

Evaluation of waste management from civil construction in Uberaba, state of Minas Gerais

Avaliação do gerenciamento de resíduos da construção civil do município de Uberaba, Minas Gerais

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ABSTRACT: The present paper evaluates environmental management, in the context of planning and guidance of Civil Construction Waste (CCW) in Uberaba, identifying factors that influence the current model and contributing with suggestions for improvement. The study is based on exploratory research, by means of qualitative and quantitative information analysis, interviews with professionals in the area and field observations in the local recyclable waste collection areas, also known as ecopoints. Based on the results, it is apparent that Uberaba has local laws that provide guidelines and criteria for the management of CCW, such as the law No. 10,876 - from December 11, 2009 - which covers the entire production cycle of materials, in addition to covering environmentally correct disposal by citizens. In this study, factors that interfere in the current model are pointed out, through indicator analyses, as well as the efficiency of ecopoints and the role of the population in the management of CCW. The collected data in the National Sanitation Information System (SNIS) show an increase in the generation of CCW by the population, with a mass of CCW per capita of 351.44 [kg/(inhabitants x year)] in 2019. It stands out the need for more effective public transparency of such information, given what was analyzed, whether due to lack of data or divergence of information. It is up to the public authorities to monitor the evolution of the indicators and promote corrective actions in this process, as well as have information about the ecopoints for the entire population, since the city still faces difficulties related to the irregular disposal of waste in inappropriate places.

Keywords: Waste Management, Ecopoints, Indicators, Medium Towns.

RESUMO: O presente trabalho avalia o gerenciamento ambiental, no contexto do planejamento e gerenciamento dos resíduos da construção civil (RCC) do município de Uberaba, identificando fatores que influenciam no modelo atual e contribuindo com sugestões de melhorias. O estudo fundamenta-se na pesquisa exploratória, por meio de análise de informações qualitativas e quantitativas, entrevistas com profissionais da área e observações de campo nos ecopontos do município. Com base nos resultados observa-se que Uberaba possui leis locais que dão as diretrizes e critérios para o manejo dos RCC, como a Lei nº 10.876, de 11 de dezembro de 2009, a qual abrange todo ciclo produtivo dos materiais, além de dispor de ecopontos para o descarte ambientalmente correto pelos munícipes. São apontados nesse estudo fatores que interferem no modelo atual, por meio de análise de indicadores, da eficiência dos ecopontos e do papel da população diante do gerenciamento dos RCC. Os dados coletados no Sistema Nacional de Informação sobre Saneamento (SNIS) apresentam um aumento na geração de RCC pela população, com massa de RCC per capita de 351,44 [kg/(habitantes x ano)] em 2019. Destaca-se a necessidade de transparência pública dessas informações de forma mais efetiva, diante do que foi analisado, seja por falta de dados ou na divergência de informações. Cabe ao poder público acompanhar a evolução dos indicadores e promover ações corretivas nesse processo, assim como dispor de informações sobre os ecopontos para toda população, visto que o município ainda enfrenta dificuldades relacionadas ao descarte irregular de resíduos em locais inapropriados.

Palavras-chave: Gerenciamento de Resíduos, Ecopontos, Indicadores, Cidades de Médio Porte.

INTRODUCTION

The construction industry plays a fundamental role in the expansion of the economy and the social environment; however, it is one of the sectors that generate environmental impacts the most, such as the excessive consumption of natural resources from non-renewable sources and the generation of waste resulting from losses and material waste (BOURSCHEID; SOUZA, 2010; GONÇALVES, 2016). In this sense, the population growth and the urban densification make the demand for construction materials escalate and, consequently, more waste is generated and sent to landfills or discarded in clandestine locations incorrectly, bringing about great environmental and social impacts. It is imperative to seek solutions that aim to reduce the impacts caused by the construction industry, with the purpose of promoting sustainable development for the city.

Silva and Fernandes (2012) researched and pointed out that public policies in Uberaba were not effective when it came to the administration and management of Civil Construction Waste (henceforth CCW) and the effectiveness of ecopoints, highlighting the portion of the population that was not adequately sensitized about the problem. The study by Faita and Sarmento (2015) also highlighted that the municipal management of Uberaba was inefficient when it came to the operation of these ecopoints because of the continued irregular disposal of solid waste in inappropriate sites. In this context, the present work evaluates the current scenario of solid waste disposal in Uberaba, a city in the state of Minas Gerais in Brazil, identifying the main bottlenecks and pointing out possible steps, taking into account the need for more recent studies on the subject, to support new research and decision-makers. For this purpose, considering the current situation, the research aimed to update the diagnosis of the municipal scenario, in order to propose improvements in environmental management in the context of planning and management of CCW in Uberaba.

THEORETICAL REFERENCE

The Brazilian legislation has rules on CCW, highlighting Federal Law no. 12,305 of August 2, 2010, which establishes the National Solid Waste Policy and the Resolution of the National Environment Council (Conama) no. 307, from July 5, 2002, which establishes guidelines, criteria and procedures for the management of construction waste.

According to article 5 from Conama Resolution no. 307, it is the responsibility of the cities and the Federal District to draw up the Municipal Plan for the Management of CCW in accordance with the Municipal Plan for the Integrated Management of Solid Waste. Art. 6 provides for the guidelines that must be included in the plan, such as the city responsibility to bring forth adequate areas for the destination of CCW, inspection measures, as well as educational policies.

Complementary Law no. 389, from December 20, 2008, established the Uberaba Environmental Code and brought in art. 238 the guidelines for the Municipal Civil Construction Waste Management Program, which has preventive effort for the proper management of this waste, from the procedures that large CCW generators must carry out, the guidance actions, agents' inspection and control, as well as educational activities to reduce generation and incentives for segregation at source (UBERABA, 2008).

Uberaba has a Municipal Law no. 10,876, from December 11, 2009, which established the system for the sustainable management of CCW and bulky waste, and

covers the entire process that involves the product life cycle, from the reduction in its generation until the final destination (UBERABA, 2009).

Large generators must prepare Civil Construction Waste Management Plans, in accordance with Conama Resolution no. 307 - art 8, informing the necessary procedures for the environmentally adequate waste handling and disposal.

Magdaleno and Nobrega (2015) emphasize the importance of environmental concern at construction sites because, based on their work, this stage is responsible for generating large waste volumes, environmental impacts and disturbances to the surrounding areas.

Ferreira, Noschang and Ferreira (2009) mention that poor administration and management of CCW is by virtue of failures during the preparation and execution of projects, as well as the disqualification of the workforce, emphasizing the lack of a culture of reuse and recycling of these materials. The authors point out the main waste from civil construction and demolition are “stones, bricks/blocks, sand, cement, mortar, concrete, wood, lime and iron. In a smaller volume, there are tailings from leftover paints, varnishes, wiring, tiles, PVC pipes, aluminum and paper scraps from packaging and human activities at the workplace” (FERREIRA; NOSCHANG; FERREIRA, 2009, p.13).

The regulatory standard NBR 10,004 (ABNT, 2004) classifies these solid wastes as Class II B - inert, which are non-hazardous and maintain their characteristics during the decomposition process. As reported by Lima and Cabral (2013), some of these residues contain impurities and contaminants in their composition, originating from polymers, gypsum, asbestos and other substances that trigger complications in soil, water resources and human health.

Conama Resolution no. 307 (BRASIL, 2002) presents in its third article the classification of CCW, as stated in **Chart 1**.

Chart 1. Classification of civil construction waste

Classes	Types of waste
A	Reusable or recyclable waste as aggregates in construction processes, demolition, renovations, paving and building repairs, such as ceramic components, mortar, concrete and soil.
B	Recyclable waste for other destinations, such as plastics, paper, cardboard, metals, glass, wood, empty packages of architectural paints and plaster.
C	Waste for which no economically viable technologies or applications have been developed allowing their recycling or recovery.
D	Hazardous waste from the construction process, such as paints, solvents, oils and others or those contaminated or harmful to health from demolitions, renovations and repairs of radiological clinics, industrial facilities and others, as well as tiles and other objects and materials that contain asbestos or other products harmful to health.

Source: Brasil, 2002.

METHODOLOGY

Uberaba is a city in the state of Minas Gerais, located in the micro-region of Minas Gerais Triangle, with a total area of 4,540.51 km², with only 256.00 km² representing the

urban perimeter (UBERABA, 2014). The city encompasses a population of 333,783 inhabitants (SNIS, 2019).

The research is classified as exploratory, which aims to come up with greater familiarity with the problem, aiming at the construction of hypotheses and the improvement of ideas (GIL, 2002). In view of this, the following steps were conducted: bibliographic survey, analysis of records on government platforms, semi-structured interviews with professionals in the area and visits to the city ecopoints.

A bibliographic survey was carried out, searching for all legislation related to the study; the articles searched were published between 2005 and 2020 and the keywords used were “management of CCW”, “sustainability” and “ecopoints”. Articles associated with small towns were disregarded in the search. It was possible - while analyzing the selected articles - to identify improvement processes in other cities that focus on sustainable alternatives to the problem and that can be applied in Uberaba. The search in the literature contributed to the theoretical foundation, as well as to the discussion of the results.

The use of the National Sanitation Information System (SNIS) platform provided a survey on secondary data about waste management, especially those of civil construction, considering the period from 2002 to 2019. The data collected were tabulated and analyzed in the Microsoft Excel software. The information analysis brought about the comprehension of the agents involved in the generation, collection, transport as well as in the identification of the amount of CCW collected and discarded in sanitary landfills, in addition to indicators already used by the city.

Interviews on economics, administration and management of CCW and public policies, based on the literature (BRASIL, 2002; LIPSMEIER, 2005; FERREIRA; NOSCHANG; FERREIRA, 2009), were held by videoconferences with experienced professionals in the area, individually and lasted about an hour.

The application of semi-structured interviews contributed to a better understanding of the issue. The contextualization with the interviewees was made in accordance with their respective experiences. **Chart 2** composes the areas of activity and the way in which the interviews were approached.

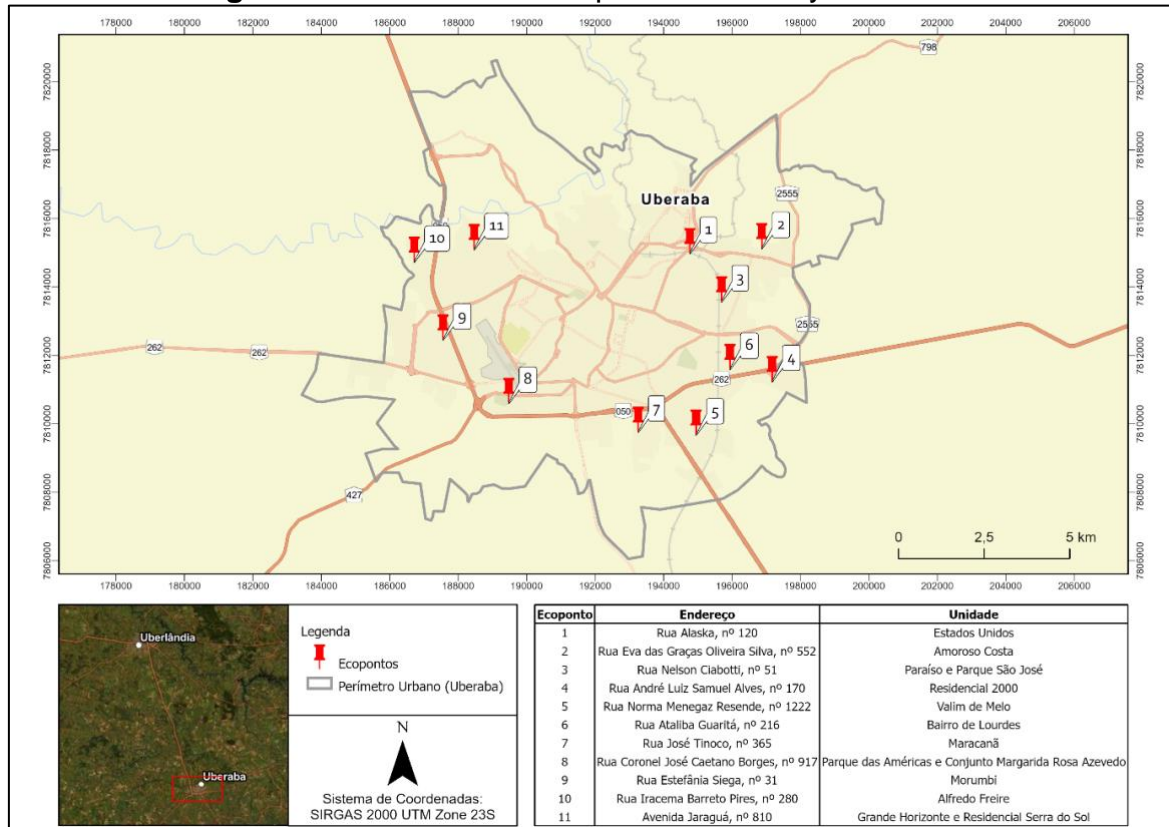
Chart 2. Profiles of professionals selected for the interview

Interviewee	Professional experience	Approach
1	Environmental Engineer, with specialization in Basic Sanitation, project coordinator in the private Sanitary Landfill	Administration and management of civil construction waste in the city's private landfill
2	Economist and Master in Regional Development and Environment	Politics and economics in the face of construction waste bottlenecks
3	Environmental Engineer, counselor of CREA-MG and President of an Association of Environmental Engineering Professionals	Politics and economics in the face of construction waste bottlenecks
4	Environmental Engineer, civil servant of the Uberaba Environment Secretariat	Administration and management of construction waste in the city

In December 2020, visits were paid at the 11 ecopoints in the city, in order to understand how these waste reception sites provided by Uberaba work, in accordance with Law No. 10,876/2009. ArcGIS Pro 2.6.3 software was used to represent the visited ecopoints on a map (**Figure 1**).

The scientific research was registered on Plataforma Brasil and approved by the Research Ethics Committee, presenting the Certificate of Presentation for Ethical Assessment (CAAE) 38056620.0.0000.5154.

Figure 1. Distribution of ecopoints in the city of Uberaba



RESULTS AND DISCUSSION

Currently, waste management in Uberaba is administered in partnership between the Bureau of Urban Services and Works (Sesurb) and the Operational Company for Development, Sanitation and Urban Actions (Codau), according to Law N° 14,026, from July 15, 2020, which updates the legal framework of basic sanitation and presents - in art. 17 - the regionalized provision of public basic sanitation services (BRASIL, 2020); while the Secretary for the Environment yields technical and legal guidance for the local environmental issues.

The sixth article of the Municipal Law N° 10,876/2009 has an integrated set of physical areas and procedures aimed at facilitating the correct disposal of waste. The article brings, as an alternative for the citizens, waste collection systems called ecopoints. The ecopoints are under the responsibility of the public authorities, but an outsourced

company, through bidding processes, administrates the management performed at the sites. Nevertheless, it belongs to the city the obligation to maintain the collection network sites in adequate conditions, both in terms of the site physical structure and the minimum requirements of comfort for workers in their workplace.

It is up to the Public Prosecutor's Office to act preventively, so that there is effective compliance with current legislation, in order to manage and inspect violators who may cause damage to the environment. Art. 225, §3 of the Federal Constitution of 1988, establishes that “Conducts and activities considered harmful to the environment will subject violators, individuals or legal entities, to criminal and administrative sanctions, regardless of the obligation to repair the damage caused” (BRASIL, 1988, p.124).

Quantitative aspects of construction waste in Uberaba

When analyzing temporal data in the National Sanitation Information System (SNIS), it is apparent a lack of information related to the amount of CCW collected for the period from 2002 to 2016 by the public sector, finding only qualitative information that, in this period, there had already been a civil construction waste collection service carried out by self-employed workers. For the year 2002, there is information on the amount of CCW collected by the private sector; still, in the report, the name of the company responsible for the collection is unknown (**Table 1**).

Table 1. Information on CCW collection

Reference year	Amount of CCW collected (ton)		
	City hall or contracted by it	Dumpsters and freelancers hired by the generator	Private sector
2002	-	-	59,576.19 *
2015	-	-	-
2016	-	-	-
2017	19,254.00	82,244.50	-
2018	21,179.40	90,468.00	-
2019	24,215.00	90,468.00 **	-

*Unknown private sector

**Discrepant information

Source: SNIS, 2020, adapted.

From 2012 on, as claimed by interviewee 1, the private landfill began to receive this waste at the site. Given the data obtained on the platform, on the amount of CCW received at the landfill by the private sector, it was only in 2015 that information on waste was filled out in the system.

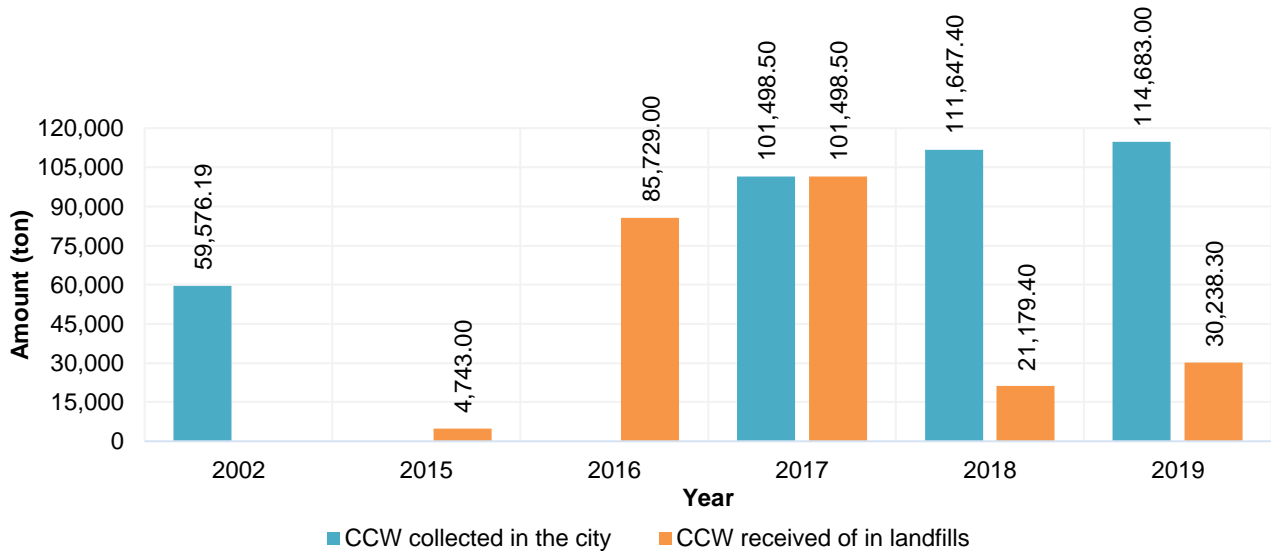
Also based on the information obtained through the SNIS, between 2016 and 2017 there was an 18.39% growth in CCW sent to landfills (**Graph 1**), being that 101,498.50 tons of CCW were collected and dumped in landfills in 2017 in Uberaba, of which 18.97% was carried out by the public sector, while the rest by the private sector.

From 2017 to 2019, data inconsistencies were observed, since there is a divergence of information in the analyzed parameters (**Table 1** and **Table 2**).

In **Table 1**, the information identified as discrepant refers to the data collected in the SNIS on the amount of CCW collected by dumpsters and freelancers hired by the generator. This value corresponds to the same value reported in 2018, which may be

wrong information, since compared with previous years it is possible to observe a growth trend of collected CCW.

Graph 1. Data on the amount of CCW collected and disposed of in landfills in Uberaba from 2002 to 2019



Source: SNIS, 2020, adapted.

Notwithstanding, while comparing the collection information (**Table 1**) with the information on the city flow of CCW (**Table 2**), it was noted that in the years 2018 and 2019, such information diverged. Questions about the data representativeness and reliability were raised, considering that the sum of the collected waste must be equivalent to the sum of the waste discarded in sanitary landfills, since Uberaba does not have a processing plant for these materials for recycling processes, which would reduce the CCW discarded in landfills.

It is noted that, in 2017, the pieces of information converge, both on the collection of CCW and on the amount received in landfills. In 2018, for the municipal sanitary landfill, the information is also consistent; nonetheless, for the year 2019, the amount of CCW received at the municipal sanitary landfill was not presented, which may cause failures in the analytical processes regarding these wastes.

Also, based on the year 2017, the amount of CCW collected by dumpsters and freelancers is equal to the amount received in the private landfill. However, it was not possible to say whether such information follows a pattern, because, for the year 2019, the value presented in **Table 2** is considerably lower than that presented in **Table 1**, even in the face of the divergence pointed out regarding the possible unchanged information between the year 2018 and 2019.

The private sector, even with the reduction in 2019, is most responsible for the correct destination of CCW, from large generators, while the public sector's contribution is caused by the aggregates taken to the ecopoints by the citizens and to urban cleaning, carried out by Sesurb, of construction waste incorrectly thrown by the population in inappropriate stations.

Table 2. Information on the CCW flow to the processing units

Reference year	Amount of CCW received (ton)	
	Municipal sanitary landfill	Private sanitary landfill
2015	-	4,743.00
2016	-	85,729.00
2017	19,254.00	82,244.50
2018	21,179.40	-
2019	-	30,238.30

Source: SNIS, 2020, adapted.

From 2017 on, some indicators began to be available by Uberaba in the SNIS, as shown in **Table 3**. It is noted that one year after the indicators were filled out in the system, in 2018 there was no longer information on the per capita mass of CCW and, in 2019, this value was already entered into the system, which shows that approximately $\frac{1}{4}$ of the waste collected by the city hall refers to CCW. It is worth noting that this information must be kept constant, so that proposals for improvements are made in the city based on consolidated data.

The lack of quantitative information causes a failure in the elaboration of laws and projects, since there is no representative analysis of the amount of CCW generated, collected and discarded in landfills, even more with the existence of illegal dumpsters who get rid of these materials in inappropriate locations, generating divergence in the parameters to be analyzed.

It is the public authorities' responsibility to develop effective policies, in order to promote the reduction of waste in the construction, renovation and/or demolition of buildings, but as the understanding of indicators and consequent economic impact on public spending improves, it becomes crucial to review such policies with a view to improving processes.

Table 3. CCW management indicators

Reference year	Ratio: amount of RCC collected by the city by the total amount (household waste + public waste) [%]	Mass of RCC per capita/year in relation to the urban population [kg/(inhabitants x year)]
2017	20.72	316.25
2018	22.84	-
2019	24.69	351.44

Source: SNIS, 2020, adapted.

Strategies related to accountability for actions (waste generation and separation) at construction sites must be fathomed by everyone, with the aim that all professionals must respect rules imposed by those responsible for works, to promote the correct use of separation buckets and the sustainable use of materials in order to avoid waste.

An adoption to increase the recycling rates of CCW in Denmark was the increase of taxes on their consumption, in order to increase the population's quality of life and conserve natural resources, having increased from 25% to 92% in the period from 1990 to 2005 (LIPSMEIER, 2005). To combat the problem related to such waste, the government

must act in a preventive way, with initiatives that promote the recycling of construction waste, guiding small and large generators on the proper management of waste, from planning to the completion of construction projects along with the private sector.

Law No. 10,876/2009, in art. 17-A affirms “Issuing a permit for construction and/or renovation is subject to the presentation of a Project with a Construction Waste Management Plan” (UBERABA, 2015, p.13). From this perspective, it should be proposed that such a plan presents data regarding the production of waste in construction, renovations and demolition so that the quantification of CCW generated in the city is specific and representative. Still, such action is vital to be done with private companies that are contracted by generators above 1 m³. It is possible to establish this action by encouraging segregation at source at construction sites in buckets and by means of specific documentation on the amount generated. Failure to submit the Construction Waste Management Plan or proof of waste disposal (greater than 1 m³) will result in a fine, pursuant to Law No. 10,876/2009.

Finally, with the aim of investigating expenses related to CCW, information about it was not identified in the SNIS. In light of this, it is recommended to implement annual estimates, in order to point out the influence of such waste on the city economy and predict a relationship between CCW expenses and their management so as to identify business opportunities related to recycling.

Infrastructure for disposal of civil construction waste in Uberaba

When it comes to CCW, Uberaba faces a major problem of irregular disposal in Permanent Preservation Areas (PPAs), which many do not have an adequate enclosure with fences, facilitating the disposal of waste on site, as mentioned by interviewee 4. One of the factors that exacerbates this problem is the cost of bucket rentals for storing this material before being unloaded correctly in the environment, in addition to the lack of awareness and commitment of the population that has their share of responsibility.

Léa Quarry, deactivated in 2011, is a large area that suffered a great environmental impact in consequence of the incorrect waste disposal, including those from civil construction. As specified by Silva and Fernandes (2012, p.341) “the waste was disposed of without segregation or even the least inspection and identification of the type of material that was being released”. Also conforming to the authors, the release of these materials in these fragile areas is because of their low economic value in the market, which makes them poorly monitored.

Nowadays, in line with interviewee 4, this area is monitored by biologists from the Secretariat of Environment to analyze environmental regeneration, in order to identify whether, in fact, there is no need for a Degraded Area Recovery Plan, in addition to being supervised by the State Foundation for the Environment (FEAM) by technicians who accompany the Secretariat.

At the time that Léa Quarry was deactivated, interviewee 3 explained that there was a draft of a project for the implementation of a recycling plant, but it did not continue, as there was no justifiable CCW volume for a high investment. Based on information from the SNIS, there was no public transparency of this data at the time, which would make analysis difficult.

It is observed that the lack of data or the lack of public transparency, regarding the volume of CCW generated, causes failures concerning urban planning, in addition to not

contributing with information to decision makers. It is paramount to continue the provision of this data, to improve future research and projects for the city.

When studying the management scenario of CCW in Uberaba, Silva and Fernandes (2012, p.343) suggested, as a solution, the “creation of a plant for recycling construction waste, requiring high fees to be charged for those who do not promote the proper disposal of waste, including on the Municipal Public Power itself”. Previous studies have already raised the question of possible improvements that the city could adopt to implement the proper treatment of CCW and as Léa Quarry is an area of low economic value, it proves to be a favorable place for the implementation of a processing plant.

Such action can bring improvements to the city in the economic aspect by reducing costs for the acquisition of new materials, using the aggregates for the maintenance and paving of access roads and in drainage systems. In the environmental aspect, there may be a reduction in landfill loads, allowing their operational life to be extended. With reference to the social context, it will enable the generation of work and income for the population.

Relative to the Municipal Basic Sanitation Plan (UBERABA, 2014), it is understood that there is a dearth when it comes to the recycling processes of CCW, as there is no processing plant for this material, so as an alternative to the problem faced. The public agency is aware that the implementation of a recycling plant is an action that guarantees the effectiveness of the processes in the axis of urban cleaning.

As much as there is knowledge about the issues that must be improved, it is clear that there are still flaws and impediments to the advancement of the proposals. In this context, the role of the municipal council in the evolution of current public policies should be highlighted.

In response to the management of CCW in the private landfill, crushing tests have already been carried out for Class A waste and there are future perspectives to implement such action in the landfill, as mentioned by interviewee 1, but for the time being, a small percentage of these wastes is reused on site. Class B waste is separated and sent to recycling companies, such as wood, where it is crushed to generate energy.

To encourage the segregation at source of the CCW that are sent to the private landfill, the waste is classified on site according to its classification, in accordance with the regulatory standard NBR 10,004. If the existence of Class II A residues mixed with Class II B residues is verified, the cost for disposal increases, since these residues may have biodegradability, combustibility or water solubility properties. From the moment the waste is disposed of in the landfill, all responsibility lies with the company and not the generator in case there is environmental damage attributable to incorrect waste disposal.

The visits to the ecopoints made it possible to understand the operation of the waste collection network strategically distributed in the urban perimeter of the city. In consonance with art. 7 of Law No. 10,876/2009, these sites are located in regions where irregular waste disposal already occurs. Thus, it became feasible to install these points, as it is an incentive for the population to dispose of their waste properly.

Pursuant to Law No. 10,876/2009, the provision of CCW is allowed for citizens and small collectors, registered at the City Hall, limited to a volume of 1 m³, according to §1 of art. 7, For these, small generators, CCW is stored in 3 m³ buckets (capacity of approximately 5 tons) and sent to the Municipal Sanitary Landfill, which is used to cover the access roads to the cells and facilitate the passage of trucks (UBERABA, 2014).

Figure 2 shows the CCW stored in the bucket before being sent to the municipal landfill. There is plastic waste in the upper part of the bucket, which should be separated in

another bucket, which proves the need to promote more adequate training for those who work on site, so that there is no rework when disposing these wastes in the landfill.

Figure 2. Three m³ bucket with rubble in ecopoint 7



Even with the existence of such law, it is clear that the population still has difficulties in figuring out what can be received at the place because, as said by the employees responsible for the ecopoints. Many of the citizens arrive at the place with waste that is not allowed, leading to the disposal on land close to the ecopoints inappropriately, including those for civil construction (**Figure 3**).

Figure 3. Waste dispose of irregularly outside the ecopoints: Ecopoint 2 (a); Ecopoint 4 (b)



(a)



(b)

Another issue associated with this fact and which makes access to information difficult is the lack of signposts informing what can be destined for the place at the entrance of the collection points. Of the 11 ecopoints visited, only three had signposts with unclear messages, in precarious situations (**Figure 4**).

Figure 4. Bad condition of the signs: hidden behind the trees in Ecopoint 6 (a); difficult access to viewing content in Ecopoint 9 (b)



(a)



(b)

In view of the facts, it is requisite for the public authorities to disseminate - in an adequate way - more information to the population on the materials that can be taken to the collection networks, as stated by interviewee 2. There are irregularities in some points, either by the volume or class of waste allowed, which would reduce the problems of irregular disposal and, consequently, result in cost reductions in terms of public cleaning.

The irregular disposal of these residues in places that do not have adequate protection for the soil ends up resulting in issues such as contamination of the water table and the proliferation of disease-transmitting agents, causing an increase in public health spending, a problem that could be avoided with more frequent urban cleaning. It can be seen in **Figure 3 (a)** residues very close to a culvert, which after rain events can cause the obstruction of sewage collection systems and generate negative consequences for the environment and for the population, providing conditions for flooding.

Ecopoints are essential for an improvement in waste management in the city. Data for the year 2020 indicate that the achievements related to the prevention of illegal acts, by the State Public Ministry and the Environmental Police have had positive effects and a greater awareness of the population, even in the face of the obstacles still faced due to irregular disposal by citizens, as presented. In line with the Uberaba City Hall (2020), around 1,600 tons of waste were deposited in the 11 ecopoints in July, 5.53% higher than the previous month, representing 87 tons more.

However, it is still necessary for the public authorities to provide better conditions for workers at the sites, such as the adequate fencing of points for better safety and minimum

adequate working conditions, as it was pointed out in some recycling points, gates and fences in critical situations (**Figure 5**).

Figure 5. Entrance gate to ecopoint 3 in poor condition



From the 11 ecopoints visited, it was found that two of them do not have electricity, which is unacceptable, as it makes it impossible to install appliances such as a drinking fountain, refrigerator and microwave, which are minimum working conditions for employees who do not have lunch hours and have their meals in their own workplace.

As for the inspection by the public authorities, it was identified that some of the areas received inspections every week, while in others they occurred in a different way (once every two weeks, for example). It is critical to supervise these points critically, to inhibit activities that cannot occur on site, such as the burning of waste, as seen in one of the ecopoints visited.

In February 2020, waste such as Eternit tile, Brasilit tile, styrofoam, sofa, pruning and plaster began to be sent to the private sanitary landfill, where four of the ecopoints have 39 m³ buckets for their storage (**Figure 6**) and are collected three times a week. In one of the ecopoints, which has a larger bucket, it was observed that it is outside the site, which makes it possible to dispose of any other type of waste in it, making the sorting process at the landfill difficult (**Figure 7**).

Even in the face of this positive action, there is a need to install these larger buckets in more ecopoints to facilitate access for the population and encourage proper disposal. In conformity with reports from employees of ecopoints that still do not have these larger buckets, when residents arrive at the site to dispose of the aforementioned waste and cannot, they are advised to look for ecopoints that have 39 m³ buckets. However, there are times when the population refuses the proposal for disposal at other collection points, argues and leaves the waste at the door of the ecopoints or irregularly discards it on nearby lands.

In general, information on ecopoints must be disclosed in order to reach all audiences, with regard to what can be taken to the collection network and the maximum volume allowed that the citizen might discard at the site. Still, most of the ecopoints visited

are in precarious situations, without signposts and with broken fences, in addition to irregularly discarded waste around them, which shows that initiatives related to environmental awareness and inspection are not being carried out effectively.

Figure 6. Dumpster of 39 m³ in ecopoint 2 and outside the site there is irregularly discarded waste



Figure 7. 39 m³ bucket outside ecopoint 10 with other waste besides those accepted in these buckets



CONCLUSION

The evaluation of the current scenario on waste from civil construction in Uberaba allowed greater clarity in relation to the strategies carried out by the Public Power and the private sector. In this article, laws related to the subject were emphasized and it was identified that Uberaba has laws that cover the sustainable management system of CCW and bulky waste, such as Law no. 10,876/2009.

The results presented showed that there is inconsistency of information in the indicators collected in the SNIS regarding waste from civil construction in Uberaba, such as the lack of data in some of the years studied. It is up to the government to develop efficient public policies regarding the management of CCW and monitor the evolution of indicators to promote improvement processes and corrective actions aimed at reducing or reusing these wastes.

A solution to improve the management of CCW is the creation of a processing plant for these materials, making them return to the production cycle, benefiting the local economy, reducing environmental impacts and generating work and income for the population.

With regard to the ecopoints, it was identified flaws in the physical structure of some of them, such as irregular fencing, lack of signposts on what can be destined for the site, lack of electricity and lack of safety at work. In addition, the irregular disposal of waste by the population was observed in some locations close to the ecopoints, which hinders the effectiveness of urban cleaning schemes in the city. The disposal of these residues in regions that do not have adequate protection for the soil may result in problems of contamination of the water table and the proliferation of disease-transmitting agents,

increasing public health expenses, a problem that can be solved with more frequent urban cleanings in these areas.

The current management model requires improvements, such as stricter operations for those who carry out the irregular disposal of waste, effective environmental education programs and projects for the population, in addition to partnerships with the private sector, aimed at reducing environmental and economic impacts. Everyone must understand strategies related to the accountability of measures promoted by large generators at construction sites in order to promote the correct use of separation buckets and the sustainable use of materials; consequently, avoiding waste.

As much as there is awareness about the issues that must be improved, it is clear that there are still flaws and impediments to the advancement of the proposals. As an alternative, the government must monitor the evolution of indicators related to CCW and determine solutions for these numbers to affect the useful life of sanitary landfills positively, by means of recycling techniques, generating, consequently, improvements in terms of economic, social and environmental aspects. As a suggestion for further research, it is recommended information surveys regarding the costs involved in the management of these wastes, from collection to the environmentally correct final disposal, to support the elaboration of municipal strategies.

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