10 de diciembre de 2008

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Estimado Ingeniero Esteban Ramos González,

El presente es nuestro informe que se llama "La Evaluación y el Plan de Manejo de Desechos Sólidos en el Cuerpo de Bomberos de Costa Rica." Fue escrito en el Instituto Nacional de Seguros desde el 21 de octubre hasta el 10 de diciembre del 2008. El trabajo preliminar fue iniciado en Worcester, Massachusetts, antes de llegar a Costa Rica. Estamos emitiendo simultáneamente una copia de este reporte a Profesoras Susan Vernon-Gerstenfeld y Isa Bar-On para la evaluarla. Después de la revisión por la facultad, la copia original de este reporte se catalogara en la Biblioteca Gordon en Worcester Polytechnic Institute. Le agradecemos el tiempo que usted y el Departamento de Ingeniería nos han dedicado.

Nos gustaría agradéceles por esta gran oportunidad y la excelente experiencia que tuvimos. Valoramos mucho el compromiso que ustedes nos han demostrado especialmente, William Hidalgo, y otros con nuestro proyecto.

Muy atentamente,

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WORCESTER POLYTECHNIC INSTITUTE – December 10, 2008

EVALUATION AND SOLID WASTE MANAGEMENT PLAN FOR EL CUERPO DE BOMBEROS

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This project report is submitted in partial fulfillment of the degree requirements of Worcester Polytechnic Institute. The views and opinions expressed herein are those of the authors and do not necessarily reflect the positions or opinions of Benemérito Cuerpo de Bomberos de Costa Rica or Worcester Polytechnic Institute.

This report is the product of an education program, and is intended to serve as partial documentation for the evaluation of academic achievement. The report should not be construed as a working document by the reader.

ABSTRACT

The goal of this project, conducted for el Cuerpo de Bomberos, was to identify the processes within the fire stations that negatively impact the environment and provide recommendations to reduce this impact. We evaluated fifteen fire stations through visits and interviews using a system provided by MINAE to assess environmental impact within the organization with respect to solid waste management. Based on this information, we made recommendations to improve their waste management to increase protocol scores and decrease the environmental impact of the Bomberos. The fire stations of the Bomberos of Costa Rica can use these recommendations to create a recycling program to minimize the amount of waste generated and comply with the pending law mandating recycling in Costa Rica.

AUTHORSHIP PAGE

As confirmed by the signatures below, each section of this report is comprised of the collaborative efforts of Katelyn Perkins, Alyssa Vincent, and Felicia White. All three students have equally participated in the creation, development, and editing of each section.

Katelyn Perkins _____

Alyssa Vincent _____

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EXECUTIVE SUMMARY

Throughout the world, solid waste management has become a growing environmental concern. Landfills, which are the most common waste disposal method, are becoming saturated in Costa Rica. Despite decreasing space in landfills, communities do not want to allow the building of new landfills and the government is attempting to conserve land for parks and recreational areas rather than using the area for landfills. The National Fire Department of Costa Rica, el Cuerpo de Bomberos, has recognized this problem. In an attempt to lower their negative environmental impact and reduce the amount of waste they send to landfills, they have begun to revise their waste management plan to be more environmentally conscious. We worked with the Bomberos to expand upon this plan by creating a recycling program which they will apply to their sixty three fire stations.

The fundamental goals of this project were to identify the processes within the fire stations that negatively impact the environment and to provide recommendations to reduce this impact considering the unique obstacles of waste management in a fire station in Costa Rica. To accomplish this, we had the following objectives:

- Evaluate the current level of environmental impact of the fire stations of el Cuerpo de Bomberos utilizing the Protocolos de Evaluación Ambiental.
- Design a plan for waste reduction by all stations to fulfill the laws outlined in the protocols to improve their score.
- Estimate the reduction of negative environmental impact as measured by the protocols as a result of successfully implementing our recycling plan.

We visited fire stations and evaluated them using the Protocolos de Evaluacion Ambiental. From this information, we were able to determine which areas of waste management

needed the most improvement. These areas would then become a major focus of a recycling program that would be designed for the Bomberos.

After a thorough analysis of our data, we determined the following results:

- In general, compliance with the topics covered in the protocols is good. Each sampled station had an average percent compliance above 60 percent, with an overall compliance of 74.2 percent.
- Recycling within fire stations is more prevalent when they are located in communities that recycle. One quarter of the stations visited have a recycling program and of these, 75 percent are located in a community with a recycling program.
- A majority of stations scored low in protocol questions related to hazardous waste. For stations that currently recycle, protocol score could improve for three waste management questions centered on the topic of storage and separation of hazardous materials.
- Average percent compliance of the waste management questions will improve when a recycling program is implemented. An increase in protocol scores and greater compliance to environmental laws will result in a decrease in negative environmental impact. When recycling is utilized, stations improve their protocol scores.
- The Bomberos are enthusiastic to participate in a recycling program and to involve the community in their recycling initiative.

The final facet of our project was to develop a recycling program that could be used throughout the sixty three fire stations in Costa Rica. We used the San Francisco Fire Department as a model for the plan, using valuable information gained through interviews and research (See Appendix F for an interview summary). We determined that education accompanied by increased convenience, prompting and reminding, feedback on participation,

and the use of incentives would be most successful. To increase participation throughout the Bomberos, we designed posters, receptacle labels, and pamphlets which will serve as information sources and reminders to the Bomberos. Additionally, we determined that competitions among stations would be particularly successful in motivating and teaching the Bomberos to recycle.

The final products of our project all aim to promote improved waste management practices within the fire stations of el Cuerpo de Bomberos, thereby decreasing the amount of waste disposed of in landfills and their negative environmental impact.

CHAPTER ONE: INTRODUCTION

Over two billion tons of municipal solid waste were produced globally in 2006 (Key Note, 2007). Despite this surprising statistic, solid waste has not been a priority of public health and safety in most communities until recently (Pitchel, 2005; Warith, 2003). Concern is rising as municipal solid waste increases and waste disposal comes to the forefront of community concerns. Keynote (2007) predicts a rise in waste of as much as 37.7 percent from 2007 to 2011. This can be attributed to global population growth and increased wealth and development, emphasizing a greater need for proper waste disposal. Common methods of waste disposal are recycling, incineration, and landfilling. Landfilling is the simplest, most used, and often easiest method to dispose of large amounts of waste, but there are environmental concerns associated with this practice. Older landfills are being shut down due to overflow and sanitation concerns. In addition, communities are hesitant to open new landfills because of the environmental responsibilities associated with them. As a result, many communities struggle to find places to dispose of their waste.

Methods to dispose of waste in communities around the world are often not sustainable. Consequently, many communities are facing the problem of overflowing landfills. Part of being environmentally conscious is reducing waste. However, as countries such as Costa Rica grow and develop, waste production increases. Increasing waste in Costa Rica must be disposed of properly, whether it is placed in landfills or other alternative waste disposal techniques are implemented. According to the United Nations Statistics Division (2007), each year Costa Ricans throw away an estimated 428 kg of waste per person (2002) compared to 676 kg (2005) in China and 747 kg in the US (2005). Although Costa Ricans have less waste than the US and China, they are still experiencing problems with waste disposal. McPhaul (2007) claims that in

addition to limited recycling practices in Costa Rica, waste is frequently disposed of in saturated landfills, presenting an additional waste management concern. McPhaul (2007) illustrates this by claiming that three hundred tons of waste are thrown away every day into rivers and vacant lots.

At the present time, Costa Rican landfills adequately contain the waste produced by the country. However, as the population grows and available land space diminishes, waste disposal will become a larger concern. As a national organization committed to protecting the community, el Cuerpo de Bomberos, the National Fire Department of Costa Rica, is aware of this problem and would like to act as a role model for other organizations. Its mission is to assess and reduce the negative impact that its sixty-three fire stations have on the environment. Thus far, the Bomberos, headed by fire fighter William Hidalgo, have begun a preliminary environmental assessment of a sample of five stations.

In order to minimize the impact of the fire stations on the problem of overflowing waste, the Bomberos want to design a program based on Costa Rica's 5R's: Reduce, Reuse, Recycle, Refuse (refuse to buy products that could harm the environment), and Responsibility (Serrano Mora, 2008). This recycling program must be appropriate for their stations considering the military-esque structural organization and uncommon materials that must be disposed of as well as the cultural context of Costa Rica. The concept of recycling is relatively new to Costa Rica. As a result, the rapidly changing state of recycling in the country, including new recycling facilities and methods, must be accounted for.

In order to reduce their negative impact on the environment, the Bomberos need to assess their current environmental performance by collecting and analyzing information in the following areas: requirements and methods of recycling in Costa Rica, location of recycling

facilities in Costa Rica, and successful recycling models of other organizations within Costa Rica and other countries.

The goal of this project was to identify the processes within the fire stations of the Bomberos that negatively impact the environment and to provide recommendations to reduce this impact considering the unique obstacles of waste management in a fire station in Costa Rica. In order to reduce this impact, we worked with the Bomberos to begin planning a revised waste management program that includes a recycling program which is applicable to the sixty three fire stations. The objectives of our project were to utilize the Protocolos de Evaluación Ambiental provided by the Ministry of Environment and Energy and Paz con la Naturaleza in Costa Rica to assess environmental performance, to design a plan for waste reduction by all stations to fulfill the laws outlined in the protocols, and to estimate the reduction of negative environmental impact as measured by the protocols as a result of implementing a recycling plan. The main methods of accomplishing these objectives were to examine other recycling models as well as to use the provided protocols to quantify environmental impact. Since the protocols are a tool to assess environmental performance, compliance with them is an indication of environmental performance. These protocols cover a wide range of environmental topics but they do not cover all areas of environmental performance. As a result, it is possible for an organization to comply with the protocols and still have a negative environmental impact. Despite this, the Bomberos are using the protocol assessment as a means of measuring their environmental impact. By combining the information gathered from research and the protocols, the Bomberos will be able to develop a recycling plan to reduce their environmental impact.

CHAPTER TWO: BACKGROUND

The following section discusses issues that provide the context necessary to understand our project with el Cuerpo de Bomberos. We outline the use and problems of landfills including the diminishing space available to dispose of waste in Costa Rica. This section also examines recycling practices in Europe and possible applications of them to Costa Rica. In addition, this section discusses current waste management practices in Costa Rica and the impact that increasing environmental awareness has on policy and practices. This growing environmental awareness has led to a national interest in implementing a mandatory recycling program in Costa Rica that directly affects the Bomberos.

LANDFILLING WASTE MANAGEMENT

Until recently, solid waste was not a global priority in relation to public health and safety, (Pitchel, 2005) but waste has become a primary global issue in recent decades due to increases in population and waste production (Warith, 2003; Pitchel, 2005). Key Note Publications Ltd is a well-established business information company that published Global Waste Management Market Assessment 2007, a report analyzing municipal solid waste globally. According to Key Note Publications (2007), the municipal solid waste produced globally in 2006 reached 2.02 billion tons and is continuing to grow every year. Key Note (2007) identified another trend correlating increasing wealth with greater waste production per capita. This means that as countries in Central America, such as Costa Rica, grow and develop, they produce greater amounts of waste. All of this waste needs somewhere to be disposed of and it often ends up in landfills.

Although landfilling is the simplest, most used, and often easiest waste disposal technique, there are many problems associated with it. Landfills are used in almost every

community to dispose of waste, but there are many environmental concerns. Most environmental complications associated with landfills are due to the decomposition of waste and the resulting pollution of the environment. This includes the emission of methane and CO_2 gases as well as leachate, or garbage juice, which pollute air and groundwater when allowed to escape landfills (Kumar, 2005; Lee & Jones-Lee, 2004). These complications foster a negative public view of landfills and in turn make it more difficult for communities including those in Costa Rica to build new landfills, even as older ones are being closed. As landfills are filling up and their availability is decreasing, the issue becomes where to put waste if it cannot be placed in a landfill. While exploring the Bomberos' motivations for beginning a recycling program, we see that on the highest level, it is because of a national waste management problem.

It is beneficial to examine Puerto Rico's waste problem to better understand motivations to change waste management programs and to then apply these ideas to the design of a waste management program for the Bomberos. The situation in Puerto Rico demonstrates how overflowing landfills can become an immediate concern because as landfills are closing on the island, there is no available land to place new ones. The analysis of Puerto Rico's waste management illustrates that recycling is a useful approach to combat the landfill problem. Costa Rica is in a similar situation because landfills and dumps are being shut down due to lack of space or environmental contamination and communities do not want to build new ones.

Puerto Rico and Costa Rica illustrate that an alternative to landfill disposal is needed. Key Note (2007) predicts that municipal solid waste disposed of throughout the world will increase by 37.7 percent from 2007 to 2011, emphasizing the need for a solution to the disposal challenge today so that we may prepare for the future. One effective way to decrease landfill space is to increase recycling efforts and efficiency (Key Note, 2007; United Nations, 2008).

Costa Rica's landfills are not only filling but they are inadequately monitored on top of poor recycling participation. According to UN statistics, each year Costa Ricans throw away an estimated 428 kg of waste per person (2002). As a result, approximately 1,280,000 tons of waste were collected in Costa Rica in 2002. The question has become, where does all the waste go? Fifty-three percent of the landfills in Costa Rica are not modern sanitary landfills; instead they are open dumps that often can cause environmental harm such as groundwater contamination (Pan American Health Organization, 2005). According to McPhaul (2007), not only are saturated landfills a problem in Costa Rica but three hundred tons of waste are thrown away every day into rivers and vacant lots. Due to poorly managed and monitored landfills in Costa Rica, waste poses a serious threat to the health of Costa Ricans (EnPower CR, 2006). This is a concern for a country that is trying to minimize its environmental impact and maintain a high quality of life for its citizens.

Not only do new sanitary landfills cost money, they also carry a stigma of not being a valuable use of land, being unsanitary, and hurting the environment (EnPower, 2006). These factors make it more difficult to build new landfills in Costa Rica. In addition, recycling is not at the level that it could be and consequently landfills are filling up with recyclable goods. The Bomberos have the opportunity to help decrease not only their own impact on the environment by recycling more and throwing away less, but they can also help Costa Rica as a whole reduce its landfill use.

RECYCLING AS A WASTE MANAGEMENT TECHNIQUE

European Environmental Awareness

Over the years, recycling has become part of daily life in countries throughout the world. Globally, several of the leading countries in recycling are located in Europe (Allen, 2005). The

European organization, Friends of the Earth (2008), states that the leading examples of these are Switzerland and Austria, two countries that recycle up to 60 percent of their total waste. Supporting this study, the most recent Environmental Performance Index (EPI) shows these countries ranked in the top ten with Switzerland being number one (Yale University Office of Public Affairs 2008). The EPI scorecard, jointly created by environmental experts at Yale University and Columbia University, ranks countries based on six categories, including environmental health, quality of air, and productive natural resources (2008). Costa Rica ranks fifth in the world and number one in Central America (Yale University Office of Public Affairs, 2008). Though Costa Rica ranks high in environmental successes, much can be learned from the four European countries ranked above it.

The European success in recycling has been studied extensively. One such study showed that if the government or managers of a company are invested in recycling, the rest of the country or organization is more apt to participate as well (Guerin, Crete, Mercier, 2001). This is applicable to the Bomberos who will need upper management support and participation to be able to successfully implement a recycling program. The study also showed that people are more likely to recycle if they fully understand the benefits of their actions in relation to their lives and the lives of their families (Guerin, Crete, Mercier, 2001). The valuable information gained from these European studies can be taken into account when implementing similar plans in other countries, such as Costa Rica.

Recycling Initiatives in Costa Rica

Oscar Arias' support of environmental preservation and awareness is evident in the many speeches he has made and actions he has taken for his country (Dilip Mirchandani, 2003). Arias confirms that Costa Rica has been recognized several times for pioneering efforts to conserve the

environment, including Arias' green revolution and laws to require recycling (2007b). Though Costa Rica leads the way in recycling efforts in Central America, Arias also recognizes the flaws in its system, speaking of the inadequacy of the country's solid waste management system (2007b). Recently, he outlined four environmental goals for his country to decrease and eventually eliminate this inadequacy, including an order for all state institutions, including el Cuerpo de Bomberos, to create an environmental plan (2007a). Thus, el Cuerpo de Bomberos has enlisted us to design a plan to reduce its fire stations' contribution to waste.

Arias also encouraged the "greening" of public administration, including action plans toward energy use and improvement of waste management (2007b). A major step to complete this plan includes legislation that would make recycling mandatory throughout Costa Rica. Although it has not yet been enacted, this legislation was presented to the National Assembly in March of 2008 (Alfaro, 2008). This regulation would apply to both households and businesses, including el Cuerpo de Bomberos, and requires the separation of recyclables from other waste. A system of fines would be established to counter noncompliance (Baxter-Neal, 2008).

Recycling Concerns in Costa Rica

A limited capacity for the Bomberos' recyclables could be a potential concern for the Bomberos and Costa Rica as a whole. Mandating recycling in Costa Rica raises the issue of an influx of materials to recycling facilities that are unprepared and possibly ill-equipped. Large organizations such as el Cuerpo de Bomberos and Parque de Diversiones will begin recycling large quantities of paper, plastic, and glass within months of each other (Cinthia Navarro, Personal Communication, November 23, 2008), potentially flooding recycling facilities in the area. A more tangible concern is that only one facility exists in all of Costa Rica that accepts

tires and batteries (Redcicla, 2008). This could potentially affect the tire recycling efforts of el Cuerpo de Bomberos.

The United Kingdom, though a territory with successful recycling, has already encountered similar issues concerning the capacity to recycle certain materials. Due to insufficient facilities to collect and recycle glass in the UK, it is possible that there will be an overflow of glass bottles that cannot be recycled (Allen, 2005). Although it is not yet a problem in Costa Rica, precautions must be taken to avoid recycling capacity problems like those in the UK.

IMPLEMENTING A RECYCLING PLAN

Although there have not been any studies conducted in Costa Rica to explore the social and educational aspects of implementing a recycling plan, numerous studies have taken place in both Europe and the United States. Much of what can be learned from these studies pertains to recycling programs in Costa Rica, but it is possible that some cultural differences exist.

Social Aspect of a Recycling Plan

For any waste management program, recycling requires a change in waste disposal behavior. This change is often the largest obstacle hindering the success of a program. According to Nigbur, Lyons, Uzzell, and Muckle (2005), recycling behavior is influenced by six major aspects of a recycling program: increased convenience, offering rewards, prompting and reminding, committing residents, setting targets, and giving feedback on participation. In corporate settings, increased convenience, consistent prompting and reminding, and feedback are often the most successful tools to encourage this change. Bacot, McCoy, and Plagman-Galvin (2002) expand upon this concept, stating that commercial participation may increase with outreach efforts that identify and elaborate on these concepts. By following this model, the

Bomberos can increase overall participation and actively change waste disposal behavior of the firefighters. Increased convenience, prompting and reminding, and providing feedback on participation will be especially important when implementing a recycling program for the Bomberos.

The age of recycling participants is also a factor correlated with waste disposal behaviors. According to Mannheim (1952), the younger generation is less threatened by changes in traditional values than the older generation and more likely to have a favorable attitude towards social problem solving. Malkis and Grasmick (1977) explain that this may be because the younger generation is less integrated into the dominant social-economic order than the older generation. Hamilton (1985) agrees, stating that in the study he conducted, younger participants were more concerned about environmental problems than older participants and therefore they more readily engaged in recycling. This correlation is attributed to the creation of recycling education within schools to encourage increased recycling in a community. According to William Hidalgo, a firefighter responsible for beginning the Bomberos' environmental plan, the average age of Costa Rican firefighters is between thirty and thirty five. He claims that firefighters near this age and younger have most likely been exposed to environmental topics during their preliminary schooling and are therefore more likely to actively participate than older fire fighters.

Education as Part of a Recycling Plan

Educational programs are established in conjunction with recycling programs to encourage behavioral change and increase participation. According to Vining and Ebreo (1990), people who recycle are better informed about which materials are recyclable, where these materials can be recycled, and are more aware of the benefits for the environment than those who

do not recycle. Oskamp, Harrington, Edwards, Sherwood, Okuda, and Swanson (1991) agree with Vining and Ebreo, stating that all three of these aspects must be considered in order to assure the effectiveness of a recycling program. However, they go on to suggest that recycling behaviors may be more related to knowledge of the details of the recycling program rather than to global environmental issues. From this information, it is evident that the Bomberos' recycling education must include information that focuses on aspects of the recycling program rather than larger scale issues. The educational resources must include a list of materials that can be collected and recycled and the locations of the recycling receptacles must be clearly indicated. This will ensure that the Bomberos will be able to quickly, easily, and efficiently dispose of recyclable materials.

According to the Professional Recyclers of Pennsylvania (2008), education programs must be appropriate for the targeted audience. Incentives and competition can also be employed to increase participation. However, according to Nigbur, Lyons, Uzzell, and Muckle (2005), participation is often limited to the duration of the incentive.

The San Francisco Fire Department, consisting of forty three fire stations, established a recycling program four years ago to collect glass, aluminum, and plastic (Velasco, S., & Kass, L., 2004). According to Tania Fokin, Public Relations Representative of the San Francisco Fire Department (Personal Communication, November 6, 2008), every firefighter attended a one-day training program to introduce the basics of the recycling program and review what materials were accepted for collection. When the recycling coordinator visited each station, posters and other materials were also provided as reminders. Emails are periodically sent to reinforce the key aspects of the program and ensure city-wide participation. The coordinator is in the process of organizing a competition among the stations to determine which stations have the highest

recycling rates. Although she is aware that participation may increase only during the duration of the competition, it is expected that constant reinforcement will aid in the future success of the program. The sixty three fire stations in Costa Rica are organized in a similar fashion to those in San Francisco, and thus this reinforcement technique can be adopted by the Bomberos.

Unique Organizational Structure of el Cuerpo de Bomberos

The fire stations of the Bomberos are organized into a military hierarchy similar to that of the San Francisco Fire Department. This top-down structure must be taken into account in order to design a successful recycling program. Within the San Francisco Fire Department, a general order was submitted by the Chief of the Department that required participation in the recycling program. According to Tania Fokin (Personal Communication, November 6, 2008), this order officially must be carried out, but there is no way to determine if the order is followed on an individual level. To encourage participation, the chiefs attended the recycling trainings along with the firefighters and actively participate in the program.

In general, authoritarian structure forces compliance, but participation in a recycling program relies upon individual behavior. How an individual acts in this setting is beyond the scope of our research. While the success of the San Francisco stations might be applicable to the Bomberos, we cannot at this point predict the success of a recycling program at an individual level.

CHAPTER THREE: METHODOLOGY

The goal of this project was to identify the processes within the fire stations of the Bomberos that negatively impact the environment and to provide recommendations to reduce this impact considering the unique obstacles of waste management in a fire station in Costa Rica. We established the following objectives to accomplish our goal:

- Evaluate the current level of environmental impact of the fire stations of el Cuerpo de Bomberos utilizing the Protocolos de Evaluación Ambiental.
- Design a plan for waste reduction by all stations to fulfill the laws outlined in the protocols to improve their score.
- Estimate the reduction of negative environmental impact as measured by the protocols as a result of successfully implementing our recycling plan.

EVALUATE CURRENT LEVEL OF ENVINRONMENTAL IMPACT

The "Protocolos de Evaluación Ambiental" is an evaluation developed by the Ministerio del Ambiente (MINAE) y Energía and Paz con La Naturaleza in 2007 to assess compliance with environmental laws. It was important that we first read the protocols and determined why they were made, by whom, and based on what information to gain a better understanding of the assessment. MINAE and Paz con la Naturaleza, experts in environmental matters, collaborated to publish this evaluation based on applicable environmental laws in Costa Rica. MINAE is an agency chiefly responsible for environmental matters in Costa Rica (2008). Paz con la Naturaleza is an initiative started by President Oscar Arias which works in Costa Rica to strengthen political involvement to decrease human impact on the environment (2008).

The protocols are divided into separate topics such as Solid Waste Management and Energy Waste Consumption. Each item in a protocol received a score of -1, 0, or 1 according to

the scoring rubric provided with the evaluation. A score of -1, 0, or 1 indicated that an environmental regulation had been breached, a requirement of the protocol had not been met, or a requirement of the protocol had been met, respectively. Scores were converted into percent of compliance depending on how many items were applicable to the organization. The scores of each protocol were then examined to identify areas of concern.

Only certain protocols pertain to fire stations. We excluded those that did not pertain. For example, "Protocolo 5: Emisión de Radiacones Ionizantes" referred to the emission of ionizing radiation, which would never apply to the fire stations because they do not possess equipment that emits radiation.

The person in charge of implementation of the waste management program is fire fighter William Hidalgo. He discussed and explained to us those protocols that may apply in certain situations and how to identify when they were applicable. For instance, Protocol 17 referred to the management of hospital waste, which was only applicable to those fire stations that provide emergency medical services.

We determined current waste management practices during visits and interviews that Sr. Hidalgo arranged at fifteen sample fire stations. The sample fire stations were selected to contain rural and urban areas as well as communities that have a recycling facility and those that do not. Location and proximity to other stations were practical concerns that were also considered when choosing stations. The number of permanent fire fighters in the visited stations ranged from three to ten, representing a range in station size. Small stations contained two to four bomberos, medium stations contained five to seven bomberos, and large stations contained eight to ten bomberos.

The original number of stations to visit was set at nineteen by the Bomberos, but was decreased to fifteen because of time constraints. We were able to visit the most stations in the time allotted by visiting Guanacaste, Cartago, and Puntarenas. This sample represented one quarter of all fire stations in Costa Rica.

We presented a PowerPoint presentation in Spanish to the Bomberos at each station, followed by a brief follow up discussion and a meeting with the chief of the station to complete the protocols. The presentation outlined information about the importance of recycling, the impact recycling has on the environment, and the types of materials that can and cannot be recycled. The purpose of this presentation was to introduce the idea of recycling rather than discuss the details of the program that will be created for each station. The brief discussion that followed was meant to elaborate on the possibilities of recycling in the fire station and uncover concerns and ideas of the Bomberos. The purpose of the meeting with the chief, which was conducted in Spanish by Sr. Hidalgo, was to complete the protocols as a preliminary audit of the station. This information was used to evaluate the current state of waste management within the fire station so that we could better understand what areas to address when designing the recycling plan to reduce negative environmental impact.

DESIGN A PLAN FOR WASTE REDUCTION BY ALL FIRE STATIONS

We revised the first objective of the Bomberos' preliminary waste management plan to contain information on the proper storage and disposal of recyclable goods. We added information regarding specific materials frequently disposed of in fire stations in Costa Rica. This included common materials such as paper, cardboard, plastic, glass, and aluminum, as well as hazardous materials such as tires, oil, and batteries. We included information regarding the proper disposal of these materials as well as the resulting impact on the environment.

We organized a list of recycling companies throughout Costa Rica into a spreadsheet to be used as a reference by all stations. This raw data has already been given to the Bomberos and is too large to include as an appendix. We included information on collection requirements such as sorting and transportation, items accepted, and condition of materials obtained by contacting recycling facilities and using the website redcicla.org.

ESTIMATE THE REDUCTION OF NEGATIVE ENVIRONMENTAL IMPACT

Nineteen questions in the "Protocolos de Evaluación Ambiental" pertain to waste management. We used these questions to predict a change in compliance to the protocol topics if the recycling plan was implemented at a success rate of 100 percent, 90 percent, and 80 percent. Questions that previously received a score of 0 and would now receive a score of 1 would be considered to have a higher percentage of compliance. The estimated change in score allowed us to predict the change in environmental impact; a higher protocol score suggests a decreased environmental impact.

CHAPTER FOUR: RESULTS AND DISCUSSION

This section outlines the major results of our data analysis. It is divided into four main sections: scores for applicable protocols, scores for waste management questions, estimated future increase in protocol scores, and successful methods of education and implementation of a recycling program. The applicable protocols refer to the eighteen protocols that apply to a fire station environment. Within those protocols, the nineteen questions that pertain to waste management were examined.

SCORES FOR APPLICABLE PROTOCOLS OF VISITED STATIONS

This section describes the origin of the protocols used to evaluate the fire stations as well as the waste management objective provided by the Bomberos. An analysis of the results of the protocols is also provided to examine trends in the data collected.

Origin of Protocols and Waste Management Objective

The "Protocolos de Evaluacion Ambiental" is a valuable means of evaluating environmental impact. The objectives of these protocols are to serve as a guide in evaluating the environmental impact of an organization and to identify areas that need improvement. The Ministerio de Ambiente y Energía (MINAE) and Paz con la Naturaleza, experts in environmental matters, collaborated to publish this evaluation in 2007 based on applicable environmental laws in Costa Rica. MINAE is an agency chiefly responsible for environmental matters in Costa Rica (2008). Paz con la Naturaleza is an initiative started by President Oscar Arias which works in Costa Rica to strengthen political involvement to decrease human impact on the environment (2008). Of the thirty one protocols, eighteen applied to a fire station environment (see Appendix H for a list of these protocols). Each protocol has a varying number of related questions. Within these protocols, nineteen specific questions were related to waste management (see Appendix I for a list of these questions in Spanish and Appendix J for the English translation).

In their plan entitled "Plan de Gestión Ambiental," the Bomberos included objectives related to minimizing different aspects of environmental impact. The Bomberos did not focus on basic recycling information in their waste management plan. The first objective (refer to Appendix G) focused on waste management but did not contain detailed information about specific types of recyclable materials as well as methods of hazardous material storage. This possibly indicates a lack of resources and consciousness about comprehensive waste management in Costa Rica and within the Bomberos.

Analysis of Protocols from Fire Station Visits

Each station scored adequately overall according to the protocols, but there are areas in which they can improve. Figure 1 shows the average score of compliance with all applicable protocol topics of each station. Each station had an average protocol score above 60 percent. The average of all scores was 74.2 percent and the environmental impact, as assessed by the protocols, was similar in each station with no real outliers for overall compliance. These scores are adequate, but the bomberos would like to decrease their negative environmental impact by improving their protocol scores.

Figure 1: Average Percent Compliance of Applicable Protocols of Visited Stations

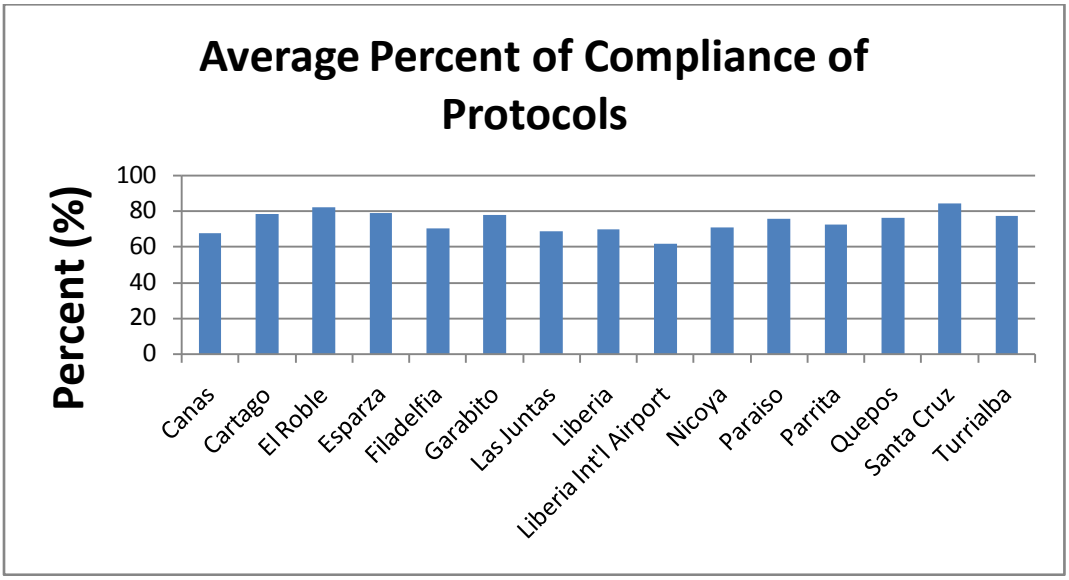


Figure 2 compares the average protocol scores from all stations with those of Santa Cruz and El Roble, the best performing stations. Most individual protocols have an average score of over 70 percent, which is relatively good compliance to all laws covered in the protocols Santa Cruz and El Roble demonstrated the highest percent compliance of 84.2 percent and 82.5 percent, respectively. Santa Cruz had 100 percent compliance of ten of the eighteen protocols while El Roble had 100 percent compliance of nine of the protocols. Both stations had 100 percent compliance for protocols 3 (vehicular emissions), 9 (odor emissions), 12 (treatment system of residual water), 16 (dangerous solid waste), 19 (prevention of natural disasters), 20 (prevention of forest fires), 21 (prevention of toxic spills), and 23 (management of hydrocarbons). As shown in Figure 2, the majority of fire stations did well on these protocols and therefore our recycling plan does not need to focus on these topics.

Figure 2: Comparison between Average Percent Compliance of All Applicable Protocols

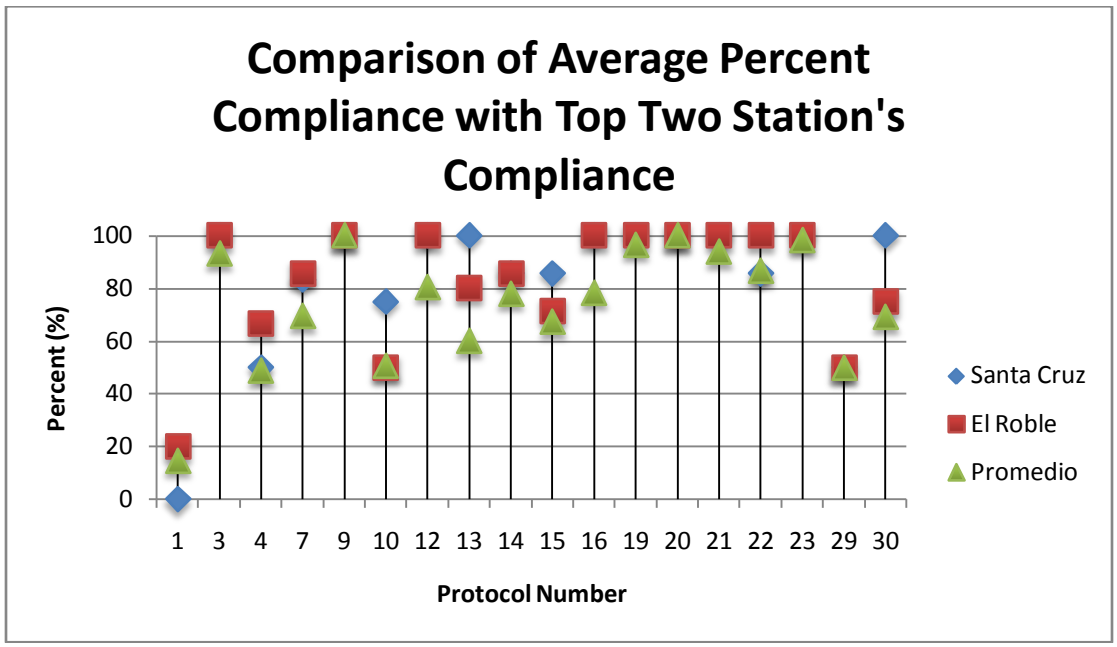


Figure 2 also illustrates that the protocols Santa Cruz and El Roble scored low on are the same as those protocols that score low overall. Without the four lowest scoring protocols, the overall score would be closer to 85 percent, which is much higher than the current 72.4 percent. This shows that the low scoring protocols lowered the average percent compliance. The low scoring protocols were: Protocols 1 (general questions), 4 (noise control), 10 (quality of potable water), and 29 (cultural and archaeological resources). These protocols are not weighted for importance and are not a concern for a plan focused on waste management. All stations scored lowest on Protocol 1, which covers general questions about employee commitment, knowledge, and comprehension of environmental impact. Additionally, each station received a score of 0 within Protocol 1 for the question related to reducing negative environmental impact. Analysis of the sampled stations shows that the topics covered in Protocol 1 are clearly a weakness throughout the country.

Within Protocol 4, a majority of stations received a score of 0 on the noise control question. It states that an organization needs a list of criteria for purchasing machinery that is quieter. It is possible that the Bomberos are limited in the types of machinery they can purchase and do not have the flexibility to choose quieter equipment. It is also possible that the Bomberos are not aware of the dangers of prolonged high noise levels. Each station received a score of 0 within Protocol 10, which refers to purifying water for human consumption. This score is low because there is no program established within the bomberos that requires examination of water quality.

Every station received a score of 50 percent compliance for Protocol 29, which consisted of two applicable questions. These stations received a score of 0 for the question regarding practical actions to discourage sexual harassment and promote equal opportunity for both sexes. If the discouragement of sexual harassment is not outwardly expressed, it could be possible to receive a score of 0 on this question. For this reason, this score does not indicate that sexual harassment exists in the stations or is tolerated; it merely indicates that a specific plan has not been established to discourage sexual harassment. This could be due to a lag in societal consciousness.

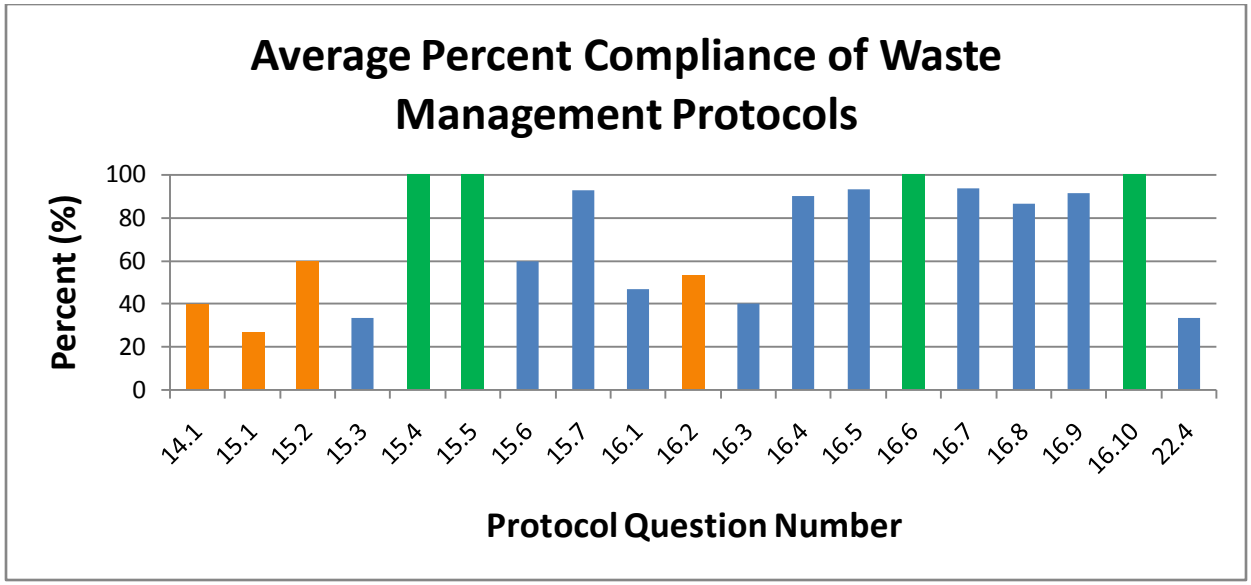
SCORES FOR WASTE MANAGEMENT QUESTIONS OF VISITED STATIONS

This section includes information on the scores of the questions relating to waste management, a comparison between the prevalence of recycling within fire stations and communities, and the relationship between the stations that scored well on the waste management questions and the stations that currently have a recycling program.

Figure 3 shows the average scores of all stations on the waste management questions. Protocol questions that scored 100 percent are represented in green. Those in orange are protocol questions that are met only by the highest scoring stations and not the lower ones.

There was 100 percent compliance by all stations in protocols 15.4, 15.5, 16.6, and 16.10. These protocols cover the following topics: identifying who is responsible for solid waste management, implementing a program of waste management, maintaining proper storage sites, and complying with the Regulations for the Management of Industrial Hazardous Waste, respectively. Since each station has a solid waste program that includes instructions for proper storage of materials and identifies someone in charge, these protocol questions were easily met.

Figure 3: Average Percent Compliance of Waste Management Protocols. Protocol questions that have 100 percent compliance are represented in green. Those in orange refer to questions that higher scoring stations comply with while lower scoring stations do not.



As shown in Table 1, protocol questions 14.1, 15.1, 15.2, and 16.2 are protocols that, with the exception of one or two stations, follow a pattern where the stations with the overall highest waste management scores comply with these protocol questions while the lower scoring stations do not (see Appendix L for the collected data). These protocols describe the recycling of waste to reduce amount sent to landfills, minimizing the purchase of materials that produce waste, reusing materials, and identifying solid waste generated to allow separation and classification (See Appendix J for a list of these protocols in English). These questions relate to the 5 R's of waste management and recycling: reduce, reuse, refuse, recycle, responsibility

(Serrano Mora, 2008). Since only the highest scoring stations complied with these topics, this shows that recycling is a focus for only stations who already have well established waste management plans. Also, the idea of recycling is still not commonly known in many areas of Costa Rica. It is possible that only the highest ranking stations have achieved these scores because the bomberos in those stations have been educated on the subject of recycling.

Table 1: Stations listed in order of increasing overall average waste management question scores

Waste Management Question Scores					
Station Name	**14.1**	**15.1**	**15.2**	**16.2**	**Overall Average Percent Compliance**
Filadelfia	0	0	0	0	52.6
Nicoya	0	0	0	0	52.6
Liberia	0	0	1	0	55.6
Liberia Int'l Airport	0	0	0	0	57.9
Quepos	0	0	0	1	57.9
Parrita	0	0	0	0	57.9
Las Juntas	0	0	0	0	58.8
Cañas	0	0	1	0	58.8
Garabito	0	1	1	1	73.7
Paraiso	1	0	1	1	76.5
Esparza	1	0	1	1	77.8
Cartago	1	1	1	1	89.5
Santa Cruz	1	0	1	1	89.5
El Roble	1	1	1	1	89.5
Turrialba	1	1	1	1	100

Four out of the six stations that comply with question 14.1 currently recycle. This question is related to the reuse and recycling of waste to reduce amount sent to landfills, Santa Cruz and El Roble are the remaining two stations that complied with this question. These stations received scores of one because they are aware of proper waste disposal. This awareness can lead to a plan for action, followed by the implementation of a recycling program.

Recycling within fire stations is more prevalent in provinces that have a greater number of communities that recycle. One quarter of the stations visited have a recycling program and of these, 75 percent are located in a community with a recycling program. Of the three provinces visited, Cartago has the highest percentage of stations that recycle. In Cartago, a recycling facility exists at the Technical University of Costa Rica. Available resources such as this increase the ease of recycling in this province, which could explain the high recycling rate among stations. As shown in Table 2, in this province, three out of four stations have implemented a recycling program and recycling programs exist in the communities of two of these stations. In Puntarenas, one out of six stations recycles and a recycling program exists in only two of these communities. None of the stations visited in Guanacaste have a recycling program and there is no community recycling.

Due to lack of community recycling, it is very inconvenient for the stations in Guanacaste and Puntarenas to recycle, and we can assume that there is limited knowledge about recycling here. In areas that do not have community recycling, there are usually limited recycling facilities and education. This lack of resources hinders the ability to create a recycling program. Also, we do not know if communities encourage fire stations to recycle or if fire stations encourage communities to recycle, but we have seen that they are linked. If community recycling facilities are located in close proximity to fire stations, they may share recycling points and therefore make recycling easier for both. For this reason, we might expect that it would be more difficult for a fire station to begin recycling without community support.

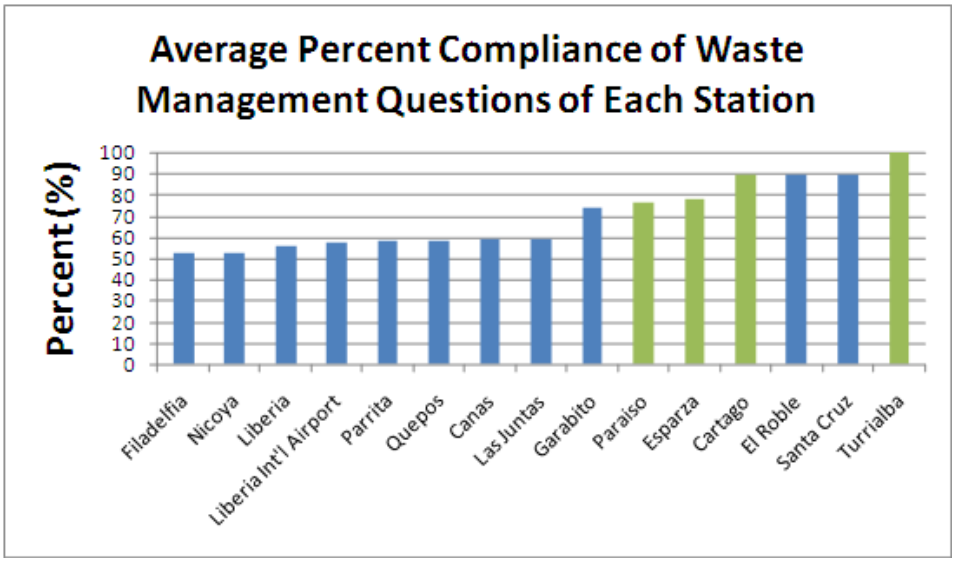
Table 2: Station and Community Recycling by Province

Station Visited	Province	Station Recycling	Community Recycling
Cartago	Cartago	yes	no
Las Juntas	Cartago	no	no
Paraiso	Cartago	yes	yes
Turrialba	Cartago	yes	yes
Cañas	Guanacaste	no	no
Filadelfia	Guanacaste	no	no
Liberia	Guanacaste	no	no
Liberia Int'l Airport	Guanacaste	no	no
Nicoya	Guanacaste	no	no
Santa Cruz	Guanacaste	no	no
El Roble	Puntarenas	no	yes
Esparza	Puntarenas	yes	yes
Garabito	Puntarenas	no	no
Parrita	Puntarenas	no	no
Puntarenas	Puntarenas	no	no
Quepos	Puntarenas	no	no

There is a correlation between protocol scores and the existence of recycling.

Recycling improves protocol scores and suggests a decrease in the negative impact on the environment. There are thirteen protocol questions that are affected by whether or not a fire station has a recycling program. As illustrated in Figure 4, four of the six stations with the highest average percent compliance of waste management questions have a recycling program.

Figure 4: Average Percent Compliance of Waste Management Questions Emphasizing the Four Stations with Recycling Programs in Green



Santa Cruz and El Roble do not recycle within their stations, but have the second and third highest average waste management percent compliance of all stations visited. Although there is no recycling within the station in El Roble, community recycling does exist in the town. El Roble still scored well on the protocols which have to do with knowledge of recycling. Santa Cruz had previously expressed interest in implementing a recycling program and acting as a drop-off center, but did not obtain permission. The chief thought that their station was too small to support the large community. However, the Bomberos of Santa Cruz are aware of recycling practices and similarly scored well on those protocols. Due to these unique circumstances, El Roble and Santa Cruz are more conscious of proper waste disposal methods and therefore scored higher without even having established an organized recycling program.

ESTIMATED INCREASE IN PROTOCOL SCORES

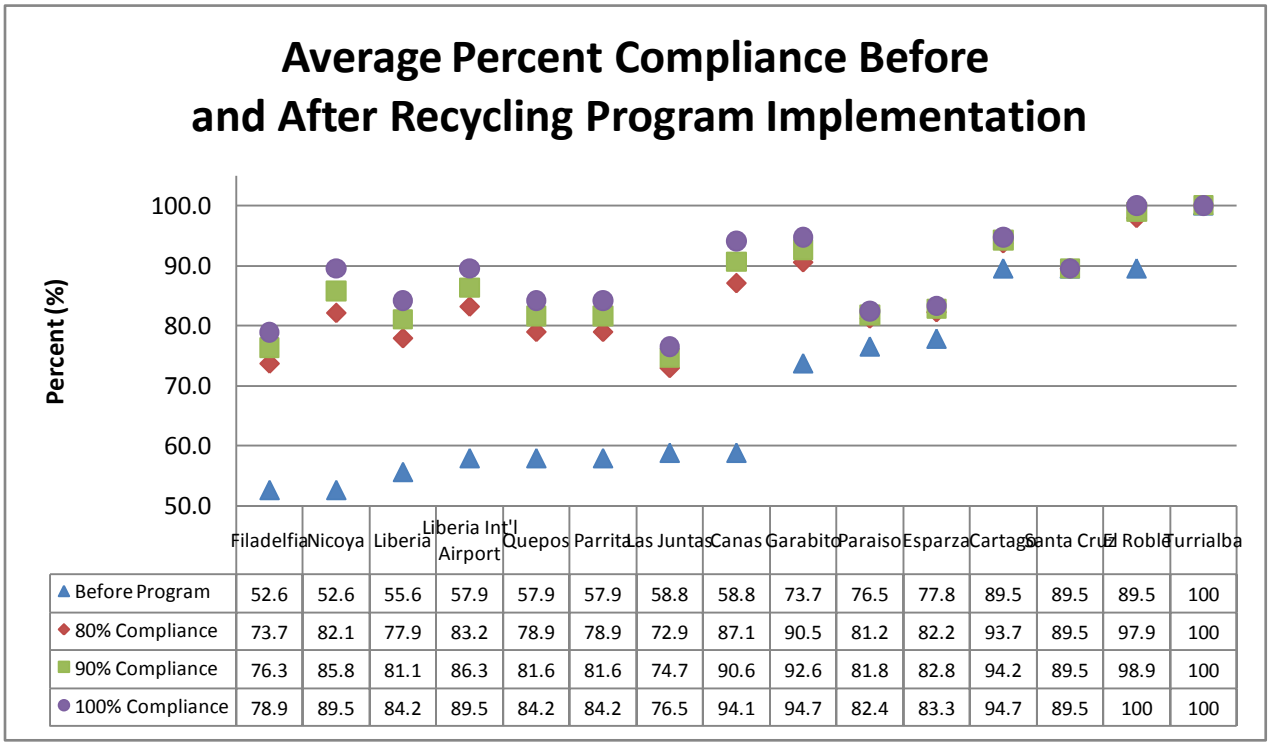
This section discusses the effect of implementing a comprehensive waste management program on protocol scores. This includes an increase in protocol score due to recycling and the proper disposal of hazardous waste.

Average percent compliance of the waste management questions will improve when a recycling program is implemented. The Bomberos assume that this correlates to a decrease in negative environmental impact. Of the nineteen waste management questions, the following will be directly affected by a recycling program and will therefore receive a score of 1 after implementation: 14.1 (reuse and recycle waste to reduce amount sent to landfills) , 15.2 (there is a plan implemented to reuse products), 15.3 (there is separation of hazardous waste from other types of waste) , 15.4 (properly identify those responsible for management of solid waste), 15.6 (there is a designated area for temporary storage of solid waste), 15.7 (comply with the Regulation of Management of Waste), 16.2 (classification of solid waste), 16.3 (there is a separation of hazardous waste and other types of waste), 16.5 (hazardous waste is stored for short periods of time), 16.6 (storage sites are maintained regularly), 16.7 (regular inspections of the storage sites are conducted), 16.9 (the generation, transport, and disposal of hazardous waste is controlled), and 16.10 (comply with the Regulations for the Management of Industrial Hazardous Wastes). Refer to Appendix J for a full description of these questions in English.

Figure 5 shows average scores obtained for waste management questions that will be affected by implementation of a recycling program. It compares the average score of each station before implementation with estimated average scores after 80 percent, 90 percent, and 100 percent compliance to the recycling plan after implementation. As seen in Figure 5, those stations with lower compliance to the waste management questions would greatly improve if the recycling program were implemented with 80 percent, 90 percent, or 100 percent compliance. This suggested decrease in environmental impact as measured by the protocols does not take into account factors that are outside of the control of the Bomberos, such as what happens to recyclables once they leave the station. As mentioned in the background, it is possible that

facilities do not have the capacity to contain these recyclables and there is not enough of a market for all recyclable goods. As shown, stations with higher initial percent compliance will still be able to improve their scores, but to a lesser degree. However, Turrialba already complied with topics discussed in the waste management questions by 100 percent and therefore would not improve according to the scores. Despite this, there is still room for improvement within the station according to the protocols that address other aspects of environmental impact. El Roble had the second highest compliance of 89.5 percent, but would improve its compliance by 8.4 percent if the plan is implemented at a feasible rate of 80 percent compliance. Santa Cruz is the one outlier in this data. Although it had an initial compliance of 89.5 percent, like El Roble, percent compliance would not improve with the implementation of a recycling program. This is because Santa Cruz already received a score of 1 on all waste management questions that would be affected by the program.

Figure 5: Comparison between Percent Compliance Before and After Implementing a Recycling Program



	Filadelfia	Nicoya	Liberia	Liberia Int'l Airport	Quepos	Parrita	Las Juntas	Canas	Garabito	Paraiso	Esparza	Cartago	Santa Cruz	El Roble	Turrialba
Before Program	52.6	52.6	55.6	57.9	57.9	57.9	58.8	58.8	73.7	76.5	77.8	89.5	89.5	89.5	100
80% Compliance	73.7	82.1	77.9	83.2	78.9	78.9	72.9	87.1	90.5	81.2	82.2	93.7	89.5	97.9	100
90% Compliance	76.3	85.8	81.1	86.3	81.6	81.6	74.7	90.6	92.6	81.8	82.8	94.2	89.5	98.9	100
100% Compliance	78.9	89.5	84.2	89.5	84.2	84.2	76.5	94.1	94.7	82.4	83.3	94.7	89.5	100	100

Hazardous waste management should be a focus of a station-wide recycling program. Overall scores of questions related to hazardous waste are low. All the stations that currently recycle will improve by less than 6 percent with a rate of 100 percent compliance. Since the stations are complying with hazardous waste management questions in the protocols, this suggests that their recycling programs are currently effective, yet there is still room for minor improvements. The performance on three waste management questions that would improve for the stations that recycle are centered on the topic of storage and separation of hazardous materials. The recycling programs currently established in these stations do not account for oil, tires, or batteries, which could explain why these stations did not receive scores of 1. A majority of the stations that do not recycle also have a problem in this area, indicating that improvements must be made in the management of hazardous waste. There are very limited programs established in Costa Rica to properly dispose of these materials. This will make it much for difficult for organizations such as the fire stations to comply with these protocol questions. For example, Fundellantas is the only established facility in Costa Rica that collects and reuses old tires (redcicla.org, 2008).

SUCCESSFUL EDUCATION AND IMPLEMENTATION OF A RECYCLING PROGRAM

The Bomberos expressed an interested in including a recycling program in their waste management plan. Education is a vital asset to any recycling program, increasing general knowledge of the program to increase participation. This section discusses various educational techniques for successful implementation of a recycling program as well as effective implementation strategies within fire stations.

An effective method of presenting preliminary information to the Bomberos was with a PowerPoint introducing the idea of recycling along with basic recycling information.

A PowerPoint was used during the visits as part of an educational program because it is easy to organize information and include visual aids. The information presented was based on knowledge prior to the visits and interviews with Sr. Hidalgo and Sr. Ramos as well as research on recycling information and recycling education (see Appendix M for this presentation). Additional issues surfaced after the visits and the PowerPoint was modified to emphasize more appropriate issues. The presentation was divided into sections including an introduction to waste and a definition of recycling, the effects and benefits of recycling, materials that can and cannot be recycled, the preparation and sorting of these materials, and proper storage and disposal of hazardous waste. Since research showed that being aware of the benefits to the environment increase participation in recycling programs (Vining & Ebreo, 1990), a section on this was included in the presentation. The presentation was created in Spanish and at an introductory level in order to target the appropriate audience. This ensured that the information is communicated effectively as suggested by the Professional Recyclers of Pennsylvania (2008).

We were very well received at every station. The Bomberos were enthusiastic to learn about the effects of waste management on the environment and how they, as individuals, could help by recycling. They found the information very helpful as they were often unaware of recycling practices. For example, most stations did not know the difference between the seven types of plastics or which plastics can be recycled. They were also very interested in why only certain types of materials could be recycled.

Interviews conducted with each station uncovered an interest in community involvement within the recycling programs. These semi-structured interviews allowed for expansion upon this topic, including concerns regarding feasibility of implementation as well as input for community involvement. A majority of the stations expressed interest in acting as

collection centers for hazardous materials such as oil, batteries, and tires. By involving the community, the stations can act as role models and effect change both in the station and the surrounding area. The fire station in Turrialba, which has recently begun recycling, has expressed an interest in directly involving their community in a recycling program. Their chief, Ricardo Machado, is interested in organizing a community drop-off at the station for all recyclable materials in the hopes of beginning a community recycling program and attracting a recycling facility to pick up in their community.

The Bomberos can include their communities by donating recyclable goods such as paper and plastic to local schools. In Costa Rica, money is given in exchange for certain recyclable materials. As explained by Sr. Hidalgo, the Bomberos do not want this monetary compensation because of possible negative public relations. The Bomberos are concerned that if they exchange their recyclables for money, they will be poorly viewed by the surrounding community. Also, according to Sr. Hidalgo, the amount of money they would receive would not be enough to significantly affect their budget. An organization such as a school would benefit more from this contribution. This is a tangible benefit of recycling within the Bomberos and can be used as motivation to recycle.

The station located in Esparza has already taken the initiative to donate recyclables to schools. The Bomberos there separate paper and plastic to be recycled, but they do not recycle aluminum and glass because these materials are not generated in large quantities. For the past two months, they have donated the plastic to a local school, Jardín de Niños de el Roble, which is located ten kilometers from the station. According to Chief Luiz Ledezma, this program has been very successful and the school greatly appreciates this contribution. Esparza can be used as a model for other fire stations to include the community with this recycling initiative.

Effective Recycling Education within the Fire Stations

Research showed that in corporate settings, constant prompting and reminding is one of the most successful tools to encourage participation (Nigbur, Lyons, Uzzell, & Muckle, 2005). Brochures and posters can be used to remind the Bomberos to recycle. The design of brochures and posters was a product of interviews and research on model recycling programs as well as recycling information in general. According to studies by Oskamp et al (1991), participation increases when information is provided on the recycling program rather than the effects of recycling on the environment. For this reason, the information in the brochures and posters is focused on the specific recycling program rather than broader environmental issues.

Posters with a concise summary of the most important aspects of the recycling program, including the benefits of recycling and location of bins, may be used to increase participation. The San Francisco Fire Department utilizes posters in their fire stations to remind firefighters to recycle and ways that recycling can benefit them directly (Fokin, 2008). Similarly, the Bomberos can put up posters in their fire stations to accomplish these same goals. Using the very successful recycling program within the San Francisco fire department as a model, posters should be hung above recycling bins and in other locations frequented by the Bomberos. Effective posters should describe the benefits of recycling and how it applies directly to the participants. Because there will only be one set of recycling bins in each fire station, other posters or signs can also be placed throughout the station reminding firefighters to recycle and informing them of the location of the recycling bins. This is intended to accomplish greater use of the recycling bins despite the fact that the bins cannot be placed in each room (See Appendices Q and R for example posters).

Labels on recycling bins are the most effective way to quickly communicate what can and cannot be recycled. We determined each station should be equipped with three recycling bins to allow the sorting of glass and aluminum, paper and cardboard, and plastic. We found that an average Costa Rican produces 8.23 kg of trash per week (United Nations Statistics Division, 2007). The largest station we visited had ten permanent fire fighters, with only three on per shift. With this information we determined the stations visited were small enough that one set of recycling bins would adequately store the amount of recyclables generated. Research by Vining and Ebreo (1990) suggests that people who recycle know more about how to recycle. Labels on bins can quickly inform fire fighters about what to properly recycle and where to dispose of materials, encouraging more participation. These labels can be supplemented with brief sorting instructions, therefore acting as a convenient resource and reminder. A concise label efficiently informs the Bomberos what can be recycled and the proper bin to place the material (See Appendices N, O, and P for samples of paper and cardboard, plastic, and glass and aluminum recycling labels).

A brochure is the most effective means of communicating about home recycling to the Bomberos. In addition to information about recycling in the fire station, it is beneficial for the Bomberos to receive material regarding recycling in their homes. By providing information about recycling in their homes, this recycling program is one step closer to effecting positive change in communities. A brochure is an effective means of providing this information and is often used by successful recycling programs (Nigbur et al, 2005). A brochure can concisely provide detailed information about how to set up recycling in the home, what can and cannot be recycled, and how a family can get their recyclable material to a recycling facility. The brochure designed for this program includes a list of which materials are recyclable, suggestions of ways

to set up recycling in the home, and resources for determining transportation of recyclable materials. The brochure also contains specific information on how to sort and recycle these goods, acting as a reference for the Bomberos both in the fire station and within their homes. Fire stations and homes recycle similar materials and therefore the habits learned at fire stations will also assist the Bomberos when recycling at home. Research about recycling in Costa Rica was used to create a sample brochure (see Appendix S).

Effective Implementation Strategies within the Fire Stations

The implementation plan we developed is based on studies conducted by Nigbur et al (2005). The recycling program developed for the Bomberos should include the following aspects: increasing convenience, offering rewards, prompting and reminding, committing residents, setting targets, and giving feedback on participation (Nigbur et al, 2005). Ways to accomplish this in addition to posters and pamphlets include strategic placing of bins in locations frequented by the Bomberos, periodic reminders, and a competition between fire stations. The periodic reminders should emphasize details of the recycling program to encourage more participation by the Bomberos (Oskamp et al, 1991).

Because the San Francisco Fire Department is similar to the Bomberos in terms of size and organization and utilizes similar recycling strategies, their plan can be used as a model for the Bomberos' program. In San Francisco, general orders were given to participate in the station-wide recycling program. However, each individual's actions are unknown. Similar to the San Francisco stations, the hierarchical structure of the Bomberos suggests that the recycling plan will be followed if an order is sent, but again there is no way to determine the individual participation of each fire fighter.

The recycling program in the San Francisco Fire Department includes yearly reassessments to account for the changing state of recycling. This can be extended to the program within the Bomberos, especially since the state of recycling in Costa Rica is drastically changing as knowledge of recycling increases. Competitions among stations are another motivational technique successfully used in San Francisco. This technique can appeal to the competitive nature of the Bomberos. The trophies displayed throughout the fire stations confirmed the idea that the fire fighters in Costa Rica actively participate in competitions. This method can motivate several stations at a time, increasing relations among stations.

CHAPTER FIVE: CONCLUSIONS

In this study, we evaluated fifteen fire stations using the Protocolos de Evaluación Ambiental. After a thorough analysis of our data, we determined the following results:

- In general, compliance with the topics covered in the protocols is good. Each sampled station had an average percent compliance above 60 percent, with an overall compliance of 74.2 percent.
- Recycling within fire stations is more prevalent when they are located in communities that recycle. One quarter of the stations visited have a recycling program and of these, 75 percent are located in a community with a recycling program.
- A majority of stations scored low in protocol questions related to hazardous waste. For stations that currently recycle, protocol score could improve for three waste management questions centered on the topic of storage and separation of hazardous materials.
- Average percent compliance of the waste management questions will improve when a recycling program is implemented. A greater compliance to environmental laws will result in a decrease in negative environmental impact, as scored by the protocols. When recycling is utilized, stations improve their protocol scores.
- The Bomberos are enthusiastic to participate in a recycling program and to involve the community in their recycling initiative.

CHAPTER SIX: RECOMMENDATIONS

RECOMMENDED RECYCLING PLAN

Each station should follow a series of six steps to successfully implement this recycling plan. Each step is accompanied by a suggested deadline for completion.

Choose a coordinator for each station

A recycling coordinator should be chosen within two weeks notice of recycling program implementation. This coordinator can be the chief or other chosen delegate who will act as mediator between the station and the head of the Bomberos' overall recycling program. The coordinator is responsible for reporting to Sr. Ramos and coordinating recycling activities within the station. This could include contacting recycling facilities, organizing transportation of recyclables to schools and facilities, organizing incentives such as competitions with coordinators from other stations, providing feedback on participation, and coordinating with other stations.

Determine the best methods of collection and storage of recyclables

Each fire station will be equipped with three recycling receptacles for the separation and collection of glass and aluminum, paper and cardboard, and plastic. These bins should be placed in a convenient and well-frequented location as soon as they have been delivered to the station. Labels should be clearly placed either on or above the receptacles to distinguish between the materials accepted (See Appendices N, O, and P for sample labels). Possible locations would be in the kitchen or main office area. The frequency of collection and disposal must be determined based on amount of recyclables generated. This is usually weekly or biweekly and should be determined after the first month of implementation. This time period should be reevaluated after six months, once recycling has become routine. An area for storage should be set aside to

contain the recyclables before transportation to a school or facility. This area should be cleaned regularly.

Determine where recyclables can be collected

The separated recyclables must be disposed of properly. Each fire station has two options: contact a recycling facility to discuss a possible contract or contact local schools to explore the possibility of donating paper, cardboard, plastic, and other non-hazardous materials. This should be completed within one month's notice of implementation. The coordinator should use the provided recycling facility spreadsheet to contact facilities and organize collection and transportation. This collection plan should be reported to Sr. Ramos or the head of the program.

Design an education portion to increase participation

A training session should be organized to introduce the recycling programs within one month of implementation. A successful method is to present a PowerPoint offering the following information (an example is provided in Appendix M and may be used):

- Explanation of the difference between waste and recyclable goods
- Benefits of recycling, stressing how the efforts of each fire fighter can impact the environment
- Discussion of materials that can and cannot be recycled in this program
- Proper preparation and sorting of these materials
- Introduction to the storage and proper disposal of hazardous waste

This should be reinforced with quarterly or biannual educational sessions. In addition, posters should be hung throughout the fire stations reminding the fire fighters of materials that can be recycled and how their efforts are affecting the environment (See Appendices Q and R for sample posters). It would be particularly beneficial to place these posters near waste baskets.

This can be accompanied by informational pamphlets that each fire fighter can bring to their families and apply to their homes (See Appendix S for a sample pamphlet). Constant reinforcement of the importance of recycling and the details of the program will strengthen participation.

Maintain motivation throughout the program

The coordinator should utilize several techniques to increase and maintain participation in the program. One important technique is periodic reminders. This can be accomplished verbally, through email reminders, or signs posted throughout the station. Rewards and incentives can be used within the station to motivate participation and provide internal competition. The coordinators can also organize competition throughout multiple stations, strengthening both participation and relations with other stations. Periodic feedback on participation and progress should be posted to directly demonstrate the impact created by the Bomberos. A basic plan should be organized within one month and exercised at the start of implementation.

Periodic Updates and Evaluation

The coordinator should report updates and progress of the plan to Sr. Ramos on a periodic basis. The program should also be updated yearly to include any advancements in recycling in Costa Rica. Some advancements could include, but are not limited to:

- New recycling facilities
- Updates recycling practices in Costa Rica
- New environmental policies within el Cuerpo de Bomberos
- New recycling or environmental laws
- Advancements in local community recycling efforts

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CHAPTER SIX: APPENDICES

APPENDIX A: El Cuerpo de Bomberos

The Instituto Nacional de Seguros, known as the INS, is a government umbrella organization responsible for selling all of the insurance policies in Costa Rica. Originally founded in 1924, the main goal of the INS was to respond to and deal with the protection needs of Costa Rican society. In conjunction with this aim, the INS has evolved to offer a wide variety of protection services ranging from financial security to safety from chemical accidents. Currently, the INS is comprised of eleven agencies, three offices, and twenty one dispatch locations throughout Costa Rica, with its headquarters located in San José (Instituto Nacional de Seguros, 2005). Along with providing healthcare and banking services, the INS has the responsibility of reducing insurance claims and keeping costs to a minimum through preventative measures such as education, regulations, and investigations.

El Benemérito Cuerpo de Bomberos, the National Fire Department of Costa Rica, is a branch of the INS responsible for all fire-related issues in the country. The first fire department in Costa Rica was approved on July 27, 1865 after receiving its first fire pump from the United States (El Cuerpo de Bomberos, 2005). During the 1900s, the prevalence of fires increased as retailers insured their businesses and then set them on fire to collect insurance from foreign agencies conducting business in San José. In an attempt to limit the occurrence of arson, an insurance law was passed on October 2, 1922. The law established that 10 percent of the premiums paid by fire insurance would be used to acquire equipment to fight fires.

El Cuerpo de Bomberos became part of the INS through a national declaration in May of 1925. As a consequence of the merge, the INS provided el Cuerpo de Bomberos with better service for firefighters, which included vital fire extinguishing equipment with all accessories

needed to efficiently extinguish fires (El Cuerpo de Bomberos, 2005). The organization also promoted the opening of new fire stations and increased the number of firefighters. Currently, el Cuerpo de Bomberos consists of sixty-one fire stations distributed throughout the country, occupied by a total of 540 fulltime firefighters and 1,000 volunteers.

On July 22, 2008, a law was passed that opened the insurance market to private organizations, thereby ending the monopoly of the INS. According to the law, el Cuerpo de Bomberos would no longer operate under the control of the INS, giving the department a larger role in overall administration (Moreno, 2008). With the split, however, the INS would no longer fund the fire fighting division, forcing el Cuerpo de Bomberos to seek alternative sources of revenue. As stated in the law, the Bomberos would receive only 4 percent of insurance premiums sold in the country to fund the department. As of now, the Cuerpo de Bomberos has not released information regarding new possible sources of income.

APPENDIX B: The Privatization of INS and Independence of the Bomberos

The Insurance Market Regulatory Law was established in accordance with the Central American Free Trade Agreement on July 22, 2008, terminating the monopoly of the INS (The Guanacaste Journal 2008). This law allows local and foreign companies organized in the country to join the insurance market, thereby authorizing these companies to operate in all insurance fields excluding occupational hazards insurance and certain types of automobile insurance(Inside Costa Rica, 2008). According to President Oscar Arias, the guidelines described in the law will be critical in regulating the insurance industry. The guidelines will also strengthen the INS through competition by stimulating transformations within the organization aimed at improving services in order to better serve customers' needs (Inside Costa Rica, 2008). Government officials estimate that the insurance market will open in September 2008, but to date the monopoly is still in place.

With the termination of the monopoly, the Cuerpo de Bomberos will become independent from INS and public funds originally supplied to the Bomberos through INS will be eliminated. From now on, the Cuerpo de Bomberos will be financed by 4 percent of insurance premiums sold in the country and given more control over the department (Ministerio de Comercio Exterior de Costa Rica, 2008). At present, exact details regarding options for other sources of revenue have not yet been disclosed to the public.

APPENDIX C: Current Environmental Laws in Costa Rica

Laws Pertaining to Greenhouse Gas Emissions

Costa Rica recently joined the United Nations Framework Convention on Climate Change, known as the FCCC, and became the first country in Central America to complete an inventory of sources of greenhouse gases (United Nations Framework Convention on Climate Control, 2007). The FCCC is currently guiding an innovative mechanism called joint implementation, which refers to international arrangements where private industry, governmental entities, and independent organizations work collaboratively across borders. Costa Rica has offered itself as the first developing country to create a national program in conjunction with the joint implementation and is currently the host to eight of the fourteen projects approved by the United States Initiative on Joint Implementation.

A "Rational Use of Energy" law was established in 1996 to encourage a country-wide reduction in greenhouse gas emissions (WRI, 1996). This law, adapted from a US model of energy efficiency standards, is designed to regulate energy consumption and mandates the use of informational labels on appliances providing annual energy consumption and adjusted volume. Established in 2000 and effective until 2010, the National Plan for the Expansion of Electricity Generation has been created, stating that 80 to 90 percent of newly installed generation capacity should be from renewable sources rather than thermal plants. Fueled by renewable sources, these plants could potentially prevent the emission of 214,445 tons of carbon dioxide by 2009 (WRI, 2000).

Laws Regulating Energy Consumption

Laws have been amended or established to minimize energy consumption. In 1990, the "Ley para la Utilización Racional y Uso Alternativo de Fuentes de Energía" was created to allow

the participation of private enterprise to generate power that utilized renewable resources such as geothermal, hydropower, or solar power. The law was amended in 1995 to increase the private power generation from 15 to 30 percent (WRI, 1990). In 1994, the "Law and Regulations on Rational Energy Use" was implemented. The law outlines the obligatory nature of executing projects that conserve electricity and includes an incentive program for businesses that promote the efficient use of energy (WRI, 1994). The same year, the Hydrocarbons Act was established to regulate the development, promotion, and exploitation of oil and other hydrocarbons.

APPENDIX D: Current Waste Management Laws in Costa Rica

The Law for Integrated Waste Management

In 2005, the Law for Integrated Waste Management, known as GIR, was established based on the need for a legal framework regulating the management of waste in Costa Rica. This law was amended in 2007 with the addition of an article promoting the prevention of pollution, waste recovery, and sustainable consumption and production (Programa Competitividad y Medio Ambiente (CYMA), 2007). The goal of this article was to reduce the pressure on natural resources, increase the lifespan of disposal systems such as landfills, and encourage the reuse of materials and proper treatment of waste.

The main objectives of the law were to include private, municipal, and civilian participation, increase education about the environment, and create a clean and healthy environment (Programa Competitividad y Medio Ambiente (CYMA), 2007). Initiatives were developed to help Costa Rican society change its pattern of consumption and the impact that has on the environment. Through these actions, the government aimed to gradually implement a system for managing solid waste.

PRESOL – Costa Rica's Solid Waste Plan

In April 2008, the Costa Rican government approved the "Plan de Residuos Sólidos Costa Rica," known as PRESOL, in an effort to organize a countrywide movement in solid waste reduction. The main goal of PRESOL was to encourage a shift from disposing of waste in landfills towards separating waste products and either reusing or recycling as much as possible (WRI, 2008b). The plan also called for a reduction in waste generation and the utilization of waste as raw material for energy production. PRESOL consists of thirty one "strategic actions" designed to promote waste management policy, such as improving public education of

sustainability, assisting municipalities in drafting and adopting their own waste management plans, improving waste collection coverage throughout the country, and replacing uncontrolled dumps with sanitary landfills (WRI, 2008a).

A section of PRESOL, discussed in the ninth strategic action, was written specifically for waste management in industry. According to the plan, specific guidelines would be implemented to regulate and reduce industrial waste. This would include separating recyclables such as paper and plastics, as well as proper disposal of "hazardous materials" such as ink toner and electronics.

APPENDIX E: Interview Summary with Saint-Gobain Northboro Research and Development Center

Members of Our Group Present:

Katelyn Perkins, Alyssa Vincent, Felicia White

Interviewees Present:

Todd Numan- Founder of "Green Team"

Eric Rober- Facilities Engineer

Date of Interview:

Thursday September 25, 2008 at 1:45PM

Meeting Overview:

1. Why did you start recycling?
    - A corporate mandate was in place stating that all Saint-Gobain must recycle. A goal was set stating that by the end of 2007, Saint-Gobain would be a net zero waste facility by recycling, reusing products, and disposing of certain materials at no cost. This goal was not met, so a "green team" under the guidance of Todd Numan was established to help achieve this goal.
2. Were there any incentives?
    - The only incentive was PR, both external and with employees.
3. What materials are you recycling and how much?
    - Two years ago, the company started recycling paper and cardboard. Bins were placed strategically throughout the office and a garbage tote was placed outside the building. The program was not enforced, however.
4. Do you sort on site?

- Originally, paper and plastic were the only materials separated from other waste. The plan that will go in effect on October 1 will require the separation of paper, plastic, glass, and metal from nonrecyclable waste. These materials will be placed in a compactor, but do not need to be sorted by category. The company does not pay for the compactor, but since sorting of the recyclables takes place at a different facility, this method does not provide a profit. This is a benefit because there is no sorting required the employees are more likely to recycle.

5. Do you know specifically the cost to have your recycling picked up?
    - We will be provided with this via email
6. What are your overall estimated costs of recycling?
    - Goal of the program was to reach zero net cost. It was estimated that $29,000 is spent in disposal of waste per year. The distribution of costs was shifted within the budget, but overall it does not cost more for Saint-Gobain to recycle.
7. If your budget is not changing, what other methods of waste management have you adopted?
    - Before recycling of any kind was implemented, the $29,000 went towards storing the waste and the collection of the waste by a hired company. Expenses included renting bins to contain the waste, the price per tonnage to pay for space in landfills, and a $150 pickup charge to cover costs of the transportation.
    - To reduce the amount of waste that needs to be collected, several changes have been made. A compactor was bought to collect the paper, plastic, glass, and metal. Although the compactor costs an additional $100 a month, it reduces the tonnage of waste removed and the amount of times collection is necessary. Most of the weight of waste came from food in the cafeteria. To significantly decrease this, all material in the cafeteria,

including utensils, napkins, cups, and straws, are now made of corn and 100% compostable. A large dumpster was recently bought to store all biodegradable products, which degrade within 120 days. Although there is an increase in cost of materials of about $8,000 to $9,000, there is an equal decrease in the cost of waste removal, resulting in net zero cost.

8. Did you do a cost/benefit analysis?
    - A cost/benefit analysis was performed to prove to management that this new program won't cost any money and determine if profit is feasible. Eric Rober will be emailing us with the model he used to conduct the analysis.
9. What percentage of people would you estimate participate? What factors might discourage someone from participating?
    - Of the 350 employees in the company, it is estimated that around 150 currently participate. According to Todd Numan, this is mainly due to the fact that a lot of people are opposed to change, whether or not it is beneficial. Once the full program is adopted, policing or enforcing could be necessary to increase participation.
10. How did you implement and raise awareness of the program?
    - Once the "green team" was established, a proposal was presented to management detailing the plan to implement a recycling program. Once this was accepted, a general survey was emailed to all employees asking about views on recycling and any suggestions. The results were compiled and sent back to the employees, showing an overall support of the plan. The survey also acted was a way to introduce the plan to the employees. After this, recycling bins were placed in two large rooms and an email was sent to employees asking them to dispose of their paper or plastic in the designated bins.

This was done as a way to see how many people would utilize the bins. The bins were only about half filled by the end of every week, indicating that the two bins were not successful. This could have been due to the location of the bins and the amount of people that frequent the two rooms compared to the 350 employees working at the company.

11. How long did successful implementation take?

- Beginning with the sending of the initial survey to the present, implementation has only taken three months.

12. What were the setbacks or problems?

- The biggest setback the company has faced is motivating people to change. There was initially some opposition by some members of management, but once statistics were presented, this opposition decreased. Legality presented a problem with respect to certain contracts, so the company had to go through the legal department in order to break a nationwide contract with certain waste management companies.

13. Did you have a timeline of implementation?

- The full recycling program will be enacted on October 1. Between October 8 and October 12, the compactor will be fully operable. The company hopes to determine and fix any kinks in the program by January and then conduct a comparison in waste management costs from year to year.

14. Have you seen the use of paper go up or down after implementing the program?

- It is too soon to determine if the use of paper will increase or decrease with the implementation of the program. New printers have been purchased that are eco-friendly and compatible with recycled paper. This special paper is currently being tested to

determine the feasibility of converting to 50% recycled paper. This will save $4.50 per case, yielding a yearly savings of $1,200.

15. Besides recycling paper, plastic, glass, and metal, what other ways are you reducing your waste?

- A policy called the "Materials Pass" was recently reenacted to allow employees to sign off that they will use certain equipment rather than disposing of it. A policy had existed within the company that if equipment had not been used in a year, it would be disposed of rather than reused. This was originally established to protect confidentiality of any information that had previously been stored in the equipment. Even if the information had been permanently deleted from the equipment, the company felt that it was not enough to ensure that some information did not remain. However, this process has been reviewed and it was determined that if all information is deleted, the equipment could be reused. There has actually been some opposition to this within the company since some people think that "waste is waste" and therefore shouldn't be reused. However, this new policy is leading to a reduction in waste production.
- Scrap metal is also being collected separately from other waste. The mixed metal is then sold for $90 per ton. If Saint-Gobain separated the metals, they could get as much as $450 per ton for certain types. Although this would be financially profitable, it would require extra work from employees and therefore not feasible.

APPENDIX F: Interview Summary with San Francisco, USA Fire Department

Members of Our Group Present:

Katelyn Perkins, Alyssa Vincent, Felicia White

Interviewees Present:

Tania Fokin – Public relations representative

Date of Interview:

Thursday November 6, 2008 at 8:00AM

Meeting Overview:

1. How many fire stations are currently recycling in San Francisco with this program?

There are currently 43 fire stations recycling in San Francisco under this program.

2. Why did you start recycling?

Four years ago the mayor of San Francisco started a recycling program in which the fire stations would use to set an example for the community of San Francisco.

3. Were there any incentives for the fire department or for its employees?

Incentives were keeping a good environmental conscience as well as immediate financial savings that added up to 120,000 dollars throughout the 43 stations over a year. Fokin is currently working on organizing a contest between fire stations to increase recycling.

4. What materials are you recycling and how much?

Upon implementation, plastic, glass and aluminum were recycled within the stations. Two years ago bags for composing were added to all stations and the fire fighters were educated on what could be put in the bags. The next step will begin in spring of 2009. All stations will add hard plastics such as plastic bags to the list of things recycled at the stations.

a. Do you have any records of these? Can you share them with us?

Records are kept of 50 percent to 75 percent of trash that are based on how many garbage containers are filled verses how many recycling containers are filled.

Some station shave decreased the amount of trash containers in the station in order to increase recycling.

b. Besides the article written in BioCycle, were there any other articles written about your program?

To Tania Fokin's knowledge, there are no other articles written on San Francisco's recycling program.

5. The article in BioCycle gave data of percentages of recyclables found in trash. This article was from 2004, do you have any more recent data?

Tania Fokin is emailing this data to us. Because firefighters and others working at the fire stations did not realize paper towels were compostable (trash cans in bathrooms have now been removed and replaced with compostable bags), Fokin believes the percentage of recyclables found in the trash has gone down since 2004.

6. What are your overall estimated costs of recycling?

In San Francisco, the stations get credit for recycling which are used to reduce their garbage bill.

a. Were there any net savings after a recycling program had been implemented?

Yes, in the first year the trash bill was reduced by 120,000 dollars. After recent training, the bill dropped by another 11, 400 dollars. The six stations that chose to reduce the number of garbage cans in the stations brought a 20 percent savings.

7. What percentage of people would you estimate participate? What factors might discourage someone from participating?

Because of the set up of a fire station, about 100 percent of fire fighters participate in the recycling aspect of the program. Not all fire fighters participate in composting because several are unsure of what can and cannot be composted. Training programs are being organized to solve this problem. Age is also a factor in the willingness to participate. Initially the older members of the stations were reluctant to recycle because they did not want change and recycling was not the "macho" thing to do. Younger members were more eager to participate, but now that recycling has been prevalent in San Francisco for so long, everyone recycling, no matter the age.

a. How did the training program affect participation in the recycling program?

The initial training informed members of the station of what recycling was because some had never encountered it before. When there are training sessions new enthusiasm is brought to recycling and the cost of disposing of waste drops. This also happens when there is motivation in the form of new posters and new bins to remind people to recycle.

a. How has the success of the program changed over the past four years?

The success of the program has stayed relatively constant over the past four years. Recycling some members of the fire stations have asked for more recycling.

8. How else did you implement and raise awareness of the program?

Awareness of the program was raised through trainings, station visits, posters, bins and compostable bags (which made composter much neater and cleaner than previously).

9. What were the setbacks or problems?

Problems were the limited time to have refresher training sessions and follow up with the stations. Fokin is trying to organize a contest between stations to keep the recycling momentum going, but the schedules of stations are very hectic and unpredictable.

10. What made recycling in a fire station unique or different from recycling in other areas such as offices?

Unlike an office setting, fire stations run a 24 hour operation in which they eat and cook where they work. This creates a significant amount of waste. As fire fighters have a hierarchal chain of command, when a general order announcing the program ad requiring participation was sent out, it was followed. There is no way to follow up on this command, but because the order has been made, it is assumed it will be followed. The chief of the department went to the training sessions and is participating in the program which encourages the rest to follow.

11. Do any of the stations have ambulance services as well?

Only one station in San Francisco also has an ambulance service.

a. Does this create another category of waste? How is this dealt with?

Medical waste is dealt with in the biohazard program in which it is stored and picked up on a monthly basis. All medical waste is disposable and therefore nor recyclable.

12. Do you know of any other fire stations with similar programs?

There are other stations in California beginning similar programs with the help of the department of environment, but the stations in San Francisco were the first to implement such a plan.

13. Did you model your recycling program after another station or company?

The recycling programs in the fire stations of San Francisco were not modeled after another station or company.

14. How do you dispose of used tires, oil, and metals?

There is a central shop area for used vehicle parts.

15. Does your recycling program involve the community in any way?

No, the entire community recycles independently of the fire stations. The only community involvement the fire stations have is for fire prevention education.

16. In addition to recycling, have you reduced your use of energy or other products?

Over the past four months the mayor of San Francisco has created a climate action plan which requires audits of energy and water usage at the stations. This also provided a grant to buy replace current light bulbs with CFC bulbs to reduce energy use. The shower heads were also replaced with more efficient shower heads, but because of low water pressure, the fire fighters took of the new shower heads. In the future, the station hopes to add solar panels to the stations. Though this will be expensive, government involvement will allow for a price reduction.

a. Do you reuse materials within the stations?

This is one of the stations recycling weaknesses. They use paper towels instead of rags. The station also goes through a lot of mops which could be saved if washing machines were provided within the stations.

17. How long did successful implementation take?

Initial implementation took about three months to reach all fire stations. The program was fairly successful from the start with an automatic reduction in price. The program was comfortably in place and followed within the first year of implementation. The goal is to have reminders to every quarter to keep the success of the station in the form of refreshing education or motivating by showing savings.

18. Did you have a timeline of implementation?

There was a rough timeline with set times to get updated materials. For example, this past January the Department of Environment provided a grant for compostable bags along with a

day's worth of training. In February, March and April new containers with lids arrived to reduce fruit flies and odor.

APPENDIX G: Waste Management Objective of el Cuerpo de Bomberos

GA-001 **P**rograma **M**anejo de **D**esechos

1. OBJETIVO Y ALCANCE

1.1 Objetivo

Establecer las directrices para el adecuado manejo, almacenamiento y disposición de los desechos generados por las actividades propias de la Institución.

1.2 Alcance

Todas las estaciones y dependencias del Cuerpo de Bomberos de Costa Rica.

2. REFERENCIAS Y DEFINICIONES

2.1 Referencias

Decreto Nº 19049-S Reglamento sobre manejo de basuras
www.costaricareciclaje.com

2.2 Definiciones

Dependencias: oficinas, centros de capacitación, talleres, bodega y cualquier otra área que conforme la organización del Cuerpo de Bomberos y que no se encuentre dentro de la categoría de estación.

Desecho: Cualquier producto deficiente, inservible o inutilizado que su poseedor destina al abandono o del que desea desprenderse.

Desecho sólido: todo objeto, sustancia o elemento en estado sólido o semisólido, que se abandona, bota o rechaza o desprende.

Basura: todo residuo putrescible o no putrescible, excluyendo las excretas de origen humano o animal, que no se puedan reciclar.

Desecho ordinario: El que por su naturaleza, composición, cantidad y volumen es generado en actividades en las viviendas o en cualquier establecimiento asimilar a estas.

Desecho especial: Incluye a los residuos patógenos, tóxicos, combustibles, inflamables, explosivos, volitalizables y radioactivos. Se incluyen es esta definición los objetos o elementos que por su tamaño, volumen o peso requieren un manejo especial.

Reciclar: uso o reuso de un desecho como materia prima o ingrediente en un proceso industrial o agrícola. Comprende la recuperación de fracciones útiles o la remoción de contaminantes, con el fin de que sean aprovechables.

3. RESPONSABLES

Es responsabilidad del encargado del Plan de Gestión Ambiental:

- Coordinar y evacuar toda solicitud sobre manejo de desechos.
- Mantener el presente documento actualizado con la información necesaria para la correcta utilización.
- Evaluar en la auditoria ambiental el contenido del presente documento.

Es responsabilidad de la Jefatura de Operaciones:

- La implementación de los procedimientos establecidos.
- Velar por el cumplimiento de las directrices descritas para el manejo de los desechos sólidos.
- Brindar los recursos necesarios para el cumplimiento de los procedimientos descritos en el texto.

Es responsabilidad del funcionario:

- Cumplir con lo establecido dentro del presente documento.
- Colaborar con el o los auditores ambientales durante el proceso de revisión del cumplimiento de las normas.

4. DESCRIPCION DEL PROCEDIMIENTO

Todos los desechos producidos dentro de las estaciones y dependencias se deberán clasificar de acuerdo a sus características en:

Desechos ordinarios: son los escombros, chatarra, aluminio, madera, cartón, papel, plásticos, vidrio y residuos ordinarios comunes.

Desechos especiales: lo conforman los sólidos con restos de aceites y grasas, baterías, pilas, fluorescentes, lámparas de mercurio, bombillos incandescentes, llantas, residuos biosanitarios,

envases que han contenido algún residuo peligroso, restos de aceite quemado, grasas, disolventes usados, pinturas, residuos líquidos inflamables y tóxicos, entre otros.

Una vez clasificados se procederá a su almacenamiento y manejo de acuerdo a lo descrito en los siguientes puntos.

Cada estación o dependencia debe designar una persona responsable de la recolección y manejo de los desechos, de acuerdo a los días de recolección establecidos por la entidad responsable del transporte de los residuos.

4.1 Manejo de desechos ordinarios y especiales.

4.1.1. Áreas de almacenamiento temporal.

El área de almacenamiento temporal debe de contar como mínimo con las siguientes características:

a) El área debe encontrarse delimitada. (desechos especiales y desechos ordinarios)
b) Provisto de contenedores con tapa y claramente identificados en ordinarios y especiales.
c) Retirado de zonas de trabajo y andenes.
d) Protegido del agua de lluvia.

4.1.2. Características de los recipientes.

Dentro de las características que deben tener los recipientes retornables para desechos, serán:

a) Peso y construcción que faciliten el manejo durante la recolección por parte del personal de transporte de desechos.
b) Construidos de material impermeable, de fácil limpieza, con protección contra la corrosión, tales como plástico o metal.
c) Si poseen tapas, estas tendrán buen ajuste, que no dificulten el proceso de vaciado durante la recolección.
d) Construidos de tal forma que, estando cerrados o tapados, no permitan la entrada de agua, insectos o roedores, ni el escape de líquidos por sus paredes o por el fondo.
e) Bordes y esquinas redondeados, preferiblemente de mayor área en la parte superior, para que se facilite el vaciado.
f) Capacidad adecuada para la cantidad de desechos que se generen en promedio, entre cada periodo de recolección.
g) Poseer una identificación, que lo clasifique como desechos ordinarios o especiales.

Los recipientes desechables utilizados para el almacenamiento de basuras, serán bolsas de material plástico o de características similares y deberán reunir, por lo menos, las siguientes condiciones:

a) Su resistencia deberá soportar la tensión ejercida por las basuras contenidas y por la manipulación.
b) De color opaco.
c) Debe cerrarse por medio de un dispositivo de amare fijo o por medio de un nudo.

4.1.3. Consideraciones para desechos especiales

Para el caso de los aceites, llantas y baterías se procederá de acuerdo a los procedimientos establecidos por la Institución donde se garantiza la disposición final de los mismos, o cualquier medio que se establezca y se comunique con anterioridad a su implementación.

Para almacenar aceites deben ser separados de otros tipos de líquidos de vehículos. Los recipientes deben colocarse en un área de almacenamiento temporal y deben ser identificados adecuadamente.

Al almacenar las llantas se debe evitar mantenerlas a la intemperie para minimizar las probabilidades de generar un criadero para los mosquitos.

Para el resto de los desechos especiales se tomarán las medidas necesarias para su disposición final, siempre tomando las consideraciones para el manejo seguro de los mismos, evitando un daño al ambiente y al personal durante su manipulación.

4.1.4. Tiempos de recolección

Los recipientes de basuras se colocarán en un sitio de fácil recolección para el servicio, según sus rutas y horarios, pero evitando la obstrucción peatonal o vehicular.

No deberán permanecer los recipientes de basura en los sitios en que se recojan en días diferentes a los establecidos por el servicio de aseo.

4.2 Reducción, Reutilización y Reciclaje de desechos ordinarios.

Durante la generación de desechos por las actividades diarias, se producen muchos residuos que se pueden evitar o reutilizar, y posteriormente reciclar para obtener un aprovechamiento mayor

de los recursos y lograr reducir la cantidad de basura que se deposita en los centros de disposición final.

4.2.1 Reducción de desechos.

Esto significa el tratar de **REDUCIR** o **MINIMIZAR** la generación de residuos ya sea en el hogar, trabajo o lugar de estudio.

Algunas de las recomendaciones generales que se dan con el fin de **REDUCIR** la generación de residuos son las siguientes:

1) En la medida de lo posible comprar artículos al por mayor o en presentaciones o cantidades grandes con el fin de evitar un excesivo número de envases, bolsas y empaques.
2) Tratar de comprar los artículos que menos empaques tengan.
3) Evitar el consumo de los productos en envases desechables.
4) Procurar el consumo de productos en envases retornables.

4.2.2 Reutilización de desechos.

El objetivo de la reutilización es **REUSAR** o **"VOLVER A USAR"** algunas cosas que consideramos inútiles o inservibles. El ejemplo más claro de ello son los envases retornables de vidrio: cervezas, refrescos y otros productos alimenticios. En realidad la reutilización es para "alargar", la vida de muchos productos que generan residuos.

Algunas recomendaciones generales para aplicar la **REUTILIZACION:**

1) Utilizar envases retornables de vidrio.
2) Pensar dos veces antes de tirar a la basura algún objeto o desecho que ya no nos sirve.
3) Hacer una lista de todos los productos que consumimos en el hogar u oficina y sus respectivos empaques: analizar las posibilidades de regalar o venderlos después de ser usados.
4) Hacer una valoración e inventario de lo que se consume mensualmente en nuestra empresa con el fin de evaluar las posibilidades de reutilización.

Todos los materiales se deberán reutilizar, en la medida de lo posible, hasta que las características de los mismos lo permitan, posterior a esto, se dispondrán de aquellos materiales reciclables conforme se establece en el apartado 4.2.3 sobre reciclaje de desechos; aquellos que no se puedan reciclar se deberán disponer de la mejor manera posible.

4.2.3 Reciclaje de desechos sólidos.

Reciclar significa volver a usar algunos de los residuos generados como materias primas en procesos industriales con el fin de convertirlos nuevamente en productos nuevos de calidad para el consumidor. Es importante conocer que muchos residuos considerados como "basura" pueden ser materias primas importantes para muchas industrias.

Para lograr el adecuado manejo y el tratamiento final de los desechos reciclables, las estaciones y dependencias de la Institución deberán, en la medida de lo posible, identificar, contactar y solicitar la colaboración de un centro de acopio de la comunidad o cercano a esta, para la recolección periódica de los materiales de reciclaje (Ver lista de centros de acopio en anexo II)

Dentro de las estaciones y dependencias, se deberá adecuar un área específica donde se ubiquen los recipientes para la recolección de los materiales según la clasificación **PAPEL/CARTON, PLÁSTICO y VIDRIO/ALUMINIO**.

- Tipos de papel y cartón que puede reciclar: Cartón corrugado, periódicos, papel de oficina, blanco y de colores, correo de propaganda, revistas y catálogos, cajas de cereal y rollos de toallas de papel, revistas, directorios y guías telefónicas, cuaderno papel, folletos, invitaciones, envolturas de jabones, libretas, carpeta, cajas cartón, tarjetas.

- Tipos de papel que no puede reciclar: Papel parafinado o encerado, cartón metalizado, embases de leche y jugos como tetrabrik y tetra pack, papel carbón, papel de fax, papel aluminio, y papel sucio o contaminado con químicos

- Tipos de plástico para reciclar: Plástico de símbolo PET o PETE con el número 1 y plástico de símbolo PEAT o HDPE con el número 2.

    - Ejemplos de número 1: Botellas de refrescos no retornables, botellas de agua purificada, botellas de aceite para cocinar.

    - Ejemplos de número 2: Botellas de champú, botellas de limpiadores, botellas de yogurt.

- Tipos de plástico que no puede reciclar: Plástico de símbolo PVC, LDPE, PP, PS y O con los números 3, 4, 5, 6, y 7, respectivamente.

- Tipos de vidrio para reciclar: Envases de alimentos y envases de bebidas. Debe reciclar los embases de vidrio por colores: verde, café (ámbar) y cristalino.

- Tipos de vidrio que no puede reciclar: cristal de ventana, espejos y lentes, objetos de cerámica y faros de autos.

- Tipos de aluminio que puede reciclar: Latas de refrescos, latas de cervezas y latas de contenedores de diversas bebidas.

- Tipos de aluminio que no puede reciclar: Latas de aluminio cono las latas de conservas o alimentos, papel aluminio, alambres o cualquier otro objeto de metal.

Esta área podrá ser la misma que la de almacenamiento temporal de los desechos, siempre y cuando se garantice el no mezclar los materiales de reciclaje con la basura por desechar.

Para más información sobre el tema de reciclaje, hacer referencia al anexo I, Panfleto Programa Manejo de Desechos. Reciclaje. Donde se detalla más a fondo y de forma concisa los materiales a reciclar.

4.3 Informe de Gestión Ambiental

El informe de Gestión Ambiental se establece para lograr indicar las medidas de protección ambiental y establecer los resultados que se han obtenido de los programas y directrices establecidas dentro del marco del Plan de Gestión Ambiental implementado.

Para esto se deberá mantener un registro de la cantidad, en peso, de los materiales reciclables que se entregue y de todas las medidas de corrección o prevención tomadas desde la puesta en marcha de los programas.

5. FRECUENCIA

De acuerdo a la tasa de generación de desechos.

6. CAMBIOS Y MODIFICACIONES

No hay.

7. ANEXOS

Anexo I. Panfleto Programa Manejo de Desechos. Reciclaje

Anexo II. Lista de centros de acopio.

APPENDIX H: Protocols Used from the Protocolos de Evaluacion Ambiental

The Protocolos de Evaluacion Ambiental is a set of protocols designed as a system to evaluate environmental impact. Based on environmental laws and regulations in Costa Rica, the main objective of the protocols is to serve as a technical tool for internal use by organizations when conducting inspections or audits of environmental compliance. Each organization intending to use this tool must first determine which protocols will be included in their inspection. Below are the protocols used to evaluate the fire stations of el Cuerpo de Bomberos:

CUESTIONARIO INICIAL

Cuestionario Inicial de Evaluación	
Entidad: Plantel de Buses Empresarios Unidos de Puntarenas	Cédula Jurídica:
Item de Evaluación	
Actualmente la entidad es acreedora de algún reconocimiento por su desempeño ambiental (Bandera Azul Ecológica, Sello de Calidad Sanitaria, Bandera Ecológica, entre otros) Especifique: No	
Gestión de Aire	
Se cuenta con vehículos para apoyar la gestión a la que se dedica la entidad?	☐ Sí ☐ No
Se cuenta con calderas o alguna otra fuente de emisiones atmosféricas?	☐ Sí ☐ No
Se cuenta con maquinaria o algún tipo de equipo que genere altos niveles de ruido?	☐ Sí ☐ No
Existen en la entidad equipos generadores de algún tipo de radiación?	☐ Sí ☐ No
Se generan olores que son perjudiciales para la salud?	☐ Sí ☐ No
Se generan emisiones térmicas?	☐ Sí ☐ No
Gestión de Desechos Sólidos	
Qué tipo de desechos sólidos se generan en la entidad?	
basura que se colecta de los autobuses: bolsas plasticas, empaques de cartón, botellas plasticas, etc.	
baterías, repuestos de los autobuses, llantas	
Qué tipo de tratamiento se le da a los desechos sólidos?	
Se almacenan temporalmente en un lugar específico. Se tiene contrato con los propveedores quienes se encargan de recolectar los repuestos , baterías y demás.	
Gestión de Flora y Fauna/ Manejo de Paisaje/Recursos Culturales y Arqueológicos	
Indique la ubicación exacta de la entidad	
Barrio cuba, San josé	
Se ha encontrado algún recurso arqueológico en los terrenos de la entidad? Especifique	
No.	
Gestión del Agua Superficial y Subterránea	
La entidad genera desechos líquidos? De qué tipo.	
aguas residuales del lavado de autobuses, servicio sanitario.	
En los terrenos de la entidad existe alguna fuente de agua superficial o subterránea? Especifique	
Sí, se ecuenta con pozo propio	
En qué actividades se utiliza el agua en la entidad?	
lavado de autobuses, servicio sanitario, consumo humano, limpieza de instalaciones	
Gestión de las Amenazas	
Se maneja algún tipo de sustancia tóxica o peligrosa? Especifique	
combustible Diesel, gas (en la soda), aceite, liquido de lavado	

PONDERACIÓN POR IMPACTO AMBIENTAL POTENCIAL

PROTOCOLO 1: ***LINEAMIENTOS GENERALES***

Lineamiento	Cumplimiento	Valor obtenido
1. La alta dirección proporciona evidencia de su compromiso por minimizar los impactos negativos que las actividades que desarrolla generan en el ambiente.	☐ sÍ ☐ No	
2. El personal de la organización conoce y comprende los objetivos planteados por la organización, relacionados con el control y reducción del impacto negativo que las actividades que desarrolla generan en el ambiente.	☐ sÍ ☐ No	
3. La alta dirección establece e implanta planes o programas para lograr sus objetivos y metas, en éstos se incluye actividades, plazos y responsables.	☐ sÍ ☐ No	
4. La alta dirección asegura de que las responsabilidades y autoridades, en los puestos que tienen injerencia en la gestión ambiental están definidas y son comunicadas dentro de la organización.	☐ sÍ ☐ No	
5. La alta dirección vela por corregir y prevenir la contaminación generada por las actividades, con el fin de dar cumplimiento a las regulaciones técnicas establecidas por la regulación vigente.	☐ sÍ ☐ No	
	Total	

Observaciones

PROTOCOLO 3: ***EMISIONES DE FUENTES MÓVILES***

Lineamientos	Cumplimiento	Valor obtenido
1. Las emisiones de los vehículos que se utilizan en la empresa no rebasen los niveles máximos permisible de emisión de contaminantes a la atmósfera.	☐ sí ☐ No	
2. Los vehículos se sujetan al sistema de verificación vehicular.	☐ sí ☐ No	
3. Se cumple con la legislación vigente en este tema.	☐ sí ☐ No	
	Total	
Observaciones:		

PROTOCOLO 4: ***CONTROL DE RUIDO POR ACTIVIDADES ANTRÓPICAS***

Lineamientos	Cumplimiento	Valor obtenido
1. Se debe cuenta con un listado de criterios de selección para la compra de maquinaria, entre los cuáles se encuentre uno que garantice que se preferirán equipos que sean más silenciosos.	☐ sÍ ☐ No	
2. Las maquinarias que generen contaminación sónica se mantienen en un área alejada, encapsuladas o cerradas con materiales absorbentes en el interior de las instalaciones en donde se encuentran.	☐ sÍ ☐ No	
3. Se cuenta con un plan de mantenimiento, engrase (de ser necesario) y balanceo periódico de los equipos y maquinaria en general que estén generando ruido, con el fin de disminuir los niveles.	☐ sÍ ☐ No	
4. Las máquinas y elementos vibratorios se ubican cercanos a las columnas y no en el centro de la luz.	☐ sÍ ☐ No	
5. No se perforan los techos aislados en donde se encuentre la maquinaria generadora de ruido, con balas de iluminación.	☐ sÍ ☐ No	
6. Se ubican en sótanos las máquinas que produzcan vibraciones altas	☐ sÍ ☐ No	
	Total	
Observaciones:		

PROTOCOLO 7: ***EMISIÓN DE VIBRACIONES***

Lineamientos	Cumplimiento	Valor obtenido
1. Los responsables de la maquinaria y equipos generadores de vibraciones utilizan los aditamentos adecuados para aislar o eliminar el efecto nocivo que pudieran ocasionar.	☐ sí ☐ No	
2. Se programan períodos de tiempo de exposición.	☐ sí ☐ No	
3. En los casos en que sea factible, se anclan las maquinas independientes de cimentación general y nivelarlas.	☐ sí ☐ No	
4. Los equipos y maquinaria se mantienen ajustados y se instalan dispositivos antivibratorios necesarios.	☐ sí ☐ No	
5. Se evita que estos equipos se apoyen en paredes colindantes o en otras que pudieran transmitir vibraciones.	☐ sí ☐ No	
6. Se cuenta y se ejecutan programas de mantenimiento preventivo y correctivo.	☐ sí ☐ No	
7. Se cumple con la legislación vigente en este tema.	☐ sí ☐ No	
	Total	
Observaciones:		

PROTOCOLO 9: *EMISIONES DE OLORES*

Lineamientos	Cumplimiento	Valor obtenido
1. Cuando por razón de procesos productivos o actividades diversas se infiera la generación de olores, el responsable de la fuente implementa las medidas correctivas y de mitigación para el control de este tipo de emisión.	☐ sÍ ☐ No	
	Total	
Observaciones:		

PROTOCOLO 10: ***CALIDAD DEL AGUA POTABLE***

Lineamientos	Cumplimiento	Valor obtenido
1. Se garantiza el suministro de agua potable en sus instalaciones.	☐ sí ☐ No	
2. Se cuenta con un programa de mantenimiento y limpieza de tanques y redes para asegurar de forma permanente la potabilidad del agua.	☐ sí ☐ No	
3. Si el agua es para consumo humano se fomenta el uso de filtros o purificadores en la salida de los grifos.	☐ sí ☐ No	
4. Se realizan periódicamente pruebas de laboratorio (el cual debe estar acreditado en los respectivos ensayos) que establezcan la calidad del agua en forma continua.	☐ sí ☐ No	
5. El agua cumple con las normas y regulaciones técnicas establecidas por la legislación vigente en este tema, que para este caso se encuentra referido en el reglamento Calidad del Agua Potable.	☐ sí ☐ No	
	Total	
Observaciones:		

PROTOCOLO 12: ***SISTEMAS DE TRATAMIENTO DE AGUAS RESIDUALES***

Lineamientos	Cumplimiento	Valor obtenido
1. Los edificios, establecimientos e instalaciones, están provistos de los sistemas de tratamiento necesarios para que sus aguas residuales cumplan con las disposiciones del Reglamento de Vertido y Reuso de Aguas Residuales.	☐ sÍ ☐ No	
2. Los sistemas de tratamiento están diseñados por un profesional calificado, quien además debe controlar la operación del sistema durante los primeros años (1 ó 2), a fin de resolver cualquier problema que pueda presentarse.	☐ sÍ ☐ No	
3. Se evalúa periódicamente la cantidad y la calidad de las aguas servidas a la entrada y salida del sistema de tratamiento, por medio de pruebas de laboratorio, para controlar la eficiencia del mismo.	☐ sÍ ☐ No	
4. Se cuenta con un programa de mantenimiento preventivo y correctivo que asegure el adecuado funcionamiento del sistema.	☐ sÍ ☐ No	
5. El personal responsable del mantenimiento y operación del sistema tiene la capacitación adecuada.	☐ sÍ ☐ No	
6. Se evita mezclar las aguas servidas con las pluviales para evitar un aumento en el volumen de las aguas a tratar ya que esto desgasta las tuberías y encarece el tratamiento.	☐ sÍ ☐ No	
7. Se cumple con las normas y regulaciones técnicas establecidas por la legislación vigente en este tema, que para este caso se encuentra referido en el Reglamento de Aprobación y Operación de Sistemas de tratamiento de Aguas Residuales Nº 31545-S-MINAE publicado en La Gaceta del 22 de diciembre del 2003.	☐ sÍ ☐ No	
	Total	
Observaciones:		

PROTOCOLO 13: *CONSUMO DE AGUA*

Lineamientos	Cumplimiento	Valor obtenido
1. Se lleva un registro del consumo de agua mediante medidores.	☐ sí ☐ No	
2. Se tiene claramente establecido si el consumo de agua se encuentra entre los rangos recomendados, de acuerdo a las características de la actividad. De no ser así, se acatan las medidas necesarias para reducir el consumo a los límites permisibles.	☐ sí ☐ No	
3. Se utilizan dispositivos para reducir el consumo de agua tales como: Inodoros Eficientes, Duchas Eficientes, Grifería Eficiente, entre otros.	☐ sí ☐ No	
4. Se desarrollan programas sobre verificación de fugas de agua, en el cual se establezcan revisiones periódicas y se lleva un registro de ubicación y reparación.	☐ sí ☐ No	
5. Se promueve e implementar programas para el ahorro de agua, donde establezcan objetivos, metas, actividades, responsables, plazos de ejecución, entre otros.	☐ sí ☐ No	
	Total	
Observaciones:		

PROTOCOLO 14: *USO Y CONSERVACIÓN DEL SUELO*

Lineamientos	Cumplimiento	Valor obtenido
1. Se procura el reuso y reciclaje de residuos para disminuir la cantidad dispuesta en los rellenos sanitarios.	☐ sí ☐ No	
2. Se evitan prácticas que favorezcan la erosión, degradación ó modificación de las características topográficas, con efectos ecológicos adversos.	☐ sí ☐ No	
3. Si la actividad provoca deterioro severo de los suelos, se establecen acciones equivalentes de regeneración.	☐ sí ☐ No	
4. No se descarga, deposita o infiltra en los suelos residuos industriales que causen contaminación o alteraciones nocivas en el suelo.	☐ sí ☐ No	
5. No se derraman o infiltran líquidos que causen contaminación del suelo, sin observar las normas relativas a la prevención y control de la contaminación del agua.	☐ sí ☐ No	
6. El uso del suelo es compatible con su vocación natural y no se altera el equilibrio de los ecosistemas.	☐ sí ☐ No	
7. Se cumple con las normas y regulaciones técnicas establecidas por la legislación vigente en este tema, que para este caso se encuentra referida al reglamento de uso, manejo y conservación de suelos.	☐ sí ☐ No	
	Total	
Observaciones:		

PROTOCOLO 15: ***MANEJO DE DESECHOS SÓLIDOS ORDINARIOS***

Lineamientos	Cumplimiento	Valor obtenido
1. Se cuenta con un programa para minimizar la compra de insumos que producen desechos.	☐ sí ☐ No	
2. Se implementan acciones concretas para la reutilización de papel, recipientes y todos aquellos materiales que sean reutilizables.	☐ sí ☐ No	
3. Se separan los desechos ordinarios de los desechos especiales y peligrosos	☐ sí ☐ No	
4. Se tienen identificados los responsables del manejo de los desechos sólidos y los participantes en el proceso de manejo.	☐ sí ☐ No	
5. En el caso de que se requiera, se identifican y se implementan los medios de protección personal, los medios de trabajo y la frecuencia o programa de trabajo de los implicados en el manejo.	☐ sí ☐ No	
6. Se cuenta con un área delimitada para el almacenamiento temporal de los desechos sólidos, provisto de contenedores con tapa y retirado de las zonas de producción y andenes, para efecto de evitar la emisión de olores y la propagación de fauna nociva.	☐ sí ☐ No	
7. Se cumple con las normas y regulaciones técnicas establecidas por la legislación vigente en este tema, que para este caso se encuentra referida al Reglamento sobre Manejo de Basuras.	☐ sí ☐ No	
	Total	
Observaciones:		

PROTOCOLO 16: *MANEJO DE DESECHOS SÓLIDOS PELIGROSOS*

Lineamientos	Cumplimiento	Valor obtenido
1. Se cuenta con planes que permitan reducir la utilización de materiales que generen residuos peligrosos.	☐ sÍ ☐ No	
2. Se realiza la identificación de los desechos sólidos generados, lo cual permitirá realizar la clasificación de los mismos.	☐ sÍ ☐ No	
3. Se manejan por separado los desechos ordinarios de los desechos peligrosos.	☐ sÍ ☐ No	
4. Dentro de los desechos peligrosos seleccionados se realiza la separación de aquellos que puedan generan reacciones químicas perjudiciales o bien explosiones.	☐ sÍ ☐ No	
5. El almacenamiento de los desechos sólidos peligrosos se da por períodos cortos.	☐ sÍ ☐ No	
6. En los lugares de almacenamiento se mantienen buenas condiciones, en los cuales no existe ruptura, escape, corrosión u otra falla.	☐ sÍ ☐ No	
7. Se realizan inspecciones periódicas a los lugares de almacenamiento.	☐ sÍ ☐ No	
8. Se tienen establecidas distancias y zonas de seguridad para residuos que sean inflamables o reactivos.	☐ sÍ ☐ No	
9. Se llevan los controles relativos a la generación, transporte, tratamiento y disposición final de los residuos peligrosos generados.	☐ sÍ ☐ No	
10. Se cumplen con las normas y regulaciones técnicas establecidas por la legislación vigente en este tema, que para este caso se encuentra referida al Reglamento para el Manejo de los Desechos Peligrosos Industriales.	☐ sÍ ☐ No	
	Total	
Observaciones: aceites, hospitalarios		

PROTOCOLO 19: ***PREVENCIÓN Y ATENCIÓN DE DESASTRES NATURALES***

Lineamientos	Cumplimiento	Valor obtenido
1. Se tienen identificados los tipos de amenazas que existen en la zona donde se ubica la instalación ya sea: deslizamientos, fallas sísmicas, cercanías de ríos u otras fuentes de agua, etc.	☐ sÍ ☐ No	
2. Se han desarrollado y se implementan planes de atención de emergencia de acuerdo a la Guía para la presentación del Programa de Atención de Emergencias emitido, por la Oficina de Protección al Ambiente Humano del Ministerio de Salud.	☐ sÍ ☐ No	
3. Se mantiene un proceso continuo de capacitación del personal, simulacros y entrenamiento en prevención y atención de desastres naturales.	☐ sÍ ☐ No	
4. Se cumple con las normas y regulaciones técnicas establecidas por la legislación vigente en este tema, entre ellos, el Manual de Buenas Prácticas Ambientales (Gaceta del 5 de noviembre del 2004).	☐ sÍ ☐ No	
	Total	
Observaciones:		

PROTOCOLO 20: ***PREVENCIÓN Y ATENCIÓN DE INCENDIOS FORESTALES***

Lineamientos	Cumplimiento	Valor obtenido
1. Se fomenta y participa activamente en programas de prevención de incendios forestales en las zonas aledañas u otras regiones del país.	☐ sí ☐ No	
2. Se cuenta con una red de puntos de agua en la zona de la corona forestal y sus inmediaciones.	☐ sí ☐ No	
3. Se fomenta la eliminación de combustible vegetal, así como la sustitución de especies xerofitas por hidrófilas, en zonas cuyas características edáficas y climáticas lo permitan.	☐ sí ☐ No	
4. Se crean franjas de monte verde, con un gran contenido en humedad, que formen una barrera capaz de contener el avance de posibles incendios en zonas de medianía o limítrofes con la zona de monte.	☐ sí ☐ No	
5. Se promueve y participa en la recuperación del paisaje afectados por incendios forestales.	☐ sí ☐ No	
	Total	
Observaciones:		

PROTOCOLO 21: ***PREVENCIÓN Y ATENCIÓN DE DERRAMES DE SUSTANCIAS TÓXICAS***

Lineamientos	Cumplimiento	Valor obtenido
1. Se cuenta con un registro del tipo de sustancia, sus características (grado de toxicidad, efectos, etc.) y cantidad almacenada o transportada.	☐ sÍ ☐ No	
2. Se desarrollan e implementan planes que permitan minimizar riesgos de accidentes y derrames de sustancias tóxicas	☐ sÍ ☐ No	
3. Se desarrolla un programa de mantenimiento preventivo y correctivo de las instalaciones y/o equipos tales como: tanques, unidades de proceso, instrumentos, unidades de transporte, etc,	☐ sÍ ☐ No	
4. Se aporta la información de los riesgos de las actividades que pueden afectar a la comunidad por derrame de sustancias tóxicas, y la preparación de esta para prevenir y actuar ante los efectos nocivos del siniestro.	☐ sÍ ☐ No	
5. Existen planes de contingencia que le permita enfrentar y controlar un derrame de manera eficaz y eficiente.	☐ sÍ ☐ No	
6. Se mantiene un proceso continuo de capacitación del personal, simulacros y entrenamiento en prevención y control de derrames.	☐ sÍ ☐ No	
7. Se cumple con las normas y regulaciones técnicas establecidas por la legislación vigente en este tema.	☐ sÍ ☐ No	
	Total	
Observaciones:		

PROTOCOLO 22: ***MANEJO DE SUSTANCIAS PELIGROSAS***

Lineamientos	Cumplimiento	Valor obtenido
1. El personal que maneje sustancias peligrosas está instruido en los conocimientos de las propiedades físicas, químicas y biológicas de estas sustancias y los riesgos que estas implican.	☐ sÍ ☐ No	
2. Si se fabrican, almacenan o distribuyen sustancias peligrosas, se tiene el conocimientos básicos de las propiedades físicas, químicas y biológicas de estas sustancias o productos; así mismo se asegura que éstas contengan la etiqueta correspondiente de acuerdo con su clasificación en un lugar claro y en letras legibles, en idioma español, con las especificaciones para su manejo.	☐ sÍ ☐ No	
3. Se ha desarrollado un plan para la evacuación y disposición final de sustancias radiactivas o combinaciones químicas o sintéticas, biológicas, desechos y otras materias, que por su naturaleza de alto riesgo puedan provocar daños a la salud de seres humanos, al medio ambiente y a los recursos naturales.	☐ sÍ ☐ No	
4. Se promueve el desarrollo y uso de tecnologías limpias o ambientalmente seguras, aplicadas bajo principios de prevención que minimicen la generación de desechos, así como establecer sistemas de administración y manejo que permita reducir al mínimo los riesgos a la salud y al ambiente.	☐ sÍ ☐ No	
5. Se promueve el aprovechamiento de los materiales peligrosos recuperables, previa aprobación por parte de las autoridades competentes, por medio de reutilización, reciclaje, recuperación o cualquier otra acción dirigida a obtener materiales reutilizables o energía.	☐ sÍ ☐ No	
6. Se tiene establecidos planes de emergencia y de contingencia, diseñados e implementados de conformidad con la reglamentación técnica vigente sobre la materia.	☐ sÍ ☐ No	
7. Se dispone de los equipos, herramientas y demás medios adecuados para la prevención y el control de accidentes producidos por sustancias peligrosas, así como para la reparación de los daños causados por tales accidentes.	☐ sÍ ☐ No	
8. Se permite el acceso a los sitios o instalaciones y prestar facilidades y equipos de seguridad a los organismos competentes para realizar labores de inspección y control.	☐ sÍ ☐ No	
9. No se transportan sustancias, materiales o desechos peligrosos en vehículos dedicados al transporte de pasajeros, alimentos, animales, agua potable u otros bienes de consumo susceptibles de contaminación.	☐ sÍ ☐ No	
10. No se traslada en un mismo vehículo sustancias, materiales y desechos peligrosos diferentes que sean incompatibles entre sí, de acuerdo a lo establecido en la	☐ sÍ ☐ No	

reglamentación técnica que rige la materia.		
11. El diseño y ubicación del lugar de almacenamiento de sustancias o materiales peligrosos está de acuerdo con la naturaleza de los materiales a ser almacenados.	☐ sÍ ☐ No	
	Total	
Observaciones:		

PROTOCOLO 23: ***MANEJO DE SUSTANCIAS HIDROCARBURADAS***

Lineamientos	Cumplimiento	Valor obtenido
1. Se cuenta y se implementa un plan para el adecuado manejo de hidrocarburos a fin de minimizar riesgos de accidentes, incendios y derrames.	☐ sÍ ☐ No	
2. Se desarrolla un programa de mantenimiento preventivo y correctivo de las instalaciones y/o equipos tales como: ductos, tanques, unidades de proceso, instrumentos, unidades de transporte, etc,	☐ sÍ ☐ No	
3. Se provee de la información de los riesgos de las actividades que pueden afectar a la comunidad por derrame de hidrocarburos y derivados y la preparación de esta para prevenir y actuar ante los efectos nocivos del siniestro.	☐ sÍ ☐ No	
4. Existen planes de contingencia que le permita enfrentar y controlar un derrame de manera eficaz y eficiente.	☐ sÍ ☐ No	
5. Se mantiene un proceso continuo de capacitación del personal, en manejo de hidrocarburos.	☐ sÍ ☐ No	
6. Se cumple con las normas y regulaciones técnicas establecidas por la legislación vigente en este tema, que para este caso se encuentra referido en la Ley Orgánica de Hidrocarburos y Manual de Buenas Prácticas Ambientales (Gaceta del 5 de noviembre del 2004).	☐ sÍ ☐ No	
	Total	
Observaciones:		

PROTOCOLO 29: *RECURSOS CULTURALES Y ARQUEOLÓGICOS*

Lineamientos	Cumplimiento	Valor obtenido
1. La actividad fomenta y participa activamente en programas de protección y restauración de sitos arqueológicos y de patrimonio cultural y científico en las zonas aledañas o en otras regiones del país.	☐ sÍ ☐ No	
2. En la promoción de la actividad se integran los elementos culturales y arqueológicos de la región y de las comunidades locales.	☐ sÍ ☐ No	
3. La actividad promociona e incentiva manifestaciones y actividades culturales y científicas.	☐ sÍ ☐ No	
4. Se debe establecer acciones prácticas que desincentivan el acoso sexual y promuevan la igualdad de oportunidades para ambos sexos.	☐ sÍ ☐ No	
5. La actividad prohibe el uso y promoción de actividades de comercio sexual, prostitución, expendio de drogas u otros problemas sociales.	☐ sÍ ☐ No	
6. Los rótulos dedicados a la orientación y promoción de la actividad no interfen con el medio cultural o social de la región.	☐ sÍ ☐ No	
7. Se debe cumplir con las normas y regulaciones técnicas establecidas por la legislación vigente en este tema, que para este caso se encuentra referida a la Ley sobre Patrimonio Nacional Arqueológico.	☐ sÍ ☐ No	
	Total	
Observaciones:		

PROTOCOLO 30: *CONSUMO DE ENERGÍA*

Lineamientos	Cumplimiento	Valor obtenido
1. Se lleva un registro del consumo de energía eléctrica mediante medidores.	☐ sí ☐ No	
2. El consumo de energía se encuentra entre los rangos recomendados, de acuerdo a las características propias de la actividad. De no ser así, se acatan las medidas necesarias para reducir el consumo a los límites permisibles.	☐ sí ☐ No	
3. Se utilizan los dispositivos para reducir el consumo de energía tales como: fluorescentes compactos, fotoceldas o controladores de encendido en los circuitos de iluminación exterior, tragaluces con los cuales se aprovechará la luz natural, entre otros.	☐ sí ☐ No	
4. Existe un programa de mantenimiento preventivo y correctivo que asegure el adecuado funcionamiento de los equipos eléctricos en general (aires acondicionados, bombas, maquinaria, etc.)	☐ sí ☐ No	
5. Se promueve la implementación de programas para el ahorro de energía, donde se establezcan objetivos, metas, actividades, responsables, plazos de ejecución, entre otros.	☐ sí ☐ No	
6. Se promueve el uso de sistema de energía alternativa para iluminación, así como sistemas de energía alternativa para el calentamiento o precalentamiento de agua, bombeo u otras.	☐ sí ☐ No	
7. Se promueve la utilización de ventilación natural, reflexión de luz y calor, sombra natural y otros para procurar un ambiente agradable.	☐ sí ☐ No	
8. Los tanques de agua caliente y las tuberías expuestas (internas cuando sea posible) están recubiertos con material aislante para evitar pérdidas de calor.	☐ sí ☐ No	
9. Se debe cumplir con las normas y regulaciones técnicas establecidas por la legislación vigente en este tema, que para este caso se encuentra referido en el Reglamento para la Regulación del Uso Racional de la Energía. Nº 25584 MINAE-H-MP.	☐ sí ☐ No	
	Total	
Observaciones:		

APPENDIX I: Waste Management Questions in Spanish

Solid Waste Management Protocols
14.1. Se procura el reuso y reciclaje de residuos para disminuir la cantidad dispuesta en los rellenos sanitarios.
15.1. Se cuenta con un programa para minimizar la compra de insumos que producen desechos.
15.2. Se implementan acciones concretas para la reutilización de papel, recipientes y todos aquellos materiales que sean reutilizables.
15.3. Se separan los desechos ordinarios de los desechos especiales y peligrosos
15.4. Se tienen identificados los responsables del manejo de los desechos sólidos y los participantes en el proceso de manejo.
15.5. En el caso de que se requiera, se identifican y se implementan los medios de protección personal, los medios de trabajo y la frecuencia o programa de trabajo de los implicados en el manejo.
15.6. Se cuenta con un área delimitada para el almacenamiento temporal de los desechos sólidos, provisto de contenedores con tapa y retirado de las zonas de producción y andenes, para efecto de evitar la emisión de olores y la propagación de fauna nociva.
15.7. Se cumple con las normas y regulaciones técnicas establecidas por la legislación vigente en este tema, que para este caso se encuentra referida al Reglamento sobre Manejo de Basuras.
16.1. Se cuenta con planes que permitan reducir la utilización de materiales que generen residuos peligrosos.
16.2. Se realiza la identificación de los desechos sólidos generados, lo cual permitirá realizar la clasificación de los mismos.
16.3. Se manejan por separado los desechos ordinarios de los desechos peligrosos.
16.4. Dentro de los desechos peligrosos seleccionados se realiza la separación de aquellos que puedan generan reacciones químicas perjudiciales o bien explosiones.
16.5. El almacenamiento de los desechos sólidos peligrosos se da por períodos cortos.
16.6. En los lugares de almacenamiento se mantienen buenas condiciones, en los cuales no existe ruptura, escape, corrosión u otra falla.
16.7. Se realizan inspecciones periódicas a los lugares de almacenamiento.
16.8. Se tienen establecidas distancias y zonas de seguridad para residuos que sean inflamables o reactivos.
16.9. Se llevan los controles relativos a la generación, transporte, tratamiento y disposición final de los residuos peligrosos generados.
16.10. Se cumplen con las normas y regulaciones técnicas establecidas por la legislación vigente en este tema, que para este caso se encuentra referida al Reglamento para el Manejo de los Desechos Peligrosos Industriales.
22.4. Se promueve el desarrollo y uso de tecnologías limpias o ambientalmente seguras, aplicadas bajo principios de prevención que minimicen la generación de desechos, así como establecer sistemas de administración y manejo que permita reducir al mínimo los riesgos a la salud y al ambiente.

APPENDIX J: Waste Management Protocols In English

Solid Waste Management Protocols
14.1. It seeks to reuse and recycling of waste to reduce the amount ready in landfills.
15.1. There is a program to minimize the purchase of inputs that produce waste.
15.2. Concrete actions are implemented for the reuse of paper, recipients and all those materials that are reusable.
15.3. Are separated from regular waste and hazardous waste special
15.4. Will have identified those responsible for the management of solid wastes and participants in the management process.
15.5. In cases where required, are identified and implemented the means of personal protection, media work and the frequency or program of work of those involved in management.
15.6. There is a bounded area for temporary storage of solid wastes, fitted container with a lid and removed from the production areas and platforms, to the effect of preventing the emission of odors and the spread of harmful fauna.
15.7. Met with the standards and technical regulations set by the law of this subject, which in this case is referred to the Regulation on Management of Wastes.
16.1. There are plans to reduce the use of materials that generate hazardous waste.
16.2. We carried out the identification of solid waste generated, which will allow the classification of them.
16.3. Are handled separately from regular waste hazardous wastes.
16.4. Within the selected hazardous waste is the separation of those who can generate harmful chemical reactions or explosions.
16.5. The storage of hazardous solid waste is taken for short periods.
16.6. At storage sites remain good condition, in which there is no break, escape, corrosion or other malfunctions.
16.7. Regular inspections are conducted at storage sites.
16.8. Are set distances and security zones for waste that is flammable or reactive.
16.9. They take the controls on the generation, transport, treatment and disposal of hazardous waste generated.
16.10. Compliance with the standards and technical regulations set by the law of this subject, which in this case is referring to the Regulations for the Management of Industrial Hazardous Wastes.
22.4. Promotes the development and use of clean technologies and environmentally safe, applied under principles of prevention to minimize waste generation and to establish systems of administration and management to enable to minimize risks to health and the environment.

APPENDIX K: Interviews With Costa Rican Fire Stations

Trips to Cartago 11/17/08

Turrialba-
Jefe: Ricardo Machado
Permanent Bomberos: 7
Population: 27,100
Other: The community of Turrialba does not recycle but the community next to it does. The Bomberos want to keep up with the neighboring community. They would like to take their experience and information from the presentation home. The Bomberos are also interested in becoming a drop-off center for the community if they can create a contract with a recycling facillity.

Las Juntas-
Jefe: Alvin
Permanent Bomberos: 4
Population: 4600
Other: The Bomberos do not recycle within the fire station, but the community recycles only cardboard. The Bomberos used to recycle different types of metal, including aluminum, but the volunteer who used to transport the metal left the station. The station does reuse coke bottles by collecting them and refilling them through a program with the company.

Paraiso-
Jefe: Ronald
Permanent Bomberos: 4
Population: 33,000
Other: At the station, the Bomberos separate recyclable goods. A volunteer then transports the materials to a recycling center. The station does not have separate receptacles, however.

Cartago-
Jefe: Wilberth Figueroa
Permanent Bomberos: 6
Population: 26,400
Other: The Bomberos separate and recycling paper, cardboard, glass, and aluminum. They do not separate special materials such as tires, batteries, and oil. The community recycles as well. There is a recycling center at the Technical University of Costa Rica located in Cartago. This is where the Bomberos bring their recyclables.

Trips in Guanacaste 11/ 19/08 – 11/21/08

Cañas-
Jefe: Edgar Monde
Permanent Bomberos: 4
Population: 18,200
Other: The Bomberos do not recycle within the station. The community does not recycle and there are not any recycling centers.

Liberia-
Jefe: Alan Maron Vega
Permanent Bomberos: 9
Population: 38,000
Other: The Bomberos do not recycle in the station and a program has not been established in the community. The Bomberos were very interested in the idea and enthusiastic about the prospect of beginning a recycling program within el Cuerpo de Bomberos.

Liberia International Airport-
Jefe: Oscar Castillo Jiron
Permanent Bomberos: 9
Population: 38,000
Other: The Bomberos were enthusiastic about the program and very impressed by our presentation and dedication. They were grateful that we were interested in helping the Bomberos create a recycling program and catering the presentation as well as follow-up information to the specific needs of the Bomberos. They explained that the airport does not recycling, and as a result they did not recycle either. They were concerned that they did not produce enough recyclable material to warrant the creation of a recycling plan.

Filadelfia-
Jefe: Hans (Spoke with AsdruBal Gutierrez)
Permanent Bomberos: 3
Population: 5700
Other: Neither the Bomberos nor the community recycle, but the Bomberos are interested in the idea.

Santa Cruz-
Jefe: Ali Camacho (Spoke with Oscar Gonzalez)
Permanent Bomberos: 3
Population: 11,400
Other: The Bomberos do not recycle, but have been interested in starting a program in the past. Previously, they had asked for permission from the chief in San Jose to create a recycling plan in

which they would be the drop-off center for the community. They were not granted permission because the chief felt that their station was too small to support the large community. They are interested in initiating this recycling plan and including the community.

Nicoya-
Jefe: Johnny Garcia
Permanent Bomberos: 6
Population: 14,700
Other: There is a recycling center in Nicoya, but no organized recycling program in the community or in the fire station.

Trips in Puntarenas 11/ 25/08 – 11/26/08

Esparza-
Jefe: Luiz Ledezma
Permanent Bomberos: 5
Population: N/A
Other: The station has been recycling paper and plastic for 2 months. They donate the plastic to a local school, Jardin de Ninos de el Roble, located 10 km away from the station. This school is able to collect money for the plastic that it brings to the recycling facility. They have a recycling bin for paper and separate paper and plastic into bags to be recycled. Volunteers bring the paper to a private facility to be recycled. The municipality that Esparza lies in recycles glass and plastic, but there is no organized program. There is no organic material recycling in the community and there is no curbside recycling in the city but a group of women collect recyclables on the curb and bring them to the facility to be recycled. The bomberos do not produce enough aluminum to make it worth collecting.
The station began recycling when they saw a TV program that described recycling in their community. They did not use any educational material, or any introduction to recycling for the bomberos, they just told the employees to recycle and they do. Mr. Ledezma has noticed a decrease in waste thrown away to landfills but could not offer us any statistics or data to support this. The bomberos say that they "enjoy recycling. (they said, "of course")

El Roble-
Jefe: Reyner Sandoval
Permanent Bomberos: 10
Population: N/A
Other: Mr Sandoval commented that many people do not know that number two plastic is recyclable. We gave them our presentation. The bomberos think it's a good idea to donate plastics to schools. They are interested in starting a recycling program with plastic and

aluminum although it will be challenging. There is not a recycling facility in El Roble and no recycling in the community.

Puntarenas-
Jefe: Alexander Araya Miko
Permanent Bomberos: 6
Population: 37,500
Other: The Bomberos were very interested in a recycling plan. During the discussion, they asked us what percentage of Americans recycle and what percentage of companies/industries in CR recycle? They asked about the different types of plastics and the difference between PET1 and HDPE2.

11-26
Quepos-
Jefe: Vladmir Rosales
Permanent Bomberos: 3
Population: 7600
Other: There is no community recycling here and no recycling facility near here. They bomberos here do not recycle and their concern is proximity to a recycling facility. We discussed the possibility of a truck picking up recyclables from fire stations in the area and bringing them to a facility. They think recycling is a good idea. The community does not recycle in Quepos. The Bomberos expressed interest in involving the community in a recycling program and said they want to create a recycling center in the front of their station.

Parrita-
Jefe: Jose Retana y Kenneth Rodriguez
Permanent Bomberos: 2
Population: 3600
Other: Parrita is starting a program to recycle in the community, but it has not been established yet. The Bomberos do not recycle and right now, the community does not. There is a recycling center, but it is currently not in service. They Bomberos are very interested in recycling.

Garabito-
Jefe: Alvaro Salas
Permanent Bomberos: 4
Population: N/A
Other: The station has just begun recycling because the rest of the municipality recycles. The Bomberos are very interested in partaking in a nation-wide recycling program for el Cuerpo de Bomberos. There is a recycling facility in the municipality. There is no transportation at the moment, but in the future they will implement a curbside program. They recycle plastic, glass,

aluminum, organic materials, paper, and cardboard. The Bomberos found the presentation to be very interesting and informativ

APPENDIX L: Table of National Waste Management COmpliance

	National Waste Management Protocol Compliance																			
Name of Station	**14.1**	**15.1**	**15.2**	**15.3**	**15.4**	**15.5**	**15.6**	**15.7**	**16.1**	**16.2**	**16.3**	**16.4**	**16.5**	**16.6**	**16.7**	**16.8**	**16.9**	**16.10**	**22.4**	**Avg Percent Compliance**
Turrialba	1	1	1	1	1	1	1	1	1	1	1	N/A	1	1	1	1	1	1	1	100
Paraiso	1	0	1	1	1	1	1	1	0	1	1	N/A	0	1	1	0	N/A	1	1	76.5
Cartago	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	89.5
Las Juntas	0	0	0	1	1	1	1	1	0	0	1	N/A	1	1	1	0	N/A	1	0	58.8
Canas	0	0	1	0	1	1	0	1	1	0	0	N/A	1	1	0	1	N/A	1	1	58.8
Liberia	0	0	1	0	1	1	1	N/A	0	0	0	1	1	1	1	1	0	1	0	55.6
Liberia Int'l Airport	0	0	0	0	1	1	0	1	1	0	0	1	1	1	1	1	1	1	0	57.9
Filadelfia	0	0	0	0	1	1	1	1	0	0	0	0	1	1	1	1	1	1	0	52.6
Santa Cruz	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	89.5
Nicoya	0	0	0	0	1	1	0	0	0	0	0	1	1	1	1	1	1	1	1	52.6
Esparza	1	0	1	1	1	1	1	1	0	1	0	N/A	1	1	1	1	1	1	0	77.8
El Roble	1	1	1	0	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	89.5
Quepos	0	0	0	0	1	1	0	1	0	1	0	1	1	1	1	1	1	1	0	57.9
Parrita	0	0	0	0	1	1	1	1	0	0	0	1	1	1	1	1	1	1	0	57.9
Garabito	0	1	1	0	1	1	0	1	1	1	0	1	1	1	1	1	1	1	0	73.7
Average Percent of Compliance	40	26.7	60	33.3	100	100	60	92.9	46.7	53.3	40	90	93.3	100	93.9	86.7	91.7	100	33.3	

APPENDIX M: Introductory PowerPoint Presented to Visited Stations

PAPEL Y CARTÓN

- No mezcles estas impurezas que perjudican el proceso de reciclaje del papel:
  - Papel Carbón
  - Plastificado
  - Encerado (Tetra Pack o Tetra Brik)
  - Con adhesivos
  - Domésticos (Servilletas, higiénico)
  - Pañales




ALUMINIO

- Latas de refrescos
- Latas de cervezas
- Latas de contenedores de diversas bebidas

- No confundir estas latas de aluminio con las latas de conservas o alimentos, ni revolver con papel aluminio, alambres o cualquier otro objeto de metal

VIDRIO

- Envases de alimentos
- Envases de bebidas (jugos, cervezas, refrescos)
- Hay que separar los embases de vidrio de acuerdo a estos colores:
  1. Verde
  2. Café (ámber)
  3. Cristalino (Transparente)

VIDRIO

No revuelva con los envases de vidrio anteriores los siguientes materiales:

- Cristal de ventanas
- Espejos y lentes
- Objetos de cerámica
- Focos de autos
- Entre otros



PLÁSTICO

- El plástico tiene muchas clasificaciones y presentaciones de diferentes tipos, por lo que es necesario estar muy bien informado para realizar efectivamente el proceso de separación y reciclaje.

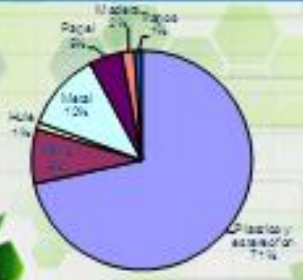
- La mayoría de las botellas de plástico están marcadas con símbolos, números o códigos que indican la clasificación a la que pertenecen, esto ayuda a identificarlos.

PLÁSTICO

- Plastico TEREFTALATO DE POLIETILENO símbolo PET o PETE con el número 1.
- Ejemplos:
  - + Botellas de refrescos no retornables
  - + Botellas de agua purificada
  - + Botellas de aceite para cocina

PETE

Porcentaje de la composición de desechos de Costa Rica



TIEMPO DE DESCOMPOSICIÓN EN EL AMBIENTE DE DIFERENTES TIPOS DE DESECHOS

Desecho	Tiempo
Botella de vidrio	No se descompone
Botella de plástico	450 años
Envase de aluminio	De 250 a 500 años
Estereofón	80 años
Vaso de estereofón	80 años
Lata de hojalata	80 años
Bolsa plástica	500 años
Materia orgánica	De dos semanas a un mes
Tetra Pack o Tetra Brik	Indefinido

Es importante para entender que ocurre cuando no reciclamos.

ALGUNOS HECHOS QUE LE SORPRENDERÁN

- Al utilizar papel no reciclado contribuimos al agotamiento de los bosques.
- Por cada tonelada de papel y cartón que se produce se cortan 15 árboles.
- Muchas de las frutas y verduras que comemos se cultivan con fertilizantes y plaguicidas altamente tóxicos.
- Una familia de cinco personas produce un metro cúbico de basura al mes.
- El 40% de la producción de desperdicios podría ser reciclado.
- Existen varios sistemas para deshacernos de la basura, pero ninguno resuelve el problema de la basura por completo.

¿CUÁLES SON LAS CINCO ERRES DE LA BASURA?

5R's

- Reducir.
  - No imprimir un documento si no necesita.
- Reutilizar.
  - Usa una bolsa de supermercado por su amuerzo.
- Rechazar.
  - Compra un producto que no tiene un impacto negativo del medio ambiente.
- Reciclar.
  - Usa material de papel para hacer un producto nuevo como un periódico.
- Responsabilidad.
  - Sabe las cinco cosas antes para reducir su impacto negativo.

MATERIALES RECICLABLES

PAPEL Y CARTÓN

- Periódico
- Libretas
- Revistas
- Hojas
- Sobres
- Legajos
- Cajas
- Folletos
- Invitaciones
- Envolturas de papel y Cartón

Nota: El papel deberá estar seco y amarrado en bolsas.

PLÁSTICO

- **Plástico de POLIETILENO DE ALTA DENSIDAD símbolo PEAT o HDPE con el número 2.**
- Ejemplos:
  - Botellas de champú.
  - Botellas de limpiadores.
  - Botellas de yoghurt.

Otros tipos de plásticos: #3 PVC, #4 LDPE, #5 PP, #6 PS y #7 O

CONSIDERACIONES PARA DESECHOS ESPECIALES

- Para el caso de los aceites, llantas y baterías se procederá de acuerdo a los procedimientos establecidos por la Institución donde se garantiza la disposición final de los mismos, o cualquier medio que se establezca y se comunique con anterioridad a su implementación.

ACEITE

- Para almacenar aceites deben ser separados de otros tipos de líquidos de vehículos.
- Los recipientes deben colocarse en un área de almacenamiento temporal y deben ser identificados adecuadamente

LLANTAS

- Al almacenar las llantas se debe evitar mantenerlas a la intemperie para minimizar las probabilidades de generar un criadero para los mosquitos

OTROS DESECHOS ESPECIALES

- Para el resto de los desechos especiales se tomarán las medidas necesarias para su disposición final
- Siempre tomando las consideraciones para el manejo seguro de los mismos
- Evitando un daño al ambiente y al personal durante su manipulación.

Muchas Gracias por su Atención

APPENDIX N: Sample Paper And Cardboard Recycling Label Placed Above Bins

APPENDIX O: Sample Plastic Recycling Label Placed Above Bins

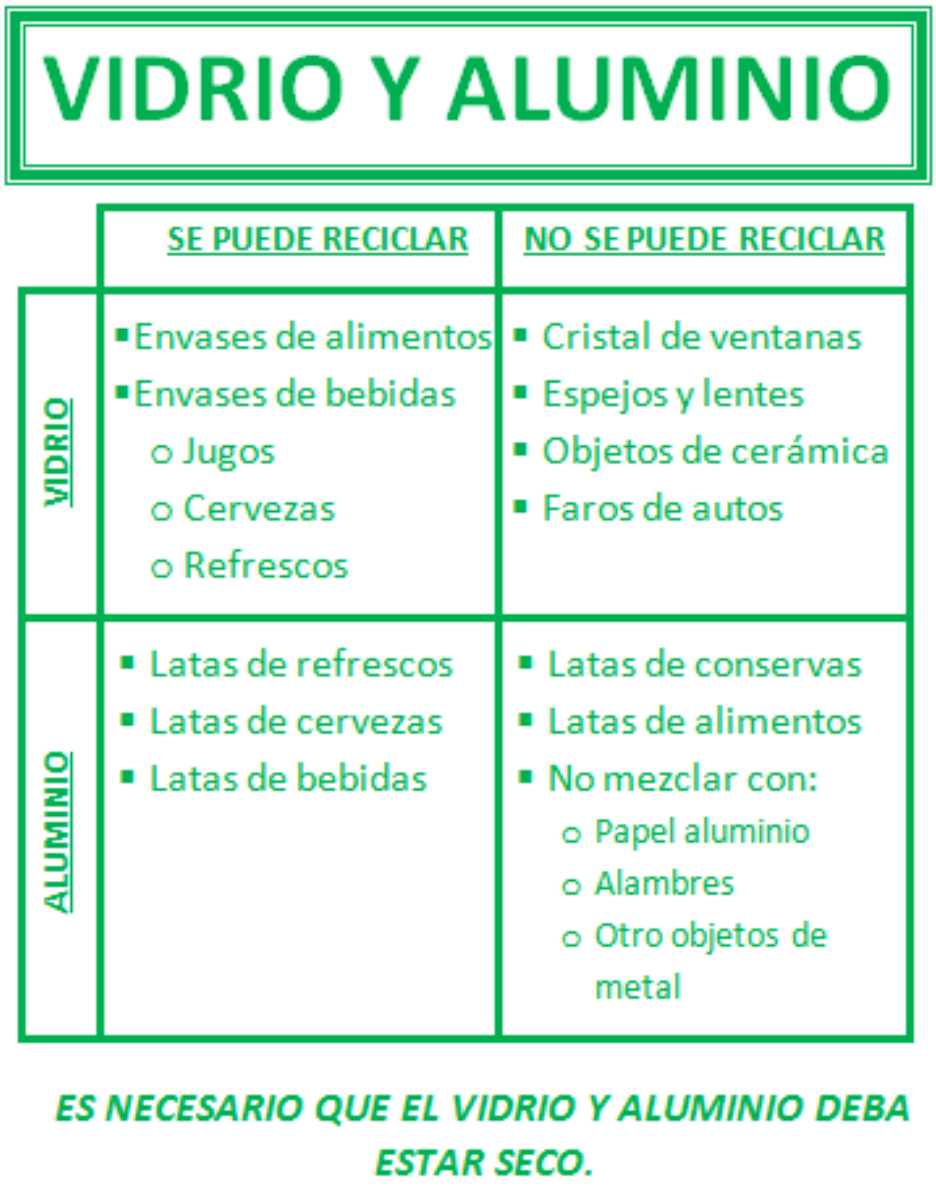
PLÁSTICO

	SE PUEDE RECICLAR	NO SE PUEDE RECICLAR
NÚMERO 1 (PET)	▪ Botellas de: o Refrescos no retornables o Agua purificada o Aceite para cocinar	▪ Otras tipos de plásticos: o #3 PVC o #4 LDPE o #5 PP o #6 PS o #7 O
NÚMERO 2 (HDPE)	▪ Botellas de: o Champú o Limpiadores O Yoghurt	

Si no hay símbolos, números o códigos:
Número 1 tiene un botón en el fondo.
Cuando estirar plástico de número 2,
el plástico es blanco.

ES NECESARIO QUE EL PLASTICO DEBA ESTAR SECO.

APPENDIX P: Sample Glass and Aluminum Recycling Label Placed Above Bins

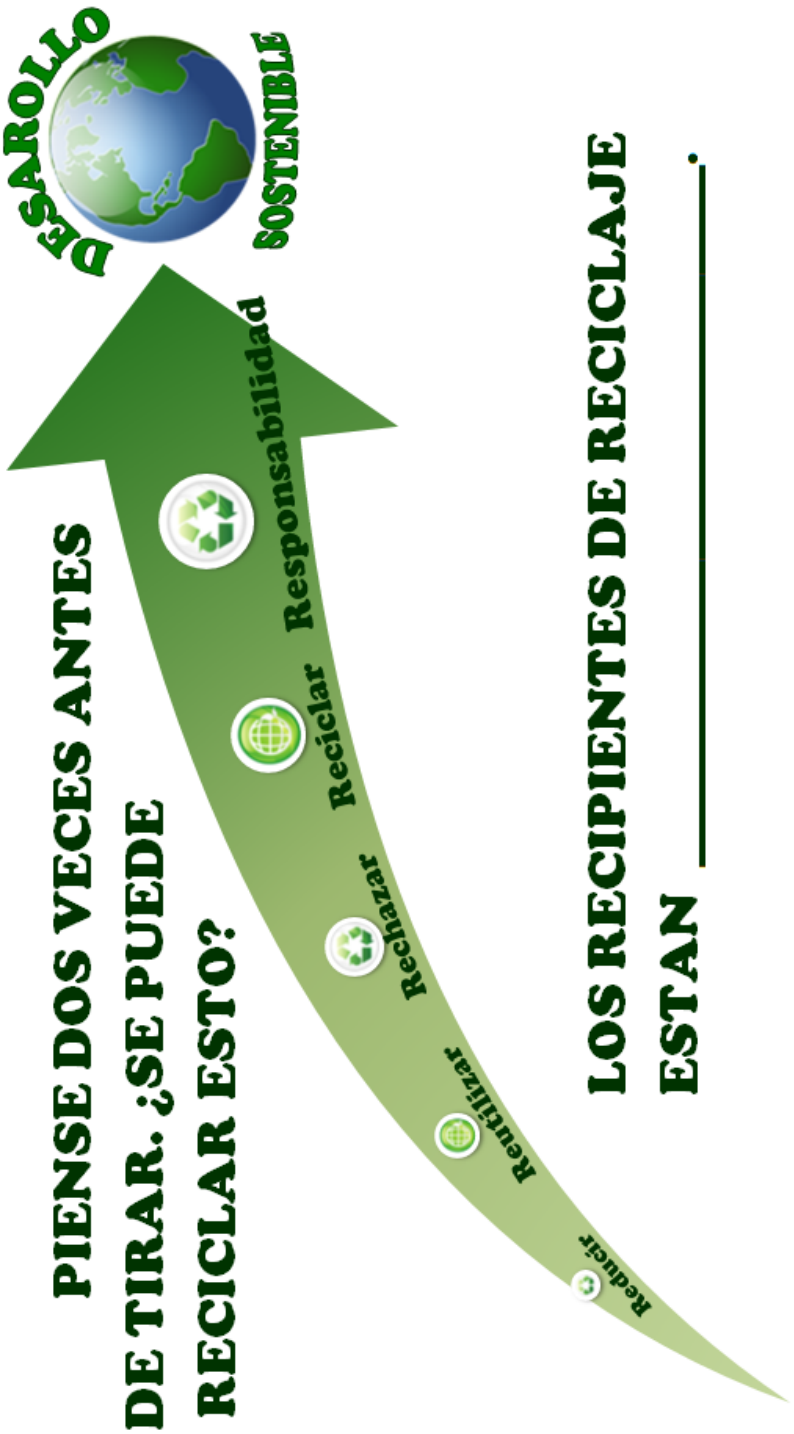


VIDRIO Y ALUMINIO

	SE PUEDE RECICLAR	NO SE PUEDE RECICLAR
VIDRIO	▪ Envases de alimentos ▪ Envases de bebidas o Jugos o Cervezas o Refrescos	▪ Cristal de ventanas ▪ Espejos y lentes ▪ Objetos de cerámica ▪ Faros de autos
ALUMINIO	▪ Latas de refrescos ▪ Latas de cervezas ▪ Latas de bebidas	▪ Latas de conservas ▪ Latas de alimentos ▪ No mezclar con: o Papel aluminio o Alambres o Otro objetos de metal

ES NECESARIO QUE EL VIDRIO Y ALUMINIO DEBA ESTAR SECO.

APPENDIX Q: Sample Reminder Poster



APPENDIX R: Sample Educational Poster

APPENDIX S: Sample Pamphlet for the Home

Diciembre, 2008

Progarama Manejo de Desechos

Para las casas y las comunidades de los Bomberos

Para más información, visita a la red:
http://costaricareciclaje.com/
http://redcicla.org/

¡No se olvide reciclar este folleto!

¿Porque Reciclaje?

- Cuando recicla **100 kilogramos de papel o cartón** salva la vida de **7 árboles**.
- **Cada botella de vidrio** reciclada ahorra suficiente energía para mantener una bombilla de 100 voltios encendida por **4 horas.**
- **Cada lata de aluminio** reciclada puede ahorrar energía suficiente para ejecutar el televisor por **3 horas.**
- **Cada jarra de leche plástica** se ahorrará energía suficiente para mantener una bombilla de 100 voltios por **11 horas.**

La información de este sección es de:
http://www.peacewithnature.org/personal-action.php?id=1
http://www.eartheasy.com/live_recycling.htm

¿Que son las 3 R's?

Dentro de la Gestión Integral de los Residuos Sólidos, internacionalmente se reconoce la terminología de las Tres Eres o "3 R" refiriéndose a las tres primeras letras de tres palabras que son: **REDUCIR, REUTILIZAR, RECICLAR.**

Reducir:

La primera "R", reducir, significa que usted debe tratar de reducir o minimizar los residuos producidos en su casa, trabajo o lugar de estudio.

Algunas formas de reducir los residuos:

- No imprimir copias adicionales que no necesita.
- Compra de artículos al por mayor para evitar el exceso de envases, siempre que sea posible.
- Utilice productos con envases retornables.

Reutilizar:

La segunda "R" es por REUTILIZAR. Esto significa que debemos reusar o "volver a usar" algunas cosas que consideramos inútiles o inservibles.

Algunas maneras de reutilización:

- Utilice contenedores retornables, siempre que sea posible.
- Utilice bolsas reutilizables de su casa.
- Vuelva a llenar una botella de agua en lugar de tirar lejos.

Reciclar:

La tercera "R", reciclar, es cuando los desechos se convierten en un producto nuevo.

Materiales reciclables de su casa:

- Papel y cartón
- Vidrio y aluminio
- Plástico

¿Que es reciclable?

Papel y Cartón:

- Periódico, revistas y catálogos
- Libretas
- Hojas
- Sobres y invitaciones
- Envolturas de papel o de cartón
- Cajas y cartón corrugado
- Correo de propaganda, guías telefónicas, folletos
- Cartón fino (cajas de cereal, rollos de toallas de papel, etc.)

Vidrio

- Envases de alimentos
- Envases de bebidas:
  - Jugos y refrescos
  - Cervezas

Aluminio:

- Latas de refrescos y bebidas
- Latas de cervezas

Plástico:

Número 1 (PET/PETE):

- Botellas de:
  - Refrescos no retornables
  - Agua purificada
  - Aceite para cocinar

Número 2 (HDPE):

- Botellas de:
  - Champú
  - Limpiadores
  - Yoghurt

1 PETE

Es necesario que el vidrio y aluminio deba estar seco. El código esta en el fondo de la botella.

2 HDPE