliminary meetings with ADOGA and the Bomberos were especially useful. During these meetings we identified gasoline stations and chemical transportation routes as major focus areas for our study. We also interviewed Dr. Sergio Musmanni, former director of CNP+L and Main Advisor at the German Development Cooperation Agency (GTZ) to gain more knowledge about past chemical accidents and hazards in Costa Rica (See Appendix A). We asked him to elaborate on his concerns about the hazards in Santo Domingo and on a national level. We used the information on existing risks and hazards to gain a more thorough understanding about the current emergency response status in Santo Domingo.

In order to learn about the current emergency response, we conducted meetings with stakeholders to discuss and identify the current existing protocols at the national and local level. During meetings with stakeholders, we used a detailed list of questions to gather more information about the current status of emergency response. To identify national protocols, we conducted meetings with the Bomberos of Santo Domingo to discuss their emergency response procedures. We asked the Bomberos specific questions regarding what protocols are used for responding to technological emergencies (See Appendix B). To gain an understanding of Costa Rica's National Emergency Commission, we met with Sr. Walter Zavala of the Ministry of Environment, Energy, and Telecommunications (MINAET) (See Appendix C). To identify general information about industrial protocols, we interviewed Lilliana Rivera at the Ministry of Health. This ministry manages

all of the industrial submitted plans related to waste management, occupational health, and emergency response. We asked questions pertaining to the Ministry's review of these protocols (See Appendix B). Our team also met with Nuria Bolaños, the Chemical Advisor of 3M, in order to understand the protocols used at a large multinational company. We asked questions regarding what specific emergency protocols are in place, as well as how often these protocols are tested, reviewed, and improved (See Appendix D). These interviews allowed us to evaluate the current level of preparedness for local emergency response and to make conclusions about the current emergency response status in Santo Domingo.

3.3 Promoting the APELL Program to Stakeholders

During each of the meetings we held with stakeholders, our team had two major goals; to gather information from the parties being interviewed and to promote the APELL program. To spread awareness of APELL at every meeting, we gave a brief presentation explaining the goals of APELL and a summary of the steps of implementation. We explained what a technological emergency is, who the stakeholders and Coordinating Group are, and what the benefits of this program would be in Santo Domingo. This provided the stakeholders a better understanding of our feasibility study and the importance of their participation in the program.

To promote the APELL program, we created two informational documents both in Spanish and English to promote the dissemination of APELL in communities throughout Costa Rica. These documents were a threefold pamphlet and a poster (See Appendix E; See Appendix F). The pamphlet included a brief overview of the program, basic steps of implementation, and a justification for initiating a pilot study in Santo Domingo. The pamphlet can be distributed by CNP+L to industry representatives and local authorities to provide a more thorough understanding of APELL. The poster is a less technical tool to promote APELL. It explains why UNEP created APELL, the goals of APELL, as well as the responsibilities of the Coordinating Group. The poster

can be used by companies and other participants of the program as a visual aid for raising community awareness.

Promoting APELL to stakeholders was most effectively accomplished through an informational forum. We felt that we could best promote discussion of the program through an organized workshop. Many of the parties we met were extremely generous in helping us gather information and expressed great interest in learning more about APELL. We invited all of our previous contacts as well as prospective stakeholders, including members of the municipality, the Bomberos, and industrial representatives (See Appendix G). Our final forum, conducted completely in Spanish, included a presentation promoting APELL in Santo Domingo, the distribution of the current version of our pamphlet, and a question and answer session. At the conclusion of the forum, we asked all participants to fill out a brief survey assessing their level of interest in the program (See Appendix H).

3.4 Facilitating the Implementation of APELL

Our greatest effort in introducing APELL in Santo Domingo was conducting a feasibility study for its implementation. We integrated our research collected from interviews with the local authorities and industries. We reported on the existing problems that demand a need for APELL in Santo Domingo, such as lack of communication and resources, and assessed industry and local authority participation in the program. With this information we drew conclusions about the practicality of APELL's success in Santo Domingo.

We recommended improvements for the collaboration of the three stakeholders, as well as methods to improve industrial involvement in APELL. We also recommended groups to be represented in the initial Coordinating Group to facilitate the implementation of the program, as well as preliminary tasks for this group. We presented our evaluation and recommendations to CNP+L in a final presentation.

CHAPTER 4: RESULTS AND ANALYSIS

By utilizing the resources that were available to us, we were able to gain an in-depth understanding of how the APELL program could be integrated in Santo Domingo. In order to better understand the current process for emergency response in Santo Domingo, our group needed to learn about the present risks and existing protocols in the canton. We were able to gather different opinions from meetings with a variety of stakeholders concerning the hazards presented in Santo Domingo as well as the areas of emergency response that needed improvement. Each meeting helped us gain more insight into the existing response situation in Santo Domingo. Ultimately, our goal was to encourage stakeholder awareness and interest in the APELL program. By synthesizing the information gathered at each of the meetings, we identified the specific risks for technological emergencies presented in Santo Domingo, the current protocols that are used for emergency response, and the current interaction between each of the stakeholders. We also identified the level of interest that each stakeholder had in the implementation of APELL in Santo Domingo. This information allowed us to develop strong justification for the APELL program in Santo Domingo.

4.1 Stakeholders in Santo Domingo and their Jurisdiction

It was necessary for us to identify the specific stakeholders in Santo Domingo who would be prominent motivators for the establishment of APELL. Through our interviews and meetings, we determined which parties are the most significant stakeholders for the success of APELL in Santo Domingo.

The local authority stakeholders can be subdivided into two groups; the municipality of Santo Domingo and the first responders. One of the stakeholders within the municipality that will be a dominant overseer of the APELL program is the Ministry of Health. Their role in Santo Domingo is to manage and collect industrial protocols regarding emergency response, waste management, and occupational health. Other ministries, such as the Ministry of Environment and

the Ministry of Employment, will be crucial stakeholders for APELL's success in the future. The Ministry of Environment will be an important party for monitoring the safety of the environment during a technological disaster, while the Ministry of Employment will be able to use their jurisdiction to promote industry participation in APELL.

There are three first responders who play a significant role in emergency response in Santo Domingo. These responders include, but are not limited to, the Red Cross, the police force, and the Bomberos. The Red Cross in Santo Domingo is responsible for the safety and health of the community by dispatching ambulances and transporting people to hospitals in the event of an emergency. The police of Santo Domingo enforce the laws of the canton. With new legislation included by APELL, the police would have the responsibility of enforcing these new laws. The Bomberos of Santo Domingo are in charge of responding to all fire and emergency related incidents in their region. By meeting with the Bombero Johnny Nuñéz, we learned that there are 64 Bomberos departments in all of Costa Rica, each covering specific jurisdictions (See Appendix I). These stations are evenly distributed throughout the seven provinces of Costa Rica. There are also three Bomberos stations in the country that are trained in hazardous materials. There is one team in Puntarenas with jurisdiction in the Pacific region, one in Siquierres with jurisdiction in the Caribbean region, and one in Tibás with jurisdiction in central Costa Rica. The Bomberos of Costa Rica all follow the same set of national protocols for responding to a variety of incidents. These responders are extremely valuable to the efficacy of emergency response and would be major contributors to the APELL program.

There are a variety of industries in Santo Domingo. The larger companies, which include international companies, are extremely valuable because they are very proactive in the community. Since they have the necessary resources to invest in the program, their impact on the community is much greater. One such industry is the company 3M, which produces sandpaper, Scotch tape, Post-

it Notes, and adhesives in the facility in Santo Domingo. These products contribute to 30% of 3M's activity in the canton, while their other efforts are focused on importing and distributing a variety 3M products. The 3M facility has a Chemical Advisor, Nuria Bolaños to oversee their chemical management, safety, and activity at the facility. Sra. Bolaños specifically ensures that the appropriate permits and protocols are reviewed as needed, and that the best chemical management strategies are employed. The productivity of this company towards a community project in Santo Domingo would greatly influence other companies to join the program.

Although we decided not to meet with community leaders for our feasibility study, we were able to meet with an active community organization called The Domingan Association for Environmental Management (ADOGA). This group is comprised of a variety of members, including representatives from the Municipality of Santo Domingo, Ministry of Health, Inbio Parque, Costa Rican Social Security Fund, and the National System of Conservation Areas. The committee has implemented and improved projects within the community, such as enhancing a recycling program. Such a motivated group will be able to spearhead the APELL program in Santo Domingo.

4.2 Stakeholder Interactions in Santo Domingo

Success of the APELL program depends largely on collaboration between stakeholders. It is therefore imperative that our group identify the existing stakeholder relationships in Santo Domingo in order to make an informed assessment of the feasibility of the program in the canton. Our team met with representatives of the three stakeholders in order to fully understand the current approaches to emergency response. During these meetings, we were able to gain insight into Santo Domingo stakeholder interaction as well as to identify the shortcomings in stakeholder communication.

We identified that industries located in Santo Domingo are required to submit technological, occupational health, and waste management emergency protocols to the canton's Ministry of Health.

These protocols are ideally reviewed annually, but in reality the process varies with each industry. One of the most prominent industries located in Santo Domingo, 3M, follows through with this process by having the Ministry of Health review its protocols annually. In addition, the Bomberos of Santo Domingo tour the facility and approve 3M's fire safety standards every three months. Because we were able to interview only 3M, we were not able to determine the extent of protocol review for other industries in the canton.

We discovered in a meeting with the Bomberos of Santo Domingo that many industries are reluctant to collaborate with local authorities. This is because the companies are unwilling to recognize the hazardous chemicals stored within their facilities as well as shortcomings in their emergency response protocols. The Ministry of Health also confirmed that many industries do not adequately complete and submit their protocols.

Due to the nature of our study, we were able to identify only one organization, ADOGA, which nurtures community involvement with local authorities and industries in Santo Domingo. Additional community members can be identified by the future supervisors of APELL.

For the concerns and needs of each stakeholder to be properly addressed, it is important to open the lines of stakeholder communication. This will facilitate the development of an efficient and collaborative emergency response process capable of better protecting the community and environment from hazards of technological emergencies.

4.3 Existing Hazards in Santo Domingo

In order to analyze the feasibility of implementing APELL in Santo Domingo, it was essential to identify the hazards present in the canton. It was important to recognize the sources of technological disasters in Santo Domingo in order to assess the need for APELL. We used the information obtained from meetings with ADOGA, the Bomberos of Santo Domingo, and the Main Advisor of GTZ to identify the risks present in both Santo Domingo and Costa Rica.

At our meeting with ADOGA, the committee indicated a variety of potential technological hazards in Santo Domingo. These included potential gas station explosions, chemical spills during transportation, the contamination of the aquifer that is the main source of water for the canton, and the leaching of petrochemicals from the underground polyduct into the soil. If the polyduct were to explode as it did twenty years ago, the water supply could be contaminated. There are three gas stations in Santo Domingo, two of which are in center of the canton while the other is located on the perimeter. The primary concern is the delivery of gasoline through the canton to these stations. When discussing the routes for chemical transportation, the members of ADOGA confirmed that it is impossible to identify all of the paths through which chemicals are transported. Of these hazards the transportation of chemicals is the primary concern, but all are serious threats to Santo Domingo.

The Bomberos of Santo Domingo pointed out similar hazards in the canton. They also stressed that transportation routes for trucks containing hazardous chemicals are not strictly defined. The Bomberos mentioned that trucks passing through the canton could employ whichever route they desired and could transport hazardous material at any time of the day. This lack of structure makes it extremely difficult to prepare for potential emergencies. The most direct transportation route is Route 32 from Limón to San José which passes directly through Santo Domingo. This is particularly dangerous because Limón is the main port for imported chemicals on the eastern side of Costa Rica. The Bomberos also expressed doubt in the education and knowledge of other first responders arriving at the site of the emergency. It is extremely dangerous if the first person on scene does not understand the danger of the situation and the proper way to react. These concerns and their reasoning provide more evidence for the need of APELL in Santo Domingo.

To learn even more about chemical hazards, we spoke with Dr. Sergio Musmanni of GTZ. At the interview, Dr. Musmanni addressed many hazards that are detrimental to Costa Rica. His primary concerns were of the education of the people using and storing hazardous chemicals as well

as the transportation of such chemicals. According to him, there are many businesses that operate out of garages, and the people running these are often unaware of how to properly store chemicals. These operations are also not registered with the College of Chemicals, which does not keep them in compliance with safety regulations. Dr. Musmanni stated that one area for improvement is that first responders on scene need to have better knowledge of the incident at hand. Around three and half years ago a detergent company in Tibás had a large chemical spill. The news reporters in the area were only standing 20 meters away from the accident and the police on scene were peering through the fence six meters away. Another incident occurred in Tres Rios at a warehouse which stored many types of chemicals. One night a fire started in the warehouse causing flames and explosions of many different colors. The community members approached the warehouse to watch the spectacle. In both situations, many people could have been hurt had the event escalated. These situations justify the need for educating the first responders and community. On the theme of chemical transportation, Dr. Musmanni expressed similar concerns to those of the Bomberos and ADOGA. Not only was he concerned about the routes and times that transportation occurred, but also that the most common accidents have been with oil derivatives, such as petroleum. Less frequent accidents have involved chlorine and pesticides. According to Dr. Musmanni, Costa Rica has been blessed with the small number of accidents that have occurred.

ADOGA, the Bomberos, and Dr. Musmanni identified many of the same hazards present in Santo Domingo. All parties expressed that the transportation of hazardous and the lack of knowledge and education of first responders were pressing concerns. These hazards which threaten Santo Domingo are aims that the Coordinating Group will address if APELL is established.

4.4 Current Status of Emergency Response in Costa Rica

During many of our interviews we collected information concerning the current emergency response in Costa Rica. We identified the protocols that are used nationally by the Bomberos as well

as the process for emergency response. We also learned about a national committee that is trying to mitigate damages from technological emergencies in Costa Rica.

At our meetings with the Bomberos, we learned about the protocols used for emergency response. They informed us that all of the 64 Bomberos stations have the same detailed and extensive protocols in place for responding to several kinds of emergencies, such as chemical accidents. We also learned about the process of response during an emergency. In Costa Rica, there is one communication center that dispatches emergency calls to the appropriate responders. This communication center is located in Santo Domingo, in the same building as the Bomberos of Santo Domingo. Costa Ricans call 911 in the event of an emergency, connecting them to the communication center in Santo Domingo. The receiver of the call records specific information about the situation, such as the location, the caller's name and phone number, and the type of emergency that is occurring. From this information, the dispatcher sends the call to the appropriate responder, including the Bomberos, Red Cross, and the police force.

In the case of a chemical emergency, the dispatcher is required to find out very specific information from the caller, such as what chemicals are involved and their serial numbers. Then, depending on the extent of the chemical accident, the dispatcher contacts one of the three Bomberos stations that are specially trained for chemical hazards. Although there are only three hazardous material teams in Costa Rica, every Bomberos member is required to learn how to respond to a chemical accident by referring to the *Emergency Response Guidebook* (Cloutier & Cushmac, 2008). Departments in Canada, the U.S., Mexico, and Argentina jointly developed the *Emergency Response Guidebook* as a tool to aid first responders in identifying the specific or generic hazards of materials involved in chemical disasters. The guide incorporates a list of hazardous chemicals, developed by the United Nations, with details on how to handle them in the case of a fire, spill, leak or first aid incident. The guide is used as a supplement to emergency response training. The US

Department of Labor's Occupational Safety and Health Administration (OSHA) requires emergency response personnel in the US to be conversant with this same guidebook (Cloutier & Cushmac, 2008). The Bomberos are also conversant in this material. Once the Bomberos execute initial response, they determine consequent actions based on the logistics of the particular incident.

We also learned that there is a national initiative to improve emergency response in Costa Rica. Walter Zavala explained to us the purpose and activities of the National Emergency Commission. The committee is made up of organizations including the director of the Bomberos of Costa Rica, the National University, the Director of Toxicology, the Ministry of Health, the Chemical Advisor of the University of Costa Rica, the Ministry of Employment, and the Ministry of Public Works and Transportation. The committee is currently working on a number of projects. These include devising and implementing legislation for the definition of specific routes for the transportation of hazardous material throughout Costa Rica. The committee is also working towards identifying all of the industries and their chemicals, as well as reporting this information in a central, accessible database. The National Emergency Commission is also concerned that the Ministry of Environment is not contacted as a first responder during a technological emergency. Without this representative, the immediate environmental impact of the disaster can be overlooked. The goals of the National Emergency Commission are consistent with the objectives of APELL but at a national level. Using a program that works at a local level may be the best method for initiating national programs throughout Costa Rica.

4.5 Current Status of Emergency Response in Santo Domingo

To be able to accurately evaluate the feasibility of implementing APELL in Santo Domingo, it was important to learn about the emergency response protocols which were currently being used. At meetings with the Bomberos of Santo Domingo, the Ministry of Health, 3M, and the National

Emergency Commission we obtained important information about the existing emergency protocols for local industries and first responders.

The Bomberos in Santo Domingo confirmed that they follow national firefighting standards. If an emergency occurs in Santo Domingo, the Center of Communication will receive the 911 call and accordingly contact the Bomberos with the necessary details of the incident. The head of the Bomberos stations will then decide the best route to travel for responding to the emergency.

When we met with Lilliana Rivera of the Ministry of Health of Santo Domingo, she informed us that all industries must submit three protocols to the ministry, which is the governing body for all industrial protocol procedures. These protocols address occupational health, waste management, and emergencies. Sra. Rivera gave us the documents that explain the requirements for the content of each protocol. By reviewing these documents, we discovered that any submitted emergency protocol would be very thorough and address many different types of emergencies due to the specific requirements for the creation of the emergency plan (See Appendix J). However, after industries submit these protocols, the ministry follows up only annually to verify their accuracy and effectiveness due to a lack of manpower and industrial cooperation (National Coordinating Group of Costa Rica, 2008). Sra. Rivera also expressed concern that without a penalty system, many industries are unwilling to complete these forms.

As a large international industry, 3M serves as a model industry in regards to their protocols and compliance with Costa Rican law. The 3M facility has many protocols in place for all forms of their operations. Currently, the Ministry of Health reviews these protocols once a year. Also, the Bomberos visit the facility every three months to address fire safety standards. 3M consistently cooperates with the local authorities and can serve as an example to other industries in Santo Domingo.

There are many different protocols in place among all of the different stakeholders. The Bomberos have national protocols regarding how to react to emergency situations, but they are not informed with specific information about each of the industries. The Ministry of Health collects all industrial protocols, but their files are incomplete and not reviewed on a regular basis. The Ministry of Health does not have enough field control to enforce when protocols are submitted to them, and they do not have strong enough disciplinary control over industries that do not submit their protocols. Ideally, all industries should submit their emergency protocols to the Ministry of Health annually and get inspected by the Bomberos once every three months. 3M is a model industry, because these guidelines are strictly followed.

At a meeting with the National Emergency Commission's Subcommittee for Technological Emergencies, we learned that the National Emergency Commission is also represented on a local level in every canton. Santo Domingo specifically has its own Regional Emergency Committee which is comprised of representatives of the Bomberos, police force, Red Cross, as well as the Mayor and Deputy Mayor. Not only is the participation of these individuals crucial for facilitating the APELL program, but also the involvement of this committee is required to implement the program in Santo Domingo. As such, this Commission must be involved in the implementation of APELL.

4.6 Stakeholder Interest Level

Since Santo Domingo has all of the necessary resources to initiate APELL, the defining aspect of our feasibility study was determining the level of stakeholder interest and commitment for the implementation of the program.

Our final forum to raise awareness and gauge interest in APELL took place on December 9, 2010 at the Santo Domingo Public Library. In attendance there were 15 members representing all three stakeholders. Representatives from the Municipality, Ministry of Health, Bomberos, and

MINAET attended on behalf of local authorities; the president of ADOGA, Ana Chacón, and two additional residents represented the community. The industry representatives that attended were from 3M and Discoramo S.A., the company which distributes Recope's chemicals (See Appendix K). In addition, the Mayor and Deputy Mayor of Santo Domingo attended the forum, both of whom are members of the Santo Domingo municipal committee of the National Emergency Commission.

After our presentation, we distributed a survey to gauge each attendee's interest in and commitment level to the program upon its implementation (See Appendix H). An astounding 100% of attendees were very interested in the establishment of APELL in Santo Domingo and very willing to participate in the program. Furthermore, the Mayor of Santo Domingo announced that the APELL program would be implemented within the coming year.

CHAPTER 5: CONCLUSIONS AND RECOMMENDATIONS

The feasibility of the establishment of APELL in Santo Domingo is supported by information that we gathered at meetings with the local authorities and industries of Santo Domingo, as well as from the results of the survey that we distributed to stakeholders at our final forum. Using this information, we recommend improvements in emergency response and the long-term application of APELL in Santo Domingo.

5.1 Feasibility of APELL in Santo Domingo

The implementation of APELL in Santo Domingo is feasible. The resources that are available in the canton provide the necessary foundation for implementing the program. These assets include specific goals that the APELL program can focus on, such as sites for potential technological disasters and the improvement of the discord in communication that we have identified between local authorities and industries. The canton also has existing emergency response protocols and effective emergency responders that can be at the disposal of the program's efforts. The canton has its own Bomberos station and is within close proximity to the Bomberos in Tibás, which are specially trained for responding to hazardous materials. In addition, the members of the local authorities and industries are optimistic about the establishment of APELL. The results of the survey from the forum in Santo Domingo revealed that 100% of stakeholders who attended are both very interested and willing to participate in the program. At least one representative of every stakeholder was present at the forum. This abundance of stakeholder interest is imperative for the success of the program. Most importantly, Santo Domingo contains an active municipality that has the potential and motivation to spearhead the APELL program. The availability of these resources and level of interest shown by all stakeholders ensures that APELL is feasible in Santo Domingo.

5.2 Recommendations for the Pilot APELL Project

Our feasibility study suggests several recommendations to facilitate the implementation of APELL and improve the efficacy of the emergency response process in Santo Domingo. Our

primary suggestion is to follow through with APELL methodology by establishing a Coordinating Group in Santo Domingo. The Coordinating Group should have representatives from the community, ADOGA, the Ministry of Health, the Ministry of Environment, the Ministry of Public Works and Transport (MOPT), the Bomberos, the police force, the Red Cross, and industries including 3M and Discorama. CNP+L should have initial involvement in the Coordinating Group until a UNEP representative can be established. A leader for the Coordinating Group should be immediately elected to manage the group's activity. The immediate activity of this group should be to develop a coordinated response plan for the canton of Santo Domingo by utilizing the guidelines suggested by the National Emergency Commission (Appendix G). As the APELL program develops in Santo Domingo, more representatives from the three stakeholders should be added according to the needs of the Coordinating Group. This group will be charged with the responsibility of overseeing the goals of APELL in Santo Domingo and ensuring that they are met and maintained.

We recommend a variety of tasks for the Coordinating Group in Santo Domingo:

1. Database of Industries

   We propose that a central database be developed for industries in Santo Domingo. The Coordinating Group should have the responsibility of identifying these industries. This database should contain all of the existing emergency response protocols, floor plans of the buildings, as well as a list of chemicals used by each industry. This database must be easily accessible to all first responder parties in either hard or electronic copies. It is most likely that the Bomberos, specifically those at the Bomberos Communication Center, should maintain this database; as the center of communication, they can dispatch this information during an emergency. The database will provide a quick resource for first responders to prepare for an emergency relating to a specific industry in Santo Domingo. As seen fit by the Coordinating Group and with permission from industries, this

information can eventually be shared between companies to improve awareness of the chemicals and protocols being employed.

2. Industrial Protocol Review

   Currently, the Ministry of Health lacks the resources to oversee the completion of emergency response protocols. The Coordinating Group should appoint a subcommittee responsible for reviewing and updating these protocols and making them accessible in the industrial database. This group should regularly report to the Ministry of Health for final protocol approval. The Chemical Advisor for every industry, or an employee appointed by the advisor, should assist this subcommittee. Any flaws in industrial protocols should be reported immediately to the company and the Ministry of Health. We suggest that the Ministry of Health have the authority to sanction or suspend the operation of industries that do not improve their protocols within a specified warning period.

3. Database of Accidents and Review

   Currently every separate responder party files its own accident report, which leads to inconsistent and deficient information among response parties. The Coordinating Group should appoint a member to compile every report by a specified time period after the occurrence of the emergency. This member is responsible for reviewing the reports to look for discrepancies as well as compiling the information into a master report. The master reports should be filed with the Bomberos and reviewed regularly with a committee of first responders to discuss the effectiveness and improvements needed in their response efforts.

4. Environmental Emergency Responder

We suggest that a representative from the Ministry of Environment be included as a first responder. The role of this responder is to immediately assess the impact of the technological disaster on the surrounding environment and direct the Bomberos in the proper cleaning of this area. This responder is also responsible for filing a first responder report. They will need to assess long-term impact on the environment and suggest further cleanup activity if it is necessary.

5. Training Programs for First Responders

   The Coordinating Group should arrange a regular training program in emergency response that all first responders, other than the Bomberos, are required to attend. This program should be approved by the Bomberos and will ensure that important or updated information regarding Santo Domingo's emergency response plans are made known to all first responders. Emphasis should be placed on proper recognition and response to hazardous chemical materials, especially those that are identified in Santo Domingo's industries. Since the Bomberos use the *Emergency Response Guidebook* as a reference, the training program can utilize the presentation that accompanies this book, which is available online and updated every four years. In addition, the University of Costa Rica currently holds a training session for handling hazardous materials, which can also be incorporated into the Santo Domingo training program.

6. Define Specific Routes and Times

   To enhance preparation for emergency response, we suggest that specific routes and times be defined for transport of allowed hazardous materials through Santo Domingo. In compliance with the Costa Rican law "Regulations for the Transport of Dangerous Goods," routes should favor wider roads with large shoulders that circumvent residential areas as well as times that avoid rush hour traffic (Ministry of Public Works and

Transport, 1995). The MOPT of Santo Domingo should adopt and enforce regulations that penalize truck drivers and/or their companies for not complying with defined hazardous material transport routes. Sanctions could include loss of driver's license, driver fines, or company fines.

7. Create an Interactive Map

   We recommend the creation of an interactive map that supplies company locations in Santo Domingo as well as their chemical transportation routes. This map can assist first responders during an emergency. The Coordinating Group should be responsible for conveying this information to the National Emergency Commission, which is working on the creation of a national interactive map for chemical transportation.

8. Chemical Transportation Signage

   The Coordinating Group should advocate that industries in Santo Domingo properly label their trucks according to the chemical being transported. Sanctions should exist for mislabeled or unlabeled trucks. Proper truck identification regarding the land transport of dangerous products will help to enforce the dictated routes for chemical transportation (Ministry of Public Works and Transport, 1998). A system should be implemented for which the truck driver loses his or her license or the company is fined for not complying with Santo Domingo's laws. The Coordinating Group should encourage companies to educate their drivers about hazardous materials and the importance of properly labeled trucks.

9. Public Programs

   The Coordinating Group should initiate programs to increase public awareness. These programs should be developed after a coordinated response plan has been established. In this way the responders' preparedness can be highlighted and public panic can be

averted. Programs should include informing the community about APELL, the dangers of technological emergencies, and the proper response to emergencies that have the potential to occur in their area. In this way the public can become aware of how best to protect themselves during a technological accident.

10. Incentive Program

    Although the industries we met with in Santo Domingo were very interested and willing to commit to the program, we were warned by several parties of the difficulties of gaining industry participation for programs such as APELL. Since APELL is a voluntary program, there are no monetary incentives for companies to join. However, advertising participation in APELL once the community is aware of the program can be a very successful public relations strategy. We recommend a program which allows industries to advertise their participation in APELL on the labels of their products or on posters in their facility. This would help further promote awareness of the program in the community as well as to foster industry participation.

The APELL program has many applications in Santo Domingo and can be the tool used by the canton to increase stakeholder communication and emergency response coordination. Our recommendations address the tasks that the Coordinating Group should accomplish in Santo Domingo to increase the safety of the community and environment.

5.3 Future Implications of Establishing APELL in Santo Domingo

With the successful implementation of APELL and significant progress of the Coordinating Group, Santo Domingo will benefit from a communicative emergency response system that will increase the safety of its residents and the surrounding environment. Communication between the municipalities, the first responders, the industries, and the community will be improved, and all parties will be educated and aware of the proper response to technological emergencies.

The program's success in Santo Domingo can serve as a model for other communities in Costa Rica. An example of one such community is Limón, which has experienced numerous past accidents that have contaminated its bay and water sources. Also, many rural towns in Costa Rica, which do not have as many response resources as in Santo Domingo, would benefit from increased emergency preparedness. By using Santo Domingo as an example, APELL can be tailored to fit many local communities and improve the safety of the citizens and environment in Costa Rica.

Growth of the APELL program throughout Costa Rica will greatly benefit national improvement programs. These include the efforts of the National Emergency Commission as well as the improvements for national chemical management outlined by the *National Profile*. Major progress can be made by using APELL at a local level to implement national programs. Additionally, as development of APELL can improve national activity, it is reasonable that success of the program can lead to national government or UNEP funding, which will allow the program to flourish throughout Costa Rica.

As the program is feasible to establish in Santo Domingo, successful implementation of APELL can serve as a model for other communities at risk of technological disasters. By embracing APELL and implementing the program in its communities, Costa Rica will be the first Central American country to join the ranks of the 30 countries that have successfully implemented the UNEP program. Not only will this accomplishment mitigate the destructive impact of emergencies throughout the nation, but also it will establish Costa Rica as a model for Central American countries seeking to protect their citizens and environment from the effects of technological disasters.

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GLOSSARY OF TERMS

Awareness and Preparedness for Emergency at a Local Level (APELL)

A program created by the United Nation Environmental Program in 1986 to foster risk awareness and emergency response for the wellbeing of the impacted community.

Community

Refers to the general public, Non-Governmental Organizations, and Interest Group, these are people put at risk in the event of a technological disaster within the jurisdiction of the program

Coordinating Group

A group established by the APELL process with representation from the local authorities

Industry

Refers to established companies dealing with potentially hazardous materials within the jurisdiction of the program

Local Authorities

Refers to municipal employees and first responders who are located within the jurisdiction of the program

Regentes de Químicos

A representative from the College of Chemicals who is assigned to one industry in order to ensure the safety and proper of use of chemicals being used, stored, and transported for the during of the chemicals lifespan.

Stakeholders of APELL

Community, industries, and local authorities who exist within the jurisdiction of the program

Technological Emergencies

An occurrence such as a major emission, fire or explosion resulting from uncontrolled developments in the course of an industrial activity, leading to a serious danger to man, immediate or delayed, inside or outside the establishment, and to the environment, and involving one or more dangerous substances (International Labour Organization, 1988).

APPENDICES

Appendix A: Interview Questions for Dr. Sergio Musmanni

11/15/2010
Interview Questions for Dr. Sergio Musmanni

1. What are the biggest problems with industries and chemical handling?
    a. Do industrial protocols apply to accidents off site?
    b. Are they efficient in responding?
2. What are some examples of past chemicals accident in Costa Rica?
    a. Was emergency response efficient and capable of responding to the emergency?
    b. Was there a trend in response vs. type of chemical accident?
3. What are the best ways to involve industries with programs like APELL?
    a. What are the best arguments to present when trying to get industries on board?
    b. What would be the best way for us to invite industries to our final forum?
        i. Do you have any contact information for industries on Santo Domingo?
4. Do you think APELL would be feasible in Santo Domingo?

Appendix B: Interview Questions for Santo Domingo Bomberos and Ministry of Health

11/1/2010
Interview Questions for Santo Domingo Bomberos

1. In your opinion, what are the largest hazards that could lead to a potential technological emergency in Costa Rica?
2. Can you recommend any ideas to help minimize these hazards?
3. In your opinion, is there adequate emergency response in Costa Rica? If not, what should be improved?
4. Do you have any valuable information on recent past chemical accidents in Costa Rica?
5. Having knowledge of the APELL program, do you think that the program could be feasible in Santo Domingo?
6. Do you have any advice to help us gain industry cooperation with the program?

Interview Question for Lilliana Rivera, Ministry of Health

1. How are you involved with governing emergency protocols of industries?

Appendix C: Interview Questions for Sra. Nuria Bolaños

12/2/2010
Interview Questions for 3M

1. What does 3m do at this facility?
2. How do materials get delivered to the facility here?
3. How do materials get delivered from the facility?
4. What types of protocols are in place for such procedures?
5. Is there MSDS (material safety data sheet) in the facility?
    a. Is everyone educated in MSDS? Is the information available?
        i. For example, does the security guard know?
6. In the event of an emergency how does one react:
    a. Internally?
    b. Externally?
7. How often are safety protocols practiced?
8. How often are safety protocols reviewed?
9. What kind of communication does 3m have with the Bomberos Municipality (M.Salud)?

Spanish:

1. ¿Qué 3m hacer en este establecimiento?
2. ¿Qué materiales se entregan a la instalación en esta lista?
3. ¿Qué materiales se entregan a partir de la instalación?
4. ¿Qué tipos de protocolos se han establecido para estos procedimientos?
5. ¿Hay MSDS (hoja de seguridad) en el edificio?
    a. ¿Están todos educados en MSDS? ¿Es la información disponible?
        1. Por ejemplo, ¿sabe el guardia de seguridad?
6. En el caso de una emergencia, ¿cómo se reacciona ...
    a. Internamente?
    b. Externamente?
7. ¿Con qué frecuencia se practica protocolos de seguridad?
8. ¿Con qué frecuencia se revisaron los protocolos de seguridad?
9. ¿Qué tipo de comunicación se han 3m con la Municipalidad de Bomberos (M. Salud)?

Pilot Study: Santo Domingo

Santo Domingo of Heredia serves as an ideal location for the pilot study of APELL in Costa Rica because there exists an active municipality and an involved community. For example, both stakeholders have worked together to promote and implement an effective recycling program.

Santo Domingo is also the location of a multinational industry, as well as a few small companies that use and store hazardous chemicals.

In addition, Santo Domingo is also a common route for hazardous chemicals being transported to other parts of Costa Rica. This presents a significant potential for accidents to occur in the canton.

The implementation of APELL in Santo Domingo would serve to involve and coordinate the effective existing emergency protocols of industries and local authorities, and also to educate the community to respond appropriately in the event of an accident.

If implementation in Santo Domingo is successful, APELL could then be used in other communities throughout Costa Rica. With a successful APELL program, Costa Rica can join the ranks of several countries that have implemented the UNEP program which will serve to maximize the safety of its citizens and the Costa Rican environment.

Information in this document was gathered from the "APELL Handbook" written by UNEP in 1986.

CNP+L COSTA RICA

The National Cleaner Production Center of Costa Rica

Costa Rica Chamber of Industry
350 meters South of the Hispanic Fountain
San Pedro, San José

Carlos Perera
Executive Director
Phone: (506) 2202-5608
Fax: (506) 2202-5672
E-mail: cperara@cicr.com
www.cnpml.or.cr

Are you prepared?

Awareness and Preparedness for Emergencies at Local Level (APELL)

Working together for the safety of the community and environment

Facts about APELL

What is APELL?
Awareness and preparedness for emergencies at local level (APELL) is a tool developed by the United Nations Environment Programme (UNEP) in 1986.

Why was APELL created?
- The program was created to minimize the occurrence and harmful effects of technological emergencies in developing countries.

What type of Disasters?
- APELL addresses technological emergencies with potential for fire, explosion, spills or releases of hazardous materials

What are APELL's goals ?
- **Community awareness**: Increase knowledge in the community about possible risks and hazards.
- **Coordinated emergency response:** formulation of a plan to protect people, property and the environment.

Why is APELL flexible?
- The APELL process is designed to build on any and all existing emergency plans to create a coordinated single local plan.

How to successfully implement APELL

Success depends on equal cooperation of three Stakeholders and proper function of a Coordinating Group. The Three Stakeholders are:

- **Local Authorities:** Governmental officials who are responsible for public safety, health and environmental protection.
- **Industries:** Local industrial plant managers that are responsible for safety and accident prevention in company operations.
- **Community and Interest Groups:** Representatives from environmental, health, religious, educational and business sectors that represent concerns and views of the community.

- **Coordinating Group (CG):** Consists of members of all three stakeholders that are capable of commanding the respect of their peers.
  The role of the CG is to provide the bridge between industry and local government with the cooperation of community leaders and develop a unified and coordinated approach to emergency response planning and communication with the community.

Ten Steps to initiating the Program

1. Identify the emergency response participants and define their roles, resources and concerns
2. Evaluate the hazards and risks that may result in emergency situations in the community
3. Have participants review their own emergency response plans for adequacy relative to a coordinated response
4. Identify the required response tasks not covered by existing plans
5. Match these tasks to the resources available from the identified participants
6. Make the changes necessary to improve existing plans, integrate them into an overall community plan and gain agreement
7. Commit the integrated community plan to writing and obtain approval from local governments
8. Educate participating groups about the integrated plan and ensure that all emergency responders are trained
9. Establish procedures for periodic testing, review and updating of the plan
10. Educate the general community about the integrated plan

Spanish

Estudio Piloto: Santo Domingo

Santo Domingo de Heredia es una ubicación ideal para el estudio piloto de APELL en Costa Rica porque existe una municipalidad activa y una comunidad involucrada. Por ejemplo, estas dos partes interesadas han trabajado para promover y poner en práctica un programa de reciclaje efectivo.

Santo Domingo también es la ubicación de una industria multinacional y de empresas pequeñas que usan y almacenan químicos peligrosos.

Santo Domingo es una ruta común para el transporte de químicos peligrosos para otras partes de Costa Rica. Ésto representa un potencial significativo para la ocurrencia de accidentes en el cantón.

La aplicación de APELL en Santo Domingo serviría para involucrar y coordinar los protocolos de emergencia efectivos existentes de las industrias y las autoridades locales. También el programa serviría para educar a la comunidad para responder adecuadamente en caso de accidente.

Si la aplicación en Santo Domingo tiene éxito, APELL podría ser utilizado en otras comunidades en todo Costa Rica. Con una implementación exitosa de APELL, Costa Rica puede unirse al listado de varios países que han implementado el programa del PNUMA, que servirá para maximizar la seguridad de sus ciudadanos y el medio ambiente de Costa Rica.

Información en el documento se reunieron del "APELL Handbook" escrito de PNUMA en 1986.

CNP+L COSTA RICA

Centro Nacional de Producción más Limpia

Cámara de Industrias de Costa Rica
350 mts Sur de la Fuente de la Hispanidad,
San Pedro, San José

Carlos Perera
Director Ejecutivo
Phone: (506) 2202-5608
Fax: (506) 2202-5672
E-mail: cperara@cicr.com
www.cnpml.or.cr

¿Estás preparado?

Concientización y preparación para emergencias a nivel local (APELL)

Trabajando juntos para la seguridad de la comunidad y el medio ambiente

Hechos sobre APELL

¿Qué es APELL?
APELL significa Concientización y Preparación para Emergencias a Nivel Local y es una herramienta desarrollada por el programa de las Naciones Unidas para el medio ambiente (PNUMA) en 1986.

¿Por qué se creó APELL?
- El programa fue creado para reducir al mínimo los efectos perjudiciales de las emergencias tecnológicas en los países en desarrollo.

¿En qué tipos de emergencias trata el programa APELL?
- APELL considera emergencias tecnológicas, incluyendo incendios, explosiones, derrames o liberaciones de materiales peligrosos.

¿Cuáles son los objetivos del APELL?
- **Conciencia de la comunidad:** aumentar el conocimiento en la comunidad sobre los posibles riesgos y peligros.
- **Coordinada respuesta de emergencia:** Formular un plan para proteger a las personas, la propiedad y el medio ambiente.

¿Cómo es APELL flexible?
- El proceso de APELL está diseñado para construir a partir de todos los planes de emergencia existentes un único plan coordinado del nivel local.

Para la aplicación exitoso de APELL

Cómo implementar correctamente APELL El éxito de APELL depende de la igualdad de cooperación de las partes interesadas y la participación adecuada de un Grupo de Coordinación. Los tres partes interesadas son:
- **Las Autoridades Locales:** Los funcionarios gubernamentales responsables de la seguridad pública, la salud y la protección del medio ambiente.
- **Las Industrias:** Los gerentes de plantas industriales locales que son responsables de la seguridad y la prevención de accidentes en las operaciones de las empresas.
- **La Comunidad y los Grupos de Interés:** representantes de grupos religiosos, sectores de educación, el medio ambiente, la salud pública y de empresas que representan los intereses y opiniones de la comunidad.

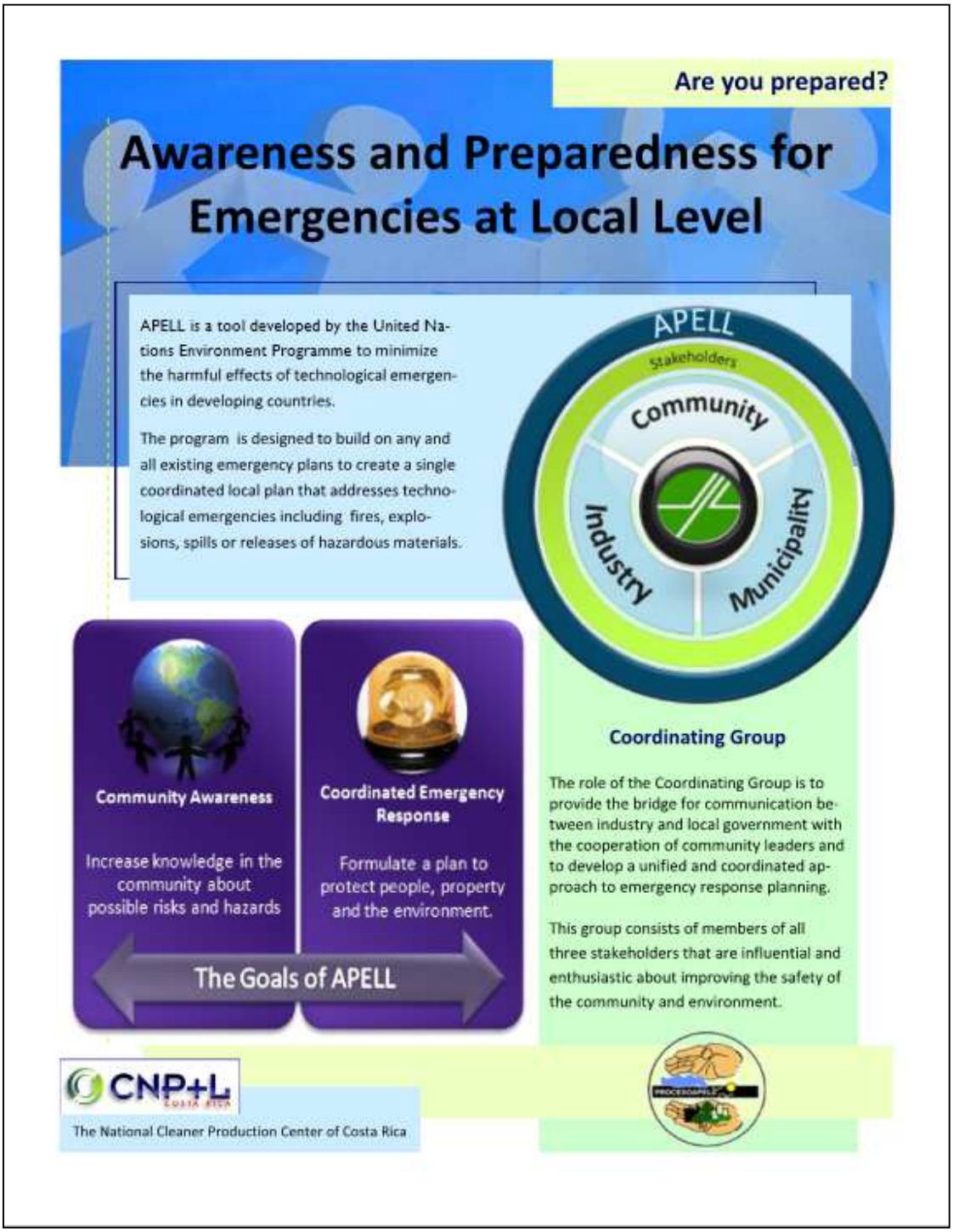
- **Grupo de Coordinación (GC):** El papel del GC es proveer el puente para la comunicación entre las industrias y el gobierno local con la cooperación de los líderes de la comunidad.
  El GC también desarrolla un enfoque unificado y coordinado en la planificación de la respuesta de emergencia. Este grupo está integrado por miembros de las tres partes interesadas que son influyentes y entusiastas de la mejora en la seguridad de la comunidad y el medio ambiente.

Diez medidos para iniciar el programa

1. Identificar a los participantes de la respuesta a una emergencia y definir sus funciones, recursos y responsabilidades.
2. Evaluar los peligros y riesgos que pueden provocar una situación de emergencia en la comunidad.
3. Hacer que los participantes revisen su propio plan de emergencia para adecuarlo a la respuesta coordinada.
4. Identificar las tareas de respuesta necesarias que no han sido cubiertas por los planes existentes.
5. Armonizar estas tareas con los recursos disponibles de cada uno de los participantes.
6. Realizar los cambios necesarios para mejorar los planes existentes, integrarlos al plan global de la comunidad y buscar un consenso.
7. Poner por escrito el plan integrado de la comunidad y buscar la aprobación de las Autoridades Locales.
8. Informar a todos los grupos participantes sobre el plan integrado y asegurarse de que todos los encargados de responder a una emergencia estén debidamente entrenados.
9. Definir procedimientos para probar, revisar y actualizar el plan de manera periódica.
10. Informar y entrenar a la comunidad en su conjunto de la utilización del plan integrado

Appendix E: Forum Documents-Poster

English



Spanish


¿Está preparado?
Concientización y preparación para emergencias a nivel local
APELL es una herramienta desarrollada por el programa de las Naciones Unidas para el Medio Ambiente (PNUMA) para reducir al mínimo los efectos perjudiciales de las emergencias tecnológicas en los países en desarrollo.
El proceso de APELL está diseñado para construir a partir de todos los planes de emergencia existentes un único plan coordinado del nivel local que considera emergencias tecnológicas, incluyendo incendios, explosiones, derrames o liberaciones de materiales peligrosos.
APELL
tres partes interesadas
Comunidad
Industria
Municipalidad
Conciencia de la comunidad
Aumentar el conocimiento en la comunidad sobre los posibles riesgos y peligros.
Coordinada respuesta de emergencia
Formular un plan para proteger a las personas, la propiedad y el medio ambiente.
Las metas de APELL
Grupo de Coordinación (GC)
El papel del GC es proveer el puente para la comunicación entre las industrias y el gobierno local con la cooperación de los líderes de la comunidad.
El GC también desarrolla un enfoque unificado y coordinado en la planificación de la respuesta de emergencia. Este grupo está integrado por miembros de las tres partes interesadas que son influyentes y entusiastas de la mejora en la seguridad de la comunidad y el medio ambiente.
CNP+L
Centro Nacional de Producción más Limpia

Appendix F: Forum Documents- Invitation

Ayudar a las personas a prevenir, prepararse y responder adecuadamente a los accidentes y emergencias.

Taller de APELL

Señora:
Lic. Akira Hidalgo
Asesora Técnica, CNP + L. San José

Estimada Señora:

Por este medio reciba un cordial saludo, y con todo respeto está cordialmente invitada al taller APELL, que será realizado en coordinación entre la Municipalidad de Santo Domingo, Centro Nacional de Producción más Limpia (CNP + L), y la Asociación Domingueña de Gestión Ambiental (ADOGA).

APELL significa Concientizacion y Preparacion para Emergencias a Nivel Local, y fue desarrollado por el programa PNUMA de las Naciones Unidas, para mitigar los daños de las emergencias tecnológicas. Los principales objetivos del programa es evitar la pérdida de vidas y bienes, y garantizar la seguridad ambiental en la comunidad.

Para lograr esto, el programa busca incrementar el conocimiento en la comunidad acerca de los riesgos y peligros en el área y desarrollar, sobre la base de esta información, planes coordinados de respuesta a emergencias. Hoy en día, el programa está siendo implementado con éxito en más de treinta países. Las metas y los detalles del proceso APELL y la importancia de su establecimiento en Santo Domingo se discutirán en el taller.

El taller "APELL Santo Domingo", se llevará a cabo el día **jueves 9 de diciembre del 2010, a la 1:30 pm en la Biblioteca Municipal de Santo Domingo "Isaac Felipe Azofeifa".**

Esperamos contar con su valiosa presencia en esta actividad, la cual permitirá aprender sobre el programa APELL, y su aplicación en Costa Rica.

Para confirmar su asistencia, al teléfono 2244-011, ext. 117 Departamento de Gestión Ambiental de la Municipalidad de Santo Domingo, o al correo electrónico apell@wpi.edu, antes del día martes 7 de diciembre a las 4:00 pm.

Se suscriben, atentamente

Raúl Isidro Bolaños A.
Alcalde Municipal

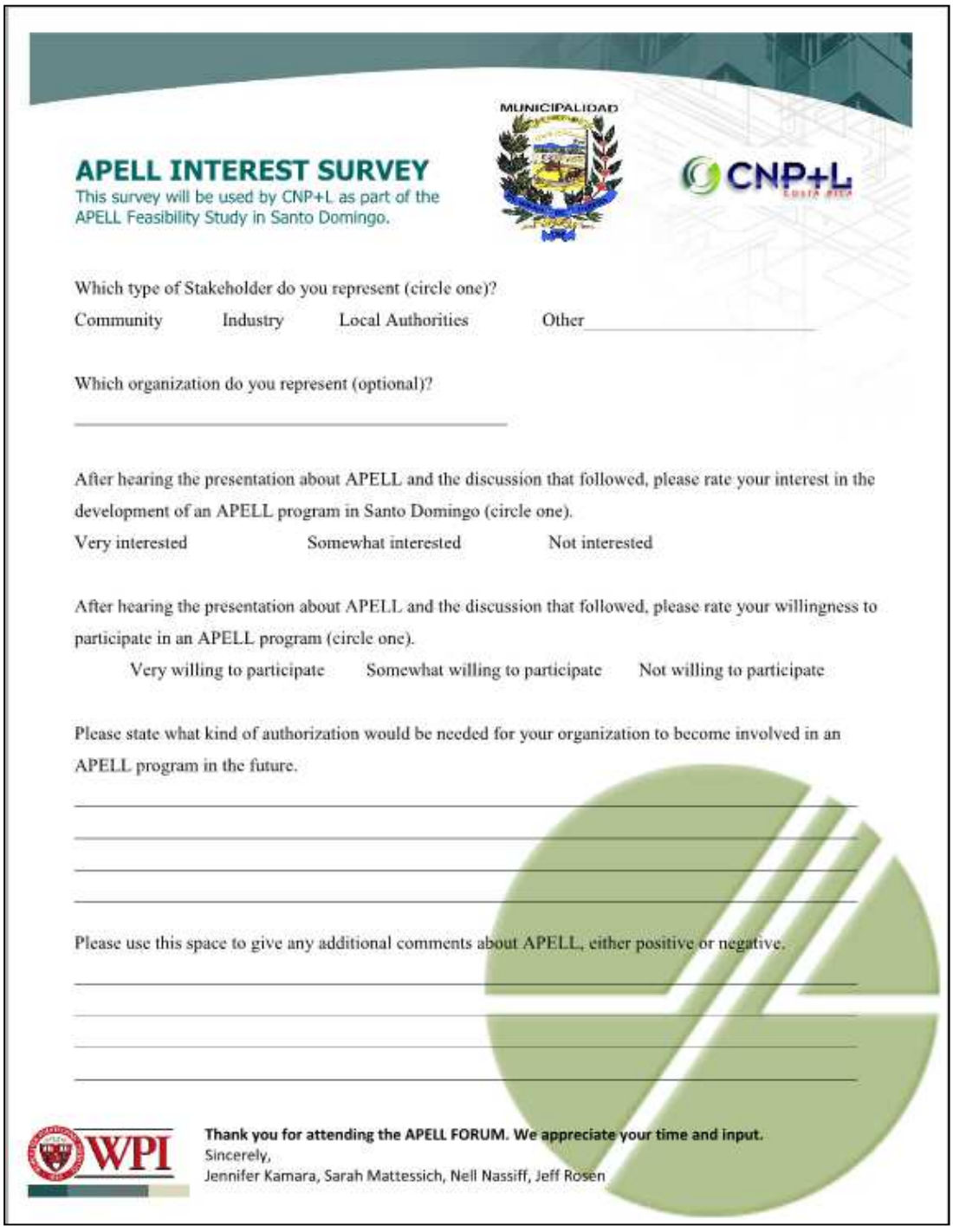
Ana V. Chacón
Presidente, ADOGA

P/ Equipo de Promoción de APELL
Instituto Politécnico de Worcester, MA. USA

ADOGA CNP+L WPI

Appendix G: Forum Documents-Survey

English



MUNICIPALIDAD

APELL INTEREST SURVEY

This survey will be used by CNP+L as part of the APELL Feasibility Study in Santo Domingo.

CNP+L

Which type of Stakeholder do you represent (circle one)?

Community Industry Local Authorities Other _____

Which organization do you represent (optional)?

_____

After hearing the presentation about APELL and the discussion that followed, please rate your interest in the development of an APELL program in Santo Domingo (circle one).

Very interested Somewhat interested Not interested

After hearing the presentation about APELL and the discussion that followed, please rate your willingness to participate in an APELL program (circle one).

Very willing to participate Somewhat willing to participate Not willing to participate

Please state what kind of authorization would be needed for your organization to become involved in an APELL program in the future.

_____

_____

_____

_____

Please use this space to give any additional comments about APELL, either positive or negative.

_____

_____

_____

_____

WPI

Thank you for attending the APELL FORUM. We appreciate your time and input.

Sincerely,

Jennifer Kamara, Sarah Mattessich, Nell Nassiff, Jeff Rosen

Spanish

MUNICIPALIDAD

CNP+L

Encuesta de interés de APELL

Esta encuesta se utilizará por CNP + L como parte del estudio de viabilidad de APELL en Santo Domingo.

¿Cual participante representa (círculo uno)?

Comunidad Industria Autoridades Locales Otra_____

¿Qué organización le representa (opcional)?_____

Después de escuchar la presentación sobre APELL y el debate que siguió, evalúe su interés en el desarrollo de un programa APELL en Santo Domingo (círculo uno).

Muy interesado Un poco interesado No interesado

Después de escuchar la presentación sobre APELL y el debate que siguió, evalúe su voluntad de participar en un programa APELL (círculo uno).

Muy dispuestos a participar Un poco dispuestos a participar No dispuestos a participar

Sírvase indicar qué tipo de autorización se necesitaría para que su organización puede participar en un programa de APELL en el futuro.

_____

_____

_____

_____

Por favor, utilice este espacio para dar cualquier comentario adicional sobre APELL, positivo o negativo.

_____

_____

_____

_____

WPI

Le agradecemos su participación en el Taller de APELL. Agradecemos su tiempo y su entrada.
Atentamente,
Jennifer Kamara, Sarah Mattessich, Nell Nassiff, Jeff Rosen

Appendix H: Interview Questions for Sr. Johnny Nuñéz

11/16/2010
Interview Questions for Sr. Johnny Nuñéz

1. What are your emergency response protocols here at the Communications Office?
2. How do you dispatch a technological emergency?
3. What specific information do you gather for the first responders to have before they arrive at the scene of the emergency?
4. Is there a hazardous material team available to respond to Santo Domingo?

Appendix I: National Emergency Commission's Aspects Included in an Emergency Plan

As defined by the **National Commission on emergencies**, **Emergency Plan**, is the product of a series of analyses, comments and evaluations planned, directed and scheduled in a document, which aims to serve as a guide to the stages of **prevention, mitigation, preparedness, response and rehabilitation** actions that must be carried out emergency or imminent disaster situations caused by the vulnerability present people, buildings and systems own nature, such as earthquakes, floods, hurricanes, volcanic activity, landslides, threats or man-made fires, spills of hazardous products and explosions.

ASPECTS THAT AN EMERGENCY PLAN SHOULD INCLUDE:

All plans shall contain general information about the company including name or business name, location, phone number, fax, number of employees, type of day, and type of activity (description of the process).

I. Stage: <u>Analysis of the Level of Threats and Vulnerability:</u>

Based on observation, reconnaissance and study of the conditions of risk which presents the center of work, both internally and externally, to determine potential hazards and situations that might be considered special in an emergency; whether its consequences or damages that may result to the people, facilities and systems. This stage allows stakeholders to count with the necessary material to propose corrective measures to address those risks. (To evaluate aspects):

I. 1. <u>External Level:</u> consists in determining the type of threats that exist in the area where is located the installation either: landslides seismic faults, vicinity of rivers or other sources of water, adjacent industrial areas, high-voltage lines and hazardous materials, deposits are considered everything what can affect the normal operation of the work center or endangering the life of its occupants.

(Should be considered in this analysis the location of the body's response or care of emergencies such as fire, Red Cross, INS and others) can still be used during an event to determine which occupy these to present times

In addition a detail of information, communication and emergency prevention procedures will include neighbors, with residences, establishments (industries, shops, services and others).

I. 2. <u>Level Internal</u>: consists of a general assessment of workplace where provided:

1.2.1 <u>Structural Conditions of Building:</u>

- State of maintenance of the structure
- Size of the building and number of floors,
- Current state of it (age or years of built)
- Characteristics of materials and techniques used in the construction.

1.2.2 <u>Conditions no structural building:</u>

- Identifying elements of construction may affect during an event such as curtains, plastering, ceilings, glass, and lamps.

- State of maintenance of electrical installations, aqueducts, gas, pipelines, tanks, boilers, furnaces.
- Analysis of offices and work space: (analyzing location and condition of machinery, equipment, as well as an analysis of the location of the personal, (permanent or temporary), if there are problems of space or overcrowding, hampered corridors as well as identify obstacles, equipment or machinery that interfere with the staff, or that may constitute a risk condition at the time an event is generated.)
- Assess location, status and capacity of doors, stairs, corridors and outputs of regular use and emergency.
- Must contemplate also greater dangers facing installation areas, as well as identify those who have greater security and that can be used as temporary areas or slip.
- Conditions of storage of hazardous materials, characteristics of products stored, controls and equipment used to handle emergencies.
- Analysis (quantity, status, type, or class, location and accessibility) conditions of fire protection equipment (fire extinguishers, hoses, pumps, hydrates, sources of water, rescue and first aid, alarm, emergency exits, emergency stairs teams security zones.) Indicate the fire prevention measures implemented by the company or determine those to be implemented, the brigades (number and characteristics of the same) and any other material support.

II Stage: Administrative Organization of the Emergency:

Components and functions of the emergencies Committee, which is the structure responsible for coordinating the implementation of activities carried out before, during and after the emergency or disaster is the organization implementing.

- Indicate the Emergency Committee as it is composed.
- Indicate name Coordinator, owners or manager's brigades and anyone else who needed that Committee must have the approval and support management, with their roles and responsibilities adequately detailed for each of the stages of an emergency.
- Append rapid response plans: in these documents shall indicate the procedure to be put in groups or teams whereas **prevention and combat of fire brigade**, **first aid**, **Security**, **evacuation and rescue** and **rehabilitation and evaluation** respectively run and shall include all three stages already mentioned.
- Indicate the training Committee and the respective emergency brigades with their respective work timetables.

III. Stage: Plan of Evacuation and Rescue:

This evacuation plan must contemplate or consider the information contained in the stage I of this guide, whereas the number of people who work or remain within the enterprise. It should be noted that the plan which then develops, is the procedure that will be deployed inside of the company, for a better guide summarizes as follows:

- Location and marking of the areas of security, indicating signals, routes of output or access to the area of security.
- Should include alternative security areas, as well as internal or external areas taking into account the type of event that is present.

- Capacity of the security zone (taking into consideration the width and position (standing or sitting) people that remain within the same).
- Indicate output paths (indicating the corridors and doors through which people accessed towards safety, fast and secure area, indicating the distribution of staff that will circulate by them). Identify distances to walk and the conditions in which these paths will be taken either as they would be at the time of an event. You must be shown by arrows, movement or flow of people, determining their journey from their own work or site that deals with until you reach the security zone.
- Dangerous as boilers, wineries (production or raw), fuel, areas signage rooms machines, etc., as establishes it the law in this field.
- Reaction to the warning signal: (must indicate the type of signal that will be used to activate the plan evacuation, at what time and how it will work the same at the domestic level of the industry.)
- Type of alarm that will use the firm to publicize the alert level of the community or area neighboring the establishment, (please coordinate with the Local Committee of emergencies or with the national emergency Commission).
- Indicate the type of actions that the company carried out for supplying information preventive and directed to persons located within the building too temporarily or eventually.
- Indicate total evacuation of the building, and respective exits from different offices or jobs (in those cases where you have already made mock) organization time.
- Identify the range of protection which will be implemented during an emergency care considering hours both diurnal and nocturnal.
- **Sketch Design:** company must have a sketch or enterprise level design which is graphic above so that the diagram is exposed inside of the plant in different sectors and ensure that workers and people that frequent the same familiar with it and that can be simultaneously used by fire, Red Cross and any others who provide help during emergency.
- Will be included in this sketch of possible location external plant with its communal location considering location, distances and sources of aid (Red Cross, fire, INS, Emergency Committee, location of water sources, hydrants, among others) travel time pointing out the radius of action that will be deployed, as well as phone numbers to use during the event.

VI. Stage: **Evaluation of the Plan**:

- Description of types of evaluation that will be used to determine the functionality, scope and limitations of the emergency plan, as well as determine the case corrections.
- Description of the actions carried out for the rehabilitation and reconstruction of the services.
- Work schedule (where you enter the following dates for packaging and repairs carried out; in order to minimize the vulnerability of installations, acquisition and installation of equipment or systems needed to deal with an emergency situation and any other action or activity arising from the evaluation performed.)

Appendix J: Forum Documents- Attendance List

ADOGA

ASOCIACIÓN DOMINGUEÑA DE GESTION AMBIENTAL
CÉDULA JURIDICA: 3-002-561327

REUNIÓN COMITÉ DIRECTOR PMGRS
CHARLA RIESGO TECNOLOGICO

09 DICIEMBRE 2010

NOMBRE	INSTITUCION
Ana Virginia Chacón Solano	Area Salud, Sto Dgo
Verónica J. Solano Cavalla	Area Rectoría Salud Sto D.
Ximena Rodríguez Carmiol	Universidad de Costa Rica
[illegible]	Municipalidad
Monserrath Núñez	Estudiante
Johnny Núñez S.	Bomberos
Luis Diego Robi B.	Muni Sto Domingo
Marianella Ruiz Arguedas	Ministerio de Salud
Carlos M Pereira Heinrich	CNPIL
Walter Zavala Ortega	MINAET
Joaquín Ramos de [illegible]	Discoramo
Ricardo Elizondo García	Discoramo
Alvaro Hidalgo Segura	CNP+L
[illegible]	Municipalidad
Randall Madrigal A.	Municipalidad S.D.
[illegible]	WPI
[illegible]	WPI
[illegible]	WPI
Jeff Roso	WPI
[illegible]	WPI

Appendix K: Contacts, Organizations, etc.

Name		Organization	Title
Nuria	Bolaños	3M	Chemical Advisor
Akira	Hidalgo	CNP+L	Secretary
Sergio	Musmanni	GTZ	Main Advisor at GTZ, President of the College of Chemicals, former director of CNP+L
Johnny	Nuñéz	Bomberos de Santo Domingo (Comunicación)	
Carlos	Perera	CNP+L	President
Lilliana	Rivera	Ministerio de Salud	
Javier	Rodríguez	ADOGA	Civil Engineer
Luís Diego	Rubí	Municipio de Santo Domingo, ADOGA	
Marinela	Ruíz	Ministerio de Salud, ADOGA	
Walter	Zavala	MINAET	

Name	Acronym
Asociación Dominigueña de Gestión Ambiental (The Domingan Association of Environmental Management)	ADOGA
Bomberos Communications Center	
Bomberos of Santo Domingo	
Colegio de Químicos (College of Chemicals)	
Comisión Nacional de Emergencias (National Emergency Commission)	
El Centro Nacional para la Producción Más Limpia (The National Cleaner Production Center)	CNP+L
Ministerio de Ambiente, Energía y Telecomunicaciones (Ministry of Environment, Energy, and Telecommunications)	MINAET
Ministerio de Salud de Santo Domingo (Ministry of Health of Santo Domingo)	
Secretaría de Coordinación para la Gestión de Sustancias Químicas (Secretariat for the Management of Chemical Substances)	
Sub-Comisión de Emergencias Tecnológicas (Sub-Committee for Technological Emergencies)	
The Deutsche Gesellschaft für Technische Zusammenarbeit (German Development Cooperation Agency)	GTZ

Appendix L: Map of Santo Domingo