

Water, Environment and Health: The impact of the open dump in Brasilia-DF, Brazil

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The biggest open dump in Latin America is located in Brasilia and has been used as an area for indiscriminate disposal of waste since the sixties. It receives 9.000 tons of waste per day. The impacts on water bodies has become worrying, mainly due to the possibility of contamination of groundwater by infiltration into the soil. Based on data resulting from monitoring of groundwater campaigns in the landfill area, this study evaluates the degree of contamination of groundwater and recommends monitoring strategies to reduce the vulnerability of the waste pickers who work there and the population living nearby.

Introduction

Being that it is an essential condition for life, water in inadequate conditions could be a social determinant which can, in turn cause specific illnesses, either by direct or indirect contact, for example, the ingestion of non-potable water, deriving from inadequate reservoirs for human consumption; contact with contaminated water and exposure to vectors related to the water. In vulnerable areas, the source of fresh water utilized by human beings suffer a continuous and increasing degradation process due to the disposal of sewage *in natura* or infected with animal feces and waste disposal in open air contaminating the water table; in addition, serving as breeding spots for mosquitoes in their immature stages, transmitters of human disease agents. Many of these impacts are the result of disorganized population growth and the lack of appropriate sewage disposal and adequate treatment of waste in the most vulnerable areas.

Collectors of recyclable materials are a category of workers recognized in 1999 by the Brazilian Code of Occupations. Apart from having a low socioeconomic standard of living and residing in vulnerable areas, workers sorting waste in inadequate and unsanitary sites are exposed to various risks. Brasilia, the capital of Brazil still depends on the biggest dumpsite of the Americas. A study done by The Brazilian Association of Public Sanitation and Special Residue Companies reports a total of 30 million tons of waste already accumulated in an area that was originally used as open dumpsite and is now managed as a controlled landfill of the Jockey Club Borough, located at Structural Village. Since the middle of the 1960's this location has received the solid waste produced in the Federal District. According to the data provided by the Technical Directory of the Sanitation Department the site received 856,571.37 tons of waste in

2014. In accordance with the National Policy on Solid Waste all dumpsites in Brazil should be closed by 2014. The Federal District will start to close the controlled landfills in 2017. This process will remain for at least two years. The workers at the Jockey Club controlled landfill will be relocated to the seven Centers of Triage which are in the stage of project, construction and reform, (two of them are in the proximities of the Jockey Club controlled landfill and three of them located at Structural's Village). The Structural Village is a place of great environmental degradation and a social conflict center mainly generated in the surrounding slum dwelling occupied by recyclable material collectors and the homeless.

The landfills make the activities of collectors very risky, resulting in deaths, mutilations and diseases. In the Federal District dumpsites, there are about 1.571 collectors who are part of 6 associations. Currently, the Landfill of Structural is a controlled dumpsite called "Jockey Landfill" which still presents horrible work conditions for the collectors. In addition to the risks for the workers, the environmental impact of a landfill is frightening in relation to consequences on human health, through the contamination of the water table (subterraneous waters) by the slurry generated by waste. In the less favored areas such as Structural, the water for human consumption is frequently sourced by water cisterns. They can be communal or otherwise, and the contamination of the water in this case is due to the decline of terrain between the waste site and the well.

The leachate (slurry) may contain dissolved or solubilized organic material, nutrients, intermediary products of anaerobic digestion of residues with organic volatile acids, chemical substances such as cadmium, zinc, mercury, organochlorides, deriving from the disposal of insecticides, and pesticides, in addition to microorganisms. Furthermore, the presence of pathogenic microorganisms in the disposed waste can contaminate the soil and aquifers, be it through the leachate, by the wind movement, or by means of biological or mechanical vectors (Castilhos Jr, 2013). The heavy metals can be bio accumulative, potentially toxic, and can provoke dermatitis, ulcerations on the skin, cancers, affective disorders, neuromuscular irritation, and cephalgia (Jaishankar et al., 2014). To minimize the effects of heavy metals, regulatory agencies have proposed the maximum allowable limits in drinking water (Who, 2011; Usepa, 2015).

Among waterborne diseases, viral hepatitis is a severe Public Health problem in the world and in Brazil. Hepatitis A, for being disseminated related to the socio-economic level of the population, can vary according to the endemic level of sanitation, health education and hygiene conditions. Data from the Office of Environmental Vigilance (DIVAL-DF) show cases of hepatitis A among the waste pickers of the Landfill of Structural in 2015. Diarrhea also has great impact on the health of the population and is related to the ingestion of food and water contaminated by infectious agents that can be bacteria, virus, protozoa, and helminths.

Dengue can also be considered a waterborne disease being that the vector *Aedes aegypti* which reproduces in still water and infects humans. It is directly associated with the lack of proper waste disposal and waste collection. Currently, on top of dengue this same mosquito can provoke Chikungunya fever and Zika. The latter is linked to cases of microcephaly in babies causing a severe public health problem in Brazil. Dengue stands out as one of the most important reemerging viral diseases transmitted by arthropods. In the Federal District, in accordance with the last epidemiologic bulletin, between January and March of 2016, 13.008 suspect cases of dengue were registered, of which 11.268 were confirmed (Ses/Gdf 2016).

The diseases mentioned demonstrate how important water care is and that this water itself can cause severe direct or indirect health risks. An analysis of the overall context creating a relationship between the environment, waste disposal, and waterborne diseases is therefore necessary to identify methods to reduce these factors which contribute to the emergence of these illnesses, which generally affects the less favored sectors of the population.

This study analyzes groundwater quality in the areas adjacent to the monitored sanitary landfill of Structural and submits the environmental issues experienced by residents and pickers of recyclable materials of DF working in this environment, and proposes mitigating, monitoring and control measures.

Methodology

Characterization of the study site:

This study is being developed at the proximities and at the “Structural open dump” area which is currently referred to as the Jockey Club controlled landfill. Located nearby Plano Piloto, between the National Brasília Park, the Structural Village, and the Cabeceira Vallum Stream (Córrego Cabeceira do Valo), it covers 200 hectares and has been in operation for 55 years.

It receives 9 thousand tons of waste daily. Currently, almost 2.000 recyclable material collectors work at the controlled landfill, 1.571 members in collector cooperatives and the remaining autonomous workers. (Codeplan PDAD, 2014; Brasil, 2014).

Description of the studies:

To monitor the subterraneous waters at the adjacent areas to the landfill two monitoring wells already being used by the Regulating Agency for Water, Energy, and Basic Sanitation of the Federal District – (ADASA) and located 200 meters from the landfill will be used, at a vegetable producing ranch. One well is 30m deep and the other is 70m deep. The static measurement level (quantitative evaluation) and the collection sample for quality evaluation were done biannually, with a 32-parameter analysis

chosen according to the Brazilian legislation for classification and cataloging of aquatic bodies, resolution of CONAMA 357/2005, being that, for heavy metals, the aliquots should be conditioned in tubes free of metals and one part filtered in the field in order to obtain data of total and dissolved metals. The GOD Method (Groundwater occurrence, Overall lithology of the unsaturated zone, Depth to the water table) was utilized to evaluate the vulnerability to contamination of the subterraneous waters in occupied urban areas.

The performed physicochemical and bacteriological analyses followed standards prescribed in the Standard Methods for the Examination of Water and Wastewater (APHA, 1995) Altogether, fifteen campaigns were held over four years, comprising dry and rainy periods. Larger numbers of parameters were monitored in the years 2013 to 2015.

Results and Discussion

The results presented below are part of the monitoring promoted by ADASA in two wells in the area located in fractured and porous areas.

Tables 1 and 2 present the results of groundwater analyses from two wells pertaining to ADASA monitoring network, and the comparison with the maximum values allowed by Ordinance 2914 of the Ministry of Health (Brazil, 2011), which establishes the standards for water quality for human consumption, and the Resolution CONAMA 396 (Conama, 2008), establishing parameters for groundwater environment regulation, considering that using groundwater is mainly done for public supply.

Table 1 – Analysis of the groundwater of the porous well in comparison with maximum permissible values.

Parameters	apr/13	jul/13	oct/13	apr/14	oct/14	feb/15	oct/15	mar/16	jul/16	aug/16	sep/16	oct/16	nov/16	MVP Brazil (2011) ¹	Res. 396 (Conama, 2008) ²
Alcalinity (mg/L CaCO ₃)	96,0	69,0	20,0	135,0	113,0	147,0	530,0	122,0	NA	NA	NA	NA	NA	NR	NR
Total Hardness mg/L CaCO ₃)	159,0	47,0	21,0	14,0	163,0	158,0	118,0	44,0	NA	NA	NA	NA	NA	500	NR
Conductivity (µS/cm)	3310,0	3310,0	1701,0	2160,0	1123,0	1307,0	1350,0	1536,0	1622,0	1728,0	1663,0	1667,0	1636,0	NR	NR
Turbidity(NTU)	264,0	402,0	409,0	1580,0	137,0	60,8	36,7	130,0	NA	NA	NA	NA	NA	5UT	NR
Total Iron (mg/L)	45,6	78,4	66,3	78,8	9,4	4,8	18,3	14,5	NA	NA	NA	NA	NA	0,3	0,3
pH	5,7	6,4	5,6	6,1	7,0	7,1	6,6	6,2	NA	NA	NA	NA	NA	6-9	NR
Chlorides(mg/L)	427,9	404,4	< 1,0	524,8	323,0	228,0	550,0	412,5	NA	NA	NA	NA	NA	250	250
Manganese(mg/L)	0,226	0,273	0,287	0,209	0,037	0,486	0,178	0,056	NA	NA	NA	NA	NA	0,1	1
Barium	NA	NA	NA	NA	NA	0,076	0,036	NR	NA	NA	NA	NA	NA	0,7	0,7
Lead	NA	NA	NA	NA	NA	0,273	NR	NR	NA	NA	NA	NA	NA	0,01	10
Copper	NA	NA	NA	NA	NA	0,032	0,008	NR	NA	NA	NA	NA	NA	2	2
Nitrate	NA	NA	NA	NA	NA	0,5	2,6	NR	NA	NA	NA	NA	NA	10	10
Nitrite	NA	NA	NA	NA	NA	5,255	0,997	NR	NA	NA	NA	NA	NA	1	1
Aluminun	NA	NA	NA	NA	NA	< QL	0,053	NR	NA	NA	NA	NA	NA	0,2	0,2
Ammonia	NA	NA	NA	NA	NA	< QL	< QL	NR	NA	NA	NA	NA	NA	1,5	NR
Zinc	NA	NA	NA	NA	NA	0,112	0,036	NR	NA	NA	NA	NA	NA	5	5
Total coliforms (MPN/100 mL)	ND	ND	ND	ND	>23	ND	ND	ND	ND	ND	ND	ND	ND	absence/ 100 mL	NR
<i>Escherichia coli</i> (MPN/100 mL)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	absence/ 100 mL	absence/ 100 mL
Level (m)	1,4	NA	2,0	3,0	3,0	5,6	2,8	NA	NA	NA	NA	NA	NA	NR	NR

Legend: 1- Maximum Values Permitted in accordance with Ordinance 2914 of the Ministry of Health for drinking water; Maximum Values Permitted in accordance with 396 Resolution of Conama with preponderant use for human consumption; NA – Not Analyzed; NR – Not Referenced; ND – Not Detected; QL – Quantification Limit;

Table 2 – Analysis of the groundwater of the fractured well in comparison with maximum permissible values.

Parameters	apr/13	jun/13	oct/13	apr/14	oct/14	feb/15	oct/15	mar/16	jul/16	aug/16	sep/16	oct/16	nov/16	dec/16	MVP Brazil (2011) ¹	Res. 396 (Conama, 2008) ²
Alkalinity (mg/L CaCO ₃)	237,0	212,0	207,0	204,5	163,0	93,0	160,0	NA	NA	NA	NA	NA	NA	NA	NR	NR
Total Hardness (g/L CaCO ₃)	141,0	131,0	167,0	133,0	135,0	143,0	132,0	NA	NA	NA	NA	NA	NA	NA	500	NR
Conductivity (µS/cm)	2230,0	1442,0	890,0	1021,0	664,0	730,0	533,0	482,0	510,0	512,0	515,0	512,0	509,0	439,0	NR	NR
Turbidity (NTU)	8,8	16,4	47,6	138	8,7	5,3	0,98	NA	NA	NA	NA	NA	NA	NA	5UT	NR
Total Iron (mg/L)	0,22	0,18	0,54	0,56	0,21	1,28	0,301	NA	NA	NA	NA	NA	NA	NA	0,3	0,3
pH	7,1	7,88	6,38	6,92	7,3	6,8	7,4							6,26	6-9	NR
Chlorides (mg/L)	135,95	130,95	115,46	110,7	100,7	78,4	105,5	NA	NA	NA	NA	NA	NA	NA	250	250
Manganese (mg/L)	0,267	0,234	0,377	0,387	0,197	0,457	0,346	NA	NA	NA	NA	NA	NA	NA	0,1	1
Ammonium	NA	NA	NA	NA	NA	NA	0,139	0,108	NA	NA	NA	NA	NA	NA	0,7	0,7
Nitrad	NA	NA	NA	NA	NA	NA	0,082	0,009	NA	NA	NA	NA	NA	NA	0,01	10
Copper	NA	NA	NA	NA	NA	NA	0,1	6	NA	NA	NA	NA	NA	NA	2	2
Nitrate	NA	NA	NA	NA	NA	NA	0,519	5,74	NA	NA	NA	NA	NA	NA	10	10
Nitrite	NA	NA	NA	NA	NA	NA	0,309	0,6	NA	NA	NA	NA	NA	NA	1	1
Ammonium	NA	NA	NA	NA	NA	NA	12,6	4,62	NA	NA	NA	NA	NA	NA	0,2	0,2
Ammonia	NA	NA	NA	NA	NA	NA	2,95	NR	NA	NA	NA	NA	NA	NA	1,5	NR
Chloride	NA	NA	NA	NA	NA	NA	3,26	2,495	NA	NA	NA	NA	NA	NA	5	5
Total coliforms (MPN/100 mL)	NA	NA	NA	NA	NA	NA	0,053	0,021	NA	NA	NA	NA	NA	NA	absence/100 mL	NR
<i>Escherichia coli</i> (MPN/100 mL)	2,0	NA	NA	NA	NA	5,1	NA	NA	NA	NA	NA	NA	NA	NA	absence/100 mL	absence/100 mL
Depth (m)	2,0	NA	3,8	2,8	3	2,55	3	2,7	3,02	2,85	3,22	3,21	2,73	NA	NR	NR

Legend: 1- Maximum Values Permitted in accordance with Ordinance 2914 of the Ministry of Health for drinking water; Maximum Values Permitted in accordance with 396 Resolution of Conama with preponderant use for human consumption; NA – Not Analyzed; NR – Not Referenced; ND – Not Detected; QL – Quantification Limit;

In General, the results obtained for the levels of porous and fractured wells, table 1 and 2, respectively, indicate little variation for this parameter over time, and can be connected to the season (dry or rainy) in which the collections were held.

Alkalinity showed variation over the sample period with a peak in October 2015 for the porous well and more homogeneous values for the fractured well, and there are no reference values by Ordinance MS 2914 MS (Brazil, 2011) and CONAMA resolution 396 (Conama, 2008). The same occurred with the hardness, in spite of this having remained well below what is recommended by Ordinance MS 2914 (Brazil, 2011). Coelho et al. (2004) when monitoring a well close to a controlled landfill, found values of alkalinity around 300 mg/L.

The electrical conductivity, considered one of the most representative parameters for evaluating the effect of landfill contamination, presented values above $1,000 \mu\text{S}\cdot\text{cm}^{-1}$ in all the analyzed periods, reaching a maximum of $3,310 \mu\text{S}\cdot\text{cm}^{-1}$ in 2013, in the porous well, Table 1. In the fractured well the average values were lower than those in the porous well, less than $1,000 \mu\text{S}\cdot\text{cm}^{-1}$, with a decreasing trend over time. This fact can be explained by attenuation on the plume of contamination over time, either for a change in displacement direction or change in waste disposal on the ground. According to Hamada et al. (2016) the expected electrical conductivity for an aquifer varies in 100 and $280 \mu\text{S}\cdot\text{cm}^{-1}$. However, this parameter is not referenced by Ordinance 2914 MS (Brazil, 2011) and CONAMA resolution 396 (Conama, 2008). The absence of quality reference does not diminish the importance of the analysis for this parameter, since that higher values are an alerting factor for contamination to the environment and human health. Lima (2003) found values for average electrical conductivity around $15,400 \mu\text{S}/\text{cm}^{-1}$, by analyzing the slurry from a controlled landfill in Rio de Janeiro.

Turbidity also showed high throughout the analysis period with values well above what is advocated by Ordinance MS 2914 (Brazil, 2011).

According to Langmuir (1997), the groundwater natural pH is between 4.0 and 9.0, reflecting the natural dynamic among acids and bases. In the performed analysis, pH ranged from 5.7 to 7.4 showing a tendency for acidity, but remained near the recommended level by Ordinance 2914 MS (Brazil, 2011), a range from 6.0 to 9.0. Beck et al. (2010) found pH values ranging from 5.4 to 7.1 when assessing water from wells next to the controlled landfills.

Chloride concentration, is also an indicator for contamination spread, since there is an ion missing in the natural groundwater in the phreatic zone of the region. This parameter is high in practically the whole sampling period, not meeting the quality standards proposed by Ordinance 2914 MS (Brazil, 2011) and CONAMA resolution 396 (Conama, 2008).

In relation to metals, there were held just two samples, in the months of February and October 2015. Practically, all analyzed parameters were below what is recommended by Ordinance 2914 MS (Brazil, 2011) and CONAMA resolution 396 (Conama, 2008), except for lead, in the porous well, which in February 2015 reached a concentration of 0.273 mg VL , being above the recommendation of the water potability ordinance. In the fractured well, Ba, Pb and Al, in October and March 2015 2016, they were above what is recommended by Ordinance 2914 MS (Brazil, 2011). High lead levels are quite worrying and highlight the need for deeper and on-going monitoring for detecting the sources of the contamination.

According to Sisinno and Moreira (1996), the low concentrations of metal ions, hexavalent chromium, zinc and copper, can be attributed to the low solubility of these ions in the range of basic pH and high organic matter content, as they may precipitate

as hydroxides and form complexes with the organic matters. In addition, the low concentrations of these elements are also a result of the landfill characteristics, predominantly receiving domestic household and non-industrial waste (Beck et al., 2010).

Nitrite and nitrate analyzes were only performed on two samples. In General, both in porous well and in fractured well, there were found low concentrations of these parameters, both were below what is recommended by Ordinance 2914 MS (Brazil, 2011) and CONAMA resolution 396 (Conama, 2008), with the exception of nitrite in February 2015. Ammonia was not detected in any of the samples.

Microbiological variables, total coliforms and E. coli were not detected in any of the samples, except for total coliforms, found in low concentrations in October 2014, in the fractured domain, and E. coli found in the samples of April 2013 and February 2015 in the porous domain. Even so, these parameters were close to what is recommended by Ordinance 2914 MS (Brazil, 2011) and CONAMA resolution 396 (Conama, 2008) in many of the samples.

The high detected electrical conductivity and chloride values can cause a toxic effect on the micro-organisms by inhibiting their growth and detection in the analysis. This does not prove that contamination by leachate is not occurring. However, the absence of these microorganisms does not make the water safe for consumption, because other analyzed parameters are found in high concentrations, indicating the presence of contamination by leachate from the controlled landfill.

Indiscriminate disposal in landfills and burning urban waste containing batteries, tires, exhaust and others produce fumes and slurry rich in metals, especially mercury, lead, cadmium, zinc, copper, iron. All metals resulting from these processes can be soluble by water, and may cause damage to the health of humans and animals, given the toxic potential of these elements. (Jaishankar et al., 2014; Chowdhury et al., 2016)

An increase in the amount of iron in water was noted in this study, although not being a toxic substance; it may generate certain unpleasant consequences from stains on clothes and dishes, aesthetic problems and bad taste that the iron gives to water causing a metallic taste.

However, lead is a toxic element that accumulates in the body and can affect several organs and systems. It may cause acute or chronic intoxication being quite severe in two situations. Death can occur after 1 to 2 days, if one survives the acute phase (up to 12 days), it is likely to arise signs and symptoms of chronic poisoning that may impair the Central Nervous System causing paresthesia, pain and muscle weakness in addition to renal injury, severe anemia and hemoglobinuria and even cancer. (ATSDR, 2015)

Thus, the contact with these substances can cause severe problems, such as nervous system dysfunction and increased cancer incidence. Residents and workers in contaminated areas must be accompanied by a long period of time, since the symptoms of these diseases can take decades to appear.

After this situational diagnosis, it is recommended to carry out monitoring, at the landfill area of Jockey Club and surrounding areas, both of water used for human consumption, and the puddle water that serve as breeding grounds for vector mosquitoes. Also, a follow-up should be done on the 1571 collectors to detect cases of waterborne diseases (WDs) and metal poisoning. This will require inter-sectoral collaboration between ADASA, Office of Environmental Vigilance (DIVAL); University, Ministry of Health of the DF (SES-DF) and Urban Cleaning Service (SLU).

The data obtained from the monitoring of the quality of the porous and fractured wells, Tables 1 and 2, and the identification of risks to human health and the environment, lead to the proposition of the following steps for risk management (Table 3).

Table 3 – Monitoring purposes of the water risk and the health conditions of the waste pickers.

Specific Objectives	Goals	Hypotheses
1) Analyze the quality of groundwater in the areas adjacent to Jockey's landfill.	Six-monthly water quality mapping for the 2 ADASA wells located in the area of Structural-DF.	There is contamination, including heavy metals, in the drinking water in the area adjacent to Jockey's landfill.
2) Analyze the quality of water surface in the areas adjacent to Jockey's landfill.	Mapping monthly water quality of Córrego do Valo that runs parallel to the landfill.	There is water contamination of the streamlet that is used for consumption and watering of vegetables.
3) Monitoring puddle water quality in the landfill area.	Monthly monitoring puddle water quality in the landfill area.	The puddle areas in the landfill area as breeding grounds for mosquitoes and vectors
4) Monitoring the occurrence of adult and immature forms of Aedes aegypti and Culex quinquefasciatus and characterize the physical and chemical parameters of potential breeding grounds in areas adjacent to Jockey's landfill.	Determining potential risk areas for diseases transmitted by Ae. aegypti and Culex and identification of preferred breeding sites of Ae aegypti female gender mosquitoes.	There are areas with different occurrences of Ae. Aegypti and Culex as per distinct climatic seasons in the DF and there is a breeding preference for developing immature forms and oviposition of female gender of that mosquito.
5) Collect, inspect, monitor through the Office of Environmental Vigilance (DIVAL) irregular wells serving for consumption of waste pickers living in the area.	Identify contamination in the water of the wells that supply the residences of waste pickers for monitoring the health of these workers.	There are many areas adjacent to the landfill where waste pickers live, as Chácara Santa Luzia, having irregular wells, next to the wells, with contaminated water.
6) Characterize the waste pickers as for gender, age, race, educational level, time working as waste picker, monthly income and housing location (University and SLU)	Drawing the socio-economic and demographic profile of waste pickers working in Jockey's controlled landfill.	Waste pickers are mostly female, fertile age group, black, low educational level and monthly income below 1 minimum wage.
7) Identify morbidities referred to by waste pickers using an interview through a semi-structured questionnaire (University and SLU)	Learn about the health conditions of these workers to refer them to the primary healthcare services in SES/DF	Waste pickers have many work-related and environment-related pathologies in the environment where they live.
8) Perform in blood and feces collection from the waste pickers for detecting waterborne diseases in addition to hair and nail collection for identifying metal poisoning.	Identify the prevalence of waterborne diseases in the waste pickers, forward the cases to treatment in SES/DF and inform them about the prevention methods; in addition to informing them on the risks to which they are exposed from the possibility of metal poisoning.	The pickers of recyclable materials that work in the Jockey's landfill are exposed to many risk factors related to water contamination and have high prevalence of waterborne diseases and metal-related intoxication.
9) Correlate found water quality with cases of waterborne diseases and metal-related intoxication	Submit a report to the related organs in the DF showing the relationship between poor water quality in the Jockey's controlled landfill and high prevalence of waterborne diseases in the local workers.	The contamination of local water favors high prevalence of waterborne diseases in the local workers.
10) Investigate the environmental risk factors in the transmission of waterborne diseases (WDs) in homes and workplace of waste pickers showing positive WDs diagnosis.	Identify and monitor water supply points having contamination of homes and workplace pertaining to waste pickers who have positive WDs diagnosis and send data to DIVAL-DF.	The waste pickers that have WDs are exposed to the contaminated water that supplies their homes and workplace, both from regular or irregular wells that exist in the area.
11) Carrying out educational practices with the waste pickers and population based on critical and reflexive actions.	Forming partnerships with the community of Structural in the consolidation of actions aimed not only to the non-proliferation of the vectors and water contamination, but above all the development of separate waste picking that brings improvements in health, environment and the local and regional economy.	The disregard, ignorance, and carelessness related to solid waste correct disposal, on the part of the population contribute to the poor health of waste pickers and environmental contamination.

Conclusions

After monitoring the porous and fractured domain wells over three years, it can be concluded that there is evidences for groundwater contamination in the vicinity of Structural's controlled landfill. The fact is rather worrying, because the region where the landfill is located is a watershed, where people use water from wells for drinking, a fact that can lead to several health problems. This is corroborated by the results

obtained from data analysis, which indicated parameters such as electrical conductivity, chlorides, alkalinity, iron and lead in high values and some of them at odds with the Brazilian legislation for drinking water and groundwater quality for human consumption. It is concluded, therefore, that the quality of the water consumed by waste collectors working in the landfill and adjacent areas presents risks to health and the environment. Thus, this study proposes integrated and intersectoral actions to monitor the water quality and the health conditions of the collectors, avoiding the dissemination of water-borne diseases.

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