Analysis of the integral management of hazardous waste of electrical and electronic equipment in the framework of the international regulations and its application in Colombia.

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Abstract

The research is about the integrated management of hazardous waste (RESPEL) of electrical and electronic equipment (WEEE).

The process of management of hazardous waste devices described, since they are generated at the end of their useful life, according to national regulations governed in Colombia and international agreements and treaties.

Disclosed are processes to be carried out with the RESPEL of WEEE, from the legal point of view. How, the generation waste becomes a problem affecting human health and the environment.

Keywords:

International agreements, residues, equipment, environment, pollution.

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List of Symbols and abbreviations

$. Indicates the US currency symbol

List of abbreviations

ANDI. National Association of Entrepreneurs of Colombia

CNPMLTA. National Center for Cleaner Production and Environmental Technologies

COP. Persistent Organic Pollutants

EMPA. Swiss Federal Institute for the Testing and Research of Materials and Technologies

LER. European Waste List

WEEE. Waste electrical and electronic equipment

REP. Producer's Extended Responsibility

RESPEL Dangerous residues

SECO. Swiss Federal Secretariat for Economic Affairs

Introduction

During the development of nations, it has been impossible to control the increase of enterprises within the States, this has generated a number of economic benefits and has provided humanity with a state of tranquility from the development of jobs. In the mid-twentieth century, nations at the global level saw the need to meet with the purpose of stimulating the economy within the States, nevertheless one had to glimpse what would be the step to follow in the environment, this is how the nations began To make agreements and treaties that facilitate an integral management of waste with the purpose of not contaminating the environment, and likewise not generating polluting bodies within the development of the life of the human beings of the planet. Colombia as a nation full of natural resources, has not been immune to this global trend, so within its development Colombia has generated public policies regarding waste management.

In this paper we will seek to investigate how the mechanisms of integral waste management in Colombia have been, specifying how the impact of international regulations within the nation has been, and as this in turn, has had a development from The global processes of international trade.

1. Formulation of the Project

1.1 Background

In Colombia and throughout the world, society in general is evolving and that is when people's needs change as their purchasing power grows. The technology that is acquired today, tomorrow may already be obsolete and new needs are created in people, therefore, every day is consumed more electrical and electronic products.

The massive consumption of electrical and electronic products generates environmental problems that affect the whole world, because of the amount of hazardous waste left after the end of its useful life.

According to an article published by researchers at the National University of Colombia "Around the world, about 150 million tons of technology-related products are produced annually, of which more than 30% are discarded, since they are of little useful life or Change for new and improved appliances "

(REVISTA SEMANA, 2015).

1.1.1 State of Art

In the management of WEEE, research has been carried out, including a document called "WEEE Management through the Informal Sector in Bogotá, Cali and Barranquilla" by Lina María Uribe Restrepo, Sandra Milena Rodríguez, Carlos Alberto Hernández and Daniel Ott in April 2010, the process of collecting, storing, treating and disposing of WEEE is captured in a manual way, as people with scarce resources resort to subsistence by carrying out daily WEEE management tasks, how to look for management Of the WEEE was a viable business for them, this was called the informal management of WEEE, since the procedure was not monitored by any entity, the document was able to identify possible opportunities for improvement for the formal management of WEEE, seeking Avoid contamination of the environment. The studies were carried out in the cities Bogotá, Cali and Barranquilla in order to increase the knowledge of the management of WEEE. (Restrepo, L. U., Rodríguez, S. M., Hernández, C. A., & Ott, D., 2010)

In the work of degree realized by Ricardo Ávila Soto and Juan Fernando Jaramillo in November of 2013 for Pontificia Universidad Javeriana titled "RECOMMENDATIONS FOR THE INTEGRAL MANAGEMENT OF WEEE IN COLOMBIA: THE CASE BOGOTÁ, MEDELLÍN, CALI AND BARRANQUILLA", as main objective of the work , Was to identify how the management and management of WEEE in Colombia, exactly in the cities of Bogotá, Medellín, Cali and Barranquilla, was how the good management of WEEE could be recommended so that it would not affect health and the environment, He mentioned the cultural problematic by the ignorance of the same one. The work also dealt with how the good management of WEEE allowed to contemplate opportunities for the reuse of materials and reduction of pollution. (Ávila Soto, R., & Jaramillo, J. F., 2013)

In 2013, Franklin Aguirre Cadena talks about a business plan that was created to mitigate the negative environmental impact of the management of WEEE in Colombia, with the creation of a company called RECITEC SAS that aims to provide a Collection and processing of WEEE. A project that seeks to meet the needs that are at the time of the disposal of WEEE. (Aguirre Cadena, 2014)

In September 2015, Carla Alexandra Echeverría Pardo carried out a research on Post-consumer Management for MIPMEs distributors of electronic equipment for UNIVERSIDAD MILITAR NUEVA GRANADA, the document indicates how the process of collecting, sorting, disassembling and final processing of WEEE is carried out , How the ignorance of the management of the same can generate irremediable damages for the water, soil, airs, humans, alive beings, also speaks of how Colombia is positioned in the statistics that are realized on the countries more generadores of wastes. (Echeverría Pardo, 2015)

The previously investigations served as research work to have a basis for informing the management of RESPELs of WEEE in Colombia, thus enabling a search for factors that benefit or affect environmental and social factors. Also analyze the integrated management of hazardous waste electrical and electronic equipment (WEEE), according to the regulations established in Colombia under the international trade standards and agreements, Basel, Stockholm and Montreal

1.2 Problem approach

The present research was done in order to answer the following question: What is the international normative framework on the integral management in RESPEL management of WEEE and how is this normativity being applied in Colombia?

Problems associated with the environment are one of the main problems for humanity today. This problem manifests itself in different forms: global warming, extinction of animal species, depletion of water sources, exploitation of natural resources, destination of fields and prairies for the uncontrolled storage of garbage and waste.

As globalization advances, the world has also seen and experienced the consequences of the effects of industrial activity on the environment.

Capitalism is a mode of production that requires the constant consumption of both goods and services to maintain its dynamism. Such activities generate large quantities of organic, inorganic and technological waste.

In that order of ideas: as time goes by, and by becoming "slaves of technology," people are seen in the decision to want to acquire new and sophisticated electronic devices to be more competitive, the acquisition of these devices, their Processing, destination, functionality and waste will have a number of significant consequences for humanity and the environment.

Developing countries, including Colombia, in their desire to insert themselves into the dynamics of the global economy, generally through free trade agreements, integration agreements and so on, make conditions more flexible allowing their products to be imported into their territories Second-hand technology ", which in most cases have reached their useful life and are simply technological waste, thus generating a serious problem for the health and the environment of the territory where they arrive.

Therefore, the present work seeks to analyze the integrated management of hazardous waste electrical and electronic equipment (WEEE), according to the regulations established in Colombia; Under international trade standards and agreements, Basel, Stockholm and Montreal.

1.3 Justification

Theoretical Justification

From the global agreements, the reaction in international business in Colombia has been to follow the regime of these international protocols and to apply it in a way that promotes public policies, regulations, laws and decrees, which are a guideline that generates a development of wellness.

The knowledge of the law, allows to know the significant consequences that are produced by not having the adequate process of recovery of materials of the products used by the

consumers, also the law informs about what are the procedures to follow when a product needs to be discarded Which will be replaced or damaged.

1.4 Objectives

1.4.1 General objective

To analyze the integral management of the management and control of hazardous waste (RESPEL), of electrical and electronic equipment (WEEE) in Colombia, related to international trade in accordance with national and international regulations established in international agreements and agreements .

1.4.2 Specific objectives

- To characterize the theoretical context regarding the design and life cycle of electrical and electronic equipment.

- To characterize the historical evolution of the national and international regulations of Hazardous Waste of WEEE and its application in Colombia.

- Identify how is the integral management of hazardous waste of WEEE from its production process to the end of its useful life in Colombia.

- Describe the environmental and human health risks faced by States in relation to the effects of WEEE hazardous waste according to their typology.

For the research project, a bibliographic search was made, in which the processes of the integral management of hazardous waste of WEEE at international level were investigated. As primary sources were consulted the international and national regulations on the management of hazardous waste from waste electrical and electronic equipment and some statistics on the generation of this waste worldwide.

1.5 Methodological framework

1.5.1 Method

The method used is the deductive, to start from the general (the international norm) to the specific (the Colombian regulations and their application).

1.5.2 Methodology

The documentary information was complemented by some interviews with people who know about the management of the RESPEL of the WEEE, to validate with their experiences the application of the regulations in Colombia.

1.6 Scope

The project was made analyzing how the RESPEL management of WEEE in Colombia, from the year 2011, until today, according to national and international regulations, has been analyzed.

2. Analysis of the integral management of hazardous waste of electrical and electronic equipment within the framework of international regulations and its application in Colombia.

2.1 Theoretical context

To talk about the integrated management of WEEE hazardous waste, it is necessary to know the theoretical context in which the technology is developed.

The following theories are economic in character; the first is the Creative Destruction, which was born of the author Werner Sombart in his book the apogee of capitalism (1916), in this text defined that creative destruction was a process by which products were reinvented with the purpose of generating more capital within organizations. Starting from this base, the theory of creative destruction has generated the search for new processes, from the innovation to improve products, that is, that are made new designs that displace older ones. (Http://innodriven.com/, 2013)

In the book Capitalism, Socialism and Democracy (1942), Joseph Schumpeter popularized the meaning of creative destruction, specifying that creative destruction is a process of innovation that allows the development of new products, the destruction of old industries and New organizations with more efficient processes. (Wikipedia, 2015)

The innovation that is applied to the new products is significant, represents important technological advances that make a lot of similar products lose value.

Taking into account the above, it is pointed out that the innovation processes have generated a great economic growth at the international level. Creative destruction is developed in different ways in each country, according to the type of government they

have in a given country, for example, in the types of government where extractive institutions prevail, do not generate changes or technological innovations and continue to implement procedures that in other countries they are completely obsolete.

As a result, when Creative Destruction is applied to production processes, more RESPEL of RAAE is generated, since the machines and each of the tools used to perform some processes are replaced by new ones.

The second economic theory that is mentioned is Programmed Obsolescence. Scheduled obsolescence it's purpose to put a standard shelf life to products, so that after a certain time, these are obsolete, thus generating the need for the end consumer to buy a new product that has better Characteristics. (Http://www.ecointeligencia.com/, 2014)

FIGURE 1. Obsolete Cell Phones.

The previous image reflects the number of cell phones that have been produced, were the first to appear in the telecommunications market, and have been replaced by new equipment that provide users with more up-to-date functions with better technology.

This theory has been established since the first decades of the twentieth century, and has generated growth in the technology industry at the international level, based on a greater

generation of jobs and economic stability in the States. However, in turn this theory has generated multiple problems globally, specifically in the environment, because the cost is not only the price of the new product purchased, but that behind this "technological update" by another Many residues are accumulating, among which are toxic, flammable, corrosive residues, among others.

The obsolescence programmed as a theory has a specific purpose, which is to generate economic profit, either by organizations or countries. And as a consequence, the environment is severely affected; Taking into account the above, it can be said that this economic theory has constituted in a large number of contaminating foci that have occurred since the industrialization and the bad process in the integral management of hazardous waste of the WEEE generated in the production processes , Handling and transportation.

The world has been changing during the twentieth century, and since the 80s have sought economic models of a sustainable nature where industrial processes and their effects on the environment are regulated.

Therefore, the third theoretical process is established within research, Sustainable Economic Development. Sustainable economic development search to ensure that economic development is through environmentally sustainable processes, that industrial processes for the manufacture of new products preserve the environment and human health; That each of these processes be governed by international agreements and treaties.

Sustainable development seeks to meet the needs of the market without directly or indirectly affecting natural resources, so that they can be enjoyed by future generations. It is here that we have sought to reduce the consumption of non-renewable products, for example, solar or wind energy are used to produce electricity. This will replace the use of fuels to produce electricity through the so-called "thermoelectricity".

Sustainable economic development also seeks to generate a global cleaning process by encouraging good waste management in order to reduce environmental and human health impacts.

And finally, the Producer Extended Responsibility (REP) is mentioned as a principle that promotes environmental improvement, in a way that extends responsibility for the recovery, recycling and final disposal of products to manufacturers.

FIGURE 2. Disordered storage of WEEE.

In the previous image a warehouse of machines that are accumulating without having an adequate use nor a treatment like RESPEL of RAAE is observed In this case it is remarkable that the final responsibility has not been put to the producer to reuse and / or to take advantage of such apparatuses.

The REP lists three key aspects: prevention of pollutants, real-life awareness and polluter-pays. That is to say, it is not a question of manufacturing something that has a short life cycle so that sales are increased, but it must be thought that the time comes when the device no longer functions and responsibility must be assumed in the Recovery and optimization of waste generated.

The REP is implemented through political, economic and informational instruments, applicable in each country and at the international level.

Manufacturers should take charge of products throughout their life cycle, so they should use materials that are sustainable, non-toxic, to make collecting and recycling easier and more effective worldwide. As the entry into the country of new machines and technology, it increases at great speed, which translates to large amounts of waste.

2.2 Normative context: historical evolution of the national and international regulations of hazardous waste of WEEE.

The integral management of the waste has a sequence of procedures in its transport, handling and collection that are detailed in all the normativity that is described next.

In international trade, the Rio Summit, the Stockholm Convention and the Basel Convention, and at the national level in Colombia, applies Law 55 of 1993, Law 1252 of 2008, Law 1672 of 2013 and Resolution 1512 of 2010. In Colombia it is projected for 2017 to establish a resolution for all the management of WEEE, Law 277/2011.

The main provisions and regulations of the aforementioned resolutions, conventions and laws will be defined below.

2.2.1 Rio Declaration on Environment and Development

The meeting was held from 3 to 14 June 1992 with the aim of forming an alliance at the international level to establish new levels of cooperation among member countries. With the aim of promoting the care of the environment and human development.

Principles mentioned at the summit:

- People need to live in a sustainable development environment.
- Each State must comply with ratified standards at the national and international levels, taking care of the environment around the world.
- That the development of the present century does not affect future generations.
- Eradication of poverty, for sustainable development.

- Cooperation among States to remedy the damage caused to the world's most important ecosystems.
- All the population in each country should have access to the information regarding the environmental guidelines, and the way in which the processes of harvesting and harvesting of the waste generated by the consumption of different products are applied. (Department of Economic and Social Affairs, 1972).

2.2.2 Stockholm Convention.

It was born as a development of the Rio summit held in Brazil in 1992, here approved the program number 21, known as the action plan to address the urgent problems of environments and development in the world.

In 2001, representatives from 127 countries signed the Stockholm Convention and agreed that, as of 17 May 2004, they should prepare an action plan to implement measures to reduce the presence of organic pollutants in the world.

The main purpose of the Stockholm Convention is to protect human health and the environment by regulating the use and production of Persistent Organic Pollutants POPs.

In this agreement, the parties undertake to restrict the production and use of chemicals, protect human health and the environment by taking the necessary measures to reduce pollution.

In order to find alternative solutions to the international environmental problem, the Stockholm Convention was created.

The agreement stipulates State Obligations, which establish that each member country must carry out a National Implementation Plan (NAP), in order to comply with the obligations contained in this legal instrument; Then applying the action plan, some POP

Persistent Organic Pollutants are eliminated. (Ministry of Environment, Housing and Terriory Development, 2010).

2.2.3 Basel Convention.

It was created to establish the management, disposal and transboundary movement of hazardous wastes. In this agreement, the agreements are drawn up for handling, exporting, importing, disposing of different hazardous wastes or wastes, avoiding environmental contamination, traffic Take legal measures, comply with the provisions of the agreement, establish conditions and policies to export hazardous wastes.

Prohibitions of persons subject to their national jurisdiction include the transport or disposal of hazardous wastes and other wastes, unless such persons are authorized or empowered to carry out such operations, require that the wastes to be exported comply with The standards of procedure for exporting, packaging, labeling and transport in accordance with generally accepted and recognized international regulations and standards in the field of packaging, labeling and transportation and taking due account of internationally accepted uses.

This agreement establishes the conditions, regulations, policies that must be taken into account and must be met for the disposal, transportation, export and import of hazardous waste.

The different competent authorities are designated to ensure proper compliance with the standard.

The Basle agreement has been signed by several countries in Latin America as described in Table 1.

Table 1.

Latin American countries subscribing to the Basel Convention (Bueti, 2015)

Member Countries of the Basel Convention			
Parties (Countries)	**Signature or succession to signature**	**Ratification Acceptance (A), Approval (AA) and Membership (a)**	**Entry into force**
Argentina	28/06/1989	27/06/1991	05/05/1992
Bolivia (Plurinational State of)	22/03/1989	15/11/1996	13/02/1997
Brazil		01/10/1992 (a)	30/12/1992
Chile	31/01/1990	11/08/1992	09/11/1992
Colombia	22/03/1989	31/12/1996	31/03/1997
Ecuador	22/03/1989	23/02/1993	24/05/1993
Paraguay		28/09/1995 (a)	27/12/1995
Perú		23/11/1993 (a)	21/02/1994
Uruguay	22/03/1989	20/12/1991	05/05/1992
Venezuela (Bolivarian Republic of)	22/03/1989	03/03/1998	01/06/1998

2.2.4 Law 55 of 1993

This Act gives approval to "Convention No. 170 and Recommendation No. 177 on Safety in the Use of Chemicals at Work".

Convention 170 deals with safety in the use of chemicals at work.

It seeks to ensure that all the chemicals they use at work are analyzed to determine the hazard they pose. The workers are informed of the danger they can pose and the preventive measures they must have, in this way it is possible to carry out each of the work activities with safety.

This agreement is applicable in all companies that use chemicals in their economic activity. Economic activities in which workers produce, manipulate, store, transport, or dispose of waste resulting from chemical products.

The agreement does not apply when workers manipulate chemicals that are not considered hazardous, that is, they do not endanger the health of workers.

2.2.5 Law 1252 of 2008

Regulates the entry and exit of hazardous waste to the national territory, in accordance with the provisions of the Basel Convention. Adapting the infrastructure of the authorities and free zones to effectively carry out the recognition of the merchandise, to detect cases in which it is considered dangerous. This law mentions the responsibility of minimizing the generation of hazardous waste, establishing policies of production that are friendly with the environment.

The principles that are mentioned in the law:

- Be alert to any attempt to enter goods from abroad that are considered dangerous. In such cases they will be punished according to the law.
- Reduce the generation of hazardous waste, implementing production processes with technologies that do not degrade the environment.
- Take care of the most important ecosystems in the country.
- Make plans in the integral management of hazardous waste, that preserve the environment and take care of human health.
- Promote entrepreneurship in the use of waste technology discarded, which could serve as raw material.

Responsibilities in the management of hazardous waste:

The generator of hazardous waste must characterize it in a way that recognizes the type of wastes that are toxic, explosive, corrosive among others, in order to be properly handled throughout the storage, transportation and collection process. The generator of the waste is responsible for them until it is delivered to the recipient, the entity responsible for disposal, then the receiver must notify the use or final disposal of the treated waste, in case it does not make the notification, it has the joint responsibility With the generator.

2.2.6 Law 1672 of 2013

In which it establishes the guidelines for adopting a public policy for the integral management of waste electrical and electronic equipment (WEEE).

Law 1672 contains:

- Public Policy for the management of WEEE.
- Regulation and implementation of selective collection systems.
- Stimulus to WEEE managers that promote exploitation and valorization, under defined environmental standards.

- Dissemination, promotion and education (transversal to the actors of the chain).
- Registration of permanent and sporadic producers and marketers.
- Information system on generation and management of WEEE.

The law defines each of the concepts that are part of the generation and manipulation of waste: electrical and electronic equipment, marketer, final disposal, generator, integral management, manager, producer.

For WEEE residues are defined, reconditioning, remanufactured appliances, retake, reuse, user or consumer, new WEEE, historical WEEE, and orphan WEEE.

Responsibilities are distributed.

1. Of the State:
    - Give the guarantee of a healthy environment.
    - Make a public policy for the management of WEEE waste.
    - Control and inspect producers when performing harvesting and management activities in an environmentally clean and safe manner.
    - Promote information through community education programs, as well as an affordable source of information for the whole country to know about waste management.

2. From the producer:
    - It must develop a collection and management system that is adequate with the environment and human health, is responsible for each appliance that it places on the market, and also to administer and finance the model that it chooses and conditions for waste management.
    - Reduce the use of materials that damage the environment.
    - Inform the consumer about the collected collection mechanism.

2.2.7 Resolution 1512 of 2010

"In which the Systems of Selective Collection and Environmental Management of Computer and / or Peripheral Waste are established and other dispositions are adopted".

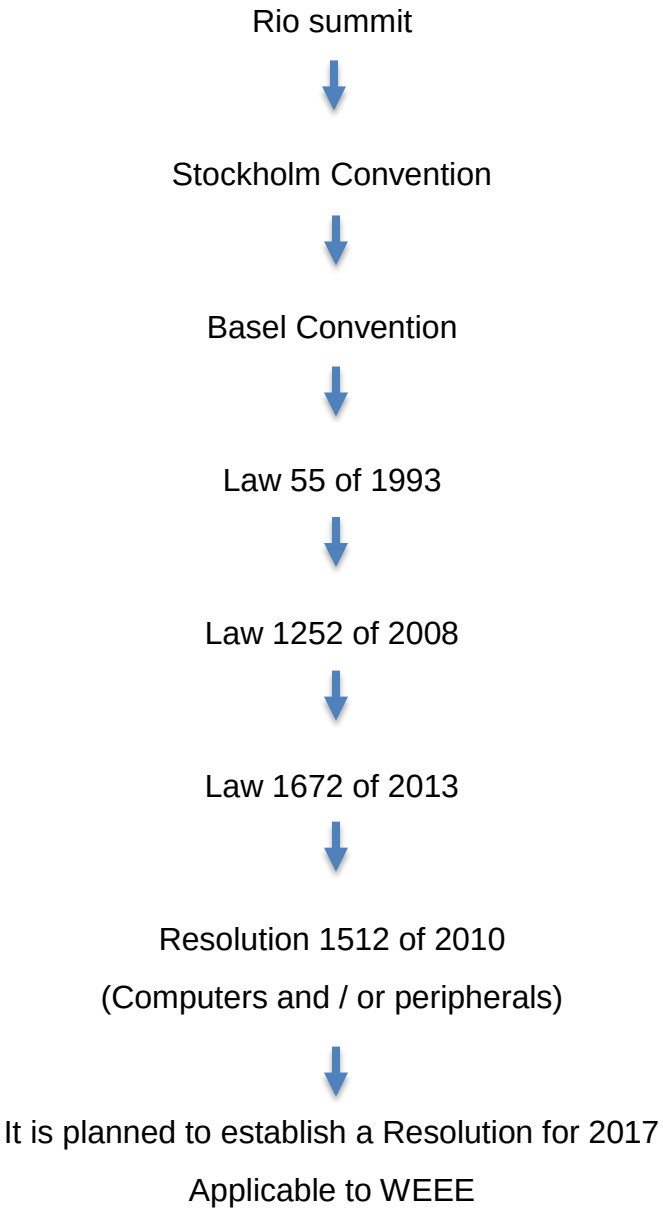
The purpose of the resolution is to establish the obligation to formulate, present and implement the Systems of Selective Collection and Environmental Management of Computer and / or Peripheral Waste, in charge of computer and / or peripheral producers that are marketed within the country. In order to prevent and control the deterioration of the environment. The places where the waste is collected must be adequately conditioned in an environmentally safe manner.

The actors involved in the entire process are manufacturers, marketers, importers, assemblers, all types of vendors selling Computers and / or Peripherals.

Finally, it is projected that by 2017 a resolution will be developed specifically for WEEE. At present only Resolution 1512 of 2010 (computer and / or peripheral waste) is defined.

In Colombia, the document entitled "Technical guidelines for the management of waste electrical and electronic equipment" was created by the Ministry of Environment, Housing and Territorial Development, to raise awareness of the importance of establishing technical guidelines to guide the Management at the national level, define technical aspects that must be considered in the management stages and thus seek prevention and reduction of environmental impacts. For Colombia, the increase in technological tools, which took them by surprise, since the logistics of storage, transport, distribution and destruction or reuse of WEEE were not estimated, the arrival of new mobile devices in the country, The sales and therefore the storage of devices that the users already believed obsolete. The recycling of WEEE can be a lucrative business, these devices contain values such as gold, silver, plastic and glass that could be extracted and then re-marketed, reused parts and repairs.

Table 2. Scheme of national and international regulations.



2.3 WEEE management in Colombia

In this chapter, we will talk about the management of WEEE in Colombia, how the arrival of the WEEE forces us to think about how to proceed with the management, threats to the environment, not only the chemicals, but also the destruction and / Or storage of electrical and electronic equipment represent a danger if they are not controlled.

To this end, Colombia has signed the Basle agreement since December 1996, with one of its basic objectives of reducing waste a new business opportunity and environmental improvement for Colombia.

This is why, since the introduction of new technology and the emergence of new generations, the increase in production and hazardous waste has also increased, leading to questioning several organizations about the proper management to be implemented with the waste.

Similarly, in 2007 the WEEE Initiative was launched in Colombia, a program launched by Seco (Swiss Federal Secretariat for Economic Affairs), EMPA (Swiss Federal Institute for Testing and Research of Materials and Technologies) and CNPMLTA Cleaner and Environmental Technologies), in order to create general requirements for the recycling of waste from WEEE in Colombia, seeking to implement measures that are environmentally friendly, sustainable and economically viable, the unexpected growth of WEEE in Colombia has created a new business opportunity, reuse of waste electrical and electronic equipment can become an important part in industries that use this waste as a source of income.

Given the increased development and living conditions of people, appliances such as televisions, computer radios, cell phones etc. They end their life cycle faster and faster, the unexpected desire for innovation makes them forget the great importance of waste

disposal, release of toxic substances, storage of WEEE in inappropriate places, ignorance of the process causes Has a much greater negative impact, the life cycle of WEEE does not end when they reach the normal household waste, the life cycle of the device, even if it no longer works, can continue, ie reuse parts, extract gold, aluminum , Glass, plastic, etc.

Also, Colombia is governed under Law 1672, of July 19, 2013, where parametrizan the integral management of WEEE, has also influenced the business contribution of companies that through corporate social responsibility must contemplate a collection system facilitating The reception of such devices. The responsibility is not only business, it is also personal, encouraging people to carry out an adequate handling of WEEE is fundamental for the advancement and reduction of environmental risks.

Former senator Claudia Wilches indicates that through law 1672 will seek to minimize the risks to health and the environment by reporting that between 2010 and 2014 about 140 thousand tons of electrical waste of computers would have been produced in Colombia. (Senate, 2013).

To this is added the help of ANDI, where the National Association of Entrepreneurs of Colombia (ANDI) brought together 41 companies (representing more than 45 percent of the national technology market) and created EcoCómputo, the first selective collection system and Environmental management of waste of computers and / or peripherals of Colombia. (Silva, 2014)

This system has helped people and companies to be aware of the importance of proper waste management and through Ecocómputo with the help of campaigns has been achieved the collection of tons of electrical and electronic equipment in different cities of the country.

In Colombia, the management of WEEE is on the right track, although there are some companies committed to the management of WEEE, committed to improving the

quality of life and the sustainability of the planet. Makes the dark panorama come to life, but it is still not enough to mitigate the environmental and health problems caused. (SILVA, 2014)

Although so much waste is produced, Colombia has a great advantage over the industrialized countries, the life cycle of electrical and electronic equipment is higher than expected, so the creation of waste will be a little more time-consuming, favoring Thus a smaller amount to handle, store or destroy.

It could be said that there are habits that make electrical and electronic appliances last longer and is not to change the apparatus, give it and not destroy it, in Colombia it is very common to make this type of gifts, from generation to generation, the total exploitation Of the equipment is good, finally are not buying new products without having ended the useful life of the previous one, this reduces costs for the people, however, companies in charge of classifying these apparatuses for the new production of others will not have inputs that are worth the pain.

Colombia, is one of the countries that generates the least amount of electrical and electronic waste, however, this can not generate confidence, alarms that help with the propagation of information and socialization of WEEE management must be ignited.

As additional information, during 2012, the world produced 49 million tons of electronic waste, which is equivalent to 7 kilos per person, and according to the studies conducted the increase for 2017 will be 33% or 65.4 million Of tons. (Custodio, 2014)

As an example of good WEEE management practice in Colombia, the experience of a Higher Education Institution in Medellín is illustrated below. According to the interview

made to the engineer Edwin Moreno of the Institution Univesitaria Colegio Mayor of Antioquia, it is possible to know more in detail the process in the management of WEEE in the institution.

In the software of the institution they manage internally each of the processes that they carry out with the RESPEL of WEEE, all the documents that are administered are registered (with the bank and other entities that intervene in the legal part) according to the normativity National, which in turn meets the international requirements. Annually, the company conducts an auction of WEEE through a financial institution (Bank) dedicated to this type of business through the figure of "hammer" or auction. Proposers who submit to the auction are required to comply with the regulatory requirements for WEEE management and must provide the corresponding legal documentation to demonstrate this.

In this Institution, the following rules are applied to the processes:

- Law 1672 of 2013 Public policy of integral management Waste Electrical and Electronic Equipment. This law is adapted by the Basel Convention on the transboundary movement of WEEE.
- Resolution 1512 Systems of Selective Collection and Environmental Management of Computer and / or Peripheral Waste.
- Agreement No.009 of 2014 Manual of inventory and goods.
- Resolution 009 of September 29, 2014 (Internal regulations of the university).
- ISO 14001: 2004: It is the standard of the Environmental Management System of the entity, which is certified by ICONTEC and includes the WEEE management program.

Another example of good practices was obtained by interviewing an industrial and commercial enterprise of the State at the municipal level (in Medellín), whose name is not revealed at the request of the interviewee. It can be identified that several devices are disposed of and have control over them, have established procedures for the collection, storage, distribution and destruction according to the current norm, take into account the environmental part when having a contractor in charge and Authorized by other entities

such as the Metropolitan Area. For this company an important data was obtained on the approximate amount of collected waste generated, how the personnel is trained having tools to consult the management of RESPEL of WEEE, it was confirmed that the company, complies with the current norm, in this Case law 1672 of 2013. This company is also certified in ISO14001 environmental management system standard.

These two experiences allow us to infer that, at least in the city of Medellín, there are already entities that have implemented orderly and systematic programs for the management of WEEE, that these programs comply with the current regulations and are articulated within the systems of Management of these companies or institutions.

2.4 Riesgos medioambientales y para la salud de los RESPEL de RAEE.

Just as environmental problems manifest themselves in different ways, environmental risks are diversified as economies develop and new industrial processes are created that generate RESPEL.

The following table is based on the European Waste List (RSL). (Http://www.asimet.cl/)

It can be seen that eight (8) of the eleven (11) mentioned components are dangerous, not only considering the component as such, but also the packaging with which the device has had contact.

Table 3. WEEE RESPEL according to LER list.

Code LER	DENOMINATION	Dangerous / non-hazardous character
16 02 09*	Transformers and capacitors containing PBC.	**Dangerous**
16 02 10 *	Discarded equipment containing PBC, or contaminated by them, other than those specified in 16 02 09.	**Dangerous**
16 02 11 *	Waste equipment containing chlorofluorocarbons, HCFC, HCF	**Dangerous**
16 02 12 *	Waste equipment containing free asbestos	**Dangerous**
16 02 13 *	Waste equipment containing dangerous components (4), other than those specified in 16 02 09 to 16 02 12.	**Dangerous**
16 02 14	Discarded equipment other than those specified in codes 16 02 09 to 16 02 13.	**No dangerous**
16 02 15 *	Hazardous components removed from discarded equipment.	**Dangerous**
16 02 16	Components removed from discarded equipment, other than those specified in 16 02 15.	**No dangerous**
20 01 23 *	Discarded equipment containing chlorofluorocarbons.	**Dangerous**
20 01 35 *	Dispose of electrical and electronic equipment, other than those specified in codes 20 01 21 and 20 01 23, containing dangerous components (9).	**Dangerous**
20 01 36	Disused electrical and electronic equipment, other than those specified in 20 01 21, 20 01 23 and 20 01 35	**No dangerous**

Hazardous components of WEEE include hazardous batteries and accumulators, also mercury switches and cathode ray tubes. (ASEGRE, 2008)

WEEE has risks to the environment and human health from components having, for example, cadmium, lead, hexavalent chromium, polychlorinated biphenyls (PBC) and polybromodiphenyl ethers (PBDEs).

The impact of each one is described below:

Cadmium: Cadmium generates a quantity of diseases in the people, damage in the kidneys, causes the elimination of important proteins for the body, damage to the nervous system, psychological disorders, among others. As for the environment, cadmium is released into rivers through industrial activities, then absorbed and contaminates surface water and soils; When absorbed by the soil, plants take these components and become contaminated, affecting the animals that feed on them. (Http://www.lenntech.es/).

Lead: Lead can poison people who manipulate it in their work and do not handle it properly, generating severe headaches, difficulty sleeping and vertigo. Lead can enter the water through corrosive metallic elements, resulting in ingestion, increased blood pressure, abortions, damage to the brain, damage to the kidneys, male infertility, impaired intellectual ability in children, among others. As for the environment, in car engines, lead is burned and generates lead salts and pollutes air and soil. When they pollute the water they are stored in crustaceans, affecting their health. Lead contaminates phytoplankton, it is a major source of oxygen in the sea, aquatic animals consume it and it becomes a global problem. (Http://www.lenntech.es/).

Hexavalent Chromium: When chromium is ingested through water, contaminated fruits or vegetables, it causes serious illnesses, respiratory problems, lung cancer, damage to the kidneys and liver, among others. As for the environment, soil absorption of large amounts of chromium affects crops and contaminates the water consumed by animals. (Http://www.lenntech.es/).

FIGURE 3. RESPEL of luminaires.

Tomada de: http://www.sustentator.com/ LOS RESIDUOS DE APARATOS ELÉCTRICOS Y ELECTRÓNICOS (MacGibbon, 2011)

When a WEEE is stored in the same place with another type of waste, when exposed to the sun and rain, they begin to release hazardous substances that seep into the soil and contaminate the water.

3. Findings

- It was found that there is no information on imports and exports of WEEE.
- It was found that there is national and international normativity regarding the RESPEL of the WEEE. It was found that in Colombia there is already a law that frames the management of WEEE but that it has yet to be regulated sufficiently so that it can be implemented effectively.
- It was found that in other European countries and some in Latin America there is more restrictive legislation for the management of WEEE.
- A bill will be prepared by 2017, in which the most detailed management of the RESPEL of WEEE in Colombia is handled in detail, in accordance with international standards.
- It was found that there are companies and institutions that have implemented systems of collection and management of WEEE, in compliance with national and international regulations and in the framework of environmental management systems that are based on ISO14001.
- It was found that those entities or institutions that do not handle WEEE properly may face sanctions.
- It was found that there is an international flow of WEEE mobilization to recover valuable materials and Colombia could participate in this international trade circuit, but also found that there are countries in Africa and Asia to which they are being exported without managing them appropriate.

4. Conclusions and recommendations

4.1 Conclusions

In the process of analyzing the information, it was found that many technology users do not know how to dispose of RESPELs for WEEE that have ended their useful life; Therefore, this work allows to inform about the procedure that must be followed, according to the normativity both.

In Colombia, laws, norms and regulations have been established for the management of RESPELs of WEEE, framed in regulations and international agreements, this is good to mitigate environmental damages that can cause the destruction of the environment and diseases to the people; It is important to recognize the efforts that are being made to promote good practice of standards, but companies and individuals should be made more aware of them in order to know and apply them in all the activities they carry out.

Colombia is making an important contribution, cooperating with the enforcement of laws that preserve the environment, each oriented to the fulfillment of international standards, which generate more recognition and security in the production processes in organizations; You can see how good management is being done in order to promote aid and beneficial practices for both companies and individuals.

WEEE represent significant risks to the environment and human health, when not given proper management in all management and handling, cause diseases that can cause death. And when they are manipulated in a disorderly way that does not obey the norm, they cause irreversible problems to the environment, deteriorate the fields, pollute the rivers, cause diseases to the animals. Therefore, it is important to know the applicable regulations in each case, to make proper management with RESPEL and reduce risks.

4.2 Recommendations

- It is recommended to the State to ensure the compliance with the laws that are established, on the management of WEEE, to have officials who are visiting the companies constantly to regulate that the norm is being applied and to be necessary to generate some type of Sanction for companies that do not comply with what is established.
- It is recommended for guilds that incentives and / or awards for companies that meet the objectives of established regulations, national recognition, support. Have strict control for monitoring and enforcement of the standard.
- It is recommended for universities to deepen the information on the international trade of WEEE by investigating their main problems and / or opportunities.
- It is recommended that companies have an environmentally friendly WEEE collection system.

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ANNEXES

A. Annex: Interview

An interview was conducted with engineer Edwin Moreno of the Colegio Mayor de Antioquia, in charge of managing the entire process to remove the RESPEL from WEEE in the institution. He answered the following questions:

Jeniffer Carmona (J): What kind of hazardous waste electrical and electronic equipment are generated in the university?

Edwin Moreno (E): mainly laboratory equipment, computers, telephones, calculators, ballasts of the lamps.

J: What is the process of collecting waste?

E: The institution has a quality management system certified by Icontec and based on the international standard ISO 14001/2004. The institution is organized by processes and a department of goods and services, an internal process of the university. There all the inputs arrive, they store them and they are the ones who are responsible for discharging them.

Each department of the university gives to the process of goods and services, the inventory of machines and other devices that report some type of failure. Then the technology department evaluates if it can be repaired.

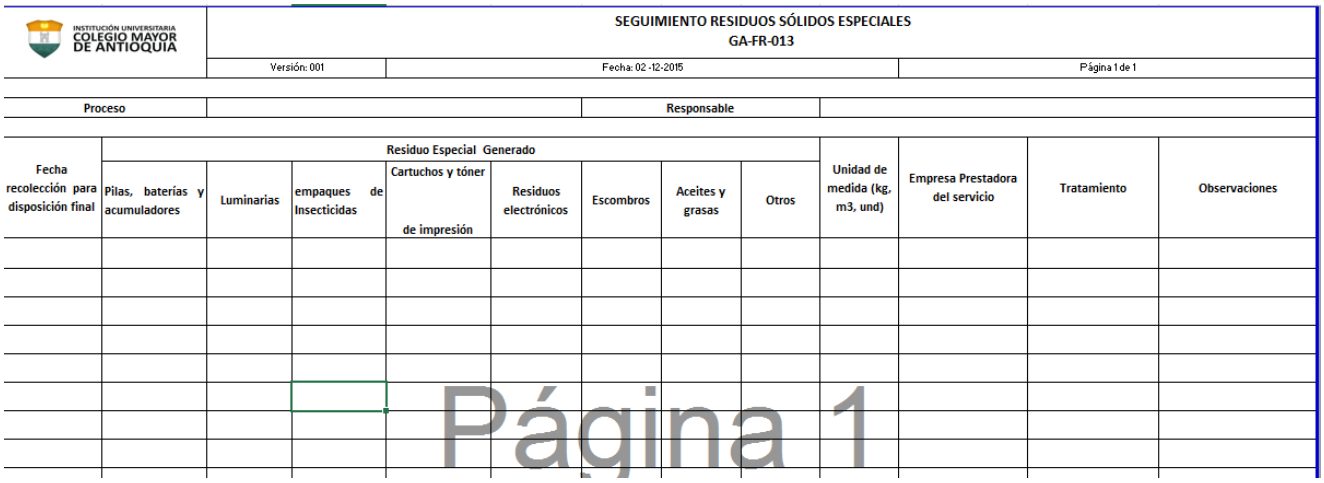
J: What is the process that is given to technology waste?

E: They carry out an auction called hammer plan, with the popular bank, (by policies of the institution, in case the equipment works can be donated to EDUCAR). Otherwise, the auction is carried out and the responsibility is awarded to the companies that win the auction. They receive a license from the Ministry of Environment, Housing and Territorial Development or the Autonomous Corporation, where they approve the type of management to be carried out With RESPEL, either incineration, recycling or repair.

Whoever wins the auction, if it is a company or natural person, must provide the information of which process applied with the waste, if it only took a part that it needed or if it had the license to discard the RESPEL of WEEE.

The whole process is oriented according to Resolution 009 of September 29, 2014 (Internal regulations of the university).

Figure 4. Special Solid Waste Tracking Format (Colegio Mayor de Antioquia)



INSTITUCIÓN UNIVERSITARIA COLEGIO MAYOR DE ANTIOQUIA

SEGUIMIENTO RESIDUOS SÓLIDOS ESPECIALES
GA-FR-013

Versión: 001	Fecha: 02-12-2015	Página 1 de 1

Proceso		Responsable	

Fecha recolección para disposición final	Residuo Especial Generado								Unidad de medida (kg, m3, und)	Empresa Prestadora del servicio	Tratamiento	Observaciones
	Pilas, baterías y acumuladores	Luminarias	empaques de Insecticidas	Cartuchos y tóner de impresión	Residuos electrónicos	Escombros	Aceites y grasas	Otros				

Página 1

The previous image is the format used by the University Institution to carry out the respective monitoring of special solid waste, including WEEE (luminaires, batteries, accumulators, electronic waste).

The processes implemented are carried out in accordance with the following regulations:

- Law 1672 of 2013 Public policy of integral management Waste Electrical and Electronic Equipment.
- Resolution 1512 Systems of Selective Collection and Environmental Management of Computer and / or Peripheral Waste.
- Agreement No.009 of 2014 Manual of inventory and goods.

J: Do you have any mechanisms where you inform students about how to dispose of appliances that have expired?

E: For the theme of chargers, cell phones and things like that, in the university they make an environment stand twice a year and there they do the collection and they give information about the disposition of WEEE.

B. Annex: Interview

An interview is made to the environmental officer of an Industrial and Commercial State Company, of the municipal order whose name is reserved by request of the interviewee.

1. What kind of hazardous waste electrical and electronic equipment is generated in the company? The Company has defined that it generates the following hazardous waste and electronic waste:

N°	Residue
1	Balloons (rubber and metal)
2	Coils (for pneumatic and hydraulic systems)
3	Valve coils (electronic component)
4	Terminals (metal or plastic)
5	Metal bushings
6	Spark plugs (metal and ceramics)
7	Hitch pins with metal contacts (copper-silver)
8	Cables
9	Cables of metrocable
10	Spark arrester chamber (metal, plastic, relays)
11	Door cylinder shirts (metal body)
12	Metal Fittings
13	Checkers
14	Door actuating cylinders (rubber, metal and Teflon)
15	Brake Cylinders
16	Resistance tapes (nickel cadmium, copper chrome)
17	Electric components
18	Contact 400A for BMS contactor, material covers

19	Contact carbon pantograph
20	Fixed contact for contactor HZS (metal)
21	Metal belts (clamps)
22	Valve bodies (copper)
23	Diodes (porcelain, silicon and copper)
24	Axes
25	Used electrodes
26	Electromagnets (metal)
27	Brush Set Ground P/ Bogie (bronze)
28	Carbon brushes motor-compressor (graphite-copper wire)
29	Carbon brushes traction motors (graphite-copper wire)
30	Switches electric (breaker)
31	Microsuiches and end-of-course professors
32	Engines, fans and exhausters
33	Metal pantograph
34	Dismantled mechanical parts
35	Additional springs (rubber and metal)
36	Door Spring (Metallic)
37	Rails
38	Wheel
39	Current and voltage sensors
40	Silentblock (metal rubber)
41	Socket (porcelain and sheet)
42	Thyristors (porcelain, silicon, metal)
43	Screws
44	Galvanized pipeline
45	Metal pipelines (iron).
46	Valves (rubber and metal)

2. How is the process of collecting waste electrical and electronic equipment generated in the company?

   The procedure established in the Company is followed for the correct handling of this waste, which is as follows:

   1. Identify the waste that is generated in the company.

2. The need and quantity of containers for waste are defined.
3. Containers are installed for the final disposal of waste.
4. Waste generated at the source is separated.
5. Coordinates with the collection of waste.
6. Waste is collected and transported to the place of collection.
7. Waste is collected temporarily.
8. Inform the amount of waste generated for the contractor to collect and give final disposal, according to the waste, and in compliance with the current standard.
9. Contractor issues final disposal certification.

3. What is the process that is given to technology waste? The final disposal process, described in the previous point, applies for technological waste.

4. Are the waste electrical and electronic equipment handled by the company or by a contractor? They are managed by a contractor who has the permits granted by the Metropolitan Area for the proper environmental management of these, which certifies that it complies with current regulations in Colombia.

5. What approximate amount is collected in a year? Approximately around 15,000 kilos, however, it is necessary to emphasize that this figure can vary considerably from year to year.

6. Where do you send the waste generated for your treatment? This will depend on the contractor, who is in charge of giving the final disposition of these elements.

7. Do you have any mechanisms to inform employees about how to dispose of appliances that have expired? All company personnel can enter the intranet and review the waste classification guide and follow the procedure indicated above.

8. Is the way in which the collection of waste is carried out, according to law 1672 of 2013? Or what law do they use? The Company and, if applicable, the contractor, follow the current norm. Currently it is made under the law 1672 of 2013.