The Disposal of E-Trash in the east zone of Manaus: The Disposal of Analog TVS

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Abstract— The disposal of thousands of electronic devices and waste in Manaus by the repair shops of electrical and electronic appliances in the peripheral districts of the city's East Zone and by the population in the public places where they are abandoned is a worrying phenomenon for the environment due to randomly, without the attendance to a public policy prioritizing the selective collection, or the reverse logistics to minimize or eliminate the damages caused by its components constituted by highly polluting substances such as mercury, cadmium, arsenic, copper, lead and aluminum that penetrate soil and groundwater contaminating plants and animals through water. This contamination can reach man through the food chain by ingestion of these foods. Studies on the potential contamination of these substances attest that the consequences of contamination can be a simple headache, vomiting, nervous system damage and cancer occurrence. The data obtained from the field research and its analysis allow us to conclude that this process is even more serious, as a consequence of the absence of public policies, or the existence of inefficient public policies, to promote selective collection and reverse logistics as tools to reduce impacts environmental impacts. Focusing on this reality, this paper presents a proposal for the adoption of a Program for the Selective Collection of Electrical and Electronic Products (PCSEE) to carry out joint actions between public authorities and workshop owners, motivated through public incentives.
Keywords— Environmental Impact; Reverse logistic; Electrical and Electronic Waste.

I. INTRODUCTION

This article is the result of a research carried out in the East Zone of Manaus about the environmental impact caused by the disposal of waste from electronic products by workshops and families, to which questionnaires were applied to obtain the information necessary to carry out the study and indicate a proposal aimed at solving the problem.

The reverse logistics system aims to return a product that has been used and completed its cycle of use and durability, or irreparable damage with the need for disposal by the consumer, by break, expense or perhaps because it has been technologically overcome. According to Leite (2009, p. 15) it is "impossible to ignore the reflections that the return of these increasing amounts of after-sales and post-consumption products causes in business operations".

In Brazil, about 500,000 tons of electronic waste are discarded per year in inappropriate places and some toxic materials that make up this type of residue contaminate the environment. The situation could get worse with the introduction of the process called "scheduled obsolescence", in which the industry "programs" products to become obsolete faster. Rodrigues (2008).

Currently the problem of waste is one of the main concerns regarding urban population growth and the habit of consumption of society. Among the various places for the destination of man-generated waste, we can find one of the most impactful, as is the case with dumps. Siqueira and Morais (2009). The problem worsens with the disposal of e-garbage randomly, in common dumpsters, springs and public laurels.

However, this concern is not the focus of this work, since the difficulties faced by companies are only part of the problem that is addressed by the environmental impact caused by the disposal of these products in full, or their waste, in the public spaces, addicted dumpsters, scraprias and water springs. The increase in electronic waste represents a challenge of difficult confrontation as a result of the impacts generated by "e-trash", or electronic waste directly related to technological evolution and scrap disposal.

Additionally, in the city of Manaus, thousands of analog televisions, with glass image tube began to be discarded after the shutdown of the analog signal of open television and beginning of digital TV broadcasts in the year 2017. This event encouraged several inhabitants to purchase new televisions, leading some residents to dispose of old equipment incorrectly.

The study aims to evaluate the condition of the disposal of electronic waste by workshops and families in the East Zone of Manaus and indicate strategies to address the problem through the adoption of a permanent selective collection and logistics program Reverse.

To meet this goal, procedures were performed to collect estimative data of the disposal of e-garbage and the consequent environmental impact, through field research and bibliographic, due to the problem and based on the subsequent methodology.

II. METHODOLOGY

To perform this research, a bibliographic survey was conducted in order to have greater theoretical basis, for this, several works were analyzed (articles, dissertations and theses) in order to understand the analyses before carried out by other experts who also discuss this theme, where they allowed the work to identify negative environmental impacts characterized by the environmentally incorrect disposal of electronic waste in the Zone East Manaus, Amazonas.

For field research, the "check-list" method, according to Silva (1999), in the glimpse and listing of sequences (environmental impacts), when considering the transformative potential of the biotic and anthropic physical environment, of causes (known impact activities).

With a way of presenting these environmental impacts analytically, the descriptive check-list was used, also recommended by Silva (1994), Arruda (2000), Ludke (2000) and Brito (2001), for this type of research.

Next the researcher performed the application of semi-structured questionnaire aimed at 25 workshop owners (who work concerting e-garbage) in the east of the city of Manaus, as well as to 50 residents, (these chosen randomly).

In this sense, this work proposes a more realistic and in-depth study on an interdisciplinary problem that portrays social behaviors, but that centralizes its focus on the environmental issue which refers as a result of the impact caused by the irregular disposal of waste and electronics and e-garbage in the East Zone of the city, locus of research.

III. THE E-TRASH AND ITS DISPOSAL AS ORDINARY WASTE

The e-garbage, or e-waste name emerged in the United States to designate garbage consisting of discarded or obsolete electronic products such as PCs, TVs, VCRs, VCDs, mobile phones, stereos, fax machines, copiers, batteries of various types and purposes, televisions, appliances in general, with their circuit boards and components.

According to data from the Municipal Secretariat of Public Cleaning (2019). In Manaus about 250,000 analog televisions began to be randomly discarded, without the existence of an official reverse logistics program and selective collection, from the shutdown of the analog TV signal in 2017. This creates a huge problem for the whole city, because new policies are still being discussed, others are already being implemented to combat this problem, according to images 1 and 2 below.

Image 1 - Source: Gonçalves (2019)

Image 2 - Source: Gonçalves (2019)

According to IBGE data that recorded a population of 1,802.014 million inhabitants for the city of Manaus in the last sense made in 2010. Assigning the average of five (5) family members it is estimated that at least 200,000 families in the city of Manaus and at least one analog TV set per family to be discarded from the shutdown of the analog signal and its replacement by the Digital TV.

This estimate does not consider the possibility for families to have more than one (1) analog TV set, which is not uncommon, even among the poorest families. Subsequent image shows the distribution of the population of Manaus city:

Image 3 - Source: IBGE

Of one million eight hundred and two and fourteen thousand inhabitants of the city of Manaus, 531,762 live in the neighborhoods of the East Zone of the city and represent about 80,000 families. According to scholars, these families will dispose of at least 100,000 analogue TV sets in domestic dumpsters and public laurels within a year.

This factor worsens, in this region where the material has been discarded together with ordinary waste, in the streams and green areas, due to the lack of recycling and reverse logistics programs, the simple ineffectiveness of existing programs and the lack of programs the population's disciplined use and disposal of electronics, with the objective of reducing environmental impact. Research data shows that most families have never received any kind of guidance to dispose of their electronic devices. When not discarded so, the TV sets are taken to existing workshops in the region for repair and abandoned by the owners forcing the owners to seek solution for disposal, or simply abandoning them on the sidewalks of the neighborhood (Image 4 and 5).

Picture 4 - Source: Gonçalves (2019)

Picture 5 - Source: Gonçalves (2019)

According to physicist Délcio Rodrigues director of GREENPEACE – NGO responsible for actions in defense of the environment around the world, these materials, among which stand out the e-garbage presented in the image above, are not biodegradable and cause serious damage to the environment environment indicating recycling and reverse logistics as viable options for solving the problem.

Through the reports of residents and store owners who use e-trash, it was found that there is a thought of sensitization and availability of actors to adopt recycling, or reverse logistics, but there is no institutional program through which is recycling can be practiced.

This absence of public policies and practical actions cause embarrassment to the owners of electronics workshops that accumulate a large volume of obsolete appliances abandoned in their workshops by owners who prefer to acquire new equipment to rescue old equipment.

This random disposal process without the existence of public policies capable of minimizing environmental impact can be translated through the statistical data of the research that present the reality of this phenomenon into reliable indicators of the dimensions of

the problem, according to the demonstration in the subsequent chapter.

IV. RESULTS

To quantify the field research on the environmental impact of electronic waste by the workshops of the East Zone of Manaus, the capture of images used in the previous chapter and the application of a check-list for the collection of data reported in Table 1 below.

Table 1: Result of the research conducted with the residents of the neighborhood.

They have Analog TV	Yes	41%	No	59%
Where Analog TV Sets Are Discarded	Dumps	43%	Workshops	57%
Know Selective Collection	Yes	58%	No	42%
Know How to Set CS Colors	Yes	29%	No	71%

The data show people who have analog TV only 41% of them still have and that 59% have already replaced analogs with digital equipment.

In the second item of the table it was found that among those who have already discarded the analog devices, 43% of them placed the appliances in domestic dumpsters in front of the residences, or in addicted dumps existing in public street spaces, water springs (streams), or green areas. According to them "there is no suitable place to place these materials".

The survey found that none of the interviewees disposed of the devices through a process of selective collection, or reverse logistics, without obtaining any guidance on the correct way to discard the e-garbage and that 57% of families abandoned the devices obsolete in workshops, after taking them for repair, without returning to the site to rescue them.

According to shop owners, we do not participate in any Selective Collection program, or reverse logistics. Thus, the exit is to turn to the scrap dealers that transit in the neighborhood collecting scraps to sell in recycling deposits, however, only some materials, such as copper and aluminum are in the interest of the scrap dealers. According to shop owners, the city's sweepers claim that they are instructed not to collect any type of junk, leaving the owners without the option of disposal of the e-garbage.

This procedure contradicts current legislation that manufacturers are required to receive obsolete or residual materials by creating a collection mechanism.

Article 1, CONAMA resolution, paragraph 257 of 30 June 1999, provides that batteries and batteries containing in their lead, cadmium, mercury and their compounds, necessary for the operation of any types of appliances, vehicles or systems, mobile or fixed, as well as the electro-electronic products containing them integrated into their structure in a non-replaceable way, after their energy exhaustion, will be delivered by users to the establishments that market them or to the authorized service network by their respective industries, for transfer to manufacturers or importers, so that they adopt, directly or through third parties, the procedures for re-use, recycling, treatment or final environmentally appropriate provision.

The standard established by CONAMA is part of reverse logistics, in which obsolete materials make the reverse route to their origin to be recycled. In the East Zone of the city, where field research was carried out there are many scrap deposits that carry out recycling and commercialize metals, copper, paper, plastics, iron and other waste, but it is a simple marketing process and not a organized LR system.

Despite the massive disclosure of damage caused to the environment by the disposal of e-garbage, no participation in recycling programs was recorded among the interviewees, or selective collection and most of those who reported knowing selective collection stated not know how to define the colors intended for waste in cs bins.

This factor statistically indicated in the above tables demonstrates that the population does not practice selective collection, where 58% say they know what selective collection is and 42% do not know how to define. Confirming the trend of random and inadequate disposal of electronic waste and others that are not collected by public collection in domestic dumpsters, such as pieces of wood, plastics, glasses, and so an..

Picture 6 - Source: Gonçalves (2019)

Among the interviewees who reported knowing the selective collection represented by the colored collectors in the image above, 71% said they could not define the specific colors of the recycle bins for each type of residue and only the remaining 29% stated that they knew the destination of colors.

According to Gonçalves (2007), the paradox exists in the problem of an increasingly growing production in a market that offers increasingly affordable high tech equipment, with a high level of waste of natural resources and contamination of the environment caused by the production process and the rapid and increasing disposal of the same.

The research indicates that most families are not oriented enough to avoid environmental damage and live with the reality of the production described above and the consequent intense disposal of e-waste-generating goods.

In addition to the restriction of city collector cars that do not collect this type of material limiting the collection only to household waste packed in bags and the absence of public policies and institutional programs of reverse logistics and selective collection are determinants for the worsening of environmental damage caused by the random disposal of e-waste expanded by the disposal of thousands of analog televisions in the city of Manaus.

This chapter presents the results obtained from the visits to the homes of some residents of the neighborhoods of the East Zone of Manaus and workshops of the Neighborhoods for the application of the questionnaire with the families that were part of the research.

Families are all low-income, residents of internal streets in the neighborhoods. And the workshops visited present common characteristics regarding the size and legal constitution, being in full micro informal enterprise, without formal hiring of labor working mainly with the work and personal administration of the Owner.

Through this work, we sought to collect data necessary to analyze the flow of disposal of these materials by the workshops randomly, considering the lack of a public service (inefficient) intended to collect these materials, since the domestic garbage collector cars do not collect electronic waste that ends up being deposited in dumpsters addicted to public rentals, according to the following images.

Image 7 - Source: Gonçalves (2019)

Image 8 - Source: Gonçalves (2019)

4.1 RESULTS OF ENVIRONMENTAL IMPACTS

The results related to the identification of negative environmental impacts and human health, caused by electronic and e-garbage waste in the eastern part of the city of Manaus / AM are presented in the form of listing (check-list), in tables 2 and 3 below:

Table 2: Chek-list method application.

Ord.	Negative Environmental Impacts	Origin
01	Contamination of surface and groundwater	Muitas das vezes esses materiais (tv analógica e e-trash) são descartados em terrenos de preservação onde existem nascentes consequentemente poluindo as águas superficiais e subterrâneas.
02	Possible damage to public health	Possible contamination with chemicals existing in these materials.
03	Depreciation of soil quality	Contamination caused by waste (Arsenic; copper; aluminum; mercury, and so an.) from analog TV and e-garbage.
04	Depreciation of soil quality	Decreased fertility because of the chemicals of these materials (analog TV and e-garbage).
05	Possibility of attacks of venomous animals	Permanence of debris and debris of these materials (analog tv and e-garbage), in inadequate places.
06	Degradation of the natural landscape	The way in which these materials (analog tv and e-garbage) are abandoned often in preservation areas consequently end up changing the landscape.
07	Risk to human health	People (sateiros) removing the materials to recycle without any protection.

Table 3: Cheklist method application.

Ord.	Chemical	Where they are found	Made to health
01	Mercury (Hg)	Analog tv and e-trash	It can harm the brain, liver, development of fetuses and cause various neuropsychiatric disorders. (SILVA, 2010).
02	Cadmium (Cd)	Analog tv and e-trash	In chronic intoxication can generate bone decalcification renal injury in addition to teratogenic (fetal deformation) and carcinogenic (cancer) (FERREIRA and ROSOLEN, 2013).
03	Arsenic (Ar)	Analog tv and e-trash	In humans it produces effect on the respiratory, cardiovascular, nervous and hematopoietic system. (SILVA, 2010)
04	Covers (Cu)	Analog tv and e-trash	damage to organisms associated with copper include damage to the gastrointestinal epithelium associated with centrilobular necrosis in the liver and tubular necrosis of the kidneys, metabolic changes in the body (OLIVEIRA e CAMARGO, 2009).
05	Lead (Pb)	Analog tv and e-trash	Soil contamination with Pb is a virtually irreversible cumulative process thus increasing the contents of this metal on the soil surface, indicating an availability of absorption of it by plant roots (SILVA, 2010).
06	Aluminum (Al)	Analog tv and e-trash	Iron deficiency anemia; chronic intoxication (ARAUJO and PINTO FILHO, 2010).

PROPOSAL TO COMBAT AND ENVIRONMENTAL DEFENSE

To address the problem caused by the disposal of electronic waste by workshops and families in the East Zone of Manaus and its consequent environmental impact resulting in risks to public health, soil contamination, resources water and atmosphere this work proposes the implementation of the SPECIFIC COLLECTION PROGRAM - PCE, by Manaus city all.

The PCE should be inserted in the current system of public garbage collection, with the use of collection trucks scheduled to collect waste in electronic workshops and strategic points, where families can deliver the equipment giving waste the correct disposal, rather than

leading them to the landfill, where they will cause irreversible damage to the soil, ground water sheets and water systems of the city that flow into the Negro River, leading to this its high potential for Contamination.

The proposal is in line with the need for immediate and efficient action by the government that cannot remain omisso to the confrontation of this problem that will be aggravated with the disposal of thousands of obsolete appliances, due to the definitive shutdown analog signal by Amazon TV stations.

In addition to the natural disposal due to wear, these equipment had their disposal accelerated by its obsolescence, after the shutdown of the analog signal in Manaus, or because they were damaged, with the disposal of the landfill of the City Hall and other places Inappropriate. According to what has been exhaustively demonstrated in this work, when there is recycling of these materials, it is always occurs in a rudimentary and precarious way.

Another aspect to be observed is the absence of a policy of regularization of the collection of these debris. "What actually exists is just a shy set of legal devices that do not meet the real environmental preservation needs at all, enabling irreparable damage to the environment and human health itself" (GONÇALVES, 2007).

V. CONCLUSION

With the present research work it was possible to realize that there is still a need to work new public policies that aim to bring more efficiency to the services offered by the city, as well as more information the population, so that we can solve this problem that every day only increases in our city.

This phenomenon of disposal of the e-garbage object of this study is concern of Environmental Engineering due to occur randomly, without the existence of a public policy prioritizing selective collection, or reverse logistics aimed at avoiding, minimizing and eliminate damage caused by its highly contaminating components such as mercury, cadmium, arsenic, copper, lead and aluminum that penetrate the soil and groundwater contaminating plants and animals through water until it reaches man through the chain food by the intake of these food and water.

Unfortunately, in recent years the problem has only worsened with the process of shutdown of analog signal by amazon TV stations, without public sectors of environmental preservation manifested and adopted initiatives to solve the problem preferring the silent permissiveness to dispose of thousands of analog TV sets in the city without guidance or any public policies to avoid the environmental impact caused by it.

Therefore, it is concluded that the damage to the environment caused by this phenomenon is a priority concern of all, and determines the urgent implementation of the Specific Collection Program - PCE by city hall Manaus to face the problem that has been causing and will also cause irreversible damage to the environment the quality of life in the city of Manaus if an effective activity of raising awareness of the population is not carried out.

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